



DEOSAI MANAGEMENT PLAN FOR NATIONAL PARK

2020-2025



AGENZIA ITALIANA
PER LA COOPERAZIONE
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Acronyms

a.s.l.	Above Sea Level
AJ&K	Azad Jammu and Kashmir
AKRSP	Aga Khan Rural Support Programme
CCHA	Community Control Hunting Area
CKNP	Central Karakorum National Park
DFO	Divisional Forest Officer
DNP	Deosai National Park
EIA	Environment Impact Assessment
GB	Gilgit Baltistan
GBFW&FD	Gilgit Baltistan Forest, Wildlife and Environment Department
GBS	Gilgit Baltistan Scout
GHG	Greenhouse Gas
GIS	Global Information System
GLOF	Glacial Lake Outburst Flood
HWF	Himalayan Wildlife Foundation
IUCN	International Union for Conservation of Nature
KIU	Karakorum International University
KNP	Khunjerab National Park
KP	Khyber Pakhtunkhwa
MP	Management Plan
MPA	Mountain Protected Area
NGO	Non-Government Organization
PA	Protect Area
PWP	Pakistan Wetland Programme
RFO	Range Forest Officer
RS	Remote Sensing
SAP	Social Action Programme
UNDP	United Nations Development Programme
UOB	University of Baltistan
WLMO	Wildlife Management Officer
WWF-P	Worldwide Fund for Nature-Pakistan

Preface

Deosai National Park is a true representative of Deosai plains of the Himalayas that are the second highest plateau in the world. Established and notified in 1993, Deosai National Park is mostly known for the Himalayan Brown bear that are found in the park, comparatively in greater number than in the rest of their habitats in GB, though other species of predators and herbivores, and high altitudinal flora are also abundant and found throughout the Park.

The credit of writing the first management plan of DNP goes to Himalayan Wildlife Foundation (HWF) in 2005 while the most recent of its plans was developed by WWF that was approved by the GB Wildlife Management Board in 2016.

As part of the UNDP project (2018-20), EvK2CNR was assigned the task of reviewing the approved plan that is valid till 2021, and based on the deficiencies in its implementation, write a revised management plan.

As a common practice and norm, the validity of a plan's prescription and activity is normally based on its implementation efficiency. If certain prescriptions or interventions that are proposed by a plan do not give the planned or desired results, that are revised in light of the deficiencies or constraints in their implementation. Accordingly, this basic principle was adopted to review and revise the existing/approved management plan of Deosai National Park.

In order to assess the validity of the proposed interventions, the park's stakeholders are the best judges. The principle stakeholder in case of DNP being the Forest and Wildlife Department, especially the DFO Wildlife/Manager of the Park and other staff that is posted in the park at least from the date that the plan had to be implemented from, the review process focused on their opinion about the validity of the plan activities that were proposed in the planning document, approved by the GB Wildlife Management Board in 2016. In addition to these, other stakeholders such as the local community were also consulted to know of their views about the implementation status of the plan.

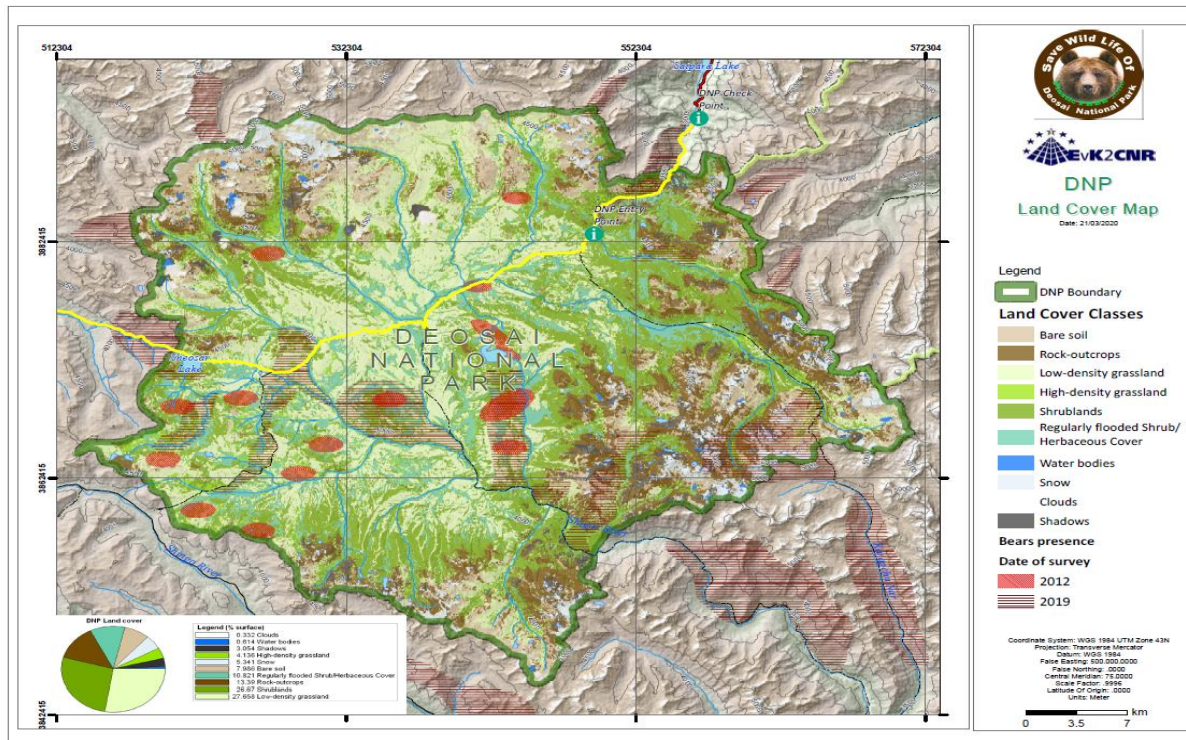
Although expected to certain extent, it was surprising to know that because of unknown reasons, the key stakeholders had no idea about the various interventions, contained therein! This being the case, there was no question left about the validity of certain activity/intervention or any deficiency that it might had?

In light of this situation, Ev-K2-CNR had no option than to re-assess the validity of the proposed interventions in light of their recent assessment of the park and its resources, for the next 5 years.

Section-A

1. Park Description

Exhibit 1: Map of Deosai National Park (DNP)



1.1. Physical Settings

The Government of the Gilgit Baltistan, declared Deosai as National/Wilderness Park on May 14, 1993, spreading over an area of approximately 3626 Km². According to IUCN protected area categories, Deosai is a category I National/ wilderness Park.

These notifications have been modified in the approval of the DNP Management Plan elaborated by WWF and in this revision.

Etymology: Deosai means ‘‘the land of Giants’’. Balti people call this place ‘‘Ghbiarsa’’ (Balti: referring to 'Summer's Place' because it is only accessible in summer).

1.1.1. Geography

The Park encompasses an area with altitude ranging from 3,500 to 5,200 meters a.s.l. The central part of the Park is relatively flat and gentle with lower elevation of 4,000 meters. Almost 63% of the area has an elevation range from 4,000 to 4,500 meters, and 22% of the area is above 4500 meters (HWF, 1996) making the Deosai Plains highest plateau in the world after Changtang Tibetan Plateau. The park protects an area of 3,000 Km² (1,200 sq. mi). It is well known for its rich flora and fauna of the Karakoram-West Tibetan Plateau alpine steppe eco-region. In spring, it is covered by sweeps of wildflowers and a wide variety of butterflies. Deosai is located at the border of Himalayas and Karakoram. It offers Western-Himalayas

ecosystem. Deosai covers an area of 1200 Km². It has a mix of plains, plateaus, hills, streams, lakes and mountains. The main body of the Deosai Mountains consists of both Precambrian sedimentary rock (formed more than 540 million years ago) and younger granite bodies. Several peaks reach elevations of more than 18,000 feet (5,500 meters). The mountains rise above the high Deosai Plateau, averaging some 13,000 feet (4,000 meters) in elevation. The Deosai Basin lies between mountain ranges; it possesses steep sides and a level floor and appears to be an ancient cirque (deep steep-walled recess in a mountain, caused by glacial erosion). The terrain of the Deosai Mountains is rugged and almost devoid of human population. Sparse vegetation sustains a few hardy alpine mammals such as Himalayan Brown Bear and the Golden marmot. The Burji Pass lies southwest of Skardu, one of several towns lying at the foot of the mountains.

The DNP is a high-altitude plateau, situated in the Gilgit Baltistan province of Pakistan between Kharmang, Astore and Skardu and administratively it falls in Skardu and Astore districts. DNP is located where two biogeographical provinces merge, in the Himalayan and Karakorum-Pamir highlands. As a result, it is a place of very rich biodiversity as species are channeled through the Karakorum range, the main crest of the Himalayas, Zaskar range (Trans-Himalaya), Ladakh range (Trans-Himalaya) and the Indus valley.

Accessibility: Deosai is located approximately 30 Km from Skardu city and it is the shortest route to visit Deosai. Most foreigners visit Deosai via Skardu. It takes one hour to reach Deosai top via Satpara Skardu. Another route is from Astore valley via Chilium. To reach DNP from Islamabad, one has to travel either through the Karakoram highway or through Naran and Babusar pass. In winter, the Babusar pass remained closed during winter months of November to May due to heavy snow. However, Karakoram highway remains accessible round the year. Moreover, PIA flights also connect Gilgit and Skardu with Islamabad.

Boundaries according to the notification of the Northern Areas Administration in 1993:

The boundaries of the Park are described as below:

North: The North boundary traces the watershed of the Tributary nullahs and passes through the water partings and drains into Deosai Nullah through the highest peak of Ali Malik Pass touching the Satpara Game Sanctuary, in Skardu Valley.

East: The eastern boundary passes through the water partings of the nullah draining into Borbartar and finally joins Brawal nullah at the confluence of small Deosai nullah.

South: The southern boundary traces the water partings of the southern tributary nullahs and drains into small Deosai nullah.

West: the western boundary is the administrative boundary between Astore Sub Division and Skardu in Baltistan Division.

1.1.2. Topography

In topographic settings, Deosai is relatively flat and the peripheral areas are elevated. However, the slopes joining with buffer zones make gorges with the elevation of 4,000 m and continuously decrease to the valley bottom.

1.1.3. Climate

Mean daily temperatures range from –20 C to 12 C. The annual precipitation is 510 mm to 750 mm, and falls mostly as snow (HWF, 1999). Snow starts in late September, making the Deosai Plains inaccessible, almost by the end of November. The entire plains remain snow bound till late May to early June and become accessible after mid-July. Most frequent winds are from the southwest towards the northeast, while winds from east to west are least frequent.

1.1.4. Soil

The soils of this area are severely eroded, of a coarser nature and mixed with gravel and stones of various material and sizes. In the flat areas between the mountains, soil is deep with marshy vegetation. Erosion due to grazing is rare and is confined to the few areas where grazier enclose their livestock. The soil texture is sandy and sandy-loam, sandier soils accept water quickly, are easy to till, but hold little water.

1.1.5. Hydrology

Sheosar Lake is the main water reservoir in Deosai. There are many other small lakes and marshlands, scattered throughout the area. The water is fresh and remains frozen during the winter season. The water table gradually adjusts to the seasons, lowering in the winter and gradually rising during the summer.

1.2. Ecological Settings

1.2.1. Fauna

Deosai is home to about 24 mammalian species. Predators other than Brown bear, like Snow leopard, Himalayan wolf and Tibetan Red fox and associated prey species mostly ungulates i.e., Himalayan ibex, Musk deer, and Golden marmot; in or around DNP play a significant role in maintaining the ecological balance and health of the Park.

Major Fauna

1.2.1.1. Himalayan Brown Bear (*Ursus arctos isabellinus*)

The Himalayan Brown bear is a highly threatened species in Pakistan. Its population is sparse and scattered throughout the Gilgit-Baltistan, KPK and AJK. The largest population in South Asia has been recorded in the Deosai National Park and their current population is more than 88 individuals, which indeed is quite below the minimum viable population size established by past researchers

Exhibit 2: Data of Brown Bear according to DNP survey report, 2018¹

S. No	Location	Survey block	Male	Female	Cubs	N.D.	Group
1	Ragichan	Ragichan	1	1	2	0	4
2	Boll-4		0	1	0	0	0
3	Long and Lama Long	Fia Bara Pani	3	1	2	0	6
4	Black Hole		4	6	2	0	12
5	Kala Pani	Yourwlli Nullah	2	0	0	0	2
6	Sanghri Top	Sheosar	1	1	0	0	2
7	Burji la		1	0	0	0	1
8	Nullah 1,2,3	Murtaza Top	3	2	0	0	5
9	Stadium area	Shatung	0	1	1	0	2
10	Bari La II&IV	Bari La	0	0	0	2	2
11	Harbachan Nullah		1	0	0	0	1
12	VallyBlaynd		3	0	0	0	3
13	Dapa	Ragichan	0	1	1	0	2
14	Shilla		1	2	1	1	5
15	Krabosh		1	2	2	0	5
16	Mtiyal		2	3	1	0	6
17	Showaran		2	3			5
18	Gultari		4	3	2		9
19	Shagarthang		1	1	0	0	2
Total			30	28	14	3	74

Most recent counting (September–October 2019) of Brown bears in Deosai National Park by DNP staff (DNP, 2019) is shown in the Exhibit no. 3. (source of information is DNP staff)

Exhibit 3: Data of Brown Bear according to DNP survey report, 2019

S. No.	Name of nullahs	Date	Brown Bear				Total
			Male	Female	Cub	This Year	
1	Lake Area	22/9/2019	-	01	02	-	3
2	Kalla Pani	22/9/2019	01	01	02	-	4
3	Sarsanghdi	23/9/2019	01	01	-	-	2
4	Yoor Walli	23/9/2019	01	01	-	-	2
5	Murtaza Top Area	24/9/2019	01	02	-	-	3

¹Base line survey feasibility studies of fauna, avifauna and flora of Deosai National Park, May 2018.

S. No.	Name of nullahs	Date	Brown Bear				Total
			Male	Female	Cub	This Year	
6	Bara Pani	25/9/2019	-	01	01	-	2
7	Lama Lung	25/9/2019	01	-	-	-	1
8	Phyalung	25/9/2019	01	-	-	-	1
9	Woolf Peak	26/9/2019	01	02	01	-	4
10	Black Hole	26/9/2019	03	02	01	-	6
11	Weely Behind	26/9/2019	-	02	-	-	2
12	Shatung Area	26/9/2019	01	01	-	-	2
13	Bole III	27/9/2019	-	01	-	-	1
14	Burji La	27/9/2019	01	-	-	-	1
15	Bole I- II	30/9/2019	01	01	01	-	3
16	Bari La Marayo	30/9/2019	01	02	-	-	3
17	Ragichan	30/9/2019	-	01	-	-	1
18	Khriam Dass Nallha	9/10/2019	01	01	01	-	3
19	Chilum Sherquli	10/10/2019	02	02	02	02	8
20	Bubin Nullah	11/10/2019	01	01	01	-	3
21	Shillah	13/10/2019	01	02	02	-	5
22	Dapa	14/10/2019	01	-	-	-	1
23	Gultari	14/10/2019	05	03	02	-	10
24	Genyal Matyal	15/10/2019	03	-	-	-	3
25	Shagarthang Nalah	16/10/2019	02	01	01	-	4
26	Karabosh Nallah	17/10/2019	02	03	01	-	6
27	Sadpara Nallah	23/10/2019	01	02	01	-	4
28	Burgye Nallah	24/10/2019	-	-	-	-	-
Total			33	34	19	2	88

Exhibit 4: Map of Brown Bear survey 2019, DNP

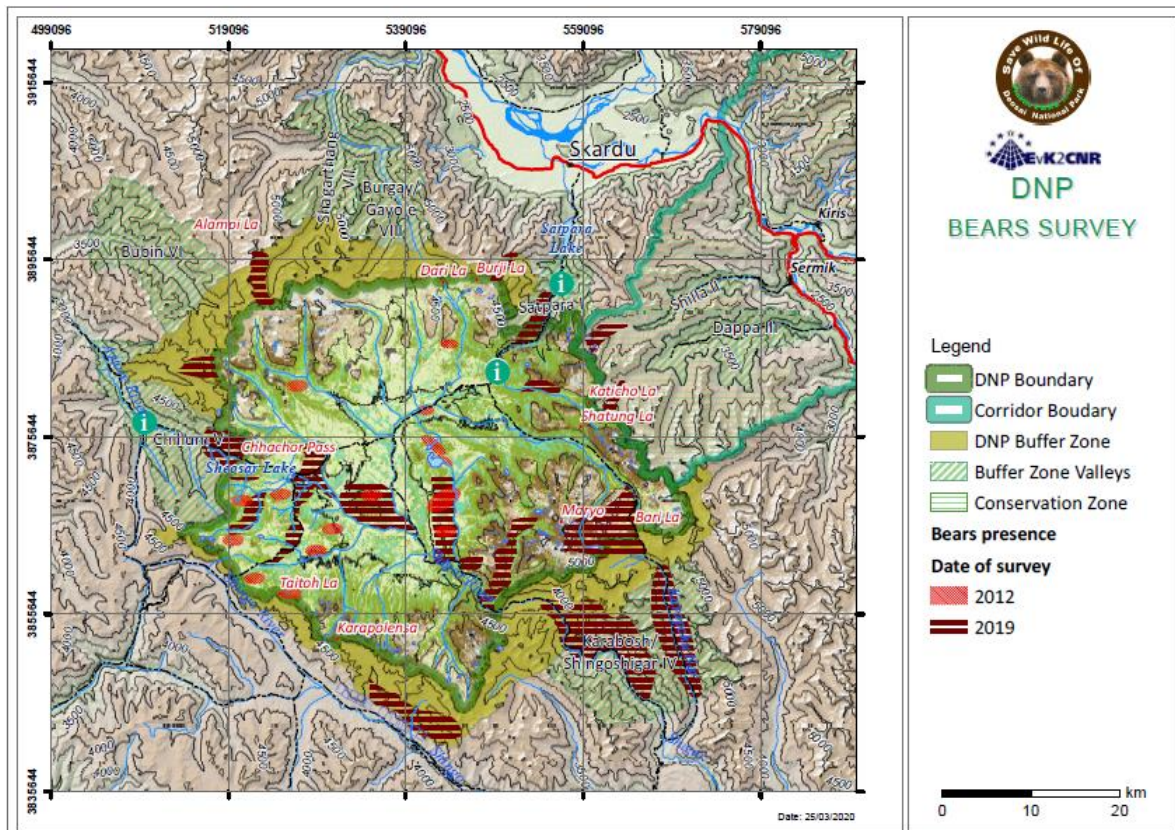
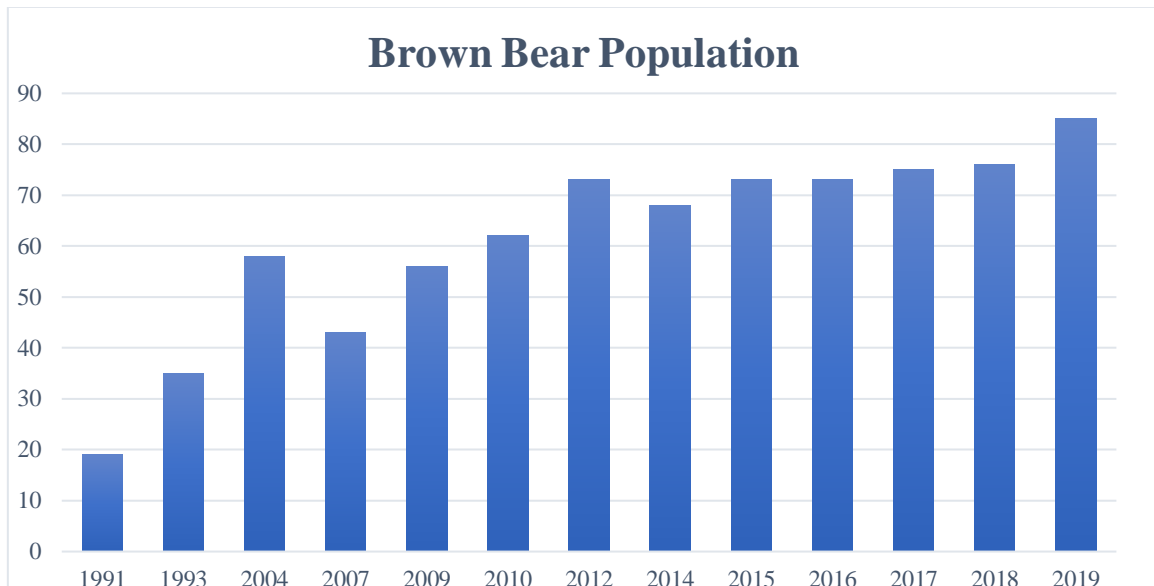


Exhibit 5: Population trend of Himalayan Brown Bear in DNP (1991-2019)



1.2.1.2. Himalayan Ibex (*Capra ibex sibirica*)

Himalayan ibex mainly occupies peripheral hills of the Park. A herd of 14 animals was sighted during the survey by HWF in 1994. The head size ranged from 2-15 individuals, which apparently seems to have grown with the passage of time. A recent survey by DNP field staff shows overall 559 Himalayan ibexes were sighted during the survey period of 2019. Out of which 233 were male, 184 female, 93 yearlings and kids. 49 Ibexes recorded as trophy size sighted in one month.

The habitat is degrading in lower areas due to presence of livestock and upper edges it is good for wildlife. The shepherds are taking care about the habitat of wildlife; they do not take livestock in the habitat of wildlife.

Exhibit 6:Himalayan Ibex population in different locations of Buffer zones, 2018²

S. No	Area	specie	Female	Male	Yearlings/Kids/ND	Trophy size	Total
1	Sadpara	Ibex	32	18	9	5	59
2	Burga		12	10	4	3	26
3	Shargarthang		18	14	14	3	46
4	Dapa zooq		18	12	6	2	36
5	Shila		17	7	9	0	33
6	Karabosh		39	32	17	12	100
7	Gultari		24	25	5	9	56
8	Bubin		33	28	11	5	72
9	Kharam		14	12	6	3	36
10	Das nullah		10	8	5	4	23
11	Chilliam		16	18	7	3	41
Total			233	184	93	49	559

² Base line survey feasibility studies of fauna, avifauna and flora of Deosai National Park, May 2018.

Exhibit 7: Himalayan ibex population in different locations of Buffer zones, 2018

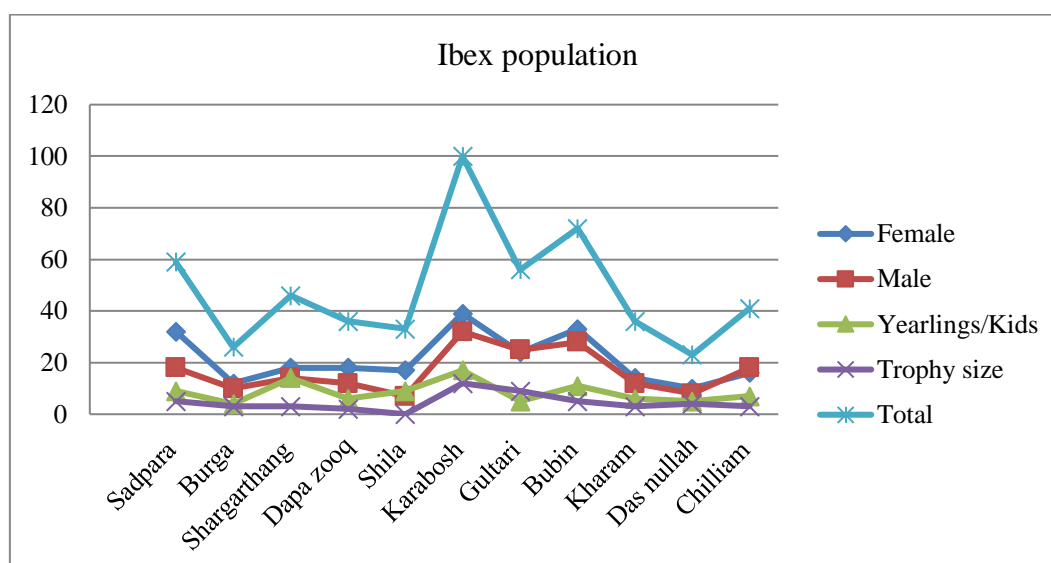


Exhibit 8: Himalayan ibex population in different locations of Buffer zones, 2019³

S. No.	Name of nullahs	Himalayan Ibex				Total
		Male	Female	Kids	Trophy Size	
1	Ragichan	6	6	2	-	14
2	Chilum Sherquli	2	3	1	-	6
3	Bubin Nullah	18	56	14	5	93
4	Shillah	2	3	1	2	8
5	Dapa	1	2	-	-	3
6	Gultari	5	4	3	-	12
7	Genyal Matyal	4	6	2	2	14
8	Shagarthang Nalah	10	15	10	6	41
9	Karabosh Nallah	13	9	9	6	37
10	Sadpara Nallah	5	6	5	3	19
11	Burgye Nallah	2	4	2	-	8
Total		68	114	49	24	255

1.2.1.3. Golden Marmot (*Marmota caudata*)

The Golden marmot, seen widely across the whole of Deosai Plains, is the most common mammal living in colonies appearing as large earth mounds with multiple inlets. Marmot spends most of the summer by feeding and basking and then hibernates by mid-September until March.

³ Source of information is DNP staff

1.2.1.4. Carnivores

Deosai National Park is not a well-preferred area for Snow leopards, mainly due to its landscape and geography. This species is reported to inhabit the steep high elevation areas surrounding Deosai plateau including the slopes of Nanga Parbat, Skardu and Astore valley. 04 Snow leopards, 153 foxes and 36 wolves were sighted during the survey periods.

Exhibit 9: Data of carnivores from Buffer zone- DNP, 2018⁴

S. No	Species	Numbers
1	Snow leopard	11
2	Wolf	64
3	Fox	153

1.2.1.5. Avifauna

A total of 130 species of birds have been recorded (Mirza, 2005, 2008) including 58 species of migratory waterfowls, from Deosai plains. These include passage migrants, vagrant, resident, breeding and irregular visitors. Many of the species breed in Deosai and are found over a large range. Commonly seen birds in Deosai include the Horned lark, Citrine wagtail, Mountain finch, Shy lark, Eastern swift, Crag martin, White capped redstart and Dippers. Waterfowls observed in Deosai include the Common teal, Shoveler, Merganser, Shanks, Curlew, Sandpiper and Great black-headed gull. A few rare species of raptor also occur in the area; these including Golden eagle, Booted eagle, Common kestrel, Long-legged buzzard and Northern hobby are also seen in the park area.

1.2.1.6. Fresh water fishes

The fresh water resources of Deosai harbor several fish species, which are predominantly Palaearctic with elements of central Asian Highlands and some mix of one species called *Ditychus pakistanicus* (Mirza & Khan, 1987). Three species have been reported from the water bodies of Deosai (Rafique, 2000, 2001) viz., High-Altitude Loach (*Triplophysa stoliczkae* Steindachner, 1866), Tibetan Snow Trout (*Ditychus maculatus* Steindachner, 1866), and Indus Snow Trout (*Ptychobarbus conirostris* Steindachner, 1866). The high-altitude Loach is abundant in Gultari River whereas, Tibetan Snow Trout and Indus Snow Trout are abundance in the waters of Deosai National Park (HWF, 2014)⁵.

The Deosai plateau also supports a significant proportion of indigenous fishes such as the high-altitude loach (*Triplophysa stoliczkae*), Slate-colored snow-trout (*Ditychus maculatus*) and Fleshy-mouthed snow-trout (*Ptychobarbus conirostris*). In Pakistan, the high-altitude loach is recorded only at Deosai where it is stable and breeding. The Slate-colored snow trout is the dominant and most common fish species of Deosai. It is also found in western China and Nepal, but stable population exists only in Deosai.

⁴ Base line survey feasibility studies of fauna, avifauna and flora of Deosai National Park, May 2018.

⁵ Himalayan Wildlife Foundation, December 2014, Ecological Baseline of Deosai National Park

1.2.1.7. Small mammals

A total of 13 small mammals have been recorded from different areas of Deosai Plateau. They include *Sorex thibetanus*, *Crocidura pergrisea*, *Crocidura pullata*, *Mustela erminea*, *Ochotona roylei*, *Hyperacrius fertilis*, *Alticola roylei*, *Sicista concolor*, *Apodemus rusiges*, *Rattus turkestanicus*, *Marmota caudata*, *Eoglaucmys fimbriatus*, and *Pipistrellus pipistrellus* (HWF, 2014)⁶.

1.2.1.8. Reptiles and amphibians

Deosai has relatively fewer species of reptiles and amphibians than the lower mountains and plains. According to Woods *et al.* (1997), three species, including one amphibian namely Ladakh Toad (*Scutigera occidentalis*) and two lizards (skinks) viz., Himalayan Ground Skink (*Asymblepharus himalayanus*) and Ladakh Ground Skink (*Asymblepharus ladacensis*) have been recorded from DNP.

1.2.1.9. Invertebrate fauna

Invertebrates found in the Deosai are potential food source for Brown bear. According to HWP, survey (mid-June-mid-September 1999), a total of 43,751 specimens represented 4 classes, 13 orders and 102 families. Arthropods also represent a potential food source for Brown bear and contribute to all over functioning of the ecosystem of Deosai.

⁶ Himalayan Wildlife Foundation, December 2014, Ecological Baseline of Deosai National Park

Exhibit 10: Survey Data of DNP 2019⁷

S. No.	Name of nullahs	Brown Bear				Himalayan Ibex			Snow leopard	Wolf		Fox
		Male	Female	Cub	This Year	Male	Female	Kids	Trophy Size			
1	Lake Area	-	01	02	-	-	-	-	-	-	02	02
2	Kalla Pani	01	01	02	-	-	-	-	-	-	03	04
3	Sarsanghdi	01	01	-	-	-	-	-	-	-	05	04
4	Yoor Walli	01	01	-	-	-	-	-	-	-	03	04
5	Murtaza Top Area	01	02	-	-	-	-	-	-	-	02	06
6	Bara Pani	-	01	01	-	-	-	-	-	-	01	03
7	Lama Lung	01	-	-	-	-	-	-	-	-	03	04
8	Phyalung	01	-	-	-	-	-	-	-	-	-	-
9	Woolf Peak	01	02	01	-	-	-	-	-	-	-	-
10	Black Hole	03	02	01	-	-	-	-	-	-	03	02
11	Weely Behind	-	02	-	-	-	-	-	-	-	-	-
12	Shatung Area	01	01	-	-	-	-	-	-	-	02	03
13	Bole III	-	01	-	-	-	-	-	-	-	-	-
14	Burji La	01	-	-	-	-	-	-	-	-	-	-
15	Bole I- II	01	01	01	-	-	-	-	-	-	-	-

⁷ Source of information is DNP staff

S. No.	Name of nullahs	Brown Bear				Himalayan Ibex			Snow leopard	Wolf		Fox
		Male	Female	Cub	This Year	Male	Female	Kids	Trophy Size			
16	Bari La Marayo	01	02	-	-	-	-	-	-	-	-	-
17	Ragichan	-	01	-	-	06	06	02	-	-	05	03
18	Khriam Dass Nallha	01	01	01	-	-	-	-	-	-	04	03
19	Chilum Sherquli	02	02	02	02	02	03	01	-	-	06	04
20	Bubin Nullah	01	01	01	-	18	56	14	05	-	05	06
21	Shillah	01	02	02	-	02	03	01	02	-	03	06
22	Dapa	01	-	-	-	01	02	-	-	-	04	05
23	Gultari	05	03	02	-	05	04	03	-	-	02	01
24	Genyal Matyal	03	-	-	-	04	06	02	02		04	05
25	Shagarthang Nalah	02	01	01	-	10	15	10	06	-	06	08
26	Karabosh Nallah	02	03	01	-	13	09	09	06	-	06	04
27	Sadpara Nallah	01	02	01	-	05	06	05	03	-	02	03
28	Burgye Nallah	-	-	-	-	02	04	02	-	-	01	03
Total		33	34	19	2	68	114	49	24		72	83

1.2.2. Flora

The flora of the surveyed areas includes highly valued medicinal plants, fruit plants, vegetation used as fuel wood and commercial purposes.

Exhibit 11: List of important vegetation, Buffer zone-DNP⁸

S#	Common Name	Scientific name	Status	used as
1	Juniper	<i>Juniper exelsa</i>	Tree	Medicine/fuel wood
2	Juniper	<i>Juniper macropoda</i>	Tree	Medicine/fuel wood
3	Blue pine	<i>Pinus wallichiana</i>	Tree	Timber/fuel wood
4	Birch	<i>Betula utilis</i>	Tree	Timber/fuel wood
5	Willow	<i>Salix viminalis</i>	Tree	Fuel wood
6	Artemisia	<i>Artemisia meritima</i>	Herb	Medicinal use
7	Ephedra	<i>Ephidra gerardiana</i>	Herb	Medicinal use
8	Wild rose	<i>Rosa indica</i>	Shrub	Medicinal use
9	Barberis	<i>Berberies orthobotrys</i>	Shrub	Medicinal use
10	Sea buckthorn	<i>Hippophae rhamnoides</i>	Shrub	Medicinal use/fuel wood
11	Stinging natel	<i>Urtica dioica</i>	Herb	Medicinal use

Other flora: *Polygonum affine*, *Thalictrum alpinum*, *Bromus oxyodon*, *Saxifraga flagellaris*, *Androsace mucronifolia*, *Aster flaccidus*, *Barbarea vulgaris*, *Agropyron longearistatum*, *Nepeta connate*, *Carex cruenta*, *Ranaculyus laetus*, *Arenaria neelgerrensis*, *Astrogalus leucophylla*, *Polygonum amplexinade*, *Echinop nivetus*, *Seria chrysanthenoides*, *Dracocephalum nutsus*, *Anapalas contorta*, *Chrysopogon echinulatus*, *Dianthus crinitus*

1.2.2.1. Vegetation distribution and land cover

The following six habitat types delineated primarily on the basis of the vegetation types (classes) as well geomorphology and topography were marshy habitat, grassy habitat, stony habitat, rocky habitat, water, and permanent snow fields (Nawaz & Swenson, 2006)

Vegetation based habitat types in Deosai National Park:

2014 HWF Data white
 2019 EVK2 CNR Data light blue

⁸ Base line survey feasibility studies of fauna, avifauna and flora of Deosai National Park, May 2018.

Vegetation Type	Habitat Description	Area (Km ²)	Area (Km ²)
Marshy vegetation	Prevalent in low-lying areas and depressions. It is dominated by various species of <i>Poa</i> and <i>Carex</i> , and <i>Aconitum violeceum</i> . Other common species of this habitat are <i>Heracleum candicans</i> , <i>Cerastium pusillum</i> , <i>Veronica anagalis-aquatica</i> , <i>Rhodiola heterodonta</i> , <i>R. tibetica</i> , <i>Euphrasia densiflora</i> , <i>Lamatogonium coeruleum</i> , <i>Pedicularis pyramidata</i> , <i>Aconitum heterophyllum</i> , <i>Thalictrum alpinum</i> , <i>Primula macrophylla</i> , <i>Saxifraga flagellans</i> sub sp. <i>stenophylla</i> , <i>Minuartia biflora</i> , and	26	
Regularly flooded Shrub/Herbaceous Cover			175.5
Grassy vegetation	Generally associated with flat or undulating areas, dominated by <i>Poa</i> species. Other associated herbs include <i>Bistorta affinis</i> , <i>Agrostis vinealis</i> , <i>Aconogonon rumicifolium</i> , <i>Rumex nepalensis</i> , <i>Galium boreale</i> , <i>Leontopodium leontopodium</i> , <i>Oxytropis cashmiriana</i> , and shrubs include <i>Tanacetum falconeri</i> , <i>Potentilla grandiloba</i> , <i>Artemesia spp.</i> , <i>Aster falconeri</i>	475	
High-density grassland and shrubland			499
Stony vegetation	The substrate is stony, dominated by herbs like <i>Saxifraga flagellaris</i> , <i>Oxytropis cashmiriana</i> , <i>Oxyria digyna</i> , <i>Lagotis kachmiriana</i> , <i>Aconogonon rumicifolium</i> , <i>Cerastium cerastoides</i> , <i>Cerastium pusillum</i> , and shrubs like <i>Saussurea falconeri</i> , <i>Senecio analogus</i> , and <i>Androsace</i>	413	
Low-density grassland			448.5
Rocky vegetation	Rocky or gravel areas that are generally devoid of vegetation or have a sparse cover of plants such as <i>Sorosaris dysaie</i> , <i>Saussuria gnaphalodes</i> , <i>Elymus longi-aristatus</i> , and <i>Saxifraga jacquemontiana</i> , <i>Aster flaccida</i> , <i>Rhodiola wallichiana</i> , and <i>Primula macrophylla</i>	526	
Bare soil and rock outcrops			346.6

Vegetation Type	Habitat Description	Area (Km ²)	Area (Km ²)
Water / Wetland	There are many mosses, swamps, streams, ponds, pools, peat lands and lakes, all over the Deosai plateau. These small and big ecological niches contain floral and faunal diversity of the Park. The prominent lake on Deosai is Sheosar Lake, which fulfills almost all criteria to be designated as the Ramsar Site.	12	
Water bodies			9.95
Snow	Areas of permanent snow	81	
Snow			86.6
Clouds and shadows			55.51
Total		1.533	1,621.66

2. Socio-Economic Profile and Natural Resources Use

2.1. Socio-economic Profile

Eight valleys, namely, Satpara, Shilla, Dappa, Shingo Shigar/ Karabosh, Das Khirum/ Chillum, Bubin, Shagarthang and Burgay, serving as entry points into the Park, surround the park. The eight valleys covering total surface area of 765.92 Km². The total number of households in 2010 were 1321 containing 12584 total population, and in 2019 total number of households is 1341 containing 12284 total population. This change in population is probably linked to the more interest of the new generations to the urban life and work opportunity that are increasing especially in Gilgit and Skardu.

Balti and Shina are the two major languages but a minority of Gujjars also speaks Gujjari. Noorbukhshi, Shia and Sunni are the main sects of Islam that inhabit the surrounding valleys. Subsistence agriculture and livestock herding are the two major sources of livelihood and family income, whereas, a limited number of people, particularly from an age range of 20-50; are also associated with the tourism industry.

Exhibit 12: Buffer zone valleys and total area

Buffer Zone Valleys		
Sr. no.	Valleys name	Surface area (sq. km)
i.	Satpara	54.01
ii.	Shilla	19.79
iii.	Dappa	82.82
iv.	Karabosh/ Shingoshigar	220.79
v.	Chillum	165.13
vi.	Bubin	139.29
vii.	Shagarthang	83.39
viii.	Burgay/ Gayole	103.11

Exhibit 13: Deosai buffer zone valleys population

Valley name	Village name	Population	Households	Male	Female
Satpara	Chogho-ghron	480	50	230	250
	Skill Ghrong	376	35	190	186
Karabosh/ Shingoshigar	Nogam	256	28	126	130
	Hunthali	176	22	86	90

Valley name	Village name	Population	Households	Male	Female
	Patothalli	48	6	20	28
	Dudyal	280	25	135	145
	Das	200	22	100	100
Shilla		560	50	275	285
Dappa		1440	135	715	725
Shagarthang	Stak-chan	210	25	107	103
	Bull-cho	80	10	35	45
	Gamb Ghorong	240	30	118	122
	Gong –ma-Ghorong	175	25	89	90
Burgay/ Gayole	Chos Pa	480	45	250	250
	Blaghar pa	576	60	281	295
	Fa Pa	640	70	310	330
	Khar pi to	440	40	225	220
	Rang na Pa	680	85	335	345
	Ba To Khor	560	60	275	285
	Spang Thang	320	30	155	165
Chillum	Sherqully	385	35	190	195
	Chillum Dass	140	15	70	70
	Lamba Chashma	70	10	30	40
	Dirlah	105	12	52	53
	Dirlah chak	56	8	26	30
	Palinyat	84	10	40	44
	Dass Bala	280	35	142	138
	Dass Pain	56	7	25	31
	Kakn Bala	56	8	26	30

Valley name	Village name	Population	Households	Male	Female
	Kakn Pain	560	70	285	275
	Kharim Daree	210	20	100	107
	Kharim	840	105	420	420
Bubin	Bubin	420	55	200	220
	Murat	105	15	51	54
	Yagam	280	35	135	145
	Bumroy	245	30	125	120
	Kharbey	175	18	85	90

Agriculture and Livestock

Main professions of people leaving around the Park are agriculture and livestock. Extreme weather conditions and lack of easy access to markets is a hurdle in their way, during the productive season. So, to attract the attention of communities in conservation, it is necessary to improve strengthen their income sources.

Pastures

Land use for Grazing

There is no permanent settlement on Deosai Plains due to extreme weather conditions. However, Gujar Bakarwals migrating from the lowlands have been using Deosai as grazing fields for their livestock and sometimes use to sell off their animals to local people, particularly to Astori and Balti dwellers.

In the summer months, people from the surrounding villages bring their livestock into the Park to take advantage of the vegetation for gazing. Summer grazing is restricted from mid-July till August due to weather. The adjacent villages have a gentlemen agreement and verbal understanding amongst themselves over designated grazing areas. As per the agreement, villagers from the Satpara valley graze their herds in the east, Katichu and Mehdiabad in the eastern and southern fringes, Chillum and Das villagers graze their livestock in the eastern and southern parts of the plateau.

The central Deosai and its western flanks are grazed by the nomadic Gujjars who travel to the area from the plains of Punjab and AJ&K. The Gujjars use the pasture of the Chota Deosai and seldom cross over to the eastern side of the main stream due to long standing rights there of the people of Gultari area.

Current use and names of pastures in and around DNP

The pastures to the north- east of Deosai *viz.*, Ribo Nulah, Sermik, Shilla and Katisho nullahs, common to the people of Astore and Skardu. Rgichan; the summer livestock camp with in the boundary limits of Deosai is used by people of Mehdiabad, whereas in Barilla the herding shed is situated outside the boundary of DNP.

To the east of Deosai are; Ginyal, Karobosh, Koshog (towards Barillah), Maryawo and Bara Pani Nullah (towards Bara Pani) are used by people of Gultari.

Chota Deosai, Showaran, Safaid nullah, lain nullah and Murtaza top are in the South of Deosai, and mostly used by Nomads because it is bit far from the park communities.

2.2. Customary Laws

The establishment of parks on traditional lands has a varying impact on indigenous peoples' lives. Indigenous values and customary practices communities to use all areas and resources while at the same time protecting them. These customary values and practices are borne out of generations of experience. They are the knowledge accumulated as the result of trial and error processes, and are embedded in customary laws and practices passed on to the next generation by the socialization process and through teachings beginning at a young age. Customary practices often transcend into spiritual beliefs, and have laws in place to regulate them. Respect for customary laws, or appropriate new protocols concluded and implemented by chosen representatives of indigenous institutions, communities, and peoples must be promoted and incorporated within national frameworks governing national parks.

Existing Customary Laws and Application to Management of Natural Resources

United Nations in its Universal Declaration (Agenda 21: Chapter 26) titled “Recognizing and Strengthening the Role of Indigenous People and their Communities” has called on Governments to recognize that the lands of indigenous people and their communities should be protected from activities that the indigenous people consider to be socially and culturally inappropriate through adoption or strengthening of appropriate policies and /or legal instruments at the national level (or intergovernmental organizations). Government of Pakistan being a signatory to this declaration has the moral responsibility to harmonize the customary laws (and rights of indigenous people) to evolve indigenous people friendly rules.

This is often being advocated that the customary laws/practices, being adopted since long times by the local communities for the management of their resources in light of their sustained livelihoods, are reasonable alternatives to statutory laws for the protection of natural resources. It is further advocated that if such customary laws/practices are equally effective in protecting park resources, these may also be useful in promoting the management of a National Park.

In order to see if there is anything good in the existing customary laws/practices and if these are effective enough to be wholly or partially accepted as substitute for the statutory laws and park rules of DNP, these were reviewed. These were further assessed to see their impacts on the conservation of natural resources and park's biodiversity. The findings are given in the following section:

Customary Laws in Gilgit Baltistan and in DNP Area

Customary laws, established by communal practice and usage for generations and passed down through oral tradition, are familiar, effective and continue to be practiced to a greater or lesser extent throughout the Gilgit and Baltistan. And yet few of them have been documented so far.

There are many opportunities for reforming statutory laws governing natural resources in Gilgit and Baltistan to converge with elements of customary law, thus adding greater legitimacy and efficacy to the state's efforts towards conservation of natural resources in the region. The history of Gilgit and Baltistan and discussions with researchers and resource persons born and raised in GB indicate that Gilgit and Baltistan even today can be described according to the political and legal systems that were in existence prior to Independence.

Certain areas had been ruled by local Rajas since ancient times; in some parts of Gilgit and Baltistan, the law of the Rajas survived till as late as 1972. Other areas had been settled by the British in the 1800s and were under British law. Certain historically tribal republics remain as such after their conditional accession to Pakistan. Due to these historic differences, the universe of the research was divided into three domains that correspond to the politico-legal systems:

- a. Rajgiri Areas: Punial, Ishkoman, Gupis, Yasin, Hunza, Nagar
- b. Settled Areas: Astore, Chilas, Gilgit, Godai/Bubin, Khaplu/Karmang/Shigar and Rondu
- c. Tribal Areas: Darel, Tangir

The three domains would ensure that any possible variations in the customary laws regarding natural resources in Gilgit and Baltistan could be encompassed and that research findings would fairly represent the reality of the universe (Russell, 1994). The customary legal system in Gilgit and Baltistan is structured around the principles of shared space and shared blood relations. In each of the three areas – Rajgiri, Settled and Tribal – different combinations and permutations of these two principles underlie the management and use of natural resources. The customary regulatory system is based on collective responsibility that in most cases aims at using natural resources in a sustainable manner.

This collective responsibility is built into the structure of the customary regulatory institutions, which are similar in all three areas, although there are local variations on specific powers and duties. Members of the communities select the functionaries of these institutions and compensate them; therefore, all members of a community have a stake in their performance. People listen to the customary authorities because they are members of the community, rather than outsiders.

These results suggest that there would be relatively little difficulty in harmonizing customary and statutory law at the operational level. Introducing the concept of collective property rights into the current statutory system would be more complicated, but feasible through consultation and consensus building. Harmonization in the sense of equity would undoubtedly be the most difficult issue to resolve, given longstanding stakes in the benefits of natural resource exploitation.

“Harmonization” in the sense does not mean diluting customary law, incorporating it into statutory law and expecting that it would then disappear. Rather, it means understanding and respecting customary laws as a sophisticated and dynamic legal system, with at least as long a

regulatory history as statutory law if not longer, and which already reformed itself to incorporate elements of the statutory law.

Long-term, effective regulation of natural resources in Gilgit and Baltistan will require reciprocal recognition of customary laws and corresponding reform to incorporate many elements of it into statutory law. The implications for sovereignty have been addressed and resolved in countries that have already taken steps to recognize and provide for the survival of the customary legal traditions practiced in their territories.

International agreements and processes are placing increasing emphasis on recognition of indigenous property rights and equitable sharing of benefits. Pakistan is already a party to many of these agreements and is an active participant in global processes. The country has an excellent opportunity to contribute to these processes by taking the results of this study to the next phase of ground-breaking work on the nexus between customary and statutory law for natural resource conservation – substantive legal reform that promotes sustainable livelihoods for natural resource-dependent communities in Gilgit and Baltistan.

All of the National Parks of GB, including DNP, have been created under the Northern Areas Wildlife Preservation Act 1975. Certain acts are mentioned in the Act inside a National Park. Working in the Park and interaction with the communities reveal that certain rule which are prohibited in a National Park is in conflict with the traditional use right of the user communities. In order to ensure that provisions in law which may not result in the violation of rules at the cost of conservation of the natural resources of the national parks, there is provision for the relevant Government authority to relax such rules to address the possible conflicting situation in a more realistic manner.

