H.P. Forest Department

(Wildlife Division Chamba)

Himachal Pradesh

Management Plan of

KALATOP KHAJJIAR

Wildlife Sanctuary

(2019-20 to 2028-29)

Divisional Forest Officer
Wildlife Division Chamba

Office of the Principal Chief Conservator of Forests (Wildlife) and Chief Wildlife Warden, Himachal Pradesh.

0177-2625205 (O
0177- 2623994 (R
0177-2624193 (FA)
E-mail: pccfwl-hp@nic.in

H.P. FOREST DEPARTMENT, ARANAYA BHAWAN, TALLAND, SHIMLA 171001

No. WLM/Management Plan/ 9615 Dated Shimla-171001, the 10/3/2020

To:

CCF, Wildlife (North) Dharamshala.

Subject: Draft Management Plan of Kalatop-Khajjiar Wildlife Sanctuary.

Memo:

This is with reference to your office memo. No. D.III.9/6830 dat 05.02.2020 on the subject cited above.

The approved copy of the Management Plan of Kalatop-Khajjiar Wildl Sanctuary for the period 2019-20 to 2028-29 is sent herewith for information and furth necessary action. This may be got printed and *hard bound two copies* thereof may be sen this office for record.

You are also requested to send the remaining management plans Gamgul Siyabehi, Kugti & Tundah Wildlife Sanctuaries at the earliest.

Encl: As above.

Principal Chief Conservator of Forests (Wildlife), and Chief Wildlife Warden, Himachal Pradesh, Shimla.

INDEX

List of Annexures

Serial No. No.	Description	Annexure
1	Notification of the Sanctuary	I
2	List of Forest, Compartment and area in hectare	II
3	List of Natural Water Source	III
4	List of Natural Caves and overhangs	IV
5	List of Existing (Proposed Artificial Salt Licks)	V
6	List of Plantation	VI
7	Flora Commonly Found in Kalatop-Khajjiar Sanctuary	VII
8	Fauna Commonly Found in Kalatop-Khajjiar Sanctuary	VIII
9	List of Existing Nurseries	IX
10	List of Existing Building in Wildlife Range Khajjiar	X
11	List of Inspection Paths, Roads and Trekking Routes in Wildlife Range Khajjiar	XI
12	Glossary of Common Local Terms	XII
13	Year Wise Breakup of Expenditure	XIII
14	Draft Proposal of Eco Sensitive Zone	XIV
15	Rules and regulations of Khajjiar Eco Tourism Society	XV
16	APO for the Management Plan from 2019-20 to 2029-30	XVI
17	Map of Sanctuary and Its Eco Sensitive Zone	XVII
18	Google Map of Sanctuary	XVIII
19	Man Animal Conflict	XIX
20	Research Paper on Diversity & Ecology of Mammals in Kalatop-Khajjiar Sanctuary	XX
21	Research Paper on Birds Species Composition in Kalatop-Khajjiar Sanctuary	XXI
22	Research Paper on Preliminary Ecological Studies on the Lepidoptera form Khajjiar Lake catchment	XXII
23	Research Paper on study of Liebigii from Khajjiar Lake	XXIII
24	Research Paper on assessment of Floristic Diversity in Khajjiar Beat	XXIV
25	Study on Rapid Ecological Assessment of Khajjiar Lake	XXV

PREFACE

Kalatop-Khajjiar Wildlife Sanctuary derives its name from the dense forests of Kalatop and famous historical "*Khajji Nag*" temple of Khajjiar. This sanctuary came into being in the year 1958 (area=19.62 sq.km.) and was partly under the control of DFO wildlife Chamba and partly with DFO (T) Dalhousie. The control of the area was shifted to the wildlife wing during the year 1987. The area of this sanctuary was increased to 69.47 sq.km. in the year 1989 after the revision of earlier notification. The First management plan for this area was prepared during 1995-96 By Sh. Nagin Nanda IFS. The area of this sanctuary was further decreased to 17.17 sq.km. in the year 2013 during the process of rationalization of boundries of protected areas. Thus in view of exclusion of some area from this sanctuary it was felt necessary to prepare a detailed Management Plan from the year 2013-14 itself. Attempt has been made to sum up the important information related to the sanctuary and operations have been suggested to be carried out on year to year basis in order to envisage wildlife conservation in a systematic and scientific manner primarily aiming at habitat Management and the species montoring.

The sanctuary is home to animals as Black bear, Leopard, Musk deer, Ghoral, Barking deer, and birds as Chukor, Monal, Koklas, Cheer, Kalij pheasant, etc. Apart from this, seasonal migration of birds and animals from higher elevation to lower elevation also increase the biodiversity in the sanctuary.

This managemenrt plan has been prepared after deliberate discussion with field staff, people living in and around sanctuary and also keeping in view of the previous management plan. This Management Plan has been envisaged to be in operation for 10 years from 2019-20 to 2028-29.

The detailed information of the sanctuary and projects/operations envisaged in the plan will be of help for better and systematic habitat management and will also provide a base line for further improvement and development in and around the sanctuary.The sancutarty experiences huge influx of tourists especially during summers and the Management plan also keep the tourism pressure in view.

I would like to express my sincere thanks to Dr. Savita IFS, PCCF Wildlife-cum-Chief Wildlife Warden H.P, Sh. Ajay Srivastava IFS, AP CCF Wildlife, Sh. Anil Thakur IFS, Sh. Pradeep Thakur IFS, Conservator of Forests, Wildlife Circle (North) Dharamshala, Sh. D.S. Dadhwal HPFS DFO (HQs) and highly grateful to Sh. Nishant Mandhotra IFS and Sh. Sanjeev Singh HPFS, Assistant Conservator of Forests Wildlife Division Chamba and other seniors as well as field functioneries for their practical and valuable guidance in completion of this plan.

Approved

Rajeev Kumar, HPFS
Divisional Forest Officer
Wildlife Division Chamba
Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

11/03/2020

Pr. Chief Conservator of Forests (WL)
and Chief Wildlife Warden (HP) Shimla

PART-I

THE PROTECTED AREA-
THE EXISTING SITUATION

CHAPTER- I

INTRODUCTION OF THE AREA

Himachal Pradesh with its varied terrain and topography exihibits an ideal cross section of the rich floral and faunal heritage distributed right from the Shiwaliks to Alpine areas. Likewise the socio- economic fabric of the State is not only multifaceted but also intricately linked with the forests the wildlife therein.

The Chamba district has unique place for being a total representative of the biogeographical diversity of the State.

1.1 NAME, LOCATION, CONSTITUTION AND EXTENT:

Kalatop-Khajjiar Wildlife Sanctuary in the Western Himalayan mountain ranges is located on the Western extremity of Dhauladhar Range and exhibits the highest elevation after which the Dhauladhar dips down towards Ravi River. This sanctuary derives its name from the famous historical *"KHAJJI NAG"* temple and dense forests of Kalatop. Initially, this sanctuary was notified in 1958 with an area of 19.62 Sq. Kms. limited to Kalatop and Khajjiar area. In view of the seasonal migration of birds and animals from higher elevation to lower elevation and vice-versa depending upon the season it was felt necessary to further extend the boundary of this sanctuary towards North upto Ravi River. This was also envisaged to provide a buffer zone to the Wildlife and ensure effective protection of wildlife accordingly. The Notification was revised during 1989 vide No. 6-2/73 SF-IV dated 26.09.1989 and as per this Notification the total area of this sanctuary was 6947 ha (69.47 Sq. Km.) and situated between 32^0- 31'-35" N to 32^0-34'-32" N Latitudes and 76^0-00'-60" E to 76^0-03'-76" E Longitudes. The limits of the Kalatop-Khajjiar Wildlife Sanctuary was further revised to 1717 ha (17.17 Sq. Km.) as per Govt.of Himachal Pradesh Notification No.FFE-B-F(6)-11/2005-II dated 7th June,2013 under Section 26(A) of the Wildlife(Protection) Act,1972. The Kalatop-Khajjiar Wildlife Sanctuary is located in Chamba & Dalhousie Sub divisions of Chamba district and falls under the administrative control of Wildlife Division Chamba.

The Kalatop-Khajjiar wildlife sanctuary is situated at 9 Kms away from Dalhousie in North West direction. The road from Dalhousie passes right to the entry of

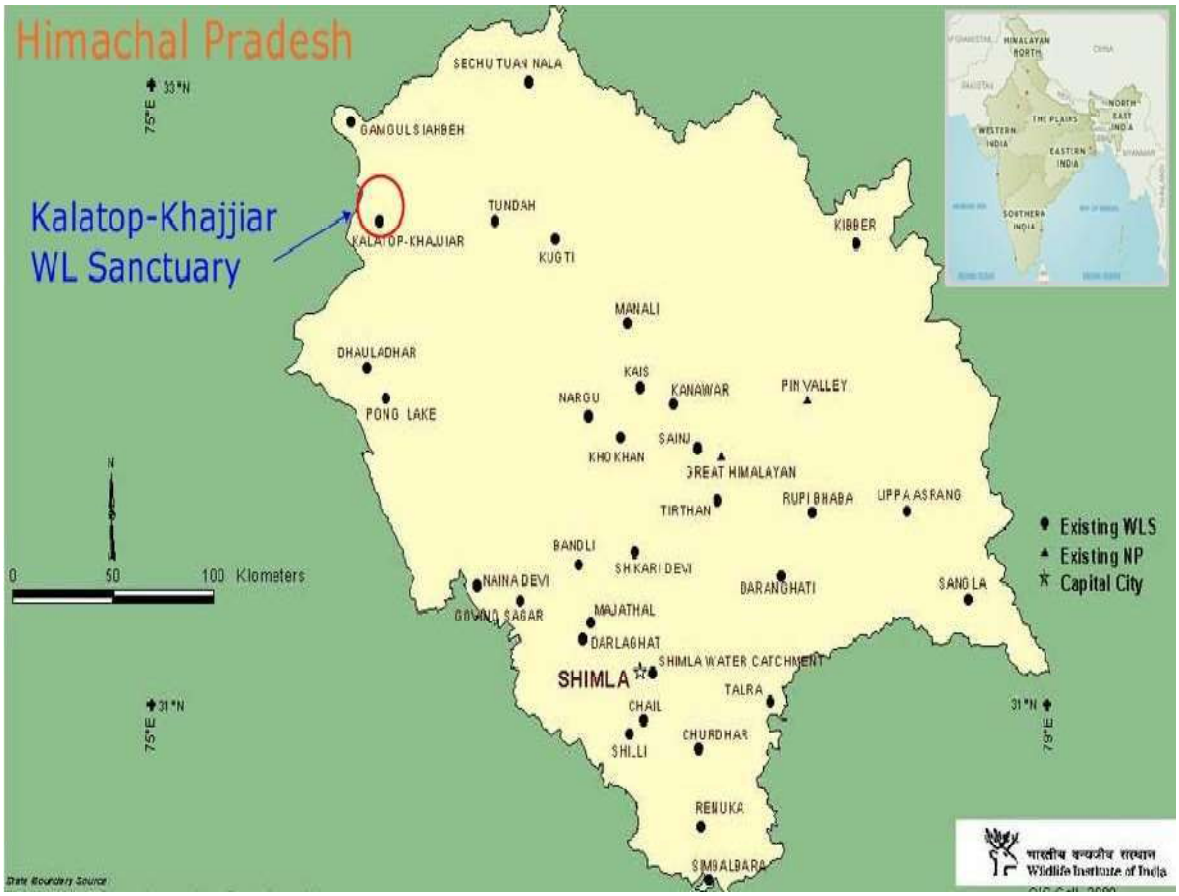
sanctuary, which also connects it to Chamba town which is 24 Kms in the North East direction. A *kachha* road (about 3 Kms) leads to Kalatop Forest Rest House from Lakkarmandi.

1.2 APPROACH AND ACCESS:

This sanctuary is easily accessible by road from Dalhousie as well as Chamba. The road from Dalhousie remains closed during winter season due to snowfall. The nearest Railhead is at Pathankot. The roads providing connectivity to the sanctuary alongwith distance is as under:

1. Dalhousie-Lakkarmandi	9 kms.	Motorable road
2. Chamba-Miarigalla	20 kms.	Motorable road
3. Dalhousie-Talai-Parel	40 kms.	Jeepable
4. Devidehra-Talai	5 Kms.	B.Path
5. Chahla-Chilbungla-Talai	7 Kms	B.Path
6. Chaned-Kohlari	6 Kms	Jeepable
7. Chaned-Singi-Khajjiar	10 Kms	B.Path
8. Sultanpur-Khajjiar via Sach	8 Kms	B.Path
9. Sitla Bridge-Miarigalla	13 Kms	Jeepable

The sanctuary remains accessible during the summer when large numbers of tourists are attracted to the scenic spot like Khajjiar and Kalatop. The most suitable season to visit this area is April to June and September to November. However, being easily approachable, the tourists keep on touring during the off season as well.



1.3. STATEMENT OF SIGNIFICANCE:

The area falls in the Himalayan mountain system, which is the line of demarcation between two of the World's great faunal realms, the oriental region to the South and the palaearctic towards the North.

The Kalatop Khajjiar sanctuary area can broadly be divided into three main types viz; dense forests, lake meadow and small portion of alpine pasture. Dense forests consist of mature mixed fir, spruce and deodar forests with some oak and rhododendron. Undergrowth in the forest is well developed, dense in places and with a good cover of grass.

The diverse climate and the varied environmental conditions prevailing in Kalatop Khajjiar Wildlife sanctuary support diverse habitat and ecosystems with equally diverse life forms. This area is known for its rich and diverse plant wealth. In this area total number of plant species is 232 belonging to 76 families and 218 genera. Out of 100 medicinal plant species recorded from the Kalatop Khajjiar Wildlife sanctuary, 7

species viz; *Cinnamonum tamala, Dioscorea deltoidea, Paris polyphylla, Podophyllum hexandrum, Polygonatum verticillatum, Taxus wallichiana, Zanthoxylum armatum* fall in the category of threatened plants.

The sanctuary is a good habitat for the endangered Musk deer. Other faunal species found here are common leopard, Black bear, Goral, Flying squirrel, yellow throated marten, Barking deer, Himalayan weasel, Himalayan fox, Rhesus monkey and langur. In the faunal diversity, 16 species of mammals, 110 species of birds are found here. In addition to this there are 49 species of butterflies reported from the catchment area of Khajjiar lake.

MUSK DEER (*Moschus moschieferus*)-

A small deer not more than 50 cms. high at shoulder. It is regarded as a undeveloped form of deer, which has not progressed with the rest of its family. It is hornless no face gland and has a gall bladder. The musk gland is situated beneath the skin of the abdomen of the males. The musk is valued as a commercial product. It induces the persecution of the species. The absence of horns is compensated for by the great development of the canine teeth in the males.

The musk deer wears a coat of thick and bristly hairs. The general colour is a shade of rich dark brown speckled with grey. They live singly or in pairs and are generally met in birch forests above the zone of blue pine. The food consists of grass, lichens, leaves and flowers. The young ones are born in summers. .

The status of the musk deer is poor. From the past records the presence of the musk deer in the area was reported, but not any photographic evidence was there.Recently the photographic evidence of presence of Musk Deer was recorded on Lakkermandi-Kalatop road and the presence of Musk Deer was thus confirmed.

GORAL (*Nemorthaedus goral*)-

A stocky goat like animal having short insignificant horns. It favours an elevation upto 7000 feet. It is an herbivore. It lives in small parties and gives loud hiss to alarm others against any danger. It greets the visits right from the start of sanctuary but does not go beyond the forested area. It prefers to hide itself on steep and rocky slopes which is inaccessible for the poachers and prefers the southern slopes. The ghoral can be spotted in Kalatop, Lakkermandi, Khajrot and Talai beats. The habitat is healthy and supporting for the ghorals.

CHAMBA SACRED LANGUR (*Semnopithecus ajax*) Gaula-

Gaula lives nowhere else in the world but in the forests around Chamba.Gaula is therefore called Chamba Sacred Langur.Gaula lives in groups with families of 20 to 30 members.There are nine species of langurs in India and three in northern India. Gaula is one of them.Gaula has dark forearms and a bushy, long brownish-grey coat. A male Gaula has a flowing mane down his shoulders and flanks.Gaula eats a lot of leaves, but also buds, bark, fruit, roots, seeds, cones, and flowers. Gaula also licks soil from under trees and loves young leaves.

KOKLAS (*Pucrasia macrolopha*) -

The Koklas pheasant occurs between elevations of 2000 m to 2400 m. It likes coniferous forests. It lies flush to ground, keeping still and flies swiftly when disturbed; as such it is hard to shoot. It relishes leaves and buds. The cock of species has dark green head with the central crest faron colour. The rest of body is streaked with black and grey. The breeding season is April to June. It has a wider distribution through out the sanctuary but it does not migrate to the alpine pastures. It generally remains in the forested areas. The area forms the catchment of Ravi River that is an important tributary of the Indus river system. The spectacular and colourful pheasants and wild animals, trekking trails, dense forests make this area of National bio-significance. This area of unparalleled scenic beauty with its perennial streams, water falls, excellent adventure trekking, hiking and camping grounds can be tapped for its tourism potential.

This area is of high scenic beauty with waterfalls, wetland, dense forests, glade area alongwith excellent adventure and camping ground offers a lot to ordinary tourists and has a great potential for wildlife enthusiast. On July 7, 1992 Mr. Walter Leu, Director General Swiss national Tourist Office brought Khajjiar on the world tourism map by recognizing it as “Switzerland of Himachal Pradesh”. About 4.5-5.0 lacs tourist visit this place every year.

CHAPTER-II

BACKGROUND INFORMATION AND ATTRIBUTES

2.1.BOUNDARIES:

The Kalatop-Khajjiar Wildlife Sanctuary is situated within the Geo-coordinates **North,** Lat. 32^0- 33'-58" N & Long. 76^0-01'-11"E, **East** Lat. 32^0-32'-16" N & Long.76^0-04'-00" E, **South** Lat. 32^0- 31'-27" N & Long. 76^0-01'-51"E, **West** Lat. 32^0- 32'-16" N & Long. 76^0-00'-36" E. The Kalatop-Khajjiar Wildlife Sanctuary is located in Chamba & Dalhousie Sub divisions of Chamba district and falls under the administrative control of Wildlife Division Chamba. The limits of the Kalatop-Khajjiar Wildlife Sanctuary as per Government of Himachal Pradesh Notification No. FFE-B-F(6)-11/2005-II dated 7th June,2013 under Section 26(A) of the Wildlife (Protection) Act,1972 are as under :

North: - Pukari Galla to Devi Ghatu and then along with the boundaries of DPF Khajroth up to Kalatop RF C-11.

East: - From Devi Ghatu along with the boundary of Khajjiar DPF to Kanjredi Nalla and then up to its origin point at Bhagot.

South: - From Bhagot through Jhurdu Ridge up to Pohlani Temple.

West : - Pohlani Temple along the boundary of Kalatop RF up to Kalatop RF C 11.

Total area of the Sanctuary: - 17.17 sq.kms.

2.2. GEOLOGY, ROCK AND SOIL:

The mountainous area is composed of Silurian rocks chiefly slates, schist's and conglomerates. The area extending from Dalhousie-Khajjiar to a little South of Chamba and through Lam Dal, Nag Dal upto Singhar pass is underlain by granitoides and granitic geaneisses (Dalhousie/Dhauladhar granite). The Dalhousie granitic principally consists of quartz, plagioclases, feldspar biotite, muscovite and tourmaline.

The area is underlain by sandstone, quartzite and silt stone yield sandy soil, those underlain by slate, phyllite and schist or by granite and gneiss yield clayey soil while those underlain by limestone, shale, litho assemblage yields a loamy soil. On the Southern aspect the soil tends to be shallow and dry

with numerous outcrops of bare rocks. Soil found in these forests is fertile and is of sufficient depth to support tree growth.

2.3 TERRAIN:

The sanctuary is located on the Western Dhauladhar range. The slopes are moderately steep to steep with a fairly good vegetative cover. The forests are comparatively easy with only few precipitous patches along the Nalas.

2.4. CLIMATE:

2.4.1. RAINFALL /PRECIPITATION PATTERN AND DISTRIBUTION:

The area receives most of the rains during monsoon season. The precipitation is also received in the form of Rain and Snow during winter season. The rainfall and snow fall data in respect of Kalatop-Khajjiar Sanctuary is tabulated as below:

Rainfall Data-

(Average monthly rainfall in mm)								
Month	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
January	55.2	56.53	20.3	20.29	15.73	6.34	33.44	0.02
February	187.55	63.69	178.32	44.02	22.93	4.55	25.53	14.60
March	87.05	36.83	46.59	55.23	66.88	42.87	12.69	4.11
April	42.2	24.58	9.95	25.19	29.25	12.15	36.40	20.45
May	23.19	6.00	7.21	21.27	5.21	11.57	9.67	13.56
June	55.88	0.9	42.32	6.71	18.41	37.88	40.45	51.70
July	267.62	69.37	193.65	71.25	84.46	71.59	80.97	105.97
August	311.28	253.71	383.47	44.48	110.47	59.29	39.97	86.00
September	240.74	123.71	28.66	107.68	94.42	9.14	6.78	71.78
October	3.82	0.5	26.91	9.29	2.96	0	0	2.60
November	0.7	3.1	3.31	0.63	2.91	0.5	2.24	33.40

December	3.6	29.1	21.79	4.97	8.20	0.26	26.71	11.10

(Source:https://www.worldweatheronline.com/khajjiar-weather-averages/himachal-pradesh/in.aspx)

2.4.1(a) SNOW FALL DATA:

(Snow fall Data in cm)								
Month	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
January	49.53	254	35.56	12.70	38.10	Nil	76.00	Nil
February	68.58	55.88	30.48	91.44	38.10	15.24	5.08	7.62
March	Nil	2.54	Nil	12.70	27.94	Nil	Nil	Nil
April	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
May	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
June	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
July	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
August	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
September	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
October	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
November	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil
December	17.78	75.00	116.84	15.24	12.70	Nil	5.08	5.08

2.4.2. TEMPERATURE:

The cold temperature conditions are more prevalent in the higher elevation whereas the down below towards North, the climate becomes little warmer. During summer the temperature shoots even up to 30^0 C or more in the lower area. However, the temperature remains pleasant in the higher elevation. During the winter season, on higher elevations sub zero conditions are also witnessed.

2.4.3.WIND:

Light wind of 6-11 km/hr velocity can be generally felt in the area. At rare occasion only due to some temperature and pressure difference in the atmosphere there may be some gentle to moderate winds of speed ranging to 12-29 km/per hours.

2.4.4. DROUGHT:

Dry weather conditions are normally felt during April-May and first half of June and during October-November. Normally such dry weather condition comes as routine seasonal change and doesn't have any noticeable influence on the forest vegetation and the water supply of the area. It is only during prolonged dry spells when the young regeneration gets adversely affected. The cultivation of crop suffers damage on this account.

