

Management Plan for Central Karakoram National Park 2020 - 2025



Developed and edited by Ev-K2-CNR and CKNP Directorate Staff:

Maurizio Gallo, Ashiq Ahmad Khan, Maria Teresa Melis, Muhammad Aurangzaib, Arif Hussain, Riaz ul Hassan, Sadia Munir, Abid Ali, Yasir Abbas Rizvi.

With the contribution of:

Agostino Da Polenza, Stefania Mondini, Elisa Vuillermoz, Franco Mari, Yasir Abbas, Nadeem Nazar, Ruby Pyara, Muhammad Raza, Muhammad Ismail, Sando Lovari, Research team of Baltistan University, Karakuram International University

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The document will be property of the Central Karakuram National Park Directorate.

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1. Introduction

CKNP is one of the biggest mountain national parks in the world, the highest one considering the average altitude including 4 peaks over 8,000 mt and it is part of the large system of protected areas that are linked together in GB, covering 60% of the total surface of the Province. If we consider that all the east part of GB that include the Siachen Glacier, the percentage of PA will increase to 75%. The PA system could be extended to other transboundary PA creating a large "Biosphere reserve" or an ecoregion that can become in future a unique opportunity and challenge under UNESCO protected Area category.

The Central Karakuram in Gilgit Baltistan of Pakistan is a mountain area endowed with rich biodiversity, natural beauty and important resources. It was declared as the Central Karakuram National Park (CKNP) in 1993. Several activities aiming at safeguarding the environment, preserving the cultural heritage and promoting rural development in Gilgit-Baltistan are being carried out by different agencies and organizations, who largely share the same objectives. However, the effectiveness of interventions is hampered by poor coordination between actors and low capacity of relevant institutions and their staff. To support an integrated social, economic and environmental development of the area, Ev-K2-CNR, in collaboration with local institutions and international agencies, launched several Projects and especially the Social Economic and Environmental Development (SEED) Project in late 2009. At that time, CKNP was still without any approved Management Plan that accounts not only for conservation but also for the needs of the local population of this area, which is characterized by a high poverty rate.

Realizing the close interrelation between poverty alleviation, social and economic development for local people, environmental research and conservation of the unique natural beauty of the area, the SEED project aims at catalyzing an integrated social, economic and environmental development, including the realization of Central Karakuram National Park.

The objective was to improve the quality of life of local communities and the conservation of environment, architectural and cultural heritage. Enhance the capacity of local communities and institutions to adapt to climate change in the Central Karakuram, promoting sustainable development in the Karakuram area through coordination of ongoing efforts and initiatives; strengthen the decision support system; strengthen institutional mechanism to better manage the CKNP, and enhance capacity of local communities and institutions to face climate change.

<u>Baselines for Management Plan</u> – providing an updated overview of the current environmental and socio-economical knowledge of CKNP region, merging data and information from bibliography with recent research results deriving from research activities carried in the framework of SEED and SHARE-Paprika Projects. Moreover, suggestions for addressing further research activities to fill the informative gaps in the identified specific thematic area are reported together with detailed description of map coverage availability.

<u>Park Management Guidelines</u> – providing, further to the available information on the current state of knowledge in the region, suggested management indications for the preservation and the sustainable use of Park resources. To better introduce these guidelines, a clear explanation

of the planning process and the strategy chosen for the definition of the Park management plan is also explained. The document is focusing the attention on the importance of park boundaries definition and zoning system in order to regulate accessibility and resource use. The core of the discussion is addressed to the need of applying a participatory approach, promoting the sharing of the information with local stakeholder and communities. This step will be fundamental prior to the official submission of the management plan to local authorities for formal approval, in order to guarantee the concrete application of the management strategy for the real benefit of local people and environmental heritage preservation.

Thematic Management Guidelines - providing thematic detailed management strategies for main specific issues related to Park conservation and sustainable use. At this stage, as first plan related the tourism sector regulation has been analyzed. Within IPMP process, a second output provided by Ev-K2-CNR is a **Research Protocols** reporting the certified research and monitoring procedures applied for the performing of the scientific activities in CKNP. This document represents fundamental tools for facilitating Park staff in the monitoring and managing of natural resources. It is fundamental to underline that these two papers have to be considered as working texts giving first management indications based on the current knowledge of the regions and its resources. The process to define a formal management plan needs to be completed with the collections of further data and information and the active involvement of the local communities. At the end of SEED program, in December 2014, a revised and updated version of the MP was prepared and approved becoming the first official CKNP Integrated Management Plan.

The Management Plan is a Process not a close document and needs to be updated after a period of five years to include the necessary modification and new regulations to continue the goal to protect the environment and wildlife and to increase the livelihood of the local communities in a sustainable way. The revision of CKNP management plan under Mountain Protected Area (MPA) project consists all the updated information received through field surveys, stakeholders' consultation and particularly the communities of the park surrounding areas who have some use rights inside the park called as buffer zone valleys in this document. These fundamental social and economic transformations, together with the huge pressure of the visitors arriving in the park area, are the new starting points for the revision of the MP. That has to include a new part regarding the villages that are inside a new proposed Zone, the Buffer Zone Valley, in which the climate change adaptation and the eco-tourism activity became two of the main goals those have to be pursued and implemented.

The approved GB forest Act (2019) and draft wildlife Act have been the basic legislations for the revised CKNP MP as the Wildlife Preservation Act of 1975 is too old and does not cover the emerging trends and various protocols and international treaties. The approved forest Act brought some fundamental changes in the management and conservation of natural resources; hence, CKNP has been redefined as IUCN category II NP.

The definition of the CKNP Management Plan started from a concept: the design of a management plan not strictly "closed" which has given the possibility of further improvements, revisions and updates. Each design phase has been defined by specific documents and this revised plan has been based on the feedbacks received through a participative approach that

witnessed direct involvement of the local communities and their social institutes, government bodies and other stakeholders.

The documents, which characterized the different phases of the aforementioned process, are given below:

- CKNP Integrated Management Plan, Information Requirements and Strategies Version 0.0, December 2009;
- Updating phase of CKNP Management Plan Version 0.1, June 2012;
- Integrated Park Management Plan for CKNP Version 1.1, March 2013;
- Management Plan for CKNP Integration and Operational Plan Version 1.1, April 2014
- *CKNP* research baseline
- VCSDPs (2016-17)
- *CKNP glacier inventory*

This document "Revised Management Plan for CKNP" demonstrates;

- 1) The new Park Boundaries and internal zoning system, as well as the proposed new rules defined upon a process of evaluation and consultation with the local communities, government and stakeholders, by complementing the previous version of the Management Plan;
- 2) The Operational Plan, which contains the actions, deemed of high priority for the CKNP management, functional to ensure the proper structuring of the various aspects related to the CKNP Directorate management, as well as the achievement of the sustainable use of natural resources both internal and external (but that could have effects inside the Park).

2. Prominent features of the Park

2.1. Ecological Features

2.1.1. Land Cover

The land cover map of the area (see Section 5.4 and Appendix 6) indicates that snow and glaciers cover a major part (66.5%). Bare rocks and bare soils also represent a substantial part (15.4%) of CKNP, whereas vegetation base classes represent about more than 14.7% of the area. Vegetation classes of the area are the followings:

- Scattered vegetation;
- Sparse vegetation;
- Pasture and/or Meadows < 3,750 m a.s.l.;
- Pasture and/or Meadows > 3,750 m a.s.l.;
- Open forest;
- Closed forest;
- Cultivated areas.

Exhibit 1: Land cover map-CKNP



2.1.2. Glaciers

From the Landsat images of 2001, 711 glaciers have been identified. Their total area is 4606.706 (\pm 5%) km². This amount accounts for the 38% of the total surface of the Central Karakoram National Park (that is 12.162 km²). Moreover, this glacierized area represents 31% of the glacial surface of the entire Pakistani Karakoram (by comparison with data from ICIMOD, 2005). Thus, the present study could represent a solid basis for future considerations on the state of glaciers in the whole Pakistan. Glacier size ranges from 0.025 to 604.237 km², with an average size of 6.478 km². The 9 largest glaciers are covering more than half of the glacierized surface but they represent only 1. 27% of the total glacier number. The smallest glaciers (433 ice bodies <1 km²) represent about 61% of the whole glacier number but they cover only 3.6% of the CKNP glacierized surface (Exhibit no. 2)

	Glacier number	Glacier area (km ²)	% with respect to total glacier area	% with respect to total glacier number
To al glaciers in CKNP	711	4606.706	100.0	100.00
glaciers< 1Km ²	433	167.2842	3.6	60.90
glaciers>1Km ²	278	4439.421	96.4	39.10
glaciers>10Km ²	51	3781.679	82.1	7.17
glaciers>50Km ²	17	3010.587	65.4	2.39
glaciers>100Km 2	9	2467.761	53.6	1.27

Exhibit 2: Glaciers in CKNP

Fifty-three glaciers in 2001 featured an area minor than 0.1 km² thus suggesting to be classified as "glacierets", nevertheless they all together covered a surface area of 2.17 km². These ice bodies were inserted in the CKNP Glacier Inventory and labeled them and "uncertain ice bodies" to follow in the inventory updates their evolution.

As regards glacier minimum elevation (which also represents the glacier terminus altitude), this resulted between 4,500 and 5,000 m a.s.l. for the 37% of the analyzed glacier, on the other hand about 47% of the total glacier area is covered by glaciers featuring a minimum elevation between 3,000 and 3,500 m a.s.l. (see Exhibit 1). This reflects the fact that larger glaciers tend to reach lower elevations, while smaller glaciers have higher termini. These patterns were observed in other glacier areas, namely the Alaska Brooks Range (Manley, 2010), the Swiss glaciers (Kaab *et al.*, 2002), the Cordillera Blanca (Racoviteanu *et al.*, 2008), and the Aosta Valley glaciers in the Italian Alps (Diolaiuti *et al.*, 2012).

Exhibit 3: Glacier minimum altitude distribution. Data are referred to 2001 glacier coverage. In yellow in the table are labeled the maximum glacier percentage with respect to glacier area and to glacier number respectively

Glacier minimum altitude	Glacier number	Cumulative coverage (km ²)	% with respect to area	% with respect to number
2000-2500	3	105.77	2.3	0.42
2500-3000	12	633.715	13.77	1.69
3000-3500	24	2152.567	46.78	3.38
3500-4000	80	945.191	20.54	11.25
4000-4500	234	449.619	9.77	32.91
4500-5000	266	259.535	5.64	37.41
5000-5500	75	35.774	0.78	10.55
>5500	17	19.243	0.42	2.39
Total	711	4,601.414	100.00	100.00

2.1.3. Vegetation Pattern

The distribution of natural vegetation is closely linked to climatic and topographic conditions and is increasingly affected by human interferences such as grazing and woodcutting. The decreasing diversity in natural vegetation towards the north, it is due to increasing aridity; thus, the expansion of forests declines northwards, so that people in the Hoper and Hispar valleys suffer from a lack of firewood. In the upper parts of Bagrote and Haramosh valleys, located further south, a greater amount of forestation can be found, ensuring better wood supply. A major cause of this, it is the significant difference in precipitation, humidity, and the varying periods of snow coverage. The vegetation of lower sub alpine areas is influenced by arid to semi-arid conditions, whereas plants of the alpine and sub-nival level are influenced by humidity. Consequently, each valley in CKNP provides agricultural lands and pastures at several distinct altitudinal levels.

Most of the cultivated area and major settlements are along the beds of the major rivers (Indus and Shigar). The most common crops of the area include Wheat, Maize and Potato while Apricot and Pomegranate are the most common fruit trees of the orchards. Populus plantation is very common within the cultivated areas and as separated plantation for domestic timber use. Eastern and western extremes of CKNP depict distinct variations with respect to land cover classes. On the eastern side, there were very few coniferous forest patches. The Artemisia spp. shrub was dominating at lower elevations, and Juniper spp. scrub at higher elevations. Whereas western side of CKNP have large patches of Coniferous forest, and Artemisia spp. is relatively less common. This difference in vegetation patterns could be attributed to their respective climate differences, because the western areas receive higher precipitation due to summer rainfall.

Vegetation Types

Vegetation type	Altitude	Description
Riparian vegetation	Azonal distribution	next to mountain streams and rivers, along a wide altitudinal gradient (azonal). Species as Willow (<i>Salix</i> spp.), Poplars (<i>Populus</i> spp.) and Sea-Buckthorns (<i>Hippophae</i> spp.) are common, often cultivated for the production of timber and firewood.
Xeric vegetation	< 2200 m	on extremely dry sites. Presence of xeric tolerant species, as <i>Capparis</i> , <i>Ephedra</i> and <i>Carduus</i> , protected by rocks or in favourable niche. Grazed by livestock in winter months.
Artemisia shrub land	< 2600 m	Occasionally presence of scattered Junipers. Can be the result of a long lasting and heavy degradation of former forests. This vegetation is common all-over the CKNP. Important grazing ground in the autumn-winter months.
Juniperus shrubs/forest	SW CKNP : < 3000 m	stands of Juniperus are distributed all over CKNP. In the South-West valleys, the stands are located mainly at low elevation (at altitude below 3000 m) or on the dry, southern

The following vegetation types are well represented in the CKNP:

Vegetation type	Altitude	Description
	(3800 m*) NE CKNP : 2800 – 3800 m	exposed mountain sides (up to treeline, 3800 m*). Moving North-East their abundance increases and Juniperus stands are located an altitude between 3000 and 3800 m. Usually stand density is low and stand dynamic is slow (scatter regeneration). The Juniperus forests are the main source of firewood for local communities inside the CKNP.
Mountain dry temperate coniferous forest	3000 – 3800 m	stands of Himalayan Blue Pine (<i>Pinus wallichiana</i> , Kail) and Morinda spruce (<i>Picea smithiana</i> , Kutwal) with marginal presence of <i>Juniperus</i> spp are frequent in the south-western valleys of the CKNP. Those forests are located on moist and fertile sites, at an average altitude between 3000 and 3800 m usually on North/North-East exposed mountain sides. In the recent past most of them have been heavily managed for timber production. The livestock grazing, which reduce trees regeneration and the lack of proper management guidelines, makes temperate mixed forest types often degraded.
Sub-alpine broadleaved forest	3300 – 3800 m	stand composed by birch (<i>Betula utilis</i>) and/or willow (<i>Salix</i> sp.) are scattered at high altitude mainly on northern exposed valley sides. Relying heavily on snow accumulation and avalanche for water availability, those species are usually composing the upper tree-line. Harvesting of firewood is low, mainly used for "paper" production.
Alpine meadows and shrubs	> 3900	The alpine pasture zone lies above the timberline that fluctuates from 3,800 m a.s.l. to 4,000 m a.s.l. At this altitude the temperature does not allow the growth of trees, however, alpine pastures shows good levels of growth and fertility(Miehe and Miehe, 1998). <i>Poa</i> and <i>Carex</i> genus are the most common plant members (EV-K2-CNR, 2009). These areas provide ideal habitats for many important mammalian species.

Forest Classification

For management purposes and due to the limitations imposed by satellite image classification, forests inside the CKNP have been classified into three broad categories according to forest biomass. Those are enough general to encompass a wide variety of similar forests and enough different between each other to simplify their recognition in the field. The classes are: sparse trees, open forest and closed forest. Two parameters have been used to classify the forests: vegetation cover and average height of the tallest trees. The vegetation cover is the ratio between the projection of the trees/shrubs canopy on the soil and the soil surface, in percent, while for average height of tallest trees we intend the mean heights of the 4-5 tallest trees of the area.

Sparse Trees Vegetation

It's a class with a reduced tree cover (<10%) which therefore cannot be classified as a forest degraded mountain dry temperate coniferous forest. The stand biomass is low as the average forest increment.

<u>Open Forest</u>

It's the first classification of forest. Such condition of forest could be the result of the degradation of a closed forest or a forest growing on poor soil. The vegetation cover is between 10 and 50% and the mean height of tallest trees is between 5 and 15 m. This category includes the forest, which might be managed in the future with more emphasis on the reforestation. The species composition can vary, from degraded spruce (*Picea smithiana*) and blue pine (*Pinus wallichiana*) to dense Juniper woodland.

Closed Forest

It's the category, which includes the most productive forests. The vegetation cover is above 50% and the mean height of tallest trees it's above 15 m. The sustainable forest management will be applied mostly to this category. Usually this class is composed of dense forests of spruce (*Picea smithiana*), Blue pine (*Pinus wallichiana*) and/or birch (*Betula wallichiana*). This category has the highest biomass and increment.

2.1.4. Wildlife Species

<u>Mammals</u>

The CKNP is a refuge area not only for threatened species i.e. Markhor, musk deer, Ladakh urial, (stable presence to be confirmed in CKNP) and snow leopard, but also for important "flag" species, i.e. Himalayan ibex, Himalayan lynx and grey wolf.

The status of those large mammals in the Central Karakoram National Park is least known: the rugged and steep high mountains, the size of glaciers and the poor road network have made it difficult to carry out reliable counts of wildlife, in very few areas.

- Gilgit-Baltistan, including CKNP, represents the westernmost part range of blue sheep. Limited range and low numbers make it vulnerable to poaching and habitat loss.
- In terms of relative numbers, the Asiatic ibex is probably the most abundant Caprinae species in the CKNP.
- The occurrence of Markhor in the area of CKNP has been reported but always at small numbers. Markhor have a limited geographical distribution, their range being squeezed between those of ibex and wild goat.
- The Ladakh urial, like the markhor, advanced into the mountains of northern Pakistan and India mainly by penetrating the major river valleys such as the Kunar, Indus, Gilgit and Shyok As to the CKNP area, some reduced populations still occur along the Shigar and Braldo rivers and possibly along the Dumurdo Nullah.
- The musk deer survive in small numbers Referring to the large carnivore species:
- Brown bears are reported in low densities from Shigar, Baraldu and Baltoro Glacier, as well as from Nagir, Chaprote and Bar Nullah (Nawaz 2007). Brown bears in the Baltoro valley subsist mostly on grass and various roots.
- Snow leopard has a patchy and restricted distribution through out

<u>Birds</u>

Around 90 species of birds are known to occur in the CKNP in 13 families. Their occurrence status varies from resident to breeder to migratory. Common snow cock, Chukar, rock pigeon, snow pigeon, oriental turtledove, booted eagle, and common kestrel are among the common resident birds of the area. Common hoopoe, common cuckoo, common swift and Eurasian nightjar represent summer breeding birds of the area. Hen harrier, Eurasian skylark, Spanish sparrow, Himalayan accentor, Eurasian goldfinch, and pine bunting are winter visitors to the area.

Rare birds of the CKNP Include Snow Partridge, Himalayan Monal, Golden Eagle, Alpine Accentor, Mountain Finch, and Hume's Wheatear. The key threats to avifauna are habitat destruction, degradation, change in land use, use of pesticides and hunting.

Reptiles and Amphibians

Pakistan hosts a highly diverse and unique herpetofauna, due to the huge environmental and altitudinal gradients, and to the complex zoogeography of the region. This richness is particularly high for reptiles (about 200 species); furthermore, about 30% of the species are endemic (Khan, 2006, 2008). Despite the Northern Areas of Pakistan, hosting a unique herpetofauna, the knowledge of Amphibians and of Reptiles of the Northern Areas of Pakistan and of the Central Karakuram is largely incomplete. Only a few areas and species have been deeply investigated, and strong uncertainties persist on the distribution and taxonomy of many amphibians and reptiles. The Gilgit-Baltistan represents an exceptional environment for both geographical and bio-geographical reasons. This area is at the boundary between the Paleartic and the Oriental Zoogeographical Realms and it is the junction point of the three world's greatest mountain ranges: Himalaya; Karakoram and Hindukush. Despite these unique features, the biodiversity of this area remains poorly studied. The Ev-K2-CNR team carried out a study on herpetofauna and surveyed seven major areas out CKNP: Gilgit; Bagrot Valley; Skardu; Shigar Valley; Shyok Valley; Hushey Valley; Deosai Plateau.

From the data an environmental suitability map for amphibians was developed. The map indicated that the high score rank areas are distributed outside the CKNP, near water bodies.

<u>Fresh water fishes</u>

The CKNP is endowed with a wealth of fresh water resources from river, stream to alpine lakes. Published literature specific to the CKNP is scarce; however, information available on fish resources of high mountains in the NAs is summarized here. The fish fauna is relatively poor due to high turbidity, low water temperature, high water speed, low benthic productivity, and long stretches of narrow gorges of rivers.

The fish species are predominantly Palearctic having elements of Central Asian Highlands with some mix of Oriental Region. Recent studies report about 17 species of native fish and three of exotic fishes, belonging to five families. Out of these 17 native species, four are endemic to the GB; while several others have restricted range confined to one or two localities.

2.2. Socio-economic Features

The peripheral zone of CKNP comprises of 230 settlements and is home to almost 219,216

people, living in about 34,265 households and relying on the park resources for their livelihood (2017 census). Field surveys conducted by Ev-K2-CNR in 2018/19 revealed the following information:

Basic Facilities

Generally, all the Union Councils have access to basic facilities as roads, electricity, telephone (except in Basha, Braldo and Dassu UCs), primary education, and health services. However, some of the remote villages and hamlets within these Union Councils are still deprived of these necessities, moreover the health ones. The non-availability of basic health and education services takes a toll particularly on women who suffer the most due to the local culture and traditions that restrict their mobility hampering access to these services at farther distances.

Population, Labor, Incomes and Poverty

The communities in CKNP buffer zone valleys are traditional agro-pastoralists that practice mix subsistence farming. Apart from the highly unfavorable demographic, cultural, and social settings, all the valleys of buffer zone are rich with natural resources, particularly land, water, forests, and related resources. To reap the maximum benefits from the available natural resources, the communities are equipped with a healthy force of skilled and unskilled laborers. For all the valleys, this situation has ensured respectable levels of per capita incomes, which are mostly derived from natural resource management.

The income consists of two major components: farm and non-farm incomes. The main contributors in farm incomes are crops, vegetables, livestock and farm-forestry resources; whereas, non-farm contributors are business, skilled and unskilled laborers, employment in public and private sector organizations. In the research area has been identify a 4:1 relationship between farm and non-farm incomes.

On one hand, this is a good sign that people are self-reliant in livelihoods very dependent on locally available farm resources. However, on the other hand, this situation also raises alarms that people place high pressure on the natural forest and wildlife resources causing degradation of local forests and wildlife and posing a threat to the biodiversity balance and environment.

Agricultural fields, Pasture and Livestock

The land ownership system of the natural resources is a mix between state-claimed ownership, community and household uses rights that were established with a mix of traditional customs, legislation, legal practices and ongoing informal appropriation.

An analysis of the situation presents the following picture about the whole of CKNP's area.

- As a general rule, and according to local informants, we could assume that the areas below the water channels are privately owned and areas above water channels are under Governmental jurisdiction.
- Cultivated land is generally, individually owned, and pastures are village commons. Rights to the utilization of pastures are collectively conferred on entire villages and are not confined to kinship groups.
- For mountain farmers animal husbandry still plays an important role in the agro-pastoral economy: it guarantees different products, gives the possibility to sell some heads if there are special needs for cash, and keeping a large number of animals assures a social status

inside the community.

- The seasonal use of the pastures through the year follow the altitudinal gradient of the vegetation availability, and it depends from the herd characteristics (e.g., see Exhibit 4). It also seems that the forages present in these arid areas assure a high quality only during the early vegetation stages, declining as forage mature (Seim and Holand, 1999).
- In general, the sheep and goat herds are guarded during the day, while lactating cows are unguarded during the day, but both the groups are kept in pens for the night. Yak, male cattle, dry cattle and crossbreeding (yak-cattle) are free ranging from early spring to late autumn.

Exhibit 4: Time space diagram for different types of pasture utilization in high mountain region



3. Major Threats to the Park

3.1. Pastures

Climate change effects, overgrazing, and degradation of pastures by livestock and consequent reduction in productivity with prominent change in the species composition, overall reduction in the vegetation cover, less quantity of litter, and gullies and rill formation. Besides, the degradation also contributes in the landslides as well as shift the grazing pressure to other pastures, which can also in due course of time would undergo the same process.

3.2. Livestock

It is composed primarily of goats and sheep, followed by cattle (local cows, yaks, and crossbreeds between cow and yak) and equines. From autumn to spring all animals except yaks are fed in and around the settlements, coping anyhow with the acute fodder shortage during the lean season; therefore, slaughtering and selling animals reduce livestock size in autumn and purchasing fodder.

Main threats for livestock are (in tentative order of importance):

- The low productivity, probably related to the features of the summer pastures under management of the community as well as to the fodder shortage in winter;
- The occurrence of endemic and eventually epidemic diseases, resulting in mortality and additional low productivity;
- Depredation by large carnivores
- Possible spread of diseases from livestock to wild animals.

3.3. Forests resources

These include:

- Lack of management guidelines
- Illegal harvesting.
- Overexploitation of trees for fuel.
- Illegal harvesting of timber (in some valleys).
- Free grazing by livestock, hampering natural regeneration, slowing forest recovery capabilities, limiting the natural regeneration capabilities of CKNP forests.
- Climate changes (representing a main source of threat to water resources, including the issues of floods and droughts, the latter cascading into food security of the populations living within CKNP and around.

3.4. Water quality

The important factor affecting the water quality is the human and the animal activities in the surrounding of the water delivery systems.

Threats to the Biodiversity with focus on large mammals:

- *Habitat loss, due to destruction, fragmentation or degradation of habitat.*
- Subsistence hunting and poaching
- *Feeding competition with livestock*
- Killing of large carnivores for limiting their impacts on livestock
- Disease transmission from livestock

3.5. Tourism impact

- Huge increasing number of visitors particularly national
- extension of ecotourism opportunities for accommodation
- waste management problems
- sustainable campsites use and maintenance
- *new short trails for domestic tourists*

3.6. Wildlife protection and CCHA programs

- Wildlife census and distribution
- Mapping
- CCHA managing and use of the income for ecological activities

3.7. Mining

However, outside the park boundaries, mining does affect the natural ecosystem and people of the area. Two types of threats were identified by the plan

- Threats emerging from the blasting of massive boulders that has serious repercussions for the natural ecosystem; alpine flora and wildlife species
- Impact of current techniques that are poor and risky on health and wellbeing of miners (safety)

3.8. Changes and trends in valleys around CKNP in last years

The census data of the 2017 shows that the population in the Buffer zone villages is increasing but at the same time there is a huge seasonal migration from the mountain villages towards the main cities Skardu and Gilgit. Officially, the population of the villages is going up but more and more people tend to live in urban towns.

Immigration from mountain villages

The remote mountain villages around CKNP have been subject to immigration due to several reasons and this had impacts on the customary practices as the rural areas were called as ethnographic museum where cultural traits were preserved earlier. The migration is happening because of changing socio-economic conditions including livelihood and income opportunities, better education, extreme weather and other modern-day facilities. Earlier, the migration was only seasonal concentrated during the winter months and for limited period of days or the householders use to spend some days in Skardu, living at friends' home, or in small hotels and the other part of the families remain in the village. The migration in central Karakoram is highly gendered phenomenon as the power, mobility for employment is mainly restricted to males, and the women are left behind in the villages to continue the traditional life in the "Kaxa" underground residence.

The construction of new houses in villages demonstrate increase in income: the traditional homes are substituted with new ones more comfortable, on the ground level or higher, destroying the old "Kaxa": more houses mean more land is taken away from agriculture use and the villages are growing in size.

At the same time, the young generation push their families more and more to shift to cities. Stimulated by the new social opportunities in the towns to transfer from the villages to Skardu or Gilgit on permanent basis, the same way a new phenomenon is going on as many families are building new houses in Skardu and Gilgit and migrate completely from the villages just leaving the older ones.

Consequences

- Culture is at risk
- Increase in the population of Skardu and Gilgit with huge problems for water supply, electricity and consequently out of control waste management issue
- Less number of livestock: it is more and more difficult for the family to carry on the traditional livestock activity as fewer young boys and girls that can manage the migration to the pastures

3.9. Climate change and adaptations

Climate change and its impacts are evident in Pakistan. The multiple threats facing by Pakistan in the recent past such as glacier lake outburst floods (GLOFs) from melting glaciers, unpredictable monsoon rains causing floods, and loss in agricultural productions due to changing weather patterns have affected different regions of Pakistan. Central Karakuram National Park (CKNP) is an area of considerable importance to Pakistan since major glaciers that feed the Indus water system are situated there. It is an area with rich biodiversity and includes different species of flora and fauna. The local community in the region is greatly reliant upon the local ecosystem for its survival. Taking into account the fact that temperature rise in the CKNP region has been higher than in other countries of the region has also exacerbated frequency of natural disasters like landslides and GLOFs hence, it is important to study impacts of climate change in the CKNP.

The Karakuram Highway (completed in 1978) opened up the Gilgit Baltistan to a series of unprecedented changes (social, economic, cultural and environmental). The KKH, CPEC, Diamer Basha Dam Project and ETI may prosper the country but may also affect the sensitive ecology of the region. CKNP encompasses the world's largest glaciers, outside the Polar Regions. It is characterized by extremes of altitudes that range from 2,000 m a.s.l. to over 8,000 m a.s.l., including K2, the second highest peak in the world (IUCN, 2008).

Mountains are unique ecosystems covering all latitudinal belts and encompassing within them all the earth's climatic zones. Mountains are widely recognized as containing highly diverse and rich ecosystems, and thus, they are key elements of the global geosphere-biosphere system. At the same time, mountains contain ecosystems that are quite sensitive and highly vulnerable to natural risks, disasters, and ecosystem changes, be it through the occurrence of rapid mass movements, such as landslides, or via slow land degradation due to human activities, with all the relevant socioeconomic consequences.

Many studies have suggested that high elevation environments, comprising glaciers, snow, permafrost, water, and the uppermost limits of vegetation and other complex life forms are among the most sensitive ones to climatic changes occurring on global and local scales. The stratified, elevationally-controlled vegetation belts found on mountain slopes represent the equivalent to the different latitudinally-controlled climatic zones, but these condensed vertical gradients are capable of producing unique hotspots of biodiversity, such as those that serve as habitat for a variety of species ranging from butterflies, frogs and toads, to birds and fish. High relief and high gradients make mountain ecosystems very vulnerable to even mild changes of temperatures and to extreme precipitation events.

Likewise, mountains provide life-sustaining water for most regions of the world. The critical

function of mountains as seasonal and longer-term water storage implies that climatic and other environmental changes in the world's mountains will have a large impact, not only on those immediate regions, but for a much greater area as well. Namely, mountain regions provide a discreet quantifiable domain where relatively small perturbations in global processes, can cascade down to elicit remarkable changes in most or all of the myriad interdependent mountain systems, from its hydrological cycle to its complex fauna and flora, and the people that depend on those resources.

Because of their altitude, slope and orientation to the sun, mountain ecosystems are easily disrupted by variations in climate. Many scientists believe that the changes occurring in mountain ecosystems may provide an early glimpse of what could occur later in lowland environments.

As the world heats up, mountain glaciers are melting at unprecedented rates, while rare plants and animals struggle to survive over ever-diminishing areas, and mountain peoples, already among the world's poorest citizens, face even greater hardships.

Changes in the volume of mountain glaciers and in their seasonal melting patterns have an impact on water resources in many parts of the world. Changes in water availability due to climate change are taking place at a time when pressure on water resources for irrigation and food production, industrialization and urbanization is increasing.

In addition, local community empowerment can be an essential step towards building climate change resilience in mountains. Climatic effects on high mountains are very specific; climate change is likely to trigger the rates and intensity of natural hazards such as landslides, avalanches and flooding with dramatic consequences for tourism destinations.

Days and nights are becoming warmer. Precipitation extremes show an increasing trend with intense precipitation events at most recording stations. More weather-related disasters such as avalanches, floods and landslides can be expected in the future. Therefore, understanding climate variation and changes is fundamental to assess the climate's sensitivity to the variety of factors, both the human and the nature.

Though Gilgit Baltistan Province has a negligible share in global emissions of greenhouse gases, it is particularly vulnerable to climate change due to fragile mountain ecosystem. Various studies have shown that the climate change impacts are evident on forests, biodiversity, water resources, agriculture, tourism and other sectors in GB. However, climate change creates both opportunities and risks for human development.

In order to address the possible climate change impacts, adaptation practices should lay emphasis on sustainable development. It is mainly about warning people about events in advance and preparing them to deal with vulnerability and uncertainty. Adaptation to climate change has received increased attention in the scientific and policy debate, and is seen as complementary to mitigation. Therefore, more adaptation assessments need to develop and conduct with the aim to identify and evaluate adaptation options in the field of tourism and other sectors.

Glacier retreat also contributes significantly to stream flow variability in the spring and summer, while glacial lake outbursts, which are becoming more likely with rising temperatures,

are an additional source of flooding risk. Pakistan's low level of development and complex topography leaves it quite vulnerable to climate change. In the Karakuram, loss of ice evokes concerns of further expansion of glacial lakes, leading to an increased potential for GLOF in the valleys downstream

Villagers have reported winters being less cold (thus, they used fewer blankets in bed at night) and mountain streams melting earlier. They regret that the summits have started to become "black" (i.e. snowless) since 1995. Overall, snowfalls are less frequent, less abundant and cover the ground for a shorter duration of time, although since 2009 some unprecedented late snowy episodes have occurred in spring, until mid-April. Snow that serves as an insulating blanket and retains soil humidity has not been replaced by rain. Consequently, potato, fodder and buckwheat yields are said to be on the decline, the first two due to a shortage of water, the third because of frost. In addition, over the last decade, villagers have noticed a greater variability in monsoon rainfalls and unusual rains at the end of September and in October, affecting the drying of fodder and disrupting the beginning of the tourist season in autumn. Everybody has observed a higher level of unpredictability concerning meteorological conditions; nevertheless, the inhabitants of the valleys are preoccupied by the availability of water in mountain streams and the main concern was the quality of water.

Villagers have noticed few changes in their agricultural practices and in climatic conditions over the last twenty years apart from, just as in the high mountains, less frequent and less abundant snowfall that covers the soil for a shorter length of time. Nowadays, snow falls at an altitude of 2,000 m or more, whereas in the 1990s, it still fell at an altitude of 1,800 m. Contrary to the high mountains, villagers have not observed any change in agricultural production; this may be linked to the drop in snow cover because, as they said, snowfall has been replaced by rain. They also reported less frost that damages crops, even though streams and some of their sources freeze during winter above 2,700 m a.s.l. Over the last decade, there has been unusual rainfall in September-October, but the pattern of spring or monsoon rainfall was said to have remained practically unchanged: the onset of the monsoon and its intensity vary from year to year, but this has always been the case, as the villagers interviewed pointed out. On the other hand, they complained about the unprecedented violent hail storms in 2009.

Villagers noted a significant increase in temperatures in the high and middle mountains: in fact, at altitude, warming has direct visual consequences, since the shrinking of the snow cover manifests it.

However, it is not possible to establish a direct link between these increases in temperatures and new practices: in the high mountains, the shift in times for potato planting reported by some farmers could be attributed to the choice of varieties used or to the overlap of agriculture and tourism calendars in spring (March-May) rather than to climate variations;

At the higher elevations, all the local populations have noticed a reduction in snowfalls (number, quantity and duration). Snowfalls have been only recorded if snow remained on the ground for at least one day and hindered the people's daily activities.

Our interviews have clearly revealed that the altitudinal limit of snowfall has been higher (2,000 m a.s.l.) for about twenty years and that snow remains on the ground for a shorter time,

probably due to the increase in temperatures.

Data collected in the high mountains indicate that snowfall precipitation has not been replaced by rainfall precipitation, while recent data show that it has been replaced by rainy precipitation in the middle mountains.

Lastly, it seems that the decrease in snow cover in the high mountains causes the ground to freeze more, which is detrimental to crops, while in the middle mountains it seems to be accompanied by less frost, which is beneficial to crops.

Although a decrease in snow cover results in a drop of fodder production in the high mountains, it appears that changes in the use of pastures, including those in the middle mountains, have little to do with a change in snow cover. Instead, they are guided by economic and social dynamics, such as the reduction in transhumance dairy farming, which is demanding in terms of manpower, that prompt people to turn to the tourism economy.

Nevertheless, villagers mentioned unusual rainfall in the high and middle mountains over the last ten years.

Uncertainties about changes in the flow of water from springs and streams

It came out from our surveys that when villagers complained about a water shortage, it was often due to a management problem and/or to a damaged network, to a diversion of water towards a hydropower turbine, or to new water uses. Moreover, multi-branch water pipes, as well as water-collecting tanks installed in the 1980s, make it impossible to estimate spring discharges: changes in the flow of water are only observed at outlets, which makes it difficult to identify their causes.

In the low mountains, explicit mention was made of springs and streams having a lower water flow due to reduced winter precipitation.

By contrast, in the high mountains, a severe reduction in snow cover and greater variability in the rains, villagers did not complain of a lack of water from springs and streams, which are partly fed by melt water from glaciers and permafrost.

Moreover, the low mountains appear more likely to be affected by climatic variations. As they intrinsically experience very marked dry seasons outside the monsoon one, they are particularly sensitive to any change of the rainfall pattern (shift over time, volume) on which the flow of water taps and monsoon-rain-fed crops are highly dependent. It is worth noting that the issue of climate raised in these low mountains is not about glaciers retreating or the decrease in snow cover but about less abundant and more irregular rains. Here, "the right moment" for rain to come, which is partly how villagers define climate, sums up well what is at stake regarding current climatic variations because it is mainly the modification of the "normal" seasonal pattern that proves to be the greatest problem for farmers.

"It is a fact that people with diverse income sources adapt more easily than those with few sources

In the middle mountains, the villagers interviewed did not complain of a reduced water shortage and have only noticed minor climatic variations, besides inter-annual variability, which has always been high. Agriculture, which is mainly rain-fed, also relies on variations in the rain pattern. However, rain is abundant here and better distributed over the year than in the low mountains; forests on the upper part of the slopes contribute to a good regulation of the hydrologic cycle, and numerous factors enable farmers to limit the risks: the altitudinal zoning of crops, the diversity of production, and now the pluriactivity linked to tourism in particular. Villagers mentioned climatic modifications that may have repercussions on the water resource.

The draft (CKNP VCSDPs 2016) indicate that more than 50% pastures of buffer zone 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 because of flooding and landslides. The facts mentioned by local community 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.

Climate Change in the perspective of Indigenous knowledge: People in CKNP buffer zone valley are well aware of changes that are happening in their climate. The main concern of local community are the climate change adaptations strategies that are required to mitigate the effect of climate changing and very little effort are being made by the communities and stakeholders in adapting these changes. The local community with increased temperatures and prolonged summer has reported change in length of season. Local community has also reported an increase in the frequency of disastrous activities. These higher temperatures may lead to degrading the permafrost layers, causing slope instability, rock falls, landslides and avalanches.

Temperature variability and seasonal shifts: local community has reported gradual increase in temperature 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. Communities reported 19 days'- early start of summer season and equal days decrease in winter. This shows an increasing impact of unpredictability in weather.

Precipitation: Local community reports reduced snowfall and increased rainfall, across the area, 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 53% decline in amount of snow fall over last 30 years. 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.

Drought: Drought is considered as one of the most damaging 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 consequences of climate, shift drought is at continuous increase of 15% 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 determine natural indicators to measure the intensity of drought for local community and evaluate the proper management actions/ interventions to improve preparedness of community for drought.

Flood: Changes in the climate have had an influence on the magnitude and frequency of flooding in GB. With respect to snow and glacier melt, the magnitude of temperature-changes during the spring and summer are sufficient to cause 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 19% 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.

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, 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 (27%) 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.

Factors	Status	Change	Trend			
		(days/ %age)	30 y ago (1989)	10 y ago	Future prediction	
Rain	Increase	Minor Increase	Less rains as compared to present	Decrease	Decrease	
Snow	Decrease	53	More snow as compared to present	Decrease	Decrease	
Temperature	Increase	10	Less as compared to present	Increase	Increase	
Summer season duration	Increase	19	Summer starts early and ends late. Temperature is comparatively high in summer now a day	Increase	Increase	
Winter season duration	Decrease	19	Winter starts late and ends early. Winter is still quite cold any dry	Decrease	Decrease	
Glacier recession	Increase	19	Glaciers were not stable	Increase	Increase	
Land slides	Increase	27	They were not frequent	Decrease	Increase	
Flood frequency	Increase	19	Less flood as compared to present	Increase	Increase	
Flood magnitude	Increase	35	Less magnitude as compared to present	Increase	Increase	

Exhibit 5: Climate change in the perspective of indigenous knowledge

Factors	Status	Change	Trend			
		(days/ %age)	30 y ago (1989)	10 y ago	Future prediction	
Drought	Increase	15	Less drought as compared to present due to less snow	Increase	Increase	
GLOF Frequency	Increase	05	Minor increase in GLOF events	Increase	Increase	

Pastures: Regional climate scenarios for CKNP valleys show prolonged growing seasons and shifts in temperature and precipitation. 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 20 % degradation has been observed. Mid and low land grazing areas have declined 32%. The local community reported possible 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.