The customary practices of eight main settlements around DNP assesses through interviews with structured questionnaire and open-ended questions. There are different customary laws in various valleys of Gilgit Baltistan to manage the local resources which will be discussed one by one in following discourse;

- Agriculture/Land use
- Fuel wood and timber
- Pastures
- Livestock
- Wildlife
- Water

Valley	Park natural resources	Customary practices
Sadpara	Harvesting of forest and other natural vegetation	The cutting of green wood from the natural forest is banned for the last 15 to 20 years. The ban has been imposed by the locals and is being supported by the relevant Government department. The locals mostly subsist on fallen and dry wood for their domestic usage with none of the wood being

Valley	Park natural resources	Customary practices
		<p>transported to other areas. If someone is caught with the fresh wood, he is fined and the wood being seized and confiscated. For their home construction they can bring some dead, dry and diseased trees from their nullahs forest. It is community rules that no green standing should be harvested but they can harvest poplar specie as they grown it on their own lands or on banks of streams and water channels.</p> <p>But trees are harvested illegally at unsustainable level from buffer zone of the DNP, and used as fuel wood and timber.</p>
	Medicinal Plants	Community harvests very few medicinal herbs and aromatic plants from Park and buffer zone for household purposes, such as Tumburk. Mostly remove whole plant from the soil.
	Livestock grazing	The local communities of Satpara have set procedure for grazing their livestock in pastures. In summer the livestock are taken to open pastures located upstream in the high-altitude alpine pastures except for a few who are kept for milking. One male from each house hold for certain period of time or days would accompany the herds. They also send their animals to Deosai National Park in the month of June and continue up to August. In the months of September and October, when harvest of the crops and its storage is over, livestock are brought back from pastures to the villages where free grazing is then practiced throughout winter.
	Pastures	According to the community they are not bringing grasses from the pastures, usually they grow fodder crops on their own fields but they bring fuel wood and medicinal plants.

Valley	Park natural resources	Customary practices
	Wildlife	Hunting is strictly banned, nor locals and neither outsiders allowed to hunt in their area.
	Water	Traditionally water is considered as important natural resource as it is critical for local agriculture and livelihood. Valley community has developed infrastructure, institutions and rules to ensure water is fairly distributed for agriculture needs. Drinking water sources are protected and washing clothes and other form of defilement are strictly prohibited. Every household send its representative for the community work for construction of new water channel, cleaning the water channel and its maintenance. Maintenance, clearing and cleaning of water channel is the responsibility of those land owners from whose land these channels pass through. Water from the nullahs are diverted through water channels and then the main channels are divided into smaller ones to make water accessibility easier.
	Agriculture/land use	Principal land use in of Satpara is dominated by subsistence cultivation, fruit production, livestock raising and forestry. However, they set aside a part of their holding for the purpose of growing fodder. Apart from the private holdings, there are community lands, which are the lands whose allocation and use is decided under customary laws. It has been a customary rule that all segments of the community get equitable share in the rights related to common lands.
Burgay	Harvesting of forest and other natural vegetation	In Burgay valley half of the fuel wood requirement is fulfilled by own resources like poplar or fruit trees and 10% is brought from forest reserve and the rest is purchased from the market. Apart from wood a good quantity of cow dung cake is used as a source of fuel. The cow dung consumption is about 2000 Kg in a year. Artemisia is

Valley	Park natural resources	Customary practices
		commonly collected for fuel wood in the area. According to the community responses they don't bring wood from the forest or park area, instead they have communal land from where they bring wood and also the poplar, willow and fruit plants wood in their own family land they use for timber and fuel wood.
	Medicinal Plants	100% community is aware about the importance of medicinal plants and 20% of the population use them regularly in case of any sickness. The collection of medicinal plants is being carried out in traditional ways, which is not sustainable and, in some case, they uproot the whole plant. Every household has some information about some medicinal and aromatic plants and herbs. Some medicinal plants like Toumbro is commonly used for cold and cough. The use of medicinal plants among the community is also declining due to the lack of knowledge and identification of plants and their use. Only the senior and elder people have some information about plants. The community extracts the medicinal plants from their communal land and pasture.
	Livestock grazing	During the summer, they kept their livestock in higher pastures for 5 months, causing a lot of pressure on the pastures and increasing the risk of degradation.
	Pastures	During the summer season, the people of Burgay take their cattle to small ruminants to community pasture land. Then to sub alpine and alpine pastures in May till September. A few numbers of zo and zomo are grazed inside the park area.
	Wildlife	Community were using Musk Deer leather for their Amulet.
	Water	Valley has very complex water distribution system. Water availability needs to be

Valley	Park natural resources	Customary practices
		improved through updating customary practices.
Dappa	Harvesting of forest and other natural vegetation	In last four decades, forest have been completely dissipated due to excessive forest cutting for timber and fuel.
	Medicinal Plants	Every household has some information about some medicinal and aromatic plants and herbs. Some medicinal plants like Toumbro (for cold and cough), Zeera (for digestion and bad stomach) and Khraqhrsa (for controlling blood pressure) are commonly used. However, its uses among the community is also declining due to the lack of knowledge and identification of plants and their use. Only the senior and elder people have some information about plants. The community extracts the medicinal plants from their communal land, pastures, buffer zone and as from the park.
	Livestock rearing	During the summer season, the people of Katisho take their cattle to Deosai and keep them there till the autumn season. The grazing season starts with spring and the start of agricultural activities. Normally residents of Katisho and Daapa send their animals in the first week of June and bring them back in the first week of September every year. One of the main sources of income is subsistence livestock rearing. Every household keeps one milking animals and a small flock of poultry. They are more inclined towards jobs in urban areas and also this profession is having less economic returns and fodder availability is a big challenge to them. The community in both cash and kind pays the herders.
	Pastures	Community have their own communal sub alpine pastures, buffer zone and as well as have grazing rights in DN. The health of pastures, the community responded that the

Valley	Park natural resources	Customary practices
		majority of pastures are in good shape and healthy, but less grass is evident from so many years and the reason is unknown to them. The overall livestock-rearing trend is decreasing due to lack of interest from the young generation, other sources of employment and also controlled grazing. Apart from cows all the livestock, including zo/zomo, goat and sheep are sent to alpine pastures in the start of June to end September.
	Wildlife	People are quite friendly to wildlife they do not hunt. Hunting is totally banned in the valley by the valley conservation committee. The community did the last hunting of an Ibex about 20 years ago.
	Land use/Agriculture	They are using the old style of cultivation and traditional crop varieties so they are not much productive.
Karabosh	Harvesting of forest and other natural vegetation	The cutting of green wood from the natural forest is not allowed. One house hold is allowed to bring one tree in year from the forest provided that the tree is dry, dead or diseased. For fuel wood they have their nullahs from their community collect firewood. According to the community one house hold is allowed to collect one tractor load in winter season which is approximately 4000 Kgs.
	Medicinal Plants	The use of medicinal plants against common ailments are quite common in Gulatri. However, young generation is not so much aware about the medicinal herbs, just a few elderly people have the knowledge.
	Livestock grazing	In summer season the local people herd their livestock to the near alpine regions where sufficient forage sprout. Besides local people some herdsmen from outside also visit these alpine pastures along with their livestock to take benefit of the nutritious

Valley	Park natural resources	Customary practices
		fodder in these ranges. One male member is mandatory to accompany herds in pastures time period and there are set rules.
	Pastures	The community has generations old practices for pasture use. In Gultari valley, the pastures are distributed among villages (hamlets) and each household has to graze their livestock in the designated pastures only. Most of the locals have constructed shepherd huts in pastures where they reside during the summers. Villages have their own community pastures and they are distributed according to the villages, clans, or tribes. Usually the grazing period in alpine pasture is from June to August. There is also rotational system intact in using the pastures. The animals spend their time in different pastures in a year or the pastures get changed in next year. It is good practice which allows the grass to grow once it's free from the livestock. Community grows some fodder in their own lands for the livestock, apart from it they cut grasses from pastures during August and September and store it for the further fodder need in winters.
	Wildlife	The community has no set rules for hunting. However, community claims that since long no illegal hunting prevails in the area except fishing which is also done in a sustainable way without using net through angling and rods.
	Water	Water is an important natural resource for agriculture and livestock. The water is extracted from the nullahs through a main channel and the main channel is sub divided into various small channels, so that everyone should have access to it. The maintenance and cleaning of the water channel is carried out by the community on volunteer basis and there are set rules for it. Each household in

Valley	Park natural resources	Customary practices
		Gultari community received water for one hour each day.
	Agriculture/ land use	The main use of private land in Gulteri valley is agriculture, fruit, and wood production from poplar plantation. The agriculture is subsistence mainly because of less arable land, lack of mechanization and extreme weather. Apart from the private holdings, there are community lands, which are the lands whose allocation and use is decided under customary laws. It has been a customary rule that all segments of the community get equitable share in the rights related to common lands.
Shagartahng	Harvesting of forest and other natural vegetation	Apart from wood a good quantity of cow dung cake is used as a source of fuel. Mainly they use juniper for fuel as well as for home construction. According to the community responses they also bring wood from the forest or park area and also from their communal land from where they bring wood and also the poplar, willow and fruit plants wood in their own family land they use for timber and fuel wood.
	Medicinal Plants	Community harvests medicinal herbs and aromatic plants from pastures and buffer zone of the park for household purposes. Mostly uproot the whole plant. They use homemade medicines for the day to day medical issues, although, the government upgraded the local 'Hikmat' to a dispensary it can only take care of minor problems. If someone gets sick, the patient is brought down on a local stretcher on the feet, which takes nearly 6 to 8 hours. Many times, the patient dies on the way.
	Livestock rearing and grazing	The community of Shgar Thang take their animals to two Nullahas named as Mundair Nullah for the residents of Shagar Balla and both communities from 10th of June to 10th

Valley	Park natural resources	Customary practices
		of December every year use Lajing Nullah for the residents of Shigar Pine and Dongharn area collectively. The productivity of livestock is very low due to low productive breeds and diseases which very common. The rearing trend of milk animals like cows is increasing, but rearing trend if small ruminant including sheet and goat is decreasing.
	Pastures	The community use pastures for grazing, fuel wood and medicinal plants collection. The anthropogenic pressure and climate negative change impacts are evident on pastures.
	Butter production	One thing they are famous for the butter, which they store for years by burying it underground in their houses. They conserve it for years and only use it on social occasions as gifts. It is a matter of pride for them; the older it is, the more valuable it becomes. The locals believe it is full of nutrition and effective in asthma-related problems.
	Wildlife	Shagarthang valley is quite rich in wildlife resources, people are quite friendly to wildlife they do not hunt, and hunting is totally banned by the community.
	Water	No customary law on water distribution because they have abundant water. For both agriculture and domestic use, they fetch water from the near water stream.
	Agriculture and land use	The deprivation of modern-day facilities also makes them strong. They feed themselves only what they grow. There is a subsistence agriculture production of barley and maize and also fruit production including apricots. According to locals, besides Apple, the valley produces over 70 kinds of Apricots. Unfortunately, 80% of the fruit is wasted as

Valley	Park natural resources	Customary practices
		there is no proper connectivity between Shagarthang and the down country.
Shilla	Harvesting of forest and other natural vegetation	Strict customary laws regarding harvesting wood from the forest and buffer zone area. Artemisia is commonly harvested for fuel wood. In Shilla valley animal dungs of domestic livestock, biomasses by the small agricultural patches and firewood from nearby upper region small forest are the main source of energy for domestic needs. While some household uses kerosene oil for lighting purposes.
	Medicinal Plants	Harvest medicinal plants in traditional ways, mostly uproot the whole plant.
	Livestock rearing & grazing	During the summer season, the people of Shilla take their cattle to Deosai and keep them there till the autumn season. The grazing season starts with spring and the start of agricultural activities. Normally residents of Shilla send their animals in start of June and bring them back in the first week of September every year.
	Pastures	Community use pastures for grazing, fuel wood collection and as well as extraction of medicinal plants. Pastures are not healthy as low grass productivity is evident because of over grazing the same pastures every year in summers and climate change negative impacts.
	Wildlife	Hunting is totally banned and have very strict rules regarding wildlife hunting
	Water	Water springs are protected.
	Agriculture/Land use	The main land use is agriculture but they are using the old style of cultivation and traditional crop varieties so they are not much productive.

Valley	Park natural resources	Customary practices
Kharim	Harvesting of forest and other natural vegetation	The community collects firewood from their own community land, nallahs and from the forest reserves.
	Medicinal Plants	The individuals involved in gathering and collecting are largely untrained regarding the pre-harvest and post-harvest treatment of the collected material. Mostly they remove the whole plants from the roots.
	Livestock rearing and grazing	Overall, the livestock-rearing trend has been declining from last few years because of less availability of fodder for livestock, lack of interest in the young generation, less economic returns from livestock and adaptation to alternate income sources.
	Pastures	Community use their own pasturelands which are healthy.
	Wildlife	Locals stated that they are the protectors of DNP wildlife and even they inform wildlife and park officials if they observe any violation, mainly the illegal fishing. Mr. Muzaffar from Das Kiran community told that even the Ibex come into their fields but they don't hunt them against send them back to the park area and the same is being done with brown bear despite the damages they are receiving from it. A lot of pheasants and snow partridges present but they don't hunt and they even don't allow to hunt. The red fox is quite common.

Bad practices into good practices

Based on ground realities, the Government of GB should initiate a process whereby the existing rules (1975) would be amended to make them effective and according realities on ground. In order to contribute to the process, the management plan of DNP is suggesting amendment/relaxation to the draft Act of wildlife. This is in light of the experience gained from the planning process of DNP. With emerging climate change, tourism trends and anthropogenic pressure they are willing to improve the old customary practices. The community shared their desire to be part of such capacity building activities. The customary practices can be further improved through capacity

building and trainings like pasture management, animal husbandry, and hospitality management and community-based socio-economic initiatives as following:

Stall-feeding: The community was of the view that they want to stall feed their animals so that grazing pressure on pastures could be reduced and to give pastures some rest. However, the community needs assistance for fodder cultivation and production, it includes technical support and provision of fodder seed. According to the community DNP, last year only provided two Kg of fodder seed, which is nothing.

Vet facility: The productivity of livestock is very low, foot and mouth disease is quite common. The area is lacking veterinary facilities; a dispensary is there but without medicines. The low productivity of livestock leading to decreased rearing trend and lack of interest from the community.

Health Facilities: It can reduce the consumption of medicinal plants

Agriculture: Therefore, there is a need to provide them with the more productive and to introduce new varieties of agricultural products.

Medicinal plants: The collection of medicinal plants is being carried out in traditional ways, which is not sustainable and, in some case, they uproot the whole plant. Every household has some information about some medicinal and aromatic plants and herbs. Some medicinal plants like Toumbro is commonly used for cold and cough. The use of medicinal plants among the community is also declining due to the lack of knowledge and identification of plants and their use. Only the senior and elder people have some information about plants. The community extracts the medicinal plants from their communal land and pasture.

Compensation/Livestock insurance: Large predators such as the Himalayan brown bear or Snow Leopard fulfil a key role in many ecosystems and are admired by many people. However, they also cause damage by preying on cattle, mules, destroying and eating arable crops. To minimize the resulting conflicts, the people affected should receive compensation payments. This compensation is an important instrument for protecting the brown bear and other large predators. Despite a hunting ban and extremely protected species and without any compensation scheme, the attitude to bears becomes increasingly hostile, some villagers may take the matter into their own hands. The community reported a lot of such incidents by the predators. But the community of DNP is yet to receive some compensation. There are other predators involved as well as wolves and snow leopards but the brown bears are the most visible threat to the community.

Plantation: Plantation schemes for the community to fulfill the needs of fuel wood and timber.

Alternate energy sources: It can also reduce the pressure on forests and pastures such as LPG, electricity and solar.

3. Park Issues

Information gathered through above stakeholders, consultations, careful analytical review of key documents including Rapid Assessment, Ecological Baseline, and Socio-economic Baseline reports by Himalayan Wildlife Foundation (2014), and field observations made by HWF project (2014) and made by Ev-K2-CNR in 2018 and 2019, reveal the following conservation challenges and threats to DNP.

The overall impact of these threats would be considerably negative on the park's biodiversity, its conservation and sustainable management. It will directly affect the remnant population of Himalayan Brown bear and other associated wildlife species that are the main components of the ecosystem. The longer impact would be more severe; a wilderness on the face of the earth will get faded.

Possibly by involving all stakeholder communities effectively in the park's decision support mechanisms, identifying their stakes equitably, providing them with appropriate alternatives for affected livelihoods, energy needs and for sustainable socio-economic and ecological development. Ensuring an effective administrative setup, equitable distribution of park benefits amongst communities, maintaining proper check and balance in resource use especially that of pastures, fish and wildlife, the existing as well as emerging park issues can be managed, and the flow of park's socio-economic and ecological services can be sustained in the longer term.

Appropriate measures have been proposed in the next section under Management Prescriptions to stop and eventually reverse fast degradation of Park resources, mostly originating from the above and many other threats, including climate change on top of the list.

3.1. Climate Change Impacts

Pakistan faces environmental challenges, including impacts of climate change, loss of biodiversity, deforestation and degradation of air and water quality. The Western Himalayas are among the most vulnerable areas facing serious challenges from global climate change with serious consequences for the survival of the rare biodiversity hotspot. Villagers mentioned climatic modifications that may have repercussions on the water resource.

1. **Invasion of alien species:** This diverse and unique alpine region is likely to suffer critical species losses, in particular the endemic alpine plants due to over grazing, collection of medicinal plants, the introduction of invasive species as well as habitat degradation due to climate change impacts. This is evident from the prevalence of 27% cosmopolitan species recorded from the DNP. The 4 plant species enlisted in the IUCN threatened taxa including *Saussurea lappa*, *Aconitum chasmanthum*, *Aconitum heterophyllum* and *Lilium polyphyllum* were recorded with having low importance values (<1%) indicating the potential risk of local extinction from the region; and reflect the need for immediate conservation measures (IUCN, 2017).
2. **Temperature:** The average annual temperature in Gilgit Baltistan has risen by 0.9 degrees Celsius in the last five decades, while the average temperature rise in the rest of Pakistan has risen by 0.5 degrees Celsius in the same period.
3. **Snowfall:** The annual snowfall is decreasing in and around Deosai but the winters are getting longer. According to Pakistan Meteorological Department, at the western edge of

the Tibetan plateau, Gilgit-Baltistan still has an average annual precipitation of just about 200 mm, most of it in the form of snow. Now that even this meager snowfall is falling, drought has become a recurring feature. A lot of snowfall occurred in winter about 30 years ago. There would be two to three meters of snow even at Chillum. Now, even during the winter season, the village rarely has more than a meter. More snow has meant more water in the rivers and streams. The grass is not adequate to harvest due to its size, which community normally cut to be used in winters.

4. **Shifts in seasons:** There is practically no spring, and the summer is always shorter. The result is that the meadow no longer has the lush grass on which buffer zone valleys of DNP residents used to graze their livestock-sheep, goats, cattle, zo, zomos and yaks. Sharp temperature rises and a huge drop in snowfall, there's little grass left in Deosai to sustain livestock.
5. **Livestock rearing:** The local source of livelihood, animal husbandry has almost been ruined by climate change. Nearly every family in the surrounding villages of DNP had between 800 and 1,000 animals, but the numbers were now down to 30-40. Even people have been forced to change their eating habits due to reduction in livestock rearing in villages. People either buy meat from nearest town or go without it. Previously, in the autumn, each household would slaughter an animal and salt the meat to be eaten throughout the winter-a practice called "Nasalo." Livestock isn't enough now.
6. **Pastures:** The communities of buffer zone valleys need to walk from the valleys to the mountaintops to find grass as pastures are shifting higher. For communities, the grass is life, in absence of livelihood sources there is no other option but to migrate.
7. **Migration:** More and more people are migrating to cities due to the threats to their traditional livelihood sources due to change in climate and absence of job prospects.
8. **Grass productivity:** In the past, the grass in Deosai would be two to three meters tall,
9. and often people walking through it would not be visible. The grass today is not only sparse but 0.3 meters tall according to the community.
10. **Fisheries:** Due to less snowfall, there is little water in Deosai and very less fish as compared to the past. Earlier the surrounding communities would catch the trout and would consume in winter.
11. **Gender:** The climate change has hit particularly hard at women. When there was a lot of grass and every household used to keep a good herd of livestock, residents of buffer zone valleys consumed milk and homemade ghee in the past. Now they have to purchase unhygienic ghee and milk from market. The forests have also disappeared, so women now have to go much further looking for fuelwood.
12. **Medicinal Plants:** Deosai is famous for being home to several medicinal plants, local villagers used to collect the herbs, aromatic and medicinal plants at different times of the year by the knowledge handed down over generations and make several products out of them. Medicinal plants were once found with relative ease in Deosai, if you knew what to look for, and the plants used to be a major source of additional income for the residents around DNP but now these herbs and plants are vanishing.
13. **Tourism:** Significant increase in tourist numbers visiting Deosai has been witnessed in last 2 to 3 years. Due to altitude, the exhaust fumes from tourists' vehicles are trapped in the

cold mountains and a big issue of solid and human waste emerged, which all are contributing the change in climate of this fragile ecosystems.

14. **Glaciers:** Change in pattern of snowfall was also affecting glaciers. Because of the heat in summer glaciers melt. In the past, the December and January snowfall used to fill that up. Now, when the temperature is relatively high, it snows and it does not get compact and melts quickly and the water goes straight to the streams and rivers. As a result, the glaciers of DNP are decaying.
15. **Agriculture:** The variability in temperature is affecting the farmers of buffer zone valleys very badly, particularly to their horticultural crops. The sudden changes in temperature affect the flowering conditions of the fruit trees.
16. **Impacts on Bakarwals (Nomads):** With higher temperatures, the economy of Bakarwal can temporarily improve due to the expanded time available for grazing. It will however damage the Deosai ecosystem and ultimately the grasslands. The September 2014 snowstorm in Deosai can also be linked to the changes in climate, which rolled back all the socio-economic progress made by the Bakarwal community since the 2005 Kashmir earthquake.
17. **Permafrost:** Not much known about the existence and role of permafrost in one of the world's highest plateau. Permafrost thawing could lead to the landslides, debris flow and impact on water quality, quantity, and release of carbon to atmosphere. Hence melting of permafrost in DNP, given warmer temperatures across the globe because of climate change, could have grave implications. It is also said that the spread of small pox disease in Bakarwal community in 2014 may be linked with the melting of permafrost in Deosai.
18. **Human Health:** Several diseases have spiked in the surrounding areas of DNP such as malaria etc., which are not so much common at higher elevations.
19. **Impacts on Brown Bear:** The Himalayan brown bears are potentially threatened by climate change impacts such as decrease in food supply, loss of natural habitat, migration to other areas and hence conflicts with humans. According to (Hagler Bailly Pakistan 1999) BIOM3 simulation models anticipated in the size and areas of forest and biomes under the impacts of climate change. The model anticipated a constructive outcome on the forest, however alpine tundra. The coniferous forest will grow more at the cost of alpine tundra and the major habitat of brown bears in country lies in the alpine tundra biome. Brown bears previously enduring natural degradation and fragmentation by anthropogenic activities will confront further shrinkage of habitat.

3.2. High-Altitude Wetlands

In addition to being important from the point of view of rare alpine flora and habitat of the endangered Himalayan Brown bear (*Ursus arctos isabellinus*), the Deosai plateau is also important as a high-altitude wetlands complex (lying above 3,000 m). Many wetland types are represented on the plateau and it is considered an excellent example of high-altitude wetland in Pakistan, indeed in the entire Himalayas-Karakoram-Hindukush mountain region. Research studies have been conducted on the biodiversity of Deosai by such eminent institutions as Cambridge University, Pakistan Museum of Natural History, University of the Free State, South Africa, Norwegian University of Life Sciences and the Himalayan Wildlife Foundation. However, very few of them have focused specifically on the biodiversity and socio-economic

status of communities dependent on the wetlands of Deosai. One of the more comprehensive surveys in this regard was conducted by the Pakistan Wetlands Programme (PWP), a nation-wide seven-year initiative being implemented by WWF-Pakistan on behalf of the Ministry of Environment whose goal is the conservation of the country's significant wetlands and their associated biodiversity while alleviating poverty.

The importance of Deosai as a wetland can be seen from a field observation that, out of the 20 natural inland wetlands types listed by the Ramsar Bureau) at least 10 types are represented on Deosai (*R. Garstang, PWP, pers. comm*). These wetlands types include glacial lakes, peat bogs, marshes, riverbank wetlands, permanent streams and creeks, seasonal streams and creeks, snowmelt ponds, seasonal pools and wet meadows. The most well-known wetland of them is Sheosar Lake, situated at an elevation of 4,100 m ASL. It is one of the oldest alpine lakes in Gilgit-Baltistan. In the local language (*Shina*), Sheosar means blind lake as its main source of water supply is apparently invisible, but it is speculated that underground springs and glacial water contribute substantially to the lake's water.

The wetlands of Deosai provide an important habitat to many resident and migratory bird species, which include common teal (*Anas crecca*), chukar (*Alectoris chukar*) and fish, hawk (*Pandion haliaetus*), grey heron (*Ardea cinerea*) another. According to a detailed survey by PWP, a total of 45 bird species were observed at Sheosar Lake alone. However, on Deosai as a whole, more than 130 bird species have been recorded, most of them utilizing the numerous wetlands for feeding, breeding, wintering or migratory stopover.

The Deosai plateau also supports a significant proportion of indigenous fishes such as the High-altitude loach (*Triplophysa stoliczkae*), Slate-colored snow-trout (*Diptychus maculatus*) and Fleshy-mouthed snow-trout (*Ptychbarbus conirostris*). In Pakistan, the High-altitude loach is recorded only at Deosai where it is stable and breeding. The Slate-coloured snow trout is the dominant and most common fish species of Deosai. It is also found in western China and Nepal, but stable population exists only in Deosai. The mammals, besides the brown bear, are represented most prominently by the golden marmot (*Marmota caudata*), Tibetan red fox (*Vulpus vulpus montana*), Himalayan otter (*Lutra lutra*), Tibetan wolf (*Canis lupis chanco*) and snow leopard (*Uncia uncia*), the last being in the mountains surrounding the plateau.

In fact, most flora and fauna found on Deosai depend, directly or indirectly, on its extensive area of wetlands. The indicator species of this region, the Deosai brown bear, would be hard pressed for survival without the nutritious resources provided by the wetlands. Therefore, it could be said that much of the biodiversity of Deosai plateau would not exist in this shape if the wetlands were to degrade or disappear from the area

3.2.1. Issues related to wetlands

Many issues and threats faced by the Park as a whole are also impacting its wetlands. However, the following issues pertain specifically to wetlands. Some of them are considered to be a direct result of the growing population around the Park and improved access to the Park by both locals and outsiders.

- Low level of awareness among line departments and communities regarding wetlands and their importance. This has impeded scientific management of wetlands and needs to be rectified.
- Inadequate scientific surveys and research relating to wetlands by reputed research institutions has resulted in poor knowledge of the values and services of the Deosai wetlands.
- Solid waste generation in the Park, especially around camp sites along important wetlands including Sheosar Lake and Bara Pani, is another
- Issue that needs attention. Easier access to the Park has resulted in
- Greater influx of visitors. This has increased the amount of solid waste in the Park. Lack of awareness, care (or both) in most visitors means that
- Much of the solid waste is left behind and has to be collected and disposed of by the Park staff.
- Grazing in the Park by large number of goats, yaks and sheep with negative impacts on wetlands such as sediment runoff, eutrophication of
- Wetlands and trampling of fragile wetlands flora. Some remoter pastures are not in a bad condition but overgrazing and trampling by livestock is
- Causing deterioration in some regions. As in other parts of Gilgit-Baltistan free grazing system is practiced here and pressure on the pastures is
- Substantial in which nomads from the plains are a major player.
- Inadequate Park resources for proper protection of the wetlands. The field staff of the Park struggle to manage tourism, solid waste and catch illegal
- Hunters, yet paucity of resources means that these important functions
- Cannot be properly executed.

3.2.2. Diachronic analysis of Wetland and Lakes in the last three decades

On Deosai Plateau, a discontinuous permafrost layer has been documented. The thermokarst topography associated to this landscape can be recognized with depressed areas and small lakes.

With the aim to recognize the changes in the last decades related to climate change effect, a diachronic analysis of remote sensing data has been done to understand the wetlands and water bodies' changes in the last three decades.

This analysis can give a contribution to the knowledge of the dynamics of the environment of the Deosai plateau, with a specific focus on the possible effects of climate changes on the ecosystem.

Moreover, this topic can play a fundamental role on the management choices of the DNP, adopting careful measures for the human activities inside the park.

Two separate multi temporal analysis have been done:

- Extraction of lakes
- Extraction of wetlands (areas non-permanently covered by water

Sensors operating in the visible-infrared, such as Landsat Thematic Mapper (TM) and Enhanced Thematic Mapper Plus (ETM+) and OLI (Operational land Imager), have proven useful for

monitoring open water bodies and wetlands extent due to their relatively high spatial and temporal resolution.

Landsat imageries available in the range of years 1990- 2019 have been acquired, on the basis of two main requirements

- Cloud cover < 30% (on the entire scene)
- Season (Summer season)

In reference to the second requirement, data acquired on August and September have been collected.

Starting from a first list of 23 available imageries, 13 images have been chosen, as unfortunately Landsat 7 data show for a large part of the dataset an internal error of acquisition of data.

Exhibit 14: Satellite images used in the analysis

Satellite	Path	Acquisition date
Landsat 4-5	149_36	19900807
Landsat 4-5	149_36	19940903
Landsat 4-5	149_36	19970810
Landsat 4-5	149_36	19980930
Landsat 4-5	149_36	19990816
Landsat 7	149_36	20000826
Landsat 7	149_36	20010930
Landsat 4-5	149_36	20080925
Landsat 4-5	149_36	20090827
Landsat 8	149_36	20130907
Landsat 8	149_36	20170817
Landsat 8	149_36	20180921
Landsat 8	149_36	20190924

3.2.2.1. Lakes extraction from satellite data

For each year, after the application of an atmospheric correction and transformation of the digital number in reflectance values, the recognition of the lakes has been carried out. The digitalization of the single lake has been done on the basis of the photointerpretation, as it is demonstrated in similar studies, that only an automatic processing does not guarantee the mis-interpretation of water and shadows.

Exhibit 15: Diachronic analysis of water bodies and wetlands, DNP

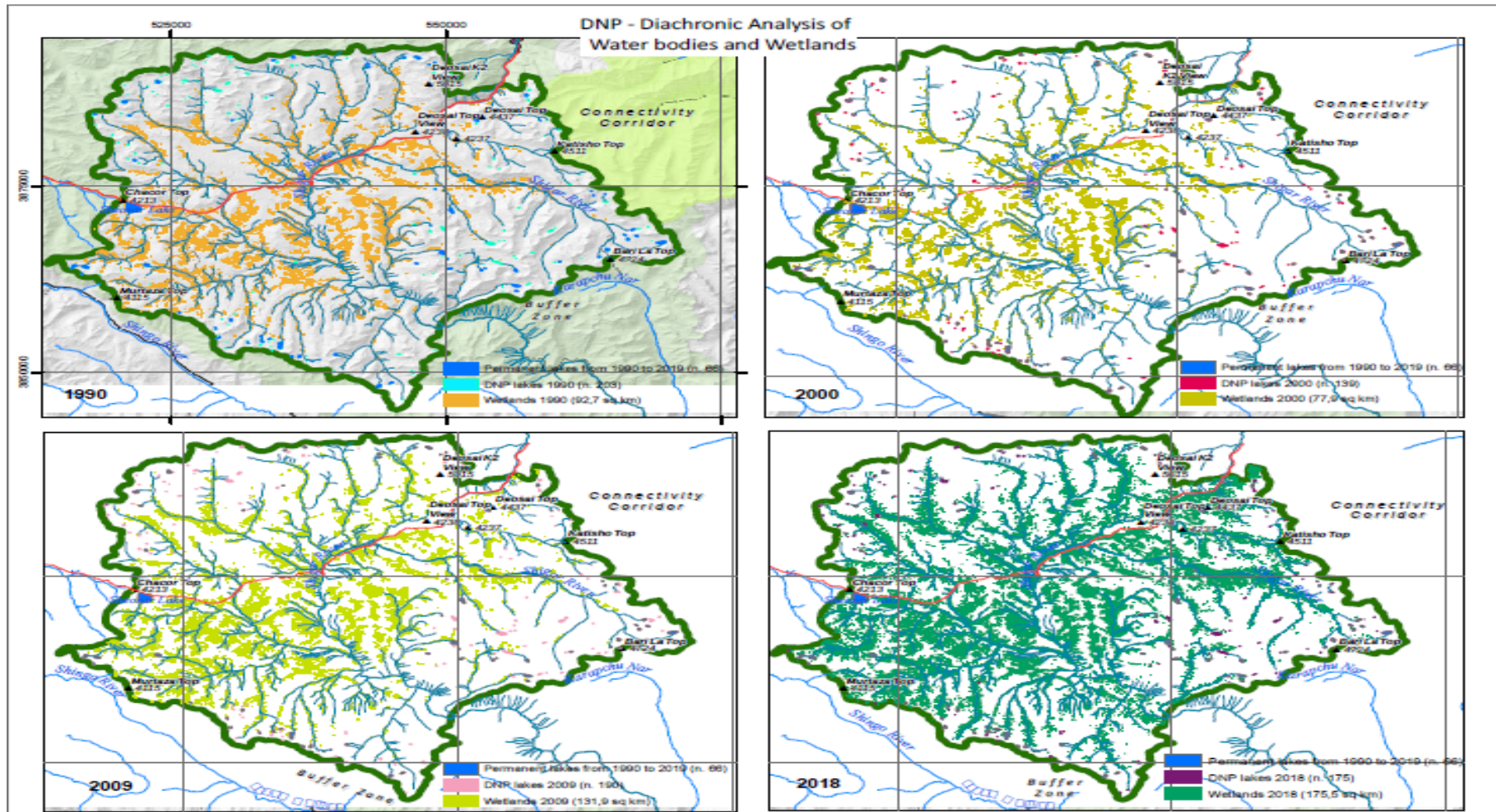
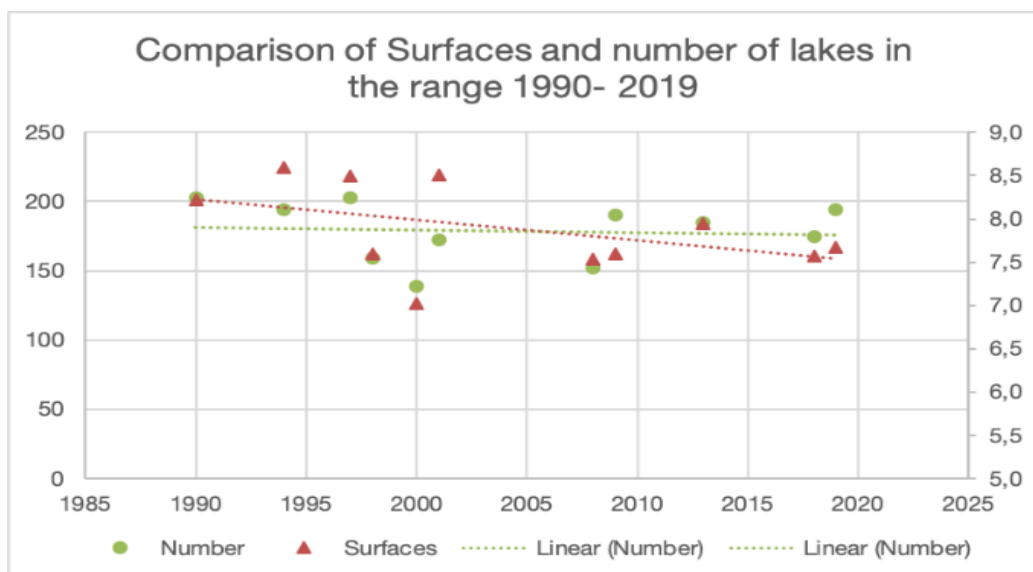


Exhibit 16: The table shows the Surfaces (sq. km) and the number of lakes extracted from each image

Acquisition Year	Acquisition Month	Surface (sq km)	Number
1990	8	11.4	290
1994	9	11.1	220
1997	8	11.3	240
1998	9	10.7	186
1999	8	8.2	164
2000	8	10.1	221
2001	9	11.4	227
2008	9	10.3	198
2009	8	10.6	253
2013	9	10.9	256
2017	8	8.7	216
2018	9	10.1	232
2019	9	9.9	217

The behavior of the changes of the total surfaces and number of lakes from 1990 to 2019 can be observed in Exhibit no 16.

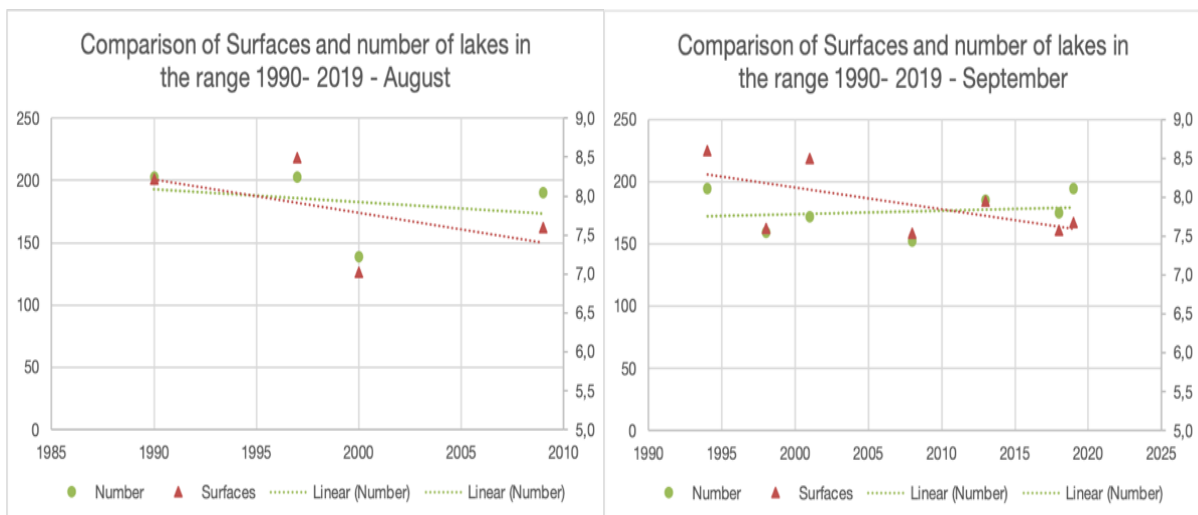
Exhibit 17: The graphs shows the Surfaces (sq. km) and the number of lakes extracted from each image



It can be observed that there is a general trend of no- changes of the total number and a very low decreasing in the total surfaces during the considered range. Instead, it is interesting to observe to analyze the dynamics of the number of lakes in these thirty years because only 66 lakes result permanent during this period, and for each analyzed year their new lakes that appear and disappear. This dynamic confirms the presence of an important sub-surficial hydrological activity. So, the general low-decreasing trend related to the geomorphological/ hydrological dynamics of the plateau cannot be considered representative of the effective changes, if the seasonal status has not been considered.

The analysis of these data, filtered by months August and September, gives some important results that can be interpreted as changes of the permafrost setting (exhibit no 17)).

Exhibit 18: The graphs shows the Surfaces (sq km) and the number of lakes extracted from each images of August (left) and September (right)



In exhibit 17 two graphs are given: on the left, the data of surfaces and number of lakes are extracted from Image of August, and on the right, the data are from images acquired on September. It can be observed that: i) the surface and the number of lakes in August have a gentle negative trend; ii) instead in September, while surfaces show a decrease, the number of lakes have a positive trend.

3.2.2.2. Wetlands extraction

Using the images of 1990, 2000, 2009 and 2018, the wetlands have been extracted from each image and the total surfaces have been compared.

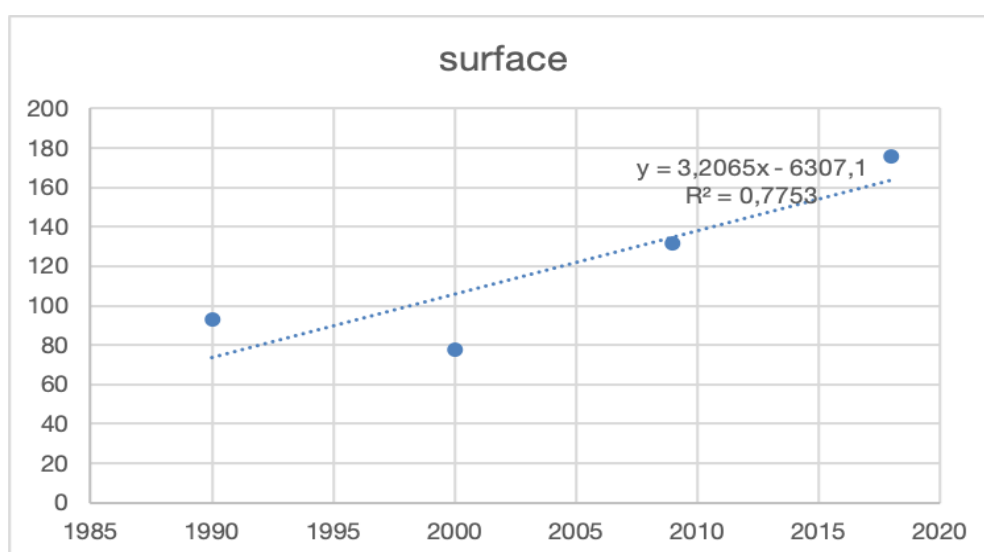
The wetlands were extracted applying of a spectral index that enhance the pixel with a high reflectance of the vegetation associated to the wetland. For this reason, the best period to analyze is the maximum phenological state of vegetation in August. Data of 1990, 2000 and 2009 were extracted from Landsat satellite, while for 2018 the Sentinel data acquired on August has been used.

Results can be seen in Exhibit 18 and 19.

Exhibit 19: The table shows the Surfaces (sq. km) wetland extracted from each image

Date of acquisition	Wetlands surface (sq km)
1990	92.7
2000	77.9
2009	131.9
2018	175.5

Exhibit 20: The graphs show the Surfaces of wetlands extracted from images.



5.2.2.3. Conclusions

For a geographic analysis of these results, the map “DNP- Diachronic analysis of Water bodies and Wetlands”, attached to this document has been done.

These first results are coherent with the outcomes of other studies in different zones of the earth with permafrost landscape. Authors confirm that changes in some characteristics of hydrological discharge and in soil moisture can be interpreted in many areas of the earth as hydrological reflections of the changes in permafrost and active layer thickness. Changes in permafrost and active layer depth directly affect the subsurface water storage and as such can be expected to also affect river discharge. Furthermore, some researchers have shown that permafrost degradation may cause a transition from a surface water-dominated to a groundwater-dominated hydrological system.

As discussed by researchers, lakes, ponds, and wetlands appear to be more dynamic, growing in some areas, shrinking in others, and changing distribution across lowland regions.

These changes are interpreted as result from a system-wide response to changing climate arising from a region-wide warming and thawing of permafrost.

As suggested by other authors in their studies, we can say that the results obtained in Deosai demonstrates that landscapes may be particularly sensitive to climate change and capable of rapid geomorphic responses to perturbations.

It is important to underline that it is the first time that an analysis like this was done on Deosai plateau. Moreover, these results can be considered preliminary and integration of climate data are required to compare the evidences from remote sensing with the availability of snow, ice and rain and with the weather conditions. Furthermore, it would be desirable that, in an environment so fragile and so rich in biodiversity, a permanent monitoring of permafrost status with a weather station were installed.

3.3. Grazing Issues with Gujjar Bakarwals

Gujjar Bakarwals are the nomad herders who travel with their animals from Kashmir to Deosai for summer grazing. The management fully abides by the law. Weak enforcement of law seems to be one of the major impediments in the way of improved management of the park, which are inevitable to be addressed fully in this revising of the draft management plan.

Grazing of livestock in Deosai degrades the vegetation cover, and creates disturbance for wildlife. In addition to grass and plants consumed by the livestock, the nomads remove bushes that provide cover to the wildlife and protect the soils from degradation, for use as firewood. Horses and sheep dogs brought in by the Bakarwals threaten the wild animals, which therefore avoid the areas occupied by nomad herders. Grazing in Deosai is also a traditional practice of communities living on the northeastern borders of the park. The threat to the national park from the Bakarwals, however, is considerably higher as the Bakarwals have been rapidly expanding the number of livestock with over 24% increase during 2000-- 2013 (n=5500 in 2013), and their areas of use in the recent past. As an indication the valleys of Phialung and Lamalung located northwest of the

Ali Malik entrance to the park which were previously available to the bears have now been taken over by the nomads. Similarly, the nomad herders started moving into the valleys along the southern boundary of the park east of the Wolf Peak, after 2005, when the controls exercised by the Wildlife Department (Department) became lax. The areas in use and number of livestock grazed by resident communities (about 1500) has not increased that fast. In the last years, some restrictions have been introduced limitation of the number of families, limitation of the pasture that could be utilized. The data collected in 2019 are seven families, total 1915 livestock including 1730 sheep and goats.

Exhibit 21:Gujar bakarwal livestock in DNP 2018

S. #	Name	Father Name	Place of Summer	Entrance Point	Caste	Mule/Horse	Goat/Sheep	Dogs	Donkey
1	Ali Ghohar	Sain Yaqoob	Kala Pani Junction	Shonter	Chichi	45	450	5	2
2	Mohammad Shafi	Sain Yaqoob	Kala Pani	Shonter	Chichi	35	400	1	3
3	Abdul Hameed	Noor Alam	Sar Sangri	Shonter	Piswal	11	50	2	0
4	Mohammad Bashir	Baz Khan	Murtaza top/Sar Sangri	Shonter	Thakria	21	200	1	5
5	Abdul Aziz	Mian Murtaza	Top/Sar Sangri	Shonter	Piswal	31	400	1	0
Total						143	1500	10	10

Source: DNP staff 2018

Exhibit 22:Gujar bakarwal livestock in DNP 2019

S. No.	Name	S/O	Tent	Man	Female	Children	Horse	Sheep /Goat	Donkey	Dog	Area Name
1	Aurangzaib	Ali Gohar	4	9	8	21	21	430	1	3	Bara Pani
2	Yousaf	Sain Yaqoob	5	8	10	10	33	330	2	3	Bara Pani
3	Shafi	Sain Yaqoob	3	6	5	3	20	200	4	2	Kala Pani
4	Muhammad Bashir	Baaz	4	7	8	6	30	170	3	1	Sar Sahangri
5	Muhammad	Muhammad Hassan	4	3	2	4	20	200	4	2	Murtaza Top
6	Ghulam Rabani	Qadir	6	8	6	5	25	200	4	2	Murtaza Top
7	Muhammad Jaan		2	2	2	3	2	200	2	1	Murtaza Top
Total			28	43	41	52	151	1730	20	14	

Exhibit 23: Local Communities Livestock survey 2019

Sr. no.	Community name	Area name	Cow	ZO	Zomo	Sheep/Goat
1	Satpara	Ali Malik Top	100	60	150	200
2	Dapa	Shatung Nala	150	100	200	60
3	Mehdiabad	Amichand	70	80	130	100
Total			320	240	480	360

3.4. Damage and Disturbance by Visitors

Studies show that the number of visitors to Deosai has constantly been increasing ever since Deosai was notified as a protected area (HWF, 2014). Major practices observed and reported that are damaging to the park environment include off-track driving, illicit fishing and littering. It has been noted that the visitors in the

absence of Park's field staff, drive freely into the core area for bears located south of Bara Pani, primarily for off track, four-wheel driving and fishing, especially in the area from Shatung to Bara Pani using nets and rods. Littering is also common in high tourist influx areas like Bara Pani and the Sheosar Lake.

3.5. Inappropriate Planning of Infrastructure

Deosai being a notified protected area, a strict policy of no permanent structures has been followed to date; the authorities demolished even a partially completed structure previously constructed by a local person at Shatung, to maintain the natural integrity of the Park. A building constructed close to the Bara Pani Bridge for the staff of Works Department for maintenance of the bridge, is illegitimate. Allowing construction of such structures will be very harmful to the park, as this is likely to start a trend of erecting ugly concrete buildings in Deosai wilderness, a building that does not fit into this landscape will be an anomaly at the location, and its associated toilets may seep into adjacent river, which is presently of drinking water quality. Currently, the toilets maintained by the Department are at least a 100 m away from the river.

3.6. Damage by Construction Contractors

Some important and useful infrastructure like bridges and roads is necessary for the visitors in terms of safety, lower costs, and reduced travel times, as well as for the Department as it improves access and helps in maintaining the integrity of the park, through due diligence, effective control and watch & ward. However, the construction contractors often not aware of the sensitivity of the Park and standard practices followed in National Parks while using local construction materials i.e., sand, stones and gravels for construction do not heed for restoration of the key habitats (fish hatching & breeding areas, marshlands and rocky areas) disturbed by construction.

Section-B

Park Management

4. Introduction

The Deosai Plateau, known as second the highest plateau in the world is located at the boundary of the Karakoram and the western Himalayas. DNP has a very interesting position as two biogeographically important mountain ranges merge at Deosai; the Himalayan and Karakorum-Pamir highlands. It is a place of richest biodiversity in the Northern Pakistan, as species channeled through Karakorum mountain range. It is a beautiful summer pasture with lush green meadows and countless species of fauna and flora. It is a plateau inhabited by the Himalayan Brown Bear for thousands of years, being an extensive, biologically and ecologically preserved habitat of the largest plateau in south Asia. The integrity of this habitat is also confirmed by the presence of the two other mammals: Himalayan Golden Marmot and the Wolf, as well as a number of other animal species.