2.5. WATER SOURCES:

The nallas are perennial. There are plenty of springs and aquifers. Water is not a limiting factor, but at higher elevation in peak summer, water does become a limiting factor and animals may have to come down to nalla beds for water requirement. The water in general is pure, clean and good. No marsh or stagnant water bodies occur except for Khajjiar Lake. The main nallas of the area are Khajjiar Nalla and Jhurdu Nalla. The other Nallas existing in the area are listed as below: -

Sr. No.	Name of Nallahs	Perennial	Seasonal.	Beat
1.	Sach Nalla	-do-	-	Khajjiar
2.	Khajroth Nalla	-do-	-	Khajroth, Lakkermandi
3	Karelnu Nalla	-do-	-	Kalatop
4	Topi Nalla	-do-	-	Dainkund
5	Lakkermandi Nalla	-do-	-	Kalatop
6	Jhurdu Nalla	-do-	-	Khajjiar
7	Rai Nalla	-do-	-	Khajroth
8	Makhol Nalla	-do-	-	Khajroth
9	Narbah Nalla	-do-	-	Khajjiar
10	Kanjredi Nalla	-do-	-	Khajjiar

2.6. HABITAT ATTRIBUTES, RANGE OF WILDLIFE DISTRIBUTION AND STATUS:

The floristic composition varies from chill (*Pinus roxburghii*) with a mixture of Ban Oak in the lower zone to pure deodar (*Cedrus deodara*) in the middle reaches which culminates in to mixed crop of Deodar, Fir and Spruce species with some alpine pasture toward Dainkund area.

2.6.1.1. BIO GEOGRAPHIC CLASSIFICATION:

Bio geographically the area falls into Western Himalayan zone.

2.6.1.2. FOREST TYPE:

Forest types found in the Kalatop-Khajjiar Sanctuary are as under:

Type 12/C-1 Moist Deodar Forests-

This forest type occurs extensively around and below Khajjiar and Kalatop Forest Rest House. In this region the crop tends to be almost pure. Whole of the Kalatop RF except compartment above Lakkarmandi – Khajjiar road and DPF Khajjiar can be ascribed to this forest type.

The deciduous associates especially in depressions are *Quercus leucotrichophora, Quercus dilatata, Litzea umbrosa, Celtis austrails, Cedrella serrata* and *Populus ciliata*.

In damp places *Ulmus wallichiana*, *Junglans regia* and *Aesculus indica* are met with. However, undergrowth is scantly and the most commonly found species are *Parrotia, Jacquemontiana, Viburnum cotinifolium, Indigofera species, Desmodium, Rubus ellipticus* and *Viola canescens* etc.

Type 12/C Id-Western Mixed Coniferous Forests-

This forest type is mainly found above the Lakkarmandi – Khajjiar road, DPF Jhurdu and DPF Khajroth can be ascribed to this type.

The deciduous associates are Aesculus indicia, Junglans regia, Acer spp, Celtis australis, Litzea species etc. The undergrowth consists of Lonicera, Viburnum, Deutzia, Viola potentilla etc.

Type 12/c 1-a Ban Oak Forests-

Nearly whole of DPF Karangra Rakh can be ascribed to this type. The chief associates of Ban Oak are Rhododendron arboreum and Pieris ovalifolia.

2.6.1.3 COVER:

The core area of the sanctuary has very good vegetation in the form of mixed forests. The lower elevation has Ban Oak and Chil forests. These different types of forests provide ideal habitat / shelter to a variety of fauna.

2.6.1.4. FOOD FOR WILD ANIMALS:

The wildlife gets plenty of food from the variety of tree species such as Kemlu, Kobra-plant, Kareri, Walnut, Horse chestnut, etc. which forms the staple diet of animals. Some animals like Black Bear, Langur dig out the roots of the herbs as well and relish it. The cultivated crops are also damaged particularly by Black Bear.

2.6.2. HABITAT QUALITY, QUANTITY AND KEY AREAS:

The core area of the Wildlife Sanctuary provides ideal habitat for variety of animals like Black bear, Common Leopard, Ghoral, Barking deer, Serrow and birds like Monal, Koklas, Chakor etc. The forests are very well stocked and the area possesses large number of perennial Nallas and springs. The thick forests along with perennial water sources provide ideal habitat for the wildlife of the area. The main key area which required to be addressed is the human–wildlife conflict as many villages are located adjacent to the sanctuary.

2.6.3. LIMITING FACTOR:

Being a place of scenic beauty and its proximity to the plains, the Khajjiar- Kalatop area is also exposed to heavy tourist pressure. The growing tourist influx needs to be managed in a more systematic and scientific manner to avoid adverse impact on the habitat of the wildlife. The Eco Tourism linkages have to be based on scientific and more systematic lines and more eco friendly activities need to be promoted so as to maintain the ecological balance of the area.

However, as the main road crossing through the sanctuary is state highway, the traffic cannot be curbed by the forest department. The Khajjiar (glade area) is just adjacent to road the same is open area and cannot be controlled. In future a study must be taken up to assess the carrying capacity of the sanctuary and accordingly the limit can be fixed for the sanctuary area.

CHAPTER-III

HISTORY OF MANAGEMENT AND PRESENT PRACTICES

3.1. GENERAL:

The earliest record regarding the management of the forests of Kalatop and Khajjiar area dates back as late as 1850 to 1870 when Deodar and Fir trees were removed to meet the demands of building constructions at Dalhousie.The forest working plan of reserve forest Kalatop was prepared by Ribbentrop during 1871 in which it was proposed to convert the selection forest in to regular high forest. This was followed by D.Arcy Plan 1886-87 to 1896-97. The D. Arcy plan was revised by Mc. Intires plan (1896-97 to 1910-11), then came Mc. Intosh plan which remained operative from 1913 to 1933. It was followed by Kartar Singh Plan 1934 to 1954, after this D.D. Mehta and Sant Ram prepared plan for the period 1954-55 to 1968-69, thereafter the plan was revised by R. C. Sharma 1969 to 1984. The aforesaid working plans covered mainly Kalatop forests where as Khajjiar part came under preview of Kang's Plan. It was during 1987, when this area was transferred to DFO, Wildlife Division Chamba.The plans discussed abovewere mainly concerned about the management and exploitation of forests and there was not much emphasis on the wild life management practices. The first management plan of this area was prepared by Sh. Nagin Nanda, IFS for the period 1995-96 to 2004-05.

3.2.TIMBER OPERATION:

The forests of Kalatop- Khajjiar Wildlife Sanctuary remained under exploitation for timber extraction till 1975-76. After this period there was no green felling in the area and only right holder's demands were met with salvage removal for some time. Now as per the directions of Hon'ble Supreme Court in IA No. 548 dated 14.02.2000, no salvage removal or extraction of any kind is being done inside the sanctuary area.

3.2.1.SIVICULTURAL SYSTEM AND TENDING OPERATION:

The forests falling in the sanctuary as covered under various plans were managed under the following working circle:

1. Regular Working Circle.
2. Selection Working Circle.
3. Chil Working Circle.
4. Protection Working Circle.

Salient features of various Working Circles-

In the **REGULAR WORKING CIRCLE**, Deodar, Kail forests were worked under the irregular shelter wood system. Felling was done according to the nature of terriain. Gentle slopes were worked as per the principle of uniform system where as the steep portion were worked under selection principle. Groups having trees below 40 cm d.b.h. and below 22 hac. in extent were retained as a part of future crop. Artificial sowing/planting was resorted to supplement the natural regeneration. 60 cm d.b.h. was fixed as the exploitable dia. with a rotation period of 120 years. 4 PBs with a regeneration period of 30 years were formed.

The **SELECTION WORKING CIRCLE** comprised mixed forests mainly of fir and Spruce with some sprinkling of Deodar and Kail situated on steep slopes. The forests were managed under the modified Punjab Selection System which permitted shelter wood felling in suitable patches of the forests on easy grounds. Exploitable size was fixed as 60 cms. d.b.h. and a felling cycle of 15 year was adopted.

Degraded forests were assigned to **PROTECTION WORKING CIRCLE**, by and large these areas required protection against excessive and uncontrolled grazing.

The **CHIL WORKING CIRCLE** comprisedof purechil forests. The forests were managed under shelter wood system modified to suit the prevalling local conditions. 60 cmsd.b.h. was fixed as the exploitable size with a rotation period of 120 years. Regeneration was envisaged to be completed in 30 years period and 4 PBs were constituted for the purpose.

Presently there is no exploitation and even the salvage removal is also not carried out.

Main operations now being carried out are supplementing the natural regeneration with planting / sowing. In order to recoupe the degraded soil in the pasture lands, improvement works including soil conservation works are carried out. While carrying out artificial plantations, due considerations are given to the broad leaved species which ultimately yield food / fodder for wild animals.

3.2.2. EVEN AGED AND UNEVENAGED SYSTEMS:

As per earlier working plans, the main objective was to get even aged crops particular in regular working circle and chil working circle. Under this system of working quite a good number of forests were managed. Luckily these areas have responded well and we find young regeneration in plenty. Due to the ban on fellings, however, some mature mother trees are still standing among the young regeneration.

For the specific management of wildlife, there is a need to create more varied type of floralcomposition in the forests which are important from wildlife habitat point of view.

3.2.3. BAMBOO WORKING:

There are no bamboo forests in the sanctuary.

3.2.4.FIRE WOOD:

About 46 years back some forests of this sanctuary like Khajroth DPF were exploited for the fire / fuel wood requirement of the Chamba town. However, this praciice was discontinued after 1970. The local people are still dependent on the forests and collect fuel wood for domesticbonafide use.

3.3. NON TIMBER FOREST PRODUCE:

The collection and export of minor forest produce was regulated under the Chamba Minor Forest Produce Exploitation and Export Act. Land owners and their tenants used to obtain permit for collection of herbs within their pargana on payment of Rs. 1.00 andother residents of the Distt.on payment of Rs. 25/- for the same. Such permits were issued for specified localities and only for a period of 3 months. The season for extraction and collection of herbs started from the Sep. till snow falls.

At present, no non-timber forest produce (NTFP / Minor Forest produce) is being extracted from the sanctuary area.

3.4. LEASES:

As there is no green felling or salvage removal from the sanctuary area hence, no leases at present exist inside the sanctuary.

3.5OTHER PROGRAMMES AND ACTIVITIES:

For supplementing the stock growth, some area has been taken up for regeneration after felling in the past. By and large all such areas have got regenerated adequately. The seed bearers however, are still standing among the young crop.

3.5.1. PLANTATIONS:

There are some forests where the growing stock has got reduced due to continued biotic interference;such areas have to be regenerated by selecting site specific planting of species suitable for Wildlife.

3.5.2. TREKKING ROUTES:

This sanctuary being close to Chamba and Dalhousie attracts large number of tourists of which a substantial number are nature and wildlife lovers. They love to trek through the forests. There are already some trekking paths in the area however for a better study of flora and fauna, some more routes and more patrolling huts are required to be constructed. Attached as **Annexure- XI**

3.5.3. ECO-TOURISM:

This area has a great potential for Eco-Tourism activities like trekking, hiking, bird watching etc. but this has to go in harmony with wildlife management practices. In this direction some steps have already been taken up and the necessary facilities like infrastructure development are also being taken up in the area. Local youth have also been trained to act as nature / wildlife tourist guides.

3.6. FOREST PROTECTION:

3.6.1. LEGAL STATUS:

The forests as per legal classification are as under:

3.6.1.1. RESERVE FORESTS:

Reserve forests were demarcated and constituted during 1878-1881 with simultaneous settlement. Subsequent revalidation was done under the Indian Forest Act by H.P. Administration vide Notification No. Ft. 43-107/56 dated Shimla-4 the 15th March 1957. At present there are 46 RF compartments, the detail of which is attached as **Annexure II**.

3.6.1.2. DEMARCATED PROTECTED FORESTS:

The old DPF's were demarcated and settled during 1912-15. Subsequently these were declared DPF vide Chamba Darbar Notification No. 80/46 dated 15th June 1946 under section 29 of Indian Forest Act. Consequent upon the merger of Status and formation of the State of Himachal Pradesh all the proprietary rights over forests area have been transferred to the Government of H.P. All forests and waste land were declared as protected forests by the H.P. Government vide Notification No. Ft. 29-241/49 dated Shimla-4 the 25th February 1952. There are 4 DPFs in Kalatop- Khajjiar Wildlife Sanctuary, the detail of which is attached as **Annexure-II.**

3.6.1.3. CONSTITUTION AND EXTENT:

The summary of the legal status of land is as under: -

S. No	Classification of Land	Area in (Ha.)	Land Use
A.	**Government land.**		
1.	Reserve Forests.	1054.60	Forest Area.
2.	Demarcated Protected Forests	662.46	Forest area
	Total	**1717.06**	**-**

3.6.1.4. WILDLIFE SANCTUARY:

As the complete area 17.17 Sq. Km. has been declared Wildlife Sanctuary. The complete area is also legally protected area as per Willdife Protection Act, 1972.

3.6.2. HUNTING:

There is a complete ban on hunting and no hunting of any kind is allowed inside the sanctuary. Prior to this ban, hunting used to be a favourite time pass particularly during winter season after getting permission from competent authority.

3.6.3. ILLEGAL ACTIVITIES:

3.6.3.1 POACHING:

Ban on hunting has been of great help to the wildlife. Poaching of wild animals in side the sanctuary used to happen during winter when the wild animals tend to come down nearer to the habitation. A strong network of informer and other antipoaching activities alongwith public awareness regarding the importance of wildlife will be of great help.

3.6.3.2. ILLEGAL CUTTING OF TREES:

General public has very restricted access to the forest inside the sanctuary area. Thus, the chances of illegal removal of trees are very low and no instances of grave offence have been noticed. However, petty offences like lopping can not be ruled out.

3.6.3.3. ILLEGAL REMOVAL OF NTFP:

NTFP's as Kasrod, Honey, Wild Mushroom, Banafsha etc. are found in the sanctuary. There are least chances of illegal removal of NTFP. Moreover, no permits for collection of NTFP's from the sanctuary are issued these days.

3.6.3.4. ENCROACHMENT AND OTHER ILLEGAL ACTIVITIES:

There are fifty six cases of encroachment. Encroachers have claimed their rights under FRA, but Divisional Forest Officer, Wildlife Division Chamba has rejected their claims in the District Level Committee. At present all the decided cases stand evicted; however one case is at appeal in the court of Divisional Commissioner.

3.6.4. DOMESTIC LIVE STOCK GRAZING:

The pressure of grazing by the domestic live stock in Kalatop Khajjiar Wildlife Sanctuary can not be ruled out. Besides this the Gaddies (30-32 flocks) pass through this area. Gujjars (nomandic grazier) also bring their cattle in this area for graizing.

3.6.5. FIRES:

The Kalatop and Khajjiar are basically temperate areas and are less prone to fires. However, the areas (RF Kalatop C-6, C-8, C-9, C-10, C-19, C-20) having chil and other broad leaved forests are susceptible to fire damage. Fire line is proposed to be constructed all around the sanctuary.

3.6.6. INSECTS ATTACK AND PATHOLOGICAL PROBLEMS:

Nothing serious about insects attack and pathological problems have been noticed in these forests so far. As far as the wild animals particularly herbivores are concerned may come in contact with domestic live stock and acquire some disease. This also is yet to be ascertained. However, Vaccination programmes are also being conducted in collaboration with veterinary Authorities.

3.7. TOURISM:

Khajjiar is a big attraction for tourists as this place is known as Mini Switzerland of Himachal Pradesh. Being very near to the plains of Punjab and Jammu Kashmir, the tourists find it quite convenient to visit. The Kalatop with its tranquil and pristine beauty offers a very suitable atmosphere to the tourists. On account of heavy tourist influx, it is imperative to ensure that there is no adverse effect on the wildlife. The tourist influx primarily gathers at three points in the sanctuary namely Khajjiar, Kalatop and Dainkund. The tourist number is active only during 9 Am to 6 Pm after which it is almost complete silence. However, the littering done by tourists is cleared by the daily wagers engaged through Eco Tourism Society.

3.8. RESEARCH, MONITORING AND TRAINING:

3.8.1. RESEARCH AND MONITORING:

The research studies will be focused on the adaptability of existing flagship species under most constrained and extremely threatened situations put forth for the very survival and existence of the wild life in the said sanctuary area. To conduct some specific research works, this can be got conducted through the specialized institutes like Universities, Wildlife Institute of India and by outsourcing through NGOs / other expert professionals. The observations of visiting scientists, professionals, tourists (local / national / international) should find a place in the management inputs. The baseline survey & ground survey for all kinds of wildlife throughout the sanctuary should be carried out thoroughly so that a comprehensive list of Mammals, Vertebrates, Reptiles, Amphibians, Fishes, Birds, Invertebrates, Insects (Crustacea, Coelenterates, Mollusca, Echinodermata) Beetles of all families available in the sanctuary are documented for future course of research and subsequent management. The use of modern survey and techniques and recording tools for each sighted wild life will be selected by the agency carrying out the type of survey suitable in the higher Himalayan region or temperate zone above 8,500 feet elevation.

3.8.2 TRAINING:

ON JOB TRAINING:

To manage ecosystem with the basic purpose of wildlife management is a highly technical subject. Wildlife is a dynamic component of the ecosystem which requires a well trained forester to comprehend, appreciate and manage.It is highly imperative that short trainings, in house trainings, refresher courses, exposure visits etc. for the field staff are made a regular feature, so that they keep abreast with the latest developments regarding different management techniques.

FORMAL TRAINING COURSES-

Regular training courses being conducted at wildlife Institute of India impart a useful technical knowhow. The officers/officials dealing with the wildlife management will be

trained. Besides this to acquaint with the latest management techniques adopted in different states/ countries, short training will be arranged for the officers and field staff.

3.9. ECOSYSTEM, HABITATS AND WILDLIFE CONSERVATION STRATEGIES AND THEIR EVALUATION:

3.9.1. AWARENESS PROGRAMME:

Along with the tourism potential there is a need to educate the tourists and local people about thethe importance of wildlife conservation. To make public more aware about the importance of wildlife, nature awareness programmes, guided tours, trekking etc. are organized. For this State and Central sponsored schemes of Forest Department, Department of Science and Technology, Special Area Development Authority and Khajjiar Eco Tourism Society are providing funds for the orgnisation of Workshops, Trainings and Meetings.

3.9.2. PASTURE IMPROVEMENT:

There is very small area (13 ha.) towards Dainkund ridge which is a pasture. The carrying capacity of this area is required to be assessed, so that the area is not over grazed.

Besides this introducing better indegenous grasses, removal of unpalatable bushes etc. and soil conservation works are necessary.

3.9.3. CENSUS OPERATION:

In order to monitor the population trends of faunal species, it is recommended that a census operation shall be undertaken twice a year i.e. in early spring when snow melts and again in autumn just before snow fall. Besides this a designated proforma must be circulated among all forest guards to record the count of wild animals regularly. The regular survey and census figure will help in better management practices and prescriptions.

3.9.4. IDENTIFYING WATER HOLES AND SALT LICK SITES:

The sanctuary is endowed with a number of perennial water sources/nallas. Thus wildlife does not seem to face any specific water scarcity. However, majority of these areas are also used by domestic live stock. Hence, it leads to man animal conflict. It may lead to a situation when the infection may transfer from domestic live stock to wild animals and vice-

versa. To avoid this possibility, it is necessary to maintain water holes nearer to the habitat pockets where domestic live stock does not visit often. The water holes need to remain enriched with water therefore percolation ponds and trenches are recommended at higher elevations as near Khajroth nalla and Dainkund area.

Natural salt licks are very rare in the area. This has to be supplemented artificially with due care so that these could notbe used by domestic live stock.

3.9.5. CATTLE TREATMENT:

In this sanctuary there are not much of migratory cattle but the chances of infection from the cattles of adjoining villages can not be ruled out. So it has to ensure that infection does not spread from the live stock of the adjacent villages to wild animals or vice versa. The domestic live stock is immunized from time to time by providing necessary veterinary facilitities.

3.9.6. PROHIBITION OF WEAPONS:

There is a ban on carrying of weapons inside the sanctuary area. The necessary sign boards of prohibited activities are already in place. However further awareness shall be taken up regularly.

3.9.7. IDENTIFYING CORE AREA:

As per Government of Himachal Pradesh Notification No.FFE-B-F (6)-11/2005-II dated 7th June, 2013 under Section 26(A) of the Wildlife (Protection) Act, 1972, 261 villages have been taken out from the sanctuary. Now the whole area of the sanctuary is treated as core zone exceptthe areas where tourist influx is heavy especially the glade area of Khajjiar,a path from Lakkar Mandi to Kalatop Forest Rest House, PWD road from Lakkar Mandi to Kanjedi nallah and road from Lakkar Mandi to Polhani Temple is excluded from the core area and is the area for the activities of Eco Tourism. The core area supports dense forest of different conifers and some broad leaved species. The wild animals generally remain confined to this zone and leave this area only during heavy snowfall.

3.9.8. ENGAGING OF WILDLIFE WATCHERS/ INFORMERS:

Protection part is mainly done by the field staff. However, inview of the concentration of habitation along the northern boundary in the core zone, it is necessary to remain more vigilant. This vigilance becomes more justified during winter when animals move downward towards the habitations. The informers can be engaged from the neighbouring villages. It will not only help in antipoaching and protection measures, but also there would be constructive participation from the villagers as well. This will be also generating employment for the villagers.

3.9.9. CONSTRUCTION OF BRIDLE PATH AND BUNKERS:

The area has some trekking routes /bridle paths which are used by the field staff for protection work and by the nature lovers for trekking. There, however, is a need to improve and extend the network of bridle paths and inspection paths which would be used by the tourists for trekking and provide an imperative infrastructure for field staff to carry out census operation and protective measure etc. The network of these paths will have to be made in such a way that points and commanding sites from wild life management point of view are well connected.

3.10. ADMINISTRATIVE SET UP:

At present the Kalatop- Khajjiar Wildlife Sanctuary is under the administrative control of Khajjiar Wildlife Range, which consists of two blocks namely Khajjiar block and Lakkarmandi block and 6 beats namely Khajjiar beat, Khajroth beat, Talai beat, Kalatop beat, Lakkarmandi beat and Dainkund beat. The existing staff position is as under:

Range Officer	1
Block Officer/ Deputy Ranger	3
Forest Guard	14
Class-IV Employee	5

3.11. COMMUNICATION:

The sanctuary has very good network of roads and bridle paths. At present the following roads and bridle paths are the imperative lines of communication.

1. Dalhousie-Chamba via Lakkarmandi-Khajjiar road	Motorable
2. Lakkarmandi-Dainkund	Jeepable
3.Lakkarmandi-Kalatop	Jeepable
4. Kalatop-Khajjiar	Trek Route
5. Devkugalla-Dibri	Inspection Path
6. Kalatop –Gutri	Inspection Path
7.Kalatop RFC1-Kalatop RFC-15	Inspection Path
8.Kalatop-Talai	Inspection Path
9. Lakkarmandi-Khajrot	Inspection Path
10. Dainkund-Pohlani	Trek Route
11. Kalatop-Kalatop RFC-16	Census Path
12.Makhol nalla-Madrani	Inspection Path
13.Guptu nalla-Madrani	Census Path
14. Sunil Lodge-Jhurdu	Census Path
15. Khajrot-Madrani	Inspection Path
16. Lakkarmandi-Lakkarmandi	Inspection Path
17. Khajjiar-Khajjiar	Inspection Path
18 Khabbi Da Goth-Devku Galla	Trek Route

For better management and strengthening of the wildlife protection measures, it is imperative to have an effective communication system in the sanctuary. This is being achieved by providing land line phone connection in Range Office Khajjiar, Walkie Talkie Sets and mobile allowance to the field staff. In the times of need the funds can also be allotted through Khajjiar Eco Tourism Society which is running at profit.