Pastures	Status	Change	Trend			Adaptation
		(days/ %age)	30 year ago	10 year ago	Future prediction	local community
Alpine and sub- alpine pastures	Degrading	20	Less degraded as compared to present		More degradation	Build creeks to hold snow and rain water in pastures
Mid and low land grazing	Degrading	32	Less degraded as compared to present		More degradation	

Exhibit 6: Impact of climate change on pastures of CKNP

Agriculture: 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 crops and fruit trees are likely to grow more rapidly due to increased photosynthesis. It is also

influencing insects, disease, and weeds, which in turn decrease agricultural production as currently happening. Aided to these, the additional stress is offered by variable precipitation and irrigation water. Early and rapid snow melting accompanied by irregular rainfall followed by drought decline the productivity of crops. Farmers reported rapid increase in weeds and pests during last 10 years, which show 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 horticultural crops e.g., potatoes, walnut, apricot, mulberry, almonds etc. has been declining in buffer zone valleys and become more sensitive to climate change than other 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.

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 in various CKNP valleys 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:

Rising temperature and CO^2 as a consequence of climate change has impacted the local forest ecosystem of CKNP by providing prolonged growth season which seems to enhance its productivity apparently. However, 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.

The water streams coming 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.

Along with this, warmer spring seasons have 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 the climate change mitigation and adaptation 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.

Wildlife: 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 CKNP valleys, faunal biodiversity, which was once common, is now at decline. Urial that existed in CKNP region, over last 30 years the population has decreased significantly, which refers to migration of species due to either climate change or rapid illegal poaching. 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 organisms were common a long time ago, but now several of the species 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. It is necessary to prioritize the species conservation actions and to monitor the effect of climate change on the small and large animals.

Water: Irrigation remains central for the continued viability of CKNP valleys inhabitants and their settlements, and for the fulfillment of a majority of households' subsistence needs. Gravity-flow hill irrigation system sourcing water from glacial or snow-field melt-water, springs and/or directly from river flows are found in each buffer zone valley. Owing to the recent climate changes, the water availability has been changed. Snow fall has declined up to 53 % and slight increase in rainfall according to the perception of local community. 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.

Tourism: Huge domestic tourism in GB over a couple of year has provided income earning opportunities for many remote communities and it is a valuable prospect for people of CKNP valleys to promote their touristic points and manage proper facilities and services for tourist, which can help them in earning income from tourism. Less earnings in winter tourism are reinforcing economic disparities between the dependent communities and compel them to depend more on the natural resources of area as a mean of their livelihood.

Present scenario of CKNP valleys 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 CKNP valleys customary laws are being practiced almost in all villages but these laws are unable to sustain and address the suitable practices and continuously generating issues, therefore needs an up-gradation.

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.

Biodiversit	Status	Altitudin al Shift	Trend			Adaptatio			
У			30 y ago	10 y ago	Future prediction	n Measures by local communit y			
Agriculture crops and fruit trees	Degradin g	N/A	Pests and crop infections were not frequent Artificial fertilizers were not used	New pest varieties have been reported required	Weeds will become common Irregular precipitatio n patterns will lead to productivit y decline	Increase in cropping area by levelling to enhance productivit y Use of fertilizers has been increased			
Natural Forest	Degradin g	Reported for some non woody vegetation	Forest patches were dense and healthy	Degrading	More degradation	No adaptation yet			
Wildlife									
Ibex	Decreasin g	Increasing	Populatio n was good in number	Less population due to hunting and habitat shrinkage	Population will increase due to the conservatio n efforts	Poaching and Illegal hunting is controlled due to trophy hunting initiatives but it is not the part of customary laws			
Urial	N/A								
Markhor	Decreasin g	Increasing	Populatio n was so	Population was good	Population is	Illegal hunting			

Exhibit 7: Impact of climate change on biodiversity of CKNP

Biodiversit	Status	Altitudin	Trend			Adaptatio
У		al Shift	30 y ago	10 y ago	Future prediction	n Measures by local communit y
			less that it was rarely seen	and is increasing continuousl y	increasing but at low rates than it should be	and poaching have been controlled to ensure the population increase
Birds	Decreasin g		Populatio n and diversity were good	Bird population and diversity was less	Bird population can either decrease due to removal of natural vegetation or it can be expected to increase due to increase in their prey	No adaptation s
Butterflies	Decreasin g		Butterflie s of several types were common	Due to absence of flowering plants butterflies are no more common	They will decrease because of land erosion and shrinking of natural vegetation areas	Not adaptation has been done yet

4. Park legal picture

The Northern area wildlife life preservation Act (1975) has gaps but the updated draft GB wildlife Act is in process and yet to be approved. Forest Act (2019) gives impetus to the efforts for protecting forest, wildlife and medicinal plants in the region and had been framed in view of challenges and demands of the present day and it would meet requirements of the future generation as well. In the revision and updating of CKNP MP, the forest Act and draft wildlife Act have been taken as main legal documents.

The Northern Areas Wildlife Preservation Act of 1975 defines three different categories of Protected Areas: National Park, Game Reserves and Wildlife Sanctuaries.

In the Section 1, point 2 k) the definition of a National Park is a "comparatively large areas of outstanding scenic merit and natural interest with the primary objective of protection and preservation of scenery, flora and fauna in the natural state to which access for public recreation, education and research may be allowed ". The Provincial Government through an official notification (Section 1, point 5) establishes the Protected Area.

For the Park's boundaries the same Section 1, point 5 reports that Provincial Government "may alter the boundaries of such areas from time to time as deemed necessary".

The possibility to enter in a National Park is regulated by Section 1, point 6 through the following rules:

- 1. The Chief Wildlife Warden shall make provisions for members of the public to have access to such part of a National Park where their presence will not conflict with its primary purpose of preserving fauna and flora in their natural state.
- 2. Notwithstanding the provision of sub-section (1) of this Section no person shall enter a National Park without obtaining a ticket at the entry gate in case such an arrangement exists, or the written permission of an authorized officer, and then only subject to such conditions as may be endorsed on that permit.
- 3. For the purpose of this Section and Section 7 (Acts restricted in a National Park) an authorized officer shall mean the Chief Wildlife Warden, the officer for the time being responsible for the administration of the park or, in his absence, any person to whom he may have delegated his powers in writing.

The Section 1, point 7 quotes the acts restricted in a National Park underlining "that no person shall:

- *i.* reside in a National Park
- *ii. carry any fire arm or other hunting weapon in a National Park*
- *iii. hunt, kill or capture, or be found in circumstance showing that it is his intention to hunt, kill or capture any animal in a National Park*

On this topic, it is necessary to underline that in Section 1, the point 23 is related to the defense of life and property, which "shall not be an offence:

- *i.* for any person to kill any animal by any means in the immediate defense of his own life or that of any other person;
- *ii. for the owner of livestock or his employee to kill any animals that is doing damage to that livestock by any means where the livestock is enclosed*".

However, it also provides "that paragraph (i) and (ii) of this Section shall not apply to any

unlawful cultivation in National Park Game Reserve or Wildlife Sanctuary or a Reserved or Protected Forest or to any livestock illegally grazing or herded therein".

- *i. introduce any domestic animal or allow a domestic animal to stray in a national Park. Any domestic animal found in a National Park may be destroyed or seized by, or on the orders of an authorized officer and shall be disposed of in accordance with the instructions of the Chief Wildlife Warden;*
- *ii. cause, any bush or grass fire (except at designated places) or cut, destroy, injure or damage in any way any tree or other vegetation in a National Park.*
- iii. cultivate any land in a National Park,
- iv. pollute any water in or flowing in a National Park;
- v. introduce any exotic animal or plant into a National Park;
- vi. pick any flower or remove any plant, animal, stone or other natural object from a National Park;
- vii. write on, cut, carve or otherwise deface any building, monument, notice board, tree, rock or other object, whether natural or otherwise, in a National Park;
- viii. fail to comply with the lawful orders of an officer while in a National Park,
- *ix. discard any paper, tin, bottle or litter of any sort in a National Park except in a receptacle provided for the purpose.*

The Provincial Government may, for scientific purposes or for the betterment of the park, or in exceptional circumstances, authorize or direct the doing of any Act prohibited by this Section".

In the case of CKNP, the communities shall be allowed to continue their traditional livestock grazing and fuelwood harvesting in the pasture on which they have use rights and customary laws. GB forest act (2019) has been adapted in the revision of CKNP Management Plan and the Park has been redefined as IUCN category II national park with strict protection zone of IUCN category I.a.

These articles have to be considered for the new regulations:

177. Strict Nature Reserves. --- IUCN category I.a

- 1. Government may, by notification in the official Gazette, declare any Forest and adjoining area to be a strict Nature Reserve to protect ecosystems diversity, species diversity, genetic diversity or geodiversity.
- 2. Government may set aside such area and may demarcate it in a prescribed manner.
- 3. Human visitation, use and impacts are strictly controlled and limited for protection of the conservation values.
- 4. Government may allow use of such areas for scientific research and monitoring.

178. Wilderness Areas. --- IUCN category I.b

- 1. Government may, by notification in the official Gazette, declare any Forest and adjoining area of land to protect the long-term ecological integrity of natural areas that are undisturbed by significant human activity, free of modern infrastructure and where natural forces and processes predominate so that the current and future generations have the opportunity to experience such areas.
- 2. Government may set aside such area and may demarcate it in a prescribed manner.
- 3. Government may allow public access at levels and of type, which will maintain the wilderness qualities of the area for present and future generations.
- 4. Government may permit indigenous communities to maintain their traditional wilderness-based lifestyle and customs, living at low density and using the available

resources in ways compatible with the conservation objectives of the wilderness area.

5. Government may allow for low-impact minimally invasive educational and scientific research activities, when such activities cannot be conducted outside the wilderness area.

National Parks. --- IUCN category II

- 1. To protect and preserve scenery, flora, fauna, geological features of special significance and biological diversity in the natural state, Government may, by notification in the official Gazette, declare any Forest and adjoining area to be a National Park and may demarcate it in such a manner as may be prescribed. <u>There is provision to designate various zones inside a national park to be managed under various IUCN management categories.</u>
- 2. Government may manage the National Park area in order to perpetuate, in as natural a state as possible, representative examples of physiographic regions, biotic communities, genetic resources and unimpaired natural processes.
- 3. The area may be managed to maintain viable and ecological functional population and assemblages of native species at densities sufficient to conserve ecosystem integrity and resilience in the long term.
- 4. It may be further managed to contribute in particular to conservation of wideranging species, regional ecological processes and migration routes.
- 5. Government may permit visitor use for inspirational, educational, research, cultural and recreational purposes at a level, which will not cause significant biological or ecological degradation to the natural resources.
- 6. Access to and visitor use of National Park may be subject to such terms and conditions, and such restrictions and such access fee as Government may prescribe from time to time.
- 7. Government may take into account the needs of indigenous people and local communities, including subsistence resource use, and local economy support through tourism as far as these will not adversely affect the primary management objective.
- 8. Provision for access roads to and construction of rest houses, and other buildings in the National Park along with amenities for public may be so made as not to impair the object of the establishment of the National Park and without jeopardizing the physical environment.
- 9. Any access to and facility provided under sub-sections (5), (6), (7) and (8) shall be in conformity with the recommendations of the environmental impact assessment or initial environmental examination within the meaning of Pakistan Environmental Protection Act, 1997 (Act No. XXXIV of 1997 and Gilgit-Baltistan Environmental Protection Act, 2015).
- 10. Government may, for scientific purpose or betterment of the National Park, or for providing incentives and concessions to the communities for participatory management, authorize doing of one or more of the afore-mentioned acts on an explicit written request made by the Chief Conservator Forests, justifying the need for such an action and certifying that it does not impair the object of establishment of the National Park.
5. Planning Phase

5.1. Approach and Goals

The planning process for areas such as the CKNP needs to be developed taking into account several peculiar aspects. In fact, CKNP is characterized by high altitude mountain range, where the ecosystem is fragile and the life of local populations is usually more critical, moreover, their different needs and expectations have to be particularly taken into account.

For this reason, a preliminary analysis of the current situation has been performed and the main considerations are reported here below:

- agriculture and livestock production are the main sources of livelihoods, and in general local communities use natural resources for their subsistence, due to the hard life conditions in CKNP environment. For this reason, it is necessary to evaluate very carefully the direct impact that any proposal for changes, even if sustainable, could produce.
- CKNP natural resource management, by local communities, seems to be more linked to a customary governance system than to the new government laws. Moreover, the big effort to establish the Local Support Organization (LSO) and Valley Conservation Committee (VCC) does not seem to have obtained the expected results to merge these customary laws with government purposes.

These difficulties in achieving the foreseen objectives could be related to a planning process based on a "conservationist approach" and not on a "participatory approach". It is important to highlight that a "participatory approach" aims at involving local communities in the whole process, in order to support their needs in a sustainable way.

The "conservationist approach" for the establishment of Protected Areas, aims at preserving the pristine wilderness, by managing the Protected Areas as "islands", through the prohibition of resource use, and sometimes, through the exclusion of people living within the areas.

The decision to use this approach for CKNP is based on the right will of CKNP communities to be directly involved in the process. Therefore, it is not linked to the failure of the previous "conservationist approach", which was used in different areas, such as the Khunjerab National Park, where the implanting process was stopped due to problems with local communities.

Starting from these considerations, the chosen approach was the participatory one, which delineates a comprehensive management plan that could be immediately applied in different local contexts.

To define the revision of the CKNP Management Plan process the following main issues have been considered.

1. Obtaining reliable basic data for the delineation of the Park and related zoning system

Reliable thematic maps have been produced, representing fundamental tools to delineate Park's and the related zoning system. The following CKNP thematic maps, deriving from satellite images and ground-based data, were developed and used in the planning process:

- Digital Elevation Model and Land Cover Map
- Glacier Cadastre Catchments Division Areas Geological Map
- Landslide Susceptibility Map
- Wildlife Distribution (large mammals, ungulates and carnivores, were chosen as

"umbrella species")

2. Starting with the delineation of Park boundaries and zoning system, considering the sustainable use of natural renewable resources by local communities

The following considerations need to be done:

2.a) while redefining the Park boundaries, it was chosen to not include the following items:

- villages
- roads (only limited access roads, used by locals under CKNP authorization, are included within the Park area)
- mining areas
- main agricultural areas near the villages

These restrictions, considering the field conditions, did not favor the concrete sustainable development of all these different items. Their related activities are a very complex and long-term consuming process, principally due to the different conditions present in the CKNP local communities.

The primary goal of this management plan is to plan a process with high perspectives of being immediately effective and applicable within this local context. For this reason, the chosen approach foresees, at this initial stage, the involvement of different stakeholders. Only in a second phase, the improvement over time of the sustainability process can be achieved.

2.b) with regard to the management indications, the following decisions have been undertaken:

To consider the four main fields of activities, which are using natural renewable resources, and in particular:

- the regulation of visitor flow: to delineate the access and related fees for the different Park zones defined in the planning process.
- the conservation of species and ecosystems: due to the waste area, the steep and mountainous land and the lack of good data for wildlife species in terms of numbers and distribution, at this initial stage large mammals (ungulates and carnivores) have been used as indicators. This because: (i) large mammals may be considered as umbrella species (i.e. a species with large area requirements for which its protection offers protection to other species, which share the same habitat). Management measures, adopted for their conservation, allow the preservation of all the species and the ecosystems present in the large areas, where they need to survive:
- *(ii) trophy hunting programs for some ungulates have an economic importance for the local communities.*
- The sustainable use of the natural renewable resources: the process is focused mainly on three aspects: (i) forestry, (ii) livestock, and (iii) wildlife trophy hunting programs
- The tourism and related waste management: In order to manage in a sustainable way this aspect which is very well developed especially in the Baltoro area, and to promote income for the local communities.

To propose more general indications to move in a sustainable way and in the short-term towards traditional activities in the different Park areas. More specific management tools could be provided for an open discussion with the local communities and stakeholders; this participatory phase would allow to define general strategies, as well as to solve particular local situations.

This achievement is linked to the development of the Buffer zone. The Buffer Zone is generally considered a peripheral area of the Protected Area, but in the case of CKNP was decided to include the Buffer Zone inside the Park boundary.

Exhibit 8: Buffer zone position: A) inside a Protected Area, B) outside the Protected Area



Boundary of conservation/protected area

To define the objective and role of this Buffer Zone that remain inside the Park Boundary, two main positions have been considered:

- 1. the conservationist approach, where the Buffer Zone role is to assure the main possible protection of the Protected Area from any limiting factor coming from outside; so, the tendency is to obtain as much as possible a "continuation" of the Protected area, by enlarging rules and bonds on this part of land too.
- 2. considering the role of the Buffer Zone as an area where the conservation of the natural ecosystem merges with the development of the local communities. This has to be achieved through the sustainable use of natural resources, mainly using the traditional activities in line with this principle.

<u>3. New Buffer Zone Valleys</u>

VCSDPs of 15 CKNP valleys have been one of first initiating points in revising of CKNP MP that include the villages that have use rights inside the boundaries of the Park. Conservation and sustainable development plans dedicated for each valley were produced with proposed interventions for the sustainable use of the resources and to develop the livelihood with a clear message of protection of the environment. At the same time, some of these valleys have been declared CCHAs for Trophy Hunting and it is important to consider that a Management System for the wildlife inside the Park pass through the communities that live around the protected area. The output of this activity is really interesting and one of the main issues was that they would like to be more involved in the Park management to increase the benefits that they could receive for example including Eco-Tourism opportunities for the accommodation of the huge number of domestic tourist that are arriving in the last year in the area.

It is now necessary to include the Valleys into the MP also considering that these valleys and villages are members of the Park. The solution proposed is to extend the actual Buffer Zone that is inside the boundaries of the Park (as explained before), with a new zone called Buffer Zone Valleys that include these 15 valleys that have use rights inside the park, with specific regulations that will be defined in the chapter 7.

The Buffer Zone Valley Plans incorporate:

- Mitigation and adaptation to the climate change effects
- Community mobilization and awareness
- Interventions plan for infrastructure: access roads, water channels for irrigation, etc.
- sub offices, information desks, trails maintenance and foot bridges, watch towers
- Promotion of ecotourism

5.2. Planning Process Description

After 5 years since CKNP MP approved and keeping the same management planning process system, the document is set to be revised and updated considering the new emerging issues and trends.

The planning process is a circular flow of activities composed by three main steps:

- Preparation of the Management Plan
- Implementation of the Management Plan
- Monitoring and review of the Management Plan



Starting from the consultative approach and the related indications described above, the management plan process was planned in the following 4 steps.

STEP ONE – Planning

Description

1.1. Planning team

During this step, a coordination board including a technical staff (national and international research experts) and an institutional part (Park Directorate) composed the team.

1.2. Preliminary values and objectives for the CKNP of the next five years.

- long term conservation of the environmental and cultural features: the planning indications have to act in order to preserve these heritages for the future generations;
- re-establishment of the CKNP biophysical integrity and definition of land use parameters: in nature exists a natural dynamic balance, to respond to the pressure of different factors (including human activities). The objective of the planning process is to act on the limiting

factors, restoring this process and the CKNP integrity also through the definition of land use parameters;

- guaranteeing to the National Park the necessary tools to reach its achievements: it is essential to assure to the Park the necessary tools, staff, equipment, structures and related fund to accomplish its institutional activities and role.
- support the traditional and sustainable use of natural resources, historic and cultural heritage: the planning process has to define an appropriate regulation to achieve this goal, also considering the basis of customary use-rights;
- promotion of economic and social well-being of CKNP local communities living in the Buffer Zone Valleys: Park activities have to consider the promotion of sustainable activities supporting the needs of local communities;
- development of sustainable tourism and recreational development of the area: at local, national and international level, following the standard of the sustainable use for protected areas, with direct benefit for local communities.
- Promoting Eco-Tourism opportunities
- 1.3. Collection of background information

Collections of all the relevant available data - both published from different organizations and institutions, and not published but present only as internal reports (grey data) were conducted.

Starting from the analysis of the different data collected, it appears necessary to improve the knowledge of some specific topics:

Climate change effects, mitigation and adaptation

- resource management and protection (focus on biological, ecosystemic and physical resources of the area);
- human use (focus on aspects of use by people including traditional use, tourism, recreation etc.)
- administration (focus on operational, manpower and financial resources required for a protected area).
- *legislative aspects (focus on the development of Park rule and regulations)*

STEP TWO – Implementation

Description

The activities are focused on the promotion of a social, economic and environmental development of the area, including the implementation and the management of the Central Karakuram National Park and the enhancement of the local communities and institutions capacities to face climate change.

Field investigations were carried out through a strong relationship between the different "vertical" and "horizontal" research activities developed in the area.

All the different collected data were geo-referenced in order to produce digital maps. This assures to produce reliable boundaries for the Park and the related zone system on the basis of the "hot spot areas" (e.g. sensitive or critical areas) individuated with this approach.

During the field work, meetings with representatives of Institutions, involved NGO's and local communities were also held, to explain the research management objectives and related results as well as to better understand the field results and to receive a specific feedback to re-calibrate

the approach if necessary.

- Assess limitations and assets (environmental, economic, political, administrative, legal etc.).
- Review the regional inter-relationships (review effects of the protected areas on the region and effects of developments in the region on the protected area).
- *Reviewing boundaries of the area and dividing the area into management zones (e.g. zones for intensive tourism development, controlled resources, production zones, full protection zones).*
- Designing management programmes and Operational Plan on different aspects.

STEP THREE - Evaluation and consultation of the Management Plan for CKNP

Description

- Distribution of the zero-draft document to all the relevant stakeholders and local communities.
- Analysis, evaluation of the document, sharing of the document with representatives of Institutions, stakeholders and discussion on the management suggestions with local communities.
- All the relevant indications and suggestions received will be considered.
- Improvement of the data with the possibility of activating further researches to fill the gaps of missing data.
- Preparation of the 1st draft document on the basis of: institutional and local feedbacks, improved data, possible redrawing of some aspects border delineation, zoning system and related management indications
- Preparation of the final draft
- Submission of the final document to the competent Authorities for official approval.

STEP FOUR - Monitoring and Revising

Description

It is important to underline that all the different components of one Park are under dynamic pressure. Thus, they would be expected to change with time; in the same way, the management techniques need to be updated in relation to know-how improvements and changes.

Starting from these remarks, any Management Plan has to be considered with a limited life span. After this period, it has to be submitted to periodic monitoring revisions. With regard to the CKNP Management Plan, initially it was suggested to reduce the revision process to three years, compared to the five years usually considered for such programs. During the Operational Plan development, the need of activating several interventions has been highlighted, thus a period of five years is considered more opportune for the Operational Plan Implementation, it being understood that in this period the validity of the border and zoning system, as well as the related management indications, will be monitored. The possible redrawing of some parts has to be considered.

The monitoring and revising process foresees:

• the realization of the interventions as described in the Operational Plan, which also comprises specific researches and analysis to improve missing data; further activities could be added as deemed opportune in order to solve specific needs. Specific indicators,

described in the Operational Plan, will be used to monitor the objectives achievement.

• the development of a Monitoring Plan, with the aim of considering, through specific indicators, the results related to the conservation achieved within the Park, and the improvements in livelihood and socio-economic conditions of the local communities.

Output

The output of this step will be the amended version of the Management Plan of the Central Karakuram National Park.

Timing

The drawing of future Amended versions should be done following the participatory approach with relevant stakeholders and local communities.

The Management Plan for CKNP developed by Ev-K2-CNR contains a broad strategic approach designed to guide the long-term management of the National Park. It is aimed at all those with responsibilities or influence over the area.

6. Management Planning

National Parks, all over Pakistan, are being created under the Wildlife Protection Rules of mid 1970s and thus have common objectives that revolve around the protection of species, and their habitats, especially those that have global significance, and are endangered. By definition and concept, National Parks should have a core zones where nature is allowed to stay undisturbed and the buffer zones where certain activities are allowed with the condition that these would not affect the natural health of the National Park. They also encourage research for the generation of knowledge about the respective national parks that is used to address management issues and allow for recreational facilities that are closely linked to creating awareness and generating support for the conservation of park resources. There is also a long list of activities, not allowed in a national Park. These are detailed in the plan for the CKNP.

Having said the above, all sites in Pakistan where National Parks are, and being established now have already remained under some kind of traditional uses and have allowed certain rights and concessions to the local population for a very long period. With the increase in population, especially of people living in or around ecologically important areas. Their demand over such areas for various commodities, especially fodder for the livestock, agricultural land to grow different crops, activities that may give cash income, fuel wood and timber also was increased with subsequent increase in pressures on natural resources with consequent degradation to various levels. By the time, need emerged to preserve a part of the landscape in the form of protected areas, the damage had already being done, posing challenges for managers of natural resources for coping with such pressures in a way that control the process of degradation and ultimately put it back on track to rehabilitation. This is a complicated task and requires tremendous capacities and skills on part of the manager to accomplish without creating conflicting situations. Conflicts certainly arise in situations where the local community have no other option for their socio-economic survival than to adhere to their traditional uses while the park administration want them to quit largely or completely, as per rule of the park. Certain National Parks in Pakistan and in the region are still struggling on how to strike a balance between the two?

CKNP is not different; it has people, it has resources, it has conflicting issues, however, it has still areas that are largely natural in looks and characters and which could be saved of the possible degradation if managed right from now. It has forests and pastures that though support a large number of people for their survival, could still be saved from serious damages if managed under appropriate management system.

With the above situation in view, and in order to address the various threats that the CKNP and its resources are facing, the management plan suggests to be working around specific objectives. The Operational Plan shall also contribute to the objectives of the management plan that are rephrased as under:

- a) Protect Biodiversity for the healthy functioning of the natural ecosystems of the park.
- b) Promote practices that ensure the sustainable uses of the park's and valley's resources and are essential for livelihood security of the local communities
- c) Find out the adaptation strategy to mitigate the Climate change effects
- d) Regulate tourism to minimize negative impacts on natural landscape and promote support

for the park

- e) Promote eco-tourism in the valleys surrounding the Park
- *f) Promote scientific research to monitor and document climate change (for needful adaptations); and to provide basis for management decisions*
- g) Build capacities of stakeholders in traits that contribute to sustainable management and conservation of the park resources
- *h) Promote awareness about the park and its resources and need for their conservation* (*Develop and implement an effective awareness and communication strategy*)
- *i)* Develop and implement a monitoring system for the plan implementation that could be used as a tool for needful corrections/improvement

Basis of Management Planning for CKNP

In order to address the various threats being faced by the CKNP, and achieve the objectives of the park and the management plan, the operational plan has suggested various management prescriptions and interventions that are based on the following ground realities/ guiding principles/ considerations:

- a) The park's natural resources, biodiversity in particular, are providing livelihood security and are accepted for protection by the Government of Pakistan under CBD. In CKNP, these are facing problems due to various anthropogenic pressures that have to be relieved through all possible means.
- b) The plan realizes that management of a National Park is not effective if it doesn't have clear boundaries and measures are not taken for such boundaries to be known to the users and are respected by them
- c) Realizing the fact that the people of CKNP have traditional rights of uses over the park's resources in certain areas. The plan accepts such rights to avoid growth in poverty and conflicts of various natures; nevertheless, it is rather essential that such uses are sustainable and doesn't cause problems to the natural health of the mountain ecosystem in the near or distant future.
- d) The park is spread over a vast area; big enough to be managed by the park administration alone. No strategy for effective management shall work until the local people are part of it and cooperate in implementing it. People are thus being accepted as part of the park planning and management. CKNP-CMC established need to be functional.
- e) The park has different ecological status in its different parts; some are comparatively least disturbed while others are degraded to various levels. There are others that either have biological assets worth protecting from all external influences, or can sustain certain economic uses. There are wild animals such as snow leopard and lynx that roam around both the intact and degraded habitats while others, such as musk deer, ibex, markhor etc. that are restricted to particular habitats. Since management requirement for different areas in the context of their ecology are different, the park has to be divided in various management zones, though with the common objective to bring a balance between consumption and production.
- *f)* The people may be willing to provide all needful support to the park and its resources; however, they may hardly do it with the required level of commitment if they do not see any

benefit for them in it

- *g)* The plan identifies different conflicting interests between people and park resources as a major reason behind the processes that lead to degradation and suggests these to be properly managed to protect rather precious park resources.
- *h)* The local mountain society is wise and has a treasure of indigenous knowledge that could be of enormous advantage to the park management, provided explored and utilized properly. However, in order to contribute their share of knowledge and skills for the management of CKNP, there need to be enough incentives for the community to compensate them for their efforts and motivate them to continue for their role in the future also.
- *i)* The social interactions with local community reveal that capacity building is basic for community to secure not only their livelihood options, but to participate in activities that are closely linked to the sustainability of the park and its resources
- *j)* There are economic activities like mining in the vicinity of the park. In order to avoid potential conflicts, the plan has kept mines and mining outside the borders of the park, nevertheless, such activities have negative impacts on the natural ecosystems, influencing the park and its resources also. Though outside the park boundaries, the mining enterprises may better contribute to the rehabilitation processes and other costs that are required to manage the park and its resources
- *k)* The park has qualified staff but less in number and not adequately trained in the required disciplines to tackle the complex socio-ecological issues of the CKNP rather professionally. This has to be improved upon through trainings and other capacity building measures.
- The plan recognizes that even when qualified and trained staff is available to the park; it still does needs research support to undertake crucial management decisions and monitor its subsequent impacts for needful corrections. Promotion of research and generation of knowledge may have to be part of park management throughout.
- m) Research baseline is fundamental to sound planning; however, not all issues in a park, especially of recent origin like the CKNP, may wait for the availability of research findings to address these. Until more reliable research findings are available, the plan accepts the preliminary research findings, observations of expert, indigenous knowledge of people, experience of relevant organizations and experience of park staff as good base for initial management planning and short-term implementation.
- n) Since some of the issues are fundamental to addressing the management needs of a national park, these must be implemented right away if needful resources are available/could be arranged. Accordingly, while the planning process continues, a part of the plan may still be implemented. The practice will not only yield lessons to be used in the future planning and implementation of the park but shall give firsthand experience to implementing partners and keep them motivated.
- *o)* The negative impacts of climate change are showing up. The management plan and its short-term implementation phase may search ways for needful adaptations if the impacts were noticed for being prominent or potentially harmful for the people's livelihood security or long-term survival of the biodiversity of the park.
- *p)* While realizing the benefits of trophy hunting for the people of the buffer zone, the planning document and its operational plan do urge to protect Biodiversity in total and not only the components that yield immediate financial benefit

- *q)* While the planning document needs to be elaborated and supported by scientific explanation and rationale for each intervention, many ideas and findings may be readily implemented. Delays in addressing some of the issues with doable actions may make the issues rather chronic and difficult to resolve at later stages. Accordingly, the implementation process must also start along with the management planning process.
- r) While the bigger document may still continue with obtaining lessons from the past and findings of research studies for it to be finalized, there are findings that are available for immediate implementation. Such implementation may help further in the identification of more critical management issues that have to be addressed through elaborated scientific research in the future.
- s) Research institutions are functional and reputed only when engaged in solving management issues in the field. This in turn needs support from the Field Managers to help identify issues and be facilitated to find a solution for. There is thus a need for closer collaboration and coordination between researchers and managers to address issues of mutual interest.
- t) The presence of Military in the national park is a blessing when they are aware of the values of the park and its resources and are committed for their protection; but definitely a source of problems, if not. The plan recognizes their role rather important and identifies them as an importance audience for the park's awareness and communication programme.
- *u)* Tourists are a blessing when managed but a disguise when not regulated. The plan has accepted these as a blessing for the park and a source of income and social motivation for its people
- v) Creation of awareness amongst the key stakeholders is an effective tool to generate interest for the park and conservation of its resources. The plan attaches greater importance to an activity that is based on the delivery of messages through various means, developed in turn on the basis of threats to the park.
- w) A sustainable financial mechanism is critical to sustain the fragile park resources as back bone to the livelihood security of dependent community. Accordingly, the management has to seeks different strategies including the generation of money from activities being taking place inside the park boundaries such as trophy hunting or along the boundaries of the park with impacts on the park and its resources such as mining; development of microenterprises, mountain marketing, cooperation of stakeholders and of available and potential donors to make the financial base of the park rather self-sustaining, both in the short and long run

Management Goals

With the overarching long-term management goal of "Reduction in gap between the production capacities of natural resources and the current Consumption trends" of the management plan, the operational plan tends to contribute significantly to the following management goals:

a) Verify the park boundaries, and the boundaries of different management zones for users to be clear on the sanctity levels of different parts of the park Enhance the acceptability of CKNP as a National Park for local community by adapting to a zoning system and undertaking actions that are most suitable under a particular set of conditions in different management zones

- b) Analyze the climate change effects and propose a local adaptation
- c) Establish the tradition of working through joint wisdom for the management of park resources in general and conflicting issues in particular
- *d) Initiate the process of supporting research as basis of management and the management issues as basis of scientific research*
- e) Regulate tourism and other economic activities to the benefit of park resources and its community
- *f)* Improve the Eco Tourism activities in the Buffer Zone Valleys
- g) Review the status of indigenous knowledge in the context of resource utilization and coping with the negative influences of climate change.
- *h)* Introduce and demonstrate awareness and enhanced interest of stakeholders as an effective tool for the conservation of park resources
- *i)* Assess the feasibility and benefits of adopting to a landscape management approach through the creation of a larger protected area. Such as Biosphere Reserve, by combining all protected areas in the Himalayan-Karakoram range of GB, and when possible, across the borders, and bringing these under a common management regime in the interest of a larger population and conservation of diverse ecosystems.
- *j)* Create and support Connectivity areas with other national parks and PAs.

7. Park Boundaries and Zoning System

7.1. Classification of CKNP

The IUCN criteria are one of the mostly used classifications at worldwide level; it categorizes the Protected Areas in six different categories according to their management objectives and without considering their institutional definition, as reported in the following table (Dudley, 2008):

IUCN Category	Description
Category I	Protected area managed mainly for science or wilderness protection I(a) Strict Nature Reserves, and I(b) Wilderness Areas. Core Zone
Category II	Protected area managed mainly for ecosystem protection and recreation (National Park).
Category III	Protected area managed mainly for conservation of specific natural features (Natural Monument).
Category IV	Protected area managed mainly for conservation through management intervention.
Category V	Protected area managed mainly for landscape/seascape conservation and recreation (Protected Landscape/Seascape).
Category VI	Protected area managed mainly for the sustainable use of natural ecosystems (Managed Resource Protected Area). Buffer Zone

Exhibit 9: IUCN classification for Protected Area

Considering a classification **CKNP has to be considered as a Category II national park** following the below description by IUCN:

Protected areas are large natural or near natural areas set aside to protect large scale ecological processes, along with the complement of species and ecosystems characteristic of the area, which also provide a foundation for environmentally and culturally compatible spiritual, scientific, educational, recreational and visitor opportunities (Dudley, 2008).

This is particularly true considering the primary goal as well as the other objectives considered for Category II Protected Area.

<u>Primary objective</u>: to protect natural biodiversity along with its underlying ecological structure and supporting environmental processes, and to promote education and recreation **Other objectives**:

- To manage the area in order to perpetuate, in as natural a state as possible, representative examples of physiographic regions, biotic communities, genetic resources and unimpaired natural processes;
- To maintain viable and ecologically functional populations and assemblages of native species at densities sufficient to conserve ecosystem integrity and resilience in the long

term;

- To contribute in particular to conservation of wide-ranging species, regional ecological processes and migration routes;
- To manage visitors, use for inspirational, educational, cultural and recreational purposes at a level which will not cause significant biological or ecological degradation to the natural resources;
- To take into account the needs of indigenous people and local communities, including subsistence resource use, in so far as these will not adversely affect the primary management objective;
- To contribute to local economies through tourism.

Zoning system applied to the CKNP comprises **Buffer Zone and Buffer Zone Valleys**, the area characterized by a renewable use of natural resources; **Category VI** could be considered for its management, following the below description by IUCN:

Protected areas conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in a natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area (Dudley, 2008).

As mining cannot be considered a renewable activity, mining areas have been placed outside the CKNP border; even if some mining areas lay near or along the external border of the proposed Buffer Zone, this does not prevent to insert the CKNP within IUCN Category II, as it was also suggested by WWF (2008) and to locate the Buffer Zone within category VI.

As described before, one of the main topics considered in this proposal for the delineation of the CKNP's planning process is the possibility to obtain a solution able to be immediately applicable in the context of the local situation.

So, on the basis of the preliminary meetings held with the 15 Buffer Zone Valleys communities, the following proposals have been submitted with the aim to preserve the unique and fragile ecosystem of the Park and in the meantime to promote the local community's needs, considering their hard life conditions.

For the **Buffer Zone Valleys**, again IUCN **Category VI** is the guideline for the indications and regulations.

A preliminary introductive paragraph is focused on **the system of fees** and deposit that was developed to support the Park's management activities and the local communities; this system is explained in details in Chapter 8.

In the following parts for every area and sector of the zoning system developed for CKNP, structure and management indications for the main four fields of intervention, individuated (Regulating the flow of visitors, conserving species and ecosystem, Sustainable use of the natural renewable resources, Tourism and related waste management) are suggested.

In order to facilitate the maintenance of Central Karakuram National Park ecological integrity while, at the same time, providing sustainable management opportunities for local communities and visitors, a zoning system has been implemented, that include two kinds of Buffer Zone: one inside the Park Boundaries, the other comprehensive of the 15 valleys that has use rights inside the Park.

This consists of two main zones, the Buffer Zone and the Core Zone, for 10,549.4 Km², as per below table:

	SURFACE
CORE ZONE	7,588.4 Km ²
BUFFER ZONE	2,961.0 Km ²
TOTAL	10,549.4 Km ²
BUFFER ZONE VALLEYS	1,494.5 Km ²
TOTAL	12,043.9 Km ²





7.2. Zoning System and Management Indications



Exhibit 11: CKNP zoning map

Zoning Rules

The park zonation in the previous MP (2014) shall remain valid with extension of Buffer Zone till Paju and introducing a new zone based on VCSDPs named as Buffer Zone Valleys

Buffer zone valleys includes 15 valleys that are individuated with the villages that have use right inside the boundary of the Park, and are the key representatives of the CMC which is yet to be operational.

In this zone main prominence is given to the eco-tourism activities and adaptation to climate change effects; at the same time is necessary to address the community share of 75% from collected fee for interventions in infrastructure, water channels, plantations, incentives and interventions for subsistence mountain agriculture, agro forestry and so on.

7.2.1. Core Zone (CZ)

The proposed Core Zone is the most relevant part of the CKNP, and it is about **7.588.4 km²**. This area is dedicated to the long-term conservation of the relevant species and ecosystems of the area.

This area is impressive both for the flora and fauna that inhabit this steep land, as well as for

the landscape that includes a relevant number of high peaks, many of them over 7.000m, and glaciers covering about the 38% of the whole Park surface.

Inside the Core Zone area, different management systems have been developed in order to address to the various needs of different Core Zone locations. Even though conservation is the main objective for the whole area, there are some areas called *Strictly Conservation Areas*, where the protection level is more severe, in order to assure the highest level of conservation for the ecosystems and/or for the threatened species of flora and fauna.

At the same way a net of famous trails, which starts from the Buffer Zone and continues for the most part of its length inside the Core Zone, attracts mountaineers and trekkers at worldwide level. This net is developed through a sustainable approach considering the level of frequentation (*Visitors Intensive Use Trails, Discovery Trails, Occasional Trails, Cultural Trails*) with the aim of reducing the impact and maximizing the benefits of local communities.

The description of each of these different areas of the Core Zone and related management indications are described in the following chapters.

To preserve the Core Zone the following indications are proposed:

Regulating the Flow of Visitors and Related Waste Management

The people are usually entering this area mainly for touristic purposes and so they are moving along the net of trails. They are attracted by the wilderness of the area and the beauty of landscapes, as well as by the trekking and climbing opportunities offered by this famous area. For the management indications proposed for each of these circuits we refer to the specific paragraph where they are explained

In order to preserve over the long-term, the unique and fragile ecosystem of the Core Zone, tourists can circulate without the CKNP Directorate authorization, only within the following tourism circuits within the Core Zone. This authorization is needed only for the areas outside these tourism circuits, for the visitors entering the Core Zone for research and study purposes. However, the people from local communities and from Gilgit- Baltistan do not need this authorization.

The priority for the release of these authorizations is for researches promoted by the Park. However, it is important to underline that it is not possible to conduct research activities in all the Park area without a preliminary written permission by the Park Directorate.

Authorized foreigner visitors and researchers have to pay the CKNP fee before entering, as the tourists. However, the CKNP Directorate should not charge them, if they carry out researches promoted by the CKNP.

As indicated before the tourism and related waste management is considered only in a part of the Core Zone where there is a net of trails that are divided in three groups on the basis of their frequentation: *Intensive Visitor Use Trails, Discovery Trails, Occasional Trails and Cultural trails.* The management indication suggested are reported in the following Thematic Management Guidelines – The Tourism Sector.