The Brown Bear in DNP is the flagship wildlife species, which deserves the utmost care and attention and which undeniably has the right to exist. The Brown Bear is one of the most valuable representatives of biodiversity in this area and plays an important role in its preservation. With respect to other animal species, the Brown Bear is at the top of the food web and is directly threatened by anthropogenic activities and climate change. Since bear and man inhabit the same areas, it is apparent that there is a need to ensure their coexistence, which is the goal that a series of measures laid down in this Plan aim to accomplish.

Implementation of measures for the conservation and the protection of biological and environmental balance of natural habitats of bears, i.e. the coexistence of bear and man, has to be devised on the basis of modern ecological knowledge governed by the adequate legislation, but there has to be also a general consensus of different stakeholders concerning key issues. Those measures cannot be applied based on individual cases or according to individuals will, but are to be regulated by an official document so, the Management Plan for the DNP.

The purpose of the Management Plan for DNP is to determine a management goal within a framework established by international and national regulations, to define measures to be implemented for the conservation of natural habitats and the bear population, as well as measures enabling the coexistence of man and bear. Furthermore, this plan should be aligned with the equivalent plans of neighboring countries that equally manage the existing bear populations, as well as with appropriate action plans of the country's institutions.

In the map (Exhibit no.2) emphasizes on importance: DNP is very close to Central Karakorum National Park (CKNP) and with a short Connectivity area. It is possible to create a unique Protected Area that becomes the largest in GB with total surface of 16,486 Km². Including the adjacent Kunjerab National Park (KNP) 18750 Km² totally protected in a unicum-connected National Park.

Therefore, it can be considered one of the largest mountain protected areas in the world and the highest for average altitude: For example:

protecting the area from threats that has either caused the extinction of some of the species or serious depletion in their populations. This has been, and still the conventional purpose of many of the National Parks in the world, including that in Pakistan.

However, over the past few decades, the importance of the natural goods and services has emerged because of extensive research, almost in all developed countries. The linkages of such services have also been, and is being explored with the quality of people's life. This has further necessitated the creation of protected areas for their contribution to secure the goods and services of the representative ecosystems. Recently, the ecosystem governance has emerged as a new priority where protected areas have gained further priority.

Keeping the above in view, National Parks are now much more in status than simply the areas that are there to protect a few key species and their habitats. Now, creation of a park is just an initial step in securing the goods and services of ecosystems that is being done by securing its elements in a protected area with further efforts to extend the protection tasks to larger areas, covering a bigger segment of the representative ecosystem through extending the boundaries of the park, creating larger buffer zone, connecting adjoining areas through corridors that are managed to restore the lost habitats and their ecological components/characteristics.

In light of the above, the current management plan has the following purpose:

Protect the ecology of the Deosai plains with focus on DNP for being home to representative Biodiversity and with a potential to extend management cover to the adjoining areas having similar ecological characters

Development Objective of the Management Plan

In light of the purpose of the plan, the current management plan shall be guided by the following Development objective:

Protect the Biotic and abiotic features of the Deosai plains within the boundaries of the DNP and explore potential of covering larger habitats in the adjoining area, currently not covered through management for conservation.

Specific Objectives of the management plan

Based on the Development objectives, the current management plan shall have the following specific objectives:

1. Conservation of the biodiversity of the Park with special focus on Himalayan Brown Bear, and other key species including medicinal plants
2. Maintain and enhance ecological integrity of the wetlands of Deosai National Park
3. Demonstrate joint management of the Park resources by the major stakeholders for replication of successful conservation approaches in the entire landscape/ ecosystem
4. Promote positive communication and mutual trust between custodian department and custodian community for the conservation of Biodiversity and sustainability of the park and human development

5. Minimize the negative impacts of conflicting issues over the park and its natural resources
6. Establish appropriate regulatory mechanisms for proper management of Buffer zone and Buffer zone valleys to avoid conflicts, excessive natural resource use and safe guard the ecology
7. Establish, improve and maintain park infrastructure
8. Promote scientific research as a basis for the management decisions of the Park
9. Make and use tourism as an effective tool to generate knowledge, awareness and interest about conservation and a sustainable livelihood option for people of the park
10. Promote awareness and natural resource conservation education for various stakeholders
11. Explore and establish connectivity areas between DNP and other ecological sites
12. Ensure financial sustainability of DNP for its continued survival and for the economic uplift of the custodian communities.

4.2. Legal Issues

DNP was established over an area of 3626 Km² on December 4, 1993 but the notified area was overestimated at that time compare to the area given in last approved MP that includes 1982 Km² and with updated GIS and ground verification the revised MP delineates an area of 1621.66 Km² as described in the chapter 8 of this document.

Moreover, Deosai was declared in 1993 as IUCN Category I Protected Area (Wilderness Park). Where grazing, illegal hunting, construction and other forms of resource extraction were completely prohibited by the law, but in the last approved MP (2016) and in this revised version (2020), the DNP has been declared as IUCN category II in which sustainable livelihood activities for local communities and presence of visitors are possible.

The Plan does not allow the following activities inside the Park:

- Entry into the Park without paying the Entry Fee
- Temporary or permanent residence
- Hunt, kill or capture or intend to hunt, kill or capture any wild animal
- Carry any fire arm, explosive or any other hunting weapon
- Introduce any pet or domestic animal
- Fire, cut, destroy, injure or damage to any tree, grass, bush or other vegetation types
- Cultivate or encroach land
- Pollute or contaminate any water resources in or flowing in to the Park
- Introduce any exotic animal or plant
- Pick any flower or remove any plant, stone or other natural object from the Park
- Write on, cut, carve or otherwise deface any building, monument, notice board, tree, rock or other object, whether natural or otherwise.
- Discard any litter, paper or waste etc.

Unless allowed by the Provincial Government of Gilgit-Baltistan (GB Parks and Wildlife Department) for scientific purposes or for betterment of the Park.

The Plan does allow the following actions to be exercised inside the Park as well as in its buffer zone, with aim to improve the Park;

- Non consumptive resource use practices in specified zones to promote local economy (tourism-based enterprises for the livelihood of locals)
- Controlled grazing in declared grazing zones to support livelihood
- Ex-situ cultivation of medicinal plants to generative income for the Park communities
- Where feasible, initiate trophy hunting Programs in the buffer zone valleys around the Park and sports angling/catch & release fishing to reward community for their contribution in conservation of Park resources
- Raise firewood plantations of native species on waste lands in the buffer zone
- Integrated agricultural development in buffer zone
- Income generation through fruit processing, packaging and marketing etc.in buffer zone
- Fodder cultivation on barren lands to promote stall feeding in buffer zone
- Livestock breed improvement to reduce pressure on pastures in buffer zone

Now these prescriptions were modified into the recently approved (2019) Forest Act in which there are these regulations:

CHAPTER XXI

176. Establishment of Protected Areas Categories System: *In line with IUCN categories of Protected Areas System, Government may declare certain areas to be strict nature reserves, wilderness areas, national parks, natural monuments or features, habitat or species management areas, protected landscapes or waterscapes, or protected areas with sustainable use of natural resources.*

177. Strict Nature Reserves:

- 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:

- 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.*

179. National Parks:

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.*
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 wide-ranging 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. Management History

In December 1993, Gilgit-Baltistan Administration notified a large area including the Deosai plain as National Park, mainly to protect the endemic species of Himalayan Brown Bear (*Ursus arctos isabellinus*) in its natural habitat and to maintain the ecological balance of its fragile habitat. Illegal hunting and poaching of wild animals, excessive exploitation of medicinal herbs, over grazing and immoderate tourist flow were amongst the key threats to Park and its natural resources (Hagler Bailey Pakistan).

In order to assist the government and local communities for sustainable management of the critical alpine ecosystem of Deosai plain. The Himalayan Wildlife Project (HWP) wrote in 1994 a draft management plan for the Park, mainly based upon its two-years socio-economic and ecological research on the plateau from 1992-1994, which somehow, could not be approved and hence could not be implemented mainly because of technical and financial constraints, at that time.

The plan aimed to protect Himalayan Brown bear in Deosai Plains. However, its separate operational objectives were designed to address the development of natural processes, minimize the negative impacts of human activities, improve socio economic condition of people and promote research for the scientific management. The management objectives of the Plan focused on ecological integrity of the park, conservation and sustainable development, scientific research and setting up a proper administrative unit for the best management of the park. The plan had certain management options such as, institutional arrangement, boundary delineation, resource management, awareness raising, research and training, community involvement and ecotourism promotion. Although the plan was a good, guideline document but was more an operational plan than a management plan. However, it did not thoroughly discuss the appropriate management approaches & strategies, research topics related to park issues, community involvement & ownership, legal & policy support, conflicts and ways for conflict management, boundary delineation & demarcation and sustainable resource use practices.

5.1. Purpose of Establishment

At an average height of 13,000 feet above mean sea level, Deosai Plains are amongst the highest Plateaus in the world, which sustain a remnant population of Himalayan Brown bears in South Asia. The purpose of the Park is to protect the Himalayan Brown bears and their habitat too:

1. Allow the wildlife some relief from humans as predators
2. Provide the wildlife with unrestricted freedom of movement
3. Allow wildlife to feed in the wild according to its instinctive behavior
4. Promote reproduction and well-being of offspring in its natural habitat

A viable population of the Himalayan brown bear is essential to allow the ecological balance to flourish on Deosai Plains to sustain itself. It is common knowledge that endangered species like the brown bear need replenishment in their population. Once the total population of a species falls below a certain threshold level, it is only matter of time before that species faces extinction.

5.1.1. Management system

DNP was notified as national park in 1993, but no proper management system was established, until the time when Himalayan Wildlife Project (HWP) developed a draft management plan for DNP, based on its two years socio-economic and ecological research on the plateau. Financial constraints and lack of a proper management guideline hindered the way of government to keep in place, an appropriate management system.

Legal and management issues aggravated day-by-day but due to some interventions of HWP, such as fodder development, water supply system, awareness about park's resources and trainings in wildlife survey, engrossed the attention and interest of communities for park management. On the basis of these benefits, communities took part in conservation efforts such as wildlife surveys, control on excessive grazing, illegal hunting, extraction of medicinal plants and cutting of natural forests.

Realizing the participation of community as strength, the government, established directorate of the park, at Skardu. Thirteen game watchers, a Divisional Forest Officer (DFO), Range Forest Officer (RFO) under the supervision of WLMO/DFO were placed in the directorate to protect park resources.

On the basis of data collected, and after an intensive consultation with the different stakeholders, HWP proposed in 2005 a zoning plan for the Park Area that includes the following three major Zones for management purposes:

1. Protected zone

The zone which is unaltered with satisfactory, Brown bear population. The main purpose of this zoning is to protect Brown bear in its natural habitat. It comprises the Central and South Eastern part of the Park.

2. Recreational and intensive use zone

This zone is composed of natural and altered areas, including those in need of recovery, at a corridor area on either side of the jeep roads crossing Deosai Plains. It has outstanding landscapes, samples of significant ecosystems and areas of recreation and educational activities. Sheosar Lake is also included in this area. The main aim of this zoning is to increase recreational and educational activities for socio-economic increase livelihood of the communities and especially for the sustainability of the Park.

3. Grazing Zone

The zone consists of the areas where the local population has traditionally grazing rights. It comprises of the area within the park boundaries excluding the protective and recreational zone. The purpose of this zoning is to permit traditional land use for grazing to preserve the economic value of grazing for local communities.

Such activities increased the awareness of local communities and park's administration to further stretch the horizon of activities for conservation of natural resources of the Park. In this course of action, Gilgit--Baltistan Forest and Wildlife Department developed five years (2003-

2008) PC--1 with provision of 26.206 million Pak Rupees. Few interventions of the project, added more to the conservation efforts such as population of Brown bear increased (from 19 animals in 1993 to 73 animals in 2015) as a result of the proper watch and ward mechanism, implementation of Park's. Rules and regulations, research on ecology of the park, boundary pillars placed for the delineation and community involvement in management of the Park resources.

5.2. Existing Management Plan Review

Due to unavailability of a proper management plan of the park for a long time (almost 10 years) the threats to ecology and biodiversity of the park increased. with the passage of time these problems overcome. The directorate of DNP planned to revise the draft management plan, and update it by incorporating the inevitable changes proposed by the participants of the DNP Consultative Workshop, to address the emerging conservation needs of the park and its buffer zone communities. Mainly arising from the social and natural resource dynamics in the area, endeavoring to make the Plan more comprehensive, simple and applicable for improved protection and management of natural resources in Deosai plains.

For this purpose, in November 2007, the Directorate of DNP requested WWF-Pakistan for technical assistance to review and update the HBP drafted Management Plan, mainly based upon its three decadal experience of community-based conservation in Gilgit-Baltistan, on conservation of unique species and fragile ecosystems, for socio-ecological upliftment of the area.

Based on the lessons learnt from this and other such projects, office of the Conservator Parks and Wildlife (Gilgit-Baltistan) intended to revise and update the draft management plan prepared by HWF for GoGB in 2010.

In response to DNP's invitation, WWF initiated the Park management planning process through preliminary consultation with the Directorate of DNP, stakeholder communities and locally active partner organizations in January 2008. Efforts were made to review all available secondary information, identify stakeholders, and explore the existing as well as emerging management issues, administrative problems and conservation impediments. Followed by the community meetings in Astore and Skardu, a daylong consultative workshop was convened at Gilgit in January 15, 2009. After the approval of this MP, the activity of the Directorate became more effective and functional to the objectives that have been underlined in the management prescriptions. Some aspects remain unsolved especially the financial issues and the participatory approach with the local communities, at the same time the absence of an Operational Plan represent a gap that needs to be studied and proposed for the next period of 5 years.

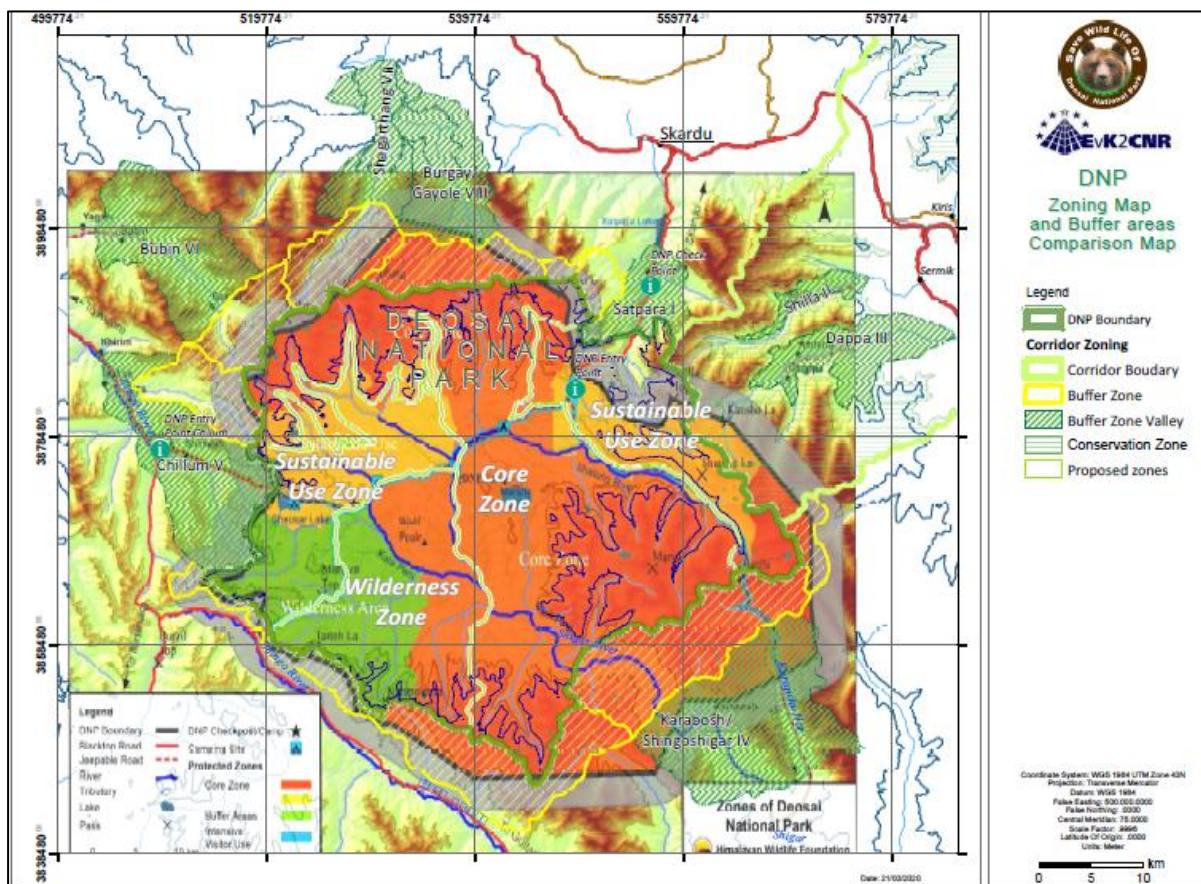
In 2018 started a new project of UNDP for the revise of DNP MP, to redefine the OP, and include the revision of CKNP Management Plan and the update CKNP Operational Plan and considering a connectivity area between two parks.

6. Management Strategies

6.1. Demarcation and Re-notification of Park Boundaries

Since DNP is an area of high ecological priority and is home to rich biodiversity, so its protection and management is essential. In order to resolve these issues and improve the management situation, the following strategic interventions are proposed:

1. Park boundaries have been accurately demarcated using GIS & RS technologies on watershed basis and validated through ground verification jointly with Park authorities and local communities but demarcation of the boundary and construction of boundary pillars remained as bone of contention between Park authorities and Satpara community. This issue should be resolved with proper community consultations and involvement of revenue department with revenue records.
2. The Park boundaries and its proposed buffer zone should be re-notified with nomenclature of “Deosai National Park, Gilgit Baltistan” by the competent authority.
3. Sustainable resource use regulations should be introduced to integrate conservation needs of the Park with livelihood needs of dependent communities, both local and nomad herders.



This map is designed with the GIS data in thisMP, and has been taken as starting point for the new elaborations that take to the delineation of the new boundaries of Deosai National Park.

6.2. Institutional Setup

Currently the Park Directorate is located at Skardu and a check post has been established at Chillum in Astore. The Wildlife Management Officer (BPS 18) looks after the park affairs with a meager proportion of human and material capital. Only 31 Game Watchers and Chowkidars, supervised by an interim Range Forest officer are entrusted to take care of 3000.7 sq. km area in the most tough, rough and remote valleys. Out of the total, only 12 staffs are regular employees, whereas, rests of the 19 are hired on contingency basis. There is a position of the Park Director (BPS 19) but is lying vacant for the last many years. Field staff appointed to protect wildlife during harsh winters has no adequate uniform, equipment and high-altitude winterized shelters. Ev-K2-CNR under MPA project has recently provided some uniform and accessories and field gears such as spotting scope (02), laptop (1), smartphones (10), drone camera (01), binocular (04), uniform (26), and dustbin (12) to field staff, whereas Himalayan Wildlife Foundation had earlier provided igloos to the Park staff which are insufficient as compared to the current needs. Gilgit-Baltistan Health Department has established a First Aid Post at Bara Pani for the summer season only. But still a lot is needed to be done. Due to inadequate capital, lack of equipment and insufficient field support, the Park resources are difficult to manage, and if adequate protection is not provided, the precious resource may become extinct from the Park.

As per notification, DNP falls mainly in the jurisdiction of Skardu district. Its southern and western boundaries just touch the administrative boundaries of Astore in Chillum, Bobin, and Mir Malik Pass. However, contrarily, the communities from both sides equally claim inherent resource use rights inside the park as well as in its buffer zone, and hence demand for equal distribution of benefits in terms of employment opportunities, share in sustainable resource use, Park entry fee and other anticipated benefits from the Park.

These administrative and management issues can be resolved by establishing and strengthening the existing Park directorate and making it accountable for the needful care and conservation of Park and its resources, with the help of following strategic interventions:

1. The vacant position of Park Director and required supervisory as well as field protective staffs should be hired and placed in appropriate offices on emergent basis.
2. Capacities of the protective field staffs improved in biodiversity monitoring, wildlife management techniques from Pakistan Forest Institute (PFI), Wildlife Institute of India (WII), other relevant national and international biodiversity conservation, and management institutes.
3. Financial resource and capacity of the Park Directorate should be amplified manifolds, and mechanisms developed for equitable sharing of benefits amongst traditional Park users in recognition of their conservation efforts and active role in management of Park resources.
4. Park infrastructure including park offices, educational and recreational facilities, should be appropriately established on both sides of the park. Since the Park Directorate is at Skardu so office of the Wildlife Management Officer (WLMO) should be established at Chillum in Astore district, while considering social and ecological sensitivities of the Park.

6.3. Participatory Park Management

Community participation largely has become imperative for better management of common natural resources around the world. In Deosai National Park, local communities have shown their reservations for not being consulted while designing conservation programs and sharing of benefits in the past park management efforts. Therefore, the local communities and other stakeholders have been putting halfhearted efforts and resultantly, the management objectives could not have yielded the desired results. Established in 1993, DNP could not be staged as an exemplary PA with an informed decision support system and protection mechanism. The park was established solely to protect remnant population of endangered Brown bear in Deosai plains. Although its population has increased from **19 in 1993 to 73 in 2015 and on the data collected in the last census in 2019 the number is 88 Brown Bears**. Moreover, the counts of other associated prey and sympatric predator species like ibex, Snow leopard, Lynx, and Wolf has not increased proportionately perhaps due to illegal hunting of prey species and retaliatory killing of predators, which may affect the ecological balance of the park in the longer run.

The buffer zone villages, that has historical use rights inside the Park Area has been putting subsistence pressure on park resources. Majority of the peripheral human settlements of Shilla, Dappa, Stakchan, Shagharthang, Karabosh, Ginyal, Matyal, Gultari, Chillum and Das Khirim are mostly concentrated in close proximity to the core and home range territories of Brown bear. Such type of resource uses, sometimes create and intensify conflicts not only amongst communities but also with the park management.

In order to ensure community participation for improved park management has to ensure effective participation of local communities in decision-making processes as well as in sharing and distribution of tangible and non-tangible benefits from the park. The following management decisions are proposed in this regard:

A Park Management Committee headed by the Secretary Forest Wildlife and Environment, Gilgit-Baltistan should be constituted with representatives from the park administration, GB Forest & Wildlife department, Armed Forces, Directorate of CKNP, Ev-K2-CNR, Gilgit-Baltistan Scouts, HWF, WWF, Police and representatives of locals from the Buffer Zone communities for course correction, strategic direction, dispute management, monitoring and evaluation of the periodical action programs. This committee should decide if a low-level committee specifically for conflict management will be needed and, if so, its composition as well.

Rural youth from different buffer zone valleys should be engaged as wildlife watchers in joint watch & guard system for effective care and conservation of wildlife in the park area.

Local communities should be involved in restoration and improvement of degraded and denuded slopes through community-based forestry plantations of native species and restriction on grazing in critical park habitats.

6.4. Conserve Biodiversity of the Park and Buffer Zone

Deosai National Park is known for its rare and unique species, richness of wild animals, birds and plants. It provides permanent habitat to endangered species of Brown bear (*Ursus arctos*), endemic to western Himalayas in Pakistan. Sheosar Lake and other high-altitude streams, lakes, peat and marshlands of the park are luxurious habitats of migratory birds and waterfowls. Snow leopard, Himalayan ibex, Red fox, Wolf and Golden marmot are amongst other mammal species of the Park. The park and its peripheral areas are unique for medicinal flora, alpine pastures, forests and lake ecosystems, endowed with rich diversity of pine, birch, juniper, scrub, shrubs, bushes and a variety of medicinal and aromatic plants. The following management measure are proposed for the conservation of the biodiversity and joint management of park resources;

- Controlling illegal hunting and killing of prey and predator species
- Establishing an effective watch & guard mechanism involving energetic youth from the buffer zone villages
- Strengthening community-based conservation practices
- Introducing trophy hunting programs in potential buffer zone valleys as an incentive in recognition of the community's support to park management
- Introducing controlled or rotational grazing systems in the resource use zones (pastures) of the park
- Implementing community led pasture management and livestock insurance schemes to stop retaliatory killings of the top predators and to improve pasture health conditions
- Establishing baseline information to know the current status and population of wildlife species inside the park and in its buffer zone habitats, and for their future monitoring
- Conduct regular wildlife surveys, biannually, to appraise population structure and other wildlife ecology related research parameters, for science-based management of the park resources.
- Promotion awareness as a source of education for the people in the species valleys/villages
- Socio-economic development of the custodian communities.
- Promotion of sustainable tourism in the park and other villages.
- Promote the eco-tourism in the buffer zone valleys to develop the tourism interest and opportunities in a sustainable way
- Micro level interventions on health and education improvement activities should be focused in future intervention in the buffer zone valleys
- Concentrated alternative income generation activities to improve living conditions and reduce pressure on local natural resources.

6.5. Integration of Livelihood Needs

As per notification of 1993, Deosai plain is a wilderness park, falling in the Protected Area Category I of IUCN and has been considered a Category II National Park, in this MP. Cutting

of forest resources, trampling of natural regeneration by excessive presence of livestock, illegal hunting of wild animals, birds, and excessive fishing are all restricted within the park boundaries. However, due to remoteness, extreme poverty and harsh climatic conditions, local people, under the customary laws, have been given certain concessions to collect fuel wood and graze their livestock in the park vicinities. The reasons being customary resource use rights and the long tradition of the custodian department's nonscientific clang (grazing fee) based permission for nomadic grazing inside the park, which may ultimately result in a loss of flora and fish species and genetic diversity, degradation of land and aquatic habitats, higher disease transmission from livestock to wildlife and retaliatory killing of predators.

Similarly, encroachment and intensive grazing in important habitats of Brown bear and its associated wildlife, by Gujjar Bakarwals (nomad herders) has also been a serious concern for wildlife in Deosai. Uncontrolled grazing degrades the vegetation cover, and creates disturbance for wildlife. In addition to grass and plants consumed by the livestock, the nomads remove bushes that provide cover to the wildlife and protect the soils from degradation, for use as firewood. Horses and sheep dogs brought in by the Bakarwals threaten the wild animals, which therefore avoid the areas occupied by nomad herders. Although grazing in Deosai (as mentioned earlier) is also a traditional practice of communities living on the northern and eastern borders of the park. The threat to the national park from the Bakarwals is a considerable concern and various areas inside the park which were available to bears had been taken over by the nomads however, from last couple of years the park administration has significantly controlled the invasion of nomads and they are being restricted to their designated grazing areas.

The information collected in 2019 by Ev-K2-CNR through DNP field staff gives a completely different picture as compared to the past. During to 2000-2013 there was over 24% increase in livestock numbers brought by nomads and various park areas such as Phialung and Lamalung located northwest of the Ali Malik entrance to the park and the valleys along the southern boundary of the park east of the Wolf Peak were taken over by nomads. The 2019 data shows a grand total of 1901 animals and 14 dogs that is much lower compare to the 5500 presents in 2013. Probably the presence of Nomads is going to become more sustainable for the environment of the Park.

The areas in use and number of livestock grazed by resident communities (about 1500 sheep and goats) has not increased that fast, yet the park resources are exposed to serious issues of over exploitation due to increased dependency of local communities on park resources to meet some of their basic needs, coupled with grazing by nomads, which will continue but may be lower with decrease of shepherd involved changing life style of the young generations. While desirable from ecological point of view, the traditional or usufruct rights of the Bakarwals are compromised but the international best practices call for special attention to the livelihoods and cultures of indigenous communities (Gujjar Bakarwals may be classified as an indigenous community), while developing strategies.

Therefore, satisfying the local needs depend upon several factors but largely on government policy and commitment to allocate funds to this sector, as well as skill and willingness of the park officials to accommodate the genuine needs of dependent communities while planning for

park management. Undoubtedly, the success of such an approach will depend largely on decisions by the Park authorities. Some of the basic needs of the local communities can be satisfied with the help of following strategic decisions:

1. Natural resource status and basic needs of the local communities in buffer zone valleys of the park should be assessed to explore the potential of various park resources to sustain such needs harmoniously with the local culture and tradition without directly using the park resources.
2. Following the principles of sustainable development and care for culture and rights of indigenous communities, a system of regulated grazing should be developed to achieve the balance between the economic benefit that the Bakarwal community is entitled to and the harm to the environment and habitat of Deosai that results from grazing.
3. Sustainable natural resource use practices should be regulated in the buffer zone outside the national park by establishing a reward mechanism for community stewardship and their participation in the park management (*i.e.*, trophy hunting and *ex-situ* cultivation of medicinal plants etc.)
4. Young and energetic males from the communities of buffer zone valleys of the park should be given preference proportionately in park related employment and other income generating opportunities, whereas, the women folk of both sides should be supported in additional income generation activities *i.e.*, cultivation of medicinal herbs, wool & hair based cottage industry, fruit processing and growing cash crops etc.
5. Non consumptive resource use practices like *ex--situ* cultivation and marketing of medicinally and economically important herbs, eco-tourism promotion, and fruit processing etc. should be encouraged through various projects, where applicable, to support the local economy and livelihoods.

6.6. Tourism Activities

Booming tourism industry in Gilgit-Baltistan is no doubt an economic blessing for the mountain communities of the area, but cost of its repair, if not managed properly, may be manifolds than its sporadic profits, which the future generations may have to pay for. Deosai being one of the highest plateaus in world, a huge number of local, national and international tourists visit the area during summers, but adequate measures have not been taken so far to manage the negative impacts of tourism on the park and its resources. Even the Park lacks facility to collect and dispose-off the garbage and filth appropriately. Solid waste alone, particularly polythene bags have been polluting the natural beauty of the spectacular landscape and having detrimental impacts on Brown bear population and its habitat.

Deteriorating water quality due to air blown paper and plastic wrappers and other wastes is another emerging issue. In order to promote socially acceptable and ecologically responsible tourism activities in the area, the following strategic decisions are suggested:

Visitor service places like roads, tracks, resting and dinning places, information and education facilities, fishing spots and camping sites should be developed in specified zones, to facilitate the visitors and to improve the quality of their experience and safety within the national park.

Trash bins should be placed at the park entry and exit points at Satpara and Chillim for collection and safe disposal of solid wastes, and the waste take-back strategy should be promulgated through signage and other IEC mechanisms.

Tourist information centers should be established at the park entries and equipped fully with park related educational and promotional materials like maps, brochures, pamphlets etc., for visitor's information, education and awareness.

The park staff placed in check posts at the park entry points should be well trained and properly uniformed to strictly check visitors and their vehicles to restrict and confiscate arms, explosives and weaponry, if found carrying any.

Appropriate signage enchanting Park rules and regulations, and ecotourism ethics with internationally accepted standards and symbols, should be displayed for visitor's education at appropriate sites in and outside the park.

Education and Tourism related park staffs and a few educated trained youths from the local communities of Astore, Skardu should arrange various educational, and awareness activities like guided tours, nature study camps, lectures, presentations and documentaries in Tourist information centers for the park visitors.

Recreational zones should be established and equipped to facilitate ecotourism activities like bird watching, wildlife sighting, catch & release fishing etc., for the park visitors.

Camping should be restricted to designated camping sites only and violations strictly dealt with, if occur any inside the Park.

6.7. Single Park Authority

DNP is closer to the border between Pakistan and the Indian held Kashmir, and so for security reasons, Pakistan army and Gilgit-Baltistan Scouts (GBS) are posted in Gultari, Minimerg, Qamari and Kharmang sectors, surrounding the Park. However, there is no evidence of illegal hunt or offence by these forces inside the park yet following their own notions may interfere in the park affairs in and outside the park boundaries. For instance, they may allow some grazers, or stop others in certain areas, due to which local grazers may feel more subject to forces than to park authorities. Consequently, park rules and administration may be relegated to a secondary position or no position at all. Similarly, while they are powerful in terms of legal authority, park watchers dare not to check a Forces vehicle on the park barrier even if they are sure of the presence of a trophy or wildlife carcass in it. Due to this and several other reasons, forces enjoy greater authority than the park administration would do.

Similarly, GB Public Works department has planned to construct several connectivity roads through DNP to provide links to the border villages of Skardu and Astore. Pakistan Air Force had planned to build an airbase in Deosai. Recently, a new inter district connectivity road has been passed through Deosai to link Astore with Skardu. Most of these roads and other infrastructures though provide linkage, connectivity and strategic services to far off border villages and forces but simultaneously, bifurcate the core and home range habitats of the endangered Brown bear and other associated wildlife species of the park, affecting their ecology, behavior and food availability at large.

In order to manage the above situations, the following decisions are proposed:

1. Generally, military activities are discouraged inside National Parks, except for study of military history in relevant PAs. However, locally stationed force units may periodically request the use of NP territory for non--combat exercises. In such a case, the Park Management should have the discretionary decision power to offer or excuse offering the Park area for such activities where appropriate following the Park rules.
2. The park administration should be declared as the top authority for the park, responsible for and authorized to decide on all issues, which either are related to or have possible impact on park resources, especially about visitors and grazers. Their decision should however be considered as final.
3. The local in-charge of Armed forces posted in the vicinity of the national park should be involved in Park management through clear advice from the Force Commander Northern Areas (FCNA) to cooperate with the park officials and assist them in their duty to help protect park resources.
4. Local in-charge of the Army and GBS should be held responsible for the violation of park rules, especially hunting, killing, poaching of wild animals and transportation of their trophies or removing vegetation by the force men inside the park boundaries.

6.8. Linking DNP with Adjacent Protected Areas

Deosai National Park is known for its rare and unique species, richness of wild animals, birds and plants. It provides permanent habitat to endangered species of Brown bear (*Ursus arctos*), endemic to western Himalayas in Pakistan. Sheosar Lake and other high-altitude streams, lakes, peat and marshlands of the park are luxurious habitats of migratory birds and waterfowls. Snow leopard, Himalayan ibex, Red fox, Wolf and Golden marmot are amongst other mammal species of the Park. The park and its peripheral areas are unique for medicinal flora, alpine pastures, forests and lake ecosystems, endowed with rich diversity of pine, birch, juniper, scrub, shrubs, bushes and a variety of medicinal and aromatic plants.

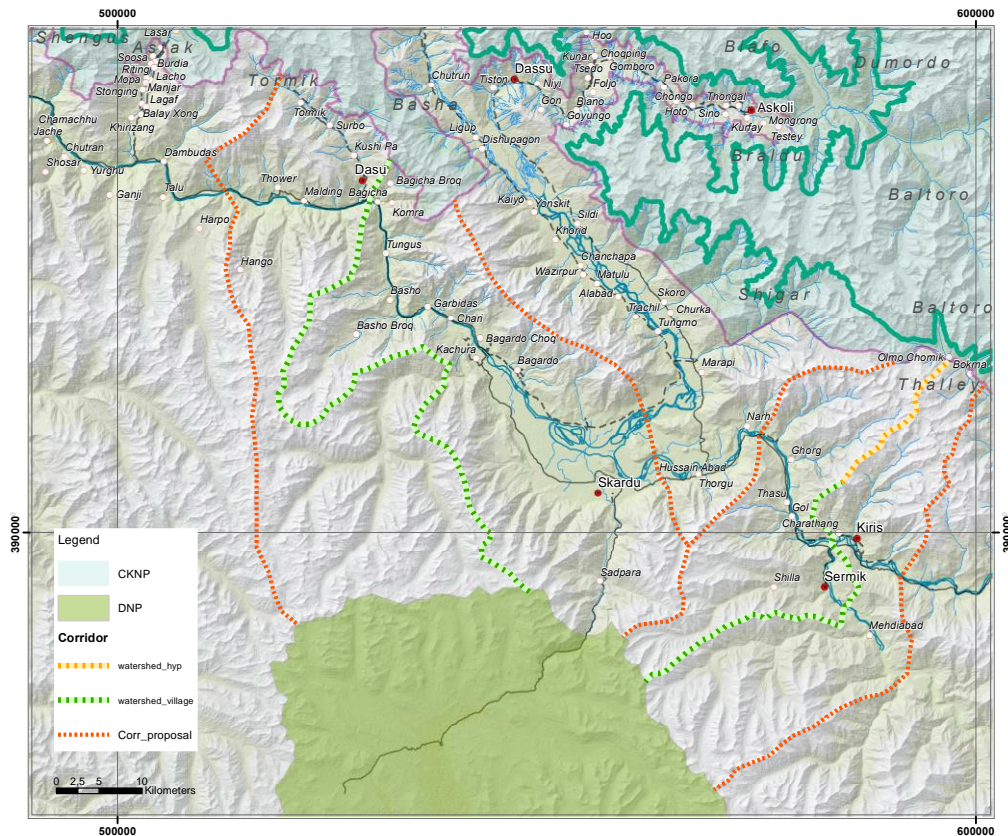
DNP is one of the few places left in Pakistan where endangered Himalayan Brown bear and other endemic species of mammals and birds are found, and their home and territorial ranges extend beyond park boundaries and even the political border between Pakistan and India. Brown bear, the flagship species of DNP has been reported to move from Deosai plains to the highlands of Indian held Kashmir across the border, and is often killed by herders and farmers in retaliation. Apparently being one and the same population, efforts to protect the remnant population of Brown bear in DNP may not be very productive unless it is protected beyond the Park boundaries.

For this purpose, policy support is needed to establish connectivity area between DNP and adjacent protected areas for holistic and improved management of Brown bear and other associated wildlife species, their habitats and ecosystems through a more pragmatic national and sub-regional conservation initiative. Following policy recommendations are proposed in this regard:

Identify, establish and notify major wildlife connectivity corridors, linking DNP to adjacent protected areas for improved protection and management of Brown bear and other associated species in the region.

Facilitate technical organizations to conduct scientific studies, pinpoint key conservation issues, and suggest science-based conservation measure for sustainable management of notified wildlife corridors.

Exhibit 25: Preliminary studies for Connectivity corridors between DNP and CKNP



The wildlife movement registered outside DNP are mainly in two directions but it has been considered for the moment to start with the connectivity area that is shorter and more functional in relation to CKNP, excluding the area of Skardu town that is completely compromised for the environmental aspects.

The studies and proposed Management Options for the connectivity area are reported in the relative document.

6.9. Financial Sustainability

The government has generally struggled to provide budget allocations infrastructure and equipment, and for the operation of protected areas, and the DNP is no exception. Rapid assessment report (2014) points out this as the most serious issue concerning the park operations, as the field protective staff mobilized in the DNP currently lacks the necessary material, equipment, and resources to operate in conditions that are challenging considering

the climate, altitude, and natural terrain of the park. GB is amongst the least developed provinces in the country, where cost of providing basic infrastructure and social services is also comparatively high in view of a challenging mountainous terrain.

Given the general shortage of resources for meeting the operational and developmental requirements of the province, funds available for wildlife management and environment tend to be limited. The park will continue to struggle for resources in these conditions, and there is a risk of the gaps increasing due to inflation and additional requirements for staff and operations associated with an increasing number of visitors. Occasional support from NGOs may help improve the situation but temporarily, if at all.

Therefore, there is a dire need for mobilizing additional resources through internal revenue generation. A level of dependence on the government for meeting the salaries of core management staff and for maintenance and operation of park offices will continue in all likelihood. However, it is possible to generate additional funds through improvement in collection of park entry fees, and permits for recreational fishing. In the long term, camping fees, and collection of fines against violations can supplement these. This approach will reduce the dependence on government funds, and could significantly reduce the shortage of funds currently being faced by the park.

Putting in place a mechanism for utilization of funds collected through internal revenue generation that is transparent and efficient.

7. Management Prescription and Interventions

S.No.	Challenges	Objectives	Management prescription	Actions
1.	Protection of Himalayan Brown Bear and other wild fauna and flora within and outside the territory of the National Park	1. Conservation of the biodiversity of the Park with special focus on Himalayan Brown Bear, and other key species including medicinal plants (within and Buffer Zone of the Park).	<p>1.1. Resource assessment and threat analysis in the Park and its peripheral communities</p> <p>1.2. Establish and strengthen watch and ward mechanism within and Buffer zone/ Buffer zone valleys</p> <p>1.3. GIS based decision support system</p> <p>1.4. Protect Brown Bear concentration areas inside the Park</p>	<p>1.1.1. Baseline surveys (status of the Park and Buffer zone resources)</p> <p>1.1.2. Threats analysis (existing as well as potential)</p> <p>1.2.1. Posting game watchers at critical points of the park</p> <p>1.2.2. Provide needful logistic support to field staff</p> <p>1.2.3. Training and capacity building of the Park's field staff</p> <p>1.2.4. Introduce species monitoring and reporting tools such as GBGeo App</p> <p>1.3.1. Mapping of the Park with its buffer zone and Buffer zone valleys</p> <p>1.3.2. GIS maps showing distribution and concentration of wild fauna and flora</p> <p>1.3.3. Mapping of all high-altitude wetlands within Park, Buffer zone, and Buffer zone valleys</p> <p>1.4.1. Demarcation of Ecological boundaries on the basis of Bear's activities (searching food, refuge, hibernation)</p> <p>1.4.2. GPS reading of the hibernation sites of bears</p> <p>1.4.3. Metaled road running along the edge of the park with tourist's resting areas (without dust bin-each tourist has to carry his left over back with him)</p>

S.No.	Challenges	Objectives	Management prescription	Actions
				<p>1.4.4. Earning support of the adjoining communities, with priority going to communities hosting hibernation sites of bears, through economic and social incentives (Rational spending of the money generated through entry fee that wins the support of community such as hiring community watchers, micro enterprises)</p> <p>1.4.5. Livestock compensation/insurance scheme (Nathiagali model- Establish reserve funding with contribution from the available government endowment fund)</p> <p>1.4.6. Restrict grazing and tourists flow</p>
			1.5. Protect wild flora and faunal habitats from the unsustainable anthropogenic activities such as grazing, and tourism	<p>1.5.1. Restrict the graziers in the notified grazing/ sustainable use zone</p> <p>1.5.2. Restrict the tourists in the notified tourist use zone</p> <p>1.5.3. Management strategies for nomadic herdsmen</p>
2.	Protection of wetlands habitat against fragmentation, encroachment, pollution and other human interventions	Maintain and enhance ecological integrity of the wetlands of Deosai National Park	<p>2.1. Strengthen protection for the wetlands of the Park</p> <p>2.2. Enhance mass awareness and capacity building for line departments and custodian communities</p>	<p>2.1.1. Demarcate wetlands boundary and set up markings and information signs</p> <p>2.1.2. Designate wetland complex as Ramsar Site</p> <p>2.1.3. Strengthen the enforcement of wetland management rules and regulations</p> <p>2.2.1. Conduct public awareness activities in local communities</p> <p>2.2.2. Promote wetlands conservation awareness in educational institutes</p>

S.No.	Challenges	Objectives	Management prescription	Actions
				2.2.3. Trainings for line departments and communities on various issues of wetlands and its management
			2.3. Ensure the utilization of wetland resources in a sustainable manner	2.3.1. Promote controlled grazing 2.3.2. Regulate point sources of land-based pollutants around the wetlands 2.3.3. Protect the wetlands against fragmentation, encroachment and diversion 2.3.4. Develop, implement, promote and regulate wetland eco-tourism
			2.4. Develop linkages and partnerships for wetlands surveys, research and monitoring	2.4.1. Develop linkages with the research institutions 2.4.2. Establishment of wetland ecological monitoring programme
3.	Lack of needful authority and control over Park resources by custodian department	Demonstrate joint management of the Park resources by the major stakeholders for replication of successful conservation approaches in the entire landscape/ ecosystem	3.1. Strengthening institutional setup of the Park	3.1.1. Capacity building of DNP directorate 3.1.2. Placement on vacant and new positions
			3.2. Declaring single Park authority	3.2.1. Strengthening and notifying DNP directorate as single Park authority
			3.3. Establish participatory park management	3.3.1. Establish a Park management committee that is representative of the major stakeholders for the implementation of the Park management plan.
4.		Promote positive communication and mutual trust between custodian department and custodian community for	4.1. Create and maintain a strong social mobilization unit at Park or relevant department level	4.1.1. Ensure the availability of a social mobilization unit. 4.1.2. Although hiring of the most relevant person for the position is a pre-requisite, arrange periodic trainings on the recent developments in social sciences for all relevant staff in the unit

S.No.	Challenges	Objectives	Management prescription	Actions
	Lack of trust and communication mechanism between the Park and people to co-exist	the conservation of biodiversity and sustainability of the park and human development		4.1.3. Ensure for the unit to be in constant touch with the custodian community and maintain a data bank for all villages and history of their interactions
			4.2. Create/strengthen social organization at village and valley levels with enough capacities of social organizations to undertake the activities, suggested by the plan	4.2.1. Undertake surveys to identify existing social organizations, and the potential for creating new organizations 4.2.2. Assess training needs of social organizations with focus on capacities to implement the suggested plan activities, relevant to them; enhancing community income from the existing sources and creating new opportunities of income; and funds management 4.2.3. Assign and support social organizations for undertaking various activities as per the suggested time frame. 4.2.4. Arrange for the monitoring of the progress and further improvement
			4.3. Identify and minimize the negative impacts of conflicting issues over the park and its natural resources	4.3.1. Undertake surveys to identify all conflicting issues in the park, major reasons behind and histories of major events 4.3.2. Make and Prioritize the list of conflicting issues on the basis of the extent of damages to the park 4.3.3. Establish procedure/mechanism to manage current and potential conflicts in the park
			4.4. Promote sustainable development opportunities for the people living in the Buffer Zone Valleys	4.4.1. Improved agriculture practices and livestock rearing 4.4.2. Training of the farmers on modern agricultural production practices, cottage industry and management of livestock and poultry. 4.4.3. Revenue sharing mechanism

S.No.	Challenges	Objectives	Management prescription	Actions
				<p>4.4.4. Promoting and supporting community-based enterprises and tourism</p> <p>4.4.5. Develop VCSDPs of the Buffer zone and Buffer zone valleys</p>
5.	Lack of appropriate regulatory mechanism for Buffer Zone and for Buffer Zone Valleys of the Park	Establish appropriate regulatory mechanisms for proper management of Buffer zone and Buffer zone valleys to avoid conflicts, excessive natural resource use and safe guard the ecology	5.1. develop regulatory mechanism for the management of the proposed Buffer zone and Buffer Zone Valleys	<p>5.1.1. the notification of proposed Buffer zone of the Park by the competent authority</p> <p>5.1.2. Create clear rules and regulations for the management of the Buffer Zone and Buffer Zone Valleys</p> <p>5.1.3. Develop necessary watch and guard mechanism</p>
6.	Lack of park infrastructure and facilities for the staff	Establish, improve and maintain Park infrastructure for the staff	6.1. Develop and improve Park infrastructure and facilities for the staff	<p>6.1.1. Maintenance of existing camp sites of the field staff</p> <p>6.1.2. Develop tourist facilitation and information centers</p> <p>6.1.3. Develop and maintain wildlife watch towers and mountains viewpoints</p> <p>6.1.4. Maintenance of existing and construction of new toilets</p> <p>6.1.5. Subject to land settlement (with Satpara community) construct and maintain boundary pillars</p> <p>6.1.6. Roadside signage</p>
			6.2. Develop park documentation and record	<p>6.2.1 Record history of previous interventions</p> <p>6.2.2. Staff tour diary</p>
			6.3. Control damages by inappropriate construction inside the Park	6.3.1. discourage the construction of the roads, building and restaurants

S.No.	Challenges	Objectives	Management prescription	Actions
7.	Insufficient research data on Park resources to address the management issues of the Park	Promote scientific research as a basis for the management decisions of the Park.	<p>7.1. Identify topics for research on biodiversity (species and their habitats and ecosystems), community dependence and livelihoods, conflicts, climate change impact on Park resources, and local wisdom/indigenous knowledge, for relevant universities/researchers to find research solutions</p> <p>7.2. Develop seasonal and annual monitoring mechanism of key wildlife species</p>	<p>7.1.1. Encourage regional academic institutions (KIU & UOB) to include DNP related issues in their regular field research programs</p> <p>7.1.2. Develop TORs and research program for social and biophysical aspect of the Park</p> <p>7.1.3. Develop indicators for ecosystem health</p> <p>7.1.4. Finalize list of research topics</p> <p>7.2.1 Develop a system to conduct periodic surveys for flora and fauna</p>
8.	Unsustainable tourism activities while generating livelihood activities for the locals also pose hazards to the fragile ecosystems within and adjacent areas of the park	Make and use tourism as an effective tool to generate knowledge, awareness and interest about conservation among visitors and to generate sustainable livelihood options and opportunities for the people of the park	8.1. Regulate and promote tourism as a source of joy and knowledge for the visitors and a sustainable income opportunity for both park and people	<p>8.1.1. Display Park ethics, and develop publicity material and gifts such as key chains, mugs etc. and interpretation materials about the park and each of its component for the education and awareness of visitors that has certain ecological, biological, geological, cultural or some other significance/interest (cost of development shall include in the entry fee)</p> <p>8.1.2. Develop information sheets about the park with maps showing the location and access of points that are/could be of interest to the visitors indicating red zones where tourists shall not be allowed to go/stay. (cost shall include in the entry fee)</p> <p>8.1.3. Hire and train the local youth on the park resources and register as guides who shall accompany the groups to see and know more about the park resources and also make sure that the tourists are not involved in activities that are injurious for the park , its resources and reputation as a peaceful environment</p>