3.12. SUMMARY OF THREATS TO WILDLIFE:-

3.12.1. GRAZIERS:

The local people and migratory graziers i.e. gujjars. pose threat to wildlife. However no serious threat from the graziers has been noticed to the wildlife in last five years.

3.12.2. PASTURE STATUS:

Due to migratory graziers, a little portion of the pastures has degraded due to soil erosion and invasion of unpalatable grasses which needs to be treated immediately.

3.12.3. FIRE:

The maximum area of the sanctuary is less prone to fires. However, the areas having chil and other broad leaved forests are susceptible to fire damage**.** The fire watchers are engaged during both in summer and winter seasons. This activity has helped in combating with fire incidence. However, sufficient funding is needed for the various operations like cleaning of pine needles, maintenance of Bridle/inspection paths, construction of watch towers, and construction of fire linesand procurement of fire resistantkits.

3.12.4. Vehicular Traffic:

The heavy tourist influx may pose a threat to wildlife. The traffic particularly inside the sanctuary is required to be regulated properly during the summer season; as the road is not too wide the vehicle moves at slower pace. However the traffic between entry points at Lakkarmandi and Miaraigalla is being controlled/ regulated by deploying field staff at Lakkarmandi and Miaraigalla check post.

CHAPTER-IV

THE PROTECTED AREA AND THE INTERFACE LAND USE SITUATION

4.1THE EXISTING SITUATION IN THE ZONE OF INFLUENCE:

4.1.1. LOCATION ETC:

The sanctuary located on the Northern aspect of Dhauladhar range has Dainkund ridge on its South, in the North the boundary extends from Pukhari Galla to Devi Ghatu and then along with the boundaries of DPF Khajroth up to Kalatop RF – C-11, on the Westren side the boundary runs from Pohlani Temple along the boundary of Kalatop RF up to Kalatop RF C-11.and on the Eastern side the boundary runs from Devi Ghatu along with the boundary of Khajjiar DPF to Kanjredi Nalla and then up to its original point at Bhagot.

4.1.2. VILLAGES INSIDE THE PROTECTED AREA:

Only one revenue village having only one house exists inside the sanctuary, as the 261 villages have already been excluded from the sanctuary area during the ratonalization in 2013.

4.1.3. LOCAL ECONOMY AND OCCUPATION:

The area is having a well developed infrastructure like roads, bridle paths, irrigation, educational and medical facilities etc. The people of the area are mainly dependent upon tourism activities, agriculture and horticulture and most of the people are self-reliant. People also get employment in the developmental works carried out through Govt. departments and many of them are also serving in the Govt. Departments as well.

During the last decade, the tourist influx has increased considerably which has supplemented the economy in the area. Agriculture is the basic occupation and the crops raised and the production is given under:

Maize	70 Kg/Bigha
Wheat	25 Kg/Bigha
Potato	100 Kg/Bigha

Rice 25 Kg / Bigha

With the improvement in irrigation facilities people have started raising seasonal vegetables which are more remunerative as compare to the traditional agriculture practices. Bee keeping is another occupation which people resort to though at smaller scale.

4.1.4. IMPLICATION OF LAND USE:

Although there is not much pressure on the forests in the sanctuary but the dependence on forests for fuel wood and fodder can not be ruled out.In view of this dependence it is necessary to aware people to raise plantations near their habitation so that the daily requirements of fuel wood, fodder etc. are met with and the burden on the adjoining forests of the sanctury is minimized. The families either should be provided LPG gas connections through Government schemes or thorugh the Khajjiar Eco-Tourism Society to reduce the pressure on forests.

So far as the agriculture land is concerned, by and large it is cultivated in traditional way. But it has to be improved by doing some soil conservation and terracing works.

4.1.5. PROTECTED AREA MANAGEMENT AND ITS IMPLICATIONS:

Under the present management practices, rehabilitation of some degraded areas by natural/artificial regeneration, Habitat enrichment activities and Eco Tourism activities are done. These activities do not have any implication for people who rather get some part time employment and supplement to their livelihood. Apart from this, the local people also get employment as informers, nature / Wild life tourist guides, photographers etc.

4.2. THE DEVELOPMENT PROGRAMMES AND CONSERVATION ISSUE:

4.2.1 GOVT. AND NON GOVT. PROGRAMMES AND THEIR IMPLICATIONS FOR THE PROTECTED AREA AND ZONE OF INFLUENCE:

At present, there is no Non-Govt. agency working in the area. The Forest Department, Department of Science & Tecnology and Khajjiar Eco Tourism Society are undertaking different activities aimed at improving the forests habitat conditions, making efforts to educate the masses regarding Wildlife Conservation and to promote Eco Tourism. For the

involvement of non government agencies, local bodies like Panchayats and other institutions like schools, Yuvak Mandals, Mahila Mandals etc. are being persuaded to take part in wildlife conservation activities. To ensure more participation some eco developmental works are also taken up in the villages by Khajjiar Eco Tourism Society. In community development and partticipaton the Khajjiar Eco-Tourism Society also intends to develop/adopt the Khajiar and Lakkarmandi School.

4.2.2 ECONOMY:

As already mentioned economically the people are self sufficient and with the growing tourism and other development works of the Govt., they have improved their monetary status.

4.2.3 PROBLEMS FACED BY PEOPLE AND EFFECT ON THE MANAGEMENT OF PA AND ZONE OF INFLUENCE:

So far as the management of Wildlife is concerned, it does not have any implication for the local public. People however, show resentment when there is man- animal conflict or some damage to the live stock or crops by the wild animals. Particularly leopard, Black Bear and monkey constitute man-animal conflicts for which people are quite apprehensive. However, scientific management can help in managing conflicts between the public and wildlife.

PART-II

PROPOSED MANAGEMENT

CHAPTER-V

VISION, OBJECTIVES AND PROBLEMS

5.1 THE VISION:

"To be a well protected sanctuary in the Western Himalayas free from any adverse human pressures, with an undisturbed; well protected ecosystem that is a home to a variety of flora and fauna and to develop as a centre for wildlife/ nature tourism providing a rich and hassle-free experience to eco tourists".

5.2 OBJECTIVE OF MANAGEMENT:

The following are the management objectives for achieving the vision statement:

1. To manage and maintain the environmental stability of habitat by conserving natural heritage, diverse floral and faunal resources.
2. To ensure the protection and maintenance of protected area on sound ecological basis.
3. To have viable and well managed estimated population of Musk Deer, Chamba Sacred Langur and Koklass.
4. To rehabilitate the Khajjiar lake based upon scientific methods and research inputs till perpetuity.
5. To promote a range of ecotourism programmes for providing good visitor experience to the tourists and supplemental incomes to the local communities.
6. To develop a comprehensive capacity-building program for front line staff and local community through training and nature education programmes.
7. To improve the degraded pasture and bring them to a sustainable level.

5.3PROBLEMS/CONSTRAINTS IN ACHIEVING OBJECTIVES:

Sr. No.	Objective	Problems/Constraints
1	To manage and maintain the environmental stability of habitat by conserving natural heritage, diverse floral and faunal resources.	(i) Heavy tourist influx (ii)Lack of Awareness about Wilidlife and its conservation among tourist and stake holders (iii) Garbage problem.
2	To ensure the protection and maintenance of protected area on sound ecological basis.	(i) Poor/No Mobile connectivity in some areas of sanctuary (ii) Sanctuary remains inaccessible during December to March due to heavy snow fall (iii) Insufficient nos. of patrolling huts/watch towers (iv) Sanctuary is surrounded by villages from all sides.
3	To have viable and well managed estimated population of Musk Deer & Chamba Sacred Langur.	(i) Small area of sanctuary (ii) Insufficient scientific data (iii) Patrolling and monitoring system is not appropriate and needs improvement.
4	To rehabilitate the Khajjiar lake based upon scientific methods and research inputs till perpetuity.	(i)) Lack of scientific data viz; hydrological study of the lake, (ii) Limited working season (iii) Religeous belief of local people.
5	To promote a range of ecotourism programmes for providing good visitor experience to the tourists and supplemental incomes to the local communities.	(i) Lack of interpretation centre for nature education (ii) Shortage of specialized resource persons (iii) No proper waste management system (iv) Scarcity of data regarding carrying capacity of the area.
6	To develop a comprehensive capacity-building program for front line staff and local community through training and nature education programmes.	(i) Shortage of specialized resource persons for knowledge exchange and guidance (ii) Lack of awareness and sense of belongingness among local community.
7	To improve the degraded pasture and bring them to a sustainable level.	(i) Regular movement of Gaddies and Gujjars with their flocks through very old traditional routes

5.4 MAJOR CHALLENGES FOR THE MANAGEMENT:

The sanctuary is facing many challenges and a summary of the same is as under:

1. **Tourism**: Heavy Tourist influx needs to be regulated to promote eco- tourism based on carrying capacity of the sanctuary. The area of the sanctuary is 17.17 sq km. About 4-5 lacs tourists visit this area every year that too in very limited period i.e. April to June and September to November. Awareness about Wilidlife and its conservation among tourist can be achieved by establishing interpretation centers in the sanctuary.

2. **Garbage management**: Garbage management is another important issue which needs immediate attention. Heavy tourist influx and lack of sense of belongingness among the stake holders are the two major causes for the garbage problem.

3. **Inadequate capacities**: Frontline staff posted to the area does not have required trainings for wildlife management. Department does make some efforts for in house training programes on specific issues. However, scientific management of the area requires staff to be equipped with different skills for protection, management as well as long-term monitoring.

4. **Anthropogenic pressures**: Due to its openness and high tourist influx, sanctuary is highly vulnerable to biotic pressure of the surrounding villages as well as from the tourists, however the pressure is less during winters and snowfall when influx of tourists decline.

5. **Scientific database and monitoring**: It is revealed during the field work that there are few initiatives of research by some of the institutions as well as department. However, the information generated through these initiatives is not consolidated into a database. Similarly there is no system of long-term monitoring for the area.

6. **Community participation**: There is one Eco tourism society namely Khajjiar Eco tourism society which has established a good platform for regular meetings and contact between department and local people. Although the public participation in the management is there but it is not of that level as it should be. There is a lack of long-term vision in PA management and ther participation is purely opportunistic depending upon availability of funds. There is need to formulate a mechanism so as to link the communities for better protection and management effectiveness of the sanctuary.

7. **Awareness**: There is no regular system of nature education programs both for the communities as well as other stakeholders. Visitors do need adequate facilities of education and interpretation before entering the area.

8. **Achieving a viable wildlife population**: Being a small sanctuary there are limited options in terms of habitat availability and variability. Wildlife population is constrained by the sanctuary size.

5.5 SWOT ANALYSIS:

Strength-

1. Very close to famous tourist place Dalhousie
2. Good connectivity with road
3. Wildlife heaven
4. Religious places nearby
5. Natural & Cultural richness
6. Traditional hospitality
7. Pollution free environment

Weaknesses-

1. Problem of garbage disposal.
2. Insufficient parking places
3. Lack of proper awareness among the community

Opportunities-

1. To Provide better opportunities to the visitors to enjoy its natural beauty
2. To develop an ideal destination for nature lovers
3. To promote as an adventurous destination
4. To conduct awareness camps.

Threats-

1. Lack of co-ordination between community and department.
2. Waste disposal and poor garbage management
3. Disturbance to the wild life
4. Convertion of Khajjiar lake into a mashy land
5. Heavy tourist influx as compared to its carrying capacity.

CHAPTER- VI

THE STRATEGIES

6.1 STRATEGY FOR ACHIEVING THE BROAD OBJECTIVES:

Kalatop Khajjiar wildlife sanctuary is a repository of unique assemblage of high altitude flora and fauna. Keeping this in mind, the proposed strategies are focused on securing the ecological integrity of this area with its connectivity in the large landscape. This will require building better understanding about the ecosystem and putting in place a mechanism which could provide intensive management, long-term monitoring of the area and generate support of the local communities for the management of wildlife sanctuary. Major strategies for future management of the area are provided as below:

6.2 ZONATION:

As per the last management plan the area is divided into two zones. That is core zone and buffer zone. However, these zones are not operative on the ground. Further, the control of the areas included in buffer zone are not with the sanctuary management. It is proposed to divide the area into following zones.

Core zone-

Being the smaller size of the sanctuary, whole area except the area demarcated for eco-tourism activities is core zone. The core area supports dense forest of different conifers and some broad leaved species. The wild animals generally remain confined to this zone and leave this area only during heavy snowfall. This area is proposed to be managed to continue its pristine status by intensive protection and long-term monitoring.

Eco-Tourism zone-

This zone is the window of the Protected Area, which will be used for eco-tourism programs. The objective of this zone will be to maximize visitor experience and generate support for long-term conservation of the area.

Khajjiar wetland zone-

Khajjiar Lake is a renowned tourist destination and a unique high altitude lacustrine wetland in the catchment of Ravi River. The lake ecosystem is threatened due to rapid anthropogenic pressure. The objective of this zone will be to rejuvenate the lake by scientific interventions.

The details about the extent, boundaries and management strategies for different zones are provided in respective zone plans.

6.3 THEME PLANS:

The theme plan which would be implemented in consonance with the plan objectives are as under:-

a) Habitat management plan: This plan provides various interventions required to conserve the habitat. In this plan various objectives and management prescriptions have been proposed.

b) Protection Plan: In this segment of theme plan, various challenges, possible threats and strategies to mitigate these constraints have been discussed.

c) Infrastructure development plan: In this plan, the existing scenario of infrastructure has been identified and required infrastructure have been proposed.

d) Species conservation plan: This plan provides the conservation plan of two flagship species (i.e. Musk Deer, Chamba sacred langur) of Kalatop Khajjiar Wildlife Sanctuary. The Chamba sacred langur/ Himalayan grey langur (*Semnopithecus ajax*) has its presence through out the sanctuary and the presence of Musk deer has been reported/ sighted by many people in the sanctuary, but recent photographic evidence verify the presence of the species in the sanctuary. Now looking at the altitudinal variations and smaller area of the sanctuary, we presumed that this species is occurring in the entire PA. This is the reason, we kept species conservation plan in the theme plan. **e) Eco development plan:** It talks about different villages that are present around the sanctuary and various measures to involve these villages in the management of the wildlife sanctuary.

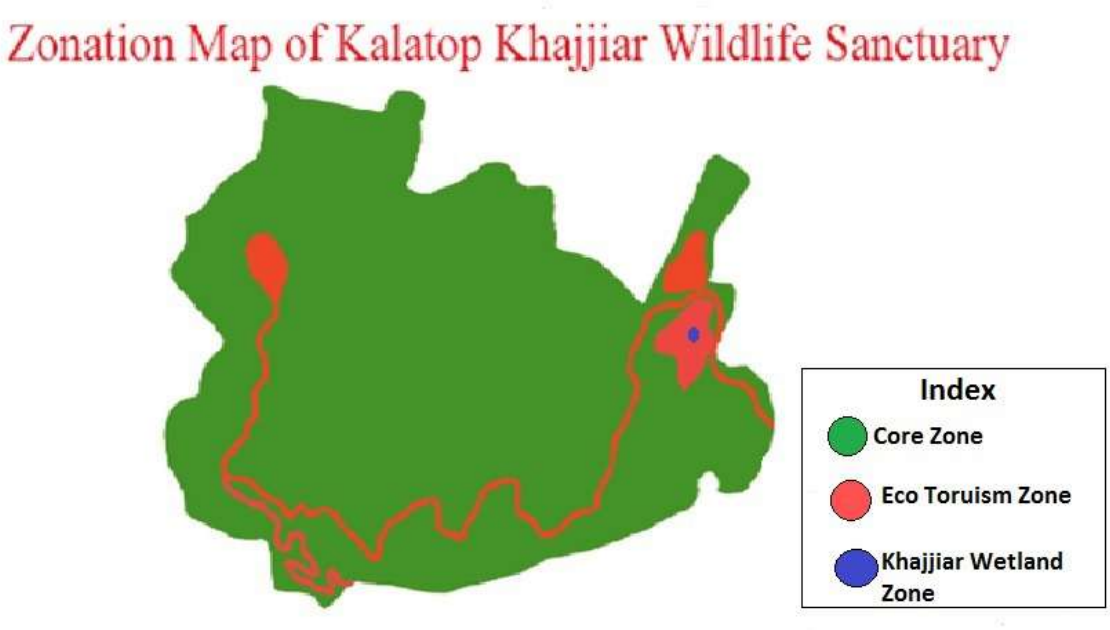
f) Research and monitoring: In this plan various monitoring techniques have been elaborated.

g) Human Wildlife conflict management plan: This plan provides different management aspects to minimize/deal with the human wildlife conflict situation.

h) Wildlife health management plan: In this plan, various preventive measures against wildlife diseases have been discussed.

6.4 ZONE PLANS:

Zones identify where various strategies for management and use will best accomplish management objectives to achieve the desired future of the Protected Area. Within each zone, the management prescriptions should be reasonably uniform but may differ in type or intensity from those in the other zones in order to accommodate multiple objectives.



6.4.1. CORE ZONE PLAN:

This zone needs complete protection and just a minimum of restorative management intervention to secure its objectives. The forests/areas in this zone should be managed as to retain these in their pristine status and there will be no interference for development in this zone. The managerial interference here would only be protection oriented and the habitat should be regularly monitored.

6.4.1.1 OBJECTIVES:

1. To maintain the naturalness and ecological integrity of area without any human interference.
2. To maintain and protect the biodiversity of the area.

6.4.1.2 PRESENT STATUS:

The core area supports dense forest of different conifers and some broad leaved species. The wild animals generally remain confined to this zone and leave this area only during heavy snowfall. This zone possess intact undisturbed vegetation

6.4.1.3 EXTENT OF AREA:

A total of 14.61 sq km (85.04 %) of the sanctuary lies in this zone. The Zonation Map given above gives the exact spatial location of this zone.

6.4.1.4 RECOMMENDED STRATEGIES:

Protection – A more intensive patrolling is suggested for this zone with more deployment of the frontline staff. Further details are given in Protection Plan (para 6.6) and Chapter X (Organization & administration).

Habitat restoration - This zone will primarily act as biodiversity conservation zone and needs complete protection with a minimum restorative management intervention to secure its objectives.

- A complete survey in this zone should be conducted in order to identify the gaps and possible augmentation activities.
- Similar survey should also be taken to identify potential soil conservation and water regime development areas.
- Further details related to these activities are given in habitat management plan

Research & Monitoring – For Kalatop Khajjiar Wildlife sanctuary available literature and ecological research data is not sufficient. Although some studies have been carried out by various researches. A floral survey conducted by Himalayan Forest Research Institute Shimla revealed several endemic floral species. The results have been enclosed in the annexure VII. Similarly a number of research papers have been published regarding faunal diversity of the area (annexure XX-XXIII). Regular research and monitoring should be done on periodic basis. Details related to research and monitoring have been given in relevant chapter (Chapter IX -Research, monitoring and evaluation).

Infrastructure development- For effective patrolling and other management activities construction of watch towers at Dibri, Dainkund & Khajroth, patroling huts at Talai, Lodhari & Khorgot, anti poaching huts at Gouthri, hideouts and bunkers at various places is also proposed.

Further details are given in Infrastructure development plan (para 6.7)

6.4.2. ECO TOURISM ZONE PLAN:

6.4.2.1 OBJECTIVES:

i. To regulate the tourism activities in the WLS without affecting the main objective of conservation.
ii. To involve local people in tourism activities, thereby generating direct and indirect economic activities for them
iii. To provide hassle-free, low volume and truly enriching experience of wilderness to the visitors
iv. To create awareness about wildlife conservation among masses.

6.4.2.2 PRESENT STATUS:

Kalatop-Khajjiar is one of the preferred tourist destinations for the people of North India especially during summers. The sanctuary being very near to Dalhousie, a famous hill station, experiences heavy tourist influx, which come here to enjoy natural scenic beauty and pleasant weather. About 4-5 lacs tourist visit this place every year. Main places of attractions for the tourists are Khajjiar lake, glade area, Kalatop, Pohlani temple temple and dainkund. Tourist influx is very high during the month of April to July. During this period problem of garbage and parking of vehicles is faced by the wildlife managers. The other major problem is traffic congestion between Lakkar mandi and Khajjiar. Tourist visitation data for last five years is as under:

Sr. No.	Year	Number of Tourist Visited
1	2013-14	293946
2	2014-15	248313
3	2015-16	367166
4	2016-17	489310
5	2017-18	523936

6.4.2.3 EXTENT OF AREA:

A total of 2.54 sq km (14.79%) of the sanctuary lies in this zone. The Zonation Map given above gives the exact spatial location of this zone.

6.4.2.4 RECOMMENDED STRATEGIES:

- In this zone, impact of human activities will be high. Therefore, regular patrolling should be done.
- Sanctuary literature (brochures/pamphlets) should be printed.
- Interpretation centre/ souvenir shops should be constructed.
- The popular treks should be maintained and monitored on a regular basis.
- Proper waste management system should be established.
- Proper signage and detailed instruction at some prominent places.
- Rest sheds, providing solar lights, benches, rain shelters and other esthetic measures for the beautification.
- Anarkali fencing with a main gate around glade area of Khajjiar to give aesthetic look.
- Further details regarding ecotourism management, capacity building of staff and community, infrastructure development etc. are given in ***Chapter VII-*** *Eco Tourism, Interpretation and Conservation Education.*

Glade area Khajjiar

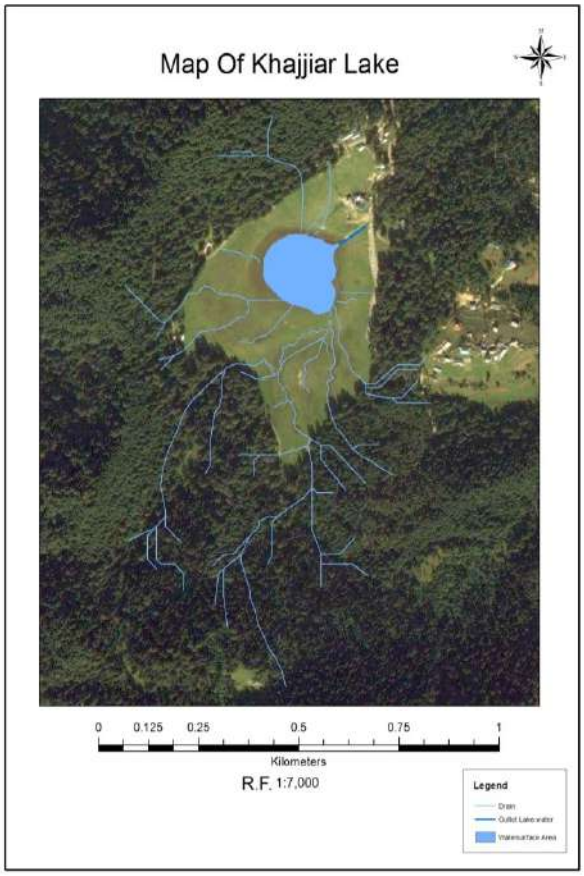
6.4.3 KHAJJIAR WETLAND ZONE PLAN:

6.4.3.1 OBJECTIVES:

i. To assess the hydrology and water quality of the lake
ii. To assess the habitat complexity and biodiversity of the lake
iii. To recommend strategies to improve the hydrology regime of the lake.