In the Core Zone the Pakistan Rules for National Parks are applied, and to entry and stay outside these three touristic sectors preventive authorization by the Park is needed, except for the

people of local communities and from Gilgit-Baltistan.

For all the visitors the following basic indication are suggested:

- *it is possible to move in the area only by feet and along marked trails, not using any motorized system*
- *no pack animals (horses, mules and donkeys) could be used for transportation, with the exception of the Intensive Visitor Use Zone;*
- use of kerosene and butane gas for cooking in the designated areas is considered, not lighting up fires to cook or to burn waste
- avoiding the use of nylon bags and bottles, or glasses bottles and boxes
- waste has to be collected and transported to nearest campsite or out to the CKNP

Conserving Species and Ecosystems of Fauna and Flora

General approach

The understanding of ecological and conservational principles, as well as reliable ecological data, are fundamental requirements for successful conservation and management actions. Information on size and distribution of any wild species are important to assess their status (*i.e.* declining, stable, increasing), in this way the strategy for their conservation could be properly addressed.

This approach is particularly important for protected areas, like the Central Karakuram National Park, where several species are present and subjected to different kind of authorized hunting. In fact, trophy-hunting program could affect "threatened" species. Furthermore, an understanding of ecological and conservational principles, as well as reliable ecological data, are necessary requirements for a successful zoning.

Management programs, incorporating sustainable use of resources, are planned to

- *i.* reduce conflicts between conservation and development,
- *ii. create long-term income sources from habitats which otherwise may have no economic value and may be altered to pursue other forms of revenue,*
- *iii. create economic incentives to restore habitats degraded through unsustainable uses, presence of feral animals or noxious weeds*
- iv. discourage illegal trade in flora and fauna,
- v. provide economic and employment opportunities, particularly to indigenous people
- vi. increase the knowledge of species and ecosystems,
- vii. identify and quantify the response of flora and fauna species to use, which may help assess conservation risks of negative trends.

One of the priorities is to have more information regarding the flora and fauna of the CKNP, not only implementing the checklists, but also trying to obtain data on distribution and relative density; obviously considering the Park size and the terrain characteristics this process needs a big effort and it is time and money consuming. As described above, the large mammals, as umbrella species, were monitored to develop the zone system and to give reliable management indications. Therefore, it is suggested to maintain a routinely and standardized monitoring of the large mammals, collecting also all the available information on the other species inhabiting CKNP, as, for example, birds or some species of flora.

It is necessary to implement this monitoring program focusing on other groups like small mammals' birds, reptile, amphibians, and fishes

- Insects
- floral species vegetation
- *medicinal plants*

From these data, it will be possible to develop valid management strategies aimed at the conservation of the different species.

For their activation it is suggested to start from some sectors of the Park as Strictly Conservation Areas and Conservation Areas, also if the Buffer Zone and the areas open to the public in the Core Zone could be interesting one also to better understand the potential impact of human activities on the different groups.

<u>*Priority rank*</u> High for the development of the monitoring plan for the different groups.

High for the realization of the program but related to the operative possibilities.

Fauna

Monitoring of large mammals' species: Ungulates and Carnivores

Following the management approach described above, data on fauna are fundamental for the management purposes of a National Park they have to be collected in all the different areas of the CKNP for all the species. Anyhow, due to the impediments highlighted above, it is suggested to concentrate mainly on large mammals both for their role as umbrella species as well as for the economic values of the ungulates for trophy hunting.

The assessment will be made combining two techniques:

1. Direct counts, through one of the following two alternatives:

- a) observation from vantage points, carried out twice a year (see below), in Strictly Conservation Areas, in Conservation Areas, in Community Controlled Hunting Areas, and in almost 1 or 2 sub-valleys of each catchments of CKNP (see Catchments Division Areas map)
- b) surveys along standardized trails, carried out monthly by Park game inspector, game watchers, in Strictly Conservation Areas, in Conservation Areas and in Community Controlled Hunting Areas.

2. DNA analysis for large carnivores. Reliable counts of carnivores may be carried out only through DNA analyses, from scats, collected along fixed itineraries, with a standardized approach, and analyzed genetically (to assess the species, the individual and the sex). Thus, minimum number of the population may be obtained, as well as some information on distribution

Following this standardized methodology that was agreed with CKNP and WWF:

1a) observation form vintage points

A good planning is unavoidable to obtain reliable wildlife surveys, and then reliable data. Therefore, an effective organization of wildlife surveys (where to go, how many people and how many teams) will have to be planned, following the organization of previous surveys. Participants should be organized in groups of 1 to 3, over different vantage points, and for each valley, the number of people involved will be function of the size of the area to be surveyed.

Wildlife surveys require reliable replications, to be effective. A reliable replication means:

- i. the same people involved (only if the same people are involved it will be easy to find out the same vantage points used in the past) – it is important that at least *1 person for each* group (team defined as "all the people involved in the wildlife survey"; group defined as "part of the team attending specific areas of the selected valley") is the same than in the previous survey;
- ii. same number of people (if reliable surveys were carried out in the past, the number of people involved should not be changed, least of all decreased),
- *iii. same areas (the same areas have to be surveyed each time, in order to obtain comparable data; the number of surveyed areas may increase, never decrease).*

The following items will be required during the wildlife survey: camera, binoculars, spotting scope, altimeter, compass, data sheet, GPS, tents, sleeping bags, food items, map of the area.

- 1. Surveys will be normally carried out twice a year, on <u>May and December (approximately)</u>. When access is difficult in spring, surveys will be carried out only in autumn.
- 2. Surveys will be carried out <u>early in the morning and/or late in the afternoon because most</u> ungulates, i.e. Ibex and Markhor, are active and graze during these parts of the day and can be easily sighted.
- 3. Vantage points will be established taking GPS references (WGS84-UTM system; dd mm ss). Binoculars and spotting scope will be used to scan wildlife in the area.
- 4. Direct counts will be used to determine wildlife numbers. The herds seen will be further classified into different <u>age</u> and <u>sex</u> classes (males, females, yearling, kids and undetermined individuals, total; among males, a separate count on trophy size individuals will be made). In autumn counts, the number of kids will be a very useful population parameter to assess reproductive rate.
- 5. For all wildlife monitoring surveys, the same vantage points, established during the first field survey, will be used. It is strongly suggested to involve the same people.
- 6. While using the same vantage points each year, if a certain pasture in one year has an ibex population/herd and, in the next survey season, no ibex herd is seen in the same pasture, from the same vantage points (VP), the survey team should note down that VP and pasture, should not ignore that but we should write real zero in that place. This will show that the same pasture has been visited in consecutive years. This information will help to analyze data, e.g. the impact of different variables on the ibex population etc.
- 7. For each observation, also the distance (roughly estimated) and the angle to the North (using the compass) will be useful to locate the herd.

2a) surveys along standardized trails

Park wardens will be monthly visiting each valley and sub-valley (previously selected by CKNP Directorate, jointly with a mammal expert), always in the same sequence; monthly counts of ibex will be carried out using the CKNP format and the location of each sighting will be geo-referenced through GPS. For each direct observation, number of individuals and group

structure will be also noted down. Game watcher will be also collecting data on winter mortality of wild ungulates, on the basis of carcasses found in the following spring season, using the CKNP data format.

3a) DNA analysis

This very costly and time-consuming activity needs to be supervised by very experienced people to give reliable results to be used for management purposes. Any information collected without any standardized approach and/or clear monitoring scheme will give useless results (without considering its high costs). Therefore, it is suggested to collect this kind of data only under a reliable supervision to plan data collection and availability of money to conduct the necessary genetic analyses.

Wildlife distribution mapping

Annual wildlife surveys and census data along with GIS information use to develop wildlife distribution maps. Dedicated maps of each year could be basis of the analysis for the movement of different wildlife species and all this information must be properly stored in the dedicated web portal developed by Ev-K2-CNR and shall be managed by Department of Parks and Wildlife.

Priority rank High

Forest and vegetation

CKNP Core Zone borders are located at an average altitude of 4500 meters avoiding, therefore, the majority of the forested areas that are concentrated in the Buffer Zone. In the few locations where scattered trees are present, we suggest to preserve those individuals by concentrating all the human activities (firewood collection & timber harvesting) in the Buffer Zone. The measure adopted for the Core Zone seems to be adequate to assure a natural regeneration of these components.

Sustainable Use of the Natural Renewable Resources

In general, no use of natural resources is considered in this area, but in some areas, the presence of some yak and yak-cattle hybrids could be possible, due to the traditional system, especially for the yak, to leave these animals free ranging. The presence of about 2.000 heads is estimated in the Park Core Zone

Livestock and pastures

Following the traditional breeding system, the yaks, zo and other yak-cattle hybrids are left free to roam and to utilize the natural vegetation, due to their capacity to forage all year round. When the summer seasons come, the yaks and hybrids are moved towards the high pastures following the availability of vegetation; when autumn comes, they move back to the lower elevations near the villages. This system avoids the need to use the fodder, which is preserved for winter time, and at the same time they are kept away from the crops, avoiding any damage. Due to this tradition, there are an estimated number of about 2.000 free ranging cattle moving in to the Core Zone for some parts of the year.

Regarding this presence a potential trophic and spatial competition is possible, but usually yaks and yak-cattle hybrids, unlike sheep and mainly goats, are not able to use the rocky and steeper

terrain, which represent the most suitable habitat used by wild mountain ungulates.

Concerning the sanitary aspects there are 35 "cattle" diseases (yak and hybrids are included) in the OIE list 2012 (http://www.oie.int/animal-health-in-the-world/oie-listed-diseases-2012/). Out of these, 14 affects exclusively "cattle", whereas 21 are multiple species diseases. "Cattle" are reservoir or co-reservoir of 8 of the last ones, and the spill-over transmission from "cattle" to sheep and goats (hence possibly to sympatric wild ruminants) is documented for 6, namely Blue Tongue, Brucellosis by *Brucella abortus*, Foot & Mouth Disease, Paratuberculosis, Q Fever and Rinderpest (currently eradicated worldwide); however, severe effects on wild ruminants in form of high morbidity and mortality, are known only for Foot & Mouth Disease (Thomson et al., 2003). Impact of this viral disease on livestock trade and economy justifies nationally and internationally funded eradication campaigns, whose organization and implementation are beyond the competences and budgetary possibilities of any conservation area. In the specific case of semi-domestic yaks roaming in the Core Area of CKNP, a vaccination policy against Foot & Mouth Disease supported by the Park would be pointless in the absence of intensive vaccination and eventually test-and-slaughter policies of all "cattle", sheep and goats within the Buffer Area and, in general, within Gilgit-Baltistan.

Summary of the Indications for the Management of the CKNP Core Zone

In the Core Zone, the National Park's regulation is in force but in the following chart the main management indication proposed are summarized.

CORE ZONE		
Entrance	The entrance in the core zone is not allowed, excluding the net of trails at different frequency of use and where the tourism is allowed (Visitors Intensive Use Trails, Discovery Trails, Occasional Trails, Cultural Trails, but not for people of local communities: for them is allowed to enter.	
	For entering the Core Zone, outside from the Indicated Visitors Trails, a specific authorization released by CKNP Directorate is required for visitors.	
	Also, the entrance for research purposes has to be authorized by the CKNP Directorate	
Fees and duties	There are no fees for people of local communities; the other visitors have to request a special permit if they want to move in the Core Zone area outside the net of trails under CKNP Directorate responsibility.	
	Authorized researches can be exempted from paying the Entry fee, the Waste Management Fee and Garbage Deposit by the CKNP Directorate.	
Transfer and stay	The entrance and stay in the Core Zone - outside the three trail nets and the Strictly Conservation Areas - are subject to the indications reported in the previous sections (Entrance; Fee and duties).	
inside the area	In Core Zone all the local community people, authorized visitors (Pakistani and foreign people) and researches have to follow these indications, if not expressly authorized in different ways by CKNP Directorate:	
	• to proceed by feet (no motorized way) and along marked trails	
	• no pack animals (horses, mules and donkeys) could be used for transportation purposes	
	• use of kerosene and butane gas for cooking in the designated areas is considered, not lighting up fires to cook or to burn waste	
Hunting	not allowed	
Game bird hunting	not allowed	

CORE ZONE		
Fishing	not allowed	
Presence of livestock	not allowed	
Presence of pack animals (horses, mules and donkeys)	Generally, not allowed. It is allowed only in the: Visitors Intensive Use Zone	
Presence of dogs and pets	not allowed	
Grazing	not allowed for livestock the grazing of the traditional free roaming yak and yak-cattle hybrids is accepted, due the importance of the local economy and the minimum potential impact to act like vector of diseases, but a program for their presence has to be started in agreement with local communities	
Wood and shrub collection	not allowed neither for fuel wood	
Timber collection	not allowed	
Collectionandextractionofmedicinal plantsandnottimberproducts	not allowed	
Research activities	it is not allowed to conduct research activities in all the Park area without a preliminary written permission of the Park Directorate.	

7.2.2. Strictly Conservation Area (SCA)

These zones are established to assure the highest level of conservation for the ecosystems and/or threatened species of flora and fauna, so no activities are allowed inside.

SCA were recognized (what is this word) on the basis of the presence of endangered large mammals, as musk deer, urial, snow leopard, brown bear, or ibex. These species have been chosen both for their role of "umbrella species", and for their need to live in large and well conserved territories. Moreover, they are able to preserve other species and ecosystems of the area.

Regulating the Flow of Visitors

In order to assure the full conservation of this area, human presence and anthropogenic activities including trekking and climbing are not allowed. Only research activities are allowed with a written approval from park directorate.

To enter an area a specific authorization is needed for all (people of local communities and from Gilgit- Baltistan, Pakistani and foreigners), and this approval shall be issued by the CKNP Directorate on the basis of the analysis of the need and actual situation. The only priority for the release of these authorizations is for research purposes promoted by the Park.

Local people, holding this authorization, have not to pay any fees. The authorized other visitors should pay the *Entry fee* at a cheaper rate. However, it is under CKNP Directorate responsibility to decide whether to charge them with *Waste management fee* and *Garbage deposit*.

The main criteria for the release of these authorizations is to conduct researches promoted by the Park; regarding the research it is important to underline that it is not possible to conduct research activities in the whole Park area without getting a preliminary written permission from the Park Directorate.

Tourism and Related Waste Management

No anthropogenic activities are allowed in area including tourism

- All the people that have been authorized by the CKNP to enter in the Strictly Conservation Area, have to follow the National Park's rule that are enforce and the following basic indication as suggested:
 - *it is not possible to climb the peaks of this area*
 - *it is possible to move in the area only on foot and along marked trails, without using any motorized system*
 - *no pack animals (horses, mules and donkeys) can be used for transportation purposes;*
 - use of kerosene and butane gas for cooking in the designated areas is considered, however no fire can be used neither for cooking nor for burning waste;
 - avoiding the use of nylon bags, plastic bottles, glass bottles and boxes;
 - waste has to be collected and transported to nearest campsite or outside the CKNP.

Conserving Species and Ecosystems of Fauna and Flora

General approach

- Monitoring of species
- Large mammals monitoring in SCA is a very important activity, as it allows comparing areas where the same approach is applied, as for example in the Conservation Areas of the buffer zone. Thus, to potentially evaluate the impact of human activities on wildlife numbers and distribution.
- A detailed monitoring plan has to be developed for different groups, to obtain data related to their distribution and their relative density. In order to develop specific management indications, we suggest to start from some particular Park sectors, for example from Strictly Conservation Areas and Conservation Areas, in this way the potential impact of human activities on different groups can be better understood.

<u>Priority rank</u> High for the development of the monitoring plan for the different groups.

High for the realization of the program but related to the operative possibilities

Fauna

Monitoring of large mammals' species: Ungulates and Carnivores.

These data are fundamental for management purposes and they have to be collected in all the different areas of the CKNP for all the species, but it is suggested to concentrate mainly on large mammals both for their role as umbrella species and for the economic values of the ungulates for trophy hunting.

The assessment will be carried out through the combination of two different techniques, which are described in the Core Zone paragraph. These techniques are focused on the target species of every area, through the following operational program:

- 1. direct counts, through observation from vintage points, carried out twice a year;
- 2. DNA analysis of biological samples for large carnivores, by following the indications described in the paragraph dedicated to Fauna in Core Zone section.

Priority rank High

Forest and vegetation

Forest

CKNP Core Zone borders are located at an average altitude of 4500 meters, therefore, the majority of the forested areas that are concentrated in the Buffer Zone. In the few locations where scattered trees are present, it is suggested to preserve those entities by concentrating all the human activities (firewood collection and timber harvesting) in the Buffer Zone. The measure adopted for the Strictly Conservation Area seems to be adequate to assure a natural regeneration of these components.

Sustainable Use of the Natural Renewable Resources

No use of natural resources is allowed in this area.

Summary of the Indications for the Management of the SCA

In the Strictly Conservation Area, the National Park's regulation is in force but in the following chart the main proposed management indications are summarized.

STRICTLY CONSERVATION AREA		
Entrance	in general, the entrance in the Strictly Conservation Area is not allowed, but a specific authorization could be released by CKNP Directorate on the basis of the local situation.	
	the entrance for research purposes has to be authorized by the CKNP Directorate	
Fee and duties	Local people, Visitors and Researchers can enter only with special authorization follow the same rules	
Transfer and stay inside the area	The entrance and stay in the Strictly Conservation Area are subject to the indications reported in the previous sections (Entrance and Fee). All the authorized people and researchers have to follow these indications, if not expressly authorized by	

STRICTLY CONSERVATION AREA		
	 STRICTLY CONSERVATION AREA CKNP Directorate: to proceed on foot (no motorized way) and along marked trails to not climb the peaks inside this area no pack animals (horses, mules and donkeys) can be used for transportation purposes use of kerosene and butane gas for cooking in the designated areas is considered, no fire can be used either for cooking purposes or for burning waste avoiding the use of nylon bags, plastic or glass bottles and boxes waste has to be collected and transported to the nearest armsite on outside the CKNP 	
Hunting	not allowed	
Game bird hunting	not allowed	
Fishing	not allowed	
Presence of livestock	not allowed	
Presence of pack animals (horses, mules and donkeys)	not allowed	
Presence of dogs	not allowed	
Grazing	not allowed	
Wood and shrub collection	not allowed	
Timber collection	not allowed	
Collection and extraction of medicinal plants and not timber forest products	not allowed	
Research activities	It is not allowed to conduct research activities in all the Park area without a preliminary written permission of the Park Directorate.	

7.2.3. Visitors Intensive-Use Trails (VIUT)

This area is a corridor of about 250 meters on both sides of the trail that move through Baltoro, Gondogoro to Hushey in the East side of the Park and Biafo Hispar in the East side, and some shorter trails that are becoming more common and frequent.

This represents the main and famous route used by trekkers and mountaineers where campsites and services for the visitors are available.

Due to high attendance rates, this is the most critical area linked to human presence and related waste generation. A long part of this area is inside the Core Zone area, where the conservation of nature is the priority, so the following indications are given.

In this zone are included;

- 1. Baltoro Gondogoro Hushey vice versa
- 2. Biafo Hispar vice versa
- 3. Shigar Thalay La
- 4. Haramosh Kutwal Lake
- 5. Rakaposhi BC
- 6. Minapin Diran peak BC
- 7. Hoper Rush Lake

Regulating the Flow of Visitors

The initial part of this route involves the crossing of the Buffer Zone area and afterwards the route enters the Core Zone area, where there is its main course.

Both people of the local communities and from Gilgit-Baltistan could enter this area free of duties and without any authorization.

Domestic and foreign visitors: the entry permission is given through the payment of the **CKNP** fee

<u>Garbage deposit</u>: At the Park entry, point a deposit is given on the basis of a list of equipment carried by the expedition. This caution money will be reimbursed at the exit point on the basis of the equipment/material carried outside the Park.

Researchers follow the rules of the group/expeditions. The possibility to exclude all or part of these duties is under CKNP Directorate responsibility. Regarding the research, it is important to underline that it is not allowed to conduct research activities in the whole Park area without a preliminary written permission of the Park Directorate.

Tourism and Related Waste Management

Higher number of people moving in this area, corresponds an amount of waste that was not properly managed in the past, leaving the need to intervene both at campsite level and through some cleaning campaigns on the high camps of Baltoro area. The waste management has to be continuously upgraded because in the last 5 years the problem remains losing time in discussion about who is in charge and for what between campsite manager, tour operators and other components.

However, the collection of waste (solid and human) is only the first part of the problem, the second one is their disposal, which is often the most important and difficult one. An effective disposal system was developed: on one hand, a recyclable waste disposal was activated with the transportation of glasses and tins to the Skardu market where they are going to be recycled, on the other the installation in 2009 at Askole of an incineration system at high temperature, which allows burning other materials without significant emission.

The analysis conducted on all the different activities, allowed both to develop an efficient waste management cycle, and the quantification of the necessary fees and duties indicated in this proposal.

The waste management proposal is related to the below actions:

- Improvement of campsite efficiency, which is related to the tourist structure and it is the responsibility of the campsite manager to activate the waste collection (cleaning, recyclable waste collection) and the related transportation to the incinerator;
- Installation of one incinerator in Minapin or Rakaposhi area
- Improvements in waste transportation. The tour operators are responsible to transport the waste produced during trekking or expeditions to outside the border of the park. Tour operators are responsible for cleaning and removing litter from the areas where there are no facilities. The campsite management shall be with local communities with overall supervision of CKNP directorate.
- The control of the whole process by CKNP, and the contribution to the payment of costs for extraordinary maintenance, where and when needed.
- The use of pack animals (horses, mules and donkeys) is allowed.

The management of campsites as well as the overall waste produced in CKNP, particularly along the Visitor Intensive Use Zone needs to be addressed properly. Along the Visitor Intensive Use Zone, following points will be considered:

- The CKNP Directorate will be responsible for ensuring effective control and good management of the Campsites though a campsites supervisor;
- Campsites should be in designated and delimitated areas;
- Separate areas for pack animals are mandatory;
- Fodder for pack animals has to be carried from outside the park;
- Animals have to be vaccinated in accordance with the veterinarian indications and have to be marked after vaccination;
- It is mandatory to create, by the campsites, a fenced area where animals must stay;
- Services has to be built and maintained using an environmentally responsible process (with the approval of CKNP);

The campsite fee has to be paid only for the campsite that are located before Goro2 along the trekking to Baltoro Base Camp. The in-process road construction to Paju campsite may change the numbers and distribution of the campsites in future.

The campsites fee has to be paid by the tourists (normally trough Tour Operators) for campsite management; the amount could be altered on yearly basis with a proposal from the communities in charge of campsites but with mandatory prior approval from CKNP Directorate.

Waste management inside the campsites

Campsite managers shall be responsible for waste management in the campsites and they have to perform following tasks:

- *Keep the campsites clean*
- Collect the waste generated in the campsite and segregate in different packs
- Transportation of the waste with their own cost to waste collection point i.e. Askole Medan, Hisper and Hushy

Regarding the presence of pack animals, it is necessary to report that in some areas, mainly near to the Intensive Visitor Use Trails as Upper Braldo Union Councils, an increase of the use of the equines (mainly mules, but also horses and donkeys) was observed in order to use these animals as pack animals, both for support the tourism activities (about 200/300 heads) and the army necessities (about 400/500 heads).

The potential negative effect of this presence along the trails of this area could be referred to two main factors: spreading of diseases to wildlife and impact on the vegetation of the area due to the continuous grazing activities.

Regarding the first aspect, the World Organization for Animal Health (OIE) (http://www.oie.int/animal- health-in-the-world/oie-listed-diseases-2012/) lists 29 diseases, out of these 11 affect exclusively equines, whereas 18 affect multiple species. Equines are not reservoir or even simply co-reservoir of any of the last ones. Hence, the equines present in CKNP Core Area cannot be the cause of cross-transmission to sympatric wildlife.

According to these indications, possible restrictions of equine presence in the CKNP Core Area should be rather based on evidence of equine-derived overgrazing.

So, to avoid any negative impacts, the following management indications are suggested:

- 1. in each campsite an area with a fenced area to gather the pack animals during their stay, has to be built. The contractor/tour operator of the animals has to collect the dung.
- 2. the contractor/tour operator has to bring the necessary fodder to feed all the pack animals for all the period of their stay in the area.
- 3. the contractor/tour operator has to provide the straightaway removal of dead animals outside the CKNP

The people moving along this trail are for most of the time inside the Park Core Zone, where the National Park's regulation is in force and the following basic indications are suggested:

- *it is possible to move inside the area only on feet and along marked trails, without using any motorized systems, however the support of pack animals is allowed (horses, mules, donkeys)*
- *it is allowed to camp only in the designated campsites*
- *in the campsite the toilets only in local style need to be installed, the plastic ones have to be removed*
- use of kerosene and butane gas for cooking in the designated areas is considered, lighting up fires cannot be used neither for cooking nor for burning waste
- segregated waste disposal, solid waste and human waste disposal
- avoiding the use of nylon bags, plastic bottles or glass bottles and boxes
- waste has to be collected and transported to the nearest campsite or outside the CKNP

It is necessary to develop a specific monitoring program to assess the potential impact of the visitors on the area.

Implementation of tourist activities in Visitors Intensive-Use Trails

The CKNP surface is covered by glaciers for about the 38% of its area, and this makes the Park extremely important not only for the local environment (i.e. the melting waters that feed the Indo affluent) but also at global level, especially in relation to the global climate change.

The VIUT extends itself on the Baltoro glacier, one of the most famous area of CKNP and destination of most of the visitors that come in this area for the magnificence of the landscape. Moreover, it is also the main access route to many important peaks.

It is important for the Park to use this area not only as attraction, but also to promote public awareness on the importance of glaciers for the environment. Therefore, it is proposed to develop in this area both *Glacier trails* and a *Glacier Museum*.

Glacier trails

Glacier trails are an effective method to promote naturalistic awareness. Glacier, Geological, Botanical and Nature trails in general are an original technique in order to transfer the knowledge acquired through centuries of study and they provide a way for learning "in the field". In particular, Glacier Trails could also become the basis for further iconography and field research. Therefore, these initiatives represent the right answer to the increasing interest in naturalistic studies on glacierized areas.

The trails need to be developed on relatively manageable routes of different length and complexity. The scenic impact of the environment is generally high. The trails need to be equipped with specific signs indicating the position reached by the glaciers during the various historic periods, as well as signs explaining various morphological evidences. The trails need to be addressed to a broad public, but it is also important to consider their level of difficulty, as some of them require the knowledge of basic techniques for ice climbing. To develop glacier trails is also possible to use pre-existing routes, thus promoting the already existing trail network. The trails need to be maintained and cleaned over time and they could be improved according to visitors and trekkers suggestions (sampled through questionnaires and interviews).

Glacier Museum

A Glacier Museum is a real and effective tool to collect, create and disseminate knowledge about snow, ice and glaciers located in a protected area like the Central Karakuram National Park.

A valuable example of such initiatives is the Norwegian Glacier Museum situated in Fjaerland, Western Norway, between Jostedalsbreen (the Jostedal Glacier) and the Sognefjord. This museum was established in 1987 and it resulted a successful initiative (Korsen, 2001), then for the CNKP, we could refer to this nice experience to develop a similar one in Pakistan.

A Glacier Museum is a glacier center of international importance, which has to include the understandings of the natural environment and interaction between humankind and nature. A glacier museum can stimulate the curiosity of those who know little about glaciers and inform those who know much more about it.

The Park managers in cooperation with KIU and EvK2CNR could develop a Glacier Museum in the CKNP. This latter can also provide informative materials (books, photographs, maps, etc.) from Italian scientists and climbers, who in the past (from the beginning of the XX century up to now) visited the park area.

The Glacier Museum could be a site where the exhibits deal with topics of current interest. It has to be developed in close cooperation with national and international scientists. Moreover,

it is essential to understand that glaciers play an important role in understanding the climate. Furthermore, the Museum could also host international workshops and conferences on climate change and impacts. In these cases, the conference attendees could also benefit from excursions within the park areas and on the park glaciers. Some CKNP glaciers attract the attention from scientists, as these glaciers are the only ones advancing worldwide. This "Karakuram anomaly" is due to surge-type phenomena (Hewitt, 2005) and supports further detailed studies in the area.

In the initial phase, the Glacier museum could be temporarily installed inside the Museum in Skardu, and afterwards a dedicated building can be planned and developed in order to host the Glacier museum.

Wildlife Watch towers

The installation of watch tower is an interesting opportunity for the visitor that approach the Park and cannot find any interest in it. Field staff for bi annual wildlife surveys would utilize these towers during winter and spring. The location of these points has to be identified by the CKNP staff and game watchers in the high part of the Buffer zone considering an easy road access and a short trek.

- Along the new road to Paju near Biafo
- Near Saicho camp Hushey
- Kanday
- Thalay
- Near Arindu
- Near Kutwal lake Haramosh
- Bagrot
- Manogah Danyore
- Rahimabad
- Near Hoper Glacier
- Near Hisper village
- Shanas Skandarabad
- Minapin (Hapakun/Tagafari area)

The visitors can visit the tower only if accompanied by the park staff.

Conserving Species and Ecosystems of Fauna and Flora

Fauna

A possible monitoring program has to be developed to better understand the potential impact of tourism.

Forest and vegetation

A possible monitoring program has to be developed to better understand potential impact of tourism.

Sustainable Use of the Natural Renewable Resources

No use of natural resources is allowed in this area.

VISITORS INTENSIVE-USE TRAILS		
Entrance	no specific authorization by CKNP Directorate is required	
Fees and duties	Entrance is free for people of local communities	
	For the others:	
	Foreign trekking groups have to pay:	
	CKNP fee in Islamabad	
	Foreign expeditions groups have to pay:	
	CKNP fee in Islamabad	
	Garbage deposit : A list of the equipment carried by the expedition into the park shall need to be deposited by the expedition leader or tour operating agency. This caution money will be reimbursed at the exit point on the basis of the equipment/material carried outside the Park.	
	National visitors and open zone foreign visitors have to pay:	
	CKNP fee at VRC	
	but with reduced amount and at the VRC points (Visitors Registration and Information Centers)	
	GB visitors have to pay: CKNP fee at VRC	
	a reduced amount at the VRC points	
	<u>Researchers</u> : follow the rules of the group/expeditions or of the singles in relation to the group size, but the Park directorate could exclude all or part of their duties.	
	All the people/researchers using campsite have to pay the camp services to the campsite manager (the money goes to the local community that holds right, and are used to maintain and manage the campsite and waste, including the related costs for waste transportation out of the Park Boundaries)	

Summary of the Indications for the Management of the VIUT

VISITORS INTENSIVE-USE TRAILS		
Transfer and stay inside the area	 on foot (no motorized way) and along marked trails use of pack animals (horses, mules and donkeys) is allowed. The contractor has to bring the necessary fodder, to maintain the pack animals in the pen built at the campsite, to provide the dung collection and its transfer. (the immediate removal of dead animals outside of the CKNP must be carried out by the tour operator/contractor) camping is allowed only in the designated areas with local style toilets or eco-toilets on the glaciated area use of kerosene and butane gas for cooking in the designated areas is considered, lighting up fires cannot be used either for cooking or for burning waste waste segregation (solid and human) waste has to be collected and transported outside the Park <i>avoiding the use of nylon bags, plastic bottles or glass bottles and boxes</i> 	
Hunting	not allowed	
Game bird hunting	not allowed	
Fishing	not allowed	
Presence of livestock	only in the first part of the trail inside the Buffer Zone	
Presence of pack animals (horses, mules and donkeys)	allowed, with the suggestions indicated in the previous section Transfer and stay inside the area	
Presence of dogs	not allowed	
Grazing	not allowed, the Tour Operator/Contractor has to foresee the necessary fodder for the pack animals	
Wood and shrub collection	not allowed	
Timber collection	not allowed	
Collection and extraction of medicinal plants and not timber forest products	not allowed	
Research activities	it is not allowed to conduct research activities in the whole Park area without a preliminary written permission of the Park Directorate.	

7.2.4. Discovery Trails (DT)/ Occasional Trails (OT)

Also, these sectors are not represented by one area but it includes a network of trekking routes linking different peaks, which are considered in the same group on the basis of their attendance: these routes and peaks are generally seldom or never frequented, but in any case, every year they attract a fair number of visitors.

DT trails can be identified within the Park as:

- 1. Spantik (Basha)
- 2. K6, K7 (Hushey)
- 3. Trango

OT trails can be identified within the Park as:

- 1. Latok Ogre and other peaks Biafo
- 2. Other peaks Baltoro
- *3. Shigar Thalley treks and peaks*
- 4. Bagrot-Haramosh treks and peaks
- 5. Rakaposhi Diran
- Here the main trails are tracked and there is the presence of the main signage and footbridges, with the presence of a simple space for camping, which is neither equipped with services nor with water.
- To preserve the Core Zone integrity as most as possible, it is not allowed going outside these marked paths, and indications are given to not affect the nature nor the landscape scenario, assuring a sustainable recreational use.

Regulating the Flow of Visitors

This area is similarly regulated as the *Visitors Intensive Use Trails*, but in order to guarantee a wider accuracy of eco-system protection, the proposed garbage deposit should also be paid by trekking parties and its amount should be increased for trekking groups and expeditions; for the last ones the proposal is to increase it by 10% in comparison to the one requested in *VIUT*.

Both people of local communities and Gilgit-Baltistan could enter in this area without any authorization and free of duties.

Pakistani and foreign visitors: the entry permission is given through the payment of the following duties:

• Trekking groups and expeditions can enter only if they get these necessary permits:

<u>Domestic and foreign visitors</u>: the entry permission is given through the payment of the **CKNP** Fee

<u>Garbage deposit</u>: At the Park entry, point a deposit will be given on the basis of a list of equipment carried by the expedition. This caution money will be repaired at the exit point on the basis of the equipment/material carried outside the Park.

• Researchers follow the rules of the group/expeditions. The possibility to exclude all or part of these duties is under CKNP Directorate responsibility. Regarding the research, it is important to underline that it is not possible to conduct research activities in all the Park area without a preliminary written permission of the Park Directorate.

Tourism and Related Waste Management

The people moving along this trail remain inside the Park Core Zone, where the National Park's regulation is in force and the following basic indication are suggested:

- *it is possible to move around the area only on foot and along the marked trails, that have to be implemented, without using any motorized system*
- *it is not possible to use pack animals (horses, mules and donkeys) except for Trango. The Contractor has to bring the necessary fodder.*
- *it is possible to camp only in the designated spaces composed by a simple space, where water is available but where no services are provided*
- use of kerosene and butane gas for cooking in the designated areas is considered, no fire can be used to cook and to burn waste
- avoiding the use of nylon bags, plastic bottles, glass bottles and boxes
- waste has to be collected and transported to nearest campsite or outside the CKNP
- The Campsites have to be considered only along the trails in these tourism zones and have to be kept in complete wilderness (without any infrastructure or service).

This sector is neither equipped with services, nor with campsites, while the waste management systems (collection and transport outside the Park) is under the total responsibility of the Tour Operator. To improve the efficiency of the process, the Tour Operators guides will be trained by CKNP staff about procedures to be followed for proper waste management. CKNP staff must check and verify that these procedures are being observed and CKNP staff must sanction behaviors that are not in line with environmental protection criteria, which in this sector are more binding.

It is necessary to develop a specific monitoring program to assess the potential impact of the visitors on the area.

Conserving Species and Ecosystems of Fauna and Flora

Fauna

A possible monitoring program has to be developed to better understand the tourism potential impact.

Forest and vegetation

A possible monitoring program has to be developed to better understand tourism potential impact.

Sustainable Use of the Natural Renewable Resources

No use of natural resources is allowed in this area.
Summary of the Indications for the Management of DT and OT

To manage these situations in this area the National Park's regulation is in force but the following indication are proposed:

DISCOVERY TRAILS – OCCASIONAL TRAILS			
Entrance	no specific authorization released by CKNP Directorate is required		
Fees and duties	Entrance is considered free for people of local communities For the others: Foreign trekking groups have to pay: CKNP fee in Islamabad Foreign expeditions groups have to pay: CKNP fee in Islamabad Garbage deposit: a deposit is given on the basis of a list of the equipment carried out by the expedition. This caution money will be repaired at the exit point on the basis of the equipment/material carried outside the Park. National visitors have to pay: CKNP fee at VRC but with reduced amount and at the VRC points (Visitors Registration and Information Centers) GB visitors have to pay:		
	a reduced amount at the VRC points Researchers: follow the rules of the group/expeditions		
Transfer and stay inside the area	on foot (no motorized way) and along marked trails no pack animals (horses and mules) can be used for transportation purposes, except for Trango. Here the contractor has to bring the necessary fodder camping is considered only in the designated spaces composed by a simple space where water is available, but where no services are provided use of kerosene and butane gas for cooking in the designated areas is considered, no fires to cook nor to burn waste can be used avoiding the use of nylon bags, plastic bottles, glass bottles and boxes waste has to be collected and transported to the nearest campsite or outside the CKNP. (collection and transportation outside the Park is under Tour Operator's responsibility)		
Hunting	not allowed		

DISCOVERY TRAILS – OCCASIONAL TRAILS			
Game bird hunting	not allowed		
Fishing	not allowed		
Presence of livestock	only in the first part of the trail inside the Buffer Zone		
Presence of pack animals (horses, mules and donkeys)	Not allowed except for Trango area. Here a veterinary annual health certification and vaccination by CKNP are requested.		
Presence of dogs	not allowed		
Grazing	not allowed, the Contractor has to foresee the necessary fodder for the pack animals		
Wood and shrub collection	not allowed		
Timber collection	not allowed		
Collectionandextractionofmedicinalplantsandnottimberforest products	not allowed		
Research activities	it is not allowed to conduct research activities in all the Park area without a preliminary written permission of the Park Directorate.		

7.2.5. Buffer Zone (BZ)

The proposed Buffer Zone is supporting a harmonic interaction between nature conservation and the use of the natural renewable resources through a sustainable way. This promotes the conservation of landscapes, traditional forms of land use, together with social and cultural features. This area, inside the CKNP's border and spreading for about **2,961.0 km²**, is not continuous around the whole Park, but it is present mainly near the human settlements and near to the areas where there are unsustainable activities and therefore a transition zone is needed.

Depending on the local situation, the Buffer Zone area could contain 2 other sub-area types -Conservation Area (CA) and Community Controlled Hunting Area (CCHA) - that are managed for the benefit of the local communities, by focusing on assuring nature conservation and sustainable use of natural renewable resources available within these specific areas.

In this area, the National Park's regulation is in force but the following indications are proposed:

Regulating the Flow of Visitors

This area is a free entrance area for the local community people, the other visitors are requested to pay the CKNP fee.

For visitors (GB visitors, Domestic Visitors, Foreign Visitors) and researches that are moving in the other Park's areas outside this Buffer Zone, a specific authorization with related fees and deposit payment has to be considered following the regulations in force in these specific areas as reported in this document in the previous chapters and detailed in Part III Thematic Management Guidelines, the Tourism Sector.

So, all the visitors and groups are requested to register at the CKNP entry points (VRC), by filling in the specific entry form and by paying the fees related to entrance in agreement with the rules of the areas that will be visited. Afterwards, while going out it is asked them to transit through one of the CKNP exit points (VRC) to fill in the exit form.

These questionnaires are a very important management tool, to improve the CKNP Directorate knowledge about: (i) the number of visitors in the different areas in different periods of the year, (ii) their origin and expectations, (iii) effectiveness of the area, tourism activities and structures management.

It is important to underline that every environment has a typical carrying capacity linked to a specific factor. However, if this limit is exceeded, a negative feedback is triggered and it subsequently involves a related negative impact on the environment.

Tourism Related Waste Management

The people are moving in an area where the sustainability is improving and where the National Park's regulation is in force; the following basic indication are suggested:

- *it is possible to move in the area only on foot and along the marked trails, without using any motorized system, however the support of pack animals (horses, mules, donkeys) is allowed. The Contractor has to bring the necessary fodder.*
- *it is possible to camp only in the designated campsites*
- use of kerosene and butane gas for cooking is allowed in the designated areas, however fire cannot be used either to cook or to burn waste
- segregate waste disposal, solid waste and human waste disposal
- avoid the use of nylon bags, plastic bottles or glass bottles and boxes
- waste has to be collected and transported outside the CKNP

Conserving Species and Ecosystems of Fauna and Flora

General approach

Monitoring of species

We start monitoring the large mammals due to their role as umbrella species, so that we can develop the zone system and the reliable management indications. However, a specific monitoring plan has to be developed for different groups, to obtain distribution data and relative density in order to attain more specific management indications. It is suggested to start from some particular sectors of the Park, as for example, the Strictly Conservation Areas and Conservation Areas, even though the Buffer Zone and the areas open to the public in the Core Zone could be also interesting in order to better understand the potential impact of human

activities on the different groups.

<u>Priority rank</u> High for the development of the monitoring plan for the different groups.

High for the realization of the program but related to the operational possibilities.

Fauna

In order to promote the conservation of threatened species of large mammals, some locations within this area have been recognized as Conservation Areas; this not only promotes the conservation of these species, but also the conservation of the whole ecosystem of the area.