S.No.	Challenges	Objectives	Management prescription	Actions
				<p>8.1.4. Manage to register all visitors of the park and record the reason for them to visit the park. Registered visitors shall be entitled to receive a pack with information sheet and interpretation booklet</p> <p>8.1.5. Discourage non-serious visitors by imposing entry fee that is comparable to other good parks of the world. Rs 300 per person coming from outside of GB; 100 per for visitors of GB and USD20 for foreigners. This could be further evaluated by the department, including other groups that are deemed essential to be charged.</p> <p>8.1.6. Introduce a system of banning those visitors in the future who have been reported for misconduct or other negative activities</p> <p>8.1.7. Maintain a record of all visitors with periodic analysis to know the trends, opinion of visitors, their likes and dislikes, behavior of park staff, guides etc. for needful correction (Questionnaire must be provided in the pack for visitors to fill and return while leaving the park)</p>
			8.2. Control various sources of pollution	<p>8.2.1. Establish a dedicated waste management system for the Park</p> <p>8.2.2. Awareness raising of tourist and other stakeholders</p> <p>8.2.3 Restrict grazing near water bodies</p> <p>8.2.4. Ban on plastic inside the Park</p> <p>8.2.5. Ban on the dustbin along the road and camp sites</p> <p>8.2.6. Restrict movement of heavy traffic</p> <p>8.2.7. Identify and establish the waste dumping sites</p> <p>8.2.8. Installation of an incinerator</p>

S.No.	Challenges	Objectives	Management prescription	Actions
				8.2.9. Adapt polluter pay approach
9.	Lack of awareness in use of natural resources	Promote awareness and natural resource conservation education for various stakeholders	9.1. Develop and implement education and awareness programmes	9.1.1. Develop, print and disseminate education and awareness 9.1.2. Develop documentaries on DNP 9.1.3. Establishment of environment clubs at various education institutes (School, colleges) around DNP 9.1.4. Disseminate information through DNP website and social media pages 9.1.5. Awareness raising of the road contractors on the Park resources
10.	Lack of connectivity between Protected Areas	Explore and establish connectivity areas between DNP and other ecological sites	10.1. Identify, map and develop management guidelines for various connectivity areas	10.1.1. Identify the possible connectivity options between DNP and other Protected Areas 10.1.2. Identify and develop various wildlife corridors within the Park for habitat connectivity
11.	Lack of Park monitoring and evaluation mechanism	Develop and maintain monitoring and evaluation system for DNP Directorate and its resources	11.1. Establish internal monitoring system	11.1.1. M&E system for the Park staff 11.1.2. M&E system for the implementation of the management and operational plans 11.1.3. M & E system for socioeconomic aspects 11.1.4. M & E system for biophysical aspects 11.1.5. Fixed point photograph monitoring system 11.1.6. Remote sensing and GIS based monitoring system 11.1.7. Initiation of radio-collaring
12.	Financial sustainability of the Park	Ensure financial sustainability	12.1. Revise and implement fees	12.1.1. Revise and regularize fees schedule i. Park entry fee

S.No.	Challenges	Objectives	Management prescription	Actions
				ii. Grazing fee iii. Angling fee iv. Camping Fee
			12.2. Draw on Government Development Funds	12.2.1. Preparation of new project proposals/ PC1s
			12.3. Draw on district government development fund and other potential avenues	12.3.1. Explore new sources of funding by holding donors conference

1. Conservation of the biodiversity with special focus on Himalayan Brown Bear, and other key species including medicinal plants (within and outside the Park boundary)

The Deosai plateau is one of the potential habitats of Himalayan Brown bear not only in Pakistan but also in the whole of Asia. It also harbors significant populations of some other important wildlife species such as; Snow leopard, Himalayan ibex, Tibetan wolf, Red fox, Musk deer and Ladakh urial (HWF, 2014)⁹. With a growing human population enjoying improvised life styles in the park's peripheries, its biodiversity has been facing many threats, including the following:

- a) Un-natural deaths of Brown bear due to direct killing and food losses
 - b) Overgrazing of pastures by livestock of the local and nomad herders
 - c) Un sustainable developments and encroachments, resulting in the shrinkage of natural habitats.
 - d) Habitat disturbance caused by sheep dogs and other pet animals taken into the park by local as well as nomadic herders
- 1.1.** Resource assessment and threat analysis in the Park and its peripheral communities
 - 1.1.1. Baseline surveys (status of the Park and Buffer zone resources)
 - 1.1.2. Threats analysis (existing as well as potential)
 - 1.2.** Establish and strengthen watch and ward mechanism within and Buffer zone/ Buffer zone valleys

In order to control poaching and hunting of wildlife in general and killing of Brown bears in particular, establish and operationalize a strong joint watch and guard system through;

- 1.2.1. Posting game watchers at critical points of the park
 - 1.2.2. Provide needful logistic support to field staff
 - 1.2.3. Training and capacity building of the Park's field staff
 - 1.2.4. Introduce species monitoring and reporting tools such as GBGeo App
- 1.3.** GIS based decision support system

GIS has now become an important decision support tool for science-based management of natural resources, particularly in Protected Areas. Most of the experts globally are using GIS based environmental databases to collect, arrange, analyze and interpret scientific information about key research parameters to make informed decisions for natural resource management, including wildlife conservation. Unfortunately, the directorate of DNP is still lacking in any such facilities. Considering the fact that the state of natural resources in and around the park is dynamic, communities living in the peripheries, so, to monitor ever-changing conditions of both the natural resource and the community, the park management should have an appropriate GIS decision support system available for implementation. In order to do so, the plan suggests the following activities:

- 1.3.1. Mapping of the Park with its buffer zone and Buffer zone valleys
- 1.3.2. GIS maps showing distribution and concentration of wild fauna and flora
- 1.3.3. Mapping of all high-altitude wetlands within Park, Buffer zone, and Buffer zone valleys

⁹ Himalayan Wildlife Foundation, December 2014, Ecological Baseline of Deosai National Park

1.4. Protect Brown Bear concentration areas inside the Park

The part of the Park, where there is a greater concentration of Brown bears being highly sensitive; should be protected and restricted for all of the following activities

- 1.4.1. Demarcation of Ecological boundaries on the basis of Bear's activities (searching food, refuge, hibernation)
- 1.4.2. GPS reading of the hibernation sites of bears
- 1.4.3. Metaled road running along the edge of the park with tourist's resting areas (without dust bin-each tourist has to carry his left over back with him)
- 1.4.4. Earning support of the adjoining communities, with priority going to communities hosting hibernation sites of bears, through economic and social incentives (Rational spending of the money generated through entry fee that wins the support of community such as hiring community watchers, micro enterprises)
- 1.4.5. Livestock compensation/insurance scheme (Nathiagali model- Establish reserve funding with contribution from the available government endowment fund)
- 1.4.6. Restrict grazing and tourists flow

1.5. Protect wild flora and faunal habitats from the unsustainable anthropogenic activities such as grazing, and tourism

Deosai is losing its ecological characteristics day-by-day just because of the excessive use of Park's resources by communities and visitors. The major impact of such anthropogenic activities is directly on the resident wildlife populations, particularly that of Himalayan Brown bear, so to help the park, maintain its ecological balance and integrity and to control undesired human activities, the park should have the grazing and tourist zones notified; for which the plan suggests the following actions;

- 1.5.1. Restrict the graziers in the notified grazing/ sustainable use zone
- 1.5.2. Restrict the tourists in the notified tourist use zone
- 1.5.3. Management strategies for nomadic herdsmen

2. Maintain and enhance ecological integrity of the wetlands of DNP

The Park has quite a few aquatic resources such as wetlands, streams and peat lands, as major components of the Park's wetland ecosystems. With the growing population and development interventions, there may be diversions, encroachments and fragmentation of the habitat. There have been many disturbances to the aquatic resources and habitats as a result of the road construction, hydro power installation and traffic flow etc.

2.1. Strengthen protection for the wetlands of the Park

Due to increased number of visits to the Park, the wetlands ecosystems are at a greater risk of being degraded with consequent loss of associated biodiversity. This needs greater attention and protection. The following measures are suggested to avert these risks.

To safeguard the Park from such disturbances; it is essential to take the following actions;

- 2.1.1. Demarcate wetlands boundary and set up markings and information signs

Clear demarcation of the wetland boundary is important for implementing management activities in the area. The area of water body and its immediate catchment should be demarcated in collaboration with concerned communities and line departments with help from GIS laboratory. This would include the following:

1. The functional zones of the wetland and functions of each zone should be identified. to establish core, buffer and outer zones.
2. Concerned departments carry out demarcation of the wetland boundaries in the presence of relevant NGOs and local CBO representatives.
3. Stones or trees should be used as boundary markers to define the area of the wetland
4. Approximately 10 signboards (international protected areas symbols) with information on wetlands and their regulations should be created at sites to facilitate visitors.

2.1.2. Designate wetland complex as Ramsar Site

2.1.3. Strengthen the enforcement of wetland management rules and regulations

1. The watch and ward mechanism already prescribed in this plan should be used to report both legal and illegal activities in the wetlands areas and prompt action should be taken by the concerned government authority.
2. Cooperation with the public administration should be strengthened since they are crucial in law enforcement and hence in the successful implementation of the management plan.

2.2. Enhance mass awareness and capacity building for line departments and custodian communities

2.2.1. Conduct public awareness activities in local communities

Public awareness and education are important for successful management of wetlands and therefore are an integral component of this plan. The following measures will be considered:

1. Public awareness initiatives focused on wetlands biodiversity and resource conservation should be conducted in consultation with stakeholders. By arranging environmental awareness events in Skardu and in communities adjoining the Park, the public will be educated about the negative impacts of solid waste, water pollution and overgrazing of the pastures.
2. Information boards and posters on the protection of wetlands should be erected along the wetland's boundaries, at strategic locations used by visitors and in local communities adjoining the Park.
3. Posters and banners regarding wetlands conservation should be placed in regional Polo festivals.
4. Articles and awareness programme about wetlands in general and Deosai in particular should be included in local newspapers and radio from time to
5. Time in order to make people aware of wetland conservation issues.
6. Focused environmental awareness initiatives should be launched for the nomadic Gujjars who graze their livestock intensively in the Park so that the issue of over-grazing leading to surface run-off and sedimentation can be addressed.

2.2.2. Promote wetlands conservation awareness in educational institutes

A few awareness raising school events in the vicinity of Deosai National Park have already been conducted by Pakistan Wetlands Programme and other projects of WWF-Pakistan. Activities focused specifically on all aspects of wetlands should be introduced in area schools as part of their environmental education. The following measures are recommended:

1. Training of school's teachers in imparting environmental education in schools, with special emphasis on wetlands. This could include guidelines on how to establish and run Green Clubs, which instill the spirit of nature conservation in students.
2. NGOs and Park management should jointly arrange lectures by both invited guests and local teachers; organize poster competitions and role-plays among students where they represent different stakeholders, documentaries and small exhibitions on wetland biodiversity and sustainable use of resources, and other activities suggested by children and teachers. Community members should be invited to attend these activities from time to time in order to enhance the level of their awareness regarding wetlands resources and the services they are offering for their livelihoods in these remote areas.

2.2.3. Trainings for line departments and communities on various issues of wetlands and its management

To enhance the capacity of the Forest and Fisheries departments and the local communities in managing the Deosai wetlands, the following capacity building measures should be undertaken:

1. Workshops, trainings and exposure visits for concerned line departments should be arranged from time to time, which focus on various wetlands issues and management. The trainings should be conducted in the area itself or nominated persons could be sent to other regions for specialized trainings. Exposure visits should be conducted to observe successful examples of wetlands conservation elsewhere in the country.
2. Workshops for the custodian communities on subjects that would facilitate them in wetlands conservation should be carried out on a need basis. Subjects could range from pasture management to eco-tourism development and from income generation from medicinal plants to fishes.

2.3. Ensure the utilization of wetland resources in a sustainable manner

2.3.1. Promote controlled grazing

The communities and the nomads should be sensitized about the need for controlled grazing in order to avoid further degradation of pastures and improve their floral diversity and biomass in order to support the wild fauna. The continued practice of this system should also be ensured. This could be achieved through:

1. Meetings with grazers to promote interest in practicing-controlled grazing.
2. This would include both the local communities and the seasonal nomads who exert a great pressure on the wetland's pastures of the Park, especially during the summer season.
3. Discuss different incentives with the grazers in order to create a positive environment for rotational grazing practices.
4. One of them may be to allocate rehabilitated pastures to grazers in compensation for controlled pastures

5. After consultation with all stakeholders, design and implement a feasible rotational grazing system in the Park.
6. Form a committee comprising of local communities, grazers and Park staff to ensure the continued implementation of controlled grazing

2.3.2. Regulate point sources of land-based pollutants around the wetlands

The following actions should be taken in this regard

1. In cooperation with the concerned line departments and other stakeholders, the sources of all land-based pollutants should be positively identified for further research and management.
2. Camping sites should be removed from the banks of Sheosar Lake and Bara Pani to other suitable places within the Park. These can be identified in close consultation with Park staff and the camping professionals.
3. The immediate vicinity of Sheosar Lake and big streams of the Park should be closed to grazing through mutual agreement with the villagers
4. Visitors and tourists should be educated against throwing garbage into the lakes and streams and urinating beside the water bodies.
5. During and at the end of summer season the Park management with the assistance of local communities should clean up pollutants and properly dispose them

2.3.3. Protect the wetlands against fragmentation, encroachment and diversion

2.3.4. Develop, implement, promote and regulate wetlands eco-tourism

Wetlands provide an interesting and unique resource to promote tourism, and particularly eco-tourism. A number of national and international tourists visits Deosai National Park every year, but so far, no concerted eco-tourism promotion efforts have been undertaken. Actions to achieve this initiative will include:

1. A carrying capacity analysis should be conducted to calculate how many visitors the Park's wetlands, both along the main route and those away from it can accommodate in a given season.
2. Publicity material about the Park's wetlands should be placed at main urban centers like Gilgit and Skardu where it will be accessible to most potential tourists
3. Visitors should be facilitated in enjoying the wilderness of the Park, its unique biodiversity and the high-altitude wetlands. These may include, but not limited to, wild flora and fauna/avi-fauna viewing and hikes by installing proper information boards within the Park and indicating permissible routes. The sign and information boards should follow international protected areas symbols.
4. Tourist guides should be trained in eco-ethics for orienting tourists to the Park and its wetlands. In addition, local jeeps and drivers should also be made aware of the uniqueness of the region.

2.4. Develop linkages and partnerships for wetlands surveys, research and monitoring

The best management is one, which is based on sound scientific facts and figures, so that such research is essential for Deosai National Park management. There is great potential for surveys and research on topics related specifically to the variety of wetlands found at the Park. The need is to tap this potential through promoting wetlands at national and international levels and contribute to the proper management of these wetlands. This could be achieved in the following ways:

2.4.1. Develop linkages with the research institutions

Formal contacts in the form of MOUs should be established with universities and other research institutions in the country and abroad to conduct wetlands research in this region. The results should be shared with management and other stakeholders so that effective management options could be devised. The following areas of research are important and should be emphasized. However, other areas may also be suggested.

1. Demarcation and boundary delineation of the wetlands of Deosai National Park
2. Quantification of ecological, social and economic benefits generated by the wetlands of Deosai
3. Study of water birds, both resident and migratory, that depend on Deosai wetlands. In addition, re-evaluate Deosai for Ramsar status.
4. The role of wetlands in the life cycles of fish found in the rivers and streams of Deosai
5. Detailed study of the food webs supported by Deosai wetlands
6. Study the peat lands of Deosai National Park
7. Development and utilization of medicinal plants found in or around the Deosai wetlands
8. Interaction between the brown bear, fish and other biota of the wetlands
9. Marketing potential of natural resources such as fish and medicinal plants by communities living adjacent to the Park.

2.4.2. Establishment of wetland ecological monitoring programme

Ecological monitoring of wetlands will provide up-to-date information about the status and quality of the environment and biodiversity within the area. Monitoring also helps the management to understand change and can be used to design and adjust management strategies to prevent degradation of wetlands and the species they support. Actions to be undertaken will include:

1. A comprehensive ecological monitoring programme should be designed in accordance with international standards. The following environmental factors should be included:
 - a) Biodiversity: monitoring of floral species, their quantity, pastures biomass (outputs) and structure of the vegetation, birds (with an emphasis on water birds), insects, mammals, and reptiles.
 - b) Chemical and physical environment: including water quality (pH, TDS, salinity, dissolved O₂, total nitrogen, total phosphorus, selected heavy metals), changes in water level and weather factors (light, temperature, rainfall and unusual weather).
 - c) Anthropogenic (socio-economic) conditions: including changes in the area of agricultural land, marginal forest and adjacent developments (livestock sheds), local population
2. Biodiversity and anthropogenic monitoring will be conducted once every year, whereas water quality assessment will be conducted a number of times every year.
3. The following research methods will be adopted for monitoring:
 - a. Fixed point monitoring: fixed ecological monitoring stations will make the data comparable and sequential.
 - b. Fixed time monitoring: the parameters for measurement will be monitored in fixed time, so that the results obtained during a given monitoring are comparable with that of last monitoring.

3. Demonstrate joint management of the Park resources by the major stakeholders for replication of successful conservation approaches in the entire landscape/ ecosystem

3.1. Strengthening institutional setup of the Park

Currently the Park Directorate is located at Skardu and a check post has been established at Chillum in Astore. The Wildlife Management Officer (BPS 18) looks after the park affairs with a meager proportion of human and material capital. Only 31 Game Watchers and Chowkidars, supervised by a Range Forest officer (BPS 14) are entrusted to take care of 3626 sq. km area in the most tough, rough and remote valleys. Out of the total, only 12 staffs are regular employees, whereas, rests of the 19 are hired on contingency basis. There is a position of the Park Director (BPS 19) but is lying vacant for the last many years. Field staff appointed to protect wildlife during harsh winters do not have adequate uniform, equipment and high-altitude winterized shelters. Pakistan Wetlands Program (PWP) has recently provided some uniform and accessories to the field staff, whereas Himalayan Wildlife Foundation has been providing necessary field gears and igloos to the Park staff on need basis. A First Aid Post has been established at Bara Pani by Gilgit--Baltistan Health Department for the summer season only. But still a lot is needed to be done. Due to inadequate capital, lack of equipment and insufficient field support, the Park resources are difficult to manage, and if adequate protection is not provided, the precious resource may become extinct from the Park.

As per notification, DNP falls mainly in the jurisdiction of Skardu district. Its southern and western boundaries just touch the administrative boundaries of Astore in Chillum, Bobin, and Mir Malik Pass. However, contrarily, the communities from both sides equally claim inherent resource use rights inside the park as well as in its buffer zone, and hence demand for equal distribution of benefits in terms of employment opportunities, share in sustainable resource use, park entry fee and other anticipated benefits from the park.

These administrative and management issues can be resolved by establishing and strengthening the existing park directorate and making it accountable for the needful care and conservation of park and its resources, with the help of following policy interventions:

- 3.1.1. Capacity building of DNP directorate
- 3.1.2. Placement on vacant and new positions
- 3.2. Declaring single Park authority**

DNP is closer to the border between Pakistan and the Indian held Kashmir, and so for security reasons, Pakistan army and Gilgit-Baltistan Scouts (GBS) are posted in Gultari, Minimerg, Qamari and Kharmang sectors, surrounding the Park. However, there is no evidence of illegal hunt or offence by these forces inside the park yet following their own notions may interfere in the park affairs in and outside the park boundaries. For instance, they may allow some grazers, or stop others in certain areas, due to which local grazers may feel more subject to forces than to park authorities. Consequently, park rules and administration may be relegated to a secondary position or no position at all. Similarly, while they are powerful in terms of legal authority, park watchers dare not to check a Forces vehicle on the park barrier even if they are sure of the presence of a trophy or wildlife carcass in it. Due to this and several other reasons, forces enjoy greater authority than the park administration would do.

Similarly, GB Public Works department has planned to construct several connectivity roads through DNP to provide links to the border villages of Skardu and Astore. Pakistan Air Force had planned to build an airbase in Deosai. Recently, a new inter district connectivity road has been passed through Deosai to link Astore with Skardu. Most of these roads and other infrastructures though provide linkage, connectivity and strategic services to far off border villages and forces but simultaneously, bifurcate the core and home range habitats of the endangered Brown bear and other associated wildlife species of the park, affecting their ecology, behavior and food availability at large.

In order to manage the above situations, the following measures are proposed

3.2.1. Strengthening and notifying DNP directorate as single Park authority

3.3. Establish participatory park management

Community participation largely has become imperative for better management of common natural resources around the world. In Deosai National Park, local communities have shown their reservations for not being consulted while designing conservation programs and sharing of benefits in the past park management efforts. Therefore, the local communities and other stakeholders have been putting halfhearted efforts and resultantly, the management objectives could not have yielded the desired results. Established in 1993, DNP could not be staged as an exemplary PA with an informed decision support system and protection mechanism. The park was established solely to protect remnant population of endangered Brown bear in Deosai plains. Although its population has increased from 19 in 1993 to 73 in 2015 and on the data collected in the last census in 2019 the number is 88 Bears. Moreover, the counts of other associated prey and sympatric predator species like ibex, Snow leopard, Lynx, and Wolf has not increased proportionately perhaps due to illegal hunting of prey species and retaliatory killing of predators, which may affect the ecological balance of the park in the longer run.

The buffer zone villages, that has historical use rights inside the park area has been putting subsistence pressure on park resources. Majority of the peripheral human settlements of Shilla, Dhappa, Stakchan, Shagharthang, Karabosh, Ginyal, Matyal, Gultari, Chillim and Das Khirim are mostly concentrated in close proximity to the core and home range territories of Brown bear. Such type of resource uses, sometimes create and intensify conflicts not only amongst communities but also with the park management.

In order to ensure community participation for improved park management has to ensure effective participation of local communities in decision-making processes as well as in sharing and distribution of tangible and non-tangible benefits from the park. The following management decisions are proposed in this regard:

A Park Management Committee headed by the Secretary Forest, Gilgit-Baltistan should be constituted with representatives from park administration, GB Forest & Wildlife department, Armed Forces, Directorates of DNP and CKNP, Ev-K2-CNR, Gilgit--Baltistan Scouts, HWF, WWF, Police and representatives of local communities from Skardu and Astore, for course correction, strategic direction, dispute management, monitoring and evaluation of the periodical action programs. This committee should decide if a low-level committee specifically for conflict management will be needed and, if so, its composition as well.

Rural youth from different buffer zone valleys should be engaged as wildlife watchers in joint watch & guard system for effective care and conservation of wildlife in the park area.

Local communities should be involved in restoration and improvement of degraded and denuded slopes through community-based forestry plantations of native species and restriction on grazing in critical park habitats.

- 3.3.1. Establish a Park management committee that is representative of the major stakeholders for the implementation of the Park management plan with the following ToRs
 - a) Periodically review progress and challenges
 - b) Identify and discuss gaps and propose solutions
 - c) Take voluntary actions on relevant management activity and, where possible facilitate implementation

4. Promote positive communication and mutual trust between custodian department and custodian community for the conservation of biodiversity and sustainability of the park and human development

- 4.1. Create and maintain a strong social mobilization unit at Park or relevant department level
 - 4.1.1. Ensure the availability of a social mobilization unit, under a qualified social scientist, to DNP for tackling any social issue before it gets chronic and becomes a barrier in achieving the park objectives
 - 4.1.2. Although hiring of the most relevant person for the position is a pre-requisite, arrange periodic trainings on the recent developments in social sciences for all relevant staff in the unit
 - 4.1.3. Ensure for the unit to be in constant touch with the custodian community and maintain a data bank for all villages and history of their interactions
- 4.2. Create/strengthen social organization at village and valley levels with enough capacities of social organizations to undertake the activities, suggested by the plan.

Social organizations are aimed at facilitating community efforts for community development. CBOs works through people-centered modes of conservation and development such as management of natural resources, plantation campaigns, development of valley conservation and sustainable development plans, availability of micro-finance, community participation in development ensuring community health education and infrastructure improves over time. The social organizations in the buffer zone valleys of the park can implement, and monitor VCSDPs and provide technical and financial help to the communities. Community organizations positively affect the process of rural change i.e. conflict resolution, community involvement in conservation, increase in income, improvement in health, nutrition and literacy status of the populations. But the social organizations in the buffer zone valleys need to strengthen through trainings and involvement in park's projects and programs. This may lead to the development of better communication and trust between custodian department and the custodian communities. In some valley's organizations do exist but they are not legally registered and in some villages the organizations even don't exist. It is suggested that more

social organizations be formed, registered and strengthened in buffer zone valleys of DNP to increase community participation and effectiveness in conservation, development and participatory park management.

- 4.2.1. Undertake surveys to identify existing social organizations, and the potential for creating new organizations
- 4.2.2. Assess training needs of social organizations with focus on capacities to implement the suggested plan activities, relevant to them; enhancing community income from the existing sources and creating new opportunities of income; and funds management
- 4.2.3. Assign and support social organizations for undertaking various activities as per the suggested time frame.
- 4.2.4. Arrange for the monitoring of the progress and further improvement

4.3. Identify and minimize the negative impacts of conflicting issues over the park and its natural resources

Establishment of protected areas such as national parks often led to human-wildlife conflicts. The challenges and conflicting issues are several and need to be addressed and manage. DNP possess multi stakeholders' interests such as peripheral communities and their livelihood, grazing issues and land settlement issues, human wildlife conflicts, nomads and their livestock often involve in illegal activities and their historical relation with Deosai, presence of armed forces inside and around the park and development projects inside the park. The plan suggests to extend the scope of the park to the neighboring valleys since the park itself is not sufficient for long term revival of the bear population in terms of its genetic connectivity to disperse populations and involve all relevant stakeholders in the management and consultations. The livelihood of the buffer zone valleys needs to be ensured so that win-win scenarios are created from conservation and communities and other relevant stakeholders-based perspectives.

- 4.3.1. Undertake surveys to identify all conflicting issues in the park, major reasons behind and histories of major events
- 4.3.2. Make and Prioritize the list of conflicting issues on the basis of the extent of damages to the park
- 4.3.3. Establish procedure/mechanism to manage current and potential conflicts in the park

4.4. Promote sustainable development opportunities for the people living in the Buffer Zone Valleys

In the remote villages of DNP subsistence agriculture and livestock rearing are the primary sources of livelihood. No adequate health facilities are available. Skin, respiratory and gastrointestinal diseases are quite common amongst the villagers and literacy rate is very low.

The area being remote, far off and harsh, the resident community is highly dependent on local natural resources for their livelihood. Having no alternatives, the poor villagers often chop the scattered bushes and shrubs, commonly Artemisia for fuel wood and use medicinal plants against common ailments.

The valleys are generously bestowed with lush green alpine pastures, unique wildlife species, snow covered peaks, glaciers, treks, steams and fertile land, offering immense opportunities to promote eco-tourism, dairy farming and organic seed production of potato. The area falls in single cropping zone

and traditional farming system is still in practice. Because of single cropping and fragmented agricultural land, local population relies on subsidized wheat supplied from the down country and markets in district headquarter for other food commodities. The valleys remain snowbound in winter; therefore, they stock food, fodder and fuel wood to cope with the freezing winter.

The plan suggests the following income generating sources and ways to improve living conditions of the people in this regard:

- 4.3.1. Improved agriculture practices and livestock rearing
- 4.3.2. Training of the farmers on modern agricultural production practices, cottage industry and management of livestock and poultry.
- 4.3.3. Revenue sharing mechanism
- 4.3.4. Promoting and supporting community-based enterprises and tourism
- 4.3.5. Develop VCSDPs of the Buffer zone and Buffer zone valleys

5. Establish appropriate regulatory mechanisms for proper management of Buffer zone and Buffer zone valleys to avoid conflicts, excessive natural resource use and safe guard the ecology

- 5.1.** Develop regulatory mechanism for the management of the proposed Buffer zone and Buffer Zone Valleys

The proposed Buffer zone around DNP are designed to maintain ecological integrity and to ensure community participation in biodiversity conservation. The buffer zone hosts majority of the brown bear population and hence needs to be regulated and protected. The proposed buffer zone is least disturbed and developed with important habitats of wildlife such as Brown Bear, Wolves, Ibex and marmot. The area needs to be officially notified as Buffer Zone of Deosai National Park, Gilgit Baltistan, with clear rules and regulation and watch and ward mechanism. It is expected that proper management of these areas will lead to an increase in the population of the Brown Bear, as well as meet the objectives of the National Park.

- 5.1.1. the notification of proposed Buffer zone of the Park by the competent authority
- 5.1.2. Create clear rules and regulations for the management of the Buffer Zone and Buffer Zone Valleys
- 5.1.3. Develop necessary watch and guard mechanism

6. Establish, improve and maintain Park infrastructure

- 6.1.** Develop and improve Park infrastructure and facilities for the staff

Park infrastructure and facilities including park offices, educational and recreational facilities, should be appropriately established inside and on both sides of the park such as maintenance of offices, construction of toilets and tourist facilitation centers. Physical infrastructure is necessary for achieving the overall vision of the DNP. Roadside signage makes an effective communication and guidance to the tourists and visitors about the park and ultimately enhances the identity of the organization. The signage should be installed at sites where they make some sense with consistent look and appropriate material to connect the place with national park vision. Boundary pillars are necessary to save the park

resources from encroachment, enhancing identity and authority of the park and for that land settlement issue with Satpara community need to resolve in the Park infrastructure are needed in accordance with the needs, especially when the outreach activities are most likely to attract more and more tourists to the Park.

Exhibit 26:Details of DNP physical infrastructure facilities

S.No.	Description	Location	Status remarks
1	Park Directorate/WLMO office	Skardu	Building maintenance and office furniture required
2	Park entry Point/ DNP Check Post	Satpara	Building maintenance, furniture, 02 toilets and tourist facilitation center required
3	Park entry Point/ DNP Check Post	Chillum	Water supply and tourist facilitation center required
4	Nursery	Chillum	Need to make it operational
5	Camp office	Bara Pani	Building maintenance, furniture and establishing a tourist facilitation center
06	Camping sites	Shatung, Bara Pani, Kala Pani, Sheosar lake	Maintenance of all existing toilets, water supply for camps, parking place and construction of 12 new toilets required

- 6.1.1. Maintenance of existing camp sites of the field staff
- 6.1.2. Develop tourist facilitation and information centers
- 6.1.3. Develop and maintain wildlife watch towers and mountains viewpoints
- 6.1.4. Maintenance of existing and construction of new toilets
- 6.1.5. Subject to land settlement (with Satpara community) construct and maintain boundary pillars
- 6.1.6. Roadside signage
- 6.2.** Develop Park documentation and record
 - 6.2.1. Record history of previous interventions
 - 6.2.2. Staff tour diary
- 6.3.** Control damages by inappropriate construction inside the Park
 - 6.3.1. discourage the construction of the roads, building and restaurants

7. Promote scientific research as a basis for the management decisions of the Park.

- 7.1.** Identify topics for research on biodiversity (species and their habitats and ecosystems), community dependence and livelihoods, conflicts, climate change impact on Park resources,

and local wisdom/ indigenous knowledge, for relevant universities/ researchers to find research solutions

To conduct scientific research in various fields i.e., biodiversity, wetlands and complex socio-economic strata; the Park management will identify appropriate topics for field research and will develop linkages with relevant local, national and international research organizations, Institutes and Universities. For this purpose, all the leading national and international organizations will be contacted to mobilize their relevant departments to conduct field research in the Deosai National Park. The Directorate of DNP will facilitate the research and researchers whereas; Karakorum International University and the Baltistan International University shall be the focal points for implementation of the research plans

- 7.1.1. Encourage regional academic institutions (KIU & UoBs) to Include DNP related issues in their regular field research programs
 - 7.1.2. Develop ToRs and research program for social and biophysical aspect of the park
 - 7.1.3. Develop indicators for ecosystem health
 - 7.1.4. Finalize list of research topics
- 7.2. Develop seasonal and annual monitoring mechanism of key wildlife Species**

So far, research has been the least bothered component in the management planning of Deosai National Park. There is not even proper data available on biodiversity of the park and other natural resources. Therefore, research is needed in various fields for science-based management of the park resources. It is essential to take the following action;

- 7.2.1. Develop a system to conduct periodic surveys for flora and fauna

8. Make and use tourism as an effective tool to generate knowledge, awareness and interest about conservation among visitors and to generate sustainable livelihood options and opportunities for the people of the park

Deosai National Park is an emerging tourist destination attracting thousands of tourists for past four years from all over Pakistan and abroad. The trend shows that in coming years the number will increase enormously. Improved law and order situation, better road facilities and proper visibility of the region has contributed in having greater number of tourists in recent years. The more tourists reach the area bring along a lot of opportunities for the local people contributing in boosting local economy. At the same time number of challenges are associated with the influx of the tourists when it goes unmanaged. Deosai National Park is suffering number of challenges with the hike in tourism and what lies on top is the waste management. Currently DNP staff is deployed at DNP who are taking care of the waste collecting, transporting and dumping it at the selected sites. However, compare to the waste generated every day, the resources including staff is quite less in number. Thus, the garbage spread along the park poses a threat to the environment at the second highest plateau.

DNP can provide abundant learning opportunities for both children and adults if there is proper interpretation of the resources such as biodiversity, wetlands, history and culture. With all stakeholders who jointly agree to serve this noble cause can bring about a substantial change inside the DNP. The national park will have a cleaner environment offering to its visitors and also for the indigenous flora and fauna. The Government Forest, Wildlife and Environment Department Gilgit-Baltistan is

committed to contribute in the best possible way to the management of waste particularly along the route and camping sites in DNP. However, it is equal responsibility of non-governmental organizations, travel agencies, tour operators, communities and all tourists to have a realization of their role and responsibilities with regard to managing, collecting and proper dumping of waste while travelling or staying inside the protected area.

8.1. Regulate and promote tourism as a source of joy and knowledge for the visitors and a sustainable income opportunity for both park and people

- 8.1.1. Display Park ethics, and develop publicity material and gifts such as key chains, mugs etc. and interpretation materials about the park and each of its component for the education and awareness of visitors that has certain ecological, biological, geological, cultural or some other significance/interest (cost of development shall include in the entry fee)
- 8.1.2. Develop information sheets about the park with maps showing the location and access of points that are/could be of interest to the visitors indicating red zones where tourists shall not be allowed to go/stay. (cost shall include in the entry fee)
- 8.1.3. Hire and train the local youth on the park resources and register as guides who shall accompany the groups to see and know more about the park resources and also make sure that the tourists are not involved in activities that are injurious for the park , its resources and reputation as a peaceful environment
- 8.1.4. Manage to register all visitors of the park and record the reason for them to visit the park. Registered visitors shall be entitled to receive a pack with information sheet and interpretation booklet
- 8.1.5. Discourage non-serious visitors by imposing entry fee that is comparable to other good parks of the world. Rs 300 per person, 1500 for the group for visitors coming from outside of GB; 100 per person and 1000 per group for visitors of GB and USD100 for foreigners. This could be further evaluated by the department, including other groups that are deemed essential to be charged.
- 8.1.6. Introduce a system of banning those visitors in the future who have been reported for misconduct or other negative activities
- 8.1.7. Maintain a record of all visitors with periodic analysis to know the trends, opinion of visitors, their likes and dislikes, behavior of park staff, guides etc. for needful correction (Questionnaire must be provided in the pack for visitors to fill and return while leaving the park)

8.2. Control various sources of pollution

- 8.2.1. Establish a dedicated waste management system for the Park
- 8.2.2. Awareness raising of tourist and other stakeholders
- 8.2.3. Restrict grazing near water bodies
- 8.2.4. Ban on plastic inside the Park
- 8.2.5. Ban on the dustbin along the road and camp sites
- 8.2.6. Restrict movement of heavy traffic
- 8.2.7. Identify and establish the waste dumping site
- 8.2.8. Installation of an incinerator

8.2.9. Adapt polluter pay approach

9. Promote awareness and natural resource conservation education for various stakeholders

9.1. Develop and implement educational and awareness programmes

Poverty, lack of community participation and needful development opportunities are the biggest hurdles in the way of participatory management of DNP. If this situation continues to stay, the ecological beauty of the park will diminish over the next couple of years, bringing in an ecological disaster; negatively impacting the ecology of the park and socio-economic conditions of the local communities. For the better management of the Park and to reduce the subsistence pressure on its natural resources; it is very essential to generate sustainable economic opportunities for the buffer zone communities. The plan suggests the following ways to promote awareness in the people in this regard:

9.1.1. Develop, print and disseminate education and awareness

9.1.2. Develop documentaries on DNP

9.1.3. Establishment of environment clubs at various education institutes (School, colleges) around DNP

9.1.4. Disseminate information through DNP website and social media pages

9.1.5. Awareness raising of the road contractors on the Park resources

10. Explore and establish connectivity areas between DNP and other ecological sites

10.1. Identify, map and develop management guidelines for various connectivity areas

Floral and faunal species in Pakistan are declining because of habitat loss and fragmentation, human-induced mortality, commercial poaching and unsustainable harvest of medicinal and aromatic plants. Increases in demand for natural resources and their subsequent depletion have many consequences for plants and wildlife. The increase in the size and number of settlements, expansion and improvement in infrastructure, transformation of land use, and attenuation of forest cover are the major factors, which contributed to the significant shrinking and fragmentation of species habitat during the last decades. Forests are being cut for timber and firewood and cleared for increasing areas for cultivation. Bear utilize alpine meadows more than any other vegetation zone in Gilgit Baltistan. The area of DNP is not sufficient for the conservation of the biodiversity and natural resources for long. To avoid habitat loss and territorial fragmentation, one of the most threats for the biodiversity (Wilcove *et al.*, 1986; Noss, 1991b), through the creation and conservation of biological corridors: able to connect the different Protected Areas maintaining the necessary flow of individuals and genes between the populations (i.e. Soule 1987; Noss, 1993). The creation of this connection area is a complex and time-consuming process considering the heterogeneity and the complexity of the matrix (public/private land and infrastructures, different degree of naturalness, presence of large number of stakeholders); so in the time span of this call it will be possible only to delineate the knots, also suggesting new areas that need the development conservation measures, and possible passages forming the net and the related strength and weakness points.

This will not provide only a direct support to the biodiversity on long term,

- Reducing habitat fragmentation

- Assuring the species migration and dispersal, and related genetic flow able to reduce the inbreeding and support the population recovery and ecosystem process
- Facing the climate change impact, thanks to the possibility for species to shift their distribution but also assure economic, social and ecological benefits for human communities, regarding:
- Livelihood security, considering that most of the communities is strictly depending on renewable natural resources for direct use
- Benefit assured by the ecosystem services product by the natural area, as: drinking water, carbon sequestration, crop pollination for agriculture
- Nature-based tourism industry
- The importance of this new approach is gaining strength during the time also considering the potential impact of climate change on ecosystem and species, especially the ones located in mountain areas that, for their specialized adaptation to the extreme conditions, are more sensitive to this phenomenon.

Based on previous MP of DNP (2016) and under MPA project implemented by Ev-K2-CNR, a connectivity area between DNP and CKNP has been identified and mapped. The proposed connectivity corridor between CKNP and DNP can promote biological conservation because it may contribute to habitat connectivity for a range of individual species. Relevant information through secondary sources had been gathered on natural, cultural and socio-economic aspects including satellite maps. To fill the data gaps and for on ground accuracy, primary information was collected through series of field surveys. Relevant data collected through secondary and primary sources were used in analysis to produce connectivity area thematic layers with the support of experts, GIS tools and computer modeling.

10.1.1. Identify the possible connectivity options between DNP and other Protected Areas

10.1.2. Identify and develop various wildlife corridors within the Park for habitat connectivity

11. Develop and maintain monitoring and evaluation system for DNP

11.1. Establish internal monitoring system

M & E system is important as it shall not only provide stewardship to the Park authorities to take timely remedial actions for achievement of the Park vision but also for any new issues that come to surface. The availability of remote sensing data and tools like GIS and fixed photography have emerged as useful monitoring tools. These can effectively be used to monitor areas inside and surroundings of the Park. An internal monitoring and evaluation system, managed by an officer, shall be fully equipped and operational to perform its duties. The standard M & E tools shall be applied as well as GIS/RS to update the Park administration on ecosystem health and wildlife populations. Besides, following self-explanatory interventions shall be undertaken under this,

- a. Biodiversity: monitoring of floral species at least once a year, their quantity, pastures biomass (outputs) and structure of the vegetation, birds, insects, mammals, and reptiles. Any identified changes shall be compared with the baseline year.
- b. Social: monitoring of demographics, use pattern of natural resources, indigenous knowledge and economic indicators at least once a year. Any identified changes shall be compared with the baseline year.

The following research methods will be adopted for monitoring:

- a) Fixed point monitoring: fixed ecological monitoring stations will make the data comparable and sequential.
- b) Fixed time monitoring: the parameters for measurement will be monitored in fixed time, so that the results obtained during a given monitoring are comparable with that of last monitoring.

Accurate number of the Bear found in DNP or in its immediate vicinity yet to be determine, there are plus 88 Brown Bears according to the latest survey report of 2019. Conducting Bear survey in DNP is a great task, which must be appreciated however, the count shall be more reliable and valid if conduct on each and every vantage point the same season, months and dates each year. Moreover, data sheet may also be modified, including information GPS coordinates, slope angle, time of sighting, activity of the Brown Bear at the time of sighting, weather condition, temperature, barometric pressure, survey-starting time and end time etc.

11.1.1. M&E system for the Park staff

11.1.2. M&E system for the implementation of the management and operational plan

11.1.3. M & E System for socioeconomic aspects

11.1.4. M & E System for biophysical aspects

11.1.5. Fixed Point Photograph Monitoring System

11.1.6. Remote Sensing and GIS Based Monitoring System

11.1.7. Initiation of radio-collaring

12. Ensure financial sustainability

12.1. Revise and implement fees

Despite least promotion of ecotourism in Deosai, many international, national and local tourists visit the plateau in huge numbers, particularly during the summer months i.e., June - October. Therefore, the Park administration in consultation with key stakeholders should arrange mobilizing additional resources through internal revenue generation to reduce its dependence on public sector funds to meet operational and programmatic costs. The amounts collected by the Department as park entry fees at the check posts are presently deposited in a special account operated by the DFO. Withdrawal and utilization of funds from this account for the purpose of park management has remained problematic due to absence of clearly defined policies and procedures for withdrawal and utilization, which are essentially required in view of public nature of funds. Fees are also not collected from hotel operators and from camping inside the national park. Similarly, no charges are applied for entry of vehicles in the national park.

A certain level of dependence on the government for meeting the salaries of core management staff and for maintenance and operation of park offices is likely to continue, yet it is possible to generate additional funds through improvement in collection of park entry fees, and permits for recreational fishing, later supplemented by camping fees, and collection of fines against violations. All the amounts collected from park entry fees, grazing fees, fishing permits if decided upon, fines and penalties, and any other revenues collected from the park could be deposited in a Wildlife Conservation Fund. A transparent mechanism devised for judicious utilization of funds therefrom, to meet emerging needs of the park and communities living in the periphery of the park.

12.1.1. Revise and regularize fees schedule

- i. Park entry fee
- ii. Grazing fee
- iii. Angling fee
- iv. Camping Fee

12.2. Draw on Government Development Funds

The government has generally struggled to provide budget allocations infrastructure and equipment, and for the operation of protected areas, and the DNP is no exception. Rapid Assessment report (2014) points out this as the most serious issue concerning the park operations, as the field protective staff mobilized in the DNP currently lacks the necessary material, equipment, and resources to operate in conditions that are challenging considering the climate, altitude, and natural terrain of the park. GB is amongst the least developed provinces in the country, where cost of providing basic infrastructure and social services is also comparatively high in view of a challenging mountainous terrain.

Given the general shortage of resources for meeting the operational and developmental requirements of the province, funds available for wildlife management and environment tend to be limited. The park will continue to struggle for resources in these conditions, and there is a risk of the gaps increasing due to inflation and additional requirements for staff and operations associated with an increasing number of visitors. Occasional support from NGOs may help improve the situation but temporarily, if at all.

Therefore, there is a dire need for mobilizing additional resources through internal revenue generation. A level of dependence on the government for meeting the salaries of core management staff and for maintenance and operation of park offices will continue in all likelihood. However, it is possible to generate additional funds through improvement in collection of park entry fees, and permits for recreational fishing. In the long term, camping fees, and collection of fines against violations can supplement these. This approach will reduce the dependence on government funds, and could significantly reduce the shortage of funds currently being faced by the park.

12.2.1. Preparation of new project proposals/ PC1s

New project proposals shall also be prepared for the communities and the Department to be presented at multi-lateral funding agencies.

12.3. Draw on district government development fund and other potential avenues

12.3.1. Explore new sources of funding by holding donors conference

A donors' conference may be considered for DNP and all potential donors may be invited to share the progress of the park and to need of funds for various important interventions. The partners with GBFW&E including Ev-K2-CNR, UNDP, HWF and WWF-P should be kept on board and invited for various issues including funding. The mentioned organizations provided sufficient support to DNP in past.

8. Boundaries Delineation and Zoning

The Park boundaries has been revised on the basis of:

- The geographic data GIS
- The watersheds
- The GPS APP
- The existing boundary pillars that had been pointed in the map with GPS data

8.1. Land Cover Map

8.1.1. Data and Methodology

The Land Cover map has been obtained from ESA Sentinel-2 imagery.

The image used for the interpretation and final classification has been chosen on the basis of phenological state of the vegetation and cloud cover percentage. Moreover, in areas without deciduous vegetation or major seasonal crop variations, one month might suffice. Considering these conditions, a single multispectral image acquired on August 06 2018 has been used.

In order to classify the remote sensing image (Sentinel-2), a supervised classification approach using the maximum likelihood (ML) classification algorithm was applied. MLC is a widely used pixel-based, parametric classifier based on the Bayes theorem. It makes use of a discriminant function to assign pixel to the class with the highest likelihood.

The result is a classification image in which each pixel is assigned to the defined classes. The assignment is based on the creation of a series of training sets of ground truth. The first step of the classification consists in choosing these pixels. To select the most optimal training sites (spectral features), the contributions to Google Earth and Open Street Map (OSM i.e., natural features, land use patterns, roads, buildings, POIs, and waterways) were harmonized with the land cover classes and then imported into the classification process.

Using visual interpretation of the underlying very high-resolution imagery, experts interpreted each sub-pixel based on the land cover type visible, which includes trees, shrubs, water objects, etc. This information was then translated into the legend using the UN LCCS (United Nations Land Cover Classification System developed by Food and Agriculture Organization- FAO) as a basis. The UNLCCS system was designed as a hierarchical classification, which allows adjusting the thematic detail of the legend to the amount of information available. Training areas were established by choosing one or more polygons for each class. Pixels fall within the training area were taken to be the training pixels for a particular class. In order to select a good training area for a class, the important properties taken into consideration are its uniformity and how well they represent the same class throughout the whole image.

The legend adopted is shown.

Land Cover DNP classes	UNLCCS Classes and Definition
Water bodies	Permanent water bodies: lakes, reservoirs, and rivers. Can be either fresh or salt-water bodies.
High-density grassland	Herbaceous vegetation: Plants without persistent stem or shoots above ground and lacking definite firm structure. Tree and shrub cover are less than 10%.
Low-density grassland	
Shrubland	Shrubs: These are woody perennial plants with persistent and woody stems and without any defined main stem being less than 5 m tall. The shrub foliage can be either evergreen or deciduous.
Bare soil	Bare / sparse vegetation: Lands with exposed soil, sand, or rocks and never has more than 10% vegetated cover during any time of the year
Rock outcrops	
Wetlands (Regularly flooded Shrub/Herbaceous Cover)	Herbaceous wetland Lands with a permanent mixture of water and herbaceous or woody vegetation. The vegetation can be present in either salt, brackish, or fresh water.
Snow	Snow and Ice: Lands under snow or ice cover throughout the year
Shadows	-
Clouds	-

8.1.2. Accuracy analysis

Accuracy assessment of the ML classification was determined by means of a confusion matrix (sometimes called error matrix), which compares, on a class-by-class basis, the relationship between reference data (ground truth) and the corresponding results of a classification. Such matrices are square, with the number of rows and columns equal to the number of classes, i.e. 10.