6.4.3.2 PRESENT STATUS:

The problem of ecological degradation of Khajjiar lake is increasing day by day and this lake is converting itself into a marshy and swampy land. Thus the need for eco-rehabilitation of Khajjiar lake arose since this area has got degreded by way of siltation and accumulation of weeds caused by multiple factors. Khajjiar has acquired the status of national and international tourist destination, as every year about 4-5 lacs tourists visit this incredibly beautiful glade situated in the lap of coniferous forests.



The major portion of the lake is infected by weeds and has become marshy and swampy due to deposition of silt and other waste material from its catchment area. A complete block known as floating island of Phragmites spp.is present in the lake. But at present due to deposition of silt and dung, this mass has stopped moving. There are no plans to destroy or tamper with this floating island since it adds to the scentic beauty of lake. Other than this, other major weeds which propogate vegetatively through roots/rhizomes. The decomposition of weeds in the stagnant lake leads to oxygen deficiency resulting in water becoming phytotoxic to phyto planktons and aquatic fauna. This process of degradation has been continuing since last many years and has caused water to become dirty and putrefied.

Thus, the need to clean the lake carefully by removing the hydrophytes manually arose. The lake reclamation cannot be viewed in isolation as a complex web of factors has resulted in its degradation. For this purpose, a separate plan for the reclamation of degraded Khajjiar lake has already been submitted to The National River Conservation Directorate, Ministry of Environment Forest and Climate Change, Government of India. In this plan, apart from reclamation works (channelization of natural drains, soil conservation works in the

catchment area, manual desilting and Dredging of the Lake) an Integrated Hydrological Study for Conservation and Management of Khajjiar Lake has also been proposed.

6.4.3.3 EXTENT OF AREA:

A total of 0.03 sq km (0.17%) of the sanctuary lies in this zone. The Zonation Map given above gives the exact spatial location of this zone.

6.4.3.4 RECOMMENDED STRATEGIES:

1. MANUAL DESILTING AND DREDGING OF KHAJJIAR LAKE:

The Khajjiar Lake has been heavily silted and is infested by various weeds. To restore the lake it was suggested that manual dredging and desilting of the lake be carried out. In past some funds have also been provided by Deputy Commissioner Chamba and Department of

Science and Technology, Himachal Pradesh for manual dredging and desilting of Khajjiar Lake but the funds provided by them were very meager and were provided in piece meals.

Total surface area of the Khajjiar Lake is 28368 Sq. mtr.Out of which 23640 sq mtr area is infested with weed and having silt. 4910.10 Sq. mtr. area has already been manually desilted / dredged with average depth up to 1 mtr. with the funds provided by D.C. Chamba and Department of Science and Technology, H.P. The detail of desilting / dredging carried out so far is as under: -

Sr. No.	**Funding Agency.**	**Executing Agency.**	**Amount received in lacs. (Rs.).**	**Volume of Muck / Silt manually desilted in m^3**	**Year.**
1.	D.C. Chamba.	H.P. Forest Department.	3.60	990.00	2010-11
2.	D.C. Chamba.	Govt. Contractor.	5.00	1550.00	2011-12
3.	Science and Technology Department.	H.P. Forest Department.	3.80	1045.00	2012-13
4.	Science and Technology Department.	H.P. Forest Department.	1.20	306.60	2012-13
5.	Science and Technology Department.	H.P. Forest Department.	4.00	1018.50	2013-14
Total: -			**17.60**	**4910.10**	

The proposal for manual desilting / dredging of the remaining silted area of Khajjiar Lake is as under: -

1. Total surface area of the silted portion of lake = 23640 Sq. m
2. Total Volume of the silt / slush to be dredged / desilted = 23640 m^3 (With average 1m depth).
3. Volume of silt already dredged or for which funds are available = 4910.10 m^3.
4. Area remaining for desilting / dredging = 18729 Sq. m
5. Remaining volume of silt to be desilted / dredged = 18729 m^3.
   (With Average 1meter depth).

2. REPAIR / IMPROVEMENT OF DRAINAGE SYSTEM EXISTING IN THE LAKE:

The catchment area of the Khajjiar Lake is very large and during the rains, the water level of Khajjiar Lake increases considerably. The gradient of the outlet drain constructed for the drainage of this water is very low and the drainage pipes laid below the HPPWD road are very narrow which usually choke and hamper the flow of water. For cleaning and desilting of the lake, the gradient of the drainage outlet is required to be improved. The starting point of the drainage outlet needs to be developed in a saucer shape to ensure smooth flow of water and silt. Apart from this, the peripheral drainage system of the Khajjiar Lake also needs improvement as it has been damaged at various points.

3. SOIL AND MOISTURE CONSERVATION ACTIVITIES IN THE CATCHMENT:

The catchment of the Khajjiar Lake mainly drains through four major nallas namely 1. Jhurdu Nalla 2. Mother Tree Nalla 3. Devi Da Ghatta Nalla 4. Bhathli Nalla. These main nallas further have their small tributaries the detail of which is tabulated as below: -

Sr. No.	Name of the main Nalla.	Name of the tributary.	Approximately length.
1.	Jhurdu Nalla.	--	3.50 Km.
		i) Kala Kunihar Nalla	1.50 Km.
		ii) Kunihar Nalla	0.9 Km.
2.	Mother Tree Nalla	--	1.50 Km.
		i) Khajji Cottage Nalla	1.50 Km.
		ii) Near Primary School Nalla	0.750 Km.
3.	Devi Da Ghatta Nalla	--	1.30 Km.
		i) Near FRH Khajjiar	0.5 Km.
		ii) Near Deodar Hotel.	0.4 Km.
4.	Bhathli Nalla.	--	0.5 Km.
		i) Near Gautam Lodge.	0.4 Km.
		ii) Near PWD Rest House	0.3 Km.

Apart from these main tributaries, these nallas also have various small feeding channels which also require soil & moisture conservation measures.

For treatment of the catchment of the Khajjiar Lake following Soil & Moisture Conservation activities shall be undertaken:-

i). Vegetative / Brushwood Check Dams.

ii) Gully Plugging / Stabilization.

iii) Dry Rubble Stone Masonry (DRSM) Check Dams and Cement Concrete Check dams.

iv) Water Harvesting Structure.

Vegetative / Brushwood Check Dams:

The main advantage of brushwood Check dams is that they are quick and easy to construct and are inexpensive to construct by using readily available materials at the site. In brushwood check dams, small branches preferably of coppiceable species are fixed in two parallel rows across the gully or Nalla and packed with brushwood between the rows of these vertical stakes. The vertical stakes are tied down with wires or fastened with sticks across the top. The important consideration in erecting brushwood Check dams is to pack the brushwood as tightly as possible and to secure it firmly. This type of Check dams is generally constructed over small gullies or at the starting stretch of gullies.

i) Gully Plugging / Stabilization:

Gullies are usually formed where many rills join and which in turn increases the volume and erosive power of the water flow. The objective of re claiming these gullies is to prevent further erosion and utilize the land again for protective and productive use. The typical measures for reclamation of small gullies include brushwood plugs; loose stone structure and small dry stone masonry check dams.

ii) Dry Rubble Stone Masonry (DRSM) Check Dams and Cement Concrete Check Dams:

The site where DRSM Check dams are to be constructed is cleared and the sides are sloped 1:1. The bed of gully is excavated for foundation to a uniform depth of 0.45 m to 0.60 m and dry stones are packed from that level. Over the foundation, DRSM superstructure of check dam is constructed. The stones are dressed and properly set in with wedges and chips. The width of check dam at the base should be approximately equal to maximum height and successive courses are narrower so the section is roughly a trapezium. It is common to find upstream face of Check dams vertical with a slope on the downstream face but while there is sound engineering reason for this in case of large check dams but it is not of any consequence in small gully control check dams. In the centre of the dam portion sufficient waterway is allowed to discharge the maximum run off. The dry stonework should go up to 0.30 m to 0.60 m in the stable portion of the gully side to prevent end cutting. Sufficient apron is provided to prevent scouring of the

structure. The thickness of apron packing would be about 0.45 m and gully sides above the apron have to be protected with packing to a height of at least 0.30 m above the anticipated maximum water level to prevent side scour being formed by the falling water. Cement Concrete Check dams are to be constructed where the size of nallas become considerably large providing proper apron sidewalls, spillway and wing walls it will act as silt detention as well as percolation structure.

iii) Water Harvesting Structure:

The water harvesting structures has been proposed to be constructed on main nallas of the catchment of Khajjiar Lake. These nallas have perennial water flow and silt coming from these nallas especially during rainy season drains into the Khajjiar Lake. Two number of water harvesting structures has been proposed to be constructed which apart from holding the silt will also have small water reservoir which will act as water holes for the wild animals of the sanctuary. The construction of WHS is necessary to control the direct flow of silt into the lake.

4. INTEGRATED HYDROLOGICAL STUDIES FOR CONSERVATION AND MANAGEMENT OF KHAJJIAR LAKE:

National Institute of Hydrology, Roorkee was requested to submit proposal on Hydrological study of Khajjiar Wetland. The NIH Roorkee has submitted a consultancy proposal on Integrated Hydrological Studies for Conservation and Management of Khajjiar Lake vide their Letter No. NIH / EGD /32/ Khajjiar dated 04-11-2013 amounting to Rupees 59,96,990./- Or Say Rs. 59,97,000/- only.

5. PURCHASE OF BOAT & OTHER TOOLS:

Boats and other tools like glove, rope, life jackets, shoes, pick axes, wheel barrow sledge hammer spade, shovels, pans etc. required for dredging, de-silting and for removal of weeds, soil conservation and engineering works have been proposed.

For desilting and dredging works in the lake, Wildlife Institute of India was approached for scientific interventions for the rejuvenation of the lake. In its report, Wildlife Isnstitute of India has recommended following conservation interventions:

- De-siltation
- De-weeding
- Reduce influx of nutrient and floating debris

- Maintenance of water level
- Management of the meadow
- Comprehensive ecological assessment to frame management plan

The detailed report in this regard is attached as **annexure=XXV**

6.5 THEME PLANS:

6.5.1 HABITAT MANAGEMENT PLAN:

Habitat management within the PA is a key to effective conservation of wildlife. Active managerial intervention, including habitat restoration will be carried out in the sanctuary for development of the forest area as ideal wildlife habitat. This would include carrying out plantations, soil, moisture conservation works & improvement of water availability etc.

6.5.1.1 OBJECTIVES:

1. To identify degraded areas inside the Sanctuary.
2. To restore these degraded areas through scientific/ managerial interventions.
3. To improve the habitat quality for different flagship species.

6.5.1.2 PRESENT STATUS:

Due to anthropogenic pressure and unregulated tourism, habitat in the area is degrading. The forests in the sanctuary are potential habitat of many species, therefore proper management is vital for protecting the biodiversity of sanctuary and achieving the objectives of the management plan.

6.5.1.3 RECOMMENDED STRATEGIES:

Protection – As protection is the core of management for any PA and the sanctuary being highly impacted by human induced pressure, several protection measures should be carried out. Further details are given in Protection plan (para 6.6)

6.5.2 HABITAT MANAGEMENT ACTIVITIES:

6.5.2.1 PLANTATIONS:

Area being moderately dense to dense forest, there is no need for tree plantation in the sanctuary. The assisted natural regeneration can be taken up at certain places. The rocky habitats will be maintained as such. However, some fruit trees will be planted in the sanctuary area, as it will provide food for the rich Avian-fauna of the area.

Following areas need to be restocked through plantation or assisted natural regeneration technique-

Kalatop RF, Khajroth DPF, Khajjiar DPF and Jhurdu DPF.

Actions to be taken –

- Every year 5 -10 hectare area will be taken up for plantation / assisted natural regeneration.
- Only native species will be planted and more emphasis will be given to assisted natural regeneration.
- In musk deer conservation area (details are given in musk deer conservation sub plan) shrub species will be preferred.
- An integrated approach with plantation and soil and moisture conservation will be followed.
- Following species are proposed for plantation:

1. *Aesculus indica (* Horse Chestnut*)*
2. *Juglans regia (*Walnut)
3. *Quercus leucotrichophora (Ban)*
4. *Cedrus deodara (*Deodar)
5. *Pinus wallichiana (*Kail)
6. *Pinus smithiana (*Spruce)
7. *Abies pindrow (* Fir)
8. *Rhododendron arboretum (*Burans)
9. *Berberis lyclum (*Kasmal)
10. *Fragaria vesca (* Strawberry)
11. *Geranium wallichianum (*Ratanjot)
12. *Dioscorea deltoidea (*Shingli mingli*)*

6.5.2.2 CREATION OF MEADOWS:

PURPOSE OF MEADOW CREATION-

Herbivore population including Musk deer, Goral and Barking deer is fairly good in number. Goral usually associate in small parties of four to eight, feeding on rugged grassy hill-sides, or rocky ground in forest whereas, barking deer prefers thickly wooded hills and come out to graze in the outskirts of these areas.

Encouragement of Gorals in the sanctuary would increase the herbivore biomass in the sanctuary and benefit the apex carnivores.

PROCEDURE FOR MEADOW CREATION AND MAINTENANCE-

It is proposed to restore small grassy openings in the Kalatop – Khajjiar Wild Life Sanctuary by active habitat manipulation. This would be done in such a way which may not affect the other important ecological function of the sanctuary i.e. water shed capability. No plantations are to be raised in grasslands. For maintenance of these meadows, manual uprooting of woody vegetation will be done regularly. Control burning of these grassy blanks in cool springs and winter can also be resorted to. For control of weeds, the strategies need to employ mechanical methods combined with protection from biotic factors. Impact of control burning on the quality and quantity of grasses shall be studied over the period of this management plan.

MONITORING OF MEADOWS-

The meadows shall be monitored for presence of herbivores using a proper monitoring protocol. Monitoring will determine the success of the intervention. Each meadow shall be given a name or number. Each meadow shall be visited every month on a particular day in the early morning and the number of herbivores seen in the meadow will be counted. Since the meadows are small it will be possible to count the approximate number of animals by visual estimation. Regular monitoring will enable to establish the degree of success of the intervention.

6.5.2.3 SOIL AND MOISTURE CONSERVATION WORKS - (BIOLOGICAL AND ENGINEERING):

Since, the sanctuary is being managed for conservation of wildlife, soil and moisture conservation works are of utmost importance. Engineering measures will be supplemented with vegetative measures as per site specific conditions.

Following actions are recommended to protect and restore the catchment value.

Actions to be taken/ Recommendations-

The overall objectives of Soil and moisture Conservation works are:

1. Increase filtration into soil
2. Controlling excessive run off
3. Manage and utilize run off for useful purpose.
4. Improving existing water resources by plantation of water holding species

Following actions are proposed to achieve above objectives

- Biological measures will be preferred over engineering measures (wherever possible)
- A plan for soil and moisture conservation works will be prepared and work will be done systematically.
- Small kacchha water ponds
- Contour staggered trenches are proposed in Khajrot DPF and Kalatop RF.
- Soil conservation works are proposed in Khajrot Nallah, Karelnu Nallah, Topi Nallah, Jhurdu Nallah, Lakkar Mandi Nallah, Kanjreri Nallah, and in all the small streams of the catchment of Khajjiar lake.

6.5.2.4 IMPROVEMENT OF WATER AVAILABILITY:

Although, the sanctuary area has many perennial streams and many seasonal springs but some more water resources are needed to be created especially for the lean period. The type of water retention structure will depend on the site condition. As there is water deficiency the trenches and percolation ponds around Khajrot Nallah, Dainkund area and other higher reaches shall be made so that the water resources and nallahs remain rejuvenated throughout year.

The first and foremost step to improve water availability inside the sanctuary is to have the information of all the existing water sources and be aware of their status. This could be done by identifying the perennial and seasonal water sources through intensive survey and water mapping that area using 2x2 km grid. Any Grid square without perennial sources represents a gap. The best way to fight water scarcity is by regenerating natural sources of water and then construction of artificial water holes. Another important criterion to manage water resources inside a PA is by proper site selection. Following points should be considered for any water development works –

- A gap in water supply is not in itself sufficient reason to establish an additional water source. Clear objectives must be established.
- A large number of small and widely scattered sources are better than a few large sources
- Water development should be avoided in areas where Endemic and rare plant species are present.
- Water development may trigger erosion on steep lands and fragile soils
- Preference should be given to near habitat edges (eco tones) where species from different habitats congregate
- Site which has shade trees and tall shrub or grass would be favourable – (escape cover nearby)
- Sites that are likely to be disturbed frequently by livestock, local people or traffic should be avoided.

6.5.2.5 PROVIDING SALT LICKS:

Provision of artificial salt lick affect the behavior and movement of wild animal and sometimes it also help poachers to locate the presence of the animals. Therefore, it is necessary to provide due care and protection where artificial salt licks have been provided. It is suggested that all the existing artificial salt lick locations should be mapped and based on the information decision to provide new salt licks should be taken carefully.

6.6 PROTECTION PLAN:

6.6.1 OBJECTIVES OF PROTECTION PLAN:

1. To maintain environmental/ecosystem stability of Kalatop Khajjiar Wildlife Sanctuary
2. To protect the vast variety of flora and fauna of Kalatop Khajjiar Wildlife Sanctuary which represent the remarkable biological diversity and genetic resources
3. To strengthen the infrastructure
4. To involve the local people in protection of Kalatop Khajjiar Wildlife Sanctuary on the principals of participatory approach.

6.6.2 POSSIBLE THREATS:

Following are possible threats –

- Human Wildlife conflict
- NTFP collection / Grazing / felling and lopping of trees
- Unregulated tourism and waste management
- Diseases transmitted through domestic cattle / Communicable diseases
- Forest Fire
- Poaching
- Climate change
- Natural threats like landslide, earthquake etc.

6.6. 3 CONSTRAINTS :

1. Inadequate infrastructure and logistics support
2. Lack of proper communication system and technologies
3. Harsh weather conditions
4. Dependency of local people on natural resources.

6.6.4 INADEQUATE INFRASTRUCTURE AND LOGISTICS:

The office & residential buildings available in the Wildlife Range Khajjiar are not sufficient and some of the buildings being old require immediate maintenance.

Absence of essential infrastructures and logistics like Forest guards huts, watch towers, patrolling huts/anti-poaching camps, patrolling vehicles makes it more difficult to manage the sanctuary.

6.6.5 LACK OF PROPER COMMUNICATION SYSTEM AND TECHNOLOGIES:

Presently the staffs are mainly located at Kaltop, Khajjiar, Miyarigalla and Lakkarmandi. Though there is telephone facility available at Kalatop & Khajjiar but Lakkar mandi and Miyarigalla Check posts are without any such facility. The mobile signal in sanctuary area is also very poor. The wireless communication may also prove very useful in such areas for better management. Hence, the option of the wireless communication has a very high relevance. Possibility of installing wireless network may be explored

6.6.6 HARSH WEATHER CONDITIONS:

The cold temperature conditions are more prevalent in the higher elevations. During the winter season sub zero conditions are also witnessed.

6.6.7 DEPENDENCY OF LOCAL PEOPLE ON NATURAL RESOURCES:

The people of surrounding villages (especially from Lakkarmandi), nomadic Gaddies and Gujjars are dependent on the sanctuary for various NTFPs including medicinal plants, fuel wood, fodder and cattle grazing. Therefore, reducing the dependency of the people from the sanctuary by providing them with alternate options should be one of the prime objectives of the management.

6.6.8 THREAT ASSESSMENT:

Threat	Over all Status	Remarks
Human Wildlife conflict	Low	WLS is surrounded by villages. One village is inside the sanctuary.
NTFP collection / Grazing / felling and lopping of trees	Medium	Fringe villages's people, nomadic Gaddies and Gujjars are dependent on the resources of WLS
Unregulated tourism & waste management	High	Khajjiar, kalatop, lakkarmandi and dainkund areas of sanctuary are facing this problem

Communicable diseases	Low	A number of cattle and dog population in villages situated along the boundary of WLS .
Forest Fire	low	Sanctuary is surrounded by chil pine forests
Poaching/Hunting	Very Low	As a result of human wildlife conflict

6.6.8.1 PLAN OF OPERATION:

6.6.8.2 HUMAN WILDLIFE CONFLICT :

Kalatop Khajjiar wildlife sanctuary is surrounded by a number of villages. Even one village (Lakkarmandi) is inside the sanctuary. Due to the increase in human wildlife conflict, local people are not supportive to conservation of wildlife and forest department (especially frontline staff) are not getting proper support from local communities, therefore management of human wildlife conflict should be the first priority for management of any PA. Details are given in para 6.10 (Human Wildlife conflict management plan).

6.6.8.3 FOREST RESOURCES COLLECTION / GRAZING / FELLING AND LOPPING OF TREES:

Fringe villages's people, nomadic Gaddies and Gujjars are dependent on the resources of WLS. The pressure of grazing in the dainkund and Pohlani is more. Nomadic gaddies and gujjars use this area as a traditional route for their flocks. The areas nearby villages are vulnerable from illegal grazing. Collection of medicinal plants from the sanctuary area is almost negligible.

Illegal felling and lopping of trees – The problem is not very severe and mainly confine to Lakkarmandi area.

Strategies to be adopted -

1. Group patrolling
2. Strengthening of Infrastructure/communication system-
3. Awareness programme
4. Regular checking at strategic point
5. Eco development activities (details are given in **Chapter VIII**) .

Wildlife Protection Maps:

There is a great need of preparing the Wildlife Protection Maps, which should indicate the hot spots of the Kalatop Khajjiar wildlife sanctuary, topography, water/salt points, the vegetation type of these WL hotspots, concerned trekking routes, availability of patrolling huts and other related information.

6.6.8.4 UNREGULATED TOURISM AND WASTE MANAGEMENT:

Due to heavy tourist influx huge amount of waste has been generated but there is no proper waste management system exists. These problems are posing a significant threat to the biodiversity of sanctuary.

Strategies to be adopted-

Bio-degradable and Non Bio-degradable garbage must be collected separately and disposed off only in the designated sites. Non Bio-degradable garbage must be disposed off in the nearest recycling units. Separate dustbins for Bio-degradable and Non Bio-degradable garbage will be provided to all Stake holders. Bio-degradable and Non Bio-degradable garbage will be collected on door to door basis. For this stake holders will have to pay nominal charges. The purpose of realizing charges from stake holders is not the revenue generation but to make them feel as a sense of belongingness. The Bio-degradable garbage will be dumped in the designated site which will be made fully insulated so as to protect it from monkeys and other stray cattle etc. This Bio-degradable garbage will be used to produce manure either in compost pits or through green waste composter machine which will further be used to grow seedings in the nursery.

Further details regarding the management of tourism pressure are given in chapter VII.