Monitoring of large mammals' species: Ungulates and Carnivores

We suggest monitoring large mammals both for their role as umbrella species and for their economic value, linked mainly to the ungulates for trophy hunting purposes (within the areas where a trophy-hunting programme was set up).

In this area, the assessment will be made through the combination of two techniques, described in the Core Zone, by following this program:

- 1. direct counts from vantage points carried out twice a year for 1 or 2 sub-valleys for each catchment of CKNP or surveys carried out monthly along standardized trails by Park wardens;
- 2. DNA analysis of biological samples for large carnivores, when the explained conditions are met.

Priority rank High

Forest and vegetation

<u>Forest</u>

In this area the main part of the CKNP, forests are present. The forest conservation has a complex role in the ecosystem and in the meantime, it plays a fundamental role to support the life of many local communities especially in remote and high mountain areas.

Therefore, while defining the CKNP forest management planning, there is the need to establish some Conservation Areas for the conservation of some patches where forests are well conserved.

Sustainable use of the Natural Renewable Resources

Forests and vegetation

Sustainable Forest Management per valley level (SFM)

The indications reported for the sustainable management of the forests in the Buffer Zone are valid also for this area, so here we report only the indications for the approach that is suggested to be followed, referring at the Buffer Zone paragraph for the indication of the specific activities.

The first step is the constitution in every valley of a *Valley Forest Committee* to manage the whole process, starting from the realization of the *Valley Forest Analysis* where the actual situation, the needed of the local communities and actual regulations are reported.

On the basis of the situation some general **guidelines** are indicated for the development of these operations in a sustainable way:

- harvesting of timber and firewood: in areas with Mountain Dry Temperate Forests.
- firewood collection: in areas with absence of Mountain Dry Temperate Forests where the collection is focused mainly on Juniperus tree, shrubs and riparian vegetation, but also as general rule for the whole CKNP.
- *firewood plantations: as support for the firewood needs in those areas where this is critical due to the scarcity of degradation of the wood sources.*

As further point to train, the local personnel involved in the forest management but also to verify the effectiveness of the management measures, for this training forests are promoted in each valley.

Priority rank High

Medicinal plants sustainable use

A harvesting linked to the real productivity of the area has to be promoted in sample areas, but until now the determination of a sustainable harvesting level for different species have to be determined.

Considering that the direct collection is only one part of the problems affecting the presence and reproduction of the medicinal plants, these experimental areas could be developed in the Park Buffer Zones with special conservation value (i.e. Conservation Zone, Community Controlled Hunting Area). A well-balanced harvesting could be allowed in some areas in agreement with the local communities.

It is suggested that inside the Park area only local communities through a specific license, issued by the responsible authority, could carry out the harvesting of the medicinal plants. This is done in order to promote the opportunity of a new income source linked to the sustainable use of another renewable natural resource.

Another suggested tool is the promotion of farming, at local community level, of some particular species; this could reduce the pressure on the wild ones, and increase incomes for local people.

Some researches, on the determination of active principles of some medicinal plants, are being carried out by KIU within the framework of SEED project. The possibility to develop an easy extraction system, linked to the cultivation, could further improve the outcome of the proposed process.

Priority rank High at both level:

- i. determination of sustainable harvesting levels for different species
- ii. promotion of their farming

Livestock and pastures

Sustainable Managed Pasture Area (SMPA) - livestock pilot management

The indications reported for the sustainable management of the pastures and livestock in the Buffer Zone are valid for this area. They aim at both improving and sustaining the productivity

of the pastures on the long term, by preserving the economic incomes for local communities, as well as by conserving the Park environment. So here, we report only the indications of the approach that is suggested to be followed, by referring at the Buffer Zone paragraph for the indications of the specific activities.

The first step is the constitution in every valley of a *SMPA Valley Committee* to manage the whole process, starting from the realization of the *Valley Livestock/Pasture Analysis* where the actual situation, the needs of the local communities and actual regulations are reported. This activity allows to understand the areas where the carrying capacity of a particular pasture is exceeded, triggering overgrazing phenomena, and where, in view of this, it becomes necessary to reduce the number of animals grazing on these areas.

As tools for these activities the Land cover map developed under Mountain Protected Area project, as well as the analysis conducted on the localization of different pastures, the relative presence of livestock in different periods and their origin could be used.

The following steps involves activities dedicated to *Improve sanitary conditions of livestock* through a preliminary analysis of the general situation and the following activation of a 3-year sanitary plan, developed in cooperation with the regional agencies in charge of animal health affairs. Another important point is the *Improvement of fodder production* with the aim to support the winter time fodder shortage which effects the productivity of the livestock.

This program, linked to a numerical reduction of livestock, has to be supported with incentives during the first phase, since the economic loss, caused by livestock reduction, would be balanced by higher productivity.

<u>Priority rank</u>High

Summary of the Indications for the Management of the BZ

In the Buffer Zone Area, the National Park's regulation is in force, but in the following chart the main management indication proposed are summarized.

DUITER ZOILL I	
Entrance	no specific authorization released by CKNP Directorate is required for people of local communities and Gilgit-Baltistan, or for the visitors that stay only in the Buffer Zone. The others visitors entering the Park have to pay the Entry fee from the Buffer Zone and moving to another zone, and in case a specific authorization released by CKNP Directorate could be required
Fees and duties	To enter and stay only in the Buffer Zone and related sub-areas (Community Controlled Hunting Areas and Conservation Areas) it is sufficient to register at the Park entry point and pay the CKNP fee according to the restriction area in ISL or at the VRC. People of local communities are free of charge. When they move to another Park zone, they have to pay the relative fees, as reported before.

BUFFER ZONE - I	UCN VI	
Transfer and stay	on foot only and along trails marked in the main points	
inside the area	(no other way except the Askole - Paju gravel road)	
	pack animals (horses, mules and donkeys) could be used for transportation purposes	
	camping is considered only in the designated spaces	
	use of kerosene and butane gas for cooking in the designated areas is considered, no fire can be used to cook or to burn waste	
	avoiding the use of nylon bags and bottles or glasses bottles and boxes	
	waste has to be collected and transported to nearest campsite or out to the CKNP.	
Hunting	It is considered only for trophy hunting programs in the authorized areas (Community Controlled Hunting Areas)	
Game bird hunting	not allowed	
Fishing	Permitted in specific delimitated areas with a license from CKNP Directorate	
Presence of livestock	It is allowed the grazing of livestock of local communities following a sustainable approach	
Presence of pack animals (horses, mules and donkeys)	Allowed	
Presence of dogs	Allowed only for vaccinated animals	
Grazing	It is allowed the grazing of livestock of local communities following a sustainable approach	
Wood and shrub collection	It is allowed the wood and shrub collection by locals following a sustainable approach	
Timber collection	It is allowed the timber extraction by locals following a sustainable approach according to the new Forest Act	
Collection extractionand of	It is allowed the harvesting by locals following a sustainable approach under license of responsible institution;	
medicinal plants and not timber forest products	Farming activities are promoted	
Research activities	It is not allowed to conduct research activities in the whole Park area without a preliminary written permission of the Park Directorate.	

7.2.6. Community Controlled Hunting Areas (CCHA)

The CCHA boundaries are defined but need ground truth with local communities. These areas are inside the Buffer Zone area and are characterized by a good presence of trophy animals (ungulates) most of them, like Markhor, are threatened or endangered, following the IUCN Red List, and under protection of national and international agreements.

The trophy hunting represents a measure of conservation for the species through the large income (80%) for the local communities generated by selling of a license fee for the harvesting of a trophy male, an authorized and scientific based trophy-hunting program is carried out in these Community Controlled Hunting Areas.

S #	Name of CCHA	Important wildlife species	Area (sqkm)			
	CCHA around CKNP					
1.	Haramosh	Markhor, ibex	601			
2.	Danyore	Markhor, ibex, snow leopard	483			
3.	Bagrot	Ibex, snow leopard	482			
4.	Sikarnderabad/ Nilt/ Jafferabad	Ibex, snow leopard, markhor	50			
5.	Gulmat/ Minapin	Ibex, snow leopard, markhor	210			
6.	Hoper/ Hisper	Ibex, snow leopard	1153			
7.	Kanday/ Sailing	Ibex, snow leopard	105			
8	Hushey	Ibex, snow leopard	583			
9.	Nar/ Ghoro	Ibex, snow leopard, urial	116			

There are 9 Community Controlled Hunting Areas (CCHA) in the following localities inside the Buffer Zone area for CKNP:

Actually, the Community Controlled Hunting Areas (CCHA) are notified by the Wildlife Department of Gilgit-Baltistan if, after four consecutive seasonal wildlife surveys, the number of target species is viable to start a trophy hunting program. The survey request, which aims at activating a trophy hunting procedure, could be promoted by the local community of the area or by any organization. It is also mandatory that there should be a community organization established, so that the cheque can be delivered to it, if the trophy hunting takes place.

Community Controlled Hunting Areas picture from 2014 to 2019

Year	ССНА	Allocated Quota	No. of Hunt	
Astore Markhor				
2014-2015	Sassi Haramosh	04	01	
	Jutial		01	
Total		04	02	

Year	ССНА	Allocated Quota	No. of Hunt
2015-2016		04	
	Total	04	
2016-2017	Doyan	04	01
	Kargah		01
	Total	04	02
2017-2018	DMT	04	01
	SKB		01
	Total	04	02
2018-2019	Jutial	04	01
	Sassi Haramosh		01
	Bunji		01
	Doyan		01
1	otal	04	04
	Blue S	Sheep	
2014-2015	KVO	08	02
	Shimshal		03
1	otal	08	05
2015-2016	Shimshal	08	01
1	otal	08	01
2016-2017	KVO	14	01
	Shimshal		04
	Total	14	05
2017-2018	Shimshal	14	09
]	lotal	14	09
2018-2019	KVO	14	03
	Shimshal		05

Year	ССНА	Allocated Quota	No. of Hunt
Т	`otal	14	08
	Himalay	an Ibex	
2014-2015	KVO	60	20
	Khyber		07
	Gulkin		03
	Passu		09
	Shimshal		01
	Hussaini		02
	Qurumber/Imit		05
	SKB		02
	Hushey		10
Т	`otal	60	59
2015-2016	KVO	60	07
	Khyber		21
	Gulkin		07
	Passu		10
	Hussaini		02
	Misgar		04
	Gulmit		02
	SKB		01
	Hushey		09
	Kanday		05
	Imit		03
Т	`otal	60	71
2016-2017	KVO	80	28
	Khyber		17

Year	ССНА	Allocated Quota	No. of Hunt
	Gulkin		08
	Passu		09
	Hussaini		09
	Misgar		03
	Gulmit		07
	SKB		01
	Hushey		15
	Kanday		04
	Qurumber		01
	Ishkoman		03
	Imit		04
ſ	otal	80	109
2017-2018	KVO	95	14
	Khyber		08
	Gulkin		03
	Passu		11
	Hussaini		08
	Misgar		05
	Gulmit		05
	Chupursun		02
	Hushey		07
	Kanday		02
	Qurumber		05
Total		95	70
2018-2019	KVO	95+07=102	14
	Shimshal		01
	Khyber		12
	Gulkin		03
	Passu		09

Year	ССНА	Allocated Quota	No. of Hunt
	Hussaini		07
	Misgar		07
	Gulmit		03
	Chupursun		01
	Ramanji		01
	Bar		01
	Kurumber		05
	Hushey		06
	Kanday		04
Г	otal	95+07=102	74

Regulating the Flow of Visitors

This area is a free entrance area for the people of local communities and Gilgit-Baltistan, but Pakistani people, foreigner visitors and researchers that stay only in the Buffer Zone area (including Community Controlled Hunting Areas and Conservations Areas) are request to pay the Entry fee.

Tourism and Related Waste Management

People moving in one area where the sustainability is improving and where the National Park's regulation is in force; the following basic indications are suggested:

- *it is possible to move in the area only on foot and along marked trails, not using any motorized system but with the support of pack animals (horses, mules, donkeys). The Contractor has to bring the necessary fodder.*
- *it is possible to camp only in the designated campsites*
- use of kerosene and butane gas for cooking in the designated areas is considered, fire cannot be used either to cook or to burn waste
- segregated waste disposal, solid waste and human waste disposal
- avoiding the use of nylon bags, plastic bottles or glass bottles and boxes
- waste has to be collected and transported to nearest campsite or outside the CKNP

Conserving Species and Ecosystems of Fauna and Flora

General approach

Monitoring of species

We start monitoring the large mammals, considering their role as umbrella species, in these way zone systems and reliable management indications can be developed. However, in order to maintain this routine monitoring system, a specific monitoring plan has to be developed for different groups, so to obtain distribution and relative density data, for more specific management indications. It is suggested to start from some sectors of the Park as Strictly Conservation Areas and Conservation Areas, even though the Buffer Zone and the areas open to the public in the Core Zone could be also interesting to better understand the potential impact

of human activities on the different groups.

<u>Priority rank</u> High for the development of the monitoring plan for different groups.

High for the realization of the program but related to operational opportunities.

Fauna

Monitoring of large mammals' species: Ungulates and Carnivores

It is suggested to continue the monitoring of the large mammals both for their role as umbrella species and for the economic values linked to the ungulates for trophy hunting.

The assessment will be made by combining two techniques described in Core Zone that for this area has to be used following this program:

- 1. direct counts through observation from vantage points carried out twice a year by the community, jointly with the Park and other involved NGOs. If enough game watcher is available, surveys will be also carried out monthly, along standardized trails.
- 2. DNA analysis of biological samples for large carnivores, when explained conditions are met.

Priority rank: High

Trophy Hunting management

A sustainable and conservation-oriented trophy hunting system may be a valid management tool, to increase the economic revenue of local communities, if a reliable monitoring of ungulate populations is carried out to assess their conservation status, to plan hunting activities and to promote it as a long-term source of income.

Trophy hunting program has to consider the following aspects to be a useful conservational tool:

- 1) it has to be based on reliable data (consistence, distribution and structure) to be sure to not impact in a negative way the population that is harvested; this is more important in the case of a threatened taxon.
 - For this reason, a Conservation Management Plan, that should be periodically revised or updated, has to be produced with indications of the population dynamic data and trends, as well as the number of animals harvested and a planning program for the next 3-5 years with all the management indications.
 - The realization of a Trophy Hunting program has to acknowledge the indications of the specific Position Statement of IPMP Research Protocols that agrees with the IUCN/SSC Caprinae Specialist Group's position, and to be in line with the following recommendations:
 - Before a new hunting program begins, and especially in the case of a threatened taxon, the surveys on which the program and quota are based upon should be (1) made in conjunction with, or by, an independent party, (2) using a standardized approach (see above). Furthermore, each new trophy-hunting program has to be set up with a critical look at defining parameters and methods, considering distribution, numbers and possibly population structure of hunted species.

- In Conservation Areas inside the Buffer Zone, the Trophy hunting program for endangered populations could not be started unless their status is well assessed through at least 3 years of seasonal data collected in conjunction with, or by, an independent party, and using a standardized approach.
- The success of CTHPs can only be determined if suitable data is systematically collected and accurately recorded, if results are analyzed, and if reports are produced and made available. In this respect, it is also very important to know movements that species make seasonally, to avoid to hunt the same population in two different areas (therefore doubling the hunting pressure on it).
- Population data and trophy hunting plans should be peer-reviewed by professional wildlife biologists within and outside Pakistan.
- Counts should focus in assessing the structure of the population, not only the number of trophy males.
- For endangered species (e.g. markhor) it is important to obtain an accurate check of their status, setting up groups of technicians for an unbiased evaluation at regular intervals (e.g. each 3-4 years).
- 2) It is important to highlight that <u>carnivore conservation</u> could be threatened by the ungulate conservation efforts through trophy hunting programs.

Local communities in fact may consider them responsible not only for depredation attacks to domestic animals, but also for those toward wildlife, deducting individuals from the trophy hunted population. It is therefore important for local communities to develop a global approach to conservation, beyond the single hunted species. Local communities need to be better informed and educated about the important role of large carnivores, including the removal of weakest individuals from prey.

That is why each THP should have a formal written Conservation Management Plan that should be periodically revised or updated. Obviously, the targets must be measurable and meaningfully related to the objectives and goals of both wildlife conservation and community development.

- 3) In CKNP 80% of revenue goes to the community and 20% goes to the respective government agencies as an administrative fee. The trophy hunting seeks to use the revenues received from the fees to generate incomes and other sustainable development activities in the areas.
- 4) There shall be a proper audit and monitoring of funds utilization by the communities. It has been observed that funds are being spent only on socio-economic interventions, though the CCHAs are responsible to spend 30% of their funds on conservation and wildlife management including natural resource management, wildlife monitoring and development of drink water and salting points for wildlife.

Priority rank: High

Reduction of human activities

The human activity that mainly could interfere with the presence of ungulates in this area is the

livestock- breeding. This presence, but mainly the related density in the same areas used by the endangered species, should elicit a numerical response from wildlife. The decreasing of the consistence of the wild ungulate's effects not only the conservation of these species on long terms, but also the possibilities for the local communities derived to the carried on of the trophy hunting programme.

For this reason, specific management activities are needed, as explained above in section regarding the trophy hunting and livestock and pastures.

Protection of livestock from carnivores

Protection systems from carnivores have to be improved in order to reduce depredation attacks on livestock.

In order to improve protection strategies of livestock from predator attacks in CKNP, thus increasing the willingness of local communities to co-exist with predators, we suggest to progressively shifting from the current policy of mere compensation of killed livestock to a mixed system composed by:

- 1) training for the Park wardens and institutional personal and NGOs to determine the causes of death in livestock.
- 2) promotion of "good" husbandry practices, which include the nocturnal allocation of small ruminants in improved predator-proof enclosures and, possibly, their herding during daytime.

The new policy will be implemented and tested, with due priority, in the Buffer Zone, in cooperation with communities whose territory and pastures still sustain the predators' presence. Such approach needs some available funds to encourage the adoption of mitigation measures, we suggest the trophy hunting areas (CCHA) as pilot areas where to adopt the new policy. In this perspective, evidence of the co-existence of local communities with predators will be the key to maintain incentives where already assigned, or having first access to such funding by new communities.

Where applicable, part of revenues from trophy hunting will be dedicated to support the implementation and the efficiency assessment of preventive measures (this approach has to be detailed by the CCHA in the Conservation Management Plan).

Forest and vegetation

Medicinal plants

The medicinal plants are distributed in a wide altitudinal range in the CKNP from forested areas to alpine and high-altitude areas, and a list of the different species present in CKNP is being developed.

The impact on these species seems mainly linked to their direct collection, as often the extracted parts are the roots and underground rhizomes, causing damages to the plant and a reduction of the possibility for vegetative reproduction; but also to the disturbance of their habitat as a consequence of human activities on forested area as well as on livestock grazing. However, these impacts have still to be quantified. Potential mitigation measures could include direct

protection of the medicinal plants in some zones of the Park, setting a sustainable utilization quantity.

Priority rank High

Sustainable Use of the Natural Renewable Resources Wildlife

Trophy hunting

The trophy hunting is a tool that "uses" some wildlife species as a renewable resource able to support the local communities.

Actually, the value assigned to each trophy animal is fixed by the Wildlife Department at which the hunter pays for the shooting license. <u>About 80% of this amount is transferred to the local community that usually uses one part of this funds to develop a watch and ward system for the surveillance of the target species, some more money is used for the reimbursement of the hunt expenses, while the remaining part (usually about the 50%) goes to the community as reserve funds.</u>

This area is open to presence of the domestic animals (livestock and pack animals) but, due to the contemporary presence of wildlife and others ungulates that are the *target* species for this area, the following management indications are suggested:

a. the admittance of vaccinated/chemo prophylactically mass treated local livestock is considered in improved health condition;

As discussed in other points of this document, livestock (mainly sheep and goats) may be source of several diseases affecting wildlife. The spill over of an epidemic disease from the domestic small ruminant reservoir to wildlife may have a severe demographic impact on nuclei of the last ones, with consequences for their conservation and, in the short term, for the continuity of trophy hunting programs.

As proposed in the part dealing with livestock management in the Buffer Zone, the development of basic veterinary surveillance schemes and the implementation of vaccination/chemoprophylaxis campaigns of livestock against selected transmissible diseases is promoted in Community Controlled Hunting Areas to limit the aforementioned spill over risks. Improved health condition of vaccinated/mass treated livestock will also mirror on per capita productivity, with the likely effect to favor local compliance with policies aimed at reducing livestock pressure on overgrazed pastures

- b. it is suggested to reduce the number of livestock in these areas to assure the balancing of the food availability for the wildlife
- The mountain ungulates populations seem to be more regulated by the environmental factors than by the presence of predators (Shackleton & Bunnel, 1989), and so the food availability play a fundamental role assuring the increase of these populations and their individuals. This increase obviously influences both the possibility of conservation on long terms, as well as the number of subjects that could be harvested.

Forests and vegetation

Sustainable Forest Management per valley level (SFM)

- The indications reported for the sustainable management of the forests in the Buffer Zone are valid also for this area, so here we report only the indications for the approach that is suggested to be followed, referring at the Buffer Zone paragraph for the indication of the specific activities.

Priority rank High

Medicinal plants sustainable use

- A harvesting linked to the real productivity of the area has to be promoted in sample areas, but until now the determination of a sustainable harvesting level for different species have to be determined.

<u>Priority rank High</u> at both level:

- i. determination of sustainable harvesting levels for different species
- ii. promotion of their farming

Livestock and pastures

Sustainable Managed Pasture Area (SMPA) - livestock pilot management

- The indications reported for the sustainable management of the pastures and livestock in the Buffer Zone are valid for this area. They aim at both improving and sustaining the productivity of the pastures on the long term, by preserving the economic incomes for local communities, as well as by conserving the Park environment. So here, we report only the indications of the approach that is suggested to be followed, by referring at the Buffer Zone paragraph for the indications of the specific activities.
- The first step is the constitution in every valley of a SMPA Valley Committee to manage the whole process, starting from the realization of the Valley Livestock/Pasture Analysis where the actual situation, the needs of the local communities and actual regulations are reported. This activity allows to understand the areas where the carrying capacity of a particular pasture is exceeded, triggering overgrazing phenomena, and where, in view of this, it becomes necessary to reduce the number of animals grazing on these areas.
- As tools for these activities the Land cover map developed in this project, as well as the analysis conducted on the localization of different pastures, the relative presence of livestock in different periods and their origin could be used.
- The following steps involves activities dedicated to Improve sanitary conditions of livestock through a preliminary analysis of the general situation and the following activation of a 3-year sanitary plan, developed in cooperation with the regional agencies in charge of animal health affairs. Another important point is the Improvement of fodder production with the aim to support the winter time fodder shortage which effects the productivity of the livestock.
- This program, linked to a numerical reduction of livestock, has to be supported with incentives during the first phase, since the economic loss, caused by livestock reduction, would be balanced by higher productivity.
- The CCHA area is considered a high priority area where to develop this program, due to the direct benefits for the trophy hunting target species, derived by an increase of trophy availability.

<u>Priority rank</u>High

Summary of the Indications for the Management of the CCHA

To prevent these situations the National Park's regulation is in force but the following indications are proposed:

ССНА						
Entrance	No specific authorization released by CKNP Directorate is required					
Fees	In order to enter and stay only in the Buffer Zone and related sub-areas (Community Controlled Hunting Areas and Conservation Areas) it is sufficient to register at the Park entry point and pay the CKNP Fee in ISL when requested for restricted areas or at the VRC points.					
Transfer and stay inside the area	on foot (no motorized way) and along trails marked in the main points pack animals (horses, mules and donkeys) could be used for transportation purposes camping is considered only in the designated spaces use of kerosene and butane gas for cooking in the designated areas is					
	considered, no fire can be used to cook or to burn waste avoiding the use of nylon bags, plastic bottles or glasses bottles and boxes waste has to be collected and transported to the nearest campsite or outside the CKNP.					
Hunting	is allowed only for trophy hunting programs					
Game bird hunting	not allowed					
Fishing	not allowed unless bearing a valid fishing license/permit					
Presence of livestock	By following a sustainable approach, it is allowed the presence of vaccinated livestock in good health conditions, owned by local communities. For this reason, the CCHA and CA are considered high priority areas to conduct veterinary controls and vaccination/chemoprophylaxis campaigns. A reduction in the number of grazing livestock is also considered in these areas.					
Grazing	The grazing of local community livestock is allowed by following a sustainable approach.					
Presence of pack animals (horses, mules and donkeys)	Allowed					
Presence of dogs	not allowed					
Wood and shrub collection	Wood and shrub collection by locals are allowed only if a sustainable approach is followed					

ССНА						
Timber collection	Timber extraction by locals is allowed only by following a sustainable approach according to the approved Forest Act					
Collection of medicinal plants and not timber forest products	The harvesting by locals is allowed by following a sustainable approach; farming activities are promoted					
Research activities	It is not allowed to conduct research activities in the whole Park area, without a preliminary written permission of the Park Directorate.					

7.2.7. Conservation Area (CA)

As its name suggests, these areas are focused on the conservation of the endangered species of large mammals (*e.g.* musk deer, markhor, brown bear, snow leopard), and/or for the particular vegetation, and/or ecosystems that are present in this part of the Buffer Zone.

Considering the primary task of conservation that they have to solve and the presence of endangered and or threatened species and ecosystems, in these areas the same indications of the Community Controlled Hunting Area are suggested with the exclusion of the possibility of harvesting wildlife; this could be only possible when and if a scientific based trophy hunting program will be approved and established.

Regulating the Flow of Visitors

This area is a free entrance area for the people of local communities and Gilgit-Baltistan, but National Visitors, Foreigner visitors and researchers, who stay <u>only</u> in the Buffer Zone area (including Community Controlled Hunting Areas and Conservations Areas), are request to pay the Entry Fee.

Visitors (Pakistani and foreigner visitors) and researches wanting to move within other Park's areas outside the Buffer Zone, are required to obtain the necessary authorizations and to pay fees and deposits in relation to the areas they want to visit, by following the regulations in force in each specific area.

So, all the visitors and groups are requested to register at the CKNP entry points compiling the specific entry form and paying the fees related to entrance and waste management, in agreement with the rules of the areas that will be visited before departure. In the meantime, at the exit it is asked for transit at one of the CKNP exit points to fill the exit form.

Tourism and Related Waste Management

The people are moving in one area where the sustainability is improving and where the National Park's regulation is in force; so, the following basic indication are suggested:

- *it is possible to move in the area only bon foot and along marked trails, without using any motorized system but with the support of pack animals (horses, mules, donkeys). The Contractor has to bring the necessary fodder.*
- *it is possible to camp only in the designated campsites*
- use of kerosene and butane gas for cooking in the designated areas is considered, no fire

can be used to cook or to burn waste

- segregated waste disposal, solid waste and human waste disposal
- avoiding the use of nylon bags, plastic bottles or glass bottles and boxes
- waste has to be collected and transported outside the CKNP

Conserving Species and Ecosystems of Fauna and Flora

These areas have been identified because range of endangered large mammals (e.g. Musk deer, Markhor, brown bear, snow leopard), and/or forest are present there.

General approach

Monitoring of species

Large mammals monitoring in SCA is a very important activity, as it allows comparing areas where the same approach is applied, as for example in the Conservation Areas of the buffer zone. Thus, to potentially evaluate the impact of human activities on wildlife numbers and distribution.

A detailed monitoring plan has to be developed for different groups, to obtain data related to their distribution and their relative density. In order to develop specific management indications, we suggest starting from some particular Park sectors, for example from Strictly Conservation Areas and Conservation Areas, in this way the potential impact of human activities on different groups can be better understood.

<u>Priority rank</u> High for the development of the monitoring plan for the different groups.

High for the realization of the program but related to the operative possibilities

Fauna

Monitoring of large mammals' species: Ungulates and Carnivores

These data are fundamental for management purposes and they have to be collected in all the different areas of the CKNP for all the species, but it is suggested to concentrate mainly on large mammals both for their role as umbrella species and for the economic values of the ungulates for trophy hunting.

The assessment will be carried out through the combination of two different techniques, which are described in the Core Zone paragraph. These techniques are focused on the target species of every area, through the following operational program:

- 1. direct counts, through observation from vintage points, carried out twice a year;
- 2. DNA analysis of biological samples for large carnivores, by following the indications described in the paragraph dedicated to Fauna in Core Zone section.

Priority rank High

Reduction of human impact

The human activity that could mainly interfere with the presence of wildlife, mostly ungulates, in this area is the livestock breeding. This presence, principally the related density in the same areas used by the endangered species, should elicit a numerical response from wildlife. The decreasing of the consistence of the wild ungulate's effects not only the conservation of these

species on the long term, but also the possibilities for local communities to develop trophyhunting program.

For this reason, specific management activities are needed, as explained above in section regarding livestock and pastures.

Protection of livestock from carnivores

Protection systems from carnivores have to be improved in order to reduce depredation attacks on livestock.

In order to improve protection strategies of livestock from predator attacks in CKNP, thus increasing the willingness of local communities to co-exist with predators, it is suggested to progressively shift from the current policy of mere compensation of killed livestock to a mixed system composed by:

- 1. training for the Park wardens and institutional personal and NGOs to determine the causes of death in livestock.
- 2. promotion of "good" husbandry practices, which include the nocturnal allocation of small ruminants in improved predator-proof enclosures and, possibly, their herding during daytime.

Due to such approach, funds are needed to encourage the adoption of mitigation measures, we suggest the Community Controlled Trophy Areas (CCHA) as pilot areas where to adopt the new policy, but this has to be activated in Buffer Zone as well as in the Conservation Areas. In this perspective, the evidence of the co- existence of local communities and predators is going to be the key element to maintain incentives, where already assigned, or to have first access to such funding by new communities.

Where applicable, part of the revenues from trophy hunting will be dedicated to support the implementation and the efficiency assessment of preventive measures (this approach has to be detailed by the CCHA in the Conservation Management Plan).

Forest and vegetation

Institution of Forest Conservation Areas

- Local communities have managed most of the forests inside the Buffer Zone for centuries. However, the few stands, which do not carry recent signs of harvesting, have the potential to become important "model forests" for the study and understanding of natural forest dynamics. It would be important to explicitly protect these stands from human disturbances, by including them in specific Forest Conservation Areas. Some example of those stands could be:
 - A Juniperus stand in upper Juglot (Darukush area)
 - A portion of Mountain dry temperate coniferous forest in Khaltaro valley: in particular, the forest located on the moraine of Dubani glacier.

<u>Priority rank</u>High

Medicinal plants

The medicinal plants are distributed in a wide altitudinal range in the CKNP, from forested areas to alpine and high-altitude areas, and a list of the different species present in CKNP is being developed.

The impact on these species seems mainly linked to their direct collection, as often the extracted parts are the roots and underground rhizomes, causing damages to the plant and a reduction of the possibility for vegetative reproduction; but also to the disturbance of their habitat as a consequence of human activities on forested area as well as on livestock grazing. However, these impacts have still to be quantified.

Potential mitigation measures could include direct protection of the medicinal plants in some zones of the Park, and the setting of a sustainable utilization quantity.

<u>Priority rank High</u>

Sustainable Use of the Natural Renewable Resources

The use of natural resources is only partially allowed in this area accordingly with the points enounced before.

<u>Priority rank</u>High

Summary of the Indications for the Management of the Conservation Area

In these areas the National Park's regulation is in force but the following indications are proposed:

CONSERVATION AREA						
No specific authorization released by CKNP Directorate is required						
To enter and stay only in the Buffer Zone and related sub-areas (Community Controlled Hunting Areas and Conservation Areas) it is sufficient to register at the Park entry point and pay the CKNP Fee in Islamabad when requested for restricted areas or at the VRC points.						
on foot (no motorized way) and along trails marked in the main points						
pack animals (horses, mules and donkeys) could be used for transportation purposes						
camping is considered only in the designated spaces						
use of kerosene and butane gas for cooking in the designated areas is allowed, no fire can be used to cook or to burn waste						
avoiding the use of nylon bags, plastic bottles or glass bottles and boxes						
waste has to be collected and transported to nearest campsite or out to the CKNP.						
Not allowed						
Not allowed						

CONSERVATION AREA						
Presence of livestock	It is allowed the presence of vaccinated livestock in good health condition owned by local communities, if a sustainable approach is followed. For this reason, the CCHA and CA are considered high priority areas to conduct veterinary controls and vaccination/chemoprophylaxis campaigns. It is also considered a reduction of the number of grazing livestock in these areas.					
Grazing	It is allowed the grazing of livestock of local communities following a sustainable approach					
Presence of pack animals (horses, mules and donkeys)	Allowed					
Presence of dogs	not allowed					
Wood and shrub collection	It is allowed the wood and shrub collection by locals following a sustainable approach					
Timber collection	Not allowed					
Collection of medicinal plants and not timber forest products	Not allowed					
Research activities	It is not allowed to conduct research activities in all the Park area without a preliminary written permission of the Park Directorate.					

7.2.8. Buffer Zone Valleys

CKNP zonation has been revised with addition of this new zone that includes all the 15 valleys and its villages around the park having use rights inside the park. After 5 years of CKNP management, it is now necessary to bring buffer zone valleys into park zonation for the better management of natural resources and socio-economic development of the communities. The VCSDPs developed in 2016 in the framework of Ev-K2-CNR SEED project emphasize heavily to address the community concerns and one of the main concerns is that the community has no advantage of this park; there are only rules and restrictions for them. This new zone shall support the community in their conservation efforts and development in a sustainable way.

Main aspects for the Buffer Zone Valley

Sustainable use of Natural Renewable Resources Forests and vegetation Valley level Sustainable Forest Management Plan (SFMP)

One basic point in the delineation of the management planning of forest resources in CKNP is that the local communities of those remote areas are still dependent from forest products (e.g. firewood and timber), a key asset for their subsistence economy.

As CKNP forests "embody complex and unique ecological processes which are the basis for the present and potential capacity to provide resources to satisfy human needs as well as environmental values" (UNCED, 1992), however, a sound and sustainable management approach must be implemented. Sustainable forest management, by definition, is the practice of meeting the forest resource needs and values of the present without compromising the similar capability of future generations, practicing a land stewardship ethic, managing for useful products with the conservation of soil, air and water quality, wildlife and fish habitat, and aesthetics (UNCED, 1992).

To meet these objective, three basic conditions, are fundamental:

- 1. to assess and evaluate precisely the forest area, forest productivity and degradation status.
- 2. to accurately estimate the forest products (timber, firewood and non-timber forest products) necessities of local communities.
- 3. to implement a careful analysis of the local cultural heritage, of the ongoing tradition knowledge, its motivations and constraints.

The long-term sustainable management, indeed, is reached when harvesting rate (point 2) is not exceeding forest increment rate (point 1).

The following management indications aim at setting the basis for participatory and sustainable forest management in the Central Karakuram National Park. This is a long lasting and continuous process, where technical skills, community awareness and civil society responsibility are all necessary ingredients for the delivery of an effective and successful plan.

The first step is the constitution in every valley of a *Valley Forest Committee* to manage the whole process, starting from the realization of the *Valley Forest Analysis* where the actual situation, the local community's needs and actual regulations are reported.

On the basis of the situation some general **guidelines** are indicated for the development of these operations in a sustainable way:

- <u>harvesting of timber and firewood</u>: in areas with Mountain Dry Temperate Forests, as in SW part of CKNP as: Minapin-Pisan, Rakaposhi, Juglot, Danyore, Bagrote, Haramosh, Shondur, Astak among others;
- Firewood collection: in areas with absence of Mountain Dry Temperate Forests where the collection is focused mainly on Juniperus tree, shrubs and riparian vegetation, but also as general rule for the whole CKNP.
- Firewood plantations: as support for the firewood necessities in those areas where this is critical due to the scarcity of degradation of the wood sources.

As further point to train the local personal involved in the forest management but also to verify the effectiveness of the management measures, **forests trainings** shall be promoted in each valley.

1a - Valley Forest Committee

In the valleys where they have not been already constituted, CKNP should promote the establishment of forest committees at valley level. The forest committees should become the reference party for the CKNP forest management on the territory, organizing the different actions planned (i.e. reforestation, plantation, etc.) and monitoring the forest threats & degradation drivers. Forest committees, moreover, are the pillars of community-based forest management, through which communities manage their forests with additional assistance of the Forest Department and the CKNP staff.

Additionally, forest committees together with CKNP staff should:

- Estimate local community's wood necessities and harvesting areas: precisely, using the questionnaire, which has been developed, by EV-K2-CNR and University of Padua and locating harvesting areas on the maps developed for the CKNP. A team, composed by the local forest committee members and local CKNP staff will organize open interviews with elders of each village, or, in larger valleys, with a representative sample. This will be a precious occasion also to raise awareness about forest resources conservation and importance.
- Report about drivers of forest degradation inside the CKNP buffer area: for each valley a report should clarify which are the most important factors affecting deforestation and forest degradation (illegal harvesting, firewood necessities, timber harvesting, lack of management guidelines, etc.).
- For the SW valleys, where Pinus wallichiana (Kail Tangshin) or Picea smithiana (Spruce –Katwul- Stak) forests are present: forest committee should be in charge for the collection of cones from those two species. [2.5 kg of Pinus wallichiana (Kail Tangshin) seeds

and/or 1 kg of Picea smithiana (Spruce – Katwul – Stak) seeds – depending on species presence in local forests - would be sufficient to guarantee assisted artificial regeneration in harvested areas.

As tools for these activities, the Land cover map developed in this project could be used.

2a - Valley Forest Analysis

Each forest committee shall prepare a simple Sustainable Forest Management Plan at valley level. This document should include a brief description of the following topics:

- *Harvesting area: locate, on a valley map, the areas used by each community to harvest firewood and, eventually, timber.*
- Estimation of local community wood necessities: through questionnaire (see management indication 1), the annual wood consumption of local people should be estimated per village (or groups of villages) level.
- *Highlight degraded areas: eventually locate on a map the forest areas heavily degraded and the motivation (if possible).*
- *Regulation already in practice: describe if some regulation has already been set up (e.g. limitation on access, ban on harvesting etc.) and for which area are valid.*

The forest committee and the CKNP shall approve the sustainable forest management plan, at least. As tools for these activities, the Land cover map developed in this project could be used.

3a – Timber harvesting in mountain dry temperate forest.

Inside SW CKNP buffer, some forested areas where mountain dry temperate forest grows (Minapin-Pisan, Rakaposhi, Juglot, Danyore, Bagrote, Haramosh, Astak among others) are eligible for organized timber harvesting.

- Those are stands, which are classified as "*closed forest*" of *Pinus wallichiana* (Kail, Himalayan Blue Pine) and/or *Picea smithiana* (Katwul, Morinda spruce). Similarly, to what is performed in Europe and North America, harvesting **of green trees** should be allowed if degradation status is limited.

General guidelines should include:

- To adopt a "target diameter" management prescription, for which only the trees which reach or exceed a certain diameter (60/ 80 cm – 23/30 inch, depending on specific site and fertility) can be cut while all the trees, smaller than this threshold, should be left to grow. These management guidelines (that shall be defined in detail) ensure a correct diameter composition of the forest stands.
- 2. Define the entire forest area eligible for felling and locate it on a map
- 3. Divide this area into parcels, with an average size of 50 hectares (120 acres) and easily identifiable and understandable borders (ridge, rivers, roads, etc.). Around 10 parcels shall be identified.
- 4. Each year, harvest timber (and eventually firewood) only from a certain parcel, selecting the trees to be cut with the target diameter system: an average cutting cycle of 10 years shall be allowed.
- 5. The area interested by the felling should be left to natural regeneration with additional assisted artificial regeneration (if necessary) provided by the above-mentioned seed harvesting.

- 6. Avoid grazing, as much as possible, in regeneration areas until average individual's height has not reached 3 meters/10 feet; eventually by building fence with thorny shrubs (i.e. seabuckthorns) to prevent goat and sheep feeding on young seedlings. In any case, a collaboration with shepherds should be promoted in order to avoid unattended grazing.
- 7. Support a complete utilization of the wood residuals following tree-harvesting (e.g. Branches, stump) also for firewood purposes.

4a – Firewood collection

Description

Firewood collection, being an essential practice for the community living around the CKNP borders, cannot be limited if alternative energy resources are not found. Moreover, in the short-term-future we do not foresee any feasible possibility for a significant reduction of firewood needs of local communities. Nevertheless, actions raising local community's awareness about the (often)-unsustainable long-term effects of the current firewood collection practices should be implemented.

Most of firewood necessities are actually met using a wide array of different forest resources according to village location: *Juniperus*, riparian vegetation and other minor shrubs (like *Artemisia*) in drier and more continental valleys (NE CKNP).

In principle, even the firewood collection activity should be included considered with simple prescriptions discussed and approved by the forest committee, local community and CKNP (e.g. reduce collection in heavily degraded areas for a certain time).