The diagonal elements of the matrix represent the pixels of correctly assigned pixels and are also known as the producer accuracy. Producer accuracy is a measure of the accuracy of a particular classification scheme and shows the percentage of a particular ground class that is correctly classified. User Accuracy is a measure of how well the classification is performed. It indicates the percentage of probability that the class, which a pixel is classified to on an image, actually represents that class on the ground (Exhibit no 28).

Exhibit 27: Producer Accuracy and User Accuracy values of the Land Cover classification of Deosai.

Classes	Producer Accuracy	User Accuracy
Water bodies	92.97%	96.75%
High-density grassland	88.46%	54.76%
Low-density grassland	93.33%	70.00%
Shrubland	93.10%	90.00%
Bare soil	82.43%	92,42%
Shadows	88.37%	95.00%
Clouds	100.00%	100,00%
Wetlands	74.49%	93.59%
Snow	92.31%	92.31%
Rock outcrops	87.50%	64.81%

We can observe that the classes “High-density grassland” and “Wetlands” show the lower values respectively of User accuracy and Producer Accuracy, indicating that the spectral behavior of these units tends to be similar.

Furthermore, two measures of overall behavior of the ML classification can be determined by the overall accuracy and Kappa coefficient. These two measures in the land cover classification of Deosai resulted respectively of 87% and 85% demonstrating the good performance of the classification (from the literature, the minimum acceptable overall accuracy is 85% and the general range for Kappa values are if $K < 0.4$, a poor kappa value; while, if $0.4 < K < 0.75$, is a good kappa value and if $K > 0.75$, it is an excellent kappa value).

On the basis of this results, the land cover classification has been extended to the area of the corridor.

8.1.3. Ground Validation and improvement of the Land Cover Map through the GBGeoApp.

After the first accuracy assessment, as proposed in the project, the Land Cover map has been validated through the new tool dedicated to this project activity: the GBGeoApp. This application for mobile has been developed with three main ambitions: the validation of the new land cover map, its improvement with land use information, and the collection of new data in the field season on and validated through the new tool dedicated to this study: the GBGeoApp.

GBGeoApp reflects the purpose to share with the local technician’s data on land use, through a process of direct involvement. Additionally, the app is dedicated to the collection of local geo- information on land use, fauna, flora, nomads and livestock including the communities in a participative approach as the local actors. All collected data are directly linked to the land cover map, based on the classification of ESA Sentinel2 data. This approach permits to correlate the land cover to one or more specific land

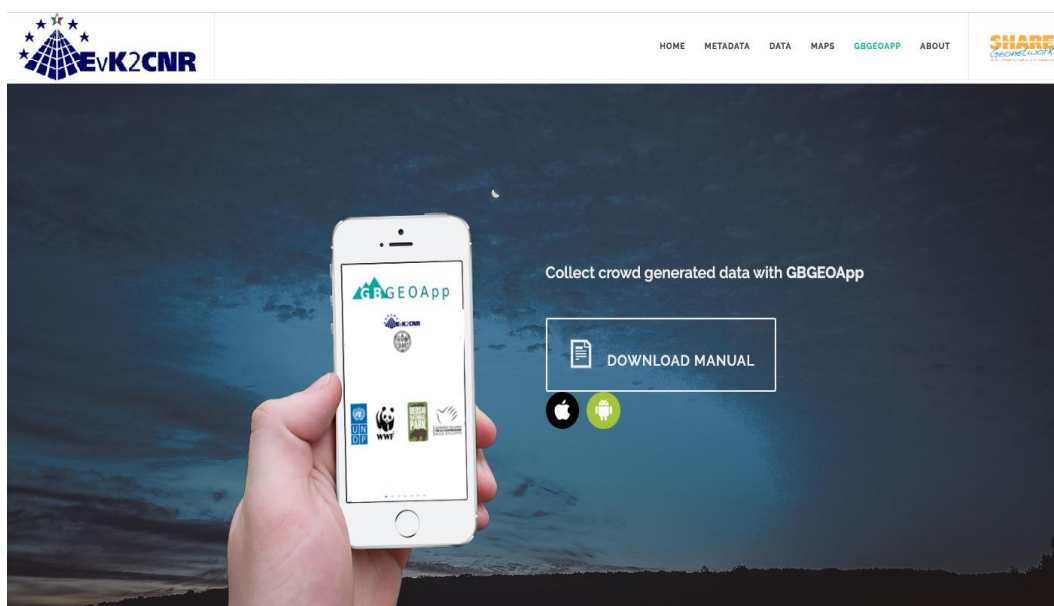
uses because GBGEOapp has been created with the purpose to be ready for ground truth data collection and validation.

The important issue of lack of network has been overcome with the ability to use the app in off-line mode.

The app has been developed with an open source SDK called Ionic Framework for iOS and Android systems, it is working, and it is available for download at <http://95.110.144.131/geoportal/app>.

Moreover, at this link, it is possible to download the User Manual, attached to this document.

Exhibit 28: Interface of the Web system where it is possible to download the app and the User Manual



The first field activity for the testing and collection of data has been done on September 2019. After some brief classes of training, the collection of data started (Exhibit no. 27).

Exhibit 29: The picture shows the activity of collecting data in the field through the GBGeo app

Training activities: field work

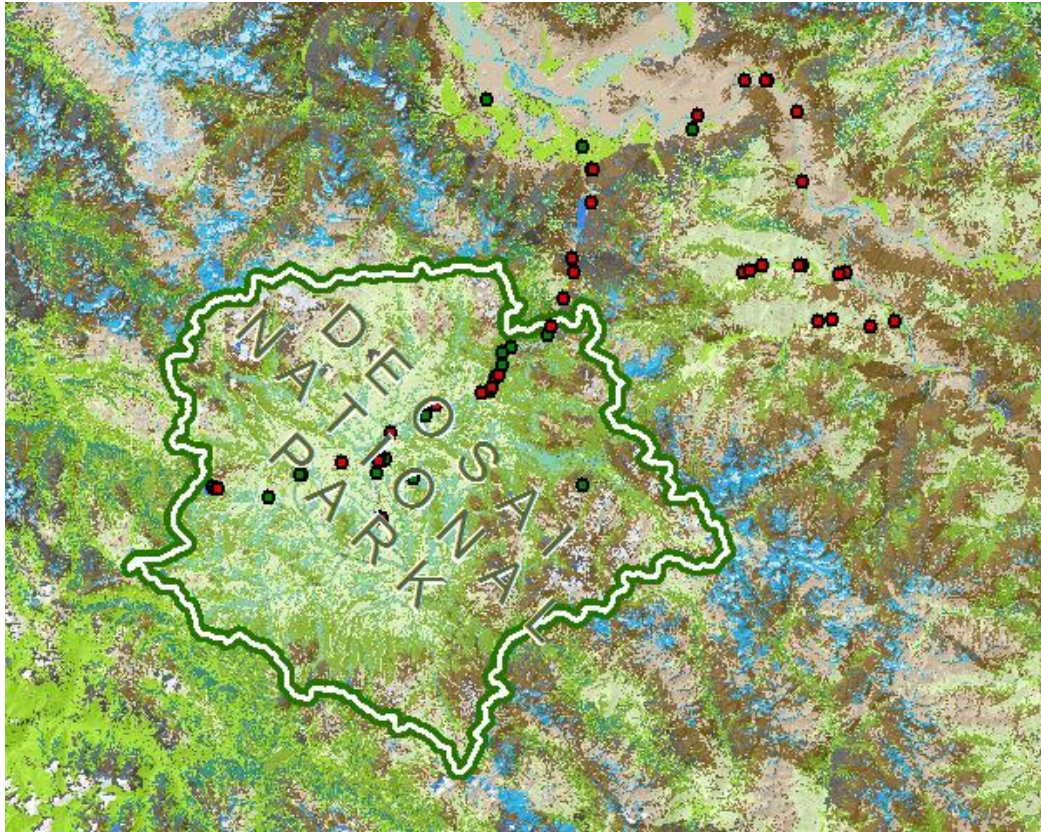
- GBGeoapp testing and data collection in the field

GBGeoApp is composed of 6 main sections of data collection:

- Fauna
- Flora
- Nomad
- Livestock
- Landcover
- Critical points

The first results are very interesting as each technician through the GBGeoApp collected more than fifty points of validation in three days of fieldwork in this mountainous area. The points were uploaded in the GeoNetwork platform and used for the validation (Exhibit no.30).

Exhibit 30: Collected points in the field: in red, the land cover points and in green the points with other information.

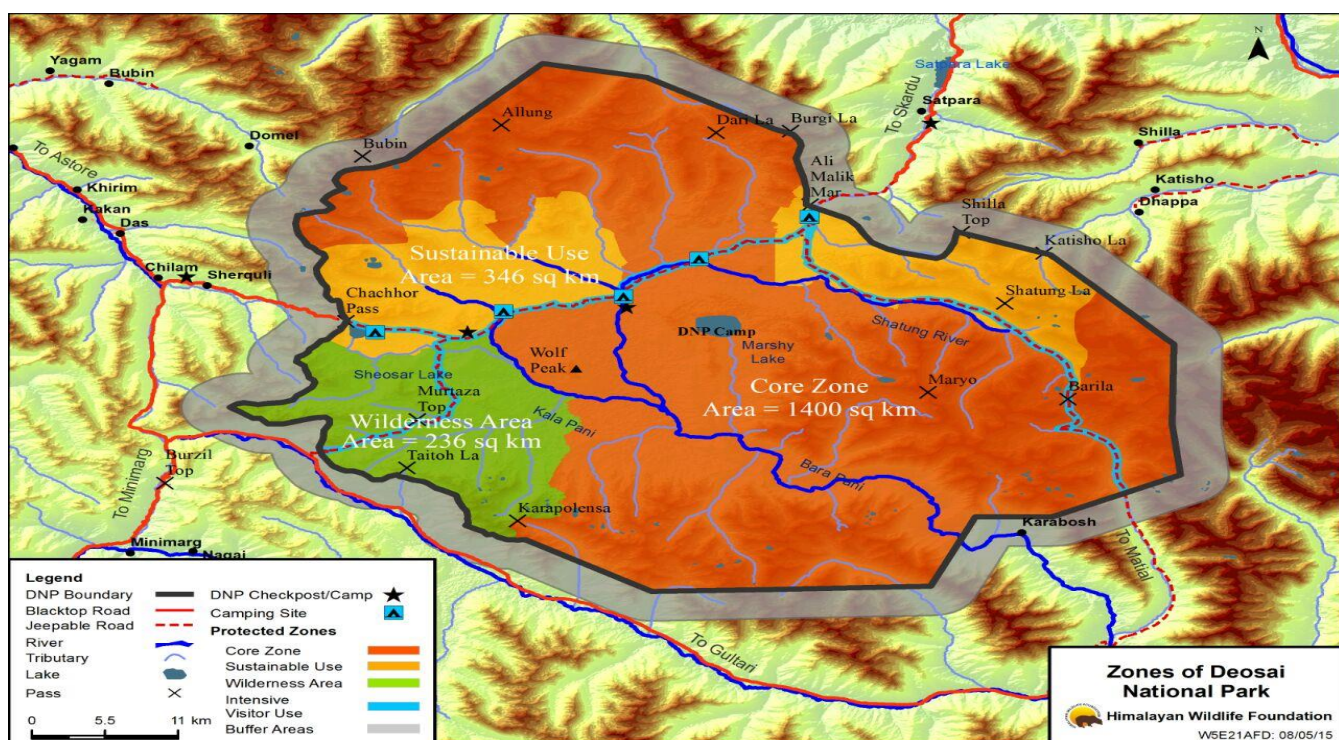


This study enhanced the importance and effective role of satellite data for the deep knowledge of remote areas. The use of the GBGeoApp, as a tool for validation and increasing of environmental data collection, seems to be completely applicable involving the local technicians in a process of data sharing. We think that it will also empower local communities to take responsibility for the integrated-sustainability of the natural resources, promoting local knowledge on the basis of a scientific and technological approach.

8.2. Park Boundaries and Zoning Surface

On the basis of this work the new data is that the surface of the park is: 1621.66 Km². The Park was established over an area of 3626 Km² area on December 4, 1993: surface that results overestimated compare to the last MP approved that indicates a surface of 1982 Km².

Exhibit 31: Previous map of DNP



Core zone: 1400 km²

Wilderness Area: 236 km²

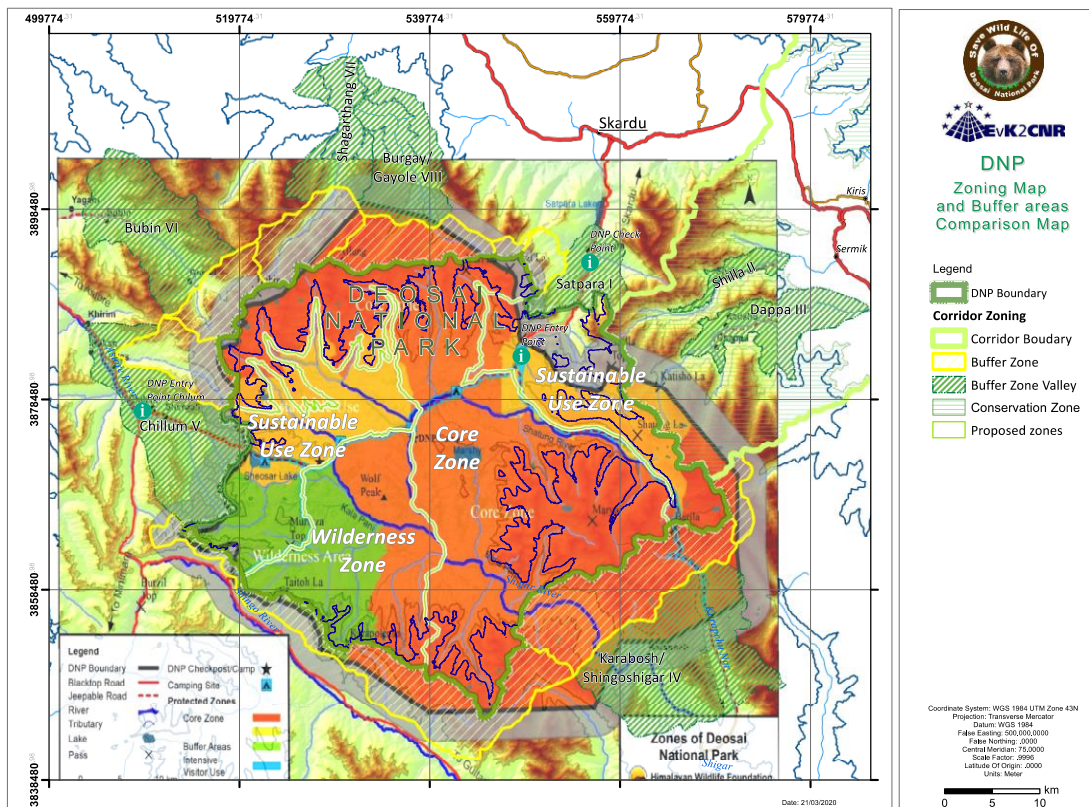
Sustainable Use Area: 346 km²

TOTAL: 1982 Km²

In this Management Plan the boundaries has been delineated with more accuracy and the surface of the Park is 1621.66, 360.34 Km² less, but if we include the Buffer Zone and the Buffer Zone Valleys the total surface is 3000.7 Km², almost the same of the proposed surface declared in 1993 at the first declaration of DNP National Park.

The difference between the surface of this map and the surface that is delineated in this plan is mainly concentrated in the SE side of the Park where it was not designed on the boundary pillars of Bari-La, but more down in the valleys. The map above is not correct also in the watersheds border especially on the N side, that delimitate the Deosai plateau and has been corrected on the basis of the GIS data, the survey of our and DNP staff, starting from the existing pillars. In these differences, there is the difference in the Core Zone area that is virtually reduced, but it is partially more extended than before or covered with a strict Buffer Zone.

Exhibit 32: DNP zoning and buffer areas comparison map



In this map is delineated the previous border with the new one in green line that is on the Deosai watershed line; the map of the approved MP is without a clear geographic concept and has been re-delineated

8.2.1. Internal zoning limits differences

The criteria for the delineation of these new limits are:

- Brown bear distribution including the information of the census of previous years and the last one in 2019
- Altitude contour line of 4300 m. that represent the forest limit derived from the land cover map
- Roads and rivers
- Exclusion of visitor presence inside the Core zone (except the main road cross)

The Sustainable Use Zone remains almost the same, with some modifications with Wilderness Zone that is partially transferred to east reaching the road that take to the Bear Watching Point.

8.2.2. Buffer zone limits

The Buffer zone boundaries are not a circle around the Park as before but its width is different in different valleys and these differences depend to:

- Brown bear distribution outside of the Park, including the areas where it is present
- Land cover

- Watershed and altitude
- Valleys and villages

This plan arrives to a clear delineation of the boundaries of the Park and include two more zones to protect the fragile ecosystem:

- Buffer Zone
- Buffer Zone valleys

To ensure conservation and sustainability in use of the national park, a zoning exercise was carried out to designate clearly defined management zones, each with a set of management principles and rules.

The exercise is based on the following GIS-based information on environmental values and existing uses in the DNP. The new land cover in very detailed scale allowed us to recognize the changes in the last years. The analysis of the modification of the relevant data in the last 5 years give us good information and allows us to achieve a precise zoning drawn from:

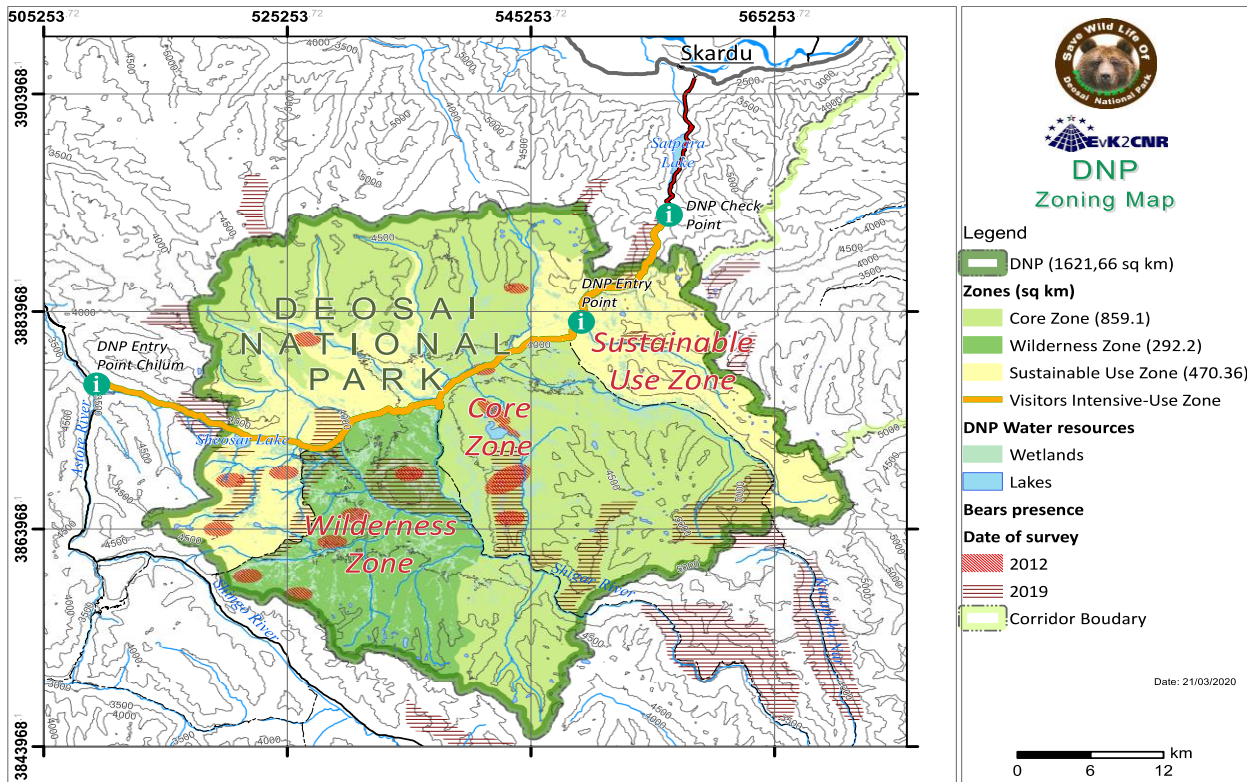
- Areas with suitable bear habitat
- Areas of wet lands
- Watershed and contour lines
- Areas encompassing other important habitats such as marshes, streams and waterways.
- Areas of intensive use by visitors such as ‘camping areas’, ‘roads’, etc.
- Areas designated as for enhanced ecotourism activities, such as ‘recreational fishing’, etc.
- Areas used traditionally by Gujjar Bakarwals.
- Areas used traditionally by communities.

Bear habitat suitability map from the studies¹⁰, Show the area where the protection is more necessary.



¹⁰ Nawaz M A, Martin J, Swenson J E, 2013, Identifying Key Habitats to Conserve the Threatened Brown Bear in the Himalaya, Biological Conservation 170 (2014) 198–206.

The new maps that are designed for the new zoning system are annexed to this document and described in the next paragraphs.



8.2.3. Proposed management zones and management principles

The zoning exercise conducted for DNP aimed to balance use and conservation, keeping conservation as a priority; however, without compromising the sustainable use of the Park. The use includes that allowed under the legislation, namely recreation and education, and traditional rights of the local communities and the Gujjar-Bakarwals that are dependent on the DNP.

The Deosai National Park is designated as “National Park” under the wildlife legislation. However, to allow for development of tailored management principles for different areas within the DNP designated zones, their purpose, and broad management guidelines are described in this chapter: there are four different zones inside the Park Boundaries and two zones outside the park in a comprehensive Buffer Zone.

- **Core Zone**
- **Wilderness Zone**
- **Sustainable Use Zone**
- **Visitors Intensive-Use Zone**

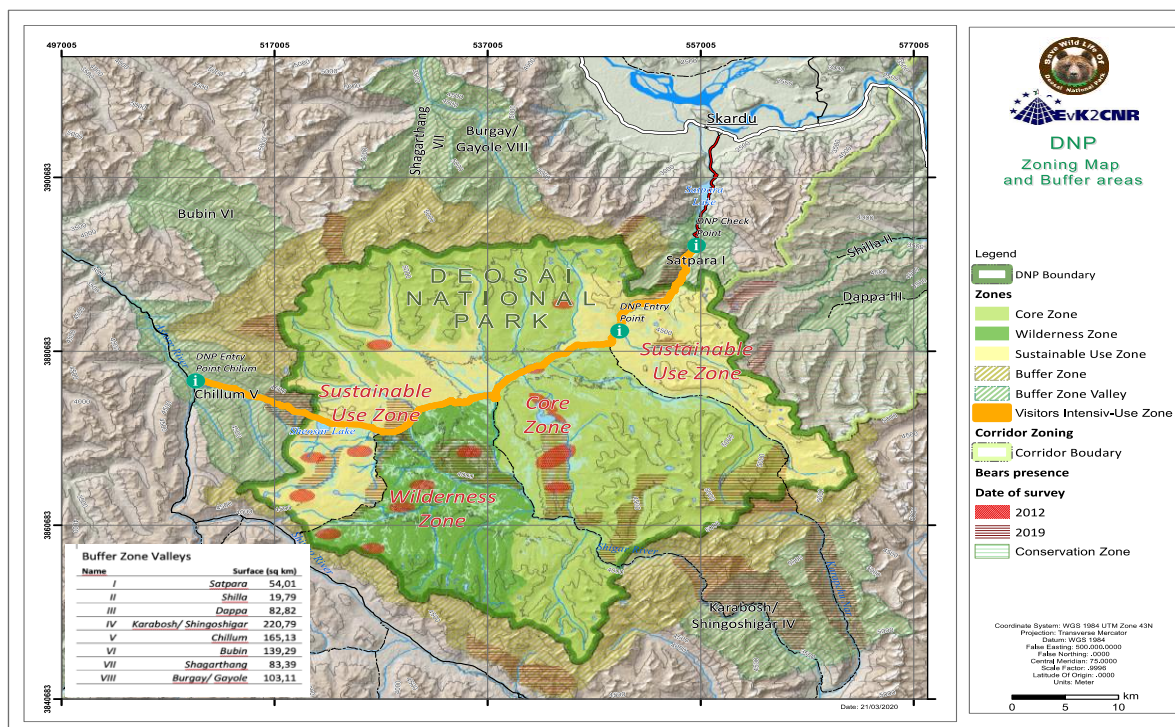
Outside the Park boundaries:

- **Buffer Zone**
- **Buffer Zone Valleys**

Proposed Distribution of Management Zones is illustrated in the next pages.

DNP			
Core Zone	Sustainable Use Zone	Wilderness Zone	Total DNP
859.1	470.36	292.2	1621.66
Buffer Zone	BZ Valleys		
613.39	765.69		1379.08
Total surface protected 3000.7 km²			

Exhibit 33: DNP new zoning and buffer area map



8.3. Core Zone

Strictly protected for biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are controlled and limited to ensure protection of the conservation values.	To ensure conservation of the Brown Bear and the Altitude Wetlands
IUCN Category Ia and ‘Wildlife Sanctuary’	Surface: 859.1 km²

The purpose of this zone is to ensure conservation of the Brown Bear, which is the apex species in the national park, and to protect the most part of the Wetlands that assure the habitat for the Brown Bear itself and of the entire ecosystem.

The criteria for the delineation of this zone are:

- Brown bear distribution including the information of the census of previous years and the last one in 2019 (see map above)
- Altitude contour line of 4300 mt. that represents the forest limit derived from the land cover map
- Wetlands surface derived from the land cover map
- Maximization of the area where it is not allowed the livestock grazing

The following broad guidelines apply in this zone:

- Strict protection of all biodiversity, habitats.
- Strict enforcement of fines for violations
- Strict limitations on entry through permit from the Park authorities and accompanied by park staff.
- No extraction of any kind permitted
- No off track driving
- No construction allowed.
- It is not allowed to build new roads and asphalt those existing
- Jeep Safari strictly not allowed
- Strict protection of all biodiversity, habitats.

Guidelines for specific activities in this zone are described below.

CORE ZONE IUCN Ia	
Entrance	<p>Core Zone has to be considered strictly closed for entering the Core Zone, a specific authorization released by DNP Directorate is required for visitors, foreign people, people of local communities and from Gilgit-Baltistan.</p> <p>Also, the entrance for research purposes has to be authorized by the DNP Directorate.</p>
Fees and duties	<ul style="list-style-type: none"> • there are no fees for people of local communities and from Gilgit-Baltistan but they need a special permit • Pakistani authorized visitors should pay the Core Zone EXTRA FEE at the Entry point. • authorized foreign visitors have to pay the Core Zone EXTRA FEE • authorized researches can be exempted from paying the Core Zone EXTRA FEE

Transfer and stay inside the area are generally prohibited	<p>In the Core Zone all the authorized visitors (Pakistani and foreigners) and researches have to follow these indications, if not expressly authorized in different ways by DNP Directorate:</p> <ul style="list-style-type: none"> • camping is strictly prohibited • it is mandatory to proceed by feet (no motorized way) only for authorized people • no pack animals (horses, mules and donkeys) could be used for transportation purposes • use of kerosene and butane gas for cooking is not allowed, nor lighting up fires to cook or to burn waste
Jeep safari	Strictly not allowed
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 and pets	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.

8.4. Wilderness Zone

Usually large unmodified or slightly modified areas, retaining their natural character and influence, without permanent or significant human habitation, protected and managed to preserve their natural condition. IUCN Category Ib Wilderness area	To ensure protection of the core zone area and allow the controlled grazing of livestock and limited human presence. Surface: 292.2 Km²
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The purpose of this zone is to ensure protection retaining their natural character; the human and livestock presence is reduced to a minimum level only for the survival of the Nomads millenarian tradition. In the future, if the Nomads are going to reduce their presence in the Park this Zone could partially become a Core zone extending the strictly protected area.

The criteria for the delineation of this zone are:

- Brown bear distribution including the information of the census of previous years and the last one in 2019
- The land cover map that show the grass availability
- The contour line of 4300 m and the physical boundaries (rivers, mountain ridges and watersheds)
- Altitude contour line of 4300 m. that represent the forest limit derived from the land cover map
- area where it is allowed the livestock grazing for the customary practice of the Nomads (with some restriction and strict control of the Park staff)
- The use right customary laws for the communities
- Flora and fauna distribution and protection

Grazing of livestock in Deosai in addition to grass and plants consumed by the livestock the Gujjar horses threaten the wild animals and sheep dogs brought in by the Bakarwals and avoid the areas occupied by the Bakarwals. Grazing in Deosai is also a traditional practice of communities living on the northeastern borders of the park. The threat to the national park from the Bakarwals, however, is considerably higher as the Bakarwals have been rapidly expanding the number of livestock and their areas of use in the recent past, while the areas in use and number of livestock for resident communities has remained static. See Sustainable Use Zone for more details.

The Park regulations impose a limitation of the livestock number:

- 1000 livestock in this area are the maximum authorized in this zone:
- No construction allowed.
- It is not allowed to build new roads and asphalt those existing
- Jeep safari not allowed
- Gujjar- Bakarwals are allowed in specific areas and according to the rules and for a short period of time
- Tight controls are maintained on number of visitors entering in these areas
- Strict protection of all biodiversity, habitats.

- Strict enforcement and fines for violations.
- Tight controls will be maintained on number of visitors entering these areas.

WILDERNESS ZONE IUCN Ib	
Entrance	A specific authorization released by DNP Directorate is required
Fees	<p>To enter and stay it is sufficient for the authorized visitors to register at the Park entry point and pay the <i>Entry Fee</i>. People of local communities are free of charge, but the Gilgit-Baltistan people have to register themselves at the Park entry point and pay a reduced fee.</p> <p>Collection of grazing fees from nomads Currently this fee is being collected by Astore Forest Division and mostly nomad's animals graze in the park so this fee should be collected by DNP directorate</p>
Transfer and stay inside the area are allowed only with a permit released by DNP Directorate	<p>In the Wilderness Area 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 DNP Directorate:</p> <ul style="list-style-type: none"> • camping is not allowed (only with special permit from DNP Directorate); allowed only in the campsites along the main road • it is mandatory to proceed by feet (no motorized way) only for authorized people • no pack animals (horses, mules and donkeys) could be used for transportation purposes • use of kerosene and butane gas for cooking is not allowed, not lighting up fires to cook or to burn waste • avoiding the use of nylon bags and bottles or glasses bottles and boxes
Jeep Safari	Not allowed
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
Collection and extraction of medicinal plants	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.

8.5. Sustainable Use Zone

<p>Areas, which conserve ecosystems, together with, associated cultural values and traditional natural resource management systems. Large, mainly in a natural condition, with a proportion under sustainable natural resource management and where low-level non-industrial natural resource use compatible with nature conservation is seen as one of the main aims.</p> <p>IUCN Category VI <i>Protected areas with sustainable use of natural resources</i></p>	<p>Areas specified for sustainable use by local communities and the Gujjar-Bakarwals.</p> <p>Surface: 470.36 Km²</p>
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The purpose of this zone is to ensure protection retaining their natural character; the human and livestock presence is permitted only for local communities. Occasional visitors reduced to a minimum level, and can move only along designed trails, or with a special permit.

The criteria for the delineation of this zone are:

- Brown bear distribution including the information of the census of previous years and the last one in 2019
- Altitude contour line of 4300 m. that represent the forest limit derived from the land cover map and the physical boundaries (rivers, mountain ridges and watersheds)
- The land cover map that show the grass availability area where it is allowed the livestock grazing for the customary practice of the Nomads and local communities that has use rights (with some restriction and strict control of the Park staff) (see map below)
- Flora and fauna distribution and protection

In this zone:

- Selected activities that are important for community livelihoods permitted with restrictions and subject to results of monitoring
- Visitors are allowed only along the road and the designed trails (or with special permit if they want to move outside for research purpose)
- Jeep safari are not allowed
- Grazing not allowed

SUSTAINABLE USE ZONE IUCN VI	
Entrance	Allowed for local communities' people and for Nomads, for National and Foreign visitors they can move only along specific trails designed on the map or only with specific authorization released by DNP Directorate.
Fees and duties	<p>For National and Foreign visitors, they have to pay the Entry Fee. After authorization if they move outside the delineated trails.</p> <p>For Nomads, enter and stay is sufficient to register at the Park entry point The Grazing Fee has to be adequate every year with the meat value.</p> <p>Collection of grazing fees from nomads: Currently Astore Forest Division is collecting this fee and mostly nomad's animals graze in the park so DNP directorate should collect this fee.</p>
Transfer and stay inside the area	<ul style="list-style-type: none"> • vehicles are allowed only along the road designated on the map • only local community people are allowed to transit in the two roads to Barila Top and Murtaza Top • apart from the roads it is only allowed to move on foot (no motorized way) and along trails marked in the main points • camping is allowed only in the designated areas • 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 out to the DNP or at the Exit Point
Jeep safari	Not allowed
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
Collection and extraction of medicinal plants	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.

8.6. Visitor Intensive Use Zone

<p>Areas which conserve ecosystems, together with associated presence of visitors, under sustainable natural resource management and where low-level non-industrial natural resource use compatible with nature conservation is seen as one of the main aims.</p> <p>IUCN Category VI <i>Protected areas with sustainable use of natural resources</i></p>	<p>Zone that present a consistent presence of people Including areas such as roads/tracks, campsites and designated fishing zones. The visitor of a national Park that could enjoy the beauty and wilderness in a sustainable way.</p> <p>Corridor of 100 meters on each side of the road that connect the two Entry Points.</p>
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The Visitors Intensive-Use Zone, will be restricted to camping sites, camping hostels, fishing areas, and an area extending to 100 meters on each side of the main road that cross the Park, which will be demarcated as such through the length of the traffic corridors.

The other jeep roads are not included in this zone and remain open only for the local community people.

In this area:

- Visitor activities permitted with restrictions to manage habitats within the zone and in the adjacent zones and subject to results of monitoring.
- Camping and fishing is allowed in designated areas only and according to rules plans
- Permanent constructions are not allowed

- Construction of building is not allowed
- It is not allowed to asphalt more the road
- Six wheelers are not allowed without a permit issued by DNP
- All plastic item is banned (such as plastic bottles, plastic tins, plastic bags, plastic containers or tanks, etc.)

The width of the track will be restricted to 6 meters. Any movement outside the Intensive Visitor Zone inclusive of the designated vehicle tracks, campsites, and campsites hostels will be considered as off-track driving and will be subject to fines and penalties payable by the driver of the vehicle.

Any building for tourist’s accommodation is not permitted inside the Park.

Hotels will be permitted only at locations designated by the Department outside the Park boundaries. It is necessary to develop a master plan for these infrastructures. At the same time, it is suggested to promote the creation of an ecotourism accommodation in the villages of the Buffer Zone Valleys.

For each campsite are delineated some trails that reach some interesting point such as Sheosar Lake tour, Brown Bear view point, K2 viewpoint: it is allowed to walk along these trails that are in Sustainable Use Zone without a special permit that is required if the visitors want to enter in other places of the Sustainable Use Zone

Guided Tours into Core Zone

Guided tours to “bear watching point” into the Core Zone may be organized for visitor groups. The following conditions will apply:

1. The tours will be organized by the Department in the summer season and will be subject to a fee per person and a separate fee for the guide of the Department.
2. Tours will be daytime only, overnight camping in Core Zone will not be allowed.
3. Visitors will be bound to remain with the guide during the tour for safety reasons.
4. A fee of Rs 1000 per day is recommended for the guide of the Department. of this Rs 500 will be deposited in the account of the Department, while the remaining Rs 500 will remain with the guide.
5. A fee of Rs 100 per person is recommended for the visitors to go on the guided tour.
6. The revenue generated from the tour fees will be used for conservation activities in the national park except as noted above.

VISITORS INTENSIVE-USE ZONE VI	
Entrance	no specific authorization released by DNP Directorate is required
Limitation of number of visitors	A maximum number of visitors per day has to be considered (last year has been registered an average of 500 visitor/day)
Fees and duties	<ul style="list-style-type: none"> • entrance is considered free for people of local communities living near the boundaries of the Park • To enter and stay it is sufficient to register at the Park entry point and pay the Entry Fee (8 USD (1300 PKR) for visitor from other countries and 100 PKR for

	<p>Nationals, 40 PKR for GB)</p> <ul style="list-style-type: none"> • Proposed 20 USD for Foreign, 500 for Nationals, 100 for GB inhabitants and no fee for buffer zone communities • researchers: 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 using campsite have to pay the camp services to the campsite manager Amount collected as fee at Bara Pani and west of Bara Pani will be deposited in the DNP Account of the Department in Skardu. Amounts collected as fee at Kala Pani and Sheosar will be deposited in the DNP Account of the Department in Astore • the funds collected goes to the local community that hold right in the percentage 75/25, and are used to guarantee a sustainable conservation of the natural resources and protect the wildlife
Transfer and stay inside the area	<ul style="list-style-type: none"> • by car along the road • on foot along marked trails • camping is allowed only in the designated campsites and Camping Hostels • 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 to the exit point office, using the bags given by the Park staff at the moment of entry • use of nylon bags, plastic bottles or glass bottles and boxes are strictly banned: NO PLASTIC ZONE
Energy provision	<p>The use of generators is not allowed (only with special permission of DNP Directorate)</p> <p>Solar energy has to be used inside the park campsites and camping Hostels and in the DNP staff lodges.</p>
Toilets	<p>Only eco-toilets are allowed with transportation of the human waste outside of the Park</p>
Bins	<p>Wildlife protected bins only inside the Campsite and Camping Hostels with different containers for tins, glass</p>
Waste Management	<p>The Camping Hostels contractors are in charge to transport the waste collected outside from the Park at the entry points waste</p>

	store Nothing can be burned or buried inside the Park The DNP staff is in charge to overview the waste system and contribute to the maintenance
Hunting	not allowed
Game bird hunting	not allowed
Fishing	Allowed only in the fishing areas of Kala Pani and Bara Pani
Presence of livestock	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 a timber forest product	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.

Disturbance to Habitat and Wildlife by Visitors

The number of visitors to Deosai has constantly been increasing ever since Deosai was notified as a protected area and especially in the last years. Major practices observed and reported that are damaging to the park environment include the following:

Off-track Driving: In the early and late season when the staff of the Department has not set up the camp at Bara Pani, there is evidence that the visitors drive freely into the core area for bears located south of Bara Pani, primarily for off-track four-wheel driving and fishing. Tracks of four-wheel vehicles in areas where vehicles are not permitted are visible at a number of locations.

Fishing: Fishing in the area from Shatung to Bara Pani using nets and rods is common. With limited mobility, the staff of the Department finds it difficult to check such violations. Inspection of vehicles at entry points for nets and caught fish also has a limited effectiveness, as thorough inspection can be time consuming and inconvenience for the visitors.

Littering: Littering is common, particularly in the Sheosar Lake area. Possible solutions to this problem are outlined in the following section.

Management Solutions

Off-track Driving

Given the sensitive ecology of Deosai and slow regeneration rates for vegetation in the altitude and climatic conditions in Deosai, there is no option but to restrict the vehicles to designated tracks only with the presence of a Park Staff as a guided ride for wildlife seeing.

- Continuation of the present policy to control off track driving through strict enforcement
- Introduction and application of fines for violations
- Installation of signage on the restriction of off-track driving at high risk locations
- Education of drivers of vehicles in Skardu, Astore, and other communities in periphery of Deosai on harm from off-track driving and applicable rules

Fishing

Prevention of illegal fishing by the visitors in DNP is a challenging task and requires active patrolling and checking by the staff of the Department. This increases the cost of enforcement. The abundance of fish in DNP, as reported in the Ecological Baseline, has also increased substantially over the years. Permitting the angling of fish is therefore the recommended option to reduce the cost of enforcement, increase the recreational value of the park, and improve revenue collection. This option can be exercised under current legislation, which allows certain actions that are normally prohibited in a national park provided the permission results in betterment of the park.

Following the principles of sustainable management, it is important that fishing activities be regulated to ensure protection of the resource. The regulation should recognize the need to maintain the health of the ecosystem, and sustainable yields as determined by scientific studies.

- The use of fishing nets is banned such as the use of rods
- Amounts collected from fishing permits should be deposited in the Wildlife Conservation Fund.
- Fishing should be restricted to designated areas, the number of permits or licenses and the fish catch should be regulated, and active checks should be maintained by the Department staff to check for violations.
- Commercial fishing should not be allowed under any circumstances.
- Appropriate amendments in the wildlife legislation should be made to explicitly allow sport fishing in the national park.

Littering

Management solutions include:

- Appropriate plastic free signage
- Providing information and advice to the visitors and jeep drivers on harm from littering and applicable rules
- Introduction and application of fines for violations
- Installation of signage on the restriction on littering at points frequented by the visitors
- Provision of garbage bins and subsequent removal, on-site disposal, or transport to a suitable location outside DNP for disposal. Providing bins and transporting collected garbage outside Deosai will be costly as the bins will have to be specially designed prevent scavenging by wildlife, and collection will have to be made on a regular basis.

Requiring the visitors to take their garbage back with them for disposal in the collecting points at the entry points of the Park

How participate in the solution – CARRY ME BACK:

An integral part of our waste-management solution, and the way to make this a success, is if all visitors participate.

The transportation of semi-processed waste-materials out of the Deosai National Park, to the Entry point's disposal, is essential for sustainable waste management.

Our Carry Me Back system is built on the participation of all visitors, guides, as well as the local population.



The semi-processed waste materials will be packaged into 0.5 kg pouches.

1. These pouches will be placed at Collection Points at the entry points. They will be offered to all visitors, guides as well as locals entering in the Park, which will give them an opportunity to take the waste back, and balance their impact on the environment.
2. They can then take the pouch to the Exit Point.
3. At Exit point there will be marked containers outside the building, for each of the pouches and the waste material in it.
4. The containers will be provided and emptied by the DNP Staff. They will recycle, re-use, and minimize waste sent to landfills.

This is how we can all make a difference and preserve this pristine region for our future. Garbage bins are normally avoided in wilderness areas in national park, as it can be harmful to animals that will look for food in them. Bears and foxes have a known tendency to scavenge for food. Bins outside the campsites and camping Hostels are not allowed.

The accepted practice is to restrict the garbage bins inside the camping sites and campsite Hostels where garbage collection and disposal facilities are available, and access of wild animals to garbage is restricted and controlled. Disposal of garbage by burying or burning in Deosai is absolutely not allowed for environmental reasons.

It's necessary to consign to the visitor's waste bag (not plastic one but bio degradable ones) and oblige to take their garbage back with them, and segregate in collection points outside of the Park at the check

post points. This use, though preferable from environmental standpoint, will require extensive education and enforcement. Introduction and application of fines for violations.

At the entry point at the moment of paying the fee the Park Staff give to the visitor a bag that has to be given back at the moment of exit with the waste produced. The waste will be collected in a segregate deposit outside of the Park and then taken to the proper points in the city.

Camping sites



Camping will be permitted at designated sites only as indicated in the annex map. The following guidelines will apply:

- Campsites will be directly accessible from the designated jeep tracks and will be marked by signboards.
- Unique design for the signboards is required
- An area measuring at least 100m X 100m will be demarcated.
- The DNP Directorate will provide Eco-Toilets.
- The following restrictions will apply, which will be displayed at campsites:
- Camping by payment of fee of Rs 100/person/night and permitted in the camping area only.
- Visitors are responsible for keeping the area clean and taking all their garbage with them.
- Burning or burying waste is strictly prohibited
- Silence will be observed to avoid disturbance to other visitors, loud music and talk is not allowed.
- Burning any local vegetation for campfire or cooking is strictly prohibited.
- Violators will be subject to fines and penalties according to applicable rules.

Camping Hostels

Camping Hostels will be permitted only at locations designated by the Department. Current designated locations are Ali Malik, Bara Pani, and Sheosar. The following guidelines and restrictions will apply.

- The Department will issue a permit for the operation of the hotel for a maximum period of three years. The permit will be subject to annual renewal on the condition that the permit holder has
- Issuance of a permit will in no means or manner entitle the permit holder to make any claim on the land, which is a government property.
- Only the residents of the villages in the periphery of Deosai will be eligible.
- The Department will reserve the right to cancel a permit if the conditions of the permit are repeatedly violated and the permit holders fails to take corrective action, and if in its opinion the damage occurring to the habitats is unjustified and not sustainable.
- An annual fee for the hostel as notified by the Department will be charged which will be escalated at an annual rate of 10% for a maximum period of three years, after which the Department will make a fresh determination of the fee.
- Amount collected as fee at Bara Pani and west of Barapa Pani will be deposited in the DNP Account of the Department in Skardu. Amounts collected as fee at Kala Pani and Sheosar will be deposited in the DNP Account of the Department in Astore.
- The boundary area for the hostels will be clearly demarcated by the Department.
- All hostel operations will be restricted to the demarcated area.
- Hostel sites will be directly accessible from the designated jeep tracks and will be marked by signboards.
- The DNP Directorate will provide Eco-Toilets.
- Any burning or burying of waste is prohibited
- Inside the Camping hostels a segregated collection of waste has to be installed with different bins (tins, glass and other) wildlife protected; the Hostels Manager is in charge to transport every day the waste collected outside from the Park at the entry points and deposit them in the proper containers.
- The hotel permit holder will maintain a register of visitors at hostel site and will be available to the Department for inspection at all times.

The following restrictions will apply, which will be displayed on the permit:

- The permit is non-transferable, no subletting or leasing is permitted.
- The permit holder is to be present on the premises with the exception of emergencies in which case he has to inform the staff of the Department in writing. The absence of permit holder should not in any case exceed six days in a month and 15 days in a season.
- The permit holder is responsible for keeping the area clean and removing all the garbage and disposing of it in Skardu or Astore.
- The hostel site will be restored at the end of the season.
- Silence will be maintained to avoid disturbance to other visitors, loud music and talk is not allowed.
- Burning any local vegetation for campfire or cooking is strictly prohibited.
- In case of violation, the permit holder will be subject to fines and penalties according to applicable rules, and cancellation of the permit in case of repeated violations.

Touristic trails

A net of touristic trails is delineated connecting some relevant points and hotspots. The idea is to offer the tourists that spend a night inside the Park some opportunities to enjoy the Deosai plateau beauty without disturbing the wildlife and the environment, in a sustainable way.

The rules for these trails are:

- Starting from the campsites
- Only inside the Sustainable Use Zone
- Connecting the Park with the Corridor
- Only by feet
- Camping allowed only in the delineated areas
- Take-back system for waste management (no bins)

The main trails are:

- Sheosar Lake tour
- Wildlife Watch Tower
- K2 view Point cross to Satpara
- Trails connected with the Corridor area to the villages of Shilla and Dappa

Signage

A unique signage design and format is required for all the campsites and trails inside the Park. Now you can find signs with different styles and need to be completely redesigned.

Recreational Fishing

Baseline fish surveys show that the Indus Snow Trout and Tibetan Snow Trout are abundant in the water bodies of the Deosai National Park. Both fish species are known to reach a length of 1 – 3 kg and are edible food fish.

As described in the Ecological Baseline Report, fishing in the area from Shatung Bridge to Bara Pani is common. With limited mobility, the staff of the Department finds it difficult to check such violations. While the staff based at the field camps of the Department at Bara Pani and Kala Pani Bridge is able to check for violations in the visible range, they make a daily trip to Shatung Bridge to maintain guard on the full stretch of the river. The staff at the check posts also frequently captures nets used by visitors to catch fish.

Prevention of illegal fishing by the visitors in DNP is a challenging task and requires active patrolling and checking by the staff of the Department. This increases the cost of enforcement. The abundance of fish in DNP, as reported by independent experts, has also increased substantially over the years. Permitting for angling of fish is recommended to reduce the cost of enforcement, increase the recreational value of the park, and improve revenue collection. Precedence for such permitting in a national park already exists in the Poonch River Mahaseer National Park in the AJK where a similar permitting system was introduced in 2015. Specific recommendations include:

Following the principles of sustainable management, it is important that fishing activities be regulated to ensure protection of the resource. Recreational fishing will be allowed in 2015 in specified areas in

the DNP to promote tourism, reduce the pressure from illegal fishing, and to generate additional revenues for the park.