6.6.8.5DISEASES TRANSMITTED THROUGH DOMESTIC CATTLE/ COMMUNICABLE DISEASES: Wildlife disease is a major protection issue. In Kalatop Khajjiar wildlife sanctuary the chances of infection from the cattle of adjoining villages and migratory graziers cannot be ruled out. Details are given in Wildlife Health management plan **(Para 6.11)**

6.6.8.6 IMPACTS OF CLIMATE CHANGE:

At present, no specific data is available to assess the impact of climate change on Kalatop Khajjiar Wildlife sanctuary. However, it is expected that in future many different types of impacts on biodiversity (individual organisms, species and ecosystems) will be felt.

6.6.8.7 FOREST FIRE PROTECTION:

Fire sensitive areas –

Khajjiar, Khajrot, Kalatop and Talai beats of Kalatop Khajjiar wildlife sanctuary have boundary with Chil pine forests of Chamba and Dalhousie Forest divisions. These beats are sensitive to fire incidents. Although there are not fire incidents for last so many years.

Strategies to be adopted –

1. During fire season fire sensitive areas must be patrolled by the front line staff intensively.
2. Introduction of modern firefighting tools and training of staff and labor in their use.
3. Regular maintenance of fire lines
4. Development of extension programme to educate villagers and visitors about fire. Sign boards with suitable messages will be displayed at all prominent places in the Wildlife Sanctauries (especially places important from tourism point of view).
5. People's Participation – As almost all the fires result from human activity, the involvement of people is essential for improved prevention and control.
6. Fire fighting operations - During the fire season the following shall be done:
   - Once fire is detected all hands must proceed to fight the fire, irrespective of range/jurisdictional boundaries
   - Range headquarter will have enough spare sets of equipment like fire rakers, small axes, sickles, water bottles etc.
   - Proper reporting of fire incidents will be ensured. The general tendency to under report has to be strongly discouraged.

The detail of the existing fire line in Kalatop – Khajjiar Wildlife Sanctuary is as under: -

S. No.	Name of Range	Name of Block	Name of Beat	Length in KM	Remarks
1.	W.L. Khajjiar	W.L. Lakkermandi	W.L. Lakkermandi	2	

- Fire watch Huts/Gang huts (Talai) will be established at vantage points. Each watch point will be managed by three-four fire watchers. Fire watchers will be provided with mobiles and fire resistant kits during fire season.
- There is a need to develop a rapid response system in case of outbreak of fire. Since people do not get much in terms of fuel, fodder and rights from the

sanctuary, in such scenario, people are reluctant to put off fire. It therefore, appears that in the short term an effective network of fire lines, which are regularly cleaned during and before the dry season be maintained and sufficient provision be made in the annual budget for this. Record of fires needs to be maintained regularly

6.6.8.8 POACHING OF WILD ANIMALS:

Ban on hunting has been of great help to the wildlife. Poaching in the sanctuary area is almost nil and no case of poaching has been reported during last so many years. However Following actions are recommended –

- Group Patrolling and Reporting: This aspect of the wildlife protection needs very effective strengthening through patrolling by the wildlife sanctuary staff.
- Unlike traditional patrolling by one Forest Guard, it is recommended that at least two Forest Guards along with one or two casual workers / local people need to form one patrolling party and conduct three or four long patrols in a month.
- Each patrol to cover interior areas of the sanctuary. The patrolling party has to have maps with their route shown on it.
- Full reporting on every patrol including collection of biological information is to be ensured.
- The biological and other information collected during patrolling must be organized and compiled.
- In addition to preventing wildlife crime, these patrolling reports may be very useful for the evaluation of management effectiveness and for monitoring habitats and population of target species.
- A well-accomplished Nature Awareness programme involving school children and locals can arouse public opinion in favour of conservation.

Anti-Poaching Operations-

- Winter season (November-March) are more sensitive months, therefore more intensive operations are required in these months
- Wherever possible local people/youths should be involved in anti-poaching operations
- In poaching sensitive areas regular combing operation (At least one in every month)

Reward to persons-

A reward is recommended to be given to a person or villager who renders assistance in the detection of an offence or the apprehension of the offenders.

Capacity building of Front line staff-

Some of the suggested courses for Forest Guards, Dy. Rangers, and Forest Rangers are:

- One week module on Identification and prevention of illegal trade in wildlife, its derivatives and parts;
- One week module on intelligence gathering, investigation and prosecution of wildlife offence cases;
- One-week module on Wildlife Protection Act 1972, and its application: This course will help develop standard Performa for booking forest and wild life offences under IFA and WPA, such as Search Warrant, Seizure Memo, Bail Bond, Case Dairy/DR etc. for the entire state. This will help in making prosecution of cases simple and will reduce the chances of technical errors in filing offence cases in the court of law.
- One week module on human wildlife conflict, Nature Conservation Education, and provisions of wildlife compensation.

6.7 INFRASTRUCTURE DEVELOPMENT PLAN:

For the effective protection and regular monitoring, proper communication system, patrolling huts in remote areas, continuous maintenance of path and small bridges are necessary requirements. In addition, other logistic support like tents and other trekking equipment's are also required.

6.7.1 LIST OF TOTAL INFRASTRUCTURES AVAILABLE AND REQUIRED:

1. **Forest road/path-**

Existing Situation	Proposed/Recommended action
• 15 inspection paths(74.5 KM) • 2 Bridle paths (1.4 KM) • 1 jeep able road (3KM)	Maintenance suggested of these path on periodic basis.

2. Check posts and Forest guard quarters-

Existing Situation	Proposed/Recommended action
• 3 Check posts at Lakkarmandi (2) and Miyarigalla • 8 Forest guard quarters	These check posts at Lakkar mandi and Miarigalla should be strengthened and be equipped with telephone facility, CCTV cameras and fire arms. Additional accommodation should be constructed with these check posts. Each check post should be provided with regular staff of 3-4 persons. Construction of one more type-II residence at Miyarigalla and two type-II residences at Lakkarmandi and Khajjiar eac is proposed. Maintenance of these check posts will be required from time to time.

3. Patrolling Huts/ Watch towers-

Existing Situation	Proposed/Recommended action
• 1 No. Patrolling Hut • 1 No. watch tower	1. Construction of patrolling huts in following places are recommended. These huts will serve as a resting place for the Front line staff and other field workers during patrolling and other management activities inside the sanctuary with very basic facility. • Talai • Lodhari • Khorgot In addition to this construction of watch towers and anti poaching hut with basic facility at following places is also proposed: • Dibri • Dainkund • Khajrot • Gouthri 2. Maintenance of these areas suggested on regular basis.

4. Office and residential complex for forest officers-

Existing Situation	Proposed/Recommended action
• 1 No.Range office – cum-residence • 2 Nos. Block officers residences	Special Maintenance of these buildings suggested on regular basis

5. Construction of other infrastructures-

Existing Situation	Proposed/Recommended action
• No proper demarcation of two different blocks and no demarcation of beats • Nature Interpretation Center (N.I.C) absent in this sanctuary • Insufficient signage at check posts and along the trails	1. Proper boundary should be demarcated and redefined. 2. Construction of one N.I.C at Khajjiar/ Lakkarmandi. 3. Effective signage like "Do's and Dont's, "species rich areas" etc should be demonstrated properly on the display at each check posts and inside the sanctuary 4. Periodic maintenance of the buildings and infrastructures present in the sanctuary

6. List of total instruments and logistics available and required-

Existing Scenario	Proposed/Recommended action
1. Vehicles for forest staff	
• One Bolero –DFO • Two motor cycles	1. One Patrolling vehicle needs to be purchased 2. 3 bikes for forest guards for rescue operation 3. One vehicle needs to be purchased for Rapid action force(team of wildlife and territorial staff to handle conflict situations)
2. Instruments and gadgets	
• Only one desktop + 1 printer +1 scanner in Range officer • 3 GPS	1. Binoculars, GPS, Camera for each beat level forest staffs 2. Static sets at every check posts and offices 3. Wireless handsets/ walkie talkie sets for all forest

• 3 binoculars • 2 digital cameras	guards 4. Snow Gear instruments

6.8 SPECIES CONSERVATION PLAN:

In Kalatop Khajjiar Wildlife Sanctuary number of endangered and rare mammal species are found , some of the important species are Musk Deer, Chamba sacred langur, Asiatic black bear, Common leopard, Goral, Rhesus macaque, Himalayan fox, Yellow throated marten Etc. . **(Details are given in annexure-VIII).**

Based on their relative abundances and distribution, two species (Musk deer and Chamba sacred langur) have been identified as flagship species for Kalatop Khajjiar wildlife sanctuary.

6.8.1 MUSK DEER CONSERVATION SUB PLAN:

Musk deer is a member of the family Moschidae. It is most threatened species and listed in schedule l of Wildlife (Protection) Act, 1972. Musk deer are small solitary, cryptic and primitive deer like ruminant. They inhabit forested mountain habitats between 2,000 m and tree line and also alpine scrub and meadows.

MUSK DEER

6.8.1.1 HABITAT PREFERENCE:

Musk deer generally are found in areas above 2000 meter with a slight seasonal variation and mainly used areas with tree cover mixed with shrubs. Deodar forests having thick shrubs are the main habitat of musk deer. Therefore to maintain the habitat of musk deer shrubs are extremely important as a refuge from predators and as a source of food Habitat preference.

6.8.1.2 RECOMMENDED ACTIONS:

Protection- Entire potential musk deer habitat needs to be thoroughly combed at least twice in a year (Spring/Summer and autumn). For confirmed habitats combing operations should be done at least three times in a year. Care should be taken that no combing operation will be carried out during breeding season of the species.

Population Monitoring – Population monitoring will be done annually in selected areas by using Silent drive count method. Location for monitoring will be selected on the basis of direct/indirect evidences observed during patrolling of areas.

Habitat Monitoring – Musk deer is a selective feeder, therefore it is necessary that habitat should be monitored regularly for any changes in composition of vegetation and extent of ground cover. It is suggested that initially base line data may be collected by involving professionals from Wildlife Institute of India/other scientific institutions and proper training should be given to field staff for future monitoring on five yearly basis.

Habitat improvement - Musk deer uses ground cover as an anti-predator strategy; musk deer rely primarily on concealment to avoid detection. Female musk deer hide their newborn in dense ground cover vegetation to protect them from predators. Therefore, in those areas dense ground cover has to be maintained. It is suggested that these areas should be surveyed properly during patrolling and gaps maybe identified and shrub species should be planted to increase the ground cover and food source for musk deer.

Awareness and involvement of local people –Any conservation initiative will not be successful without involving local people. Various eco development programmes that reduces the dependence of local people on the resources of Kalatop Khajjiar wildlife sanctuary and strict protection measures are the two main strategies to conserve musk deer. Regular awareness programmes for locals, students/youth are required to get their support.

6.8.2 HIMALAYAN GREY LANGUR (*SEMNOPITHECUS AJAX)* CONSERVATION SUB PLAN*:*

The Chamba Sacred Langur, is an Endangered leaf eating primate endemic to the valley of Chamba. First described in 1928 from a skin specimen by Reginald Innes Pocock from Chamba, this species has since remained virtually unknown to primatologists in the subcontinent. Detailed and well informed distribution assessments have confined the species to the Chamba Valley implying endemism. The interesting and distinguishing feature of the Chamba Sacred Langur is the adult male's shoulder mane. The males and females have long fur giving them a puffy, bushy appearance. Its endemism to Chamba has in effect earned Chamba Valley the Alliance for Zero

Extinction Site status. The Chamba Sacred Langur, though, faces its own survival threats and population pressures ranging from fragmentation, deforestation, forest fires, retaliatory killing due to crop raiding, expanding horticulture, and the growing antagonism towards the Langurs due to their crop raiding behavior. The Langur distribution, its dietary preference, behavior, and their role in the ecosystem services of the western Himalayan ecology is yet to be understood and appreciated thereby justifying detailed research on the Langurs.

Chamba Sacred Langur (*Photo:- Sh. Vishal Ahuja)*

6.8.2.1 HABITAT PREFERENCE:

The langur occupies the sub alpine moist deciduous forests of the western Himalaya of Chamba, having altitude 1700 meter to 2500 meter with an estimated occupancy range <500km^2 and a population of about 250 mature individuals. It prefers dense forests.

6.8.2.2 RECOMMENDED ACTIONS:

Population Monitoring – Population monitoring will be done annually in selected areas. Location for monitoring will be selected on the basis of direct/indirect evidences observed during patrolling of areas.

Habitat Monitoring – Chamba sacred langur eats a lot of leaves, but also buds, bark, fruit, roots, seeds, cones, and flowers. Chamba sacred langur also licks soil from under trees and loves young leaver. Therefore it is necessary that habitat should be monitored regularly for any changes in composition of vegetation. It is suggested that initially base line data may be collected by involving professionals from Wildlife Institute of India/other scientific institutions and proper training should be given to field staff for future monitoring on five yearly basis.

Habitat improvement - It is suggested that these areas should be surveyed properly during patrolling and gaps may be identified and wild fruit bearing species should be planted to increase forage for Chamba sacred langur.

Awareness and involvement of local people –Any conservation initiative will not be successful without involving local people. Various eco development programmes that reduces the dependence of local people on the resources of Kalatop Khajjiar wildlife sanctuary and strict protection measures are the two main strategies to conserve Chamba sacred langur. Regular awareness programmes for locals , students/youth are required to get their support.

6.9 ECO DEVELOPMENT PLAN:

There is a lot of scope to promote the Eco Development activities in and around the sanctuary so that the following objectives could be achieved:

a. To provide healthy, hygienic environment to the general public residing in and around the sanctuary and to improve their living conditions.
b. To help the local people in ameliorating their economic status.
c. To manage the human wildlife conflict in buffer area.
d. To encourage ancillary occupation in the area.
e. To improve the agricultural productions by adopting better techniques like terracing, soil conservation measures etc.
f. To provide basic medical facilities both to human being as well as cattle.

Detail regarding specific issues, broad strategies Etc. is in **Chapter VIII**

6.10 RESEARCH AND MONITORING:

Detail regarding this plan is in **Chapter IX**

6.11 HUMAN WILDLIFE CONFLICT MANAGEMENT PLAN:

6.11.1 OBJECTIVES:

1. To assess the human wildlife conflict situation in surrounding areas of PA
2. To suggest various actions to mitigate human wildlife conflict
3. To strengthen the infrastructure required for managing human wildlife conflict
4. To involve the local people in management of human wildlife conflict on the principals of participatory approach.

6.11.2 HUMAN WILDLIFE CONFLICT - SENSITIVE AREAS :

Based on data collected and available official records the following areas in and around wildlife sanctuary are vulnerable for human wildlife conflict: Lakkarmandi, Khajjiar, rotta, Lahri, Roun, Bangbehi, Jhagrota, Darol, Sundhar and Mandrani.

6.11.3 STRATEGY/ RECOMMENDED ACTIONS:

The Human wildlife conflict is a resultant of various aspects of the natural resource degradation as well as societal stratification. Very often damage caused by the wild animals directly affects the poor, marginalized rural communities living next to the wildlife sanctuary.

Crop Depredation - The state govt. has imposed ban on the hunting of wild animals. Because of this ban, the number of wild animals has been increasing in the area. The resource-deficient villagers need to resort to labour intensive measures of crop protection and such actions mostly result in disproportionate cost of raising crops by the poor and marginal villagers. The villagers often use retaliatory measures of harming/killing the wild animals of which there is hardly any record or report. The depredation enhances dramatically when there is an increase in the number of livestock as well as the area under cultivation close to the PA; when there is a decline in the availability of the natural food; when there is an increase in the number of large wild herbivores due to “conservation measures”. In all these circumstances, the crop depredation or killings of livestock are escalated exponentially. The top crop damaged is mainly maize and top crop raider was Rhesus macaque followed by Asiatic black bear.

Livestock Depredation - Due to small area of sanctuary, and harsh weather conditions especially during winters wild animals migrate towards lower elevation resulting in human wildlife conflict.

The Rhesus macaque and Chamba sacred langurs are able to adapt themselves to the human presence. The wild animals intrude into agriculture fields as the crops raised are more palatable, and they are located in easy locations. The domestic livestock is very easy prey for the wild animals. The areas mentioned in foregoing paras are more prone to human-wildlife conflict and Asiatic Black Bear is responsible for most the of the conflicts. Crop raiding incidents problem is more severe than livestock killing.

Compensation - There is a provision of providing compensation to the person whose sheep, goats or cattle have been killed by the wild animals. Similarly, State Government through other departments is also providing compensation for the damage to agriculture and horticulture crops. In future, the situation can be quite alarming as the damage done to their crops by the wild animals is enormous. This may also adversely affect the acceptance of the conservation ideas among the locals.

6.11.4 RECOMMENDED ACTIONS:

Proactive Actions – To prevent the damage by the wild animals.

- The villagers are already using deterrents such as making sounds, beating drums or putting up a scarecrow in their fields. The WLS staff and the local villagers need to put up a combined defence against the human-wildlife conflict.
- There is a need to undertake action research on human-animal conflict so that preventive guidelines are made in consultation with the villagers.
- Regular census of ungulates and carnivores in the wild will give an insight into the prey-predator relationship. This will also help understand the carrying capacity of their habitats.
- To increase the availability of food, plantation of wild fruit trees should be done in the forests areas.
- A Joint Rapid Action Team (a mix of Territorial and wildlife staff) is suggested to be constituted to manage the incidents.
- Reproduction rate of monkeys may be controlled through various means like sterilization through surgical method which is already in place.
- Proper waste management is very important to avoid attracting wild animals to human settlements and to prevent wild populations being augmented and artificially sustained by human induced food availability. Each stage of waste handling should be addressed, from collection to transportation to disposal. It is suggested that through various awareness programmes, local people and civil authorities should be encouraged taking this issue

seriously. Proper waste disposal is the key strategy to reduce the conflict between human and monkeys.

- Awareness activities at different levels, for instance in schools or in village level meetings should be held regularly. These programmes are essential for building local capacity in conflict resolution and increasing public understanding of human wildlife conflict. Educating rural villagers in practical skills would help them to deal with wild animal species and to acquire and develop new tools for defending their crops and livestock

Reactive Actions - When the damage by the wild animals has already been done.

- Compensation for damage to livestock must be given timely as per rule.
- The future of human wildlife conflict resolution lies as much in the involvement of the local communities in the wildlife habitat management.
- Vide Notification No. FFE-B-A (10)-1/2009 dated 18/09/2018; guidelines for dispensing compensation for life/property losses during human wildlife conflict have already been issued **(Annexure XIX)** and it should be strictly followed.

People's participation –

Resolving human wildlife issues becomes difficult without active support from the local communities. It is recommended that to increase the involvement of local stakeholders a Village level response team involving local youth from the vulnerable areas should be formed. Initially these youth should be trained to handle various issues of human wildlife conflict. Following responsibilities may be given to local youth after initial training:

- Managing the agitated locals to maintain safe distance from the conflict animal
- Communicating with the forest tranquilization team on time in respective ranges
- Wherever possible, first aid to small injured animals and birds
- Medical help to injured villagers in the conflict situation.

Infrastructure requirement-

For effective dealing of human wildlife conflict incidences and preventive measures various equipments and other infrastructure like transportation vehicle, communication etc are necessary requirement.

6.12 WILDLIFE HEALTH MANAGEMENT PLAN:

The increase in human-wildlife-domestic interface increases the threat of transmission of diseases from wildlife to human-livestock and vice versa. Therefore, disease transmission has important implications not only for wildlife management, but also for public

health, livestock development, and rural livelihoods.

Proper surveillance programs all year round are crucial in maintaining management health plans. This will help develop databases which will help in forecasting disease outbreaks and establish early warning systems.

6.12.1 IMMUNIZATION:

All domestic animals and livestock around the Kalatop Khajjiar wildlife sanctuary should be vaccinated against the transmissible diseases endemic in the area. This will prevent the transmission and introduction of diseases from wild animals to domestic and vice versa.

6.12.2 PUBLIC AWARENESS:

To prevent wild animals from frequenting into human habituated areas, the communities living around the Wildlife Sanctuary should be made aware of the repercussion of irresponsible disposal of garbage and livestock carcasses.

6.12.3 EDUCATION AND TRAINING:

All the stakeholders require education and training for at least basic public health concerns and bio-security to achieve the desired outcome. Protocols for handling carcasses, attending disease outbreaks, etc should be made. The field personnel should be made aware of this and given at least basic training for this purpose.

CHAPTER-VII

ECO TOURISM, INTERPRETATION AND CONSERVATION EDUCATION

The eco tourism in a very broad sense means venturing into and enjoying nature in such a way as to assure that negative impacts on the cultural and natural environment are minimized and mitigated. It is therefore responsive tourism which besides being ecologically and culturally sensitive helps the local community in realizing social and economic benefits.

7.1. GENERAL:

Kalatop-Khajjiar is one of the preferred tourist destinations for the people of North India especially during summers. The sanctuary being very near to Dalhousie, a famous hill station, experiences heavy tourist influx, which come here to enjoy natural scenic beauty and pleasant weather.

There are several categories of visitors and their aspirations vary widely. The common man wishes to see spectacular wild animals within the limited time and money he can afford to spend. Some kind of thrill and picnic is central to most people's aspirations. There of course is a much smaller section of visitors who are well informed and look forward to a rewarding wilderness experience. Nature based tourism in India is mostly mass tourism. But the objective of Kalatop - Khajjiar Sanctuary is to provide hassle-free, low volume and truly enriching experience of wilderness to the visitors. Wildlife tourism will create awareness about wildlife conservation among masses. It will help to garner support for various conservation issues faced by the sanctuary. Involvement of local youth in eco tourism may benefit them in the long run.

Success of wildlife tourism inside the sanctuary depends on good experience of tourists. Good management of the sanctuary, especially reduction of anthropogenic pressures, minimising weeds, enhancement of availability of forage and high level of protection, are essential for improving wildlife sightings.

7.2. OBJECTIVES:

Each protected area should have its own eco tourism policy to define the manner in which tourism will be developed.

Wildlife tourism is a double edged sword that needs to be used with care. There is always a risk of overdoing the tourism especially in view of a heavily burdened sanctuary with

meagre core area. Tourism on foot through established routes will be encouraged. The number of treks and number of participants in a group shall be regulated.

Khajjiar Eco-Tourism Society **(detail is annexed as annexure-XV)** and Wildlife wing of Forest Department is responsible for executing eco-tourism in the sanctuary. This eco-tourism society came into existence in the year 2002. Eco-tourism in true sense implies that the benefits of tourism should go to the local people without adversely impacting the nature. This will also give them much needed sense of ownership and will help in sanctuary's protection actively. In Kalatop–Khajjiar, the infrastructure belongs mainly to the Forest Department. The Forest Department is providing the infrastructure while the people of the Eco-Tourism society are actively participating in the eco tourism activities by way of providing food items through stalls and adventure activities primarily in their own land.

7.2.1. THE MAIN OBJECTIVES CAN BE LISTED AS BELOW:

(1) To regulate the tourism activities in such a way to have least interference to the wildlife.
(2) To provide a network of trekking routes and promote nature tourism.
(3) To identify area for wildlife watching.
(4) To provide gainful employment for the local people of the society through nature tourism.
(5) To aware the masses about the Wildlife and its conservation.