Management indications for firewood collection, which might be considered by the forest committees, include:

- Juniperus trees: it is recommend to not harvest complete individuals but rather cut single branches. Juniperus trees, indeed, show a rather strong resilience and are able to sprout new branches in the following years.
- Regarding riparian vegetation: for coppice plants like sea-buckthorns or willows it is suggested to cut single basal shoots from each plant to preserve its root system. By doing so, new shoots can re- grow rapidly producing new biomass to be harvested.
- Shrubs: For coppice plants, it is suggested to partially cut the basal shoots trying to avoid, if possible, the cutting of whole individuals. In these cases, local knowledge and traditional management system should be emphasized and taken into consideration.

5a – Firewood plantation

In those areas were firewood from local forests is hardly sufficient to cover the needs of local communities, or where forest degradation has depleted above ground biomass to extremely low amounts, specific actions should be implemented to increase wood availability from non-forest areas. Plantation of trees (poplar, willow, sea buckthorn) to be managed as coppices for the production of firewood, therefore, should be promoted as an effective tool to reduce the pressure on natural forests. Those activities shall be directed particularly to those valleys where forest cover is naturally scarce, as NE CKNP like Braldo, Hispar, Shigar, Basha, Hushey among others)

6a – Training forests

Within the buffer areas, training forest could be promoted for each valley through the support of local communities. The objective of training forest is to train local park rangers and members of the forest committees in different forest management practices. Different types of cuttings can be adopted and the effects on forest regeneration monitored, in time. Those would be ideal areas also for evaluating the regeneration capabilities of forests in time. One training forest shall be identified for each most common forest typology present in the valley.

Priority rank: high

Provision of alternative forms of energy

The biggest amount of timber products is gathered for heating purposes and this could not only have an impact on some forested areas but it can also be a time-consuming activity, which is being carried out mainly because in some areas this is the only possibility to get energy, or where other sources are available, timber products are however a cheaper option.

A very important step is to develop a specific analysis of the possibility to use different alternative energies with particular attention to the renewable ones; regarding the last ones the possibilities linked to hydropower is considered promising in the local situation.

Priority rank high

Medicinal plants sustainable use

A harvesting linked to the real productivity of the area has to be promoted in samples area, but till now the determination of a sustainable harvesting level for different species has to be determined.

Considering that the direct collection is only one part of the problems affecting the presence and reproduction of the medicinal plants, these experimental areas could be developed in the Park Buffer Zones with special conservation value (i.e. Conservation Zone, Community Controlled Hunting Area). A well-balanced harvesting could be allowed in some areas in agreement with the local communities.

It is suggested that inside the Park area the harvesting of the medicinal plants could be done only by the local communities through a specific license request issued by the responsible authority, this to promote the possibility of an income linked to the sustainable use of another renewable natural resource.

Another suggested tool is the promotion at local community level of farming only for some species; this could reduce the pressure on the wild ones, and increase incomes for local people.

Some researches on the determination of active principles of some medicinal plants are carried out at KIU within the SEED project and the results are waited for the end of this year. The possibility to develop an easy extraction system, linked to the cultivation, could further improve the outcome of the proposed process.

Priority rank High at both level:

i. determination of sustainable harvesting level for different species

ii. promotion of their farming

Livestock and pasture

Protection of livestock from carnivores

Protection systems from carnivores have to be improved in order to reduce depredation attacks on livestock.

In CKNP, livestock mortality, caused by carnivore's attacks, is well documented but difficult to quantify, due to two principal issues:

- lack of trained personnel able to identify the right cause of livestock death.
- lack of compensation for attacks and/or predator species.

Actually, some compensation is provided in some areas of CKNP, but it covers only 25% of the market value of the livestock, which is killed by snow leopard (compensation paid by Snow Leopard trust) or by other carnivores (by WWF).

In order to improve protection strategies of livestock from predator attacks in CKNP, thus increasing the willingness of local communities to co-exist with predators, we suggest to progressively shifting from the current policy of mere compensation of killed livestock to a mixed system composed by:

- 1. training for the Park wardens and institutional personnel and NGOs to determine the causes of livestock death.
- 2. promotion of "good" husbandry practices, which include the nocturnal allocation of small ruminants in improved predator-proof enclosures and, possibly, their herding during daytime.

The proposed **Insurance Scheme** that is already in use in some Buffer Zone Valleys (Thallay)



has to be extended and reinforced in all valleys; the initial funds for insurance scheme can be arranged through community share from CKNP fee and some part from livestock owners.

The new policy will be implemented and tested, with due priority, in the Buffer Zone, in cooperation with communities whose territory and pastures still sustain the predators' presence. Such approach needs some funds to be available to encourage the adoption of mitigation measures; we suggest the trophy hunting areas (CCHA) as pilot areas, where to adopt this new policy. In this perspective, the evidence for the co-existence of local communities with predators is going to be the key element in order to maintain incentives, where they were already assigned, or to have first access to such funds by new communities.

Where applicable, part of the revenues deriving from trophy hunting will be dedicated to support the implementation and the efficiency assessment of preventive measures (this approach has to be detailed by the CCHA in the Conservation Management Plan). In turn, the presence of good numbers of preys (assessed through standardized counts) as well as the presence of large predators will be key parameters requested to local communities as pre-requisite to have access to trophy hunting options.

<u>Priority rank high</u>

Livestock Management in Sustainably Managed Pasture Areas (SMPA)

In CKNP the pastoralist, system involves seasonal movements between villages and temporary settlement in the high alpine zone, following the altitudinal gradient of the vegetation availability.

In general, sheep and goats' herds are guarded during the day, while lactating cows are unguarded, but both groups are herded for the night. Male and dry cattle, but especially Yak and yak-cattle hybrid (zo, zomo), are free ranging from late spring to autumn. An increase of herding of equine (horses, mules and donkeys) is reported mainly in Baltoro area, where they are used as pack animals.

A general increase in the number of reared animals is reported in the area, but this is not followed by an increase in productivity, due to two main factors: the poor sanitary/ health conditions of the livestock and the food shortage (e.g. Khan, 2003).

For the first aspect different diseases are recorded in this area affecting mainly sheep and goats, with an high rate loss; regarding the second one, this is linked to the low availability of fodder during winter time (November - March) and poor rangeland pastures, due to overgrazing, where a fragile ecosystem is present for the critical environmental conditions (e.g. Khan, 2003).

This situation has a negative impact on the economy of the local communities, as livestock and agriculture are the main sources of livelihood. At the same time, the increasing number of raised livestock can have a negative impact on the environment too. This can be caused by overgrazing of pastures, which are a source of nourishment for wildlife and livestock, however the contemporaneous presence on the pasture of both wildlife and livestock can increase the transmissions of diseases from domestic to wild animals. This disease transmission can be the cause of a reduction in local community's revenues generated by trophy hunting program.

The idea of buffer zone is to allow local communities to continue their natural development

processes, but minimizing the damaging effects of man induced factors. Therefore, the purpose of this part of the park is to allow traditional land use for grazing, preserving its economic value for local communities, but activating at the same time a conservational approach that minimize its impact.

In view of the above, a pilot management project is proposed with the creation of a "Specially Managed Pasture Area" (SMPA) focused on the activation of good practices to decrease the number of heads, by improving the livestock productivity and health; this approach decreases the risk of pathogen spill-over from livestock to wildlife.

The optimal places, where to start this project, are the *Community Controlled Hunting Areas* (CCHAs), for the clear synergy and positive feedbacks from trophy hunting, that this process can generate: the reduction in the number of domestic animal is able to balance out the food availability for wildlife. The mountain ungulates populations seem to be more regulated by environmental factors than by the presence of predators (Shackleton and Bunnel, 1989), and so the food availability play a fundamental role assuring the increase of these populations and their individuals.

In the same way the spreading of a disease from livestock to wildlife (i.g. severe outbreak of sarcoptic mange that affected Blue sheep in Shimshali Dagleish *et al.*, 2007) could considerably affect the survival of these nuclei with consequences both on their conservation and to the problems related in the continuation of the trophy hunting program.

Here we consider the development of the pilot program linked to the *Community Controlled Hunting Areas* and *Conservation Areas*, that will become also a *Sustainable Managed Pasture Areas* (SMPAs) regarding the pasture/livestock management, but it is possible to start in any part of the Buffer Zone on the basis of agreements with local communities.

After the agreement with local communities, the first step to realize this program at valley level is the constitution of the *SMPA Valley Committee* for the specific area

1a - SMPA Valley Committee

CKNP should promote the establishment committee at valley level, with the aim to support a sustainable management of the livestock and pasture, in the prospective to:

- assure the long-term productivity of pastures, by avoiding that the number of grazing animals exceeds their carrying capacity;
- sustain and improve the fodder availability also for winter time, through activation of specific farming programs in the cultivated areas;
- promote, in cooperation with regional agencies in charge of animal health affairs, good practices for animal rearing and periodical basic veterinary surveillance, also considering vaccination and chemoprophylactic programs.

This integrated approach is tuned on the needs of Park nature conservation and, in parallel, aims to preserve a viable livestock economy for the communities.

2a - Valley Livestock/Pastures Analysis

Each committee shall prepare a simple document at valley level, including a brief description of the following topics:

- 1. *identification of all herds and flocks (number of heads for species and their provenience) that are grazing in the SMPA, the related owners and care-takers;*
- 2. areas grazed by the different herds and flocks, as identified in the previous point, in the different periods and their size.

The land cover map developed in this project, as well as the first survey on pasture delimitation, related also to their use by different herds and flocks could be used as base for the development of the two above points.

The collection of i) basic information on the prevalent causes of disease-related mortality; ii) information on sympatric use of pastures by livestock and wild Caprinae; iii) eventual accounts of suspect disease episodes in wildlife. From these data an estimate of the risk of overgrazing could be obtained based on simple formulae taking into account: i) the number and diversity of domestic ruminants exploiting a pasture; ii) its surface; iii) the number of weeks/months during which that pasture is grazed by domestic ruminants. A policy of livestock reduction will be progressively encouraged on pastures with a high to medium overgrazing risk factor

3a - Improving sanitary conditions of livestock

Through a specific survey:

- a zero-survey of representative herds and flocks grazing in the buffer zone of the CKNP, aimed to define the most prevalent infections to consider for vaccination and/or chemoprophylactic treatment. The survey will be carried out in coordination with the regional agencies in charge of animal health affairs.
- data dealing with: i) best timing and operational costs of vaccination and chemoprophylactic (anti- parasitic) treatment campaigns under the generally uncomfortable local conditions; ii) bureaucratic steps to follow to comply with the Country national and regional veterinary legislation.
- the definition of Good Practices Guidelines to improve the general sanitary conditions of livestock and indications of the most important vaccinations and prophylactic treatments that have to be considered.

The output is a first three-year sanitary plan for the SMPA-related herd, including: i) periodic veterinary surveillance; ii) yearly mass vaccination against prevalent infectious diseases which, besides being regionally prevalent, must be characterized by high pathogenicity and spreading potential; iii) a single yearly mass strategic treatment against highly pathogenic endo- and ecto-parasites which may be cross-transmitted to sympatric wild Caprinae.

This sanitary plan has to be developed and sustained in strict cooperation with the regional agencies in charge of animal health affairs.

In the development of the CKNP Management Plan, it was considered the goals of the conservation of the Park nature and integrity, linked to the necessities of the local communities, strongly depended by the natural resources.

4a - Improving fodder production

As previously described, the traditional livestock breeding system utilizes the primary productivity of pastures during the warm season, and mainly fodder in winter time; the shortage of fodder during winter is one of the recognized factors limiting livestock economy in the

CKNP area. This chronic seasonal deficiency of nutrients is linked to under nourishment, low productivity and predisposes the livestock to parasitism, epidemics and breeding problems (Humphreys, 1984).

A program to increase the availability of fodder through its cultivation, as per results of previous projects developed in CKNP area (i.e. Dost, 2001), is promoted.

This program will be run in parallel in some areas with the aforementioned livestock reduction policy. Direct incentives will be necessary to support the program in its starting phase (e.g. for improvement of irrigation for fodder cultivation). Nevertheless, it is reasonable to assume that initial economic losses related to reduced livestock will be balanced by enhanced productivity as a consequence of: i) grazing pastures which are less intensively exploited; ii) being fed more adequately during winter; iii) being less exposed to disease-related mortality and production loss. In the medium term, additional benefits will derive to local communities by a predictable increase of wild ruminants due to diminished resource competition and sanitary risk.

Summary of the Indications for the Buffer Zone Valleys

In these areas, the National Park's regulation is in force but the following indications are proposed:

BUFFER ZONE VALLEYS							
Entrance	No specific authorization released by CKNP Directorate is required						
Fees	To enter and stay only in the Buffer Zone Valleys is free						
Transfer and stay inside the area	 camping is considered only in the designated spaces avoiding the use of nylon bags, plastic bottles or glass bottles and boxes waste has to be collected and transported to nearest disposal center 						
Game bird hunting	Not allowed						
Fishing	Allowed with fishing License System						
Presence of livestock	It is allowed the presence of vaccinated livestock in good health condition owned by local communities, with a sustainable approach. It is also considered a reduction of the number of grazing livestock in these areas.						
Grazing	It is allowed the grazing of livestock of local communities following a sustainable approach						
Presence of pack animals (horses, mules and donkeys)	Allowed						
Presence of dogs	Allowed						
Wood and shrub collection	It is allowed the wood and shrub collection by locals following a sustainable approach according to GB Forest Act						
Timber collection	Allowed according the rules of GB Forest Act						
Collection of medicinal plants and not timber forest products	Allowed in a sustainable approach						
Research activities	It is allowed to conduct research activities						

ACTIVITY		Hunting	Game bird hunting	Fishing	Presence of livestock (small animals)- Sheppard grazing	Presence of livestock (large animals)- free grazing	Presence of pack animals (horses, mules and donkeys	Presence of dogs	Wood, shrub, bush, and timber utilization only by local communities' members	Mining (only for authorized hotspots by local communities' members)	Collection of medicinal plants, flowers and no wood products and extraction of roots only local communities' members
BUFFER ZONE VALLEYS		Only authorized trophy hunting in CCHA	✓ With license only	YES, with license	YES	YES	YES	YES	YES	YES	Following a sustainable approach
BUFFER ZONE		Only authorized trophy hunting in CCHA	✓ With license only	*	~	V	*	✓	V	With poor authorization	✓ Following a sustainable approach
COMMUNITY CONTROLED HUNITNG AREAS (CCHAs)		~	With license only	✓ With license only	✓	~	~	*	~	*	Following a sustainable approach
CONSERVATION AREAS (CAs)		✓	*	*	~	~	*	*	~	*	Following a stricter sustainable approach
CORE ZONE (CZ)		*	*	*	*	\checkmark	*	*	*	*	*
STRICTLY CONSERVATION ZONE (SCZ)		*	*	*	*	Not recommended	✓	*	*	*	*
TOURIST TRAILS	VISITORS INTENSIVE USE ZONE	*	*	*	*	*	~	*	*	*	*
	DISCOVERY TRAILS (DTs)	*	*	*	*	*	*	*	*	*	*
	OCCASIONAL TRAILS (OTs)	*	*	*	*	*	*	*	*	*	*

Exhibit 14: Summary of the zoning for the management of the CKNP areas

8. Fee System



Exhibit 15: CKNP tourist map

The proposed fee mechanism is integrated with the last version of the management plan and based on two main fees:

The actual system is based on two main fees:

1) Royalty Fee for expeditions 2) Permit Fee

- 1. Paid for CLIMBING Peaks above 7500 mt.
- 2. Paid for TREKKING inside restricted zone (Baltoro Hushey Hispar).

Paid by the tour operators, to the Federal Government in Gilgit Baltistan council, but it is now in process to be transferred to GB Province and to be used for improvement and management of tourism sector in Gilgit Baltistan.

8.1. Royalty Fee

Currently the Royalty Fee for expedition (**for foreign climbers only**) is collected in Islamabad that remains with the Gilgit Baltistan Council, but it is proposed to be transferred to GB government, CKNP and to be used to improve the quality of tourism services in CKNP and facilities provided. In order to contribute to the process, the management plan of CKNP is suggesting amendment/relaxation to the existing and procedures for Tourism Policy of Gilgit Baltistan and particularly to the Trekking Permit Rules 1996. This is in light of the experience gained from the planning process of CKNP.

Government of Pakistan has announced 40% discount on the original fee that makes a huge
difference. It is also important to mention that the royalty fee of Mount Everest in 2019 is 11,000 USD that is very high compare to what is charged for K2. The details of fee are given here:

- Zero royalty fee for peak up to 6500 m.
- 10% royalty fee on mountains situated in Gilgit, Damir and Ghizer except on Spantik/Golden Peak.
- 05% royalty fee on all peaks during winter season (December-February)

40% Discount on royalty fee on all peaks except as mentioned in (i) & (ii) above as detailed below:

Original Fee				With 40% Discount			
S.#	Height of the Peak (m)	Royalty Fee (7 members)	Each Additional Member	S.#	Height of the Peak (m)	Royalty Fee (7 members)	Each Additional Member
1.	K2-8611	\$ 12000	\$ 3000	1.	K2-8611	\$ 7200	\$ 1200
2.	8001-8500	\$ 9500	\$ 3000	2.	8001-8500	\$ 5400	\$ 900
3.	7501-8000	\$ 4000	\$ 1000	3.	7501-8000	\$ 2400	\$ 300
4.	7001-7500	\$ 2500	\$ 500	4.	7001-7500	\$ 1500	\$ 180
5.	6501-7000	\$ 1500	\$ 300	5.	6501-7000	\$ 900	\$ 120

Expedition on K2 are charged 7,200 USD up to seven participants whereas 1,200 USD are charged for each additional member. Peaks of 8,001 to 8,500 are charged with 5,400 USD until 7 participants (+ 900 USD for each additional member). Peaks with altitude between 7,501 and 8,000 is charged with 2,400 USD until 7 participants (+ 300 USD for each additional member). Peaks with altitude between 7,001 and 7,500 is 1,500 USD until 7 participants (+ 180 USD for each additional member). Peaks with altitude between 6,501 and 7,000 constitutes 900 USD until 7 participants (+ 120 USD for each additional member).

At the same time for Trekking, Groups pay for Permit Fee is 50 USD per person (also for expeditions under 6.500 m). Expedition with Pakistani members pay only half of the amount requested.

Documents Required:

All applications for climbers/trekkers in respect of foreign tourists for the Peaks/Treks located in Gilgit-Baltistan are submitted in Gilgit-Baltistan Council Secretariat through designated tour operators registered with Department of Tourist Services Government of Pakistan including 7 sets of following documents:

- Application from tour operator on their letter head
- Application form for mountaineering expedition
- Name list of members of expedition
- *Route map of proposed peak/trek*
- Passport copies of members of expedition

- Visa application form (duly filled) of foreign climbers/trekkers
- CV of Expedition members
- Copy of license of tour operator company

Procedure and Process

- After receipt of complete application from tour Operator Company, the same is forwarded to concerned departments/agencies for obtaining requisite clearances.
- *Time required 4-6 weeks as per existing Pak Visa Regime.*

Increasing of Royalty Fee

Comparing the Royalty Fee in use at the moment with that are imposed for example in Nepal, it is necessary to upgrade the fees applied in Pakistan for the next years going to a percentage of 20% discount on the previous rate. However, the original fee needs to be regularized.

Original Fee			With 20% Discount				
S.#	Height of the Peak (m)	Royalty Fee (7 members)	Each Additional Member	S.#	Height of the Peak (m)	Royalty Fee (7 members)	Each Additional Member
1.	K2-8611	\$ 12000	\$ 3000	1.	K2-8611	\$ 10000	\$ 2500
2.	8001-8500	\$ 9500	\$ 3000	2.	8001-8500	\$ 7900	\$ 2000
3.	7501-8000	\$ 4000	\$ 1000	3.	7501-8000	\$ 3300	\$ 800
4.	7001-7500	\$ 2500	\$ 500	4.	7001-7500	\$ 2000	\$ 400
5.	6501-7000	\$ 1500	\$ 300	5.	6501-7000	\$ 1250	\$ 200

There are currently no restrictions on the number of climbers in a commercial expedition for safety reasons, this need to be limited up to 12 members in a single group who can climb, if the group consists more than 12 members, they need to pay addition against royalty fee. At the same time to address the growing traffic and litter on higher camps and as well as in base camp, it is proposed to restrict the expedition groups to maximum 10 groups in a season.

8.2. Permit Fee

Trekking permit is required for foreigners from federal government (GB council) and to pay trekking fee to walk through treks in Baltoro area or restricted areas. Trekking fee is 50 US\$ per person for one month for treks situated in 8 restricted areas of Gilgit-Baltistan.

8.3. Waste Management Fee

This fee was proposed and implemented in alternate of pollution fee, climbers and trekkers need to pay this at the time of issuance of trekking and climbing permits. It was a difficult task to implement this as tour operators had very strong concerns but they were made understand about the utility and benefits of this fee. However, unfortunately, this fund remained unavailable to CKNP directly and it hampers waste management activities a lot and tours

operators and tourists found complaining against CKNP for badly managing the litter. Waste management fee is 68 US\$ for each member of mountaineering expedition and 50 US\$ per person for one month of trekking groups.

8.4. CKNP Fee

The proposed new fee system shall enhance the value and simplify the process including all the fees (including entry fee) into a single payment called as Aggregate Fund and foreign tourists will need to pay in Islamabad or at the VRC points for Pakistani nationals. These new rates need approval from GB government to be implemented.

Visitor cate	r& Fee gory	CKNP FEE	CKNP Share		Community Share	Total	Currency
		Entry	2.5		7.5	10	
-		WMF	152		38	190	
Foreign	Expedition	(restricted zone)	154.5		45.5	200 per member	USD
		Entry	2.5		7.5	10	
		WMF	112		28	140	
Foreign	Trekker (F	Restricted Zone)	114.5		35.5	150/ per member	USD
		Entry	2,5		7.5	10	
		WMF	72		18	90	
Foreig	n Expeditic	on (Open zone)	74.5		25.5	100 per member	USD
		Entry	2.5		7.5	10	
		WMF	40		10	50	
Forei	gn Trekker	(Open zone)	42.5		17.5	60 per member	USD
		Entry	125		375	500	
		WMF	2000		500	2500	
Pakista	ani Expediti	ion (All zones)	2125 875 3000 I per member		PKR		
		Entry	125		375	500	
		WMF	1520		380	1900	
Pakistani Trekker (All zones)		1645		755	2400 per member	PKR	
		Entry	12.5		37.5	50	
		WMF	80		20	100	
GB Exp/Trek/Tourist Group		92.5		57.5	150 per member	PKR	

Exhibit	16.	CKNP	Fee	structure
LAHUH	10.	CIVIT	TUU	Suuciuic

The collected funds will support CKNP Directorate to implement various interventions in managing and facilitating the tourists in the remote areas:

- To cover the expenses for the maintenance of the Eco-platform on the glacier
- To cover the costs for transportation of the human waste to the disposal zones
- To install new Eco-Platform and incinerator
- To supervise the campsite waste management interventions
- To manage the incinerators and payment of the employees
- To transfer the segregated waste to the down cities for recycling
- *Campsite employees pays*
- Mule sheds
- Porter sheds

Park entry fee has not been implemented successfully, and this is only way to address the grievances of the communities in buffer zone valleys as 80%-75% of this fund supposed to be invested on community development and to support their conservation efforts. Villagers around CKNP are disgruntled for financial reasons, as they had to surrender their community lands voluntarily for the national park. Although they were promised jobs, education, health and infrastructure and were told that revenue generated through tourism will be spent on the community, the promises were not fulfilled.

In the proposed fee system, entry fee is included in CKNP fee with following guidelines of collection;

- Free entrance for local communities of CKNP buffer zone valleys
- CKNP is a free entrance area for local communities' people of CKNP surroundings
- Foreign visitors need to pay in Islamabad at the moment of issuance of the climbing permit and restricted zone trekking permit
- Foreign visitors that plan a trekking in open zone will pay in the CKNP VRC the CKNP fee.
- National visitors and Gilgit-Baltistan people will pay in the CKNP VRC the CKNP fee.

8.5. Entry for Research Purposes

The process adopted to develop the CKNP Management Plan has set environmental and socioeconomic research as a base for the Park management. The current knowledge of the CKNP region was merged with recent research results deriving from activities carried in the framework of the SEED (*Social Economic Environmental Development*) and SHARE (*Stations at High Altitude for Research on the Environment*) projects. With this assumption, the entrance to the Park for scientific research purposes shall be treated as priority and researchers need to pay as well.

8.6. Fee Distribution Mechanism

The following CKNP fees mechanism has been devised after thorough consultations with all the relevant stakeholders and the organizations working in this field as well as the lesson learnt from the previous mechanism with partial or without involvement of the CKNP Directorate. This fee mechanism approval from the competent authorities will be vital for the Park Directorate to enforce the mechanism jointly with local communities to keep clean the largest protected area of the country, the fresh water towers and the most important fragile mountain ecosystems harboring a unique biodiversity. The Directorate of the Central Karakuram National Park is the institution responsible for managing and administering fees collection for the entry of tourists into CKNP.

The objectives of fee implementation are to support local communities, compensate use right holders and coverage of CKNP costs as per below scheme;

75% of community share from entry fee shall be used for socio economic development and conservation efforts against proposals to be submitted to CMC every year. CMC shall decide after reviewing the proposals and availability of funds.

<u>The CKNP Fee for Foreign Visitors</u> will be collected, all together at the time of issuance of Trekking and Climbing permit and the fees will be transferred to GB Government account and at the end transferred to CKNP Directorate, for the others in the CKNP VRC.

The management plan of CKNP that was approved by the government in 2015 proposes that the ownership of the royalty fee of the K2 and other peaks inside CKNP to be shifted to the CKNP directorate accordingly, the same for the trekking permit fee and waste management fee.

The fee revenue will be utilized for following intervention in CKNP

- 1) Peak's and base camps cleanup campaigns (high altitude camps)
- 2) Trail maintenance
- 3) Mobilization and awareness raising
- 4) Rescue and first aid services (Concordia Rescue Team)
- 5) Promotion
- 6) Measures for climate change mitigation (fuel efficient services, afforestation)
- 7) Base camp management
- 8) Campsite management
- 9) Facilitation of porters, sardars and cooks setting up eco-friendly sheds etc
- 10) Training and capacity building of porters, high altitude porters, climbers/mountaineers and sponsorship of Pakistani Expeditions
- 11) Use-right holder communities
- 12) Eco -toilets
- 13) Waste management mainly along the glaciers area

Monitoring Mechanism

A committee will be constituted with the approval of competent authority for monitoring and regulation of the royalty fee. A Member from the following departments will be included in the committee.

- Government Forest Wildlife and Environment Department GB
- Government Planning and Development Department GB
- Government Environmental Protection Agency GB
- Government Tourism Department GB
- Directorate Of CKNP

8.7. Campsite Fee

The management of campsites as well as the overall waste produced in CKNP, particularly along the Visitor Intensive Use Zone needs to be addressed properly. The Campsites have to be considered only along the trails in the tourism zones mentioned in the Management Plan for CKNP and have to be kept in complete wilderness (without any infrastructure or service), except along the Visitor Intensive Use Zone.

Along the Visitor Intensive Use Zone, following points will be considered:

- The CKNP Directorate will be responsible for ensuring effective control and good management of the Campsites trough a campsites supervisor;
- *Campsites should be in designated and delimitated areas;*
- Separate areas for pack animals are mandatory;
- Fodder for pack animals has to be carried from outside the park;
- Animals have to be vaccinated in accordance with the veterinarian indications and have to be marked after vaccination;
- It is mandatory to create, by the campsites, a fenced area where animals must stay;
- Services has to be built and maintained using an environmentally responsible process (with the approval of CKNP);

The campsite fee has to be paid only for the campsite that are located before Goro2 along the trekking to Baltoro Base Camp.

The road construction that is in process (probably completed in the next 2 years) that will reach Paju campsite will change the number and distribution of the campsites

The campsites fees have to be paid by the tourists (normally trough the Tour Operators companies) at the campsite management (with the approval of CKNP) these amounts could change year by year proposed by the communities in charge but always previous approval from CKNP Directorate.

Waste management inside the campsites

Campsite managers (from the community/ CKNP Directorate) shall be in charge of the campsites and they have to perform following duties:

- Maintain and clean the campsite
- Collect the waste generated in the campsite and segregate in different packs
- Transportation of the waste to collection point (Askole Medan, Hispar, Hushey)

The proposed fee for each night in the campsite is:

PAID for	AMOUNT		
	(per night)		
Mess tent	600 PKR		
Kitchen tent	600 PKR		
Member tent	500 PKR		

The following are the categories of Baltoro Campsites, facilities and staff required management:

Categories of Baltoro Area Campsites

1. Big Campsites (Managed By The Communities)	2. Small Campsites	3. Glacier Campsites
Paju	Bardumal	Goro
Urdukas	Khorburtse	Concordia
Jula		Base Camps
		Ali Camp

Facilities required

for Category 1	for Category 2	for Category 3	
Big Campsites (managed)	Small Campsites	Glacier Campsites	
Paju, Jula and Urdukas:	Korophong, Bardumal,	Gore II, Concordia, Base	
6 toilets for tourists and 6 for	Khorburtse:	Camps, Ali Camp:	
porters (minimum) – 4 washing places – 1 Store	2/3 toilets and washing places	No fix building (only tents) – Eco platforms (tour operators in charge of waste management)	

Staff required

NO.	DESIGNATION	NO(S)	CRITERIA	RESPONSIBILITIES	PAID BY
1.	Camp site managers	1 for managed camp sites	Not necessary from the Community use rights	Will be in charge for the overall maintenance and facilities.	Community
2.	Camp Site Supervisors	1 for each main		Who will keep daily visitors list and registration?	CKNP Directorate
3.	Waste crew	1/2 for each campsite	selected from use right holding communities	who will responsible for the overall maintenance of facilities (toilets, lavatories) Recyclable- waste disposal?	CKNP

Notes

- In the main campsites, Cat 1 (Paju, Urdukas) total 4/5 people will be employed.
- In the other campsites Cat 2 and Cat 3, the involved people should be 2/3.

8.8. Waste management outside the managed campsites

The campsites as well as the overall waste management in CKNP, particularly along the Intensive Visitor Use Trails in Baltoro, Hushey and Biafo, Hispar, is one important component, which needs to be addressed properly. Therefore, for the improvement of the existing system the below mechanism has been devised after thorough consultations with all the relevant stakeholders and the organizations working in this field. This mechanism will be enforced and developed jointly with local communities in order to keep the largest protected area of the country clean and, in turn, to protect the most fragile mountain ecosystems and its unique biodiversity.

Mainly Tour Operators will manage waste management outside the campsites.

Expedition groups

Waste Management costs for the expedition groups shall be covered by **Tour Operators** that have to:

Organize the collection of the not burnable waste produced in the base camp and in the higher camps;(bags given by CKNP staff) bags cover the transportation costs of all the waste produced out of the park boundary to a designed storage area.

Trekking Groups

Waste Management costs for the trekking groups shall be covered by **Tour Operators** that have to:

Organize the collection of not burnable waste daily produced along the trekking route (using the bags given by CKNP staff at the entry point or during the briefing session); cover the transportation costs of all the waste produced out of the park boundary to a designed storage area.

Special Notes

- In case Tour Operators do not abide the law, CKNP staff shall charge those tour operators from 200\$ up to 1000\$ which will be collected at exit/entry points.
- At the entry points, the CKNP staff will provide the bags to the groups (guides) for the waste segregation and transportation outside the Park.
- Guides and cooks employed by the Tour Operators should be trained by the CKNP Staff on how to manage the waste collection and transportation.
- CKNP Directorate should construct a waste storage point in each Park Exit Point. It is mandatory to locate in each entry/exit point a waste storage where the tour operator guides deposit the segregated waste coming down from trekking routes or expedition.
- Along Baltoro, from above Urdukas Tour Operators should manage the waste management.

CKNP will be responsible to cover the incinerator costs, the eco platform, maintenance and cost of transportation of human waste. If needed, CKNP can organize a cleanup campaign in

any part of the park. EPA, Forest Dept, Tourism Department and communities will ensure the compliance with the SoPs (Standard Operating Procedures)

Briefing and Debriefing Process

The briefing and de-briefing process has to be carried out in GB Tourism Department Offices in Gilgit or Skardu together with CKNP Staff and with the cooperation of EPA.

Contents of debriefing are:

- Verify the report of CKNP camp sites supervisors/managers about the waste management and respect of the environment;
- Verify the equipment carried out and the paying back the deposit (when Garbage Deposit will be operative);
- Feedback from expedition or trekking (summiteers, problems, etc).
- the CKNP Directorate and EPA in consultation with the Tourism Department GB.

Garbage Deposit

In Nepal, in Mount Everest National Park, the Garbage deposit is a procedure activate 12 years ago, and after initial difficulties, now is going in the direction of force the Expedition Groups to take back all their equipment without leaving some stuff on the mountain in the higher camps or in the BC.

These systems reduce the waste leaved in the park, simplifying the cleaning activities and reducing their cost.

How it works:

- Before the starting of the expedition each group pay to the Park authorities an amount as deposit
- The equipment of the expedition passes through a control with the Park staff and is enumerated and quantified, and listed (especially oxygen bottles, gas bottles, tents, etc.)
- At the end of the expedition the equipment is checked again: if some items are not present and remain behind, the amount leaved in advance as deposit, is not given back partially or completely.

In the next years similar Garbage Deposit has to be implemented to reduce the costs for CKNP Directorate in the cleaning activities; the foreign climbers already know this mechanism and in the current opinion in climber's behavior about **"leave the mountains as they are before you're coming"**, they will accept and appreciate the introduction in Baltoro area.

Implementation of Garbage deposit mechanism.

PHASE 2 To be implemented	Authority for Management
Garbage Deposit (fee)	Garbage Deposit administrated by the
	CKNP Directorate. This process has to be implemented in the future.

Expedition Groups

- The deposit it is proposed to be paid during the briefing at the Tourism Department offices to the CKNP Directorate staff (that has always to be present during briefing and debriefing).
- The proposed amounts to be deposited are as follows:

No	Peaks category (elevation wise)	Amount
1	Peaks above 8,000 m	1500 USD till 7 participants + 100 USD for each
		additional member
2	Peaks between 7,000 m and 8,000	1,000 USD
3	Peaks between 6,500 m and 7,000	600 USD

Checking of Equipment by CKNP Staff

For each expedition group, at both entrance and exit of the Park, CKNP Staff must check the following equipment lists:

At the entrance:

Generators: No	_Oxygen cylinders: No		
Batteries: No	_Solar panels: No		
Small tent BCs and High Camps: No	_Mess tents and Kitchen tents: No		
Epigas bottles: No	Climbing ropes and fixed ropes: Mt		
Kerosene stoves: No	_Special equipment: Type_ No		
At the exit:			
Generators: No	_Oxygen cylinders: No		
Batteries: No	_Solar panels: No _		
Small tent BCs and High Camps: No	_Mess tents and Kitchen tents: No		
Epigas bottles: No	_Climbing ropes and fixed ropes: Mt		
Kerosene stoves: No	Special equipment: TypeNo		
Waste (3kg/-per member every 10 days in the C	KNP) Kg		

Deposit return

The Garbage Deposit will be withheld as indemnity to cover further expenses for the material, and left waste transportation in the following cases:

- The lists do not match;
- The quantities of waste consigned at the exit point will not correspond to the right calculated amount.
- Assumption of proportional class with respect to percentage of:
- The quantity of equipment left in the Park;
- The waste not transported;

8.9. Regulating the Flow of Visitors

This area is a free entrance area for local communities and Gilgit-Baltistan people, but people coming from down country, foreigner visitors and researchers, which stay only in the Buffer Zone area, are requested to pay the Entry fee (8 USD for visitors from other countries and 20 PKR for Pakistani national).

For visitors (Pakistani people, foreigner visitors) and researches that are moving in the other Park's areas outside this Buffer Zone, a specific authorization with related fees and deposit payment has to be considered following the regulations in force in these specific areas as reported in this document in the previous chapters and detailed in Part III Thematic Management Guidelines, the Tourism Sector.

So, all the visitors and groups are requested to register at the CKNP entry points situated in Skardu, Askole and Hushey, by filling in the specific entry form and by paying the fees related to entrance and waste management in agreement with the rules of the areas that will be visited. Afterwards, while going out it is asked them to transit through one of the CKNP points in Skardu, Askole, Hushey and Hisper to fill in the exit form.

These questionnaires are a very important management tool, to improve the CKNP Directorate knowledge about: (i) the number of visitors in the different areas in different periods of the year, (ii) their origin and expectations, (iii) effectiveness of the area, tourism activities and structures management.

It is important to underline that every environment has a typical carrying capacity linked to a specific factor. However, if this limit is exceeded, a negative feedback is triggered and it subsequently involves a related negative impact on the environment.

Visitor limitations suggested

The flow of mountaineers and trekkers is going to increase in the last years remaining for the moment below the sustainable level. At the same time, the Commercial Expeditions start for the 8000 meters peaks with a huge number of climbers including Nepali Sherpa for each peak. For these big expeditions, it is necessary to put some limitation because the number of people in a base camp and on the mountain cannot be over certain limitation.

As preliminary approach, a rough estimation for the Park's carrying capacity related to mountaineers and trekkers was conducted from the available data.

The indication is that during each season, the Park can only accommodate and manage the following visitors:

Max. 12 mountaineers per expedition Max. 10 expeditions per peak Max. 120 mountaineers per peak Max. 8000 trekkers/ visitors

These maximum entrances threshold must be yearly evaluated by CKNP according to the environmental impact of tourism in the previous years.

8.10. Proposal of Revised Rates of Park Entry and Waste Management Fee

Directorate of CKNP is currently collecting CKNP Waste Management Fee from visitors but not entry fee not yet implemented. In order to implement the waste management activity and to provide incentives to the local communities in shape of park entry fee, it is proposed to revise/enhance the existing fee rates for the coming year. This proposal developed after thorough consultation with all relevant stakeholders and secretary FW&E.

Visitor	Existing	New P	roposed Revise	Proposed	roposed Revenue Share	
Category/ Zone	Rates	Park Entry Fee	Waste Mgt Fee (WMF)	Total	CKNP 25% Park Entry & 80% WMF	Use right community 75% Park Entry & 20% WMF
Foreign Expeditions per person (Restricted Zone)	68 USD	10 USD	190 USD	200 USD	154.5 USD	45.5 USD
Foreign Trekker per person (Restricted Zone)	50 USD	10 USD	140 USD	150 USD	114.5 USD	35.5 USD
Foreign Expeditions per person (Open Zone)	Not notified	10 USD	90 USD	100 USD	74.5 USD	25.5 USD
Foreign Trekker per person (Open Zone)	Not notified	10 USD	50 USD	60 USD	42.5 USD	17.5 USD
Pakistani National Expeditions (all zones)	PKR 3500 / group)	500 PKR	2500 PKR	3000 PKR / person	2125 PKR	875 PKR
Pakistani National Trekkers (all zones)	PKR 3000 (per group)	500 PKR	1900 PKR	2400 PKR / person	1645PKR	755 PKR
GB Expedition/ Trekking/ Tourists Groups (all zones)	PKR 500 (per group)	50 PKR	100 PKR	150 PKR /person	92.5 PKR	57.5 PKR
Locals residing	g CKNP buff	er zone (peri) (students an	pheral valleys), s d scientists)	stakeholders, r	esearchers	Exempted

9. Park Organization and Staffing

9.1. Existing Administrative Arrangements

The CKNP is currently being managed by a Project Director with a team of approximately 40 members including project director, ecologist, admin & finance officer, range forest officer, game inspectors, game watchers and supporting staff at Park Directorate office- Skardu. Further, two field sub offices/ visitors' registration centers have been established at Askole and Hushey having CKNP building while one rented building is situated in Hisper and Minapin where registration process of visitors take place. The proposed staff should continue their duties and accomplish the activities by achieving the park objectives according to below mentioned organizational chart.