1. The regulation should recognize the need to maintain the health of the ecosystem, and sustainable yields as determined by scientific studies.
2. The number of daily permits to be issued in the first year should therefore be limited to 500, with a bag limit of five fish per permit, and a fee of Rs 500. Fishing should be restricted to designated areas where the staff of the Department is positioned to monitor fishing activities.
3. The fishing area will be clearly demarcated with signboards showing start and end of the fishing zone.
4. Warning signs for visitors indicating restriction on fishing will be placed at other areas such as Shatung Bridge where fishing has been reported before. The signs will also inform the visitors on where the fishing is permitted. Signs at the entry of the park will also inform the visitors on fishing rules and permitted area.
5. The staff of the Department at Bara Pani and Kala Pani will issue permits and maintain a register for this purpose.
6. The staff of the Department will continue vigilance at Shatung Nala and at Kala Pani Nala to ensure that violation of restriction on fishing in all areas other than permitted areas does not take place.
7. Fish populations will be monitored on an annual basis using the same methodology as in the Ecological Baseline Report to ensure that harvesting stays at sustainable levels. Extension of the policy beyond 2015 will be considered after monitoring the fish population towards the end of season in 2015.
8. Amounts collected from fishing permits will be deposited in the existing account in which the park entry fee collected is deposited, and later in the Wildlife Conservation Fund when it is constituted.
9. Amount collected in Shatung Nala will be deposited in the account in Skardu, while that collected at Kala Pani will be deposited in the account in Astore.
10. Commercial fishing will not be allowed under any circumstances.

Based on the abundance and population distribution of fish, two areas are suggested as proposed Fishing Areas for recreational fishing. Permit based recreational angling will be allowed in these Fishing Areas subject to above restrictions.

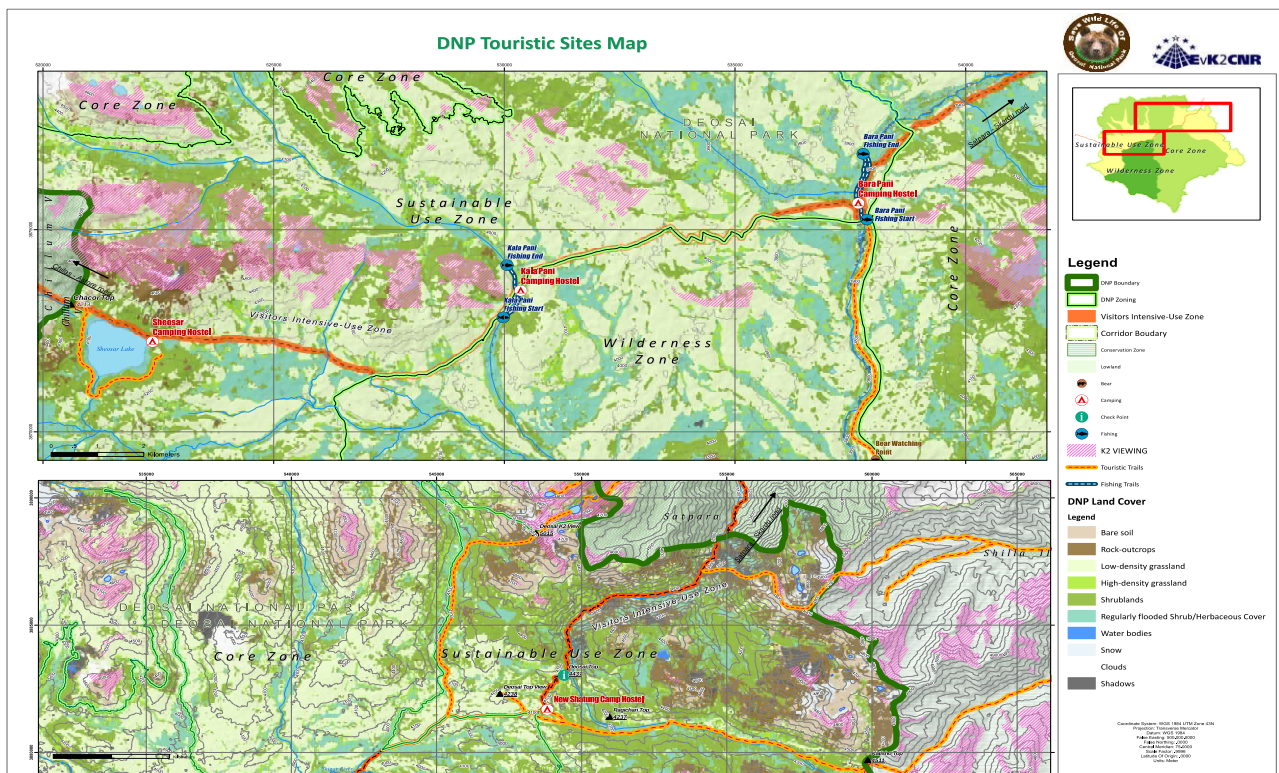
Watch and Wards

The identification of key threats and their appropriate management is central to keeping the integrity of protected areas intact. People do not hesitate to farm, hunt, or consume any resource available in protected areas because they feel that everyone owns state land, and that anyone can therefore take whatever one wants. Given this situation, specified goals cannot be achieved without active management in a study of 86 tropical national parks; successful species management was attributed to the greatest number of guards per unit area as well as clearly marked and maintained park boundaries. Most examples from around the world show that sufficient trained staff, equipment, and communication infrastructure is essential to a park's success.

The watch and ward provided by the Department will be improved by capacity building and training of the Department staff and providing them equipment and transport. The watchers will ensure the following:

- Prevent encroachment of locals and Gujjar Bakarwals into the Core Zone and Habitat/Species Management Area.
- Limit entry of visitors particularly in the Core Zone and Habitat/Species Management Area. However, permit based entry of researchers, scientists and visitors may be allowed in these zones.
- Prevent habitat degradation including grazing, removal of vegetation, construction, and extraction of plants from Core Zone, Habitat/Species Management Area, and Wilderness Area.
- Curtail illegal fishing (without permits) including non-selective fishing, and fishing in breeding season of fish.
- Prevent hunting of wildlife particularly Brown Bear
- Limit vehicles to designated tracks only
- Prevent visitors and hotel permit holder from disturbing wildlife and violating.

Exhibit 34: Tourist map, DNP



8.7. Buffer Zone

The frequent sighting of Brown Bears especially during the winter period in an outdoor area at the edge of the park has led to the definition and delimitation of the Buffer Zone which is no longer a simple circular crown around the Park but rather an area defined by linking Brown Bear sightings, the orography and the plant cover.

This area that functions as a buffer around the park requires a careful management also because it could become in the future an extension of the Park itself.

The Park Directorate guarantee the control on the activity in this Zone and provide Watch and Ward system by the Park staff, including the census of the wildlife species.

<p>Areas outside the DNP that have relevance to the conservation of the Brown Bear and other wildlife in DNP.</p> <p>IUCN Category VI <i>Protected areas with sustainable use of natural resources</i></p>	<p>Community engagement for protection of species that seasonally migrate to and from DNP or enjoy a protected status under legislation.</p> <p>Surface: 613.39 Km²</p>
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The criteria for the delineation of this zone are:

- Brown bear distribution outside of the Park including the information of the census of previous years and the last one in 2019
- The forest limit derived from the land cover map
- area where it is allowed the sustainable use of the natural resources according to the customary laws of the communities that has use rights (with some restriction and strict control of the Park staff)
- Protection of the Core Zone of the DNP

In this area:

- No construction allowed
- Strict protection of all biodiversity, habitats
- Limited presence of visitors, only along delineated trails
- Strict enforcement and fines for violations

<i>BUFFER ZONE IUCN VI</i>	
Entrance	No specific authorization released by DNP Directorate is required, for visitor it is allowed to walk only along the demarcated trail designed in the maps (see Connectivity Corridor Touristic Map)
Fees and duties	No fee
Transfer and stay inside the area	<ul style="list-style-type: none"> • vehicles are allowed only along the roads designed on the map • out from the roads it is allowed to move on foot (no motorized way) and along trails marked in the main points • camping is not allowed • avoiding the use of nylon bags and bottles or glasses bottles and boxes • waste has to be collected and transported out to the Buffer Zone

Hunting	Not allowed
Game bird hunting	Not allowed
Fishing	Not allowed
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, this area is considered high priority to conduct veterinary controls and vaccination/chemoprophylaxis campaigns. It is also considered a reduction of the number of grazing livestock in these areas. It is allowed the grazing of livestock of local communities following a sustainable approach
Presence of pack animals (horses, mules and	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 fire wood and shrub collection by locals following a sustainable approach
Timber harvesting	Not allowed
Collection and extraction of medicinal plants	It is allowed the harvesting by locals following a sustainable approach under license of responsible institution
Research	It is allowed to conduct research activities

The Buffer Zone is more extended outside the Core Zone of the Park to protect the Brown Bear and the other wildlife species.

Where the boundary is with Sustainable Use Zone, the Buffer Zone is included into the Buffer Zone Valleys, because the protection of the Core Zone is less important being guaranteed by the Sustainable Use Zone itself.

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, outside the DNP's border and spreading for about **613.39 km²**, is not continuous around the whole Park, but it is present mainly near the Core Zone and near to the areas where there are unsustainable activities and therefore a transition zone is needed.

In this area, the 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 not allowed outside the delineated roads and trails.

For visitors and researches that are moving in the Buffer Zone, a specific authorization has to be considered following the regulations in force in these specific areas as reported in this document.

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.

Fauna

In order to promote the conservation of threatened species of large mammals, some locations within this area have been recognized 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 Brown bear presence especially during the winter period. Monitor of 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 DNP 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.

Protection of livestock from carnivores

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

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.

In order to improve protection strategies of livestock from predator attacks, thus increasing the willingness of local communities to co-exist with predators, we suggest 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 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 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 funding’s 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.

Forest and vegetation

Forest

In this area, some 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 DNP forest management planning, there is the need to establish some Conservation Areas for the conservation of some patches where forests are well conserved, and to give *Forests and vegetation*.

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).

A well-balanced harvesting could be allowed in some areas in agreement with the local communities.

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.

Livestock and pastures

Sustainable Managed Pasture Area

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

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 wintertime 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.

8.8. Buffer Zone Valleys

Areas outside the DNP that have relevance to the conservation of the Brown Bear and other wildlife in DNP.	Community sustainable use of the natural resources, engagement for protection of species that seasonally migrate to and from the DNP.
IUCN Category VI <i>Protected areas with sustainable use of natural resources</i>	Ecotourism focused zones Surface: 765.92 Km²

The rules for the Buffer Zone Valleys are resumed in this scheme:

<i>BUFFER ZONE VALLEYS IUCN VI</i>	
Entrance	Free Entrance
Fees and duties	No fee

Transfer and stay inside the area	<ul style="list-style-type: none"> • vehicles are allowed only along the roads designed on the maps • out from the roads it is allowed to move on foot (no motorized way) and along trails marked in the main points • camping is allowed mainly in designed areas • use of kerosene and butane gas for cooking in the designated areas is considered, no fire can be used to cook or to burn wastes • avoiding the use of nylon bags and bottles or glasses bottles and boxes • waste has to be collected and transported back
Ecotourism	Promoted in several villages
Timber collection	According with Forest Act approved
Hunting	Allowed only in CCHA areas according to the regulations and correct reuse of the income
Game bird hunting	Not allowed
Fishing	Not allowed
Presence of livestock	<p>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, this area is considered high priority to conduct veterinary controls and vaccination/chemoprophylaxis campaigns</p> <p>It is also considered a reduction of the number of grazing livestock in these areas. It is allowed the grazing of livestock of local communities following a sustainable approach</p>
Presence of pack animals (horses,	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 fire wood and shrub collection by locals following a sustainable approach
Collection and extraction of	It is allowed the harvesting by locals following a sustainable approach under license of responsible institution
Research activities	It is allowed to conduct research activities

Promote sustainable development opportunities for the people living around the park

Poverty, lack of community participation and needful development opportunities are the biggest hurdles in the way of participatory management of DNP. If this situation continues, the ecological beauty of the park will diminish over the next couple of years, bringing in an ecological disaster;

negatively impacting the ecology of the park and socio-economic conditions of the local communities. For the better management of the Park and to reduce the subsistence pressure on its natural resources; it is very essential to generate sustainable economic opportunities for the buffer zone communities. The plan suggests the following income generating sources and ways to improve living conditions of the people in this regard:

Agriculture and livestock:

Main professions of people living around the Park are agriculture and livestock. Extreme weather conditions and lack of easy access to markets is a hurdle in their way, during the productive season. So, to attract the attention of communities in conservation, it is necessary to improve strengthen their income sources. The plan suggests the following measures to improve agriculture and livestock in the buffer zone areas of the park;

- Introduce high yielding varieties of crops such as potatoes, wheat and maize etc., to help people earn more money for their families from the marginal small land holdings.
- Help rehabilitation of degraded slopes to bring more waste land under the plough for agricultural and fodder productivity
- Introduce breed improvement programs to promote high milk cattle breed in the area
- Develop marketing of dairy, hair and wool products to generate avenues for additional income for farmers
- Training in sustainable agriculture techniques and practices (SALT)
- Develop access to local markets through building small link roads
- Improve the communication system such as telephone lines for better communication and improved marketing jointly with the relevant agencies and departments (SCO)

Trainings in food processing, handicrafts and its marketing:

- Support local communities, especially women, in processing of fruits and potato products for making chips, jam and jelly etc., (apricots, apple and sea buckthorn)
- Trainings for women in handicrafts making, weaving and making woolen/hair products
- Help women increase their savings through Aga Khan Rural and Support Programme and the Mountain to Market (MM & BB) designed saving and business schemes.
- Introduce small women led projects of food processing, dry fruits, handy crafts, arts and local food etc.
- Develop a sustainable marketing mechanism in collaboration with the enterprise development section of the AKRSP for timely and profitable sale of local products.

Jobs for local communities:

Since this component is highly related with the socio-economic development so the following agencies may jointly implement the actions based on their past experience of working in community development, as AKRSP, MM & BB, Local Government and Rural Development, GB tourism department, WWF-Pakistan and other projects, programs and organizations jointly with Directorate of DNP and community based organizations to create short and long term job opportunities for the local men and women.

Entry Points Master Plan

The Entry points of DNP are extremely important and they have to increase their functions and become not only a registration point but an area where different functions have to find a proper space and design.

- The Area of the Entry/Exit points has to be delineated and fenced with wood poles or stone walls
- A proper signage system reporting a map of the Park, the rules for the Visitors Intensive Use Zone, specific rules for waste management.
- Uniform the different signage's in a unique design.
- No Plastic Park declaration and rules
- Camping sites and camping Hostels locations and rules
- Fishing locations and rules

Inside the Entry/Exit, area has to be included:

- The staff building (max 2 floors) made with local components, stone walls, solar energy, low consumption stove)
- A Parking place for 20 vehicles
- Park Interpretation Centre. These interpretation centres will not have the aim to collect, conserve or study objects; their aims will be to communicate the significance of the Park and protection of the Environment. They will work to educate and raise awareness. They will use different means of communication to enhance the understanding of heritage and to aid and stimulate the discovery process and the visitor's intellectual and emotional connection to habitat protection.
- Toilets for visitors (4 males, 4 females)
- Waste disposal system to collect the waste collected in the Campsites and Camping Hostels segregate tins, glass, plastic and burnable waste
- Garbage dumpsters have a greater storage capacity and reduce the number of pick-up locations. However, they also must be provided a larger area that is accessible by a garbage truck.
- Solar system to provide energy to all the necessities of the Entry point services

In proximity of the entry points has to be located:

- Incinerator for burnable waste
- Pit for human waste collected in the campsites and hostels toilets

No other buildings, such as hotels, lodges, for tourist accommodation, can be built around the entry points but only in the two tourists, Hotspots described below.

Two tourist Hubs has to be located near the villages of Chillum, Astore side and Satpara, Skardu side, following the indications indicate in the next paragraphs.

ECOTOURISM IN THE BUFFER ZONE VALLEYS

Touristic flow can be a dangerous phenomenon

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 Tourism¹¹ 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 are rich mix of natural and cultural heritage makes the region a particularly important tourist destination. However, tourism development has been hampered

¹¹ UN World Tourism Organization defined CBT "as a promising alternative to conventional approaches to development, a participatory, holistic and inclusive process that can lead to positive, concrete changes in communities by creating employment, reducing poverty, restoring the health of natural environment, stabilizing local economies, and increasing community control". The Responsible Ecological Social Tours Project (REST, 1997) states that CBT is not merely a tourism business which seeks profit maximization but is more concerned with the impact on the community and natural resources from tourism: Community-Based Tourism therefore corresponds to Community-Based Ecotourism.

by the lack of policy guidelines, insufficient investment, inadequate tourism infrastructure, insufficient human resource 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 pro-poor 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 above mentioned 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 Intervention

The DNP 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.

Skardu, is the most important centre in the area, it 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.

The plan involves the creation of two Tourist hot spot, one at Satpara and one at Chillum where Deosai scenic road starts, the plans for these Buildings are described below.

B) Scenic Route

The Deosai road, open from mid-June till end of October, is crossed every year by thousands of vehicles in ways incompatible with the need to protect and preserve the natural area. Tourist cars stop along the route and invade the surrounding areas in a free and unorganized way.

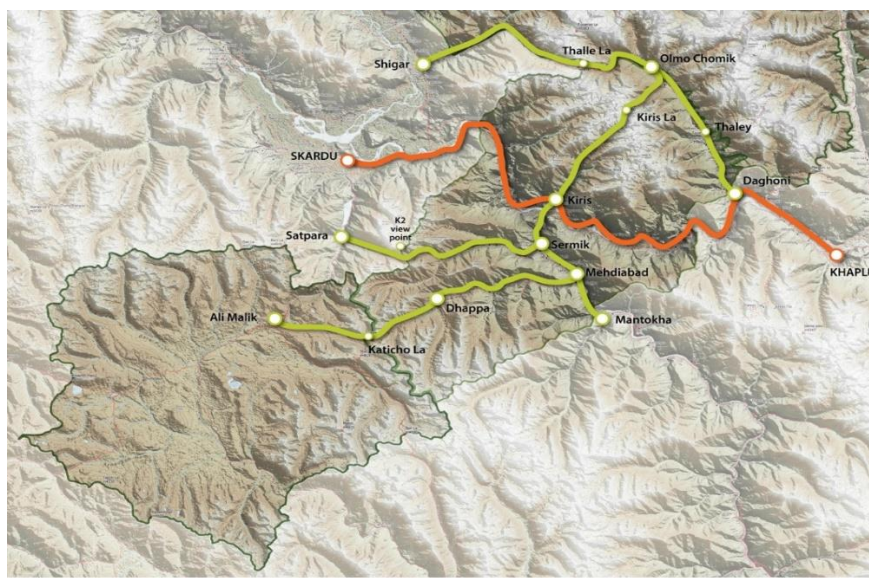
Deosai road is a “Scenic Route”, it has to be implemented creating parking areas and other facilities supporting tourists and avoiding off road excursions.

C) 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.

Exhibit 35: Tourist trails example in the connectivity area



D) 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.

E) 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

F) 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.

Infrastructures and buildings for tourist accommodation in the villages

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 of Deosai National Park.

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.

Example of eco-accommodation



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.

Placement of maps and signs

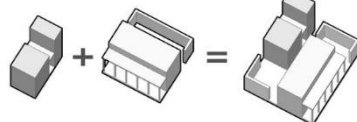
A huge number of trekkers visit the territory for short and long treks. Currently trekking routes have only been identified yet with minimum information. Signage development along the routes with adequate information can increase in the number of tourists and assist visitors in understanding and enjoying the natural and cultural heritage.

Different grouping schemes

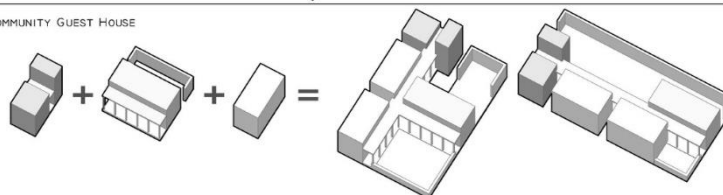
COMMUNITY WATER AND SANITATION FACILITIES



COMMUNITY CAMP SITE



COMMUNITY GUEST HOUSE



9. Fee System

The Fee System is divided in three levels:

- Foreign Visitors
- National Visitors
- GB resident Visitors
- BZV resident visitors

The local communities' inhabitants have free entrance in the Park. Currently to enter and stay it is sufficient to register at the Park entry points and pay the Entry Fee (8 USD (1300 PKR) for foreigner and 100 PKR for nationals, 40 PKR for GB). With the last year visitors, the amount collected is around 4.79 million PKR.

The management plan strongly suggests to revise the current Park fee structure and proposes 20 USD for foreigners, 500 PKR for nationals, 100 PKR for GB inhabitants and no fee for buffer zone communities. Moreover, the plan also suggests the grazing fee paid by nomads is being collected by Astore forest division which must be collected by DNP Directorate and also proposes following revisions in the grazing fee structure:

- Goats/Sheep: 50 PKR/-
- Mules/ Horses: 100 PKR/-
- Angling fee: 1000 PKR. /- per permit
- Campsite fee per person per night for local/ national= 300 PKR/-
Foreigner= 10 US \$

Put together:

- Entry Fee
- Grazing Fee
- Fishing Fee

These funds have to be transferred to DNP Directorate for the coverage of its expenses and mainly for waste management (25%), and 75% of community share against the submission of valley conservation and sustainable development plans or the local communities shall discuss the division of the 75% amount with the competent authorities for an acceptable agreement. It is mandatory that the social organizations do exist in the valleys and are registered with relevant departments.

10. Park Organization and Staffing

10.1. Existing Administrative Arrangements

At present, the Park is being administered by an eighteen-grade official of the Gilgit- Baltistan Forest & Wildlife department, as DFO/WLMO, having an established directorate at Skardu. Wildlife Management Officer (WLMO) is officially responsible to look after all technical, administrative and financial affairs of the Park. Under him, is strength of 17 regular staff including 01 RFO, 12 Game Watchers and 04 Admin personnel. Thirty-three staffs have been working against the present development scheme namely; “Management of Deosai Wilderness Park NAs”, though majority of them are engaged on short-term contractual basis. The number and placement of regular staffs is as under:

Exhibit 36: Existing core, supervisory and protective field staff in DNP

Staff	No.	Infrastructure	Location
Wildlife Management Officer (PBS 18)	01	RFO Office/ Rest House	Astore
Office Superintendent (BPS 16)	01	Check Posts (1)	Satpara
Accounts Assistant (BPS 11)	01	Check Posts (1)	Chillim
Game Watchers (BPS 5)	12	DNP	Bara Pani
Driver (BPS 4)	01	DoDNP	Skardu
Naib Qasid (BPS 1)	01	DoDNP	Skardu
Total	17		

The available field staff strength is inadequate to provide sufficient vigilance and care to wildlife and other precious resources of the Park. The position of Park Director is laying vacant and even, the Park has no regular Range Forest Officers (RFO) to supervise field protective staff. Similarly, twelve numbers of Game Watchers with no means of transportation can never be enough to effectively protect 3000.7 sq. km area. However, the present staff, even if vacant posts are filled and provided to the Park, may not be sufficient to achieve the objectives of conservation at the desired level until the positions are given specified assignments, relevant expertise, proper training and logistic support. Please see the Institutional Development Plan (2015) by HWF for details.

Environmental awareness and Eco-tourism promotion are two processes suggested to be continued so, in order to implement the plan in its true spirit and manage park resources on sustainable basis, the plan suggests hiring the following additional technical, service and support staff for implementation of the Management Plan:

Exhibit 37: Proposed strength of core, technical and field staffs for DNP

Title of post	BPS	Total required	Existing	Required
Technical / Professional Staff				
Park Director	19	01	00	01
Deputy Director/WLMO	18	01	01	00
Tourism Officer	17	01	00	01
Biologist	17	01	00	01
Limnologist	17	01	00	01
Social Organizer	17	01	00	01
Education Officer	17	01	00	01
Veterinary Officer	17	01	00	01
GIS Analyst	16	01	00	01
Range Forest Officer (RFO)	16	02	00	02
Park Inspector	12	03	00	03
Game Watcher	7	30	12	18
Support & Service Staff				
Office Superintendent	16	01	01	00
Assistant Accounts	14	01	01	00
Computer Operator	14	01	00	01
UDC	11	01	00	01
LDC	9	01	00	01
Driver	4	03	02	01
Chowkidar	2	04	01	03
Grade I	1	03	01	02

Positions and Terms of References for All Park staff

As obvious from the staffing structure on above page, a senior position of Wildlife Management Officer (BPS 18) is already available to DNP but the position of Director Park (BPS 19) is for the time being vacant.

At present, interestingly, there are three Park directors of grade BPS 19, one each for KNP, CKNP and DNP, supposed to look after 5000, 10000 and 3000.7sq. km areas of the KNP, CKNP and DNP, respectively. However, in real sense, the Director KNP has been providing vigilance and care to only 500 Km² area of the park, mainly along KKH. Contrarily, the entire Gilgit-Baltistan, encompassing more than 72,000 Km² area, having a network of 05 National Parks, 03 Wildlife Sanctuaries, 07 Game Reserves and 24 Community Controlled Hunting Areas (CCHA), is administered by the Divisional Forest Officer, (Wildlife) in BPS 18. Territorial DFOs (BPS 17 or 18) are responsible to protect wildlife in areas outside the Protected Areas under direct supervision of the Conservators of Forests &

wildlife, Gilgit and Baltistan (BPS 19), which shows that the officers in senior positions remain usually under-occupied because of very small area under their control and work load, compared to officers in similar grades of other departments. Furthermore, the Wildlife Management Officers (DNP & KNP) and Deputy Director (CKNP) holding grade 18 positions, in the presence of Park Directors are extremely underutilized, even, seem surplus sometimes. Therefore, in order to utilize their time, energy, knowledge and experience efficiently and more productively, the plan proposes to re-designate the position of director KNP (BPS 19) as Conservator Parks & Wildlife Gilgit-Baltistan and placed in Gilgit as in- charge of all wildlife and parks affairs. DFO Wildlife, Wildlife Management Officers (KNP & DNP) and Deputy Director (CKNP) of grade BPS 18 officers should be re-designated as Deputy Conservator Park or Park Warden and placed in their relevant districts as Park Managers to look after their respective parks. They will directly report to Conservator Parks and Wildlife GB.

In addition to the above already existing positions, the plan proposes a few new positions to implement the plan. A brief description of each post is given below:

Park Director (BPS 19)

Recruit staff for government executed component and engage consultants; facilitate coordination and collaboration with controlling authorities, project partners and stakeholders in the privilege of DNP management and project activity implementation, supervision of all technical and financial affairs of the DNP 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.

Biologist (BPS 17)

Park Biologist 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 monitoring protocol; guide and coordinate biodiversity research in the project areas, collection of park entry and camp sites flat fee, manage waste in DNP, and report to the Deputy Director on regular basis.

Limnologist (BPS 17)

A limnologist needs to observe and reports on freshwater inland ecosystems, such as streams, ponds, lakes, and marshland, conduct chemical analysis and take plant, fish and water samples to understand ecological impact, prepares water management plans, and collaborates with government agencies to manage the environmental impacts of human consumption and waste.

Social Organizer (BPS 17)

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.

Education Officer (BPS 17)

DNP was established in 1993, and till now it is present on the map, but so far it has not been successful in meeting its objectives of protecting its natural resources. One major reason for this is the lack of public education and general awareness. The need for such education becomes more important in situations like that of DNP where peripheral communities and visitors exploit park resources unwisely putting the park at risk. In order to spread the message of conservation to local communities, visitors and other stakeholders, and to seek their support and cooperation for park management, a full time Education Officer is suggested to be hired and placed within the park area.

Ecotourism Officer (BPS 17)

Deosai has tremendous tourism potential but ill-managed tourism activities during the past couple of years have been a threat to Park resources. The Gilgit-Baltistan Tourism department (GBTD) cannot fulfill the requirements and demands of eco-tourism in Protected Areas, especially in DNP. Although it has established tourist information Centre in Chillim to facilitate tourists but this plan suggests promoting sustainable tourism in the park area to generate revenue for the Park and its buffer zone communities. Which is a specialized field requiring effective planning and management as per the needs of tourists as well as the tourist carrying capacity of the Park, and subsequent monitoring to avoid any harmful impacts to Park ecosystem. Therefore, a full-time ecotourism officer will be required to meet these needs.

Veterinary Officer (BPS 17)

Transmission of diseases from livestock to wild animals on shared habitats is a common problem in Protected Areas, as people graze their livestock in pastures and rangelands where ungulates live and feed. In DNP, local and nomadic herds quite often graze in the same areas, which increase the chance of disease transmission from livestock to ungulates. In order to reduce chance of such incidences, livestock from the peripheral valleys need to be vaccinated on regular basis, before they are taken into the Park vicinity, which obviously can be done by a permanent veterinary staff of the Park. Moreover, sometimes, wild animals are injured and need instant treatment and care. Therefore, the plan suggests engaging a full time Veterinary Officer to meet such animal care and vaccination needs.

GIS Analyst (BPS 16)

Develop maps of National Park, Valleys, resources, Data analysis through GIS. 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 Biologist in Ecological assessment and monitoring and report him on regular basis.

Range Forest Officer (BPS 16)

Unrestricted grazing of livestock by both locals as well as nomads is a major issue in DNP. However, as per the prescription of the management plan, the local community will be allowed to graze their livestock in the grazing zone of the Park, which again would not be easy to enforce in true spirit without assessing the productivity and carrying capacity of different pastures based on which a specific number and kind of livestock will be allowed. There are quite a few qualified range experts available in PFI, NARC, AARU and WWF who may provide useful guidance on several range related issues of the

Park, but only permanent park official who are responsible for rangelands can do effective implementation and monitoring of the pastures and rangelands. So, the plan suggests that grazing pressure in the park be minimized allowing scientific grazing in grazing zones only and also by developing alternative grazing areas outside the Park boundaries, for which a permanent employee stationed full time within the park would be required.

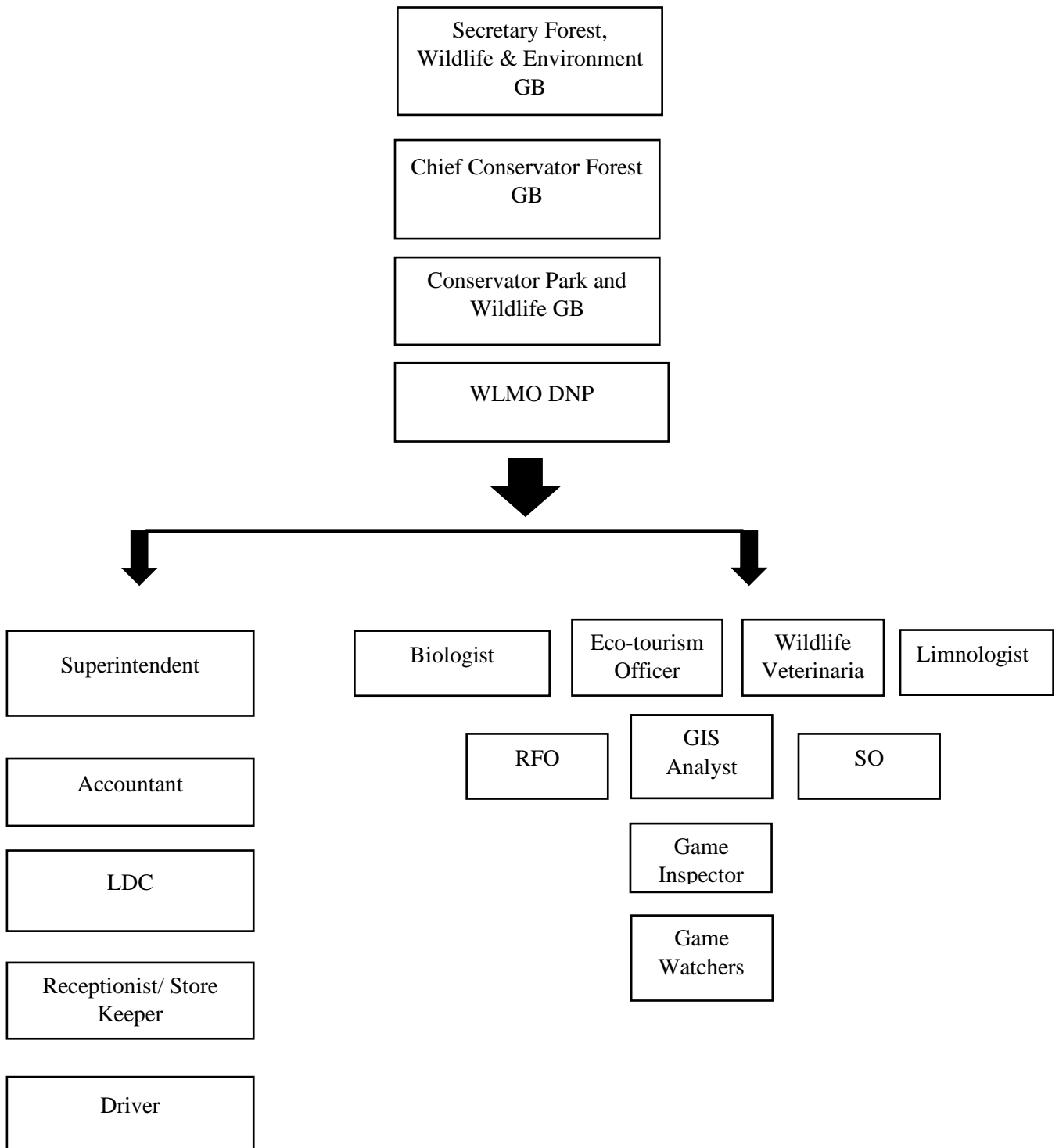
Park Inspector (BPS 12)

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-conservation movements in the respective jurisdiction and take into confidence the community conservation committee members for preventive measures or otherwise.

Game Watcher (BPS 7)

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.

Proposed staff organogram for DNP



10.2. Park Management Structure

10.2.1. Governance for the management of the DNP

Desirable management of DNP 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 DNP close to natural state, if not completely natural. Various organizations such as DNP 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 DNP. Accordingly, the management plan thus prescribes as under:

10.2.1.1. DNP sub-committee

Proposed Functions

- Discuss and provide guide on policy and legal issues related to maintaining ecological health of the DNP as represented of the Himalayan 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 DNP 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, Wildlife, and Director/ WLMO of DNP (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 DNP and one community members from each DCC.

10.2.1.2. DNP Management Committee

Proposed Functions

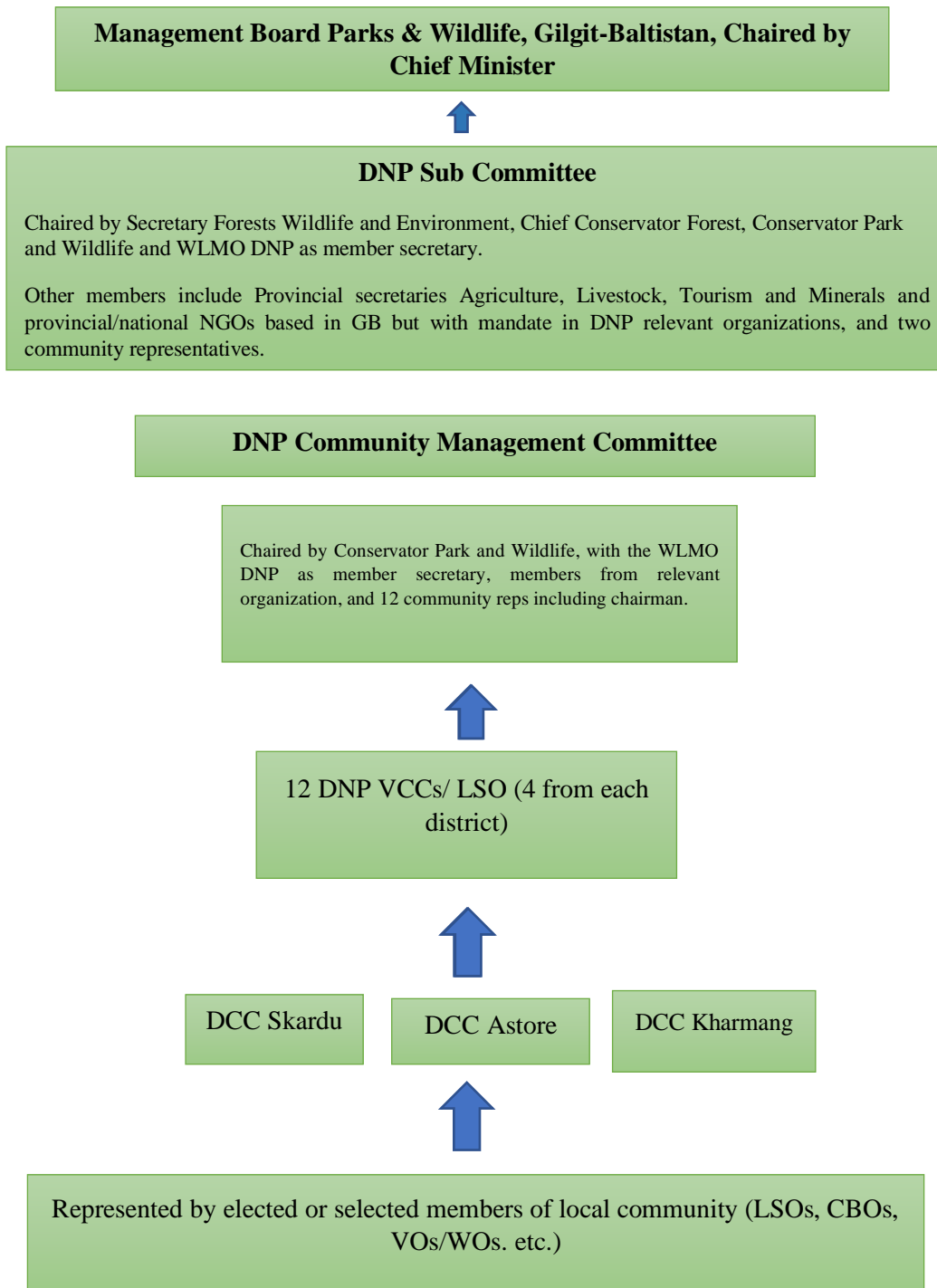
- Make sure that DNP maintains its ecological health and does not deteriorate due to excessive uses of its natural resources. This should be made possible through building consensus in meetings of the committee, seeking guidance from relevant experts/ departments.
- Undertake issues related to visitor 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 WLMO DNP as member secretary, members from relevant organization, and 12 community reps including chairman.

Graphical representation of the above committee is given below;



11. Campsites and Infrastructure Development Plan

This Plan Provides an overview of the infrastructure available in the Deosai National Park, current constraints and gaps, recommended policy and principles for provision of infrastructure, the strategy for development of the infrastructure, and specific aspects of infrastructure that need to be developed. The scope of the plan includes the following:

1. Infrastructure to support visitors
2. Infrastructure to support park management

Overview of Available Infrastructure

The following is a description of the available infrastructure:

Roads and Tracks: Black top road currently extends from Skardu to about 23 km from the point of entry into the national park at Ali Malik, and about 13 km from Chilium to Chachore Top. The road across Deosai connecting Skardu to Astore is now in good condition and partially asphalted. The remaining tracks are dirt roads, connecting to Murtaza Top onwards to Gultari, and through Bari La to Matiyal.

Camping Hostels: Local owners are presently operating hostels at Ali Malik, Bara Pani, Kala Pani, and Sheosar Lake. All of these Camping Hostels provide very basic food and tent accommodation.

Toilets: The Department, generally two at each hotel location, provides all Fiberglass toilets. The Department staff and the visitors commonly use toilets at Bara Pani. The hotel operator at Sheosar provides a tent type toilet for visitors.

Campsites: Informal and unregulated camping areas are operating at Ali Malik, Bara Pani, Kala Pani, and Sheosar. The hotel operators allow the visitors to camp on their premises for a small fee, Rs 200 per tent at Bara Pani.

Park Management Infrastructure

Main Park Office: The main park office is located in Skardu on Satpara Road.

Check posts: Constructed check posts exist at Satapra and Chilium.

Rest Houses: These are available at Skardu and Chilium.

Field Camps: Field posts consisting of tents and fiberglass igloos are being operated at Shatung, Bara Pani, and Kala Pani. The main field camp at Bara Pani has a masonry and concrete room constructed at the base of the hill.

Current Constraints and Gaps

Roads and Tracks: The road is now in good condition compare a few years ago when the dirt tracks become difficult to negotiate in wet conditions. At that time, secondary tracks are formed when the vehicles negotiate bypassing the existing tracks that develop deep ruts, resulting in habitat damage. The remaining road are only jeep able roads but there are a lot of

tour operators that organize jeep safari and off-road experience, with dangerous impact on the environment.

Camping Hostels: With some exceptions, the conditions at the Camping Hostels are generally not clean and are unhygienic, including kitchens and tents accommodating visitors.

Toilets: Toilets are generally in disrepair and in poor condition. Toilet facilities for visitors are not available at the check posts.

Campsites: Without clear demarcation, the visitors tend to camp at will often disturbing areas which have previously not used for camping, and locating toilet tents close the rivers and streams thus potentially contaminating the flowing water

Park Office: No office facilities are available in Astore due to which management of the western part of Deosai and liaison with the communities located there is weak.

Check posts: These are adequate in terms of the buildings. However, water supply at the Satpara check post is a problem in the late season when the water in the stream from which the supply is taken of the check post dries out.

Rest Houses: Rest houses are currently constructed at Skardu and Chillum. These are adequate for the needs of the park staff and management.

Field Camps: Field camps facilities are adequate. Continuous replacement of tents and igloos will be required.

Recommended Policy and Strategy for Infrastructure

Recognizing the generally pristine and fragile nature of the national park habitats, HWF initially maintained a policy of 'no permanent structures' within the national park boundaries. The objective of this policy was to prevent mushrooming of commercial and government buildings that would degrade the landscape and habitats. With the Department now established in the national park and having some degree of control over new constructions, this approach can be reviewed and revised. Specific policies and guidelines are outlined below:

Visitor Infrastructure

Infrastructure should be developed to facilitate the visitors and to improve the quality of their experience and safety within the national park, but everything has to be done in a sustainable way to preserve the ecosystem especially the wildlife in the Park area.

Roads and Tracks: Black top road should be extended over all high traffic corridor to make it possible for cars to safely traverse Deosai. This will reduce travel times and dust emissions, improve the safety and quality of experience for visitors, and protect the landscape from damage from use of multiple tracks by vehicles.

The other jeep road has to remain like they are and only the local people can transit on them.

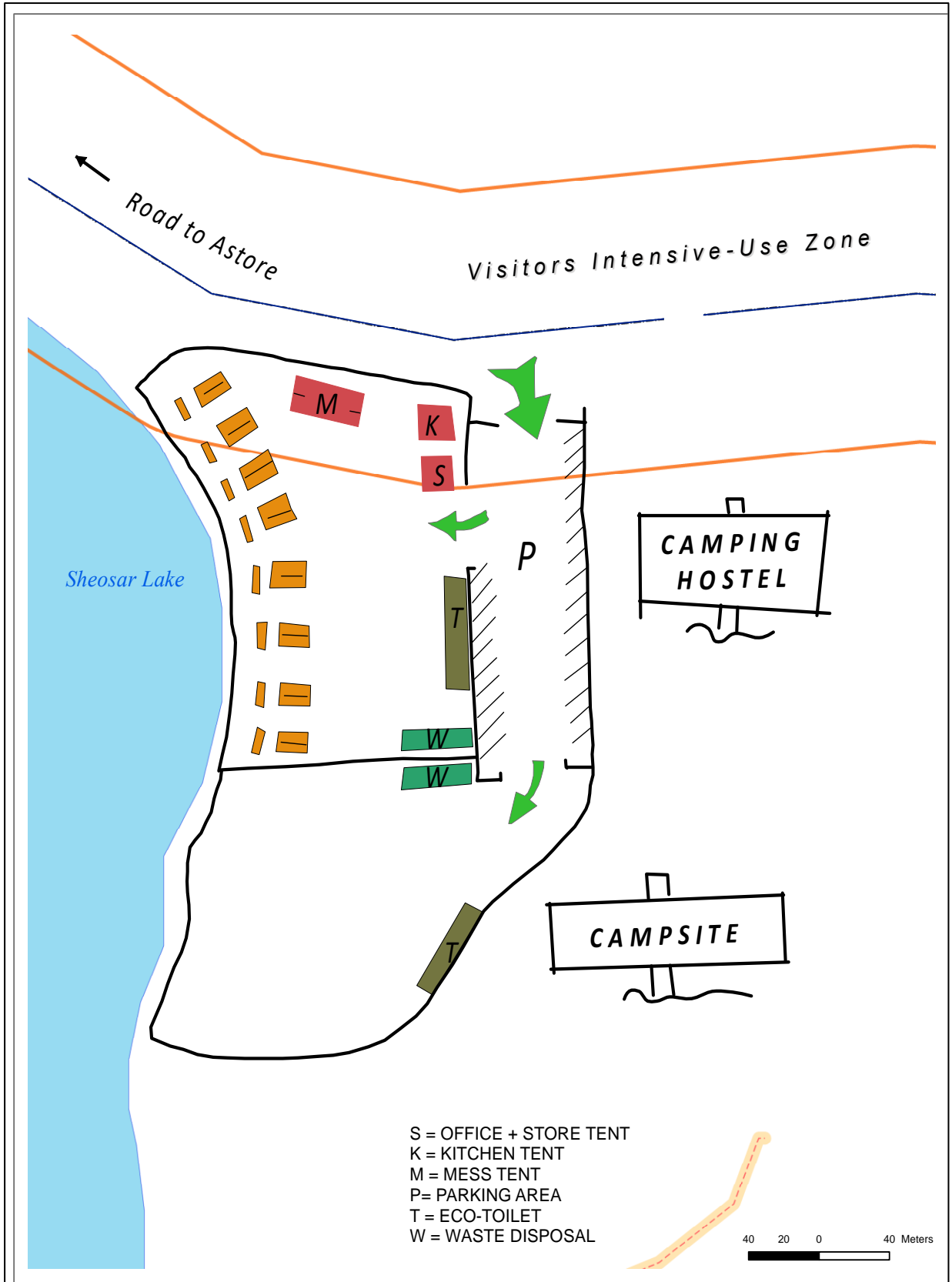
Camping Hostels: Guidelines for facilities and operation of hostels have been included in the Visitors Intensive Use Zone rules. Preparation of standard plans is recommended for the layout and facilities of the hostels. A draft layout for the four Camping Hostels is included.

Campsites: Camping areas should follow standard layout plans and should be regulated through permits by the Department. A camping fee per tent of the order of Rs 300 per person per night is recommended. Toilet facilities and drinking water should be provided at all campsites. A draft layout of the camping facilities in the four campsites is included.