7.3. ISSUES AND PROBLEMS:

1. Heavy tourist influx.
2. Smaller size of the sanctuary.
3. Main road a state highway passing through the sanctuary.
4. Ecological degradation of Khajjiar lake.
5. Lack of Professional knowledge about wildlife among staff.

7.4. THE STRATEGIES:

Tourism in Kalatop Khajjiar Sanctuary focuses on natural landscape, scenic beauty of the area, bird watching, pleasant weather and ecosystem services provided by the forest; Sighting of mammalian fauna being a chance affair.

Tourism is concentrated mainly on glade area of Khajjiar and on guided walks and treks in the

sanctuary on designated trails and is restricted to small groups. This also increases the chances of sighting mammalian species specially the Goral and Barking Deer.

Carrying capacity of the sanctuary shall be determined and tourism will be regulated accordingly. However as the road is owned by the HPPWD, the number of vehicles can not be regulated by wildlife wing. Possibililiy of such solution in consonance of district administration shall be seen in future.

Garbage Management:

Waste management is a key management activity and should be a priority for eco tourism site. A vociferous education campaign directed on tourist as well as local host patriotic cleanup campaign may also be useful. The slogan "reduce, reuse and recycle" is appropriate. Trash can be divided into organic, burnable and non burnable (non- biodegradable), organic can be converted into compost or fed to domestic animals. Burnable material (paper products, cigarette butts etc can be burned on site or in smalls pits designated for this use. Non- burnable, Non-biodegradable trash includes plastic bottles, bugs, wrappers, glass and metals. These items are the most difficult to deal with and become the scourge of many tourist area in the mountains. What cannot be disposed locally will need to be transported to the nearest recycling facility. This can be carried to the Chamba/ Dalhousie on weekly basis where it can be delivered to Municipal Committee of Chamba/Dalhousie. The best method to check on the waste management is creating awareness among all the stack holders.

7.4.1. IDENTIFICATION OF THE ZONE:

The whole area of the sanctuary is treated as core zone except the areas where tourist influx is heavy especially the glade area of Khajjiar, a path from Lakkar Mandi to Kalatop Forest Rest House, PWD road from Lakkar Mandi to Kanjedi nallah and road from Lakkar Mandi to Polhani Temple is excluded from the core area and is the area for the activities of Eco Tourism. The core area supports dense forest of different conifers and some broad leaved species. The wild animals generally remain confined to this zone and move to lower altitude only during heavy snowfall.

(Glade Area of Khajjiar)

Khajjiar which is a main point of attraction shall also be managed properly. So that it's tranquil atmosphere, scenic beauty, green glade and already disturbed lake do not give way under the pressure of heavy tourist activities. This however, is being dealt with under separate plan.

Trails will be identified for wildlife viewing inside the sanctuary. They will be given clear names for identification. A brief description will be written of the main features of each trail, including the wildlife likely to be seen on the trail.

7.4.2. INFRASTRUCTURE DEVELOPMENT:

The area has already some basic infrastructure which is required to be improved. The infrastructure available at present inside the sanctuary is as under: -

7.4.2.1 INSPECTION PATH:

Sr. No.	Name of I/Path	Length. (Km.).	Year of construction.
1.	I/Path L/Mandi to L/Mandi.	12	Not known
2.	I/Path Kalatop C-19 to Kalatop C-20.	2	Not known
3.	I/Path Kalatop to Talai-I.	4	Not known
4.	I/Path L/Mandi to Kalatop c-26 & 27.	2	Not known
5.	I/PathLakkar Mandi to Khajroth	5	Not known
6.	I/Path Kalatop C-I to Kalatop C-15.	15	Not known

7.	I/Path Kalatop C-13 to Kalatop C-16	1.50	Not known
8.	I/Path Sunil Lodge to Jhurdu	2	Not known
9.	I/Path Khajjiar around the Khajjiar.	6	Not known
10.	I/Path Khajroth to Mandrani.	5	Not known
11.	I/Path Devkugalli to Dibri.	4.5	2005-06
12.	I/path Kalatop to Dibri.	5.5	2005-06
13.	I/Path Dainkund to Pohlani	2	Not known
14.	I/Path Mokhu Nalla to Madrani	3	Not known
15.	I/Path Guptu Nalla to Madrani	5	Not known
Total:-		**74.5**	

7.4.2.2 JEEPABLE ROAD/ BRIDLE PATH:

Sr. No.	**Name of road.**	**Length. (Km.).**	**Year of construction.**
1	L/Mandi to Kalatop (Jeepable road)	3	Not known
2	Khajjiar tp Bangbehi (Bridle Path)	0.6	Not known
3	Khajjiar to Pukhari (Bridle Path)	0.8	Not known

7.4.2.3. TREKKING HUTS:

To provide better facilities for stay, the following Rest houses / Trekker huts are available which require immediate maintenance. However, it is necessary to have some more Trekker/Transit huts/Dormatories.

(Forest Rest House at Kalatop)

Hideouts/machans and watch towers at convenient and suitable points are also proposed, where from the visitors can have an over view of the area as well as close up to wild animals. The Rest houses and Trekker Huts available inside the sanctuary are as under: -

1. FRH Kalatop – 2 Bed rooms
2. FRH Khajjiar – 2 Bed rooms
3. Trekker Huts at Kalatop 5 Sets
4. Transit Hut at Khajjiar 1 Bed Room Set
5. Trekker Hut at Khajjiar 2 Bed Room
6. Dormitory at Khajjiar 4 Beded room

7.4.2.4. TREKKING ROUTES:

Sr. No.	Name of Trekking Route.	Length. (Km.).	Year of construction.
1.	Kalatop to Khajjiar.	12	1991-92
2.	Khabbi Da Got tu Devkugalla	0.5	Not known
	Total:-	**12.5**	

7.4.2.5. SANCTUARY LITERATURE:

Brochures/pamphlets about the sanctuary will be printed for distribution to tourists. The brochure will give the trekking map of the sanctuary including trails, list of wild animals, birds and plants. It will inform the tourists about the rules to be followed in the sanctuary.

7.4.2.6. SIGNAGES:

Signage needs to be developed in the sanctuary and be placed at vantage points. Some points for inclusion in the signboards are as follows:

Name and area of the sanctuary.

- Wildlife (Flora & Fauna) found in the sanctuary.
- Significance of the sanctuary.
- Historical background of the area.
- Rules and regulations.

- Fire safety.
- Distance from famous places.
- Do's and dont's.

It would be ideal to develop a proper signage plan by a professional agency including the location of each signboard and content and design of each signboard. The actual signage put up will be as per the signage plan.

7.4.2.7. DEVELOPMENT OF INTERPRETATION CENTRE:

Nature interpretation and conservation education are integral part of eco-tourism. Interpretation centres are instrumental in changing the perception of visitors as well as those of the local community in support of conservation. Therefore, to fulfil these twin objectives, interpretation centres-cum-Souvenir Shops shall be constructed at Khajjiar and Kalatop/Lakkar Mandi. The interpretation centre will perform the following functions:

- Create awareness about the sanctuary values.
- Inform people about the biodiversity of the sanctuary.
- Educate people to follow sanctuary rules.
- Design and development of the interpretation centre will be entrusted to a professional organization.
-

7.4.2.8. DEVELOPMENT OF TOURIST INFORMATION CENTRE:

Tourist information centres need to be developed to give information to the visitors. There are two check-posts at Lakkarmandi and Miarigalla, which can also be used as the Tourist Information Centres by constructing an additional room. Provision for setting up of CCTV cameras at both check posts is also proposed. Construction of Entry Gate cum Ticket window to the glade area of Khajjiar is also proposed.

7.4.2.9. CAPACITY BUILDING:

Local Eco-guides will be trained to acquaint the tourists about the sanctuary. The main skills for which they need to be trained are as follows:

- Knowledge of animals, birds and plants in the sanctuary.
- Wildlife interpretation skills.
- Basic principles of safety while escorting the tourists.
- Cleanliness and prevention of littering.

The field staff shall also be trained in these skills so that they can act as resource persons for future trainings. The staff at trekker huts / FRH Kalatop and FRH Khajjiar shall be trained in basic hospitality skills by professionals, either private hoteliers or trainers from the Tourism Department.

7.4.3. REGULATIONS, MONITORING AND EVALUATION:

The basic information about the sanctuary be displayed from the information centres at Lakkarmandi and Miarigalla.The troop size of the visitors and timing to visit the sanctuary will be decided as per the availability of infrastructure facilities and subject to the conditions that there is least disturbance to wildlife.

To get a feedback proper record would be kept in the prominent places wherein the tourists can make remarks regarding the sanctuary and other observations for its development. This would also help in making more concrete efforts towards eco tourism promotion. Proper record of the number of visitors will also be maintained at the check posts.

Tourists however, would be desired to create least disturbance in the sanctuary area. No weapon shall be allowed in the sanctuary area. Tourists will also be advised *not to use any kind of polyethene* and *keep the sanctuary area clean and green*.

CHAPTER VIII

ECO-DEVELOPMENT

8.1 OBJECTIVES:

Main objectives of various Eco-development activities would be as under:

1. To provide healthy, hygienic environment to the general public residing in and around the sanctuary and to improve their living conditions.

2. To help the local people in ameliorating their economic status.

3. To encourage ancillary occupation in the area.

4. To improve the agricultural productions by adopting better techniques like terracing, soil conservation measures etc.

5. To provide basic medical facilities both to human being as well as cattles.

8.2. SPECIFIC ISSUES:

Eco-development works will be carried out in the fringe villages by sanctuary authority. This will help in development of the villages and it will also help to gain their cooperation for sanctuary objectives. Some activities that may be carried out are as follows:

- To reduce the people dependency on the forests, it will be necessary to meet the basic requirements like fuel wood, fodder etc. by raising plantations in the vicinity of villages. Distribution of LPG gas connection and fuel saving devices at subsidized rates will be of great help.
- People are engaged primarily in agriculture and sheep rearing. To improve their economic status it becomes imperatives to initiate better agricultural techniques, better land use, introduction of better cattle breed etc.
- Water conservation structures such as check dams,van sarovars, water percolation ponds and trenches.
- Irrigation tanks.

- People do not pay much attention to the hygienic aspect. This requires to be improved so that the living conditions of the people are healthy one even by helping them to construct toilets.

- To aim at harmony between the ecologically dictates and the various developments, it is necessary to generate awareness among the people towards nature in general and wildlife conservation in particular.

- Other activities depending on needs of each village

8.3. BROAD STRATEGIES:

Although the local people have already been involved in the Khajjiar Eco-Tourism society, but still there is a need to involve them in all management practices of the sanctuary.

Presence of human population near the sanctuary is an unavoidable reality. The presence of local people affects the sanctuary's biotic components in a number of ways. It is important to manage the interaction of the community with the sanctuary so that the most beneficial results are obtained for the people as well for the sanctuary.

Interactions with local community are often ad hoc and without a fixed policy and direction. Therefore, true progress is not achieved in co-operative efforts. Conflicts arise because proper communication does not take place. Taking this into consideration some objectives of interaction with the local community are described in this section. Dealing with local people with well defined objectives and directions will help to achieve progress in the relationship with local people.

The objectives of the interactions with local community shall be as follows:

- Create awareness about sanctuary values among local people.

- Obtain cooperation from local community for sanctuary management.

- Give benefits to local people from the sanctuary, especially to the poor.

- Resolution of various issues and conflicts that the sanctuary authority may have with local people and vice versa.

8.4. VILLAGE LEVEL SITE SPECIFIC STRATEGIES:

The strategies evolved to tackle the village level problems will be as under:

1. Construction of village paths.
2. Soil conservation works including terracing, check dams etc.
3. Construction of public toilets.
4. Construction of water ponds.
5. Improvement of water channels.
6. Distribution of solar cookers, Solar lights, Hammam, Gober Gas, etc.
7. Afforestation in the vicinity of villages.

8.5. MONITORING AND EVALUATION:

Regular meetings with all local people will be conducted, in which the progress of all eco-development activities carried out will be monitored. The representatives of local community will also be involved for the decision making, execution and monitoring of eco development activities. Local people, especially school and college children, will be involved in treks, outings and various field programmes for spreading awareness and conservation message among local people.

CHAPTER IX

RESEARCH, MONITORING AND TRAINING

9.1. RESEARCH AND MONITORING:

9.1.1. MONITORING OBJECTIVES:

Monitoring of wildlife population is very important aspect of wildlife management as it reveals the results of the management. Without a clear objective, monitoring may absorb considerable time without achieving anything useful.

Important conservation question that monitoring could answer include: how are the populations of species of conservation interests changing on a site? How are the populations of predator species changing? Where are the most important areas for a species? What are the habitat requirements of a species? How do populations respond to changes in the management?

Changes whatsoever, in the habitat are manifested in the changing trends of wildlife. Since it is a slow process, the studies in this regard have to be on a long term basis. This comprehension is imperative to arrive at effective management techniques.

The main oobjectivs of monitoring would be as under:

1. To carry out survey and census exercise of main species and monitor their relationship with habitat dynamics.
2. To study the feasibility of re-introducing serrow in the sanctuary.
3. To evolve simple method for recording evaluation and observation by the field staff.

9.2. MONITORING:

The main target of the monitoring program is large terrestrial mammals and pheasants. These include Black bear, leopard, goral, barking deer, sambar, languor, rhesus macaque and cheer and Kalij pheasants.

Some of the methods that can be used for monitoring are described in the following sections. The techniques described can be divided into index-based monitoring techniques and absolute population estimation techniques. Monitoring by index-based techniques yields trends in populations. Monitoring must be carried out for a few years before clear population trends emerge. Absolute population estimation techniques can give estimates of population within error margins.

The techniques described assume an even distribution of animals. Species with clumped populations or high habitat specificity, such as goral and cheer may require different monitoring techniques.

9.2.1. MONITORING TECHNIQUES FOR MAMMALS:

Some mammal species are obvious and can be readily counted. However, most species are difficult to see. Some of the species of greatest conservation interest are both secretive and occur at low densities. Some of the methods of mammal census are as follows.

9.2.1.1. ANIMAL ENCOUNTER RATE:

In this method a network of routes are marked inside the sanctuary that are well dispersed inside the sanctuary. The routes should not follow the main trails only but should pass through the undisturbed parts of the forest where probability of encounters is higher. Each route should be about 4 to 5 km long. The total length of routes inside the sanctuary should be sufficient to give reliable results. These routes should be regularly walked at fixed hours in the morning and evening, when animal visibility is higher, and animals encountered along the route should be recorded. This exercise should be carried out regularly throughout the year, say once in a month. The encounter rate of a species is defined as follows:

$$\text{Encounter rate (i)} = \frac{\text{Number of animal sighted of } i^{th} \text{ species}}{\text{(Total length of routes walked X no. of times walked)}}$$

The encounter rate is an index of population density. If this exercise is carried out every year we can get population trends reliably. However, this exercise cannot give estimates of absolute population.

9.2.1.2. SIGN ENCOUNTER RATE:

The sign encounter rate relies on sighting/ collection of animal signs. It is useful for monitoring populations, since their scats are highly visible. Sign encounter routes are laid as above. Since there is no compulsion on walking during morning hours or evening, the length of route can be increased to 10 km. The routes should be broad and clear with no vegetation growth so that scats can be spotted easily. Heavy human traffic should not be there on the routes so that scats are not trampled. These routes are also walked a number of times in a year and scats of leopard and other carnivores with highly visible scats, are collected.

Scat encounter rate (i) = Number of scats sighted of i^{th} species

(Total length of routes walked X no. of times walked)

The scat encounter rate is an index of population density. It is possible to obtain population trends if this exercise is carried out every year. This exercise also cannot give estimates of absolute population. It is less reliable than animal encounter rates which relies on direct sightings. However, it is useful for monitoring population trends in species wherein sightings are very low, such as leopards.

Leopard scats collected during the exercise can be analysed by microscopic examination of hair of prey in the scat samples to determine the dietary pattern of leopards.

9.2.1.3. PELLET DENSITIES:

This method is used for monitoring population of ungulates by estimating density of their dung pellets. Pellet densities are estimated by laying plots in the forest all over the sanctuary and counting the pellet groups in each plot. The pellet groups refer to the small pellets deposited during a single defecation at one place. In this method, the basic assumption is that rate of defecation is constant for the species. The plots should be laid in the same season and month every year. The number of pellet groups divided by the defecation rate gives the number of the total deer population as indicated below:

Total Deer Population= the number of pellet groups

Number of days for the count

This method is fairly simple but it cannot give absolute population estimates.

9.2.1.4. LINE TRANSECTS SAMPLING:

Line transects sampling is used for estimating absolute densities of wild animal populations. A large number of straight lines, known as transects, are laid in the forest in a scientifically designed pattern. Each transect has a fixed length, generally 3 to 4 km, and a fixed orientation. Transects are clearly marked by marking the trees along transect in red or yellow paint. Bush cutting is necessary only if undergrowth is very thick.

These transects are walked by observers according to a specific sampling design and observations of each animal sighting are recorded. The distance of the group is estimated by a rangefinder and a compass bearing is taken for each encounter. This data is used to estimate the

perpendicular distance of the animal from transect. In this manner all transects are walked and animal sightings recorded. All transects must be walked a number of times so that sufficient observations are obtained to make reliable population estimates. If number of observations is low, reliable estimates cannot be made. Typically 5 to 10 repetitions may be necessary. It may be possible to carry out the sampling by making monthly rounds of observations without much loss of accuracy.

Line transect sampling requires a high level of training of the observers for proper recording of observations such as compass bearings and distance estimation by rangefinders. It is also a fairly laborious technique. The advantage is that it can give reliable estimates of animal populations. Design and layout of line transects need considerable effort. These transects need to be remarked annually if they are to be used on a repetitive basis. Considerable effort is also needed in carrying out observations. Nature enthusiast volunteers from nearby towns and even youth from local villages may be invited to participate in the monitoring exercise. If necessary, labourers may be engaged for making the observations.

9.2.1.5. POPULATION ESTIMATION BY WATERHOLE COUNT:

Waterhole count is a traditional method used in India for estimating wildlife populations. The waterhole count is not useful if there are extended water bodies such as perennial streams or lakes since it is difficult to count animal all along such extended water bodies. It is carried out at the peak of summer, either in May or June, depending on the date of arrival of monsoon.

Well-camouflaged machans are built on trees near all perennial water sources including natural and artificial waterholes. Hides are made if it is not possible to have machans. A team of three persons keeps watch at each waterhole for 24 hours and records the mammals and large birds such pheasants coming to drink water at the waterhole. The total count of animals of each species for all waterholes is the population of that species. The method suffers from some uncertainties but is nevertheless a useful method for population estimation.

9.2.1.6. TERRITORY MAPPING:

Mapping is best for those species that are clearly territorial such as many primates and carnivores. In mapping, the location of sightings and territorial calls are mapped. In many mammals the territory may be held by a group and thus mean group size has also to be determined. Territory mapping can be better done with the help of radio telemetry. The territory mapping for each animal can be fixed with regular field verification and use of telemetry.

9.2.1.7. PUGMARK METHOD FOR MONITORING LEOPARD POPULATION:

The pugmark method has been traditionally used for estimating tiger populations in protected areas in India. It has not been regularly used for estimating leopard population but the technique can easily be used for estimating leopard populations also. Since leopard pugmarks are smaller there is greater possibility of making mistakes in identification since small mistakes in tracing can alter the shape of the pugmark. Hence greater care needs to be exercised in tracing pugmarks.

To achieve proper impressions of the pugmarks should be on a hard surface with a thin layer of fine dust. These conditions are achieved on forest roads and trails in summer. Hence pugmark census is generally carried out in the month of May.

The original pugmark method relied on tracings on glass plates, which created possibility of error while tracing. Digital cameras can be used for taking photographs that can later be converted to pugmark outlines after transferring to the computer. This can increase the reliability of the method. Alternatively there are special optical instruments that can increase the accuracy of the tracing and minimize errors.

The pugmark census is carried out over a period of a few days, generally a week. All forest roads and trails are searched intensively for pugmarks during this period. In a smaller sanctuary like Kalatop Khajjiar a shorter census of 2 to 3 days should be sufficient.

9.2.1.8. POPULATION ESTIMATION OF LEOPARDS BY DNA ANALYSIS OF SCATS:

DNA analysis of leopard scats can be used for population estimation. DNA analysis can be done by taking mucous layer covering the scat and then analysing it in the laboratory. The technique is still at an experimental stage in the country. The technique may

soon become generally available, but it is definitely expensive. The technique requires collection of fresh scat (within 24 hours) and its preservation by an appropriate method. DNA analysis is carried out in specially-equipped laboratories.

9.2.2. MONITORING TECHNIQUES FOR BIRDS:

Birds have the advantages that they are often reasonably conspicuous; have diagnostic calls or songs and many people have the expertise necessary to identify them in the field. As a result of the ease of counting them, birds are good for monitoring environmental change. Monitoring techniques for birds are as follows:

9.2.2.1. FOOT TRANSECTS:

Counts along transect lines, are useful for estimating relative abundances, as well as for estimating densities.

Line transect is a simple, easy to execute method that can help in obtaining density estimate for pheasants in India. In this method, one walks along a straight line and counts animals on both sides of the line. Line transect could be permanently marked and vegetation trimmed for the observer to walk easily and carefully look for animals. In case of temporary transects, the observer walks in a straight line using a compass on a predetermined bearing. At least 2 or 3 transects of length ranging between 1 and 3 km to be laid in each habitat/area and walked at least 2 or 3 times in a month during the early morning hours. For every sighting, species, number, age and sex (if possible), sighting angle and sighting distance are measured. This information will be useful in calculating the encounter rates and density of pheasants in an area. This technique is best suited for pheasants. Software such as distance could be used to analyse line transect data for obtaining encounter rate and density estimates.

The actual number of birds encountered on transect can act as a simple index of abundance for comparative purposes. Care must; however, be taken to ensure that the visibility in the habitat is similar during all the counts being compared. A decrease in visibility may lead to fewer birds being encountered, even though the actual number may be the same. Since visibility often changes seasonally as a function of the amount of foliage, counting in the same season is an effective way of controlling for visibility. The conspicuousness of a bird also depends on its behaviour; birds, especially males, are highly visible during the breeding season when they are

singing and advertising their territories. The best season for counts is thus the breeding season, when birds are most conspicuous.

9.2.2.2. POINT COUNT:

A variation of the transect count is the point count. Here the observer stands at a fixed point for a specific period and count all birds, either within a specified circle (of say 25m or 50 m radius), or as far as birds can be seen (open radius). This is actually like a transect count of length zero. Each individual should be counted just once. It is often sensible to wait 5 minutes before counting so that the birds are less disturbed. The count is for a fixed period of 3-10 minutes depending upon how conspicuous the birds are. The counts should be completed as quickly as possible to reduce the risk of double counting and allow more points to be visited. Points should be at least 200 m apart to prevent double counting.

Point counts are particularly useful in areas of difficult terrain such as hills or swamps, where one cannot easily lay a straight, continuous transect.