Exhibit 18: Proposed CKNP management structure (organogram) - (Suggested by Forest, Wildlife & Environment Department- Gilgit- Baltistan)



S.#	Name of	Qualification	Experience	Functions
	position and Basic Pay			
	Scale 1 dy			
1	Director (BPS- 19) or a lump sum salary package	Degree of M.Sc. in Forestry from a recognized Pakistan or foreign university.	Twelve years' experience in technical and financial administration should be computer literate and possess communication and presentation skills in English. (age limit 45) Similar experience in National Parks	Recruit staff for government executed component and engage consultants; facilitate coordination and collaboration with controlling authorities, project partners and stakeholders in the privilege of CKNP management and project activity implementation, supervision of all technical and financial affairs of the CKNP directorate; provide leadership to project staff ; be responsible to enforce regulation in connection with protection of park resources; be responsible to involve stakeholder communities in the participatory management of park resources.
2	Ecologist (BPS 18)	M.Sc in Biological Sciences from a recognized Pakistani University or abroad	10-year experience relevant work. Strong scientific background in ecological assessments, conservation planning and wildlife species management and conducting trainings, particularly in	Park Ecologist will be responsible for ecological assessments; development and implementation of thematic as well as conservation plans; train project staff in the data collection, use of equipment, data record, analysis and application, establish baseline information, set biological indicators as part of a community-based wildlife monitoring system and standard wildlife

Positions and Terms of References for all Park Staff (existing and new)

S.#	Name of	Qualification	Experience	Functions
	position and Basic Pay			
	Scale			
			the remotest mountain areas of GB. (age limit 45)	monitoring protocol; guide and coordinate biodiversity research in the project areas, collection of park entry and camp sites flat fee, manage waste in CKNP, and report to the Project Director on regular basis.
3	Admin/Finance Officer (BPS- 17)	Degree of M.A. from a recognized university; experience in accounting and/or administrative matters will be given preference.	Four years relevant working experience in a government or non-government organization with skills to use computer soft- wares will be required. (age limit 40)	Assist the Director in dealing all administrative and finance matters within budgetary limits, administrative and accounting procedures; prepare statement of accounts, maintain record of official business matters and accounts matters, prepare salary bills of project staff and check field activity bills/ vouchers provided by field staff, prepare checks for signature of Director and further disbursement of cheques and cash to claimants. Maintain the record of all project equipment's and vehicles.
4	Glaciologist/ hydrologist BPS (17)	Masters/Mphil in glaciology or water resources	Three years relevant working experience in a government or non-government organization	Glaciologist needs to analyze snow and ice and their physical properties, particularly movement of glaciers and to analyze changes in response to climate change and how these changes in turn influence climate and surrounding environment.
5	Wildlife veterinarian BPS (17)	DVM/Mphil in wildlife veterinary	Three years relevant working experience in a government or	The duties of a wildlife vet may include sedating animals for procedures, performing exams, giving

S.#	NameofpositionandBasicPayScale	Qualification	Experience	Functions
			non-government organization	vaccinations, taking blood samples, administering fluids, performing surgeries when needed.
6	Eco-tourism Officer (BPS 17)	Masters in tourism, hospitality management	Three years relevant working experience in a government or non-government organization	He/She has to work in partnership to develop plans and solutions to improve the viability and sustainability of transport, travel for visitors and waste management
	Social organizer (BPS 16)	Master in Social Sciences	At least three years of relevant work experience in mountain areas of Pakistan (age limit 40)	Social organizer will be responsible for keeping liaison and coordination with partner organizations, communities and other stakeholders concerned; will initiate dialogues with target communities of un- approached valleys; mobilize communities for participatory resource conservation; establish social structures for smooth implementation of project activities; facilitate field implementation of social mobilization related activities; resolve inter and intra community conflicts, if arise over common resource uses, and assess and conduct trainings of the village activists and communities
5	GIS Analyst (BPS 16)	Master Degree in GIS from a recognized	At least 2 years of relevant work experience in	Develop maps of National Park, Valleys, resources, Data analysis through GIS.

S.#	Name of position and	Qualification	Experience	Functions
	Basic Pay			
	Scale	Pakistani or Foreign University	Mountain Areas particularly in Application of GIS in Natural Resources Management (age limit 40)	Verify GPS coordinates of vantage points of wildlife surveys, taking coordinates of plantations, signage, tracks, and camp sites and manage them properly and develop maps as per need. Train staff in GIS and Remote sensing. Assist Ecologist in Ecological assessment and monitoring and report him on regular basis
6	Veterinarian (BPS-16)	Master Degree in Veterinary Sciences from a recognized Pakistani or Foreign University/college	At least 2 years of relevant work experience in Mountain Areas in managing Livestock diseases, vaccination and treatment, having knowledge about wildlife diseases (age limit 40)	To assess the wildlife and livestock diseases. Assist in Livestock vaccination and insurance schemes. Assessment of predations of livestock by predators and give indicators, results and out puts for its better management. Assist Ecologist in Predation Assessment, database development, analysis, reports and proposals writing. Report Ecologist regularly.
7	Range Forest Officer BPS-16	Degree of B.Sc. in Forestry or equivalent from a recognized Pakistani or foreign university.	At least two years working experience in the capacity of a Forester or Game Inspector or other kinds of forestry related activity.	Be responsible to control, guide and supervise protective field staff including Game Inspector, Game watchers etc., facilitate smooth relationship with community appointed wildlife Guides/Watchers, submit periodical wildlife

S.#	Name of	Qualification	Experience	Functions
	Basic Pay Scale			
				population census reports, register forest and wildlife offense cases if community conservation committees fail to resolve at local level, and execute other project activities /official tasks as may be given from time to time on need basis.
8	LDC (PBS-7)	Matric pass	Having 1-year experience in relevant field	Assist the admin office in drafting, typing and account matters and also support the other project staff in letters drafting and report writing.
9	Receptionist (PBS-7)	Matric pass	1 year working experience	Maintain telephone directory, attend calls and record keeping, maintain dispatch and receive letters daily etc.
10	Game Inspector (BPS-11)	Metric with science, higher qualifications will be given preference.	At least two-year experience in the capacity of Game Watcher or Forest Guard (BPS-5), any additional experience in the relevant field will be given preference.	Supervise duties of Game Watchers, obtain monthly and seasonal wildlife assessment census reports including forest and wildlife offence reports from Game Watchers, compile these reports and furnish to higher authorities, Coordinate efforts with community wildlife guides and register offence cases on the recommendation of community conservation committee President or his nominee for proper legal action, be vigilant in respect of any illegal anti-

S. #	Name of	Qualification	Experience	Functions
	Basic Pay Scale			
				conservation movements in the respective jurisdiction and take into confidence the community conservation committee members for preventive measures or otherwise.
11	Game Watcher (BPS-7)	Matric (preference will be given to science)	Field experience in conservation related activities from Forest Department or NGOs will be given preference.	Game Watchers will be charged with responsibilities of protecting wildlife and their habitats including forests, pastures and rangelands; conducting ocular wildlife population assessment and surveys; and furnishing monthly and periodical census and observation reports to the Game Inspector concerned; and also coordinate activities with community appointed Wildlife Guides (if any) in protecting natural resources and where required enforce regulatory laws. Be responsible to accomplish the activities assigned by the office including camp site management, waste management, signage, trails and other interventions in their respective duty areas.
12	Driver (BPS-4)	Middle pass with Driving License issued by appropriate government authority	3 years driving experience.	Driving and maintaining official vehicles, maintaining Log Books, etc.
13	NaibQasid (BPS-1)	Middle Pass; higher	Previous working	Help all directorate staff in providing facilities, petty

S.#	NameofpositionandBasicPayScale	Qualification	Experience	Functions
		qualification will be preferred.	experience will be preferred.	office works; Assist Diary/Dispatch Clerk; maintain clean environment in the office premises
14	Chowkidar (BPS-1)	Primary Pass	Experience preferable.	Security and Watch-ward of office premises and government assets.
15	Cook/ Sweeper (BPS-1)	Primary pas will be preferred	Experience preferable	 Having experience in high altitude cooking in field, physically fitness Office cleaning and relevant jobs
16	Camp Manager	FA or equivalent will be preferred		Overall responsible for overall camp management and report to Ecologist
17	Camp Supervisor	Matric pass will be preferred		Supervise waste crew to ensure cleanliness and waste transportation. Report to manager
18	Waste crew	Primary pass will be preferred	Experience preferable	For cleaning of camp sites regularly according to assigned tasks
19	Visitor Registration Assistant	Primary pass	Experience preferable	To assist the registration in charge/manager
20	Visitor Registration watch man		Experience preferable	Security and Watch-ward of registration center premises and government assets.

9.2. Park Management Structure

9.2.1. Governance for the management of the CKNP

Desirable management of CKNP shall require the presence and availability of major stakeholders on relevant committees to discuss the issues that are both conflicting and damaging to ecological health of the park, or interventions that may be essential to undertake to maintain in CKNP close to natural state, if not completely natural. Various organizations

such as CKNP Directorate and Evk2CNR have been working on the structures and functions of such committees and have recommended these to be useful for the management of the CKNP. Accordingly, the management plan thus prescribes as under:

9.2.2. CKNP sub-committee

Proposed Functions

- Discuss and provide guide on policy and legal issues related to maintaining ecological health of the CKNP as represented of the Karakuram landscape with natural features and elements of global significance.
- Address trophy hunting issues that are to be decided by wildlife management board
- Undertake/ endorse decisions of CKNP management committee related to promotion of tourism or facilitation of tourists
- Decide upon any conflicting issue and suggest solutions
- Guide on the generation of additional financial resources for the promotion of conservation and sustainable development. The committee may guide on the sustainable marketing of local resources, especially medicinal plants from places that do not affect negatively the ecology of the area
- Decide on fixing a percentage to be charged to miners that shall ultimately be spent on improving the health of the national park resources.
- The committee shall meet at least twice a year.

Propose Structure

- Chaired by secretary Forest, Wildlife & Environment, CCF, Conservator Parks and Wildlife and Director of CKNP (as member secretary).
- Other members include provincial secretaries such as agriculture & livestock, tourism, minerals, provincial/national & international NGOs/ Universities based in GB with mandate in CKNP and two community members from Baltistan region and one from Gilgit region.

9.2.3. CKNP Management Committee

Proposed Functions

- Make sure that CKNP maintains its ecological health and does not deteriorate due to excessive uses of its natural resources. This should be made possible through building consensus in meetings of the committee, seeking guidance from relevant experts/ departments.
- Undertake issues related to visitor facilitation, maintenance of camping sites, cleanup operations, rescue etc.
- *Responsible to distribute funds (entry fee) among the deserving communities.*
- *Resolve conflicts among members communities related to the entire park.*
- Pick points of discussions and needful approval by the sub-committee.
- The committee shall meet at least twice a year.

Proposed Structure

• Chaired by Conservator Park and Wildlife, with the CKNP Director as member secretary and members from relevant organization, and twenty community reps.

Graphical representation of the above committee is given below;

Management Board Parks & Wildlife, Gilgit-Baltistan, Chaired by Chief Minister



10.Tourism Sector

10.1. Impact of Tourism inside the Park

The exceptional growth in the numbers of visitors in CKNP region was made possible by the series of promotional campaighns and arranging Karakoram festivals in various citis of Pakistan under the frame work of SEED project during 2013-2015 by Ev-K2-CNR, every year screening of best moutain movies in film festivals, upgradation of KKH, opening of Naran Jhalkhad road through Babusar Pass and favourable law and order situation.



Exhibit 19: Domestic tourism inflow in GB, 2007-2018

Tourism in CKNP has started increasing unexpectedly from 2015 and onward as GB became wellknown all-around Pakistan, 2015 was the first year after approval of CKNP management plan in 2014. The tourist arrived in GB were beyond the accommodation capacity of the region. In 2019, the tourist's number reached more than 1.6 million and have contributed hundreds of millions to the local economy of GB in recent years.

Many of the tourists are really interested to visit CKNP but because lack of their mountaineering and climbing skills with the high mountains and glaciers, they would like to practice short trekking routes that touch the Park near its boundary, enjoying the nature and increase their awareness on protected areas and protection of wildlife and forest. This experience could become an incredible educational promotion for the Pakistani people that are not so familiar with these values.



Exhibit 20: International tourist inflow in GB, 2007-2018

Tourist flow in CKNP

A great deal of revival of foreign tourists visiting Baltoro and other high peaks in the region has been witnessed after unfortunate incident of Nanga Parbat in 2013. This phenomenon of increased tourists flow will further enhance with tourist-friendly policies as well as better law and order situation in the region. However, the problem of the waste will further be aggravated having no proper system in place.





The Exhibit no. 23 clearly shows the incremental trend of mountaineers, trekkers and obviously as well as the porters. The number of tourists to the Baltoro may increase more in coming years. In 2018 almost 1.5 million domestic tourists visited Gilgit Baltistan.

The number of visitors entering in the Park are increasing in the last years especially for the increasing number of National Tourists that are coming in GB. In any case the trend for foreign tourist is positive both for expedition groups and trekking groups. If we look only to the Askole data they pass from 599 in 2011 to 1340 in 2019 with an increase of more than 120 %

Year	Trekking parties	Potters		Total members	No. of guides	CKNP waste management fee
		Low	High			
2010	154	1618	0	578	154	
2011	145	2111	0	723	145	
2012	170	2066	0	767	175	
2013	136	1570	0	565	140	
2014	99	1237	0	447	99	
2015	64	653	0	209	64	
2016	98	1386	0	473	98	
2017	130	1747	0	675	132	3333463
2018	157	2232	0	912	158	6178120
2019	153	2388	1	906	153	6834239

Exhibit 22: Data of trekking parties 2010-2019



Exhibit 23: Expedition parties' data from 2011-2019

Year	Expedition	Potters		Total members	CKNP waste
	parties	Low	High		management fee
2011	18			132	
2012	27		0	158	
2013	17		0	123	
2014	26	1102	6	171	
2015	29	1261	26	259	
2016	28	789	26	184	
2017	34	993	36	217	1762935
2018	37	1142	48	260	1736541
2019	12	232	7	68	480119



10.2. Eco-Tourism

The Eco-tourism is one of the most important challenges for the future in the valleys and villages around CKNP: As already show the visitor's trend is increasing with exponential rate and this process is expected to continue in the next five years.

Mainly it concerns the domestic component that arrives in GB and find only accommodations along the main towns' roads in Gilgit, Hunza and Baltistan, in hotels and other solutions that are growing

everywhere with any attention to the environment and without any regulations.

For the visitors it is difficult to find a different approach, more connected with the nature, small villages especially where are possible to enter in touch with the Protected Areas.

This sustainable tourism with low impact is what is called "Eco-tourism".

Principles of Ecotourism

Ecotourism is defined as "responsible travel to natural areas that conserves the environment and improves the well-being of local people".

CONSERVATION	COMMUNITIES	INTERPRETATION	
Offering market-linked long-	By increasing local capacity	With an emphasis on	
term solutions, ecotourism	building and employment	enriching personal	
provides effective economic	opportunities, ecotourism is	experiences and	
incentives for conserving and	an effective vehicle for	environmental awareness	
enhancing bio-cultural	empowering local	through interpretation,	
diversity and helps protect the	communities around the	ecotourism promotes greater	
natural and cultural heritage	world to fight against poverty	understanding and	
of our beautiful planet	and to achieve sustainable	appreciation for nature, local	
	development.	society, and culture.	

Ecotourism is about uniting conservation, communities, and sustainable travel. This means that those who implement and participate in ecotourism activities should follow the following ecotourism principles:

- *minimize impact.*
- build environmental and cultural awareness and respect.
- provide positive experiences for both visitors and hosts.
- provide direct financial benefits for conservation.
- provide financial benefits and empowerment for local people.
- raise sensitivity to host countries' political, environmental, and social climate.

Tourism causes damage. Ecotourism strives to minimize the adverse effects of hotels, trails, and other infrastructure by using either recycled materials or plenty fully available local building materials, renewable sources of energy, recycling and safe disposal of waste and garbage, and environmentally and culturally sensitive architectural design. Minimization of impact also requires that the numbers and mode of behavior of tourists be regulated to ensure limited damage to the ecosystem

Provides financial benefits and empowerment for local people: National Parks and other conservation areas will only survive if there are "happy people" around their perimeters. The local community must be involved with and receive income and other tangible benefits (potable water, roads, health clinics, etc.) from the conservation area and its tourist facilities. Campsites, lodges, guide services, restaurants and other concessions should be run by or in partnership with communities surrounding a park or other tourist destination. More importantly, if Ecotourism is to be viewed as a tool for rural development, it must also help shift economic and political control to the local community, village, cooperative, or

entrepreneur. This is the most difficult and time- consuming principle in the economic equation and the one that foreign operators and "partners" most often let fall through the cracks or that they follow only partially or formally.

These are the definitions, we see that if well oriented and realized in a correct way the activities, which are being carried out in the Park, can be included within these parameters if managed under strict control of Park itself particularly for waste management, total control on infrastructures and management. To these already existing activities, others, as cultural and environmental routes of 2/3 days, which rely on structures realized following eco-tourism criteria, can be added so to complete the offer also for the tourist m demand not interested in long climbing trails.

In this direction, all the new initiatives, which can be retraced, to eco-tourism must be incentive most of all near park borders, but most of all the efforts must be concentrated to effectively render the activities, which are being carried out in the Park as an eco-tourism experience.



Ecotourism Plan

Among the various possibilities of tourist development sustainable ecotourism is a development model that can reconcile the inevitable tourist development with preserving the natural environment and protecting local communities. An important tourism planning principle includes the establishment of staging areas, and the clustering of attractions. Concentrated development can be important in attempting to minimize the impacts of tourism on the natural as well as socio-cultural environment in the host region. Another important tourism planning principle includes the dispersal of tourists and thus the dispersal of tourism's economic benefits to marginal areas. The dispersal of tourists and thus the dispersal of tourism's economic benefits to marginal areas can permit the integration of activities and attractions into one unified system. The concentration of facilities and the clustering of attractions and the dispersal strategies can be seen as antithesis. But they can find a great synergy in the tourist routes.

The tourist itineraries permit the concentration of facilities in areas that can minimize potentially negative impacts on the natural and socio-cultural environment and at the same time permit the tourist dispersing. The realization of mini-hubs and the creation of new attractions can not only diversify the tourism product but can also increase the number of night stay of tourists.

The Eco Community Tourism involves communities controlling, managing and developing their own tourism industry, whereby tourists and travelers can experience the community's way of life and consider their social, economic, and environmental impacts upon the destination they are visiting.

An extremely important tool to foster a sustainable development of the region, to protect and strengthen both natural and cultural diversities and ensure that tourism meets its potential as a tool for to create employment and income generating opportunities also for women, young people and marginalized groups.

Gifted with rich natural and cultural heritage, the territory of the ecological network between DNP and CKNP offers unique potential for tourism development adventure, cultural and nature tourism. Moreover, its strategic location offers opportunities for trans-boundary tourism through promoting border trade, commerce, scientific, cultural and conservation exchanges.

Tourism sector has the potential to contribute economic growth and improve the livelihoods of the local communities through sale of local goods and services and local employment generation. An integrated planning and development approach could harmonize between the long-term ecological, cultural and development goals.

IUCN (2003) reported that Northern areas (GB) are rich mix of natural and cultural heritage makes the region a particularly important tourist destination. However, tourism development has been hampered by the lack of policy guidelines, insufficient investment, inadequate tourism infrastructure, insufficient human recourse development and weak marketing.

In Pakistan, the National Tourism Policy and the National Conservation Strategy emphasize the crucial interdependence between tourism and the environment. The interdependence between tourism and the environment is recognized worldwide. A recent survey by the Industry and Environment Office of the United Nations Environment Programme (UNEP/IE) shows that the resource most essential for the growth of tourism is the environment (UNEP 1995:7).

Understanding that poorly managed tourism practices may have undesired effects and significant environmental, economic and social costs, Northern territory of Pakistan provide ideal conditions to initiate tourism valorization and CBET practices, trying also to include the proposed action plan in the Development of Cultural and Ecotourism in the Mountainous Regions of Central and South Asia promoted by UNESCO.

Eco-tourism technically defined as "responsible travel to natural areas that conserves the environment, sustains the well-being of the local people, and involves interpretation and education" (TIES, 2015) is helpful from economic perspective by creating job opportunities and business ventures for local community and other people keeping conservation as a primary goal.

Eco-tourism becomes more productive for the local communities and allied bodies if appropriate revenue-sharing mechanisms are put in place to enhance the benefits for local communities and propor impacts of tourism (Hamilton et al., 2007). Eco-tourism industry is most developed in the least-developed countries rich with natural resources. The protected area being major attraction for eco-tourists, totaled US\$ 142 million per year in 14 African countries (UNWTO, 2014). This huge sum of money collected from the eco-tourism at protected areas shows their diversity and varied composition, majorly attracting the tourist because of majestically beautiful landscapes, unique flora and fauna, beautiful blend of cultural/heritage sites and much more in the protected areas set aside for the protection and conservation of natural resources.

Proposed Interventions

The CKNP Buffer Zone Valleys include several actions, which connected to each other and creates a tourism system, in addition to protecting the natural environment; can ensure visitors are given unique and authentic experiences, by creating new tourist products and improving the existent ones according to the specific characteristics of each territory and landscape.

Gilgit and Skardu are the most important centres in the area; acts as regional hub and, could satisfy most of the demand for tourist reception.

The inhabited centres of each valley constitute tourist gates to the protected area. Here, the small size of the settlements and the seasonality of the tourist fluxes, do not allow the construction of large facilities for tourist accommodation. To preserve the environmental quality of the villages, it would be better if small 8/10 room accommodation facilities were built that can be managed by the community or individual families.

From design point of view, accommodation facilities must respect the characteristics and shapes of traditional constructions, avoiding large and impactful buildings, using local materials for construction.

A) Tourist hub

A tourist hub is a place where all the tourist-friendly elements are present, as tourist attractions of various kinds like information points, guides, eating joints, shopping options, accommodation and local transport.

B) Network of Discovery routes

The Network of Discovery treks leading hikers through specific wild places in the Buffer Zone Valleys. The Network of Discovery treks - also through the presence of trained guides - can to providing a safe and enjoyable experience for all guests on hiking tours, while educating them about the awe-inspiring natural features of the outdoors that they are hiking through.

Discoveries routes crosses the entire area connecting its opposite sides. Those itineraries are the same followed by wild animals during their seasonal moving. Watching point will be made according with the evidences on wildlife presence.

C) Hiking itineraries

Activity of moderate difficulty, which involves walking across trails or paths. It is a great way to immerse in the natural environmental and in the culture and history of an area. Each hike is a gateway to wider outdoor adventure inside lyrical landscapes. They are connected with the network of Discovery routes.

D) Parking areas

The best landscape and natural experience happen when the visitors step out of vehicle and explore the territory. It is necessary to identify the appropriate parking areas of the cars (especially in stops along the scenic routes) so that they do not damage the environment, do not become a cause for conflict and do not adversely affect the experience of visitors

E) Camp Site – Guest room – Tourist hotspot (facilities)

A series of interventions are envisaged to provide the territory with a network of accommodation facilities, such as camping sites for overnight stay in an outdoor area or guest room. They are designated areas with the necessary improvements and various facilities for tourists. They must all be eco-friendly and culturally sustainable. Specific project for construction and management has to be implemented.

F) Infrastructures and buildings for tourist accommodation in the village

In order to fill this gap with the increasing tourist flow and lack of facilities, it is necessary to provide new eco-accommodations/guest houses in selected areas of the Buffer Zone Valleys.

The new eco-accommodations will emphasize elements such as environmental responsibility and minimizing negative impact. They will offer as much as possible renewable energy sources (they will be equipped with a solar system as independent power supply) recycling services, eco-friendly toiletries, energy efficient lighting, locally sourced food, non-toxic cleaning supplies, non-disposable dishes, water conservation methods and various other sustainability-focused initiatives. They will be designed to be active in nature and wildlife conservation, with focus on educating visitors about the flora and fauna of local ecosystems, and more deeply connected with the area's indigenous culture. To stay in eco-accommodations will be an exclusive experience of taking part in community initiatives, a way to help visitors to conserve and appreciate local customs, and contribute to the local economy.

G) Picnic spots and rest areas with toilet facilities

Along the main access routes and itineraries there is a lack of toilet facilities and other light facilities for tourists including women and children. Toilet facilities, picnic spots and rest areas must be provided along the main access routes to prevent that anthropogenic pressure spilling over uncontrolled into areas of high environmental value. This type of facilities could be developed following incremental schemes that can be modified and integrated as use need. Local communities can manage it and

promote specific services for tourists. Hotspots will serve that tourist as interpretation centers to increase knowledge and awareness about environmental and natural resource issues.

Building Construction

Buildings should be far enough from the river to avoid flash flood, and should not be constructed near or on steep slopes due to the high risk of damage.

Landslides or rock fall areas should be avoided while selecting a site for building construction. Apparently, some slopes may look stable, but an earthquake could trigger failure. Landslides and rock fall can damage buildings. Cliffs made of soft or crumbly, clay loam; deposits materials, etc. should be avoided.

Ecotourism Guidelines and Regulations

The Eco-tourism opportunities located in the Buffer Zone Valleys has to follow these guidelines:

Ownership	 Local community, residents, alone or in partnership with: NGO; touristic organization; private investors Financial sustainability.
Guest house	 Low environmental impact: no plastic, solid waste management system proximity of a village and tourist itinerary or destination; accessible by jeepable road or easy trekking path; use of traditional materials for construction (wood and stones). Wood must come from environmental certified supply chains; Deodar wood is only permitted for the restoration of existing buildings. Low dimensional impact, max. 2 floors and max 45 ft front of the building 24 max. guest accommodations managed tree plantation on surrounding area green houses for organic cultivation of local products for selling and consumption in the guesthouses; Organic cultivation only; minimum one toilet and shower every 4 guests; room size: min. 45 sq. ft. for guest: Water tank or fresh water supply system; Improved stoves only, open fires are not allowed; Specific area dedicated to exhibitions and interpretative activities on environment, local traditions and heritage;
Camping Hostels	 Low environmental impact: no plastic, solid waste management system Low building impact: only one for reception, store, kitchen, common room and one for sanitary facilities;

	• proximity of a village and tourist itinerary or destination;
	 accessible by jeepable road or easy trekking path;
	• use of traditional materials for construction (wood and stones). Wood must come from environmental certified supply chains; Deodar wood is only permitted for the restoration of existing buildings.
	• Low dimensional impact, max. 1 floors and max. 30 ft front of the building
	• capacity up to 24 people
	• tree plantation surrounding area
	• open fires are allowed in dedicated areas only.
	• Water tank or fresh water supply system;
Energy Supply	• In the absence of a power supply, photovoltaic panels and solar panels must be the main energy production systems for water heating and electricity power generation.
~ "FF-5	• Other permitted power generation systems are micro hydro and micro wind power where environmental conditions allow it
Waste management	Separate waste disposal and transportation to the nearest collection point

The Guest houses and Camping hostels income has to be shared according to the decision of the VO in a percentage for the owner and for the Local Community. Only if was built with the financial support of public development programs.

Wood Management

The communities of CKNP buffer zone valleys adopt various means and ways to tackle extreme temperature and to meet their wood requirement for fuelwood and timber required for construction are two main uses of wood in the buffer zone valleys of CKNP.

For timber community prefers mature trees of *Pinus wallichiana*, *Picea smithiana*) juniper and populus spp. with good height and diameter.

For fuel wood the branches of populous, juniper, fruit trees after pruning, trunk of juniper, birch, shrub wood and Artemisia are used.

Inside the park to remove trees for timber shall remain forbidden but tree plantation for timber purposes shall be promoted outside.

The practice of planting poplar must be extended in the valleys where it has not yet been introduced and must be presented and developed in collaboration with local communities (each family should plant 20/30 poplar each year).

With reference to the New Forest Act, in general, the cutting of trees or shrubs is allowed, where:

appropriate and essential either, because of the absolute dependence of community with no alternative sources; community's commitment for participation in social forestry programme and using fuel saving devices or this is required to eradicate invasive plant species, safeguarding against forest fires or some other management purpose which is in line with the management and conservation requirements of the park.

In specific, the following regulations should apply in some sample areas for sustainable use of forest resource in the CKNP Buffer Zone.

Construction and heating system

Stone or adobe constructions are poorly insulated and cement block buildings require massive amounts of fuel wood to heat them during the long cold winters. In open fire and low-efficiency heating and cooking stoves, most of the heat generated, disappears through the chimney.

Introducing modern construction technologies is not possible because of socio-economic circumstances. However, existing traditional technical solutions and locally available materials can be taken into consideration for appropriate solution to improve building insulation and stove efficiency.

For low-income people, it is important to find appropriate solutions taking into consideration the local economy of the people and local entrepreneurs, as well as the available skills, tools, materials and other resources, to create affordable products for an improved living conditions and livelihood.

To improve their living conditions, more and more people in the Gilgit Baltistan are copying construction techniques from down south and being built with cement blocks because of their betterquality finish and "modern look" compared to the traditional houses of the region. This type of housing, however, has a high heat transmission co-efficient, which means the rooms rapidly cool off in cold climates.

Making the buildings more comfortable and reducing internal air pollution in traditional and new highaltitude buildings is one of the important aspects and it is linked to energy sources and thermal insulation.

In traditional stone and mud plastered houses at altitudes around 2000m, insulated houses consumed 40-50% less firewood than non-insulated houses.



Insulation

Mixing straw with lime / cement creates durable insulation material, which can be used under and above floors, against walls and in ceilings. In the remote valleys, straw can be the lowest cost option for insulations if the villagers supply the material.

Straw-lime-cement have an excellent performance as building insulators, it has been used for more than 100 years in building construction. All three materials are durable, do not rot and have good moisture regulating properties. They absorb and release the moisture, stabilizing indoor climate. The porous fiber finish can be easily plastered or tiled.

Since straw is widely available, it can be used for the manufacturing of insulation material or cast insitu with cement powder or lime.

The straw should be stripped of the thin leaves. The thicker stems are chopped into 1- 2-inch-long pieces is weighed and 25% of the weight of the dry material is added as water. This is thoroughly mixed. The water amount should not be more or less.
Two times the weight of the dry wood shavings is added as cement (straw: cement is 1:2). Half the amount of cement can be replaced with lime if this is locally available and economically interesting, Rc = 5.0 m2. K/W.

The cement powder is thoroughly mixed with the wet straw and layered into position and slightly compacted.

The same proportions can be used for horizontal floor insulation. The freshly cast layer is compacted by a person, having attached half meter-long planks under his feet and systematically walking over the surface.

The layer of slightly compacted and hardened straw-cement can be covered with a thin layer of plaster to equalize and smoothen the surface.

In buildings having large floor loads, the compacting should be stronger and the cement plaster covering thicker. In buildings where impacts are expected on the floor, thin chicken wire mesh, thicker expanded metal mesh or a stronger 6 mm bar reinforcement web can be applied, depending on the situation.

Thin chicken wire mesh, fixed to the wall, can be used to support the mix when placed on vertical surfaces.

On roof and pavement 6 to 8 inches of insulation are recommended, while 6 inches can be enough for wall insulation.

Fuel efficient stoves

EvK2CNR in collaboration with directorate of CKNP under SEED project has developed and provided customized fuel stoves to the communities of Arandu in 2015 which are believed to be fuel efficient.101 fuel efficient stoves were developed by Directorate of CKNP under PC-I (Phase-II) and provided to the chairman and notables as well as Environment clubs of schools of CKNP valleys from Hushey to Hisper. The stove consumes less wood but meets the needs of the communities for cooking and heating. A value addition of the stove is producing hot water within the same wood consumed for cooking. The efficiency of wood can be calculated with this single formula that with same amount of wood it cooks food, heats at the same time it also provides hot water.

Feedback from the users:

Once discussed with the communities the overall feedback from the users of the fuel-efficient stoves was very positive. They termed it very productive and useful. Women particularly found the stove very beneficial as they told had caused a lot of ease and comfort in their lives. Previously they used to go high, high for fetching of wood and now the required amount of wood has reduced, and hence they felt very happy.

Advantages:

- Low consumption of fire wood i.e.15 to 20 kg wood is saved by using this new stove (approximately 2 tractor load wood saved in winter season)
- Less respiratory diseases because of proper discharge system for the smoke.
- Availability of hot water as tank has been attached to the stove which heats up water during cooking and heating
- Easy to clean and for the maintenance

- Provides more heat than the traditional stoves
- Decreased work load on women for hot water for children and livestock
- Less time consumes for cooking.
- Good for children and senior people.
- Good for livestock too.

Disadvantages

- Quality of the material can be improved.
- Gets cooler /low heat consistency
- Cannot use water tank and stove separately. (But now after the feedback from the communities it can be separated any time).
- Creates too much heat in summers.
- Water leakage near tap.

The community is very happy with the stoves. The real beneficiary of the stove is woman however; on the whole it has facilitated the whole family. Majority of the users claim that the fuel efficiency is very good. It will, in the long run help to save the forests and will help to exert less pressure on the pastures for the wood. Obviously, it has also decreased workload of women. Women can now utilize the available time for other useful and productive activities including income generation and agriculture.

One of the significant contributions of the stoves has been provision of hot water to the communities. Hygiene and related diseases in the area are very high as because of non-availability of hot water people hardly take bath or wash cloths in winters. It creates several hygienic issues. Now, with the fuel-efficient stove, there is hot water available all the time at home which can be used for drinking, bathing, washing clothes as well as for their animals.

Fuel-efficient stoves are the one of the best options for natural recourses conservation. It can decrease workload of women, which will give chance to women to focus on other potential areas of their contribution. Other people also demanded for the stoves. This model can be replicated in other such harsh climatic villages and similar very fruitful outcomes can be seen.

10.3. Waste Management

Gilgit Baltistan's mountain communities face significant challenges in managing the growing amounts of solid and human waste. Tourists on treks and mountaineering expeditions contribute to the increasing volumes of solid waste in pristine valleys and higher mountain regions. Unfortunately, there are no adequate systems in place to collect and manage the waste – particularly in poorer countries and regions rather waste is dumped on the side of trails, at camps, or in glacier crevasses. The growth in tourists visiting popular mountain regions and the accompanying waste issues can be staggering. For example, with the rise in domestic tourism in Pakistan in recent years, Baltoro glacier has seen an exponential increase in visitors.

Mountain tourism and incremental trend of mountaineering and trekking expeditions are adding more strains to the fragile ecology of CKNP. K2 base camp trek is becoming one of the most famous treks in Pakistan. Besides mountain climbing expeditions, throngs of trekkers flock to the Central Karakoram every year. Fortunately, there seems to be a growing awareness, but the implementation of coordinated, long-term sustainability policies may collide with the private interests of expeditions, tour operators, and individual trekkers.

Exhibit 24: Collection of solid waste near K2



Ev-K2-CNR started its activities of waste management in Baltoro area in 2006 along with Alpine Club of Pakistan and it resulted in collection and removal of 3250 kg of solid waste. In 2008, Ev-K2-CNR installed Eco Incinerator in the village of Askole to dispose of waste; the first and only of its kind in Pakistan. In continuation of this great cause, Ev-K2-CNR and Alpine Club of Pakistan removed 9318 kg of trash from Baltoro in 2009. In 2010 - 2011, Ev-K2-CNR, with the financial support of Italian Cooperation launched "Keep Baltoro Clean" project, which resulted in the removal of a big chunk of garbage and human waste weighing 21,140 kg. 2010 was the first year in the history of K2 and Baltoro that Eco Toilets were installed for the management of human waste., The number of Eco Toilets was further increased in 2011 providing the facility to the other tourist concentration areas including the basecamp of K2, G-I, G-II, Broad Peak etc.

In the last five years (2015-2019), with the support of Moncler, Italy 28900 kg of waste including 15600 kg of solid waste and 13300 kg of human waste has been removed, segregated and disposed from Baltoro and world's famous mountain base camps. The team accumulated include packing tins, cartons, polythene bags, glass, paper, foodstuff etc. The waste was carried to Askole the last village en-route to Baltoro glacier from Shigar where there is an incinerator installed by Ev-K2-CNR for the disposal of waste collected from mountains and glaciers every year.

Year	Human	Solid
2013	2,500	9,500
2014	1,900	3,400
2015	3,800	3,000
2016	3,200	2,700
2017	3,500	3,000
2018	2,800	2,700
2019	2,300	1,900
Total	20,000	26,200





- Concordia is much cleaner and the stinking smell and the garbage dumps which irritated the visitors is far less and this unique place is again a place to enjoy. This will attract more visitors, which will benefit all the stakeholders.
- With lesser water borne diseases the lesser cases of dysentery of the porters has decreased and which has further helped in controlling the problem
- (Using cleaner water) the glacier is further saved from pollution; the staff does not have to very far to get clean water for kitchen use.
- The water downstream is much safer to use

Exhibit 26: The clean-up activity of 2017 resulted in the collection and collection of 2100 kg of solid waste from Baltoro Glacier.



Safe disposal

After the collection, packages are sealed to avoid any leak for waste during the transportation. The waste is subsequently transported to Askole village where there is an incinerator installed. The solid waste is segregated between burnable and non-burnable. The burnable is incinerated and the recyclable material is separated and sent to Skardu market. It incurs very high cost as a porter requires almost six days to walk down to Askole. It requires a very large number of disposable bags in different colors for easily segregation of the type of waste to dispose of later on.

Recommendations for next years

There is dire need to extend the glacier cleanup campaign to other mountain base camps and glaciers as well with the fact that they are faced with similar waste management issues particularly in recent years with the heavy influx of tourists.

The large number of domestic tourists arriving in GB are interested to visit the Park and are looking for short and easy treks. These areas urgently need waste management system to be in placed:

- o Hushey area
- Minapin Diran peak base camp
- o Rakaposhi area
- Hoper area

Rising Winter Expeditions

A huge quantity of trash is accumulated and left by the winter expeditions who attempt to ascend K2 and other peaks in winters. The number of winter expeditions is increasing for last few years. The garbage left behind conceals under the snow and surfaces in the summers with snow melting. It is almost impossible to transport the waste down to the incinerator in winters. The dumping points can be built where the trash can be dumped and can be transported in summers.

Animal carcasses

The use of horses, mules, donkeys, and yaks for transporting supplies has also resulted in scores of carcasses left improperly which are disposed directly on the glacier putting immense pressure on the fragile ecosystem. A proper system for their removal is a dire need to cut the bones through a pressure saw machine and further transportation to Askole. Furthermore, it is important to sensitizing the owners about health of such animals ensuring to have vaccinations. <u>Only healthy and vaccinated animals shall be allowed to go on to the glaciers.</u>

Exhibit 27: CKNP staff collecting and counting the waste collected at the incinerator machine (Askole Shigar)



Eco-toilet

The Issue of Human Waste

Prior to the initiation of Ev-K2-CNRs waste management interventions, there was no regular waste collection system even for solid waste. En-route to K2, there were no toilets even at the campsites and the mountain base camps, where there are more tourists, trekkers, mountaineers, porters, cooks and support staff during the climbing seasons. Climbers usually used to dig holes in the snow for their toilet use and leave the human waste there which started causing a grave ecological problem and pollution. Moreover, Baltoro glacier is one of the most important tributaries to the Indus and millions of people downstream are dependent on it for agriculture and drinking purposes.

Eco-Toilets Installation

The main aim of this activity was to provide toilet facilities for mountaineers and trekkers on Baltoro Glacier and base camps. Human waste was littered across the rocky moraine and lurking in the snow all along the route up to the base camp of world's second largest peak. Dr. Michael Loso, an associate professor of earth sciences at Alaska Pacific University, has found that the fecal material deposited in a crevasse becomes encased in ice and remains intact until it is removed, it doesn't dissolve or decompose, as some climbers believe.

Management of human waste has been a daunting challenge; climbers usually used to dig holes in the snow for their toilet use and leave the human waste there. Prior to initiatives of Ev-K2 CNR, there were no such facilities available, the tourists and porters had no other option than to use the glacier, and this caused the gigantic problem of cleanliness and bad smell.

The team reinstalled the first Eco-platform on Ghoro-2 camp and then in Concordia. With the gradual melting of snow, the team reinstalled other Eco-platforms on different mountain Basecamp as Broad Peak base comp, K2 base camps and kept it functional till the end of the first week of September 2019. In total 10 eco-toilets were installed at following sites;

Number of Eco-Toilets installed at Baltoro						
K2 base camp	Broad Peak base camp	Concordia campsite	Ghoro II			
02	02	04	02			

This activity resulted in the collection and transfer of 3075 Kg of human waste.

The below table describes the amount of human waste removed from mountain base camps and campsites;

K2 base camp	Broad Peak base camp	Ghoro II	Concordia	Total
775	650	700	950	3075

Exhibit 28: Eco-toilet installed on Baltoro



Maintenance and Repair for Eco Platforms

Eco-platforms or eco-toilets are installed and uninstalled each year and it also includes their transportation from Askole to various camps where they need to be installed, due to this, they need regular maintenance. Three available eco-toilets are damaged and need to be fixed.

The number of eco-toilets need to be increased:

02 more at K2 base camp

02 at GI and GII base camps

01 for Ali Camp

The sustainability of this intervention costs as to put the toilets in place on glaciers requires travelling for many days. Furthermore, the filled drums are replaced on a regular basis as the human waste in each drum is transported to the land area where it is buried deep. This activity requests a huge amount of funds, manpower and time this has to find some place in the OP trough the new **CKNP fee.**

Raising Awareness

All stakeholders including tourists, tour operators, porters, guides and the owners of animals need to have greater awareness about their critical role in keeping the beautiful natural treasures neat and clean carrying their own waste on way back.

Proposed Fees

In order to support park activities and its management different types of fees and deposits have been considered for visitors. The Fee System has to be revised and updated in accordance with the recent decisions adopted by GB Government.

Some new fees as Waste Management Fee, or the Entry Fee, or Garbage deposit had been suggested in the last approved MP (2014). Entry Fees are collected in other National Parks, and Garbage deposit is a new approach and addition to the charges that a tourist has to pay for visiting the area for climbing and trekking activities. In both cases, the common aim is to promote a disbursement mechanism of these funds at park level to support the financial needs of the Park for its activities, and to support the local communities living in the Park.