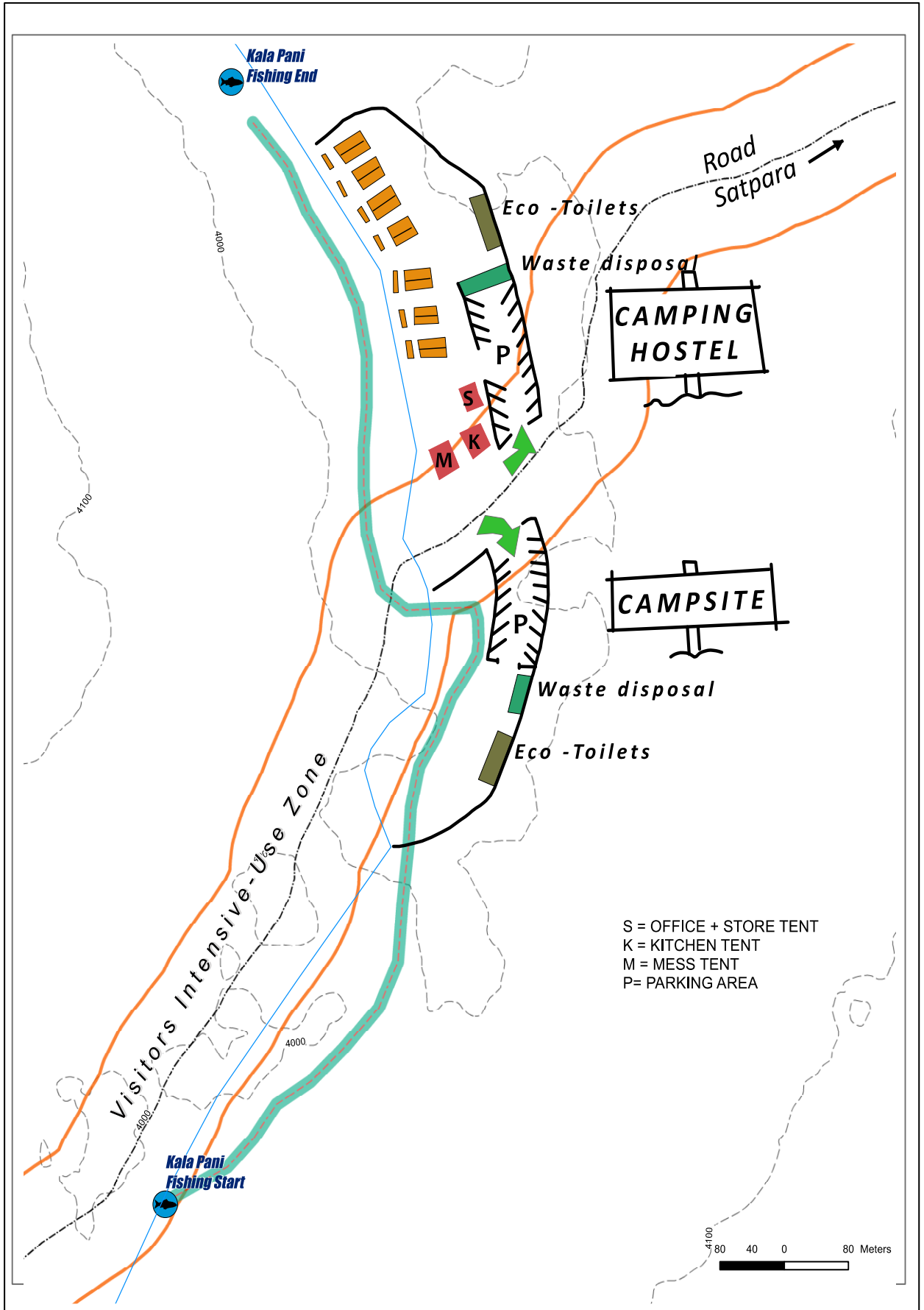
The Campsite has to be located next to the Camping Hostel area, with the same access from the road and same parking. The rules for the Camping Hostels plan are:

- Easy access from the road
- Parking area near the entry (far from the river)
- Reception tent
- Store tent
- Kitchen tent
- Store tent
- Eco-toilets (far from the river)
- Waste disposal wildlife proof, different bins for tins, glass, etc.
- Solar system for energy supply
- Water supply from the river
- Tents placed along the river (max 10)
- Tables and benches river side

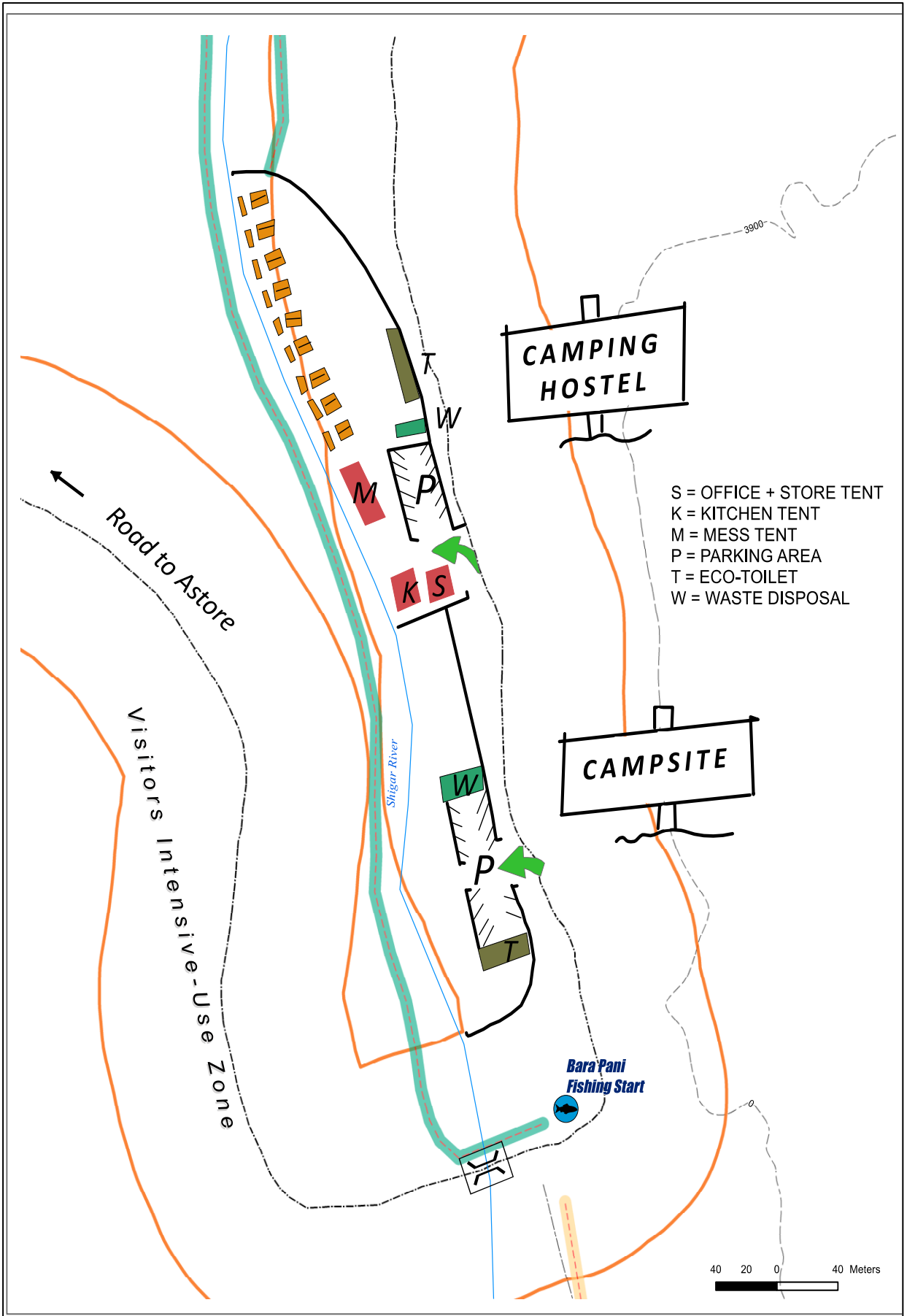
Sheosar Lake sketch plan



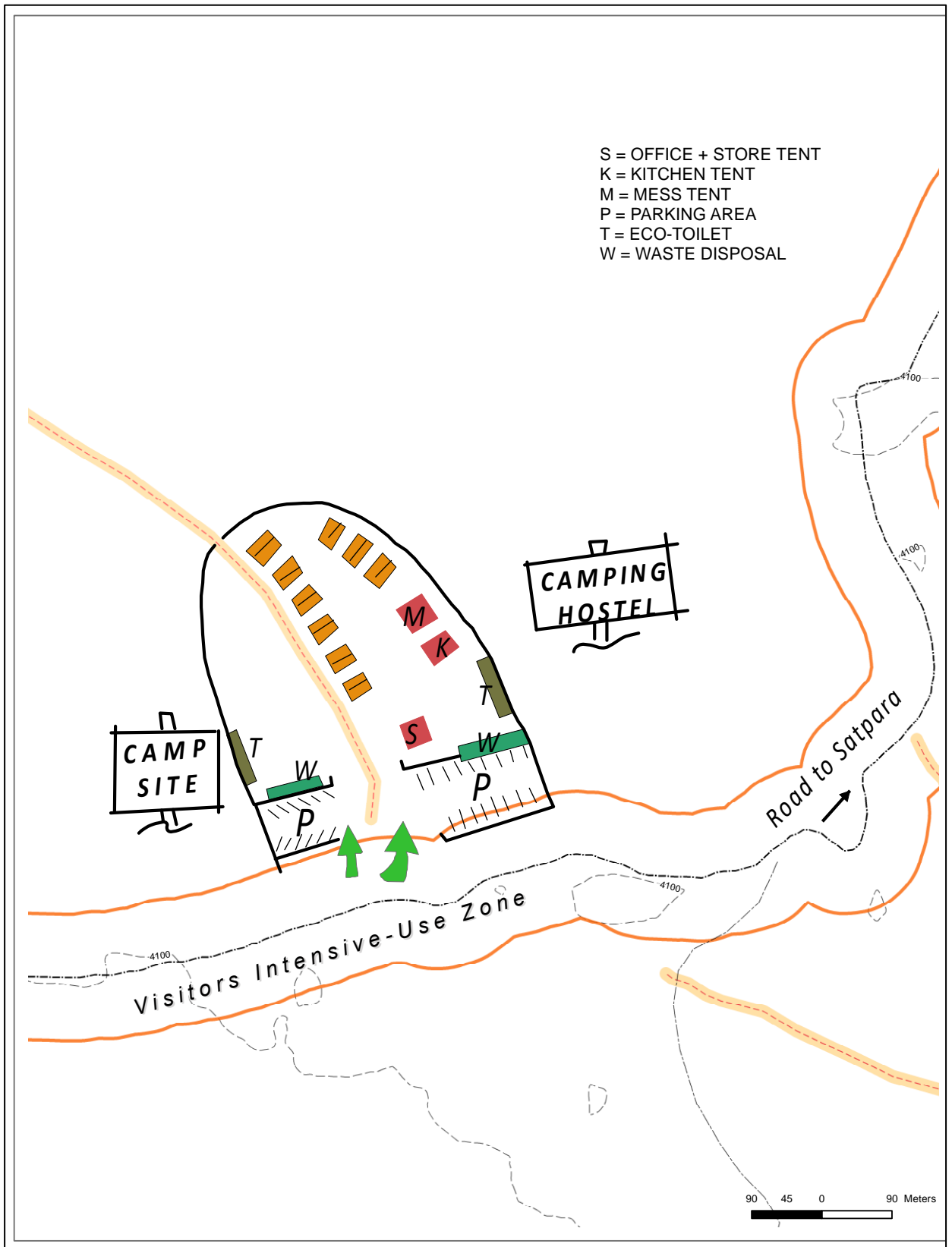
Kala Pani Sketch plan



Bara Pani sketch plan



New Shatung sketch plan



TOILET

The Campsites and Camping Hostels must use only ECO TOILETS

The toilets inside the Park has to be concentrated inside the camping site and the camping hostels. These toilets have to be only temporary and at the end of the season have to be removed and take away outside of the Park Boundary.

At the same time, it is very dangerous to leave the human waste in the ground considering the high quantity and the proximity of the campsites with the river.

For these reasons, a kind of ECO-TOILET has to be introduced, realized with a drum in which the human waste is collected and transported away by the staff of the campsite and taken to apposite pits near the entry points. In CKNP, there are these Eco Toilets in use in the campsites over the glaciers that can be taken as sample for DNP.



These are some samples of eco toilets; introduction of a **Composting Toilets System** is an advanced solution that can be considered.

A **composting toilet** is a type of dry toilet that treat human waste by a biological process called composting.

Composting toilets, together with the secondary composting step, produce a humus-like end product that can be used to enrich soil if local regulations allow this. Some composting toilets have urine diversion systems in the toilet bowl to collect the urine separately and control excess moisture.

Composting toilets use the natural processes of decomposition and evaporation to recycle human waste. Waste entering the toilets is over 90% water, which is evaporated and carried back to the atmosphere through the vent system. The small amount of remaining solid material is converted to useful fertilizing soil by natural decomposition.

When human waste is properly composted, the end product does not contain any pathogens or viruses (these are destroyed by bacterial breakdown). This nutrient-rich fertilizer can then be used on plants or around the base of trees, as part of the natural cycling of nutrients, reducing your need for commercial fertilizers and preserving local water quality.

A composting toilet must perform three completely separate processes:

1. Compost the waste and toilet paper quickly and without odor
2. Ensure that the finished compost is safe and easy to handle
3. Evaporate the liquid

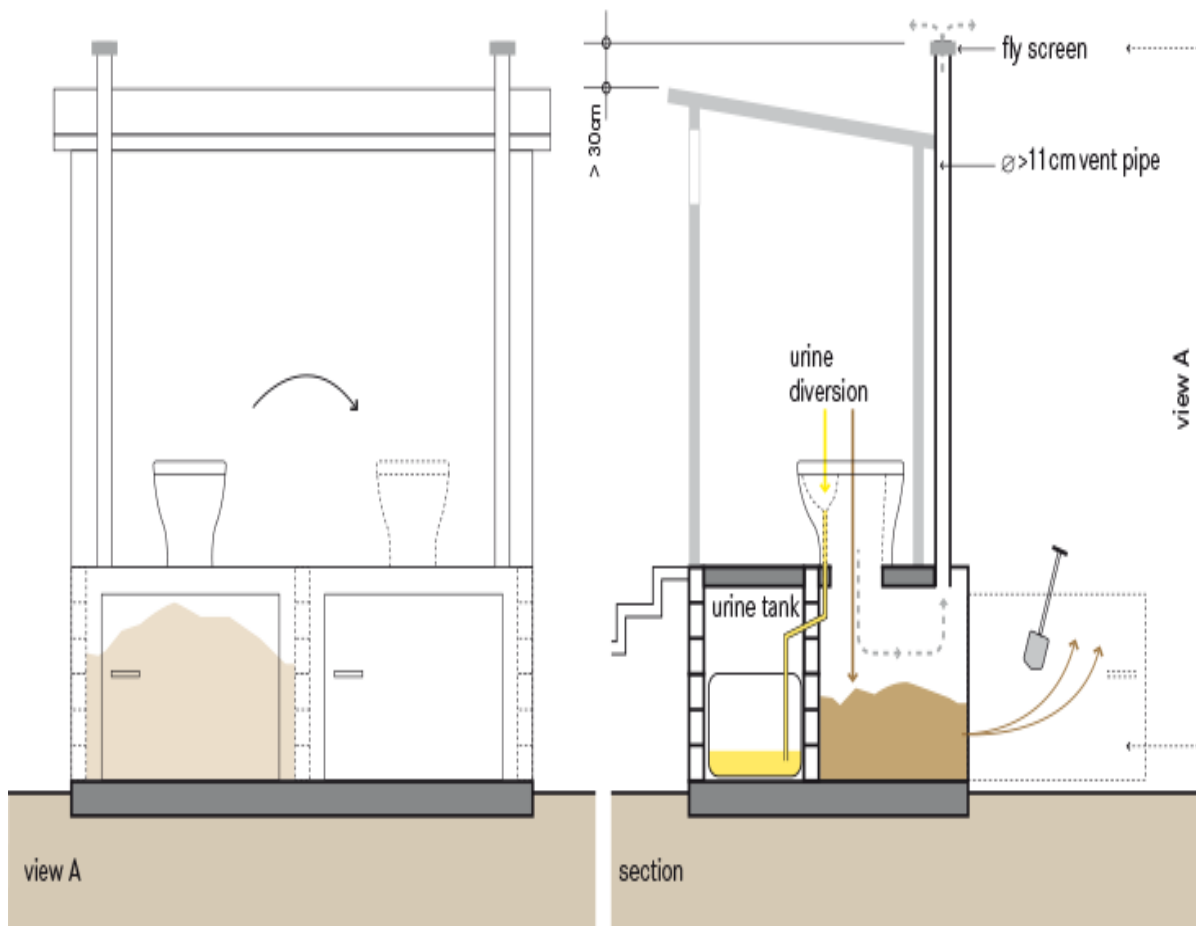
A **urine-diverting dry toilet (UDDT)** is a type of dry toilet with urine diversion that can be used to provide safe, affordable sanitation in a variety of contexts. The separate collection of feces and urine without any flush water has many advantages. Some type of dry cover material is usually added to the feces vault directly after each defecation event. The dry cover material may be ash, sawdust, soil; sand, dried leaves, mineral lime, compost, or dried and decomposed feces collected in a UDDT after prudent storage and treatment. The cover material serves to improve aesthetics, control flies, reduce odor and speed up the drying process.

2-hole (pink) and 3-hole (blue) urine diversion ceramic squatting pan

3-hole urine diversion squatting pan to accommodate anal cleansing with water



Schematic of the dehydration vaults of a UDDT with two vaults



Research Studies

AN OUTLINE OF THE FLORA OF THE DEOSAI NATIONAL PARK AND ITS BUFFER ZONES, GILGIT-BALTISTAN, PAKISTAN

1. Introduction

Plants are the keystones to drive the ecological processes, productivity and shape many terrestrial ecosystems. The processes of the ecological system thought to depend upon the diversity and identity of the species. Biological diversity is crucial for the functioning and stability of the ecosystem apart from the economic, ethical and aesthetic benefits (Marston, 2008; Cardinale *et al.*, 2012). Plants are vital among biotic factors of the ecosystem and execute the ecosystem processes as producers in many terrestrial ecosystems, for instance, grassland, savanna, mountain ecosystem etc. Mountains are one of the major land ecosystems and possess a wide range of spectacular physiography encompassing a great diversity of species (Jackson, 2006; Becker *et al.*, 2007). Nearly one-quarter of the terrestrial biological diversity, half of the world hotspots and, considerable ethnic groups with varied cultural practices confined in the ecological system of the mountains (KOrner, 2005; Huber *et al.*, 2006). These high ecosystems have high biological diversity but the complete inventory of life forms of the World's mountains is still missing. The understanding of the diversity of nature is one of the fundamental goals of ecological research (Lubchenco *et al.*, 1991). The identification and overall floristic diversity is a prerequisite to understand the other ecosystem phenomena regarding vegetation dynamics and services of the ecological system (Miller, 2012). Therefore, species-level diversity has been given great importance to understand the status of any land ecosystem. The immense World's flora (300,000 species) displays an uneven distribution across the world at continental, regional and ecosystem levels. In relation to Pakistan, the national flora is in its exploratory phase. In spite of unceasing exertion for floristic exploration, various areas are yet to be explored for example Baltistan, Pubbi hills, Sulaiman Ranges, etc. (Ali, 2008). The publication processes of floral monographs have been unbroken since 1970 to date, but national botanical institutes and herbaria lack even the inventories of several areas. Pakistan is rich in plant diversity and the sum of 6000 species were identified and described in more than 2014 plant families. Its enormous phyto-diversity indicates the country's varied climate, edaphology and multiple ecological regions Nasir *et al.* (1972). Deosai plateau is one of the spectacular high-altitude alpine ecosystems and resides the enormous biological diversity of plants. In 1993 it was declared as Deosai National Park. Stewart *et al.* (1972) published the first list of plants of the Deosai plateau and still is regarded as the important reference. After the mentioned study no, other precise floristic survey has been conducted. Other botanical works include Shaheen and Qureshi (2011), Shaheen *et al.* (2011), (Zakir, 2014) etc. But the yearly increase in the intensity of posed varied environmental and anthropogenic challenges on plant biota makes it urgent to investigate its floral diversity and to address imposed threats for effective management plan and conservation. The current study was aimed to assess the plant diversity along with anthropogenic-natural threats.

2. Site Description

Deosai (350.02' N, 0750.25' E) is an amazing alpine plateau in the ranges of Western Himalayan range, Northern Pakistan. It borders with buffer zones such as Sadpara, Shila, Dapa, Shingo Shigar, Gultari, Chilam, etc. In topographic settings, Deosai is relatively flat and the peripheral areas are elevated. But the slopes joining with buffer zones make gorges with the elevation of 4000m and continuously decrease to the valley bottom. It experiences long winter (mid-September to Mid-April) and short summer (mid-June to August). Mean daily temperatures range from -20 C to 12 C . The annual precipitation is 510 mm to 750 mm, and falls mostly as snow (HWF, 1999). Grassy meadows are the dominant habitat type while rocky hills, marshy areas, alpine boulders, alpine scree are also remarkable habitats. The vegetation is predominately herbaceous perennials, grasses, and sedges (Bellemain *et al.*, 2007; Nawaz, 2008). Deosai was declared as National Park in 1993 to protect the natural, biological and ecological habitat balance of this fragile ecosystem. Deosai enjoys plenty of water from a large number of brooks and shape marshy vegetation along stream banks.



Figure1: Landscape of Deosai plateau

3. Materials and Methods

Field trips were undertaken to the study sites in order to collect all possible plant species covering all types of habitat and accessible altitudinal range. The walk and collect method (Oosting, 1956) was used. The collected and tagged plant materials were kept in the presser for 48 hours in the room temperature by periodical changing of blotting papers. In order to protect from plant pathogens, pests, and fungi the specimens were treated with Mercuric chloride, copper sulphate and absolute alcohol (2 g mercuric chloride and 10 gram copper sulphate dissolved in 1000 ml absolute alcohol) (Jain and Rao, 1977; Maden, 2004). The poisoned and dried specimens were properly mounted on standard size herbarium sheets and recorded field information were written on label for further studies. The plant species were identified by Flora of Pakistan (Nasir, E. and S.I. Ali (Eds.), 1970-1989); Ali, S.I. and Y.J. Nasir (Eds.), 1990-1991; Ali, S. I. and M. Qaiser (Eds.). 1993-2018 and flora of china http://www.efloras.org/flora_page.aspx?flora_id=2. The botanical names and respective

families were confirmed by angiosperm phylogeny group (Group, 2009), and The Plant List (2010) <http://www.theplantlist.org>. The identified plant specimens were properly labelled, stamped and given voucher numbers after identification. Finally, they were deposited in the offices/laboratories of Deosai, and Central Karakorum national parks as future records.



Figure2: Plant field survey and collection



Figure3: Pressing and drying process of plant specimens



Figure4: *Papaver nudicula*; a common species of alpine meadows

4. Results

A total of 203 vascular plant species were recorded in 200 genera and 47 families presenting three major plant groups (Pteridophytes, Gymnosperms and angiosperms). Pteridophytes were presented only by a monotypic family Equisetaceae. Ephedraceae and Cupressaceae were the representative families of Gymnosperms with 2 genera (Ephedra, Juniperus) with three and two species respectively. Alliaceae, Cyperaceae and Poaceae were the leading monocot families. Angiosperms were the most successful plant group and presented 170 species in 43 families. Family Asteraceae was the dominant family with 41 species.



Figure5: *Epilobium angustifolia*; a species of alpine scree

Table1: Floristic diversity of the Deosai national park and its adjoining valleys

Families	Botanical Name
Equisetaceae	<i>Cystopteris dickieana</i> R. Sim
Cupressaceae	<i>Juniperus excelsa</i> M.Bieb.
	<i>Juniperus communis</i> L.
Ephedraceae	<i>Ephedra geradiana</i> Wall. ex Stapf
	<i>Ephedra intermedia</i> Schrenk & Meyer
	<i>Ephedra regeliana</i> Florins
Alliaceae	<i>Allium carolinianum</i> DC.
Cyperaceae	<i>Carex melanantha</i> C.A.Mey.
	<i>Carex nubigena</i> D.Don ex Tilloch & Taylor
	<i>Kobresia laxa</i> Nees
Poaceae	<i>Agrostis canina</i> L.
	<i>Agrostis nervosa</i> Nees ex Trinius
	<i>Alopecurus arundinaceus</i> Poir.
	<i>Bromus hordeaceus</i> L.
	<i>Bromus pectinatus</i> Thunb.
	<i>Calamagrostis pseudophragmites</i> (Hall.f.) Koel.
	<i>Chrysopogon gryllus</i> (L.) Trin.
	<i>Echinochloa crus-galli</i> (L.) P.Beauv.
	<i>Elymus dahuricus</i> Turc.
	<i>Elymus nutans</i> Griseb.
	<i>Festuca altaica</i> Trin.
	<i>Pennisetum lanatum</i> Klotzsch
	<i>Phragmites karka</i> (Retz.) Trin. ex Steud.
	<i>Poa alpina</i> L.
	<i>Cymbopogon jwarancusa</i> (Jones) Schult.

	<i>Koeleria gracilis</i> Pers.
	<i>Leymus secalinus</i> (Georgi) Tzvelev
	<i>Poa alpina</i> L.
	<i>Poa pratensis</i> L.
	<i>Poa supina</i> Schrad.
	<i>Stipa orientalis</i> Trin.
Amaranthaceae	<i>Atriplex tatarica</i> L.
Apiacea	<i>Lagusticum elatum</i>
	<i>Bupleurum thomsonii</i> C.B.Clark
	<i>Heracleum pinnatum</i> C.B. Clarke
	<i>Platytaenia lasiocarpa</i> ssp. <i>thomsonii</i> (Clarke) Rech. f. & Riedl
	<i>Pleurospermum candollei</i> (DC.) C. B. Clark.F.
	<i>Pleurospermum hookeri</i> C.B. Clarke
	<i>Selinum papyrassum</i> C.B. Clarke
	<i>Schultzia dissecta</i> (Clarke) Norman
Apocyanaceae	<i>Cynanchum acutum</i> L.
Asteraceae	<i>Ajania fruticulosa</i> (Ledeb) Poljak
	<i>Allardia tridactylis</i> (Kar. & Kir.) Schultz
	<i>Anaphalis boissieri</i> E. Georgiadou
	<i>Anaphalis nepelensis</i> var. <i>monocephala</i> (DC.) Hand. -Mazz.
	<i>Anaphalis nepalensis</i> var. <i>nepalensis</i> (C. B. Clarke) Ridley
	<i>Anaphalis staintonii</i> Georgiadou
	<i>Anaphalis virgata</i> Thomson ex. C.B.Clarke
	<i>Artemisia absinthium</i> L.
	<i>Seriphidium brevifolium</i> (Wall. ex DC.) Ling & Y. R. Ling.
	<i>Artemisia tournifortiana</i>
	<i>Artemisia rutifolia</i> Stephan ex Spreng.
	<i>Artemisia santolinifolia</i> Turcz.ex Krasch.

<i>Artemisia scoparia</i> Waldst.
<i>Chondrilla graminea</i> M. Bieb.
<i>Cichorium intybus</i> L.
<i>Cirsium vulgare</i> (Savi) Ten.
<i>Cousinia thomsonii</i> Clarke.
<i>Crepis flexuosa</i> Kit.
<i>Echinops cornigerus</i> DC.
<i>Erigeron flaccidus</i> (Bunge) Botsch.
<i>Filago hurdwarica</i> (Wall ex DC.) Wagenitz
<i>Filago paradoxa</i> Wagenitz
<i>Jurinea dolomiaea</i> Boiss.
<i>Hieracium umbellatum</i> L.
<i>Inula rhizocephala</i> Schrenk
<i>Lactuca decipiens</i> Hook.f. & Thomson ex C.B.Clarke
<i>Lactuca orientalis</i> (Boiss.) Boiss.
<i>Leontopodium leontopodium</i> (DC.) Hand. Mazz
<i>Saussurea candolleana</i> (Wall.ex DC.) Clarke
<i>Saussurea ceratopcarpa</i> (Dcne.) Benth. & Hook.f.
<i>Saussurea lappa</i>
<i>Saussurea falconerii</i> Hk. f.
<i>Saussurea jacea</i> (Klotzsch) C.B.Clarke
<i>Saussurea obvallata</i> (DC.) Sch. Bip
<i>Saussurea taraxicifolia</i> (Lindle.) Wall. Ex DC.
<i>Scorzonera virgata</i> DC.
<i>Senecio analogus</i> DC.
<i>Senecio krashinumkovii</i> Schischk.
<i>Tanacetum falconeri</i> Hook.f.
<i>Tricholepis tibetica</i> Hook.f. & Thomson ex C.B.Clarke

	<i>Laggera alata</i> (D. Don) Oliver
Balsaminaceae	<i>Impatiens edgeworthii</i> Hook.F.
Berberidaceae	<i>Berberis orthobotrys</i> Bien. ex Aitch.
	<i>Berberis pseudoumbellata subsp. gilgitica</i> Jafri
Betulaceae	<i>Betula utilis</i> D.Don.
Boraginaceae	<i>Arnebia euchroma</i> (Royle ex Benth.) I.M. Johnston
	<i>Cynoglossum glochidiatum</i> Wall. ex Benth.
	<i>Lindelofia longiflora</i> (Benth.) Baill.
	<i>Myosotis alpestris</i> F.W.Schmidt
	<i>Onosma hispida</i> Wall. ex G.Don.
Brassicaceae	<i>Draba winterbottomii</i> (Hook.f. & Thoms.) Pohle
	<i>Barbarea intermedia</i> Boreau
	<i>Barbarea vulgaris</i> R. Brown
Campanulaceae	<i>Codonopsis clematidea</i> (Shrenk) C.B.Clark
Capparidaceae	<i>Capparis himalayensis</i> Jafri
Caprifoliaceae	<i>Lonicera heterophylla</i> Decne.
Caryophyllaceae	<i>Cerastium cerastoides</i> (L.) Britton
	<i>Dianthus anatolicus</i> Boiss.
	<i>Silene gonosperma</i> (Rupr.) Bocquet
	<i>Silene gonosperma subsp. himalayensis</i> (Rohrb.) Bocquet
Chenopodiaceae	<i>Chenopodium botrys</i> L.
	<i>Chenopodium foliosum</i> Asch.
	<i>Kochia prostrata</i> (L.) Schrad.
	<i>Krascheninnikovia ceratoides</i> (L.) Guldenst.
Convolvulaceae	<i>Convolvulus arvensis</i> L.
Crassulaceae	<i>Haloteliphium ewarsii</i> (Ledeb.) H.Ohba
	<i>Rhodiola heterodonta</i> (Hook. f., & Thomson) Boriss.
Fabaceae	<i>Astragalus peduncularis</i> Royle

	<i>Astragalus polemius</i> Boiss.
	<i>Astragalus rhizanthus</i> Benth.
	<i>Colutea paulsonii</i> ssp. <i>paulsonii</i> (Shap. ex Ali) Ali
	<i>Hedysarum falconeri</i> Baker
	<i>Medicago minima</i> (L.) L.
	<i>Oxytropis lapponica</i> (Wahlenb.) Gay
	<i>Oxytropis cachemiriana</i> Cambess.
	<i>Sophora alopecuroides</i> L.
	<i>Trifolium pratense</i> L.
	<i>Cicer microphyllum</i> Benth.
Fumariaceae	<i>Corydalis govaniana</i> var. <i>govaniana</i>
	<i>Corydalis thursiflora</i> Prain
	<i>Corydalis flabellata</i> Edgew.
Geraniceae	<i>Geranium nepalense</i> Sweet
	<i>Geranium</i> spp.
Gentianaceae	<i>Comastoma borealis</i> (Bunge) T.N.Ho
	<i>Gentianodes eumarginata</i> Omer
	<i>Gentianodes pedicellata</i> (D.Don) Omer
	<i>Gentiana olivieri</i> Griseb
	<i>Lomatogonium carinthiacum</i> (Wulfen) A.Braun
	<i>Lomatogonium spathulatum</i> (A. Kern.) Fernald
	<i>Swertia petiolata</i> D. Don
Grossulariaceae	<i>Ribes orientale</i> Desf.
Lamiaceae	<i>Dracocephalum pualsenii</i> Briquet
	<i>Isodon rugosus</i> (Wall.ex Benth.) Codd
	<i>Leonurus cardiaca</i> L.
	<i>Nepeta discolor</i> Boyle ex Benth.
	<i>Nepeta floccosa</i> Benth.

	<i>Nepeta coeruleascens</i> Maxim.
	<i>Nepeta leucolaena</i> Benth. ex Hook.f.
	<i>Nepeta linearis</i> Royle ex Benth.
	<i>Perovskia abrotanoides</i> Kar.
	<i>Stachys tibetica</i> Vatke
	<i>Phlomis spectabilis</i> Falc. ex Benth.
	<i>Nepeta bracteata</i> Benth.
	<i>Thymus linearis</i> Benth.
Malvaceae	<i>Malva neglecta</i> Wallr.
Morinaceae	<i>Morina coulteriana</i> Royle
Onagaraceae	<i>Epilobium angustifolium</i> L.
	<i>Epilobium latifolium</i> subsp. <i>latifolium</i> P.C. Hoch & P.H.Raven
Orobanchaceae	<i>Orobanche cernua</i> Loeffl.
Papaveraceae	<i>Papaver nodicaule</i> L.
Parnassaceae	<i>Parnassia nubicola</i> Planch.ex Clark
Plantaginaceae	<i>Plantago major</i> L.
	<i>Plantago ovata</i> Forssk.
Platanaceae	<i>Platanus oreintalis</i> L.
Plumbaginaceae	<i>Acantholimon lycopodioides</i> (Girard) Boiss.
	<i>Dictyolimon macrorrhados</i> (Boiss.) Rech.f.
Polygonaceae	<i>Bistorta affinis</i> (D.Don.) Green.
	<i>Oxyria digyna</i> (L.) Hill
	<i>Persicaria amphibia</i> (L.) Delarbre
	<i>Polygonum paronychioides</i> C.A. Mey.
	<i>Polygonum plebejum</i> R.Br.
	<i>Rheum tibeticum</i> Maxim. ex Hook. f.
	<i>Rumex crispellus</i> Rech. f.

	<i>Rumex hastatus</i> D.Don.
	<i>Rumex nepalensis</i> Spreng.
	<i>Rumex acetosa</i> L.
	<i>Rumex patientia</i> L.
Primulaceae	<i>Androsace muscoidea</i> Duby
Ranunculaceae	<i>Aconitum heterophyllum</i> all ex. Royle
	<i>Aconitum violaceum</i> var. <i>weileri</i> (Gilli) Riedl
	<i>Aconitum rotundifolium</i> Kar. & Kir.
	<i>Aquilegia fragrans</i> Benth.
	<i>Clematis orientalis</i> L.
	<i>Delphinium brunonianum</i> Royle.
	<i>Pulsatilla wallichiana</i> (Royle.) Ulbr.
	<i>Ranunculus pulchellus</i> C.A. Mey.
Rosaceae	<i>Sorbus tianschanica</i> Rupr.
	<i>Prunus armeniaca</i> L.
	<i>Cotoneaster nummularius</i> Fisch. & C. A. Meyer
	<i>Potentilla atosanguinea</i> Lodd.
	<i>Potentilla salesoviana</i> Steph.
	<i>Rosa webbiana</i> Wall.ex Royle
	<i>Sibbaldia cunneata</i> O. Kunz
Rubiaceae	<i>Rubia cordifolia</i> L.
	<i>Galium boreale</i> L.
Salicaceae	<i>Salix karelinii</i> Turcz.
Saxifragaceae	<i>Bergenia stracheyi</i> (Hook.f. & Thorns.) Engl.
	<i>Saxifraga flagellaris</i> Willd.
	<i>Saxifraga hirculus</i> L.
	<i>Saxifraga sibirica</i> Gaud.
Scrophulariaceae	<i>Scrophularia nudata</i> Penn.

	<i>Lagotis kunawurensis</i> (Royle) Rupr.
	<i>Pedicularis bicornuta</i> Kl.
	<i>Pedicularis pectinata</i> Wall. Ex Bth.
	<i>Pedicularis albida</i> Pennell
	<i>Euphrasia multiflora</i> Pennell
	<i>Verbascum thapsus</i> L.
Tamaricaceae	<i>Myricaria germanica ssp. pakistanica</i> Qaiser
Urticaceae	<i>Urtica dioica</i> L.

5. Discussion

Deosai plains host remarkable plant biodiversity. Angiosperms are the successful group of the area due to their adaptations with varied habitat types. These findings show harmony with the Abbas (2012) in Tormik valley and (Khan, 2007) in the valleys of Haramosh and Bugrote. Asteraceae was dominant family in terms of species (41). It is considered as highly advanced and specialized in morphology. Moreover, it possesses broad ecological niche and makes their assortment in all world biomes from tropics to polar regions (Xiaoping and Bremer, 1993; Barreda *et al.*, 2012). The family has also been reported in other studies as prevailed taxon such as Chawla *et al.* (2008) and Noroozi *et al.* (2008). The present total is considered not to be very much high based on the total area of the area. Off-season survey may be the basic reason for the less total of the plant species. Habitat is the basic prerequisite for the survival and maintenance of biological diversity. The floral variability is directly associated with the ecosystem and habitat types (Tews *et al.*, 2004). Habitat diversity enhances the species diversity making easy assessment and conservation of biological diversity of any region (Amoros, 2001; Partel, 2002). The alpine meadows are the main habitat type and assort maximum species. A number of species could have been gathered but season barrier made it difficult. The flora with dominant herbaceous plants strongly indicates the harsh environment, short growing season and thick snow layer (Lekhak and Yadav, 2012). Shrubs and sub shrubs were uncommon and decline with increase in elevation. Only four tree species were observed and only Birch tree presented its considerable clump in the sub alpine areas of Sadpara River. The short vegetation season and low precipitation could also be co-related with less tree number in the study area these outcomes agreed with the outcomes of Mahdavi *et al.* (2013) carried out in the Alborz Mountains, Iran.

5.1 Conservation issues

Being a well-known picnic spot Deosai is frequently visited by local and foreign tourists. This trend is increasing annually, which is very pleasant in one way and unpleasant in the second. It directly and indirectly boosts up the regional economy and advantageous for laymen and businessmen. But in the view of biological diversity and conservation it is alarming because

everyone does not know the worth of biological diversity and its conservation. Therefore, the flora of Deosai face several humans made threats in the form of over grazing, camping, off road driving, pollution (land & Water), nomadic activities, and hoteling and road construction. If it remains, continue the ecosystem will lose its integrity in the near future.

5.2 Study drawbacks

The mountainous areas experience very short vegetation season and the period between July 15 – 15 August is considered the peak season. Therefore, any type of botanical research must be done in the peak vegetation season in order to achieve the desired and expected goals. However, the current study was started and completed in almost off vegetation season of the region. Therefore, following obstacle faced while carrying out the research work,

- Deosai is a vast plateau and has several elevated tracks. Due to season barrier, all-important sites/tracks could not be focused.
- At least 60 – 70 % of vegetation were colored and wilted.
- The main habitat type expected for maximum species i.e. alpine meadows were fade.
- Most of the annual plants and ephemerals were unseen.
- The available collected species were mostly in fruit form, blossoms were absent and vegetative parts were damaged. It caused difficulty in their identification.
- Few plants of hilly areas and subalpine were fresh for collection.
- The plants of waste lands and arable field borders in Dapa, Sherkuli and Shila were already harvested and spread (stored) on rooftops for drying as winter fodder.
- In the buffer valleys, the uplands plants were fading and mostly they were cut as for winter.
- Likewise, the plants of lower areas were also harvested and uprooted for domestic purposes.
- As far as the ethnobotanical study is concerned the seasonal nomads must have been fruitful for wild plant uses but they had already migrated from the plateau.

6. Recommendations

Deosai is a national park and in the light of increasing yearly threats to the park sustainability following suggestions are recommended for both effective research activities and conservation plan.

1. The research projects must start in the peak vegetation season, particularly related to flora, vegetation and ethnobotany. In this way, the devised objectives could be achieved.
2. Deosai is a vast plateau and the research field surveys must be in detail. It should be comprised of more than fifteen days to cover maximum areas especially famous tracks and passes. Then of course the total plant species will increase.
3. Deosai Plateau is connected with five buffer zones (Sadpara, Dapa, Shila, Shingo and Gultari) and they claim their right on park resources such as fodder, wood, wild life etc. They are often advised or restricted from the resources of the park for its ecosystem

integrity. They will keep on availing the resources by different means unless they are benefited by the organization dedicated to the conservation of biodiversity.

4. These buffer communities are almost equally affected by Park restrictions (for natural resources) and wild life (Carnivores/herbivores). They must be compensated in order to make the dwellers loyal to the park. There must be a given-take system between communities and organizations. Because it is very easy to avail the objectives by communal contentment and unity rather than by restrictions and limitations.
5. According to the communities of the park periphery, the collected entry fees have been a bone of contention among them. People of Sadpara and Chillum (entry points) considered them deserve for the amount. It is urgent to resolve the case, and must be reached at the point of a unanimous agreement so that each community could be satisfied to ensure the park sustainability.
6. The signboard showing the few sentences of advice at the entry points is a good step but not enough to conserve the park. It is hardly read by people. The visitors must be advised verbally by the DNP staffs to make them more careful for illegal activities in the park vicinities.
7. There must be tourists guiding points at different localities of the park at interval distance in order to guide and share the park rules and regulations.
8. The camping site must be determined and allocated to the visitors by DNP employee in the park area. The tourists must be stopped camping randomly in the areas of their selection.
9. The number of dustbins is next to nothing in the park area and garbage is commonly dispersed in the form of food wrappers, clothes, plastic and glass wares etc. In addition to warn at the entry points about garbage, the number of dustbins should be increased and hoisted at specific distances.
10. There should be strict garbage management and disposal system in the park so that the water and land could be safe.
11. Off driving is a common activity in the park and there is no restraint for this by any organization or personnel. The driving road must be demarcated. It is possible by warning signboards, barb wires, stones and allocating DNP employees on off-driving areas.
12. Deforestation should be stopped particularly at Deosai top and Gultari areas. Again, they must be provided with alternate fuels (oil, gas) in the substitute of wood to combat the blood-freezing winter weather and domestic purpose. Otherwise, it is almost impossible to halt wood cutting.
13. Livestock rearing is a centuries old culture and still in practice in the buffer zones. They have pasture right on Deosai plains and bring there for 2-3 months according their pastoral time table. Shepherds are oblivious of the importance of plant diversity and they only know how to graze the herds and how to have dairy products. Therefore, they mostly graze their livestock in the area of their cattle and shepherd's homes repeatedly. There is no system of shuffling in grazing lands. It could cause a decline in vegetation cover and leads to desertification by grazing, trampling and erosion impacts. Still, there is no any management for pastures and if there is, not applied. It is impossible to restrict

them from rearing, as it is their bread source. There is no substitution for their livestock and their products.

14. The activities of advent, settlement, and movement of nomadic people should be restricted or should develop a policy for their stay and camping.

7. Conclusion

The Deosai national park possesses a remarkable biological diversity of the plants. A detail and extensive field survey is needed for the thorough exploration of the plant species. The floral wealth of the study area has been under severe anthropogenic impacts and advocates an effective management plan.

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ETHNOBOTANICAL DATA OF DEOSAI NATIONAL PARK AND BUFFER ZONE

Ethnobotany is an inventory of useful plants and their corresponding uses among Native peoples. It is a people-plant relationship that has caught and maintained the attention of people from all fields of the world (Nolan and Turner, 2011). In human population management and valuation of wild plants are central aspects of the traditional knowledge. For the survival of cultures, the traditional practices relating plant gathering, regeneration and conservation knowledge should be transfer from generation to generation (Toledo *et al.*, 2009). One of the most important aspects of ethnobotany is ethno medicine. Medical ethnobotany is assessment of traditionally used significant medicinal plants, their cross-cultural applications and analysis of existing bioactive compounds (Nolan and Turner, 2011).

The antiquity of medicinal plant is as old as the history of human beings. Medicinal plants are indigenously used to treat many diseases throughout the globe (Shaw & Singh, 2014). According to World Health Organization (WHO), about 80% population of underdeveloped and developing countries still depend on traditional medicine practices for their primary health care needs (Ijaz *et al.*, 2019). Plants are not only the source of traditional medicine, people in the modern society having interest in herbal medicine as well (WHO, 2004).

According to Shinwari and Qaisar (2011), about 400-600 medicinal plant species are existed in different ranges of Pakistan from which 70% of the medicinal plants are inhabited in Himalaya ranges (Pie & Manadhar, 1987). About 84% of Pakistan population was dependent on traditional medicines in early 50s (Hocking, 1958). The highland of Gilgit-Baltistan with 3000 medicinally important plants is the hot spot of medicinal and endemic plants in Pakistan (Khan *et al.*, 2015). Studies on alpine ecosystems show that plant diversity in Himalayan alpine biome is higher than the average diversity index of world biomes. Most of these plants are reported on alpine regions. Deosai plateau is one of the most important alpine ecosystems in Pakistan. For the protection of this unique ecosystem, in 1993 it was designated as National Park. Deosai plateau contains many leading plant species which have high medicinal value. Not only buffer zone community but people from other areas are aware of medicinal plants and involved in random collection, cause serious threat for the precious native flora. One of the primary objectives of ethnobotanical investigations is the documentation of indigenous knowledge associated with these plant species, which is diminishing day by day in general, and among people living in close proximity to the National park.

Results and discussion

The Ethnobotanical survey was conducted randomly while visiting core and buffer zones of Deosai national park during the study period to document the contemporary uses of native plants of profound importance to the intellectual, spiritual, and cultural vitality of the native and other large communities. This traditional knowledge further adapted, linked, and transmitted through generations.

Informant's demographics

It is showed that the indigenous knowledge about the medicinal plants are declining due to changing lifestyles, technological advancement, allopathic medication, urbanization and migration. Young generation lack interest in the traditional use of medicinal plants. The indigenous information is confined to older folks of the area. Most of the informants (shepherds, farmers, housewives) were illiterate while the few literates were secondary school level or below. Both male and females had equal traditional knowledge of nature and plants because females are also involved in outdoor activities along with males.

Vernacular nomenclature in contrast to Balti and Shina communities

Vernacular nomenclature represents the local names of plant species used for medicinal or cultural purposes. Indigenous knowledge of plants and their uses change with respect to geographic area and ethnic group (Rinne, 2001). Both Balti and Shina communities have different specific local names for the same species in their languages. The local name of *Artemisia scoparia* Waldst. & Kit. is Bursay in balti language while in Shina it is known as Chikiring or Zoon. *Tanacetum falconeri* Hook.f. species from Asteraceae family is known as Tyalo or Pholing in balti and Flagyl in Shina. In balti *Taraxacum officinale* (L.) Weber ex F.H. Wigg. is named Khoshmas or Shantha while Guleikasidi in shina. Local name of *Cichorium intybus* L. is Shantha in balti and Ishkanagi in shina. *Carum carvi* L. is known as Naqpo thalay in balti community and in shina it is Hayyo. *Rheum australe* D. is called Shoot or Lachu in balti while Chontho in shina, *Phegophyrum asculentum* Moench is Bro in balti language and Ghiawas or Baraw in shina. *Thymus linearis* Benth. is Tumburuk in balti while in shina it is Tumuro, *Mentha royleana* Wall.ex Benth. is known as Foling in balti while fhileel in shina, *Galium boreale* L. Shatong in balti and Karazeh in shina, *Arnebia guttata* Bunge is known Thang marsi in balti while in shina Kazban, *Trifolium repense* L., Gul e Nasreen is known as Skabuksuk and in shina as Chapati, *Juniperus macropoda* Boiss is Shukpa in balti Cheli in shina, *Verbascum thapsus* L. is Apo Tambaku in balti while Tamakush or Chanchomoro in shina, *Berberis pseudumbellata* R. Parker have name as Skiurbu or Shokurum and Ishkeen in shina, *Bergenia stracheyi* (Hook.f. & Thomson) Engl. is called Shaphur in balti and Sansper in shina, *Rosa webbiana* Wall.ex Royle is Siya or Siyamarfo in balti while Shighaye in shina, *Tribulus terrestris* L. is known as Kokoring in balti while in shina it is Kurkosul-e-kono, *Ephedra gerardiana* Wall.ex Stapf. is known as Chay in balti while in shina it is Soom, *Chenopodium album* L. in balti is known as Snew and in shina known as Sheleet or Kunoaw, in balti *Urtica dioica* L. is known as Khashing or Khashoshing and known as Jumi in shina, *Solanum nigrum* L. is known as Drumba Shoghlo in balti while Gabeeli in shina, *Hippophae rhamnoides* L. has local name Karsokh in balti and Buru in shina, *Allium carolinianum* DC. is Reforo or bloqchong in balti while Kachpauk in shina, *Ribes alpestre* Wall.ex Decne is known as Askuta in balti and Shumlooh or Choorkani in shina, *Viola serpens* Wall.ex Ging. has local name Skor mindoq in balti and Lailo in shina, *Dalphinium brunonianum* Royle is called Makhoting in balti, and in shina it is called as Mahoti.

Different species of same genera have confusing similar names as *Artemisia scoparia* Wildest. & Kit. And *Artemisia brevifolia* Wall. both are known as Bursay and Zoon, *Cichorium intybus* L. and *Taraxacum officinale* (L.) Weber ex F.H. Wigg. both are called as Shanghai, *Thalictrum*

foliolosum DC. and *Thalictrum foetidum* L. both are known as Momiran, *Juniperus excelsa* M. Bieb. and *Juniperus macropoda* Boiss. are known as Shukpa in balti and Cheli in shina. Some species have two names in single language like *Codonopsis clematidae* (Schrenk) C. Clarke is known as Bajo mindoq as well as Loosunma, *Taraxacum officinale* (L.) Weber ex F.H. Wigg. is known as shantha and Khoshmas, *Berberis pseudumbellata* R. Parker is known as Skiurbu and Shokurum, *Allium carolinianum* DC. is known as Reforo as well as bloqchong.

Medicinal flora and their uses

It is an irrefutable fact that communities inhabit near forest have an intimate relationship with the indigenous flora and maintain immense knowledge on the uses of various forest products over centuries to meet their life necessities from them. For the people of remote areas herbal remedies are easily obtainable and effective drugs for treating their health issues. Therefore, they intentionally, as well as unintentionally, transfer their invaluable indigenous knowledge from one generation to the next orally without any written text. The flora of the Deosai national park is rich in species number, dominated by taxonomically complex groups (Abbas *et al.*, 2016). During the fieldwork of the present study, we collected data on 58 species belonging to 29 flowering plant families used to treat more than 30 different human ailments. All reported species were angiosperms, except *juniperus spp.* Asteraceae, Ranunculaceae and Apiaceae were the most dominant families with 11 and 5, 5 species respectively), followed by Polygonaceae and lamiaceae (with 4 species in each), and Gentianaceae, Rubiaceae, Boraginaceae, Fabaceae, Cupressaceae and Zygophyllaceae with 2 species each, while other families were represented by one species only. Among genera, *Artemisia*, *Carum*, *Juniperus*, *Allardia*, and *Thalictricum*, each featured two ethno medicinally important species. With respect to growth habit, herbs were the dominate form followed by shrubs. Reported species were also used as wild vegetables, fruits, flavoring food and as natural dyes. From the reported results, it is clear that most of the plant species are used to treat abdominal related health problems and diabetes. Abdominal disorders are predominant due to unhygienic food and contaminated water. Diabetes problems can be cause due to unhealthy habits and nutritionally empty fat-laden, high-carb foods.