9.2.2.3. CALL COUNTS SURVEY:

This method can be used for most of the pheasants which call during morning hours in their breeding season. The counts can be made from strategic point in the habitat of the particular pheasant. The number obtained can be doubled for obtaining the estimate of breeding population. The counts of calling males assume that all the existing males in the area will call every morning. In case of Koklass the best time to carry out this count is January to June and September to December (Gaston 1980; Young et al. 1987; Ridley 1986). Most of the observations are made during the short time period of about half an hour. For observation strategic points which allow the observer to hear the birds over as wide an area as possible, should be selected. A point on the ridge allows the observer to listen to the pheasant calls on both the sides. Observation points should be marked at an interval of about 500m to 600m. All the observers must visit their observation points on the previous evening of the survey day. They should be in position well before dawn so that all the calling pheasants are counted.

9.2.2.4. TERRITORY MAPPING:

This is a standard method of counting birds in most ornithological studies, and regarded as the most reliable. The technique is based on locating singing males in an area on a map. This is done repeatedly (3-4 times) within a limited period (maybe a week, or the breeding season). A composite map is then prepared by overlaying the locations of each separate count. One can then find clusters of locations indicating territories of individual males. The number of each cluster is thus number of territorial males in the area, and assuming all of these are monogamous, one can then estimate the breeding population.

An obvious limitation of this technique is its being restricted only to the breeding season and non-breeding members are left out. The technique also requires skill in identifying territories correctly from clusters (correct mapping) otherwise it can lead to interpretational errors. This would require a degree of familiarity with the general ecology of the species, which would require extra efforts. Hence this is of more limited use for a manager, than the generalised transect or point counts.

9.2.2.5. ENCOUNTER RATES:

Encounter rate is the simple index for abundance estimation and is expressed as number seen per unit effort. The unit effort could be time spent in intensively searching for animals in an area or it could be the distance travelled in an area intensively searching for animals. Number seen could be based on direct evidences (sightings) or indirect evidences such as calls, droppings and other signs such as digging signs for feeding.

Survey could be done along existing roads, paths, trails, ridges, and nullas or along a predetermined bearing using a compass or GPS. If the distance travelled is measured, then one could use that as effort(ER=number seen/km walked). In cases when distance travelled is not known, one could use the time spent in searching that area as effort (ER=number seen/ time spent). Indirect evidences such as calls and droppings could also be used, but one should be very careful in identification of calls of different species and calls of different individuals of the same species. Similarly, care should be taken to identify droppings or other signs of a species.

Encounter rates are good for monitoring the abundance of pheasants in an area, if done regularly (monthly/ seasonally/ annually). Comparison of ER of a species in two similar habitats located in different areas could be made. Adequate number of walks per month or season

is necessary for calculating mean ER and standard errors. The technique is applicable for most of the pheasants.

9.2.3. MONITORING TECHNIQUES FOR PLANTS:

Vegetation is a major component of wildlife habitat. It is made up of a number of plant communities, which can be distinct entities or more diffuse merging slowly into each other. The value of the habitat for wildlife species is directly linked to the type and variety of plant communities and their conditions. Changes will have a positive or negative effect on the overall quality of a habitat for a particular habitat species.

Assessing and monitoring vegetation as a basis for manipulating it in tune with management objective is one of the important aspect of protected area management. It involves qualitative processes such as floristic inventory and community description as well as quantification of factors such as vegetation cover. Some of the monitoring techniques for plants are as follows:

9.2.3.1. TOTAL COUNTS OF PLANTS:

Total counts seem easier than they usually are. Unless carried out methodically it is easy to miss individuals or count them twice. One approach is to grid out the entire area and systematically search each grid square, marking each individual with a flag once found. This can be very accurate and provide excellent information on distribution but is time consuming.

9.2.3.2. QUADRATS:

Quadrats are the most widely techniques used for the plant census. Quadrats could be rectangular strips, square (10mX10m) or circular (10m radius).

The number of individuals of the species of interest can be counted. It is usual to only count those rooting in the quadrate. Percentage cover may be used for mat-forming species or when it takes too long to count all individuals, but it is less accurate. Percentage cover is often used when the observer can stand above the vegetation or for estimating canopy cover above the observer, but it is difficult to estimate scrub or tall herbaceous vegetation at the observer's height.

9.2.4. MONITORING ENVIRONMENTAL VARIABLES:

It is often impossible to interpret the changes over a period of time unless there is a programme of monitoring environmental variables. Some of the environmental variables which can be measured are as follows:

9.2.4.1. TEMPERATURE:

Maximum-minimum thermometers can be used to give the daily temperature range. They are best located 1.25 m above ground as this is the standard height for meteorology (and thus best for comparison with other sites).

For conservation studies, thermometers are often located in relation to the ecology of the species being studied. Recording of temperature at set intervals is very good for ecological measures of microclimate. For ectotherms in temperate areas, temperature is often critical; sward height, aspect, slope and colour may all have marked effects on the local temperature and detailed measurements can help interpret the ecology and behaviour.

9.2.4.2. RAINFALL:

Rain can be collected in open containers, but they are likely to be inaccurate due to evaporation. For accuracy rain-gauge can be used.

$$\text{Rainfall} = \frac{\text{ml or } cm^3 \text{ of rain}}{(\text{Diameter of rim of gauge in cm})^2}.$$

A rain gauge should be positioned such that water does not get splashed in and all the standing objects like trees etc. are four times their height away. Rain gauges are usually emptied daily at a fixed time. If visited irregularly then a little oil may be added to reduce evaporation.

9.2.5. MONITORING HUMAN IMPACT:

It is often useful to be able to document human impacts such as the number of offences, number of visitors and mining in the area etc. The approach is same as in monitoring populations or environmental variables. It is necessary to find a sensible sampling regime and a repeatable way of monitoring. Without precise definition it is difficult to distinguish variation in classification from actual changes.

9.2.6. PHOTOGRAPHIC MONITORING:

Photographs are a good way of documenting changes to sites. Photographs are not usually useful for documenting small scale changes for which data from Quadrats is usually preferred. Aerial photographs are invaluable for monitoring and documenting gross changes to sites, such as changes in the extent of woodland. A series of photographs may show changes imperceptible to site managers, especially when managers change. Photographs may also be valuable for legal uses although the documentation must then be rigorous. Photographs can be a very dramatic way of illustrating change and problems and are likely to be of more widespread public interest than, presenting data on changes in species composition within a quadrate.

9.2.7. RECOMMENDED POPULATION ESTIMATION AND MONITORING METHODS:

The **animal encounter rate** and **sign encounter rate** technique will be used. Trails 4 to5 km long should be laid. The trail should be walked on a fixed date once every month. The data collection on the trail should include animal encounter, animal signs and habitat parameters. Animal sign survey and animal encounter rate survey should be carried out separately. Data analysis should be done carefully. The **pugmark method** will be used for estimating leopard population. Training in the proper technique is very important to prevent the staff from making mistakes. The **line transect** method will be started for population estimation in the sanctuary. Design of the line transect is very important. A well designed line transect network should be laid in the sanctuary area. The length of each transect should be 3 to 4 km. Due care should be taken in data analysis.

The transect lines will be walked once a month. Training in recording the observations is very important. The staff should be well trained in making observations at the beginning of the exercise. Hired manpower may be necessary for line transect surveys since every transect needs to be walked by two people. Educated and intelligent young men should be identified and hired from the surrounding villages. Volunteers from Chamba and nearby town may also be called for the line transects exercise. Care should be taken that they are well trained.

The **point count** method of population estimation of bird will be used. For point count 500 m distance should be divided into 5 segments 100m each. Birds should be counted at 6 points i.e. starting point, 100 m, 200m, 300m, 400m and 500m. Observations like species, number, perpendicular distance and activity should be recorded. Data analysis should be done carefully.

The **territory mapping** method of counting pheasants will be followed. Due care should be taken in identifying the call, recording observation and overlaying the locations on the map.

Line transect method will be used for density estimation of pheasants. **Encounter rate** method should be used for relative abundance of the pheasants.

In addition to above methods, modern day tools and techniques like **Trap cameras** should also be used for effective monitoring of faunal species especially nocturnal ones. The modern camera trap is simply a digital camera connected to an infrared sensor which can see warm objects that are moving, like animals. When an animal moves past the sensor it causes the camera to fire, recording an image or video to the memory card for later retrieval. Camera traps can be left in the field to continuously watch an area of habitat for weeks or even months, recording the rarest events which occur in nature. Camera traps are also wildlife friendly as they cause little or no disturbance to wildlife.

For monitoring of plants **circular Quadrats** will be laid. Centre point of the quadrat should be fixed and observation should be taken annually on a fixed date of a particular month. Circular plots of 10m radius for trees and sapling, 5m radius for shrubs and seedlings and 1m radius for ground cover should be laid.

Monitoring of indicative species of flora and fauna (orchids, lichens, insects amphibians etc.) should be done regularily.

9.2.8. MONITORING DURING REGULAR PATROLLING WALKS:

Animal encounters and animal signs observed during regular patrolling walks should be recorded in specified formats. The animal signs recorded shall be mainly of Black Bear and leopard pug marks and well preserved scats.

9.2.9. RESEARCH NEEDS IN THE SANCTUARY:

Sanctuary managers often function in an information vacuum. Research in a sanctuary can contribute considerably to effective management of the sanctuary by providing useful information on the biological features of the sanctuary.

Research studies may be carried out according to the preferences of the researcher. Some important areas for research in the sanctuary are:

Surveys of pheasants, mammals, reptiles and amphibians

- Water conservation studies
- Studies on prey-predator ecology

- Evaluation of pastures
- Corridor studies and other landscape level planning studies

Research papers published already are annexed as Annexure- XX, XXI ,XXII, XXIII and XXIV .

9.3. TRAINING:

Training is a very important tool for capacity building and improving the professionalism of sanctuary staff. The sanctuary staffs, while carrying on their normal protection duties, also need to develop an understanding of various issues related to sanctuary management at a professional level. Capacity building in this regard can best be achieved through trainings designed for this purpose.

Improving the knowledge and capacity of the staff has several benefits. It helps them to carry out their duty with an increased understanding and awareness and hence with increased dedication. It gives them more confidence in their work. This helps them to deal with various stakeholder groups, such as local people and tourists, with more confidence. Improved skills and knowledge will improve their productivity and quality of output.

9.3.1. ON JOB TRAINING:

To manage ecosystem with the basic purpose of wildlife management is a highly technical subject. Wildlife is dynamic component of the ecosystem which requires a well trained forester to comprehend, appreciate and manage. It is highly imperative that short trainings, in house trainings, refresher courses, exposure visits etc. for the field staff are made a regular feature, so that they keep abreast with the latest developments regarding different management techniques.

9.3.2. FORMAL TRAINING COURSES:

Regular training courses being conducted at wildlife Institute Dehradun impart a useful technical know how. The officers/officials dealing with the wildlife management will be trained. Besides this to acquaint with the latest management techniques adopted in different states on India, short training will be arranged for the officers and field staff.

Some areas where training will benefit the staff are as follows:

- Knowledge and identification of mammal species found in the sanctuary, habits of species, biology and ecology of important species
- Identification of bird species found in the sanctuary
- Knowledge of reptile and amphibian species found in the sanctuary
- Knowledge and identification of plants, including medicinal plants found in the sanctuary
- Soil and water conservation techniques
- Sanctuary ecology, inter dependence of plant and animal species
- Monitoring methods, population estimation methods
- Anti-poaching skills and documentation of offence cases
- Wildlife interpretation skills
- Wildlife tracking and field signs
- Conflict resolution skills for dealing with local people
- Weapon training
- Controlled burning techniques
- Nursery techniques
- Darting and trapping wild animals
- Use of instruments such as compass, binoculars, digital camera etc.
- GPS skills
- Computer literacy

Field staff will be given small projects on which they should collect information from the field such as information on mammal, bird or plant species. They should make write-ups and give presentations on their project.

Training will also be imparted to local people, particularly guide and tour operators with the intention of upgrading their skills for tourism. Some training subjects are:

- Sanctuary rules
- Skills of dealing with tourists
- Interpretation skills
- Basic information on identification of species, tracks and signs, habits of species.

Professional organizations will be involved in developing and conducting training programmes. Officers of the department should also be involved in training programmes

9.3.3. EXISTING CENSUS / TREKKING ROUTES AND TRANSECTS:

The existing census / trekking routes and transects meant for the census purpose are as under:-

Sr. No.	Particular		Length
1	Guptu Nalla-Mandrani	I/Path	5 km.
2	Khajjiar-Kalatop	Trekking route	12 km
3	Lakkarmandi-Kalatop-Lakkarmandi	I/path	12 km.
4	Kalatop FRH-kalatop RF C-10 & 20	I/path	2 kms.
5	Kalatop-Talai	I/path	4 Km.
6	Lakkarmandi-Kalatop RF C-26 & 27	I/path	2 Kms
7	Lakkarmandi-Dainkund	Road	5 Km.
8	Kalatop RF C-1 to C-15	I/path	15 Kms.
9	Kalatop FRH-Kalatop RF, C-13 & c_16	I/path	1.5 kms.
10	Khajjiar DPF	I/path	6 Kms
11	Makol Nalla-Matunu	I/path	6.5 Kms.

These paths alongwith their Geo Coordinates are required to be depicted on the map.

9.4. EVALUATION OF ECOSYSTEM SERVICES:

The advantage of including the concept of ecosystem services in management is that it encourages a wider consideration of the benefits and stakeholders involved in an area. Ecosystem services are usually categorized into Provisioning, Regulating, Cultural and Supporting services which include all type of physical goods and non extractive benefits from the environment. Consideration of this range of services and of who benefits from them locally

and in other areas helps to build sustainability and wider societal support for management decisions. So, evaluation of various ecosysyem services is must and will be got done by some professional agency.

9.5 MANAGEMENT EFFECTIVENESS EVALUATION (MEE) –

Management Effectiveness Evaluation (MEE) is an useful tool to assess the effectiveness of management initiatives and to understand better what is working and what is not, and to plan any necessary changes as efficiently as possible. Normally management effective evaluation is done by regional expert committee. In addition to this it should also be done (in house) on regular basis to assess the effective implementation of the management plan.

Mid term review of the management plan will be carried out by some expert agency.The purpose of mid term review is to assess the extent to which management of PA to which the plan applies has been undertaken in accordance with the plan, including the extent to which key performance indicator targets are being achieved.

CHAPTER X

ORGANISATION AND ADMINISTRATION

10.1. STRUCTURE AND RESPONSIBILITIES:

Presently the sanctuary has a total area of 17.17 Sq. Km. The administrative control of the Kalatop –Khajjiar Wild Life Sanctuary is with Range Forest Officer (Wildlife) Khajjiar under Wild Life Division Chamba. The Wild Life Range Khajjiar consists of two Blocks namely Khajjiar and Lakkarmandi and 6 beats.

The detail of blocks and beats is tabulated as under: -

Name of block.	**Block H. Q.**	**Name of beats.**	**Beat H.Q.**	**Area of the beat. (Ha.)**
1. Khajjiar	Khajjiar	1. Khajjiar	Khajjiar	302.46
		2. Khajroth	Khajjiar	360.00
2. Lakkarmandi	Lakkarmandi	1. Dainkund	Lakkarmandi	285.32
		2. Lakkarmandi	Lakkar Mandi	356.50
		3. Kalatop	Kalatop	275.59
		4. Talai	Talai	137.19
			TOTAL	**1717.06**

Over all supervision of works is done by Range Forest Officer (Wildlife) Khajjiar. He draws out the plan of operations and accordingly the works are executed after approvel from the higher ups. Block Officer gets the various development works executed through the Forest Guards. Forest Guard besides undertaking all development works are also the main guardian of wildlife. Anti poaching measures are also carried out by the field staff. Census/Survey operations and other related activities are executed by joint venture of the staff.

10.2. STAFF AMENITIES:

The staff posted in the sanctuary is provided with Govt. accommodation. The existing buildings/ housing for the staff are as under:

1. Range Office cum residence	Khajjiar
2. Block Officer quarters 2 Nos	1. Khajjiar
	2. Lakkarmandi
3. Forest Guard Huts 7 nos.	1. Talai
	2. Lakkarmandi
	3. Khajjiar
	4. Miarigalla
	5. Lakkar Mandi (Dainkund Beat)
	6. Khajjiar (Khajroth beat)
	7. Kalatop

The forest guards deployed in the Check Posts are residing in the private accommodations. Therefore three more forest guard huts are proposed at Lakkar Mandi and Khajjiar/Miarigalla. Two Chokidar's huts cum stores at Kalatop and Khajjiar are also proposed.

Besides this Trekker Huts, Patrolling Hut are also available for the staff. However, some more dormatories, Transit Huts, Patrolling huts/ Watch Towers are also proposed for the better management of the sanctuary.

For education purpose the school exists at following places:

Name of School	**Standard**	**Location**
1. Khajjiar	S.Sec. School	Khajjiar
2. Kohlari	S.Sec. School	Kohlari
3. Sach	S.Sec. School	Sach
4. Lakkarmandi	Pr. School	Lakkarmandi
5.Khajjiar	Pr. School	Khajjiar
6.Banska	Pr. School	Banska
7.Gate	S.Sec. School	Gate

10.2.1. MEDICAL FACILITY:

The staff during its course of protection and executive role, if meets any exigency, it is necessary to impart basic training to the staff regarding first aid and will be provided with the necessary first aid kits.It will not only help the staff but also to local people and visitors as well. Vaccination to the staff is also an integral part of medical facility. Life insurance of the staff will also be done.

CHAPTER-XI

THE BUDGET

11. THE PLAN BUDGET:

Total outlay for the plan period i.e. 2019-20 to 2029-30 comes around Rs. 3049.45 Lacs the major portion of works is proposed to be under the stipulations of Kol Dam, Khajjiar Eco Tourism Society and other Centrally Sponsored Schemes. The detail of works has been discussed in the earlier chapters.

APO Attached as Annexture XVI

CHAPTER-XII

THE SCHEDULE OF OPERATIONS AND MISCELLANEOUS REGULATION

12.1. THE SCHEDULE:

The area being high altitude one, works are necessarily to be executed before the winter season. With this time constraint the works have to be meticulously planned. In this context the instructions issued from time to time have to be followed in letter and spirit.

12.2. RECORD OF DEVIATION AND IMPLEMENTED TARGETS:

The final execution of works will depend upon the funds availability. But still the deviation from the plan prescriptions will be brought on record so that the plan objectives are not defeated.

12.3. THE RECORD OF EMPLOYMENT POTENTIAL:

All works in the sanctuary, though basically are to improve the habitat for wildlife, but at the same time there has to be a healthy and cordial relation with the common people as well. For their benefit we have to give them gainful employment through various developmental works. In this way not only their income will be supplemented but also they will feel involved in this activity. To achieve this target a society named as Kalatop-Khajjiar Eco Tourism Society has already been formed, which is actively taking part in the management affairs of the sanctuary.

12.4. THE CONTROL FORMS:

At present there is no felling in the sanctuary area. Besides this other works like maintenance of boundary pillars, regeneration works and other works are carried out. All these works have to be entered in the relevant forms which are to be maintained on regular basis.

12.5. MAINTENANCE OF COMPARTMENT HISTORIES:

Compartment history files are being maintained in which regular forestry operations are entered. The general condition of the forests particularly in relation of wildlife trends, digital maps of forests upto compartment level, Geo-coordinates of Boundary pillars, Census operations will also be recorded.

Results of Trap Cameras in Kalatop Khajjiar Wildlife Range

Black Bear

Leopard Cat

Yellow Throated Marten

Porcupine

,

Yellow Throated Marten

Common Leopard

Photo: Sh. Sachin Sirmouri. Forest Guard

Rock Bunting

Koklas

Photo: Sh. Sanjeev Singh, HPFS

ANNEXURE-I

NOTIFICATION OF THE SANCTUARY:
GOVERNMENT OF HIMACHAL PRADESH
DEPARTMENT OF FOREST FARMING AND CONSERVATION.

No. 6-2/73-SF-IV Dated: 26.09.1989

NOTIFICATION

Whereas the Governor of H.P. consider that the area mentioned in the schedule below are of the adequate ecological faunal floral geomorphologic natural or ecological significances for the purpose of protesting propagating or developing wildlife or its environments.

Now therefore in exercise of the powers conferred under section 18 of the Wildlife Protection Act 1972 (Act 53 of 1972) the Governor H.P. is pleased to declare the aforesaid areas as a sanctuary for the purpose protection propagating or developing Wildlife or its environment in particulars modification of this department Notification No. 6-2/73-SF-IV dated 21.04.1984.

SCHEDULE

Sr. No.	Name of Sanctuary		Situation of the sanctuary (Revised)
1	Kalatop-Khajjiar	NORTH EAST: SOUTH: WEST:	Ravi River Ridge from Miarigalla to Karuingalla and then up to Sach Nala, Kaded Nalla originating from Khadadanda upto Rathiar Main Dainkund ridge upto Khadadanda separating boundary of Bakloh and Chowari range. Rikh nala along Jandrighat upto Ravi river.

Area of the Sanctuary: 6,947 hac.

By Order

Commissioner Cum Secy (Fts) to the
Govt. of Himachal Pradesh.

(Authoritative English Text of this Department draft Notification No.FFE-B-F (6)11/2005-I dated 7th June , 2013 as required under Articles 348 (3) of the Constitution of India).

GOVERNMENT OF HIMACHAL PRADESH
DEPARTMENT OF FORESTS

No. FFE-B-F(6) -11/2005-II/ Kalatop – Khajjiar Dated Shimla-2, the 7th June 2013

NOTIFIACATION

Whereas a notification under Section 26A of Wildlife (Protection) Act 1972(53 of 1972 was issued by the State Government vide Notification No. FFE-B-F(6) -7/99 dated 23.10.1999, to declare **Kalatop Khajjiar as Wildlife Sanctuary** comprising an area of 69 sq. km.

And whereas, the matter with regard to rationalization of the Wildlife Sanctuaries and National Parks in Himachal Pradesh was under consideration of the Hon'ble Supreme Court in IA No. 139/2010 in Writ Petition Civil No. 337 of 1995 titled Centre for Environmental Law, WWF-I Versus Union of India & Others.

And whereas, in Pursuance to the Hon'ble Supreme Court order dated 7th May 2010, the State Government issued intention Notifications under Section 18 of the Wildlife (Protection) Act, 1972 in respect of the Wildlife Sanctuaries and National Parks for which rationalization had been proposed.

And whereas, the Hon'ble Supreme Court vide its order dated 05/08/2011, further directed the State Government to follow the procedure laid down under Section 18 to 26A and 35 of the Wildlife (Protection) Act, 1972, before issuance of final Notifications under Section 26A of the Wildlife (Protection) Act 1972, which procedure was duly followed;

As whereas, the Hon'ble Supreme Court vide order dated 01/02/2013 passed in IA No. 155 (earlier IA No. 139/2010), has permitted the State Government to issue final

Notification under Sections 26A, 35(4) & 36 A of the Wildlife (Protection) Act, 1972 with regard to the proposed rationalization of boundaries of Wildlife Sanctuaries and National Parks in Himachal Pradesh.