In last five years the fees were partially applied and there were issues in further utilization of the collected fees by Park Directorate. This revised MP proposes a new mechanism, which simplifies the collection of various fees into a single fee named as CKNP fee.

Briefly, the fees and deposits were the following:

Entry Fee: following the experience of other national parks contiguous to CKNP, it is recommended to have an entry fee with different amount for foreign and national visitors.

<u>Waste Management Fee:</u> will be used to support the activities of campsites management, management of the eco-platforms installed on the glacier, management and maintenance of incinerators installed in Askole, Hushey, Minapin and extraordinary cleaning campaigns arranged for particular locations where cleanup is needed for the continuous waste accumulation. This fee will be collected in Islamabad at the same time with the Permit fee for trekking and Royalty Fee for Expeditions.

<u>Permit fee for restricted areas</u>: Currently GB council in Islamabad for trekking groups is collecting this fee; it is suggested that this fee has to be transferred to a competent authority in Gilgit-Baltistan such as CKNP (for CKNP area) and tourism department, which will receive the funds and transfer to the Park Account.

Royalty Fee for climbing Peaks: Currently GB council in Islamabad for expedition groups is collecting this fee; it is suggested that this fee has to be transferred to a competent authority in Gilgit-Baltistan such as CKNP (for CKNP area/ peaks) tourism department, which will receive the funds and transfer to the Park Account.

The new fixed fee is established on the basis of visitor origin, following these categories:

Local communities: people belonging to local communities, having a part of their territories inside the Park boundary.

They have free access to all the whole Park area without the need for any registration before entering or for any authorization from CKNP Directorate. The only exception is the entrance to a small part of the *Core Zone*, the *Strictly Protected Area*, here a permit is needed.

They do not have to pay any fees, on the contrary they shall have share from the revenue generated by the park such as the entry fee or from part of the trophy hunting program.

<u>Gilgit-Baltistan visitors</u>: people belonging to communities living in the Gilgit-Baltistan area.

They need to register at the Park entry point before entering the CKNP and they also need to register at the exit point. However, they have to pay at the VRC points the CKNP fee in a VRC.

National visitors: people belonging to the Pakistan country.

They need to register at the Park entry point before entering the CKNP and they also need to register at the exit point. They have **to pay at the VRC points the CKNP Fee** but more economical and cheaper could be considered for them.

Foreign visitors: people belonging to foreign countries.

They need to register at the Park entry point before entering the CKNP and at the exit point.

They have to pay the **CKNP Fee in Islamabad** now of issue of the permit for climbing or entering in a restricted area, as well as the Garbage deposit when owed (at the Park entry points). Foreign visitors going to open zones need to register and have to pay the fee at CKNP VRCs.

Research Protocols

1. GLACIOLOGY

Guidelines to Perform Field Surveys

1.1 Carrying out mass balance measurements

The focus of this paragraph (taken from Kaser *et al.*, 2003) is the application of the "direct glaciological method". This method determines the surface net mass balance over given time periods. Measurements are best carried out twice per year –at the end of the humid and the end of the dry season. More visits may be necessary to maintain instruments and stakes in the glacier. The net mass balance has to be measured on a selected number of sites. For clarity, in subsequent chapters, the two dates of subsequent visits to the glacier are called t_1 and t_2 . (t_1 , might be October 1_{st} in 2012, and, t_2 , October 1_{st} in 2013). Since accumulation and ablation measurements require different techniques these to topics are presented separately.

Ablation measurements

Net ablation can occur on bare glacier ice in the ablation zone low on the glacier and, under strong negative mass balance conditions, also from firn in the upper regions of the glacier. Typically, stakes are drilled into the glacier in the ablation zone and changes in surface level are measured against stake height. For ablation conditions, the level, measured (between t_1 and t_2), drops (or the distance from the stake top increases). The density of glacier ice is considered constant at 917 kg m⁻³ and there for the specific mass balance in [m we] or [kg m⁻²] is calculated from the product of the level change between readings and the ice density.

In the accumulation zone, if firm ablation can be expected, stakes must also be set in those areas. Density of the ablated material must be made prior to the ablation, that is at t_1 , at near the stake location but not close enough to the stake to affect measurements.

Ablation stakes

Ablation stakes can be made from a variety of materials. The stakes must not self-drill into the ice by their own weight or by melting due to the absorption of energy. For ablation greater than 0.5 m yr⁻¹, a sectioned stake is usually needed. Plastic or metal pipe in sections about 2 m long have been used. The sections are kept together either by interior plugs inserted into the pipe, by wire or cable ties, connecting each section through holes drilled in the sides, or by exterior sleeves. Metal stakes have one major disadvantage, in areas with high air temperature or high insolation, stakes warm up or absorb energy that cases them to melt out of the bore holes in which they originally were set. Metal stakes will also melt down into the ice, thereby reducing the read ablation values from their true values. This problem can be reduced by inserting a wooden plug at the bottom end of the stake, thereby reducing the thermal conduction from the stake to the ice. Plastic stakes are lightweight and may appear ideal. However, some plastics (e.g. PVC) become brittle at low temperature and splinter easily when winds pick up. Plastic stakes can therefore not be recommended. In many places, including low latitude countries, bamboo stakes have proved suitable: they are easily available, strong, resistant to weather, have a low thermal conductivity and low weight, and they are inexpensive. Wire connections are useful for bamboo stakes. Connecting devices are shown below. A disadvantage of the wire connection may occur when the lower stake emerges only very little from the ice. The upper stake is then laying on the

surface and it can be difficult to find the site, particularly if it is, in addition, covered by let's say a thin autumn snow cover. The advantage of any particular system depends on the availability of materials locally, the cost, and weight. In places where glaciers can or will be revisited repeatedly during a season, such stakes

may be very useful. However, a lost stake from melting out is a severe blow to any mass balance program and the choice of stake material must be made in accordance with the expected frequency of visits to the glacier. Kaser *et al.* (2003) strongly recommend any mass balance program to make their own evaluation of different stake materials in parallel to establish which materials suit their needs the best. *There is no single best way to measure mass balance that is applicable to all glaciers*. However, it *is* important that whoever makes decisions on changes to methods of measuring mass balance does so backed up with much knowledge, and perhaps most importantly, much experience from the field.



Exhibit 1 Connection devices for ablation stakes: a) rubber tube, b) metal sleeve, c) wire connecting bamboo stakes (from Kaser et al., 2003).



Exhibit 2 A stake buried by a rather thin snow cover (from Kaser et al., 2003)

Selecting sites

Ablation, in comparison to accumulation, is rather uniform and point measurements can be representative over large areas. This implies that significant small scale $(10^{-2} - 10 \text{ m})$ differences can be averaged out over long periods (>days). Statistical analyses from a variety of studies agree that 10 - 15 ablation stakes are sufficient to estimate a glacier's mass balance, independently from the size of the glacier (e.g. Fountain and Vecchia, 1999). A useful distribution is on a longitudinal axis along the central flow line of the glacier and some additional crosswise profiles where accumulation differences due to wind distribution, shading, or avalanching may be significant. On many glaciers, ablation stakes are distributed more or less regularly over the ablation area with no particular structure. Stakes should be established at the same position each year. By "same position" we mean within about 100 m. This means that a stake location is a circle of 50 m radius on the glacier. Within this radius, mass balance is not expected to vary significantly. These values only apply to a larger glacier that is 500-1000 m wide and several km long. On a smaller glacier it becomes more critical to re-establish stakes at the same position. Establishing the location of stakes can be made by either using a hand-held GPS with pre-programmed waypoints or using a sighting compass and landmarks such as peaks, ridges or other features in the surroundings to establish the point by optical intersection. Regular surveying can of course also be made but requires heavy equipment and larger number of personnel. Establishing stakes at predetermined locations has the advantage that values from different year can be compared directly. Remember that mass balance is strongly elevation dependent, primarily because melting decreases with altitude since it depends on temperature, which decreases with altitude. This means that on any glacier which has a large elevation span (ca. 1000 m) the strongest variation in mass balance will be along the long axis of the glacier. The primary goal for setting stakes should therefore be to cover as much elevation as possible, especially important is to maintain stakes at both high and low altitude, near the head and terminus of the glacier, respectively. Lateral variations in mass balance originate from shading of the glacier. If your glacier is located so that there is reason to suspect that certain sites on the glacier receives much less or more energy, lateral stakes should be placed to capture the decreased or increased melt in such area. Kaser et al. (2003) recommendation is to concentrate on establishing 10-15 stakes along a longitudinal profile covering as much elevation as possible. Stakes should be placed so as to be evenly distributed in altitude, not distance on the glacier. This means closer distance on steeper parts of the glacier and more distance between stakes on flatter areas. Lateral extending of the stake network should be made either in a cross like figure or in a diamond like figure where lateral stakes are set in altitudes between the central stakes. The latter supports best the contour type evaluation of mass balance.



Exhibit 3 Stake setting along the central flow line of the glacier and some additional crosswise profiles (from Kaser et al., 2003).

The stakes should be numbered and tagged by a small metal plate, tied with wire to the upper end of the stake. The stake number is stamped or scratched into the plate together with the year of drilling in the stake (a lost stake may re-appear again). Several numbering systems are practiced from a chronological numbering to spatial numberings that infer stake location. For example, along the central flow line stakes are numbered 10, 20, 30, 40, etc., and lateral stakes are numbered 21, 23, 25 on the left-hand side and 22, 24, 26 on the right-hand side. Note that any numbering system which allows the unambiguous

recognition of stakes is of value. Due to the ice movement stakes are dislocated from their original position after some time. Depending on the glacier velocity the stakes must be repositioned occasionally. Often, this can be conveniently done when the stakes are ablating out entirely.

Drilling ablation stakes

Ablation stakes are drilled into the glacier using either a mechanical hand auger or with a steam drill. For deep emplacement (>3 m) a steam drill is usually easier. Because of heat loss along the sides, a typical steam dill has a depth limitation of 8-12 m. The depth of the holes for the stakes depends on the magnitude of expected ablation between the measurement interval. The greatest ablation is usually highest close to the terminus and can reach up to 10m or more per year. Thus, drill limitations may dictate the minimum time interval between visits.

The reading of ablation stakes

For net ablation measurements the length of the stake from the free end to the surface, L, is measured at two (t_1, t_2) or more (t_n) successive dates. At t_2 , the last measurement of the ablation season, the depth of snow over the ice is also measured. The difference between exposed stake lengths, $L_{i(t2)} - L_{i(t1)}$ plus snow depth at t_2 , gives the net ice ablation at this point. If snow covers the surface during both visits, then it has to be accounted for in each visit.





If snow covers the last visit and remains snow covered for the rest of the season, presumably, the time of maximum ablation (minimum mass balance) took place at some point earlier. Weather records from a nearby station help with determining more accurately the date of snowfall and therefore the date of minimum glacier balance.

Mapping the ablation area

The knowledge of the pattern of bare ice appearing at the end of the observation period (particularly at the end of the ablation season) is of great use when drawing the mass balance features into a topographic map. It would be best to measure the extent of bare ice by geodetic methods but a field mapping supported by photographs taken from different points is sufficient.

The steam drills

A butane (or propane) burner heats water in a boiler and generates steam. When the valve is opened the steam escapes through the nozzle of a drilling pipe at the end of an insulated hose. The condensing steam transfers energy to the ice causing it to melt. The high degree of latent heat contained in the steam guaranties a very efficient energy flow from the boiler to the ice. The entire drilling device consists of the steam generator, the rubber hose, and the drilling pipe with interchangeable tips. It can be carried on the back like a rucksack and can be operated by one person. A small drill tip (21 mm in diameter) creates hole diameters of 30 to 35 mm and a large drill tip (30 mm in diameter) creates hole diameters of 35 to 45 mm in ice.



Exhibit 5 The steam-driven HEUCKE ICE DRILL (from Kaser et al., 2003)



Exhibit 6 Drilling an ablation stake with the Heucke steam drill at Concordia – Baltoro Glacier (Photos by C Mayer)



Exhibit 7 Drilling an ablation stake with the Heucke steam drill at Khoburse Glacier (Photos by C Mayer)



Exhibit 9 An ablation stake installed at Khoburse Glacier. This stake is also equipped with thermistors and data loggers to record debris temperature data along the debris vertical profile (Photo by C Mayer)



Exhibit 8 A bamboo ablation stake installed at Khoburse Glacier (Photo by C Mayer)

Accumulation measurements

The net accumulation is measured by digging pits at each of the stakes in that area of a glacier where snow has accumulated during the immediate past period (t_1 to t_2) of investigation (i.e. season or mass balance year). Like in the ablation zone, the amount of accumulated snow is measured in water equivalent length units [m we] or water mass per area units [kg m⁻²]. This is calculated from measured snow depths and the respective snow density. For the necessary measurements the snow cover has to be penetrated to the last observation dates (t_1) horizon either by digging snow pits or by taking cores with a respective drill.

Selecting the sites

The accumulated snow cover has usually a rather complex distribution of depths but comparable uniform density profiles. Because of the logistical limitations, the number of measurement sites is limited and depend on the extent and the complexity of the respective accumulation area. Typically, 3–5 measuring points are suggested. These points with depth and density measurements are complemented by spatially extensive depth information from probing. Successful probing depends on a reference layer of clearly greater density (usually the previous summer surface), which can be identified. If no reference layer can be found when probing, which is rather probable under low latitude climates the number of measuring points must be increased. The location of accumulation measurements must represent a possibly large surrounding area. To a certain extent, the field experience of the investigator can help to find most representative sites.

The identification of previous year layers

Net accumulation is, as the net ablation too, determined in respect to a previous surface position. Whereas this can be easily determined in the ablation zone because of the ice surface, any natural or artificial marking in the accumulation zone made at t_1 will be buried by snow by t_2 . Under mid-latitude conditions, a well definable layer usually develops at the end of the ablation season. This is because the surface had experienced melting, collected dust during the ablation season, and re-froze before the arrival of winter snow. This reference layer is characteristically dusty and hard. Thus, all snow superimposed on this hard-dusty layer is considered to be new accumulation. Under low latitude conditions measurements of net accumulation are more complicated. Neither in the monsoon type regime (Ageta and Fujita, 1996), where accumulation appears during the warm season, nor in tropical regimes, where melting occurs all the year round, does a hard-dusty layer develop. Sometimes a dust layer will be found on low latitude glaciers, but they are seldom regularly developed and are often linked to individual events such as storms rather than to the end of the ablation season. In this case, artificial markers are needed. Dust or soot are not suitable because it will tend to wash out and will alter the surface energy balance leading to increased local ablation. Accumulation stakes can be installed with a piece of tape marking the level of the surface prior to the accumulation season. These stakes have to be quite stable since they have to erect substantially for not being buried entirely by subsequent snow. Markers fixed on stakes and buried by the accumulated snow can only be found by digging a snow pit.

Still, the pit can also be used for the necessary density measurements. In the accumulation area it will be very important to establish the net addition of mass. Sometimes the previous year's surface may be difficult or impossible to distinguish. In such cases we recommend to sprinkle saw dust, preferably dyed dark with a water insoluble dye. Saw dust is very useful since it is lightweight when dry but becomes more immobile on a snow surface since it soaks up water and becomes heavier. Dusting should be made so that the surface is not completely covered with sawdust but is neither so lightly dusted so that identification of the dust in a snow pit may be impossible. When digging a snow pit at the stake the following year, the sawdust can be distinguished and the previous surface positively identified. It is also possible to cycle through a series of colours so that deep pits can verify several years of accumulation. This is however not necessary for the standard mass balance program. If sawdust is sprinkled around a stake it is advisable to spread dust over a relatively large area and make notes on the size of the area. This becomes useful if the stake is lost during the year, e.g. snowed over. The likelihood of hitting the dust when digging in the assumed area of the lost stake is higher the larger the area that is sprinkled with saw dust.

Snow density

The best way to measure the density of a snow pack is by digging a snow pit and making careful measurements of the snow density down the pit wall. Coring may be easier and faster, but the action of coring compresses the snow somewhat leading to over estimating the actual snow density. The size of a snow pit and its shape depends on the expected depth. The deepest point of the pit should be a square approximately 0.5×0.5 m to provide sufficient room for making density measurements. Also, for density measurements and stratigraphy observations, one continuous wall from the top to the bottom of the pit must be planned. This measuring- wall is oriented to avoid direct sunlight.



Exhibit 10 Shape and size of a 5 - 6 m deep snow pit (from Kaser et al., 2003).

Each experienced investigator has their own technique and philosophy for planning a pit dig to achieve the proper depth, size, and measuring wall. The above reported figure is one such suggestion. Note that measures are not in usual length units but in relation to the human body and, to some extent, related to the length of the shovel. It is generally advised that all walls should be kept perpendicular while digging and all angles as right angles. This is the most effective way to reach the required depth with a minimum of volume to be removed. A well-made pit is shown below.



Exhibit 11 Digging a snowpit (see the vertical profile for snow layer analysis and sampling) at the Godwin Austen basin (Photo by C Mayer).



Exhibit 12 Digging a snowpit at the Gasherbrum basin (Photo by C Mayer)

The **snow density** ρ , is determined by measuring the weight (mass), m^* , of a snow sample of sample volume, V^* :

$$\rho = m/V^1$$

For this purpose, tubes with a volume capacity of 500 cm³ (usually with a length of 20 cm with the respective diameter) are very practical. They can easily be made from stainless metal. Note, however, that the sharp side must not affect the sampling of the volume. Since the aim in context of mass balance investigations is not primarily the variation of density with depth but the determination of the water column stored in the accumulated snow pack, samples must not be taken horizontally but as vertical cores each one beneath the other. If clear changes in snow properties are met, which indicate a certain event or change in the accumulation processes, this can be considered by accordingly separating the density measurements. Necessary tools and their use are shown here following.



Exhibit 13 The sharp edge of a density tube must not affect the sample (from Kaser et al., 2003)



Exhibit 14 For mass balance purposes sampling is better made vertically (From Kaser et al., 2003)

Each measurement is recorded in a field book filing up the lengths of the samples in one column, the density in the next column, the length-weighted mass in the third. For a final check the sum of taken sample lengths is compared with the separately measured total depth of the pit from the surface to the reference layer.

In many cases, a stratigraphic description of the snow layers can be very helpful when analyzing the data and when comparing the results from different snow pits. This has not to be as sophisticated as for avalanche studies, but should consider major changes in the snow pack (change from crystals to grains, dust layers, descriptive free water content, ice layers etc.), which can be related to certain weather conditions throughout the accumulation season.



Exhibit 15 Firn core at the Godwin Austen Glacier (Photo by C Mayer).

1.2 The locating of the measuring points

The position of the measuring points must be known. In mass balance analysis, a best guess estimate of the location of the points on a good map may be sufficiently accurate to obtain a reasonable mass balance. This caused by the extrapolation from points to surface area values, and as long as the point is within the area it represents, then the exact position is not required. Importantly, the input data must be more accurate than the method of analysis by an order of magnitude to obtain the best results possible. In many cases, at least the ablation stakes are located each year geodetically, which provides data for analyzing the ice velocity.

The snow pits are usually dug relative to topographic features on the glacier, which are rather constant over long periods. Thus, their position is relatively easy to determine from a map and rather constant in time.



Exhibit 16 The GPS Master station located at Urdukas (Baltoro Glacier). In 2011 it was used as reference station to evaluate stake positions and then glacier surface velocity (the measurements were

acquired twice, at the beginning and the end of the field work thus permitting a comparison of the surveyed data). The GPS Master station was located close to the Share AWS (on the right in the photo provided by C Mayer).

1.3 Practical experiments and methodology for monitoring the mass balance of debris covered glaciers.

Since in the CKNP several debris covered glaciers are located (see Mihalcea *et al.*, 2006; 2008; Mayer *et al.*, 2006; 2010) we consider fundamental to add information on the best practices to monitor such glacier type, which are peculiar and need to be analysed with further details. A debris covered glacier is a glacier with the largest part of its ablation area covered by debris ranging from a few cm up to 1-2 m or more (Benn and Evans, 2010).

Supraglacial debris cover is crucial in determining rates and magnitudes of buried ice ablation (Østrem, 1959; Nakawo and Rana, 1999) that is reduced (Mihalcea *et al.*, 2006) when the debris thickness is higher than a *critical value* (Mattson and Gardner, 1989).

On debris-covered glaciers, a "stake farm" experiment to determine the *critical debris thickness* (see Mattson and Gardner, 1989) should be performed on representative area, which presents an wide range of debris thicknesses.

Usually this experiment is performed at the mean elevation of the ablation zone over an 10x10 m area: The stakes are drilled at sites with different debris thickness on flat surfaces: few mm to 30-50 cm. One or more stakes should be positioned on debris-free ice on a flat surface or over surfaces with varying exposition (S, N, W, E). Thin debris cover (0.1 -4 cm) greatly influence the ablation rate, then at least 10 stakes should be drilled within this thickness range. The "stake farm" experiment is very useful to establish the curve of ablation rate as a function of debris thickness by eliminating the elevation effect.

When installing stakes in debris covered areas the following procedure should be followed:

- 1. Select the site: elevation, position (longitudinal/cross profile or "stake farm" experiment)
- 2. Aspect and slope measurements
- 3. Debris thickness (DT) measurements
- 4. Debris cover characteristics: grain size, colour, whether or not the layer is stratified.
- 5. Remove cautiously the debris by leaving one site of the profile undisturbed to be able to observe and characterize the vertical profile and measure the thickness
- 6. Drill the ablation stake
- 7. Measure the stake length above the ice (L_{ice})
- 8. Reconstruct the original debris profile by repositioning the material trying to maintain the original conditions as much as possible (larger clasts at the surface and small grains at the bottom of the layer if is the case).
- 9. Measure the stake length above the debris (L_{debris}). Please pay attention that the stake length difference: L_{ice} - L_{debris} should correspond to the original debris thickness (DT)



Exhibit 17 Installing ice ablation stakes on debris-covered ice (Photos by C Mihalcea)



Exhibit 18 Stake farm to measure ice ablation with varying debris thickness (Photos by C Mihalcea).



Exhibit 19 Debris cover measurements (Photos by C Mihalcea)

As above mentioned, describing the installation of ablation stakes on bare ice, the stakes should be numbered and tagged by a small metal plate, tied with wire to the upper end of the stake. Due to the ice movement stakes are dislocated from their original position after some time. Depending on the glacier velocity the stakes must be repositioned occasionally. Often, this can be conveniently done when the stakes are ablating out entirely.

Ice ablation on debris-covered glaciers

On DCGs the supraglacial debris mantle greatly influences the surface ablation rates and their distribution.





The strong variability of ablation rates measured on the selected DCGs surface (see the above reported figures) is due to the large spatial variations in debris thickness: from a few millimetres on the upper part of the glacier, ice cliffs and crevassed areas, to more that 3-4 m thickness at the terminus. Therefore, down glacier increase in debris depth leads to a positive relationship between ablation rate and elevation in the debris-covered zone, the opposite to debris free glaciers (Mihalcea *et al.*, 2006). Elevation alone (i.e., when the effect of different debris thickness is removed) is not a sensible factor in controlling ablation rates on some DCGs (e.g. Lys and Miage glaciers) due to relatively low altitude differences along the whole debris-covered tongue (this is not valid for large DCGs such as Baltoro glacier).

Generally, it appears that the complexity of the ablation pattern increases in the upper tongue sector and crevassed areas, where the debris thickness variability is high. This is due to differential ablation and high ablation rates, which occur on the ice cliffs, areas with supraglacial lakes and seracs.

High ablation rates in the upper part of ablation area may support the final dynamic separation between the upper debris-free sector and the debris-covered tongue. This pattern is observed on some Italian debris-covered glaciers during the last years (i.e.: Brenva and Belvedere glaciers, Italian Alps).

Different studies demonstrate that also surface characteristics (roughness, slope, aspect) and debris properties (albedo, humidity, grain size, thermal resistance and void space) are key factors in the ablation variability on DCGs, but modelling energy fluxes over surfaces with high variability of these conditions is quite difficult (Nakawo *et al.*, 2000).

Debris cover characteristics

Continuous debris mantles at the glacier surface can result from rockfall events generally in the accumulation area, but also in the ablation area, originated from the lateral rock walls (Deline 2002) and the melt-out of englacial debris that has been elevated from the bed along the shear plans (Benn and Evans, 2010). Exceptional rockfall events occurred in the past on several glaciers which completely covered the ablation area of originally debris free glaciers, thus making them actual DCGs (e.g.: in 1920 it happened on Brenva Glacier, Mont Blanc area, Alps, see Deline, 2002). In other cases, the transformation from debris free glaciers to debris covered ones took from decades to centuries (e.g.: Miage Glacier on the Alps and Baltoro Glacier in Pakistan).

Supraglacial debris cover commonly exhibits a great variability in thickness, lithology and grain size, reflecting the distribution of debris sources and transport paths, and subsequent reworking on top and within the glacier. Debris variability (spatial distribution, grain size) on the glacier surface is responsible for large differences in the distribution of thicknesses and therefore in thermal properties of the glacier surface over short distances, resulting in differential ablation (Benn and Evans, 2010).

Due to low albedo and high thermal conductivity, a thin debris cover increases melting of ice while a thick debris layer insulates the underlying ice and retards melt rates compared to surrounding bare ice surfaces (Østrem,1959; Nakawo and Young, 1981, Mattson and Gardner, 1989).

The lithology on a debris-covered glacier is usually very complex in relation to the lithology of the surrounding rock walls and comprises: granite, gneiss, schist and limestone. The debris properties: colour, grain size and shape (granulometry), determine the surface albedo, layer porosity and structure influencing the thermal impact of debris on the ice ablation.

Where the debris cover is thicker (in areas close to the glacier terminus, where velocity is lower and the debris profile remains undisturbed or on the median moraines), the debris profile often shows a stratification (vertical sorting): fine debris in the deepest layer at the contact with the ice; mixed granules sand and a few pebbles in the internal layers and the last level close to the surface consists of coarse clasts with high void ratio (Kirkbride *et al.*, 2006). The lithology of the debris cover on Baltoro glacier is very complex. In principle it shows a mixture of granite, crystalline schists and limestone.



Exhibit 21 Debris profiles and measurements at Miage Glacier (Alps).

Surface temperature

Surface temperature (Ts) is the most important parameter when studying the surface energy balance of a debris covered glacier. It contributes directly or indirectly to all terms except the short-wave radiation flux (see Mihalcea *et al.*, 2008b).

Supraglacial temperature measurements are of two types: field measurements with high temporal resolution (5 and 10 min) by thermistors and remotely sensed measurements from instantaneous ASTER surface kinetic temperature (90 m pixel size). The thermistor probes operate over a -30 to + 50 °C temperature range with a resolution of 0.25 °C at 0 °C degrading to 0.4 °C towards the extreme values. In our study thermistor probes were attached with their tips to rock surfaces, because an experiment demonstrated that this is the most stable method to measure surface temperature on debriscovered ice (Mihalcea *et al.*, 2008b). A comparison between the two sets of data evidence that, where the debris cover is discontinuous at the pixel scale, generally ground-based data are higher than the ASTER data. A 24-hour high resolution Ts measurement series shows differences between the minimum and maximum of up to 25-30 °C due to the rather low heat capacity of the debris cover. There is a high correlation Ts-SWin (Ts increases and decreases rapidly as response to SWin variation during clear sky and cloudy days) on debris-covered ice, demonstrating the influence of SWin on Ts. An important parameter that greatly influences the Ts distribution is debris to higher Ts due to the reduced influence of the underlying ice and the associated 0 °C temperature at the debris-ice interface.

The surface temperature distribution on debris-covered glaciers has a large spatial and temporal variability and therefore it is difficult to model. An empirical model was developed and applied to Baltoro glacier and we obtained a good correlation between modelled Ts and ASTER Ts data. A physically based model that gives a correct formulation for Ts from the general meteorological parameters would give better results, but it is difficult to produce distributed results, because the conditions at the debris-covered glacier rapidly change.



Exhibit 22 Surface temperature measurements (Photos by C. Mihalcea).

2. FORESTRY

Landcover Classification Protocol

2.1 Landcover classification for forest vegetation

Concerning the forest vegetation, the draft landcover developed by University of Padova and University of Cagliari presents a classification based on 3 forest classes.

The number of classes and their definition is due to the limits posed by the photo-interpretation process: since it's impossible to directly register the vegetation cover of the soil and the species composition from the satellite images, two indices (NDVI and NIR) which express the reflectivity of vegetation have been utilized. Those indices, however, are not directly proportional to a quantitative variable but are related to some properties of the forest vegetation (like the canopy cover, biomass, etc.). Therefore 3 forest classes have been developed, enough general to encompass a wide variety of similar forests and enough different between each other to simplify their recognition.

The classes are: herbaceous-sparse trees, open forest and closed forest.

Each class has been coupled to precise NDVI/NIR values and to 2 measurable parameters: the vegetation cover and the mean heights of trees. Those two parameters are therefore the one which can be used to distinguish, with precise and rapid analyses, the different classes.

Classes definition

First class: Herbaceous – Shrub-land – Sparse trees

It's a class with a reduced tree cover (<10%) which therefore cannot be classified as a forest according to FAO standards.

The tree individuals which might be present are sparse and small (less than 5 meters high).

With the current techniques, it's impossible for us to distinguish between shrub land and herbaceous land. This class, therefore, contains a variety of different landscapes characterized always but the absence/scarce presence of trees. I.e. the arid Artemisia herbaceous vegetation and the sparse Juniper forest.



Exhibit 23 Examples of firs class: Herbaceous – Shrub-land – Sparse trees

Second class: Open Forest

It's the first classification of forest. Can be the result of the degradation of a closed forest or a forest growing on poor soil. The vegetation cover is between 10 and 50% and the mean height of tallest trees is between 5 and 15 meters.

In this category are included the forest which might be managed in the future and in which reforestation is suggested. The species composition can be various, from degraded spruce (*Picea smithiana*) and Pine (*Pinus wallichiana*) to dense *Juniperus* woodland.



Third class: Closed Forest

It's the category which includes the most productive forests. The vegetation cover is above 50% and the mean height of tallest trees it's above 15 meters.

The sustainable forest management will be applied mostly to this category. Usually this class is composed by dense forests of spruce (*Picea smithiana*), pine (*Pinus wallichiana*) and/or birch (*Betula utilis*)



Exhibit 25 Examples of third class: closed forest

Parameters used for the classification

Vegetation cover:

The vegetation cover is the ratio between the projection of trees/shrubs canopy on the soil and the soil surface, in percent (see image below). The green dots represent the area occupied by the plant canopy while the larger black circle is the surface of the study area. The vegetation cover therefore is given by the ratio between green and white.

The three forest classes which have been defined are:

- 1. Herbaceous/Sparse trees: vegetation cover < 10%.
- 2. Open forest: vegetation cover between 10 and 50 %.
- 3. Closed forest: vegetation cover > 50%.

I CLASS: HERBACEOUS	II CLASS: OPEN	III CLASS: CLOSED		
/SPARSE TREES	FOREST	FOREST		
Below 10%.	Between 10 and 50%.	Above 50%.		
\smile				
	A CLASS: HERBACEOUS /SPARSE TREES Below 10%.	I CLASS: HERBACEOUS II CLASS: OPEN /SPARSE TREES FOREST Below 10%. Between 10 and 50%. Image: Class of the second seco		

Table 1 Classes of vegetation cover

Average height of tallest trees.

As average height of tallest trees we intend the mean heights of the 4-5 tallest trees of the area:

- 1. Herbaceous/Sparse trees: average height of tallest trees < 5 meters.
- 2. Open forest: average height of tallest trees between 5 and 15 meters.
- 3. Closed forest: average height of tallest trees vegetation > 15 meters.

2.2 How to use the landcover validation:

1. Instrumentation needed:

- a) GPS
- b) Compass
- c) Camera
- 2. Filling norms:

The operator, both if he/she is located in the forest environment or in open space:

- 1. Localize with GPS his/her position and fill the appropriate columns (Cl3 and Cl4 of the Table 2 using coordinates system WGS 84 UTM 43 N) and date (Cl2 of the Table 2). Always with GPS, he/she registers his/her altitude (Cl5 of the Table 2). Finally indicates with a progressive number (1,2, 3...) the surveyed point (Cl8);
- 2. Observing the environment around him, he/she indicates in which class the forest can be classified (First class, Second class or third class) in the designed column (Cl6 of the Table 2);
- 3. In the designed column (Cl7 of the Table 2), the operator selects which is the dominant plant species (conifer or deciduous).
- 4. Shoot two photographs (writing the two-progressive number in the provided space, Cl1 of the Table 2) one towards North the other one towards South.

Regarding the photographs: a wide shot is preferred to a single detail since it gives more information. The photographs in two opposite directions should provide an objective overview of the forest status.

Regarding number of points to be taken: for the landcover validation some 10-20 points per valley should provide enough information. There is no need to take the points at a certain distance one to each other, but it would be preferable to take one point when forest densities/composition vary (over a sufficient surface of approximately one hectare).

Through the compilation of the landcover validation protocol, useful information will be gathered which are essential to provide an accurate forest landcover map.

CI 1	CI 2	CI 3	CI 4	CI 5	CI 6		CI 7			CI 8	
					VEGETATION			MAIN LEAF TYPE			
PHOTO N°	DATE	COORD X	COORD Y	ALTITUDE (M)	I CL: COVER <10% HEIGHT <5 M	II CL: COVER: 10- 50%HEIGHT: 5-15 M	III CL: COVER: >50% HEIGHT: >15M	CONIFERS	BROADLE	EAVES	POINT N°
North:											
South:											
North:											
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Table 2 Field survey protocol to validate draft and land cover classification

How to use Protocol

Photo number: indicate the exact name of the picture. The operator must take one shot in each direction (towards North and towards South).

Date: the operator must indicate the date in which the picture was taken.

Coord X and Coord Y: using coordination system **WGS 84 – UTM 43 N** (I.E.: 36°25'58''N 74°35'28''E; or kilometric coordinates).

Altitude: in meters, if possible, using a pressure altimeter.

Vegetation: state the vegetation class for the forest:

I class: the tree/shrub vegetation cover (projection of canopy on the ground) is below 10% of the total surface, average height of the 4/5 tallest trees/shrub (if present) below 5 meters.

II class: tree vegetation cover between 10 - 50 % of total surface, average height of the 4/5 tallest trees between 5 and 15 meters.

III class: tree vegetation cover above 50% of total land surface, average height of 4/5 tallest trees above 15 meters.

Main leaf type: the operator must state the composition of the main tree species: *conifer* (pine, spruce, juniper, etc.) or *broadleaves* (Betula, Rosaceae spp, etc).

	i Class – Herbaceous /Sparse Trees	ii Class – Open Forest	iii Class – Closed Forest
Vegetation cover	Below 10%.	Between 10 and 50%.	Above 50%.
Average Max Tree Height	Below 5 meters.	Between 5 and 15 meters.	Above 15 meters.

Table 3 Classifications for vegetation covers

3. FORESTRY

Reforestation Guidelines: Brief Notes for the Storing and Seeding of Seeds

3.1 Storing of Cones

Once cones of conifers species (*Pinus wallichiana* and/or *Picea smithiana*) have been collected, the operators should:

- *Place them in large sacks;*
- *Fill cones only up to one –half of the sack to avoid heat buildup;*
- Ensure that filled sacks are tied at the top to allow for cone expansion;
- Store the filled cone sacks on their side not upright;
- Change sacks if they become wet;
- Store the sacks in a dry, cool and ventilated place.

Generally, freshly picked cones are very moist, and is essential to reduce the moisture gradually to prevent fungi spread and mimic, at the same time, the natural maturation process. Try to avoid, if possible, to picking the cones during wet weather. Alternatively, reduce the number of cones per sack to promote uniform and faster drying.

It's important to keep the bags not in direct contact with earth to avoid soil moisture to spread into the sacks. After 2/3 weeks the cones will dry and ultimately, they will open, making seeds extraction easy.

3.2 Extraction of seeds

First is important to evaluate if cones dryness is sufficient to allow a complete extraction of the held seeds:

- Check that the cones scales are sufficiently open to allow an easy extraction on all (or most) of the cone's length.
- Check more than one cone per sacks to evaluate the dryings process status.

From each cone a careful extraction of seeds is mandatory to avoid damages. Seeds shall be extracted on a fine knitted towel by gently shaking the cones. Spruce seeds are comparably smaller than pine one and should be handle with more care. In particular:

• Avoid extraction in open environment to prevent seeds dispersion by wing gusts.

If possible, try to clean the seeds from the debris and eventually take the seed wings off by gently pressing it. This will facilitate the seeding process.

3.3 Storing of seeds

Once extracted, seeds shall be preserved inside sacks and stored in a dry and cool location. (Temperature shall be equal to or below 5° C). Seed can be satisfactorily stored in this condition until the following spring, provided it is kept cool, in sealed sacks. Make particular attention on selecting the location for the seed storing: try to avoid as much as possible places which can be reached by rodents (mice, squirrels, etc.). Place barriers or hang the sacks on the roof to make it harder to reach for those animals. Ideally, seed storing location should be close to the area selected for reforestation or at least at a similar altitude. This is important to couple local climate with seeds, making them "ready" to germinate.

3.4 Pre-treatment

This chapter will deal with the most important activities to do before seeding. Seeding can be done in late autumn-early winter (Winter seeding) or in spring time when snow melts (Spring seeding).

A) *Winter seeding*: winter seeding shall be preferred whenever possible if the following condition are met:

- reforestation location already chosen
- *fence/protection of young seedlings from livestock browsing already built (or in the case it is not needed).*
- Seeds extraction completed before snow accumulation on reforestation ground.

Treatment of seeds: since the seeds are planted in a location where trees are already growing, there is no particular treatment to do to the seeds to increase their germinability. The seeds dormancy will be naturally broken when warmer temperatures and water availability increase as snow melts in spring time.

B) *Spring seeding*: if winter seeding is not possible, an additional treatment to be performed on seeds before seeding is needed.

• Stratification: seeds shall be placed in a box filled with sand and kept wet with cold water (5°C) for at least 4/5 days. This treatment is needed to break the dormancy and allow a fast germination once the seeds will be sowed.

3.5 Seeding

Every 1-meter (3 feet) make a small (5-inch x 5 inch) hole in the ground with a shovel. Break the soil surface and the largest pieces of soil and create a soft, uniform and well mixed seeding ground for the seeds. Try to make the seedbed firm and horizontal.

Place 5 seeds on the seedbed trying to keep them separated one to each other. Cover the seeds with a uniform depth of soil so that the seed is not visible but mechanical impediment is not preventing seed germination. (be careful: pine and spruce seeds need a very tiny layer of soil to cover them, otherwise they do not have enough energy to germinate).

If possible, irrigate the hold to fix the seeds and to increase water availability.

Move 3 feet apart and make the next repeat the operation. If seeding on a slope, follow the contour line (move horizontally and do not go uphill, see fig. 1).

Figure 13

Exhibit 26 Contour seeding is following the red line, making holes always at same altitude

4. WILDLIFE

Wildlife surveys: standardization of methods and periods for CKNP Area

4.1 Standardize data collection

In order to enhance collaboration among stakeholders working on Wildlife in CKNP area and to make data available for all partners, a standardized data collection should be considered. Therefore, priority valleys for CKNP management should be agreed and for each valley specific action plans should be developed mentioning specific tasks, roles, sharing of resources and costs. Data collection and filing should be carries out in a standardize way.

Methods, data and objectives of surveys should be shared among all the stakeholders (i.e. if surveys are carried out to set up a trophy hunting programme, the goal of the survey has to be clear to all the interested organizations).

The basic concept is to operate with the same methodology and in the same periods for the wildlife surveys.

4.2 Proposed Wildlife Surveys

Survey team

Each survey team should be made up by groups composed by 1 to 3 members. For each valley to be surveyed the number of people involved will be function of the extension of the area to be surveyed.

Wildlife surveys require reliable replications, to be effective. A reliable replication means: (i) the **same people** involved (only if the same people is involved it will be easy to find out the same vantage points used in the past) – it is important that at least *1 person for each group* (team=all the people involved in the wildlife survey; group=part of the team attending specific areas of the selected valley) *is the same than in the previous survey*; (ii) **same number of people** (if reliable surveys were carried out in the past, the number of people involved should not be changed, least of all decreased), (iii) **same areas** (the same areas have to be surveyed each time, in order to obtain comparable data; the number of surveyed areas may increase, never decrease).

Planning

A good planning is essential to obtain reliable wildlife surveys, and then reliable data. Therefore, an effective organization of wildlife surveys (where to go, how many people and how many teams) should be planned well in advance, following the organisation of previous surveys.

For this purpose, a valley specific action plan should be drafted and shared <u>1-2 weeks before the surveys</u>, in order to inform the other stakeholders working in the area about the planning. This document has to mention vantage points to be used (a map should be attached), people involved, days of the survey, specific tasks, roles, sharing of resources and cost by each partner.

Requirements during survey

The following items will be required during the wildlife survey: camera, binoculars, spotting scope, altimeter, compass, data sheet, GPS, tents, sleeping bags, food items, map of the area.