Herbal drug preparation and utilization

Recorded plant species were also examined for part(s) used, remedy preparation, route of administration and given dosage for a particular ailment. Eleven different parts of these 58 plants were being utilized in the region against different ailments. It is reported that more than 30 different ailments were treated using medicinal plants. The maximum number of species were used for abdominal and gastric pain, diabetes, fever and hepatitis. The dosage of the medicinal preparation (quantity, doses, frequency, period of use, etc.) is not very precise, as it generally varied based on application, disease, age, patient's physical health, illness severity, diagnosis and experience of traditional healer. The most commonly used plant parts in herbal preparations were flowers followed by leaves, root, seeds, fruits and whole plants. Decoction was the most common method of herbal drug preparation followed by powder drug, paste, dry eaten, infusion, juice, fresh part, boiled, oil dipped and poultice. Regarding routes of administration, large number of species were taken orally and few were reportedly applied externally, while remaining were used either orally or externally.

Comparative analysis of findings in different areas

Captivatingly, indigenous knowledge of plants and their uses change within the people of same geographic area and tradition. Flowers of *Viola serpens* Wall.ex Ging. used to treat abdominal pain in Dapa valley but in Sadpara and Chillum it is used to treat fever. Decoction made from the fruits of *Berberis pseudumbellata* R. Parke is used against hepatitis as well as to treat constipation in Dapa but in Sadpara and Shilla valley the same species is used to treat diabetes. In Sadara valley whole plant of *Aconitum violaceum* Jacquem Ex. Stapf. in powder form used to treat abscess and dermatitis while in Dapa root decoction used to remove pin from livestock and in other valleys used against pneumonia typhoid and abdominal pain. Seeds of *Carum carvi* L. used to make tea and flavoring in all study area but in Chillum it is used to treat gastric pain. Decoction made from aerial parts of *Thymus linearis* Benth. is used to treat cough, flatulence and as veterinary medicine in Dapa but in other reported areas leaves and flower used against hypertension. *Dalphinium brunonianum* Royle is used to treat asthma and for weight loss in Chillum but in Sadpara to treat pneumonia and in Dapa and Hushay used as hair tonic, anti-lice and for hypertension and joint pain. People in Dapa valley used umbel decoction of *Pleurospermum candollei* (DC.) C.B. Clarke in Hook f. for the treatment of stomachache but in other study areas used to lower blood pressure. The bulb of *Allium carolinianum* DC. is effective against blood pressure reported in Chillum while in Hushay used to treat cold and cough.

Other ethnobotanical Use

Plants have potential uses those related to medicine, food and other requirements and essential to human survival. Other than medicinal uses, many medicinal plant species also used for food purpose. Almost all reported species are used as fodder and forage. Twenty-three species including 6 species of edible wild fruits, 5 species of vegetables, 6 species flavoring food and 4 species used for making tea were reported to be used by the inhabitants of the area. Wild fruits including *Galium boreale* L., *Berberis pseudumbellata* R.Parker, *Rosa webbiana* Wall.ex Royle, *Solanum nigrum* L., *Ribes alpestre* Wall. ex Decne, *Hippophea rhamnoides* L. Wild food plants have represented the milestone of the traditional food systems and could still represent a pillar of the local food sovereignty, while medicinal plants play a vital role, which need to be reconsidered and carefully re-evaluated by ethno pharmacologists and public health actors (). native people also use medicinally important plants as wild vegetable like *Allium carolinianum* DC., *Convolvulus arvensis* L., *Chenopodium album* L., *Pleurospermum candollei* (DC.) C.B. Clarke in Hook.f., *Taraxacum officinale* (L.) Weber ex F.H.Wigg., *Cicer microphyllum* Benth. *Thymus linearis* Benth., *Mentha royleana* Wall.ex Benth., *Dracocephalum heterophyllum* Benth., *Carum carvi* L., *Foeniculum vulgare* Mill. *Carum bulbocastanum* L., used to flavoring food. Seeds of *Carum carvi* L., *Foeniculum vulgare* Mill. *Carum bulbocastanum* L., while leaves of *Pleurospermum candollei* (DC.) C. B. Clarke in Hook.f. traditionally used in making beverages like tea. It is also reported that people used *Rubia cordifolia* L., *Arnebia guttata* Bunge as natural dye. Dry leaves and wood of *Juniperus macropoda* Boiss. and *Juniperus excelsa* M. Bieb. used as domestic fuel in winter and for cooking purposes. *Hippophea rhamnoides* L. and *Rosa* spp. are used in making huts and fencing. The twigs, branches and stems of these species are used to build huts used to rear

livestock. Fences are built around home gardens, vegetable patches and other crop fields to protect them from herbivorous animals. The small twigs and branches of *Berberis pseudumbellata* R. Parker, *Betula utilis*, *Colutea paulsenii* Freyn and *Spiraea canescens* are used to thatch baskets. People of Chillum valley reported that *Rumex hastatus* D. Don is also medicinally used by birds when get fracture. People used seeds of *Peganum harmala* to protect their home from evil spirits. *Convolvulus arvensis* L., *Trifolium repense* L., AND *Rubia cordifolia* L. are widespread invasive weeds damaging for crops.

Medicinal Plants of DNP and its Buffer Zones													
S. No.	Botanical Name	Local Name	Family	Habit	Parts Used	Administration route	Mode of Preparation	Applications	Availability	Distribution	Market Selling	Locality	Other Uses
1	<i>Artemisia scoparia</i> Waldst. & Kit.	Khobursay/Bursay/Chikiring*Zoon*	Asteraceae	Herb	Flower/Leaves	Oral	Decoction	Abdominal worms, Urethritis	Wild	Common	No	Shila, Dapa, Sadpara, Hushay	
2	<i>Artemisia brevifolia</i> Wall.	Bursay/Zoon*	Asteraceae	Herb	Leaves	Oral	Powder	Abdominal worms	Wild	Common	No	Shila, Dapa, Sadpara, Hushay	
3	<i>Senecio chrysanthemoides</i> DC.	Apomindoq/Apimindoq*	Asteraceae	Herb	Whole plant	Oral	Decoction	Joint pain	Wild	Common	No	Shila	
4	<i>Tanacetum falconeri</i> Hook.f.	Tyalo/Pholing/Flagyl/Zoon*	Asteraceae	Herb	Flower	Oral	Decoction	Diarrhea, Abdominal pain	Wild	Common	No	Chillum, Dapa, Shila	
5	<i>Taraxacum officinale</i> (L.) Weber ex F.H.Wigg.	Khoshmas/Shantha*/Guleikasidi *	Asteraceae	Herb	leaves	Oral	Curry	Diabetes	Wild	Common	No	Chillum, Dapa, Shila, Sadpara,	Wild vegetable
6	<i>Allardia tridactylites</i> (Kar. & Kir.)	Patkanswa	Asteraceae	Herb	Whole plant	Oral	Decoction	Food poisoning	Wild	Common	No	Shila	Making tea

Medicinal Plants of DNP and its Buffer Zones													
S. No.	Botanical Name	Local Name	Family	Habit	Parts Used	Administration route	Mode of Preparation	Applications	Availability	Distribution	Market Selling	Locality	Other Uses
	Schultz-Bip												
7	<i>Allardia tomentosa</i> Decne.	Tarkhan	Asteraceae	Herb	Flowers	Oral	Decoction	Menstrual cramps, Abdominal pain	Wild	Common	No	Hushay, Chillum	
8	<i>Lactuca orientalis</i> (Boiss.) Boiss.		Asteraceae	Herb	Latex	External	Fresh latex	To cure wounds	Wild	Common	No	Shila	
9	<i>Cichorium intybus</i> L.	Shantha/Ishkarnagi*	Asteraceae	Herb	Leaves/Root	Oral	Juice/Decoction	Gastrointestinal problems, cardiac	Wild	Common	No	Shila, Dapa, Sadpara, Hushay	
10	<i>Jurinea dolomiaea</i> Boiss.	Sathing	Asteraceae	Herb	Root	External	Poultice	To relieve inflammation	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay,	
11	<i>Cousinia thomsonii</i> C.B.Clark e.	Charchu	Asteraceae	Herb	Flower	External	Powder	Dermatitis	Wild	Common	No	Sadpara	

Medicinal Plants of DNP and its Buffer Zones													
S. No.	Botanical Name	Local Name	Family	Habit	Parts Used	Administration route	Mode of Preparation	Applications	Availability	Distribution	Market Selling	Locality	Other Uses
12	<i>Dalphinium brunonianum</i> Royle	Makhoting, Mahoti*	Ranunculaceae	Herb	Flower/whole plant	Oral/External	Decoction/powder	Fever, Joint pain, Anti-lice, Asthma/Hair tonic	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	
13	<i>Aconitum violaceum</i> Jacquem Ex.Stapf.	Buma	Ranunculaceae	Herb	Root	Oral	Decoction	Abdominal pain	Wild	Common	Yes/300/kg	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	
14	<i>Thalictrum foliolosum</i> DC.	Momiran	Ranunculaceae	Herb	Flowers/Root	Oral	Powder/Decoction	Wound/Eye ache	Wild	Common	No	Chillum	Birds use to make nest
15	<i>Thalictrum foetidum</i> L.	Momiran	Ranunculaceae	Herb	Leaves	Oral	Fresh Leaves		Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	If use more than 1 flower, cause headache
16	<i>Ranunculus repens</i> L.	Khser mandoq	Ranunculaceae	Herb	Flowers/Leaves	External	Paste in oil	Pimples	Wild	Common	No	Shila, Dapa, Sadpara, Chillum	

Medicinal Plants of DNP and its Buffer Zones													
S. No.	Botanical Name	Local Name	Family	Habit	Parts Used	Administration route	Mode of Preparation	Applications	Availability	Distribution	Market Selling	Locality	Other Uses
17	<i>Pleurosporum candollei</i> (DC.) C.B. Clarke in Hook. f.	Shamdun	Apiaceae	Herb	Umbel	Oral	Decoction	Stomach ache, Hypertension	Wild	Common	No	Shila, Dapa, Sadpara, Chillum	Wild vegetable/ making tea
18	<i>Carum carvi</i> L.	Naqpo thalay/Hayyo *	Apiaceae	Herb	Seeds	Oral	Decoction	Gastric pain	Wild	Common	Yes 1000/kg	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	Used for flavoring/ making tea
19	<i>Carum bulbocastanum</i> L.	Karpho thalay/Hayyo *	Apiaceae	Herb	Seeds	Oral	Decoction	Gastric pain	Wild	Common	Yes 1000/kg	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	Used for flavoring/ making tea
20	<i>Foeniculum vulgare</i> Mill.	Badian	Apiaceae	Herb	Seeds	Oral	Decoction	Labor pain, Constipation	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	Used for flavoring/ making tea
21	<i>Heracleum candicans</i>	Ghang	Apiaceae	Herb	roots	External	Powder	Dermatitis	Wild	Common	No	Shila	

Medicinal Plants of DNP and its Buffer Zones													
S. No	Botanical Name	Local Name	Family	Habit	Parts Used	Administration route	Mode of Preparation	Applications	Availability	Distribution	Market Selling	Locality	Other Uses
	Wall.ex DC.												
22	<i>Polygonum falconeri</i> L.		Polygonaceae	Herb	Whole plant	Oral	Powder	Epilepsy	Wild	Common	No	Shila, Sadpara, Chillum, Hushay	
23	<i>Rheum australe</i> D.	Shoot/Lachu/ Chontho*	Polygonaceae	Herb	Roots	Oral	Powder	Stomach ulcer	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay	
24	<i>Rumex hastatus</i> D.Don	Churki	Polygonaceae	Herb	Roots	External	Powder	Fracture	Wild	Common	No	Sadpara, Chillum	Birds also use when get fracture
25	<i>Phegophyrum asculentum</i> Moench	Bro/Ghiawas/ Baraw*	Polygonaceae	Herb	Seeds	Oral	Powder	Diabetes	Cultivated	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	To make breads
26	<i>Thymus linearis</i> Benth.	Tumburuk/Tumuro*	Lamiaceae	Herb	Whole plant	Oral	Decoction	flatulence, Abdominal pain, Cough, Veterinar	Wild	Common	Yes/800/kg	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	Used for flavoring, making tea

Medicinal Plants of DNP and its Buffer Zones													
S. No.	Botanical Name	Local Name	Family	Habit	Parts Used	Administration route	Mode of Preparation	Applications	Availability	Distribution	Market Selling	Locality	Other Uses
								y medicine					
27	<i>Mentha royleana</i> Wall.ex Benth.	Foling/Phileel*	Lamiaceae	Herb	Leaves	Oral	Decoction	Hypertension, Abdominal pain, Weight lose	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	Used for flavoring
28	<i>Nepeta leucolaena</i> Benth.ex Hook.f.	Azoomal/Askuta*	Lamiaceae	Herb	Leaves/Flowers	Oral	Decoction	Gastric pain	Wild	Common	No	Shila, Dapa, Sadpara, Chillum	
29	<i>Dracocephalum heterophyllum</i> Benth.	Triba	Lamiaceae	Herb	Flowers	Oral	Decoction	Abdominal pain	Wild	Common	No	Shila	Used for flavoring
30	<i>Gentiana oliveri</i> Griseb	Tikta	Gentianaceae	Herb	Flowers	Oral	Powder	Diabetes	Wild	Common	No	Shila, Dapa, Sadpara, Chillum	
31	<i>Swertia petiolata</i> D.Don.	Brama	Gentianaceae	Herb	Leaves/Root	Oral	Decoction, Powder, Paste	Hepatitis, Pneumonia, Dysentery	Wild	Common	No	Dapa, Shila	

Medicinal Plants of DNP and its Buffer Zones													
S. No.	Botanical Name	Local Name	Family	Habit	Parts Used	Administration route	Mode of Preparation	Applications	Availability	Distribution	Market Selling	Locality	Other Uses
32	<i>Galium boreale</i> L.	Shatong/ Karazeh*	Rubiaceae	Herb	Fruits	Oral	Powder	Hepatitis	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay	Wild fruit
33	<i>Rubia cordifolia</i> L.	Zghinoq	Rubiaceae	Herb	Root	Oral	Powder	Skin diseases, Inflammation, Arthritis	Wild	Common	No	Shila, Dapa, Chillum, Hushay	Natural dye, Invasive weed
34	<i>Myosotis alpestris</i> F.W.Schmid	Midaskor	Boraginaceae	Herb	Flower	Oral	Decoction	Abdominal pain, Fever	Wild	Rare	No	Shila, Dapa, Sadpara, Chillum	
35	<i>Arnebia guttata</i> Bunge	Thangmarsa/ Kazban*	Boraginaceae	Herb	Root	External	Dip in oil	Hair tonic	Wild	Common	No	Dapa, Sadpara, Chillum	Natural dye
36	<i>Cicer microphyllum</i> Benth.	Stranjung	Fabaceae	Herb	whole plant	Oral	Decoction	Kidney stones	Wild/ Cultivated	Common	Yes	Dapa, Sadpara, Chillum	Wild vegetable
37	<i>Trifolium repense</i> L.	Gul Nasreen/ Skabuksuk*/ Chapati*	Fabaceae	Herb	Flowers	Oral	Decoction	Pneumonia	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	Invasive weed

Medicinal Plants of DNP and its Buffer Zones													
S. No.	Botanical Name	Local Name	Family	Habit	Parts Used	Administration route	Mode of Preparation	Applications	Availability	Distribution	Market Selling	Locality	Other Uses
38	<i>Juniperus excelsa</i> M. Bieb.	Shukpa	Cupressaceae	Tree	Fruit	Oral	Decoction	Stomach ulcer, fever, Diabetes	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	Dry leaves used as domestic fuel
39	<i>Juniperus macropoda</i> Boiss.	Shukpa/Cheli*	Cupressaceae	Tree	Fruits	Oral	Dry eaten	Kidney stone, Diabetes	Wild	Common	No	Dapa, Hushay	Dry leaves used as domestic fuel
40	<i>Peganum harmala</i>	Isman	Zygophyllaceae	Herb	Seeds	Oral	Decoction, Powder	Fever, diarrhea, abortion	Wild	Common	No	Sadpara, Chillum	use to repel evil spirits
41	<i>Tribulus terrestris</i> L.	Kokoring/Kurkosul-e-kono*	Zygophyllaceae	Herb	Whole plant	Oral	Decoction	Urinary disorders	Wild	Common	No	Shila, Dapa, Sadpara, Chillum	
42	<i>Verbascum thapsus</i> L.	Apo Tambaku/Tamakush*/Chanchomoro*	Scrophulariaceae	Herb	seeds Flowers	Oral	Decoction	Tonic, Labor pain	Wild	Common	No	Chillum	
43	<i>Berberis pseudumbellata</i> R.Parker	Skiurbu/Shokurum/Ishkeen*	Berberidaceae	Shrub	Root	Oral	Decoction	Hepatitis, Constipation, Diabetes	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	Wild fruit

Medicinal Plants of DNP and its Buffer Zones													
S. No.	Botanical Name	Local Name	Family	Habit	Parts Used	Administration route	Mode of Preparation	Applications	Availability	Distribution	Market Selling	Locality	Other Uses
44	<i>Bergenia stracheyi</i> (Hook.f. & Thomson) Engl.	Shaphur/Sansper*	Sexifragaceae	Herb	Root	Oral	Decoction	Stomach ulcer	Wild	Common	No	Shila Sadpara, Chillum	
45	<i>Rosa webbiana</i> Wall.ex Royle	Siya, Siya marfo, Shighaye*	Rosaceae	Shrub	Seeds, Leaves, Root	Oral	Decoction	Jaundice, Anemia, Vitamin C deficiency	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	Wild fruit
46	<i>Epilobium angustifolium</i> L.	Pondol	Onagraceae	Herb	Leaves	Oral	Decoction	Febrifuge, Teeth cleaning	Wild	Common	No	Shila	
47	<i>Codonopsis clematidae</i> (Schrenk) C.Clarke	Bajo mindoq/Loosunma*	Campanulaceae	Herb	Flowers	Oral	Infusion	Stress relief	Wild	Common	No	Shila	
48	<i>Ephedra gerardiana</i> Wall.ex Stapf.	Chay/Soom*	Ephedraceae	Shrub	Fruits	Oral	Juice/Root paste	Tonic/Ophthalmia	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay	

Medicinal Plants of DNP and its Buffer Zones													
S. No.	Botanical Name	Local Name	Family	Habit	Parts Used	Administration route	Mode of Preparation	Applications	Availability	Distribution	Market Selling	Locality	Other Uses
49	<i>Chenopodium album</i> L.	Snew/Sheleet, Kunoaw*	Chenopodiaceae	Herb	Leaves	External	Poultice	Swollen feet	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	Wild vegetable
50	<i>Urtica dioica</i> L.	Khashing/Khashoshing*/Jumi*	Urticaceae	Herb	Leaves,	External	Paste	Pimples	Wild	Common	No	Chillum, Shila	
51	<i>Solanum nigrum</i> L.	Drumba Shoghlo/Gabeeli*	Solanaceae	Herb	Seeds	External	Roasted seeds	Toothache	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay	Wild fruit
52	<i>Rhodiola imbricata</i> Edgew.	Chondul	Crassulaceae	Herb	Roots	Oral	Powder	Anemia	Wild	Common	No	Chillum	
53	<i>Hippophae rhamnoides</i> L.	Karsokh/Buru*	Elaeagnaceae	shrub	Fruits	Oral/External	Jam/powder	Cancer, Diabetes, dermatitis	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay, Thalay	Used in fencing, Use in making jam, Wild fruit
54	<i>Allium carolinianum</i> DC.	Reforo/bloqchong/Kachpauk*	Alliaceae	Herb	Bulb	Oral	Infusion/Powder	Cold, Cough	Wild	Common	No	Chillum, Hushay	Wild vegetable

Medicinal Plants of DNP and its Buffer Zones													
S. No.	Botanical Name	Local Name	Family	Habit	Parts Used	Administration route	Mode of Preparation	Applications	Availability	Distribution	Market Selling	Locality	Other Uses
55	<i>Ribes alpestre</i> Wall.ex Decne	Askuta/Shuml ooh/Choorkan ji*	Glossulariaceae	Shrub	Leaves	External	Paste	Ringworm	Wild	Common	No	Shila, Dapa, Sadpara, Chillum, Hushay	Wild fruit
56	<i>Picrorhiza kurroa</i> Royle ex Benth.	Karoo	Plantaginaceae	Herb	Whole plant	Oral	Powder	Body ache	Wild	Common	No	Chillum	
57	<i>Viola serpens</i> Wall.ex Ging.	Skor mindoq/Lailo *	Violaceae	Herb	Flowers	Oral	Decoction	Abdominal pain	Wild	Common	No	Dapa, Shila	
58	<i>Convolvulus arvensis</i> L.	Thringthring mo	Convolvulaceae	Herb	Flower	Oral	Boiled leaves	Constipation	Wild	Common	No	Shila, Dapa	Wild vegetable, Invasive species

Conclusion

This study contributed to the establishment of an inventory of plant-based medicines used by native people of Deosai national park. It will provide a sense of socioeconomic responsibility among the local community, conserving the local valuable medicinal flora and preserving its natural beauty to attract tourism in the valley, which will enhance the prosperity and wellbeing of the rural community. A large proportion of the population is poor and depends upon agriculture, livestock's, production of fuelwood and other forest resources. They fulfill their food and medicinal needs from the local wild flora. The rich medicinal flora is threatened by heavy influx of nomads; open grazing by communities, exploitation of fuelwood, unmanaged tourism and absence of incentives to buffer-zone communities. The findings of this paper advocate for the need of comprehensive researches and establish research centers where these plants can be studied and preserved as well as to ensure the dynamic conservation of invaluable local knowledge systems in an area that faces serious economic problems, illiteracy, and isolation. We strongly advocate for these diverse ecological communities and the cultural traditions that both shape and are sustained by those communities.

Recommendations

There are many methods to preserve these endangered precious natural resources from extinction, which are discussed as follows.

- Mostly females are involving in the collection and rough business of medicinal plants; they sell highly valued medicinal plants at very low cost. There should be formal marketing of medicinal plants. When women earn their own income, they can re-invest in their household children's education, health, better food and nutrition for the family. We do not encourage anyone to wild gather, but we encourage to plant native plants in home gardens, in commercial landscaping and by establishing nurseries.
- There should be more awareness programs to educate the people about the economic value of the medicinal plants and to avoid the disturbance of natural habitat of these plants by over exploitation.
- If it is difficult to preserve in nature, we can use alternative ways such as germplasm (completely set of genetic material) preservation of plants. In-situ conservation and Ex-situ conservation are two distinct methods of plant germplasm conservation
- In In-situ conservation, endangered plant species is conserved in its natural habitat by establishing national parks, gene reservations. In Pakistan, many national parks are not fallen on the criteria of national parks. In the process of Ex-situ conservation, an endangered species is preserved outside its natural habitat by removing part of the plant population from the threatened habitat and planting it in new location. Seed gene bank, in vitro storage, DNA storage, pollen storage, field, gene banks and botanical gardens are kinds of ex-situ preservation. There should be serious work on ex-situ preservation methods in GB to save these important natural resources.

- Absence of incentives to buffer-zone communities make them disappointed they depend on their livestock so they do open grazing in national park by communities. When we talked them, they said, if government pay them incentives, they would stop their livestock from open grazing.

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AQUATIC HEALTH ASSESSMENT OF DEOSAI NATIONAL PARK (DNP) & CENTRAL KARAKORAM NATIONAL PARK (CKNP) SKARDU, GILGIT-BALTISTAN, PAKISTAN

Executive Summary

Watersheds increasingly serve as organizing units for assessing and managing human impacts on the environment. Watersheds are, for instance, the locus of natural resource management efforts analyses of water systems. However, the processes through which biophysical and social variables affect water systems are complex and vary across space and time, complicating efforts to understand general relationships and practices to conserve and restore water resources. Indicators of the ecological status of watersheds can be useful for synthesizing the interacting biophysical and social structures of the landscape. Like all ecological indicators, watershed indicators can be used to assess the condition of the environment to monitor. Ultimately, the value of a watershed indicator is to enable data-driven management decisions. In this work, physicochemical and macro biological indicators have been used to assess stream health

The results of different locations from to assess streams and rivers health in Deosai national Park based on presence or absence of macro fauna and have used different water quality parameters that indicates the health status of streams and river locations of DNP.

Scientific investigations may help in achieving this goal for sustainable development of national parks. The basis for developing effective policies includes a strong reliance on sound science and effective instrumentation with careful consideration of stakeholders' interests. Only with such directed policies can the future availability of clean drinking water sources be ensured.

1. INTRODUCTION

Healthy watersheds provide many ecological services as well as economic benefits. Healthy watersheds perform a number of jobs as water continually cycles through, the watershed stores, releases water, and filter many pollutants. Trees and plants help to anchor soil and absorb rain and snow melt, so flooding and landslides are less severe. Vegetation also provides shade, keeping water temperatures cool and stable so fish and other aquatic life can thrive. In a healthy watershed, water, soil and air are clean. Many indicators have been proposed by environmentalists to assess the watershed health such as soil, water quality and vegetation cover. The most sensitive invertebrate species are negatively affected initially on degradation of the fresh water resources subsequently the species habitually more tolerant to the stressed environment at the time of sampling, different physical and chemical methods reflect water quality.

2. Objectives of the Research

The specific objectives of the research are,

1. To evaluate the physicochemical and biological indicators of river and streams in DNP & CKNP.
2. To give recommendations on the basis of findings for future studies that would help for making policies regarding watershed management.

3. MATERIAL AND METHODS

3.1 Sampling

For sampling different streams and river, locations were identified from DNP & CKNP. From each location of river and streams water, macro fauna and fish sample were collected for identification. Biological sampling Macroinvertebrate and fish assemblages were sampled in 7-9 September 2019. The samples were collected using the methodology developed and utilized by the Stream Biomonitoring Unit of the New York State Department of Environmental Conservation (NYSDEC). Samples were collected from different locations of river and Nullahs of DNP & CKNP through random sampling. Samples were transferred to bottles and then preserved in alcohol and taken to the laboratory for further analysis. All samples were dated and recorded.

3.2 Laboratory analysis

All samples were then transferred to the biological sciences lab, university of Baltistan for the sorting and identification of macroinvertebrates through HKH macro keys by using stereo-microscope. Water samples were collected at each site during biological sampling to provide baseline water chemistry data, transported to the laboratory on ice for analysis of nutrients and suspended solids, and analyzed within 24 hours.

The chemical parameters were analyzed at Pakistan Council of Scientific & Industrial Research (PCSIR), Skardu. The fish sample analyzed in food sciences lab Karakoram international university lab. For (microbiological test): water samples will be tested and analyzed through Del Agua Water Testing Kit, which employ the Membrane Filtration Technique and membrane lauryl - Sulphate Broth as medium.

4. MAJOR FINDINGS

4.1. Results of biological parameters

The result shows some dominant macroinvertebrate orders were found among different locations in DNP& CKNP.

Table1: Results of Macroinvertebrates distribution among the locations.

Location	Location Name	Macroinvertebrate Orders	Counts
1	Sadpara Top (Chasma)	Ephemeroptera	40
		Neuroptera	01
2	Shatong Nullah	Ephemeroptera	20
3	Bara Pani	Ephemeroptera	30
4	Kala Pani	Ephemeroptera	17
5	Chota Deosai Nullah	Tricoptera	11
		Ephemeroptera	18
6	Shella Nullah Sermik	Ephemeroptera	25
		Tricoptera	2
		Placoptera	1
7	Mehdi Abad Nullah	Ephemeroptera	35
		Tricoptera	05

Above table shows that overall population of macro fauna from different locations i.e. Deosai top, CKNP villages in river locations and Nullahs/ tributaries. The four orders like Ephemeroptera, Placoptera, Tricoptera, and Neuroptera orders were found.

Table2: Fecal coliform test results

Location	Location Name	E.coli Counts/100ml	Status Per WHO guide lines	Action
1	Sadpara Top (Chasma) DNP	0	No Risk	No action
2	Shatong Nullah DNP	06	Intermediate to high risk	Action priority
3	Bara Pani DNP	05	Intermediate to high risk	Action priority
4	Kala Pani DNP	15	High risk	Urgent action
5	Chota Deosai Nullah DNP	02	Intermediate to high risk	Action priority

Location	Location Name	E.coli Counts/100ml	Status Per WHO guide lines	Action
6	Shella Nullah	12	High risk	Urgent action
7	Mehdi Abad Nullah	20	High risk	Urgent action

The results of the water samples taken from different streams of DNP & CKNP showed bacteriological contamination posing health risks

4.1.1. Assessment of Heavy Metals in Fish Body Parts Collected from Bara Pani Deosai National Park Using Atomic Absorption Spectrometry

Environmental pollution in our ecosystem is increases day by day due to anthropogenic activities in recent years. One of such pollution is water pollution by accumulation of heavy metals and heavily affected by aquatic biota especially fish. When their level crosses at permissible limits they cause several health and environmental problems. The fishes are the most vulnerable biota became sick then die when too much contamination of heavy metals. The main purpose of current investigation is to highlight heavy metals concentration in different fish body parts collected from Bara Pani Deosai National Park Gilgit, Gilgit-Baltistan Pakistan.

Table3: The concentration of different body part of fish sample collected from Deosai National Park

Concentration of metal, mg/kg															
Fish Sample	Co (mg/kg)		Cd (mg/kg)		Pb (mg/kg)		Fe (mg/kg)		Cu (mg/kg)		Zn(mg/kg)		Ni (mg/kg)		Mean
	Bone	0.69	Bone	0.58	Bone	1.09	Bone	0.15	Bone	0.012	Bone	0.94	Bone	1.68	0.76
	Skin	5.48	Skin	1.38	Skin	0.86	Skin	0.76	Skin	0.028	Skin	1.86	Skin	4.58	2.18
	Flesh	2.34	Flesh	0.63	Flesh	0.86	Flesh	0.19	Flesh	0.11	Flesh	1.02	Flesh	2.44	1.1.15
	Tail	6.78	Tail	1.08	Tail	1.14	Tail	0.54	Tail	0.039	Tail	1.76	Tail	4.57	2.32
	Mean	3.82		0.91		0.98		0.41		0.047		1.39		3.32	

Results indicated that the mean of heavy metal concentration (mg/kg) in different body tissues were recorded as CO 3.82, Cd 0.91, Pb 0.98, Fe 0.41, Cu 0.047, Zn 1.39 and Ni 3.32. Fish body part wise highest concentration was recorded in tail (2.32 followed by skin and flesh while least in bone.

Figure1: Mean concentration of heavy metals in fish sample

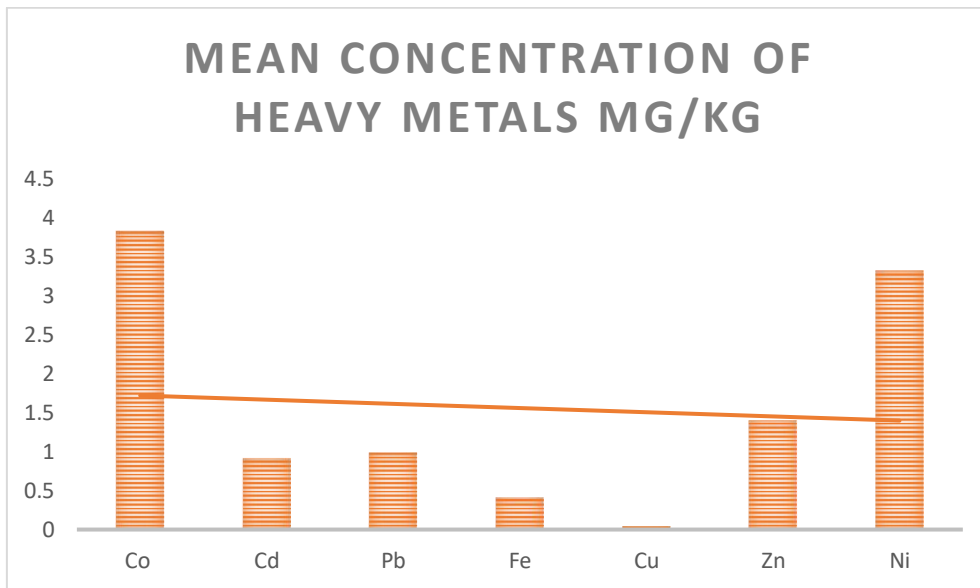
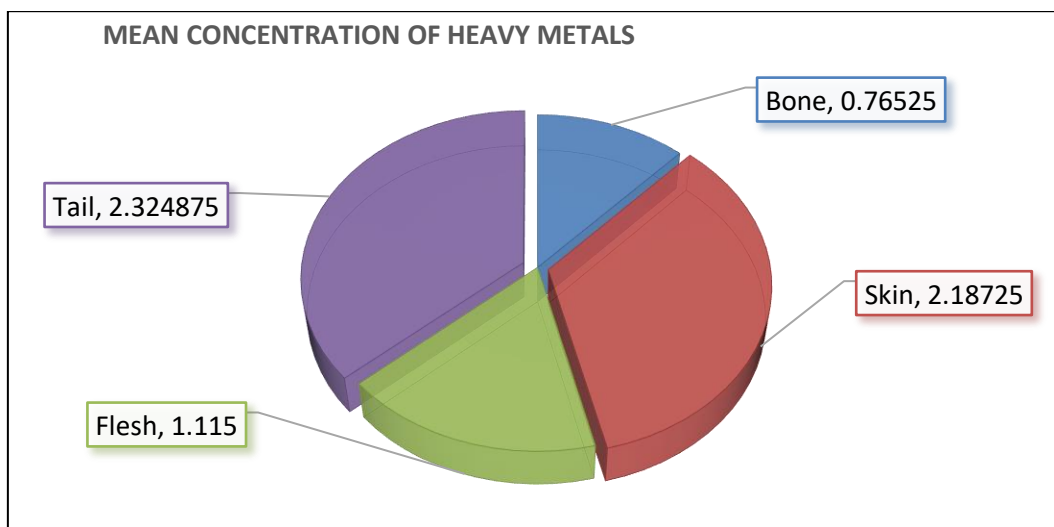


Figure2: Mean concentrations of heavy metals at different body parts of fish



4.2. Chemical Parameters Analysis Results:

On the basis of results all chemical parameters like Total Dissolved Solids (TDS), Total Suspended Solids (TSS), total hardness as CaCO_3 , Magnesium as CaCO_3 , Total Alkalinity as CaCO_3 , Chloride as Cl^{-1} , Nitrite as NO_2^{-1} , Conductivity, Sodium as Na, Potassium as K and temperature are lie within the permissible limits of WHO drinking water.



Figure3: Field activities in DNP & CKNP

5. Conclusion

To conclude that, this research work provides the baseline information regarding which type of aquatic species found on different Streams & River Locations of DNP & CKNP watersheds and also provide the status of Physicochemical parameters and water quality status which indicates the health of the streams.

6. Recommendations

- Protection of catchments' areas right from the source. Strategies should be required for the DNP & CKNP watershed catchment management.
- Attention should be given for the monitoring of streams.
- Enforcement of laws to control illegal use of cutting of native vegetation.
- The Watershed management approach should include five steps: planning, collecting data, assessing current water quality and targeting desired standards, developing goals and strategies to reach those standards, and putting those strategies into practice and measuring their effectiveness.

Inventory of the Insect Fauna of the Deosai National Park (DNP) and its Buffer Zones

1. Introduction

Insects play vital role in our economy and plant protection so we have to save the insect fauna, invertebrates are overall more important in maintaining ecosystems than vertebrates and if invertebrates disappear, the human race would be unable to survive more than a few months. Despite their great importance to almost every ecosystem on earth, most people do not have a basic understanding of invertebrate life and are largely unaware of their importance. Insect life was that "Global trends in insect populations are not known but rapid declines have been well documented in some places. Local decline of insect populations such as wild bees and butterflies have often been reported, and insect abundance has declined very rapidly in some places even without large-scale land-use change, but the global extent of such declines is not known. The proportion of insect species threatened with extinction is a key uncertainty, but available evidence supports a tentative estimate of 10 percent. "Pakistan also loss that beneficial insects which are beneficial for us, Insects in the production of fruits, seeds, vegetables and flowers, by pollinizing the blossoms some of the insect most affected include bees, butterflies, moths, beetles, dragonflies and damselflies. The decline has been attributed to habitat destruction, caused by intensive farming and urbanization, pesticides use, introduced species, climate change and artificial lighting. The use of increased quantities of insecticides and herbicides on crops has affected not only non-target insect species. Also, the pollinators, predators and plants on which they feed. Climate change and the introduction of exotic species that compete with the indigenous ones put the native species under stress, and as a result, they are more likely to succumb to pathogens and parasites. Gilgit-Baltistan is an agricultural land in responding to the decline, ideally backed up by more robust data than is available so far. In particular, they warned that excessive focus on reducing pesticide use could be counters productive. Pests already cause a 35 percent yield loss for crops, which can rise to 70 percent when pesticides are not used, they wrote. If the crop shortfall is compensated for by expanding agricultural land with deforestation and other habitat destruction, it could exacerbate insect decline. We have to make policies to prevent the loss of diversity generally, such as habitat preservation, rather than specifying measures to protect particular taxa. Pollinators are the main exception to this, with several areas reporting efforts to reduce the decline of their pollinating insects. The presence work about the insect fauna of Deosai National park unfortunately limited research, about the insect's population. Therefore, we can't estimate how much insect population decline from there but the global situation of Pakistan and irregular use of pesticides the Deosai insects are also affecting. We need to study these creatures very carefully, in order that we may be able to distinguish insect friends (beneficial insects e.g. pollinators, predators etc.) from insect enemies (pest for crops e.g. grasshoppers several bugs, caterpillars etc.). The national park is not for public entertainment place due to several activities of human many plants are decline so that those insects, which are feed on such plants, are also decline. Not all insect orders are affected in the same way; many groups are the subject of limited research, and comparative figures from earlier decades are often not available. The decline of the scientific field of entomology may also be contributing to errors

in data analysis and overgeneralization from limited findings, resulting in exaggeration of the decline in insect populations.

We have to make policies to prevent the loss of diversity generally, such as habitat preservation, rather than specifying measures to protect particular taxa. Pollinators are the main exception to this, if we protect pollinators than we protect our cross-pollinated plants. There should be insect museum. Many agricultural and other landscapes can indeed support many insect species, including those adapted to survival in particular disturbance regimes, but these are usually only a small subset of the former natural fauna of the area, which can persist only if suitable resources are provided. Just like abroad, short training courses for identification of various families of insects should be offered to entomologists as well as students. These courses will help to start taxonomic research. Aware the people to maintain plant diversity in their National parks so they save insects "natural habitat. Also, aware the scientists, educators, and citizens to promote invertebrate conservation in an ecosystem, applied research, advocacy, public outreach and education. Ongoing project include the rehabilitation of habitat for endangered species, public education about the importance of native pollinators, and the restoration and protection of insect fauna.

2. Materials and Methods

Methods for collecting, preserving and studying insects, and others terrestrial arthropods by Murray and Beth L. Mantle 2010.

Preserving insects:

There are two main methods of insect preservation. It is important to label insects and to keep a detailed record of each insect. The methods of labeling of each insect is given below:

Name of insect: Grasshopper

Locality: Deosai

Date: 16-09-2019

Collector: Shahida

Label should always write with waterproof pen. Once dried, identified and labeled, insect should be stored away in insect boxes or in museum cabinets with should preferably be kept in an air-conditioned room.

Pinning and drying:

This is a method adopted for keeping insects in boxes and cabinets. The insects collected when killed in killing bottle are then spread on a pinning stage and an entomological pin is pushed through the thorax. Special stainless-steel entomological pins are available on scientific stores. The pinned specimen is kept in drying cabinets.

Direct pinning:

In this method the insect is mounted by inserting pin through the thorax, in such a way that about 1/4 the part of the pin above the insect, large bugs are pinned through the meso scutulum and the beetles are the pinned through the right elytra.

Carding:

The insect is placed on the white or transparent rectangular card; the insects is stuck on the card with a drop of gum. An entomological pin is passed through end of the card (near the posterior end of the insects) and the data tables are attached underneath the table. This method is suitable for the small coleopteran heteroptera and the ants.

Setting:

Setting means the spreading the wings and legs of the insects in a horizontal position on a standard setting board. These boards can be made locally by a carpenter. The insect (for example a butterfly) is placed is such a way that the thorax and abdomen rest in the groove of the board and then an entomological pin is passed through the thorax. The wings are then spread out with setting needles on the board so that the inner margins of the fore wings are in straight line at right angles to the body of the insect. Once set, the insect is left in a drying cabinet for few days or in the laboratory for few weeks where the insect is dried.

3. Result and discussion

Riaz *et al* (2017) Reported the results of surveys for natural enemies of *Drosicha* sp. conducted in 2017 in Skardu (Olding, Khargrong, Chumik, Tangus, Sundus and Sumbul Town) and adjoining areas such as Baghicha, Pakistan, at lower elevations and approximately 40 km from Skardu. Two natural enemies were identified attacking the pest. These were *Cryptochaetum* sp. nr. *Grandicornis* (Diptera: Cryptochetidae) and *Tetrastichus* sp. (Hymenoptera: Eulophidae). Releases of the predator *Sumnius renardi* (Coleoptera: Coccinellidae), which occurs naturally in some areas of Pakistan but not where *Drosicha* sp. has reached pest status, were also initiated. This represents the first report of *Cryptochaetum* sp. nr. *grandicornis* associated with *Drosicha* sp. in Pakistan. This cryptochetid is found primarily in the Mediterranean basin, but similar cryptochetids have been reported from India. Adult flies were reared from aggregations of *Drosicha* sp. on *Salix* spp. in Olding, Khargong, Sundus and Chumik in Skardu and Baghicha. The phenology and biology of this natural enemy on *Drosicha* sp. is not clear. It appears that adult flies deposit their eggs on surfaces near aggregations of *Drosicha* sp. Larvae hatching from the eggs were observed feeding on various immature stages in the aggregations. Larvae pupated within these aggregations, and adults emerged singly from puparia. *Tetrastichus* sp. wasps were reared from *Drosicha* sp. nymphs and adult females from May to September. Parasitism was highest in August, approaching 70% of *Drosichasp.* in the aggregations. *Sumnius renardi* has been reported from India and Pakistan, but its only known host is *Drosicha stebbingi*. Nawaz *et al* (2017). Reported that the taxonomy is considered basic for research in the field of biology. It has correlation with all important fields of study like ecology, medicine, biodiversity, agriculture etc. By collecting the data regarding new species recorded from 2000 to 2017, the work of Pakistani taxonomists is negligible against taxonomy of insects as they covered only some parts of these orders like Coleoptera, Hymenoptera, Orthoptera, Odonata, Diptera, Neuroptera and Phthiraptera. Topography and climatic conditions of this country is favorable for insect biodiversity but there are some challenges need to overcome by financial support, taxonomy as a compulsory subject for zoology students,

conduction of short national and international training programs, availability of related literature, enough journals to publish work and establishments of identification centers.

Timothy (1999), reported that Interest in insects as conservation foci and as tools in broader conservation assessment has accelerated markedly in recent years, but the diversity and complexity of insect life demands a more focused and structured approach to “biodiversity” and inventory studies than has commonly occurred. Strategies for insect conservation are reviewed, together with the variety of uses for insects as ecological tools in broader monitoring of environmental quality. Principles for selecting optimal focal groups are discussed, and the importance of developing standard protocols to sample and interpret insect assemblages emphasized. The global values and relevance of the pioneering lessons in insect conservation developed in Europe are summarized.

Conclusion

Skardu-Baltistan is an agriculture land and blessed with a lot of fauna but lack of interest in proper education, research and identification of species resulted to negligence in basic field of biology; taxonomy. Keeping in view the significance of taxonomy, there is urgent need to organize research facilities, hire basic courses at undergraduate as well postgraduate level and establishment of regular organizations for preservation of this valuable fauna. In addition, we have to save our pollinators and other beneficial insects because in our collection we mostly find those insects which are pest or harmful for our cash crop and for other crops of both agriculture and horticulture.

Drawbacks

1. Due to seasonal variation we have very less collection because it is time to insect go for hibernation.
2. For entomological survey the collector has to visit in a singular place for 5 to 6 time or weekly visited than estimate the insect population
3. Very limited research on the insect’s fauna of DNP and its Buffer zones.

Table1: Insect fauna of DNP and its Buffer Zone

Common name	Scientific name	Family	Order	Status
Honey bee	<i>Apis</i>	Apidae	Hymenoptera	Alive
Bumble bee	<i>Bombus</i>	Bombidae	Hymenoptera	Alive
Spider wasp	<i>Priocnemis</i>	Pompilidae	Hymenoptera	Alive
Social wasp	<i>Vespula</i>	Vespidae	Hymenoptera	Alive
Horntail	<i>Sirex</i>	Siricidae	Hymenoptera	Alive
Ichneumon wasp	<i>Ichneumon</i>	Ichneumonidae	Hymenoptera	Alive
Sweat bee	<i>Dieunomia</i>	Halictidae	Hymenoptera	Alive

Common name	Scientific name	Family	Order	Status
Sand wasp	<i>Bembix</i>	Carabridae	Hymenoptera	Alive
Orange pupa	<i>Akymichneumon</i>	Ichneumonidae	Hymenoptera	Alive
Ground beetle	<i>Calosoma</i>	Carabidae	Coleoptera	Alive
ground beetle	<i>Carabus</i>	Carabidae	Coleoptera	Alive
ground beetle	<i>Laricera</i>	Carabidae	Coleoptera	Alive
Troutstream beetle	<i>Amphizoa</i>	Amphizoidae	Coleoptera	Alive
Lady beetle	<i>Psyllobora</i>	Coccinellidae	Coleoptera	Alive
Lady beetle	<i>Brumoides</i>	Coccinellidae	Coleoptera	Alive
Lady beetle	<i>Hippodamia</i>	Coccinellidae	Coleoptera	Alive
The may beetle	<i>Liatongus</i>	Scarabacidae	Coleoptera	Alive
Green shield bug	<i>Palomena</i>	Pentatomidae	Hemiptera	Alive
Leaf footed bug	<i>Mamuirus</i>	Coreoidae	Hemiptera	Alive
Sting bug	<i>Halyomorpha</i>	Pentatomidae	Hemiptera	Alive
Sting bug	<i>Euschistus</i>	Pentatomidae	Hemiptera	Alive
Red cotton bug	<i>Dysdercus</i>	Pyrrhocoridae	Hemiptera	Alive
Fire bug	<i>Pyrrhocoris</i>	Pyrrhocoridae	Hemiptera	Alive
Grasshopper	<i>Conozoa</i>	Acrididae	Orthoptera	Alive
Cricket	<i>Falcicula</i>	Gryllidae	Orthoptera	Alive
Ground cricket	<i>Eunemobius</i>	Gryllidae	Orthoptera	Alive
Brown trigs	<i>Anaxipha</i>	Gryllidae	Orthoptera	Alive
Shield-back Katyids	<i>Anabrus</i>	Tettigoniidae	Orthoptera	Alive
Swallow tail butterfly	<i>Parnassius</i>	Papilionidae	Lepidoptera	Alive
Leaf footed butterfly	<i>Hipparchia</i>	Nymphalidae	Lepidoptera	Alive
Hawk moth	<i>Platypleura</i>	Cicadidae	Lepidoptera	Alive
Cabbage butterfly	<i>Colias</i>	Pieridae	Lepidoptera	Alive
Four footed butterflies	<i>Vanessa</i>	Nymphalidae	Lepidoptera	Alive

Common name	Scientific name	Family	Order	Status
Cutworm moth	<i>Neutxuerta</i>	Noctuindae	Lepidoptera	Alive
White moth	<i>Euproctis</i>	Lymantriidae	Lepidoptera	Alive
Blow fly	<i>Cuchliomyia</i>	Calliphoridae	Diptera	Alive
Blow fly	<i>Calliphora</i>	Calliphoridae	Diptera	Alive
Blow fly	<i>Bellardia</i>	Calliphoridae	Diptera	Alive
Hover fly	<i>Cheilosia</i>	Syrphidae	Diptera	Alive
House fly	<i>Musca</i>	Muscidae	Diptera	Alive
Stem sawfly	<i>Janus</i>	Cephalidae	Hymenoptera	Alive
Dragonfly	<i>Anisoptera</i>		Odonata	Alive