If the planning is well done and the number of groups and vantage points known well in advance (i.e. we know, by now, that 3 groups are needed for the Nar valley, therefore a team of 9 people), also the

material retrieval (each group has to be provided by 1 compass, 1 GPS and 1 spotting scope; i.e. if 3 teams are needed to survey the Nar valley, 3 GPS, 3 spotting scopes and 3 compasses should be available) among all partners will be easier.

Objectives of the survey

- 1. To count and estimate the population of Himalayan ibex and Markhor in the catchment area/valley.
- 2. To record any other wildlife species observed in the area.

Methodology of the survey

- 1. Surveys should be normally carried out twice a year, on <u>May</u> and <u>December</u> (approximately). In very few areas, surveys will be carried out only in Autumn, because of difficult access in spring.
- 2. Surveys should be carried out <u>early in the morning</u> and/or <u>late in the afternoon</u> because most ungulates, i.e. ibex and markhor, are active and graze during these parts of the day and can be easily sighted.
- 3. Vantage points should be established taking GPS references (WGS84-UTM system; dd mm ss). Binoculars and spotting scope will be used to scan wildlife in the area.
- 4. A camera should be used to take photographs of pastures where observations are carried out.
- 5. Direct counts should be used to determine wildlife numbers. The herds seen will be further classified into different <u>age</u> and <u>sex</u> classes (males, females, yearling, kids and undetermined individuals, total; among males, a separate count on trophy size individuals will be made). In autumn counts, the number of kids will be a very useful population parameter to assess reproductive rate.
- 6. For all wildlife monitoring surveys, the same vantage points, established during the first field survey, should be used. It is paramount to get involved the same people.
- 7. While using the same vantage points each year, if a certain pasture in one year has an ibex population/herd and, in the next survey season, no ibex herd is seen in the same pasture, from the same vantage points (VP), we should note down that VP and pasture. We should not ignore that but we should write real zero in that place. This will show that the same pasture has been visited in consecutive years. This information will help to analyze data, e.g. the impact of different variables on the ibex population etc.
- 8. For each observation, also the distance (roughly estimated) and the angle to the North (using the compass) should be useful to locate the herd.
- 9. Investigation through a questionnaire and general discussions with the local people, shepherds and former hunters living in the village/valley (10% of the population of the Valley randomly selected) should be carried out.
5. WILDLIFE

Trophy hunting programmes

5.1 University of Siena position paper.

As a position statement, the University of Siena (hereafter Unisi) agrees with the IUCN/SSC Caprinae Specialist Group's position on trophy hunting programmes.

The IUCN Caprinae Specialist Group, as well as Unisi, recognize that, under appropriate management conditions, trophy hunting can be a valid component of conservation programmes for Caprinae and their habitat. We **support** trophy hunting programmes which satisfy the following criteria:

- A science-based harvest plan to limit as much as possible the difference in age structure between trophy hunted and unhunted populations. Harvest of trophy males must be limited in numbers, target the oldest age classes and allow for a substantial number of mature males to die of natural causes. Present knowledge is insufficient to estimate the proportion of males who must not be harvested to avoid negative long-term ecological or genetic consequences for the population. Excessive levels of trophy hunting may lead to selection for small horns, or alter the life-history strategy of male Caprinae, possibly decreasing subadult survival.
- A conservation-oriented use of the funds generated by trophy hunting. We do not support trophy hunting of Caprinae for purely economic goals. We support programmes which will demonstrate that a substantial part of the revenues is used to foster effective conservation, habitat protection, population monitoring, environmental education, or research. We support community-based trophy hunting programmes where funds are channelled into local conservation initiatives.

We **do not accept** the following practices, sometimes associated with trophy hunting:

- Trophy hunting of Caprinae for purely economic goals, where revenues go into general government funds or are absorbed only by International outfitters.
- Alienation of local communities to favour foreign trophy hunters. Support of local communities is essential for the success of conservation programmes.
- *Predator control, with the sole goal of increasing the availability of trophy males.*
- Artificial feeding to increase horn growth.
- Selective hunting, with the goal of affecting horn morphology, or artificial introductions of individuals thought to have genetically larger horns.

• *Hunting regulations which allow outfitters to overharvest an area and then move to different areas.* Furthermore, in parallel to trophy hunting programmes, we would like to remark that surveys are the most important tool to assess if trophy hunting is or will be sustainable.

The wildlife surveys require reliable replications, if they have to be effective. A reliable replication means: (i) the **same people** involved (only if the same people are involved, continuity of methods will be enhanced *e.g.* use of the same counting techniques, as well as vantage points, used in the past); (ii) the **same number of people** (if reliable surveys were carried out in the past, the number of people involved should not be changed, least of all decreased), (iii) the **same areas** (the same areas have to be surveyed each time, to obtain comparable data; the number of surveyed areas may increase, never decrease).

Therefore, an effective organization of wildlife surveys (where to go, how many people and how many teams) is needed not to damage conservation: *e.g.* often 3 days are not enough to carry out surveys in harsh terrain.

Furthermore, the involvement of expert personnel (not necessarily local) for an unbiased evaluation has to be planned at regular intervals (i.e. every 3-4 years).

Research Studies In CKNP Under Seed Project

Title of Ph.D. Thesis

Spatial Distribution of Black Scurf Disease of Potato, Its Management and Soil Fertility Status in CKNP Region Gilgit-Baltistan, Pakistan

Background

Potato is the main cash crop of Gilgit-Baltistan in particular of buffer zone of Central Karakuram National Park. There are many biotic and abiotic threats to its production. Amongst them the black scurf disease, which is caused by *Rhizoctonia solani* is the major one. To assess spatial distribution of black scurf of potato a comprehensive survey was carried out during the years 2012-13 in four valleys that consisted of twenty-four villages of the region. The survey revealed that valley wise mean disease prevalence was high in Bagrote (63.85 ± 9.06) and low in Haramosh (45.40 ± 14.62). Maximum mean disease incidence and severity were recorded in Hoper valley, while least disease incidence appeared in Haramosh and severity in Bagrote valley. Village wise spatial analysis of black scurf distribution showed that among the twenty four villages eight villages were found with >60% disease prevalence, thirteen in the range of 40-60% and three villages with <40%, while disease incidence and severity were recorded in eight villages >15%, thirteen villages 10-15% and three villages <10% respectively.

Production practices as risk factor were assessed through a questionnaire. Results showed that the majority of farmers performed activities in field that were supportive to the black scurf epidemics, such as, use of pits for storage of late harvested potato tuber for growing in next season, table potato, lack of general awareness about black scurf, not maintaining proper depth of sowing, irrigation, harvesting time and crop rotation.

Twenty isolates of *Rhizoctonia solani* were obtained from infected potato tubers of several locations of study area. These isolates were used for variability study among them. The morphological data viz radial colony growth (RCG) and sclerotial production (SP) were categorized into low, medium and high. Results indicated that out of total isolates, 60% showed medium RCG and 40% fast growth, while 10, 60 and 30% isolates showed low, medium and high SP. Furthermore, sclerotial characteristic such as size, shape and distribution pattern were also recorded. Cluster analysis of RCG isolates were categorized into two main groups i.e. A and B. 70% of the isolates fell in cluster A while 30% in B. Among the twenty isolates, fast growing isolates were treated at different temperature and pH levels. Results showed that all isolates attained above 80 mm RCG at 30°C, 70-80 mm RCG at 25°C and Optimum pH for RCG of isolate was 6.5-7.5. Different culture media were used for assessment of radial colony growth (mmd⁻¹) and sclerotial production (cm²). The results indicate that potato dextrose agar was the suitable medium for RCG and sclerotial production of isolates. Mycelial compatibility and incompatibility among the *R. solani* isolates was also studied. The results indicated that out of 190 combinations, 72.10% were compatible, whereas were 27.90% incompatible.

Fungus protein profile of twenty isolates of *R. solani* was carried out by sodium dodecyl suplphate gel electrophoresis (SDS-PAGE) recovered sixty-one bands with different frequencies among the isolates. Cluster analysis of twenty isolates divided into two major lineage groups (A and B). Lineage A contained 65% of isolates whereas lineage B contained 35% isolates. These lineages were further divided into thirteen clusters from C_1 - C_{13} , A comprised of eight and B contained five clusters respectively.

In vitro efficacy of three fungicides at different concentrations i.e. 50, 100, 150 and 200 ppm were

tested against *Rhizoctonia solani* isolates. Results indicated that increase of fungicide concentration significantly inhibited the mycelial growth of respective isolates. However, sensitivity reaction of each of isolates against each fungicide was also differential. Fungicide ridomil gold and mencozeb showed more toxic effect against the fungus compared to vitavax. Wherease the *in vitro* effect of botanical extracts revealed that increasing concentration from 5 to 15% suppressed the mycelial growth of all isolates. A highest antifungal property was found in *Cannabis sativa* which was followed by *Peganum harmala* and *Datura starmonium* while, *Capparis spinosa* was least effective. Similarly, the tested bioagents mycelial growth inhibition of *R. solani* isolates was recorded in case of *Trichoderma harzianum* (48.32-72.72%) and *Trichoderma viride* (28.75-56.80%). *T. harzanium* caused highest mycelial inhibition in RS₁₀ and was least effective against isolate RS₄ whereas *T. viride* was most effective in RS₃ and least effective in RS₁₅.

In this portion of study two types of field experiments viz. pathogenic variability of *Rhizoctonia solani* isolates against potato cultivars and integrated management of black scurf were undertaken. Black scurf incidence and disease severity were used as the criteria to evaluate pathogenic variability of *R. solani* strains. Results showed that differential aggressivity was apparent in the isolates of *R. solani* against the tested cultivars, but none of them proved to be apathogenic neither destroyed all test plants. The potato cultivars also responded differently to *R. solani* infection. Highest susceptibility was observed in cultivar 'Desiree', while the lowest in Muroto. Two types of field experiments viz. growing healthy potato tubers in artificially infected field and naturally infected ones were carried out to study integrated management of black scurf of potato. Healthy and naturally infected tubers were treated with either T_1 or T_2 *Trichoderma* based preparations by dipping the tubers before planting. The results revealed that T_1 was more effective for management of black scurf in both trials as compared to T_2 . The information generated through this study could help the potato growers regarding disease management and selection of resistant cultivars improving profitability and food security in the region.

The main theme of current study was to explore the status of soil parameters. Ninety sixty soil samples were collected by a random sampling technique using Global Positioning System (GPS). Results indicated that soil of study area was loamy or silty loam with 7.23-8.30 range of pH and normal electric conductivity. Soil organic matter status was low (15.62%), medium (83.33%) and adequate (1.04%) in tested samples. Macronutrients NO₃-N was low in 85.42%, medium 14.58% samples while > 90% tested samples showed adequate PO₄-P and K while micronutrients (Cu, Fe and Mn) were found high except Zn. The Zinc concentration was low in 57.29% samples, medium in 30.20% samples and high in 12.50% samples respectively. GIS maps indicates that soil parameters were spatial distributed between the valleys even within the same valley. Mapping is an important operation, since it plays a vital role in the knowledge about soil nutrients and how it can be used for sustainable agriculture. The observed spatial variability maps of study area helps potato growers in crop management decisions to increase productivity and improve farmer's livelihood.

Knowledge and conservation of soil mycoflora is essential for sustainable agriculture development. In the current study a total number of thirteen mycoflora species were isolated from the composite soil sample of four valleys. The valley wise population per gram of soil was recorded as 24×10^{-6} in Bagrote, 18×10^{-6} in Haramosh, 15×10^{-6} in Hoper and 26×10^{-6} in Shigar valley. The most dominant among them were *Aspergillus flavus*, *Mucor species*, *Rhizopus stolonifer*, *Penicillium species* and *Alternaria alternata*.

Research Description

The present research on spatial distribution of black scurf of potato, caused by *Rhizoctonia solani* was undertaken during the years 2012-13 in selected valleys of Central Karakoram National Park (CKNP), Gilgit-Baltistan, Pakistan. During the research, laboratory studies were conducted in the Department of Agriculture and Food Technology, Karakoram International University, Gilgit-Baltistan and Crop Research Institute, National Agriculture Research Center, Islamabad. Field trials were conducted at Research field of Department of Agriculture and Food Technology, KIU.



Location map of study

MAJOR FINDINGS/CONCLUSIONS

- Black scurf is a major biotic constraint of potato. It is major disease and its prevalence, incidence and severity varied from valley to valley or even with the villages of same valley.
- During this study it was found that potato growing farmers of CKNP region have poor purchang power, use uncertified seed and have no subsidy package from Government and lack awarness in relation to black scurf disease.
- Lack of skills regarding sowing practices as well as sorting and grading of potato
- Variability among the isolates of Rhizoctonia solani has been confirmed.
- Botanical extract (Cannabis Sativa L.), bioagent (Trichoderma harzianum) and fungicide (ridomilgold) has significant effect for mycelial inhibition of Rhizoctonia solani isolates in laboratory tests.
- Black scurf disease is serious threat to potato growers all over the world and it is necessary to adopt integrated management practices. This study showed the combined formulation of botanical extracts, bioagents and fungicides has the potential to control disease and their continuous use in a regular manner may help in better management of the disease.
- The soil of study area was slightly alkaline, with normal electric conductivity and loam or silty

loam soil. Medium to low organic matter contents.

- *Macronutrients NO3-N was deficient while PO4-P and K was adequate.*
- Micronutrients Cu, Mn, Fe were adequate while Zn was deficient.

FUTURE LINE OF WORK

- Epidemiological survey of black scurf may be extended to other potato growing valleys of Gilgit-Baltistan to assess status of black scurf in the entire region.
- Awareness campaign needs to be started regarding use of certified seed, particular by about disease and production practices.
- Govt and other donor agencies should provide subsidy to farmers for purchasing certified seed.
- Farmer training should be arranged to develop human resources.
- Broad based molecular techniques like RAPD, SSR and RELF can be applied for better understanding of variability among the Rhizoctonia solani isolates.
- Search for the most effective high potential botanical extracts and bioagents is needed for effective management of black scurf disease.
- More studies on Integrated Disease Management (IDM) are required to make potato production cost effective.
- Extensive soil fertility study of other potato growing valleys of Gilgit-Baltistan needs to be carried out.



A. Field Survey

B. Lab Experiment



C. Field Experiment



PUBLICATION

Azhar Hussain, Muhammad Saeed Awan, Francesco Morari, Sh. M. Iqbal, Syed Najam ul Hassan. (2014). Spatial analysis of potato black scurf disease distribution using GIS and variability of Rhizoctonia solani isolates in Central Karakoram National Park Gilgit-Baltistan, Pakistan. 2014. International Journal of Bioscience, 4 (1), 1-9. http://dx.doi.org/10.12692/ijb/4.1.1-8.

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Exploring the quality of drinking water sources in proximity to the world largest mountain glacial deposits.

Maisoor Ahmed Nafees¹, Khalil Ahmed¹, Azhar Hussain², Andrea Lami³

- 1- Department of Biological Sciences Karakuram International University, Gilgit, Pakistan
- 2- Department of Food and Agriculture Karakuram International University, Gilgit, Pakistan
- 3- Institute of Ecosystem Studies, Verbania, Italy

Abstract:

A study was carried out to examine the water quality picture of the sources utilized by the inhabitants of Bhasha and Braldo valley, Gilgit-Baltistan Pakistan. The area is known to harbor world mightiest glaciers outside polar region and constitutes a larger portion of CKNP (Central Karakuram National Park) and Water samples were investigated for the physico-chemical and bacteriological parameters. The important drinking water parameters relatable to chemistry were within the specified limits of WHO. Na, Ca, K, SO₄, Cl, Si, F, NH₄, Total Nitrogen, Total Phosphorous, Reactive phosphate were among the studied elements and compounds. The microbiological pictures were however pathetic having multiple bacterial contaminations. The presence of E. coli coupled with Enterococci in the high alpine climate were indicative of fragile and vulnerable sources of water and immense anthropogenic activities. The CFU count ranged from 9 to 38 11 to 22 of E. coli and intestinal Enterococci in 100 ml respectively. The Total Bacterial count was 120 to 261 in 1 ml. The absence of salmonella in all the observed samples was recorded. It was concluded that proper protection of sources and piping facility from source to last point of use is must. Proper monitoring and surveillance along with use of water disinfectants is need of the area. Due attention to inhabitant's personal hygiene was also pleaded. Key words: CKNP, water quality, Bacteriology, Gilgit-Baltistan

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Ethnobotany, Phytochemical Investigation And Bioassay Screening Of Some Important Medicinal Plants From Selected Valleys Of Central Karakoram National Park (Cknp) Gilgit, Gilgit-Baltistan, Pakistan

QAMAR ABBAS

Research Area: Medicinal Plants

Supervisor: Dr. Sher Wali Khan

SEED SCHOLAR BATCH- II PhD Completed: 3rd May 2018 Co. Supervisor: Dr. Muhammad Ismail

Research Description/ Abstract

The present research conducted in the four selected valleys of CKNP (Haramosh, Bagrote, Hoper and Shiger) to record ethnobotany, land cover classification, phytochemical investigation and therapeutic potentials of selected medicinal plants. Field visits were conducted during the years 2012-15 to the selected valleys to record floral diversity in four different ecological zones, (desert, temperate, subalpine and alpine). A total number of 369 plant species were recorded belonging to 185 genera and 62 families. Out of these, maximum number of species belong to Angiosperms (360) followed by Gymnosperms (8) and Pteridophytes (3). Based on species distribution in different ecological zones, 259 species (39%) were recoded from the subalpine zone, 213 species (33%) from the alpine zone, 127 species (19%) from the temperate zone and only 59 species (9%) were reported from the desert zones. The floristic inventory on the basis of habit and life forms revealed that, hemicryptophytes were represented by 249 species (68%), therophytes 61(17%), Phanaerophytes 46(12%), chamaephytes 8(2%) and geophytes were only 5 species (1%). In terms of conservation status, 6 species were endemic, 313 species were common (84%), 25 species were infrequent (7%), 21 species were very common (6%), 7 species were rare (2%) and only 6 species were very rare (1%). Among the 369 collected specimens, 226 plant species were medicinally important and used for the treatment of 14 major diseases of different categories. The Informant Consensus Factor (ICF) presented the highest value for eye diseases (0.9), followed by tonics (0.87), anticancer (0.85), ear, nose and throat (0.85), urogenital diseases (0.85), cardiac diseases (0.84), respiratory diseases (0.84), and gastro intestinal diseases (0.83). Land Covere Classification (LCC) was performed by using the Remote Sensing techniques. The LCC divided Hoper valley into eight major categories, Bagrote and Haramosh valley into eleven, and Sigher valley into eight different categorize. Results pertaining to phytochemical potentials of selected medicinal plants, Compound 1 was isolated from the ethyl acetate fraction of P. wallichiana through repeated column chromatography and preparative thin layer chromatography. This compound was identified as anemonin 1 with the help of spectroscopic techniques and its molecular formula was comprehended as C₁₀H₈O₄ corresponding to molecular mass of 192 amu. This compound is reported first time from *Pulsatilla wallichiana*. Five medicinally important plant species were subjected to bioassay screening to reveal their therapeutic potentials based on traditional knowledge. The ethyl acetate fraction of *P. wallichiana* exhibited encouraging activity against DPPH radicals with IC50 value of 31µg/mL, comparable with the standard antioxidant compound (gallic acid IC50 of 23µg/mL). Methanolic fractions of P. wallichiana, Saussurea simpsoniana and Salvia nubicola showed the highest antiglycation activity with 45%, 41%, and 40% respectively. The dichloromethane fractions of S. simpsoniana and S. nubicola exhibited maximum immunomodulatory activity (IC50 of 51.2 and 54.28 µg/mL, respectively). The current findings conclude that the folk wisdom about medicinal plants will guide the advance research in the field of natural compound isolation from the diverse flora and its sustainable utilization in therapeutics. This data will further provide a base line information for the conservation of nature.

CONCLUSIONS

The study indicates natural flora of these valleys is under pressure due to the agro agriculture, over grazing, deforestation and anthropogenic activities. The residents of CKNP valleys have been indicated that, climate changes are observed in large scale and it has great impact on their livelihood. People are still environment friendly, but the harsh climate, natural disasters and anthropogenic activities are influencing their life style. Natural resources are going to squeeze due to fast urbanization, over exploitation and deforestation. Even complete dependency on natural resources is also become decrease gradually due to increase the job opportunities, educational facilities and trade activities. The study shows that, the over exploitation of these resources, and need to conserve them for the future generations. The assessment of customary laws and practices with the modern scientific guidelines should incorporate to acquire the better result. The output of this study will be based on the findings, and procedures adopt for the implementation of suggestions and recommendations by the responsible institutions in true spirit. This will be a milestone for the new advance research, in the field of pharmacology, molecular genetics and biotechnology.as well as for making strategies of conservation and sustainable utilization of these natural flora.

RECOMMENDATIONS

The main suggestions and recommendations are proposed for further future studies and research works are;

- 1. To aware the local communities about the importance of biodiversity and train them for the sustainable utilization in scientific way.
- 2. Proper legislation is required for the utilization of Non forest products and forest products with co-ordinate their customary laws and practices.
- 3. *Ex-situ* as well *in-situ* conservation activities should promote with collaboration of local communities.
- 4. To promote the tourist activities for the economic activities and develop the interest of local communities in control way without disturb the nature.
- 5. Cultivation of medicinal and economical species should encourage and develop entrepreneurship.
- 6. Chemical analysis and bio-assay screening of medicinal plant should evaluate through sophisticated techniques and conserve them in scientific way.

Medicinal plants of CKNP

Family	Botanical name	Part(s) used	Medicinal uses
Alliacea	Allium carolinianum DC.	Bulbs	Bulb decoction taken for gastro intestinal disorders while bulb paste applied on joints and bones as pain killer
Alliacea	Allium cepa L.	Bulbs	Fresh bulbs cooked in ash and taken to cure indigestion and vomiting
Alliaceae	Allium sativum L.	Bulb	Bulb used for cough, colic, constipation, asthma, flatulence and cardiac troubles
Alliaceae	Allium victorialis L.	Whole plant	For abdominal troubles, swellings, asthma, respiratory problems and dysentery
Amaranthaceae	Aerva lanata Juss.	Whole plant	Plant ash applied on wounds for healing
Anacardiaceae	Pistacia khinjuk Stocks	Galls	Galls decoction used against dysentery, diarrhea, fever, inflammation and leucorrhoea
Apiaceae	Carum carvi L.	Seeds	Decoction of seeds effective for asthma
Apiaceae	Coriandrum sativum L.	Fruits & leaves	Used for flatulence, dysentery, diarrhea, cough, stomach problem, jaundice and vomiting
Apiaceae	Daucus carota L.	Roots	Fresh and boiled tap root used for urethritis
Apiaceae	Ferula assa-foetida L.	Resin & roots	Resins and roots for asthma, stomach problem ulcer, cough, anxiety and fever
Apiaceae	Ferula jaeschkeana Vatke	Latex & seeds	Stem latex and root powder used against asthma, arthritis and menstrual irregularities

Family	Botanical name	Part(s) used	Medicinal uses
Apiaceae	Foeniculum valgare Mill.	Seeds	Decoction of seeds used for constipation and gastric trouble
Apiaceae	Pimpinella diversifolia DC.	Whole plant	Decoction taken for fever, stomach ulcer and as blood purifier
Apiaceae	Pleurospermum candollei (DC.) Benth. Ex CB Clark	Whole plant	Plant decoction used for jaundice
Apiaceae	Selinum papyraeceum C.B.Clarke	Whole plant	Whole plant for asthma and heart problems
Asclepediaceae	Caralluma tuberculata N.E. Brown	whole plant	Whole plant for paralysis and joints pain and fever
Asparagaceae	Polygonatum geminiflorum Deene	Roots	Rootsfordisturbedmenstruation,uterine tumor and swellings
Asparagaceae	Polygonatum verticillatum (L.) All.	Roots	Rootsfordisturbedmenstruation,uterine tumor, swellings
Asteraceae	Actaea spicata L.	Barries & roots	Berries and roots for asthma, nerves disorders rheumatism and paralysis.
Asteraceae	Arctium lappa L.	Seeds & roots	Seeds and roots for diabetes, blood pressure, joints pain, gout and rheumatism
Asteraceae	Artemisia santolinifolia Turcz.ex Krasch.	Branches	Decoction of fresh branches is effective for abdominal worms
Asteraceae	Artemisia scoparia Waldst. & Kit.	Whole plant	For fever, cough, and heart problems
Asteraceae	Carthamus tinctorius L.	Flowers	Flowers for fever, cough, throat problems, typhoid fever

Family	Botanical name	Part(s) used	Medicinal uses
Asteraceae	Cousinia thomsonii C.B.Clark	Flowers	Boiled flowers applied on infected area on skin
Asteraceae	Helianthus annuus L.	Seeds & flowers	For fever, cough, and throat
Asteraceae	Inula obtusifolia Kern.	Whole plant	Used for tuberculosis, chest problem, cough and as an antiseptic
Asteraceae	Inula royleana DC.	Whole plant	Whole plant for intestinal problems
Asteraceae	Saussurea lappa (Deene.) Sch.	Roots	Roots for asthma, cough, paralysis, brain problems, nervous problems, rheumatism, gouts, throat problems, influenza and as sex stimulant
Asteraceae	Saussurea simpsoniana (Fielding & Gardner) Lipsch.	Whole plant	Decoction of whole plant is orally used for back ache, fever and dermatitis
Asteraceae	Tanacetum artemisioides Schultz-Bip.ex Hook.f.	Whole plant	Used for blood pressure, abdominal disorders, ringworms, flatulence, headache and fever
Asteraceae	Tanacetum falconeri Hook.f.	Whole plant	Decoction taken for body ache and fever
Asteraceae	Taraxacum officinale Weber	Roots	Decoction effective for hypertension
Balsaminaceae	Impatiens edgeworthii Hook. f.	Whole plant	Plant extract is used in burns
Berberidaceae	Berberis brandisiana Ahrendt	Leaves	Infusion of leaves is used for jaundice
Berberidaceae	Berberis orthrobotrys Bien. ex Aitch.	Leaves	Leaves infusion is used to treat jaundice

Family	Botanical name	Part(s) used	Medicinal uses
Berberidaceae	<i>Berberis pseudoumbellata</i> subsp. <i>gigitica</i> Jafri	Flowers, fruits & seeds	Seeds and fruits eaten and flower decoction taken to treat jaundice
Berberidaceae	<i>Berberis pseudoumbellata</i> subsp. <i>gigitica</i> Jafri	Roots/stem bark	Used for wounds, infection, piles, jaundice, liver problems, kidney stone, diabetes, sore throat, leucorrhoea, bleeding, uterine tumor and swellings
Betulaceae	Betula utilis D.Don.	Bark	The papery bark is made warm and apply topically for the treatment of ringworm
Biebersteiniaceae	<i>Biebersteinia odora</i> Steph. ex Fisch.	Flowers	Migraine and fever treated by flower decoction
Boraginaceae	Arnebia guttata Bunge	Roots	Fresh root eaten for heartburn and indigestion
Boraginaceae	Myosotis alpestris F.W.Schmidt	Flowers	Powder of flower used for bronchitis, fever and asthma
Boraginaceae	Onosma hispida Wall. ex G.Don.	Whole plant	Cooked materials taken for jaundice and constipation
Boraginaceae	Rubia cordifolia L.	Roots	Roots for blood purification, liver problems, swellings, nervous disorders, gout, rheumatism bleeding control, uterine tumors, leucorrhoea, wounds, cough, bone fracture, general debility
Capparidaceae	Capparis spinosa Jafri	Leaves	Decoction of leaves used for arthritis and back ache
Caprifoliaceae	<i>Linicera microphylla</i> Willd. Ex Roem.	Stem/Branches	Fruits are used in skin problems in place of glycerin
Chenopodiaceae	Kochia prostrata (L.) Schrad.	Roots	Roots for toothache
Convolvulaceae	Convolvulus arvensis L.	Whole plant	Cooked plants eaten with bread for constipation

Family	Botanical name	Part(s) used	Medicinal uses
Cruciferae	Brassica napus Reichb.	Roots & leaves	Roots and leaves used as tonic and aphrodisiac
Cruciferae	Brassica rapa L.	Roots	Fresh root is effective for hepatitis
Cruciferae	Descurainia sophia (L.) Webb. & Benth	Whole plant	Whole plant used for chest complains, cough
Cruciferae	Descurainia sophia (L.) Webb & Berth.	Whole plant	Decoction taken for asthma and constipation
Cruciferae	Lepidium sativum L.	Seeds	For constipation, abdominal problems in children, feminine problems during delivery bleeding, uterine tumors, menstruation, swellings and eye problems
Cruciferae	Raphanus sativus L.	Roots, seeds & leaves	Used for indigestion, colic, stomachic, jaundice, inflammation, flatulence and skin diseases. Roots for asthma, diarrhea, paralysis while seeds for aphrodisiac
Cucurbitaceae	Cucumis sativus L.	fruits	Unripe fruits for fever, general debility, burns and indigestion
Cucurbitaceae	<i>Cucurbita maxima</i> Duch.ex Lam.	Fruits	Unripe and ripe fruits for burns, inflammation, Jaundice, and nervous disorders
Cucurbitaceae	Lagenaria siceraria (Molina) Standley	Fruits	Unripe fruit for jaundice and as tonic
Cupressaceae	Juniperus turkestanica Komarov		Used against kidney stone, urinary problems, skin infection

Family	Botanical name	Part(s) used	Medicinal uses
Cuscutaceae	<i>Cuscuta epithymum</i> (L.) L.	Stem	Fresh stem is eaten for asthma
Cuscutaceae	Cuscuta europaea L.	Whole plant	Effectiveforjaundice,cough,bronchitis,blood purification, fever and sex stimulation
Elaeagnaceae	Elaeagnus angustifolia (L.) Kuntze	Roots	Fruits are edible and medicinally used in liver problems and dysentery. Roots are very useful for jaundice and hepatitis A, B and C.
Elaeagnaceae	Elaeagnus angustifolia (L.) Kuntze	Fruits	Decoction of fruits is used for bronchitis
Equisetaceae	Equisetum arvense L.	Whole plant	Decoction is used for urethritis
Equisetaceae	Equisitum arvense L.	Whole plant	Decoction taken for urinary tract infection
Fabaceae	Caragana brevifolia Komarov	Roots	Used for lowering the blood cholesterol
Fabaceae	Caragana tragacanthoides var. himalaica Komarov	Roots	Roots of both plants are used for lowering the blood cholesterol
Fabaceae	Cicer microphyllum Royle	Whole plant	Cooked and eaten for kidney stone and urinary problems
Fabaceae	Desmodium gangeticum L.	Roots	Decoction is used for cough, cold and asthma
Fabaceae	Glycyrrhiza glabra L.	Roots	Effective for cough, bronchitis, asthma, fever, sore throat, abdominal pains
Fabaceae	Hedysarum falconeri Baker L.	Roots	Fresh root is used for loss of appetite
Fabaceae	Medicago sativa L.	Seeds	For joints pain, gouts, indigestion and as general tonic
Fabaceae	Pisum sativum L.	Fruits	Cooked fruits are used for constipation

Family	Botanical name	Part(s) used	Medicinal uses
Fabaceae	Robinia pseudoaccacia L.	Legumes & resin	The legumes and resin are used for backache and as aphrodisiacs
Fabaceae	Sophora alopecuroides L. (Royle) Baker	Roots	Root decoction is effective for joint pain
Fabaceae	Trifolium pratense L.	whole plant	used for sore throat, fever, pneumonia, meningitis
Fabaceae	Trifolium repens L.	Leaves	Fresh leaves are effective for eye ache and wounds
Fabaceae	Trigonella feonum-graecum L.	Leaves	Fresh leaves mixed with curd is effective for low blood pressure and gastric trouble
Fabaceae	Vicia faba L.	Seeds	Cooked seeds are used for constipation
Fumariaceae	<i>Corydalis adiantifolia</i> Hook.f. & Thomson	Roots	Root paste is used as hair tonic
Fumariaceae	<i>Corydalis oneri</i> Hook. f.& Thomson	Roots	Useful for cough, fever, nerve disease and hair elongation
Gentianaceae	Comastoma borealis (Bunge) T.N.Ho.	Whole plant	Effective for pneumonia, sore throat and fever
Gentianaceae	<i>Gentianodes eumarginata</i> var. eumarginata Omer	Whole plant	Pasteforthroatproblemsofchildren.Leaves for killing lice and hair elongation and jaundice
Gentianaceae	Gentianodes tianschanica (Ruper.ex Kusn.) Omer, Ali & Qaiser	Leaves	Leaves for abdominal disorders, liver problem, cough, bronchitis and jaundice, Malaria, fever, pneumonia, hair elongation, lice control, gastric trouble, dyspepsia, diabetes, eye problems and blood purification

Family	Botanical name	Part(s) used	Medicinal uses
Gentianaceae	Swertia cordata (G.Don) Clark	Leaves	Leaves decoction is used for diabetes mellites
Gentianaceae	Swertia petiolata D. Don	Whole plant	Used for typhoid, fever, pneumonia, throat problems and bronchitis
Geraniaceae	<i>Geranium collinum</i> Stap ex Willd.	whole plant	Used for wounds, swelling, inflammation, tumor, nerve problems
Geraniaceae	Geranium pratense L.	whole plant	Used for wounds, swelling, inflammation, tumor, nerve problems
Glossulariaceae	Ribes orientale Desf.	Fruits	Fresh fruits are eaten for abdominal worms
Juglandaceae	Juglans regia L.	Seeds	Fresh seeds are eaten for asthma
Labiatae	<i>Clinopodium umbrosum</i> (M. Bieb.) C. Koch	Whole plant	Plant powder for wounds, bleeding, and cardiac problems
Labiatae	Clinopodium vulgare L.	Whole plant	Plant powder used for wounds, bleeding, and cardiac problems
Lamiaceae	Dracocephalum nutans L.	Seeds	Seed decoction is effective for asthma, gastric trouble and post birth trace release
Lamiaceae	Isodon rugosus (Wall.ex Benth.) Codd	Leaves	Leaves for hypertension, body temperature, rheumatism and toothache
Lamiaceae	Mentha arvensis L.	Leaves	For stomach problems, Powder of leaves for birth control
Lamiaceae	Nepeta leucolaena Benth.	Leaves	Leaves decoction effective for indigestion and abdominal worm
Lamiaceae	Ocimum basilicum L.	Leaves & flowers	Leaf decoction and flowers for flu, fever, stomach problems, and headache

Family	Botanical name	Part(s) used	Medicinal uses
Lamiaceae	Salvia nubicola Wall. ex Sweet	Roots & leaves	Roots decoction for cold cough, leaf paste for skin eruptions
Lamiaceae	Thymus linearis Benth.	Flower	Decoction used for abdominal pain and vomiting
Malvaceae	Abelmoschus esculentus (L.) Moench	Fruits	Unripe fruits for cough, asthma, diarrhoea, neural disorder, aphrodisiac and general debility
Malvaceae	Malva sylvestris L.	whole plant	Young plant is used as vegetable and old
Moraceae	Ficus carica L.	Fruits	Used for cardiac troubles, abdominal problems, constipation and as tonic while stem latex is used for skin problems
Moraceae	Morus alba L.	Roots/fruits	Roots are used for diabetes and fruits are used as general tonic and sore throat
Moraceae	Morus nigra L.	Fruits	Fresh fruits for bronchitis and as blood tonic
Oleaceae	Fraxinus hookeri Wenzing	Bark	Stem bark used for typhoid fever and pneumonia
Oleaceae	Fraxinus xanthoxyloides (G.Don.) DC.	Fruits	Stem bark of both plants is used for typhoid fever and pneumonia
Oleaceae	Olea ferruginea Royle	Bark	Some people use its stem bark for fever.
Papaveraceae	Papaver nodicaule L.	Flowers	Flowers powder useful for wounds and injuries
Papaveraceae	Papaver somniferum L.	Seeds	Seeds for cough, chest troubles, diarrhea, and dysentery
Parnassiaceae	Parnassia nubicola Planch.ex Clark	Flowers	Flower decoction used for low blood pressure and gastric trouble

Family	Botanical name	Part(s) used	Medicinal uses
Pinaceae	Picea smithiana (Wall.) Boiss.	Resin	Used for heart problem
Pinaceae	Pinus gerardiana Wall. Ex Lamb.	Resin	Used as antiseptic
Plantaginaceae	Plantago depressa Willd.	Leaves and seeds	Leaf extract for wounds and seed for constipation, abdominal pain, eye redness and washing hairs
Plantaginaceae	Plantago major L.	Flowers	Flower decoction used to cure gastric trouble and constipation
Plumbaginaceae	Acantholimon lycopodioides (Girad) Boiss.	Flowers	Decoction of flower used for stomach ulcer
Poaceae	Triticum aestivum L.	Seeds	Bread is made and taken for constipation
Poaceae	Zea mays L.	Carpels	Urethritis is cured by carpels decoction
Polygonaceae	Bistoria affini (D.Don) Green	Seeds	For dysentery and weakness of urinary bladder
Polygonaceae	Polygonum tataricum L.	Seeds	Seeds powder is taken for stomach ulcer
Polygonaceae	Rheum australe D.Don	Root	Root decoction for asthma, fever and pneumonia
Polygonaceae	Rheum webbianum Royle.	Stem	Sole and lip crack are cured by fresh stem
polygonaceae	Rumex acetosa L.	Whole plant	Whole plant used for jaundice, vomiting, and liver problems
Polygonaceae	Rumex nepalensis Spreng.	Leaves	Boiled leaves effective for birth trace release and labor pain

Family	Botanical name	Part(s) used	Medicinal uses
Polygonaceae	Rumex patientia L.	Leaves	Paste of leaves are effective for boils and pustules
Punicaceae	Punica granatum L.	fruits	Fresh fruits are eaten for fever and vomiting
Ranunculaceae	Aconitum heterophyllum Wall. ex Royle	Roots	Root decoction used for abdominal worm and root applied on suffering tooth
Ranunculaceae	Aconitum violaceum var. weileri (Gilli) Riedl	Roots	Root paste effective for abdominal worms
Ranunculaceae	Clematis orientalis L.	Whole plant	Plant paste externally applied for joint problems and as antiseptic
Ranunculaceae	<i>Clematis alpina</i> subsp. <i>sibirica</i> (L.) Kuntze	Whole plant	Decoction of whole plant is used for asthma
Ranunculaceae	Pulsatilla wallichiana Ulbr.	Flowers	Powder is applied used for dermatitis
Ranunculaceae	Ranunculus repens L.	Flowers	Ringworm is treated by flower paste
Ranunculaceae	Thalictrum foetidum L.	Tubers	Tubersforwounds,swellings,uterinetumors,paralysis, joints pain and nervous disorders.
Ranunculaceae	Thalictrum foliolsum DC.	Roots	Fresh root is applied on eye to alleviate pain
Rosaceae	Malus pumila Mill.	Fruits	Fruits are prescribed for weakness and as blood purifier
Rosaceae	Prunus amygdalus Baill.	Seeds	Seed oil and seeds are useful for increasing memory and eye sight. These are also used in constipation and as tonic
Rosaceae	Prunus armeniaca L.	Fruits/ Floral buds	Decoction of fruits effective for constipation and paste of floral buds used for ringworm

Family	Botanical name	Part(s) used	Medicinal uses
Rosaceae	Prunus avium (L.) L.	Fruits	Constipation is cured by taking cooked fruits
Rosaceae	Rosa indica L.	Flowers	Used for hairs and cardiac problems.
Rosaceae	Rosa webbiana L.	Root bark/fruits	Hypertension, cold and flu are treated by root bark and fruit decoction
Rosaceae	Rubus irritans Focke	Fruits	Fruits are very useful for blood purification, increase blood formation, liver problems
Rosaceae	Spiraeae canescens D.Don.	Branches	decoction of branches effective for abdominal pain
Salicaceae	Berginia ciliata (Haw.) Sternb.	Rhizome	Decoction taken stomach ulcer and paste applied on eyelids for eye ache
Salicaceae	Populus nigra L.	Bark	Bark decoction is effective for jaundice and ringworm
Salicaceae	Salix acmophylla Boiss.	Bark	Stem bark is boiled in water and used in fever, headache and paralysis. Leaves and branches are externally used for itching and allergy.
Salicaceae	Salix acmophylla Boiss.	Flowers & seeds	Same uses
Salicaceae	Salix iliensis Regel	Flowers & seeds	Stem bark is boiled in water and used in fever, headache and paralysis
Solanaceae	Hyoscymus nigerL.	Seeds	Seeds powder paste effective for tooth ache
Solanaceae	Solanum nigrum L.	Fruits	Toasted fruits are applied on tooth pain
Thymelaeaceae	Daphne mucronata Royle	Leaves	paste is used for muscular pains and nerve problems. Fruits are internally used for eye problems
Urticaceae	Urtica dioca L.	Whole plant	Decoction used against joint pain, pimples while chopped leaves applied on pimples
Zygophyllaceae	Tribulus terrestris L.	Whole plant	Decoction taken urinary disorders and body ache

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