And whereas as a consequence of rationalization of boundaries of Kalatop- Khajjiar Wildlife Sanctuary, out of total area of 69.00 sq. km, 51.83 sq.km area (as per Collector Chamba recommendation instead of 52.76 sq. km) (comprising of 261 villages list attached as Annexure – A) is hereby de notified. The remaining area of 17.17 sq. km shall constitute the Kalatop- Khajjiar Wildlife Sanctuary after rationalization;

Now, therefore, the Governor, Himachal Pradesh in exercise of the powers vested in her under Section 26A of the Act ibid is pleased to declare this remaining area of 17.17 sq. km as **'Kalatop- Khajjiar Wildlife Sanctuary '**with immediate effect for the purpose of protecting, propagating and developing Wildlife and its environment.

The limits of the area of Kalatop- Khajjiar Wildlife Sanctuary shall be as under:

Sr. No.	Name of Wildlife Sanctuary	Constituents i) District ii) Forest Division	Boundaries of Kalatop- Khajjiar Wildlife Sanctuary
1.	**Kalatop Khajjiar**	i) Chamba ii) Chamba (WL) Division	**NORTH:** Pukhari Galla to Devi Ghatu and them along with the boundaries of DPF Khajroth up to Kalatop RF –C-11. **EAST:** From Devi Ghatu along with the boundary of Khajjiar DPF to Kanjredi Nalla and then up to its origin point at Bhagot. **SOUTH:** From Bhagot through Jhurdu Ridge up to Pohlani Temple. **WEST:** Pohlani Temple along the boundary of Kalatop RF up to Kalatop RF C-11.

This area is situated within the Geo-coordinates **North** Lat.32^0 33'58" N & Long 76^0 01'11"E **East Lat.**32^0 32' 16" N & Long 76^0 04' 00"E, **South** Lat.32^0 31'27" N &Long 76^0

01’51”E **West** Lat.32^0 32’16” & Long 76^0 00’36” E which falls on Survey of India topo sheet No. 52D/2 on scale 1:50000.

Area of Kalatop Khajjiar Wildlife Sanctuary= 17.17 sq. km

By order

Principal Secretary (Forests) to the
Government of Himachal Pradesh.

Endst. No. As above Dated Shimla – 2 The 7th June, 2013

Copy forwarded to:-

1. All the Administrative Secretaries to the Govt. of H.P. Shimla-2.
2. All the Divisional Commissioners, Shimla , Mandi & Dharamshala, H.P.
3. All the Heads of Departments of H.P.
4. The Principal Chief Conservator of Forests, H.P Shimla – 1.
5. The Principal Chief Conservator of Forests, (Wildlife) H.P Shimla – 1.
6. All CCFs/ DFOs (Wildlife) in H.P.
7. All the Deputy Commissioners in H.P.
8. All the CCFs/ CFs/ DFOs in H.P.
9. ALR-cum- Under Secretary Law to the Government of Himachal Pradesh.
10. The Commissioner, Municipal Cooperation, Shimla.
11. The Controller H.P Printing & Stationary Department Shimla-5 for publication

In the Raj- Patra (Extra – ordinary) Five Copies of the Raj- Patra be sent to this Department.

12. Guard File.

Under Secretary (Forests) to the
Government of Himachal Pradesh.

Annexure – 1 of Notification

List of villages to be executed from Kalatop Khajjiar Wildlife Sanctuary

Sr. No.	Name of Village.
1.	Darrel
2.	Gothalu
3.	Rotta
4.	Chorui
5.	Khajjiar
6.	Bhathali
7.	Bainska
8.	Dadota
9.	Rikhanbehi
10.	Jhagduie
11.	Chambi
12.	Ghagni
13.	Parel
14.	Gumeli
15.	Fatehpur
16.	Sehlanu
17.	Sukerni
18.	Darmata
19.	Dhardei
20.	Nui
21.	Bainska
22.	Mihila
23.	Ganodi
24.	Singi
25.	Reh
26.	Sagui
27.	Dadoga
28.	Bhagri
29.	Kalyuna
30.	Gotha
31.	Badi
32.	Darbad
33.	Kot di bethi
34.	Noda

35.	Bangotu
36.	Chaneda
37.	Taktola
38.	Dhapri
39.	Dehdi
40.	Bhaloli
41.	Lidbara
42.	Bhujal da dima
43.	Chalehi
44.	Pukhari
45.	Kupada
46.	Divkari
47.	Nadhuien
48.	Achhala
49.	Kupari
50.	Tadoli
51.	Khuner
52.	Janota
53.	Padhreti.
54.	Sach.
55.	Keluhani.
56.	Tipra.
57.	Kathyad.
58.	Ahlankhol.
59.	Garahanbehi.
60.	Chhonalla.
61.	Padhrotu.
62.	Basodhan.
63.	Talai-I
64.	Chhajoti.
65.	Majeer.
66.	Devi Dehra.
67.	Suned.
68.	Bhaloli.
69.	Talai.
70.	Rakhela.
71.	Phat.

72.	Chanjuie.
73.	Dugli.
74.	Bangbehi.
75.	Khabber.
76.	Miyari.
77.	Lahga.
78.	Diyoli.
79.	Khalsa.
80.	Miyari-II
81.	Chanadu.
82.	Randoh.
83.	Jhalei.
84.	Gate.
85.	Badi.
86.	Sau.
87.	Rathiar.
88.	Mandrani.
89.	Kakela.
90.	Lodhari.
91.	Lindibehi.
92.	Bhagrotta.
93.	Dibri.
94.	Pukhrog.
95.	Kasiyad.
96.	Phati.
97.	Behi.
98.	Khabber.
99.	Dug.
100.	Kohlari.
101.	Karachad.
102.	Kunna.
103.	Bhamrota.
104.	Rariyara
105.	Cheli.
106.	Gharanu.
107.	Chalga.
108.	Chil bangla.

109.	Khaniyaru.
110.	Dhar-II.
111.	Thopla.
112.	Dhampu.
113.	Chahla.
114.	Sukrehi.
115.	Chapdol.
116.	Kupadi.
117.	Kut.
118.	Panjoh-I.
119.	Panjoh-II.
120.	Malha-I.
121.	Malha-II.
122.	Gallu.
123.	Kandu.
124.	Guniyala.
125.	Karelen.
126.	Rikhnali.
127.	Kafroti.
128.	Reh.
129.	Bhikhanu & Lohli Khadd.
130.	Bhatoli.
131.	Chamladi.
132.	Khadkadi.
133.	Siya.
134.	Gutadi.
135.	Gargada.
136.	Tikru.
137.	Madhyar.
138.	Lahani.
139.	Tavela.
140.	Darbad.
141.	Thanda pani.
142.	Goli.
143.	Manola.
144.	Muchyanka.
145.	Khaniyaru.

146.	Pardhuda.
147.	Dradda.
148.	Dhar.
149.	Gunu.
150.	Tipri.
151.	Parhalo.
152.	Dhat.
153.	Duge.
154.	Kehla.
155.	Saru.
156.	Kuthar.
157.	Pukhar.
158.	Thedu.
159.	Hujara.
160.	Parihar.
161.	Mukrethi.
162.	Sanuie.
163.	Namlika.
164.	Chhani Lahad.
165.	Chaminu.
166.	Kota.
167.	Ronna.
168.	Bhadoli.
169.	Baniska.
170.	Sanjui.
171.	Nadhuie.
172.	Chhana.
173.	Gadiyar.
174.	Diyul.
175.	Dharoti.
176.	Madharka.
177.	Vayara.
178.	Thukarala.
179.	Darbada.
180.	Lalyada.
181.	Udalka.
182.	Muniyara.

183.	Kathal.
184.	Lilli.
185.	Sudhali.
186.	Bhamnika.
187.	Ladot.
188.	Katuien.
189.	Karoti.
190.	Dhaneta.
191.	Kadot.
192.	Dadar.
193.	Potla.
194.	Hadotha.
195.	Kunna.
196.	Talla.
197.	Tikker.
198.	Bharyah.
199.	Chehali.
200.	Lagangala.
201.	Salga.
202.	Seru.
203.	Khabber.
204.	Khalsa.
205.	Dehra.
206.	Sapri.
207.	Chhamba.
208.	Padder.
209.	Sadi.
210.	Bai.
211.	Doula.
212.	Chaned.
213.	Lumuth.
214.	Dharmuri.
215.	Bansa.
216.	Pathankari.
217.	Gadiyad
218.	Dharamanu.
219.	Tadoli-I

220.	Tadoli-II
221.	Dhapu.
222.	Dharniyad.
223.	Udaipur-I
224.	Udaipur –II
225.	Gothali.
226.	Chikdyani.
227.	Badhan.
228.	Jhumar.
229.	Chimha-I
230.	Chimha-II
231.	Dulla-I
232.	Dulla-II
233.	Dhanei.
234.	Tikker-I
235.	Surei.
236.	Daru.
237.	Tunaaa.
238.	Kupada.
239.	Rinda.
240.	Darvaa-I
241.	Darvaa-II
242.	Oda.
243.	Lalein.
244.	Kholi.
245.	Kut.
246.	Tikker-II
247.	Duaru.
248.	Fatehpur.
249.	Simli.
250.	Rodi.
251.	Bhunka.
252.	Pargana.
253.	Padhrotu.
254.	Tikker.
255.	Matolla.
256.	Bhagodi.

257.	Dadoon.
258.	Lohli Khad.
259.	Niharu.
260.	Darmanu
261.	Kalatop.

ANNEXURE-II

LIST OF RESERVE FOREST (COMPARTMENT WISE)

Sr. No.	Name of Forest Compartment.	Forest Type.	Area in Hac.
1	Kalatop RF C I(a)	Mixed Coniferous	33.18
2	Kalatop RF C I(b)	Mixed Coniferous	14.17
3	Kalatop RF C II(a)	Mixed Coniferous	19.02
4	Kalatop RF C II(b)	Mixed Coniferous	10.93
5	Kalatop RF C III	Mixed Coniferous	17.00
6	Kalatop RF C IV(a)	Mixed Coniferous	21.04
7	Kalatop RF C IV(b)	Mixed Coniferous	9.71
8	Kalatop RF C V(a)	Mixed Coniferous	11.33
9	Kalatop RF C V(b)	Mixed Coniferous	12.95
10	Kalatop RF C VI	Mixed Coniferous	35.61
11	Kalatop RFC VII(a)	Mixed Coniferous	4.04
12	Kalatop RFC VII(b)	Mixed Coniferous	24.28
13	Kalatop RF C VIII(a)	Mixed Coniferous	6.88
14	Kalatop RF C VIII(b)	Mixed Coniferous	12.95
15	Kalatop RF C IX	Mixed Coniferous	28.34
16	Kalatop RFC X	Mixed Coniferous	14.16
17	Kalatop RFC XI	Mixed Coniferous	29.14
18	Kalatop RFC XII	Mixed Coniferous	40.47
19	Kalatop RFC XIII(a)	Mixed Coniferous	12.54
20	Kalatop RFC XIII(b)	Mixed Coniferous	17.40
21	Kalatop RFC XIII©	Mixed Coniferous	11.33
22	Kalatop RFC XIII(d)	Mixed Coniferous	21.05

23	Kalatop RFC XIV(a)	Mixed Coniferous	14.57
24	Kalatop RFC XIV(b)	Mixed Coniferous	15.66
25	Kalatop RFC XV	Mixed Coniferous	33.99
26	Kalatop RFC XVI(a)	Mixed Coniferous	24.68
27	Kalatop RFC XVI(b)	Mixed Coniferous	28.13
28	Kalatop RFC XVI©	Mixed Coniferous	26.59
29	Kalatop RFC XVII	Mixed Coniferous	14.17
30	Kalatop RFC XVIII	Mixed Coniferous	40.88
31	Kalatop RFC XIX	Mixed Coniferous	12.14
32	Kalatop RFC XX(a)	Mixed Coniferous	14.98
33	Kalatop RFC XX(b)	Mixed Coniferous	4.04
34	Kalatop RFC XXI(a)	Mixed Coniferous	42.09
35	Kalatop RFC XXI(b)	Mixed Coniferous	22.66
36	Kalatop RFC XXI©	Mixed Coniferous	18.21
37	Kalatop RFC XXII(a)	Mixed Coniferous	12.55
38	Kalatop RFC XXII(b)	Mixed Coniferous	25.91
39	Kalatop RFC XXII©	Mixed Coniferous	10.51
40	Kalatop RFC XXIII(a)	Mixed Coniferous	27.52
41	Kalatop RFC XXIII(b)	Mixed Coniferous	21.85
42	Kalatop RFC XXIII©	Mixed Coniferous	33.59
43	Kalatop RFC XXIV	Mixed Coniferous	42.90
44	Kalatop RFC XXV	Mixed Coniferous	51.80
45	Kalatop RFC XXVI	Mixed Coniferous	54.64
46	Kalatop RFC XXVII	Mixed Coniferous	53.02
		Total	**1054.60**

LIST OF DPFs IN KALATOP-KHAJJIAR WILDLIFE SANCTUARY

Sr. No.	Name of Forest Compartment.	Forest Type.	Area in Hac.
1	Khajroth D.P.F.	Mixed Coniferous & Broad Leave	360.00
2	Khajjiar D.P.F.	Deodar	118.80
3	Jhurdu D.P.F.	Mixed Coniferous & Broad Leave	76.80
4	Khajroth part D.P.F.	Mixed Coniferous & Broad Leave	40.00
5	Glade area	Pasture	18.00
6	KarangraRakh D.P.F. (Part)	Mixed Broad leave.	48.86
		Total	**662.46**

THE SUMMARY OF THE LEGAL STATUS OF LAND IS AS UNDER

S. No	Classification of Land	Area in (Ha.)	Land Use
A.	**Govt. land.**		
1.	Reserve Forests.	1054.60	Forest Area.
2.	Demarcated Protected Forests	662.46	Forest area
	Total	**1717.06**	**-**

ANNEXURE-III

LIST OF NATURAL WATER SOURCES:

Sr. No.	Name of Resource/Nalla
1.	Sach Nalla
2.	Khajroth Nalla
3.	Karelnu Nalla
4.	Topi Nalla
5.	Lakker-Mandi Nalla
6.	Kakailla Nalla
7.	Nallu-Da Nalla
8.	Jhurdu Nalla
9.	Rai Nalla
10.	Makhol Nalla
11.	Narbah Nalla
12.	Kanjredi Nalla
13.	Goli Nalia

WATER PONDS:

Sr No.	Beat	Name of Forests	No. Of Ponds
1.	Kalatop	Kalatop RF c-2	1
2.	Kalatop	Kalatop RF c-3	1
3.	Lakkar Mandi	KalatopRF c-22	1
4.	Dainkund	Kalatop RF c-25	1
5.	Khajjiar	Jhurdu DPF	1
6.	Khajroth	Khajroth DPF	2
		Total	**7**

WETLAND

1.	Khajjiar

ANNEXURE-IV

LIST OF NATURAL CAVES AND OVERHANGS:

A. CAVES:-

Sr. No.	Name of Place	Location
1.	Kalatop Ridge	Kalatop RFC-XXIII
2.	Lakkermandi	Kalatop RFC- II
3.	Watch Tower Kalatop	Kalatop RFC-XVI
4.	Kalatop	Kalatop RFC-IX
5.	Matuna	Khajroth DPF
6.	Khajroth	Khajroth DPF
7.	Devka Nalla	Khajroth DPF

B. OVERHANGES:-

1.	Kalatop Ghar	Kalatop RFC-XVI
2.	Kalatop	Kalatop RFC-I & II
3.	Matuna	Khajroth DPF
4.	Khajroth	Khajroth DPF

ANNEXURE-V

LIST OF EXISTING & PROPOSED ARTIFICIAL SALT LICKS:

A. EXISTING ARTIFICIAL SALT LICKS

Sr. No.	Name of Place	Location
1.	Lakkarmandi Block	Kalatop RF C-V, X, XII, XV, XVI, XXI, XXIII, XIV
2.	Khajjiar Block	Devku Nallah, Matunu, Loiya Da Kotha, Khajjiar c-I, c-II, Jhurdu DPF

B. PROPOSED ARTIFICIAL SALT LICKS

1.	Kalatop	Kalatop RFC-IX, XX
2.	Khajjiar	Kahjroth DPF

ANNEXURE-VI

LIST OF PLANTATION:

Sr. No	Name of Plantation	Spp. Planted.		Area (Hac.	Year of Establishment
1	Janotha CA	Deodar=1600	-	2 Hac.	2005-06
2	Sach CA	Robinia=3000 Ban/Oak=3400 Shisham=1100	Ban/Oak seed=15 Kg	10 Hac.	-do-
3	Chanjothi CA	H.C.Nut=3900	Ban/Oak Seed= 3 Kg Walnut Seed= 5 Kg	5 Hac.	-do-

Sr. No	Name of Plantation	Spp. Planted.		Area (Hac.	Year of Establishment
1	Talai (New Pasture Area)	Robinia=1000 Ban/Oak=530	H.C Nut=670	2 Hac.	2006-07

Sr. No	Name of Plantation	Spp. Planted.		Area (Hac.	Year of Establishment
1	Sach CA	Robinia=1200	-	10 Hac.	2007-08
2	Sach CA	Live Hedge Spp=383	Ban/Oak =4400 Alnathus=500 Paplur=600	5Hac.	-do-
3	Chanjothi CA	Ban/Oak=-530 Robinia=800 Walnut=400 Chulli=140	(Live Hedge) Agave=870 Rubus=965 Barberis=675 Nargal=1250	3 Hac.	-do-

Sr. No	Name of Plantation	Spp. Planted.		Area (Hac.	Year of Establishment
1	Kapari (Sach) CA	Robinia=935 Ban/Oak=500	Walnut=850 Chulli=115	3 Hac.	2008-09

Sr. No	Name of Plantation	Spp. Planted.		Area (Hac.	Year of Establishment
1	Patka CA (Pasture Improvement)	Ban/Oak=200 Chulli=400	Rubus=200 Berberis=150	1.5 Hac.	2009-10
2	Gadkot CA	Robinia=4550	-	6 Hac.	-do-

Sr. No	Name of Plantation	Spp. Planted.	Area (Hac.	Year of Establishment
1	Sach CA	Ban=1500 Kachnar =300 Tuni=200. Amla=200	2 Hac.	2012-13

		ANNEXURE-VII
GLOSSARY OF TREES,SHRUBS AND CLIMBERS ETC. FOUND IN SANCTUARY:		
Timber yeilding plants		
Scientific	**Local Name**	**English Name**
Aesculus indica	Goon	Horse-chestnut
Ailanthus altissima		
Abies pindrow	Fir	Himalayan Fir
Albizia chinensis	Ohi	Chinese Albizia
Cedrus deodara	Diar	Deodara
Celtis australis	Khirk	nettle tree
Juglans regia	Akhrot	Walnut
Picea smithiana	Tosh	Spruce
Pinus roxburghii	Chir	Chir pine
Pinus wallichiana	Kail	Blue Pine
Populus ciliata	Pahari poplar	Poplar
Fodder plants		
Albizia chinensis	Ohi	Chinese Albizia
Celtis australis	Khirk	nettle tree
Ficus palmata	Anjir	Fig
Grewia optiva	Dhaman, Beul	Bihul
Quercus leucotrichophora		Ban
Quercus dilatata	Mohru	Green oak
Morus alba	Shahtoot	White Mulberry
Trifolium pratense	Tripatra	white clover
Medicago falcata		
Poa alpina		
Robinia pseudoacacia		Robinia
Fuel wood plants		
Aesculus indica	Goon	Horse chest nut
Albizia chinensis	Ohi	Chinese Albizia
Ailanthus altissima		
Berberis lycium	Kasmal /Kamal	
Celtis australis	Khirk	nettle tree
Ficus palmata	Phegra	
Grewia optiva	Dhaman, Beul	Bihul
Indigofera heterantha	Kathi	
Jugulans regia	Akhrot	Walnut
Olea cuspidata		
Populus ciliata	Pahari poplar	Poplar
Pyrus pashia	Kainth	Wild Madlar
Quercus leucotrichophora		
Rhododendron arboreum	Lal Burans	
Rhamnus virgatus		
Vitex negundo	Nirgundi, Banna	Chaste Tree

Wild fruit Yielding plants		
Berberis lyclum	Kemal/Kasmal	
Ficus palmata	Phegra	
Grewia optiva	Dhaman, Beul	Bihul
Jugulans regia	Akhrot	Walnut
Phyllanthus emblica	Amla	Amla
Punica granatum	Anar	Pomegrana
Pyrus pashia	Kainth	Wild Madlar
Rubus ellipticus	Akhre	Raspberry Yellow
Fragaria vesca	Strawberry	Strawberry
Myrica esculenta	kaphal	Bayberry
Plants for agricultural implements		
Ailanthus altissima		Ailanthus
Albizia chinensis	Ohi	Chinese Albizia
Cedrus deodara	Diar	Deodara
Celtis australis	Khirk	nettle tree
Grewia optiva	Dhaman, Beul	Bihul
Jugulans regia	Akhrot	Walnut
Pyrus pashia	Kainth	Wild Madlar
Quercus leucotrichophora		
Quercus dilatata	Mohru	Green oak
Vitex negundo	Nirgundi,Banna	Chaste Tree
Zanthoxylum armatum	Tirmira	Timber
Dye and Tannin yielding plants		
Artemisia parviflora		
Berberis lyclum	Kemal/Kasmal	
Geranium wallichianum	Ratanjot	Wallich Geranium
Phyllanthus emblica	Amla	Amla
Religious plants		
Achyranthes aspera		chaff-flower
Athatoda zeylanica		
Cynodon dactylon	Durva	
Leucas lanata	Dhurlu ghaas	Woolly Leucas
Phyllanthus emblica	Amla	Amla
Punica granatum	Anar	Pomegrana
Vitex negundo	Nirgundi	Chaste Tree

Medicinal Plants

Achillea millefolium	Puthkanda,	Gordaldo
Achyranthes aspera Linn.		Prickly Chaff Flower,
Acorus calamus	Safed bach	Sweet Flag
Aesculus indica	Goon	Horse chestnut
Ajuga bracteosa	Nil Phal	Bracted Bugleweed
Anaphalis triplinervis		Snowy Mespilus
Anemone Obtusiloba	Ratanjot	Himalayan Thimbleweed
Aquilegia pubiflora		Columbine
Artemisia parviflora		Indian acalypha
Aster molliusculus		Abelia chinensis
Berberis aristata	Chitra, chotra	Indian Barberry
Berberis lycium		Barberry
Bergenia ciliata	Patharkuchi, Asmabhedaka	
Boenninghausenia albiflora	Dampate, Ankuree	White Himalayan Rue
Callicarpa macrophylla	Phalini, Daya	Large-Leaf Beauty Berr
Cannabis sativa	Bhang	Marijuana
Capsella bursa-pastoris		Shepherd's purse
Chaerophyllum villosum	Khelti	Mithi patis
Chenopodium album	Bathuwa	Bathua
Cinnamomum tamala	Tejpatta	Cassia bark
Cirsium wallichii	Bungsee	Wallich's Thistle
Clematis grata		
Commelina benghalensis	Kanchara	Bengal Dayflower
Cuscuta reflexa	Amar bel	
Cynodon dactylon	Dhub, Hariali	Bermuda Grass
Cyperus rotundus	Bara-nagar-motha	Nut grass
Dactylorhiza hatagirea	Salam Panja	
Demosdium triflorum	Motha	Trefoil
Digitalis purpurea	Tilpushpi	Common foxglove
Dioscorea deltoidea	Shingli-mingli	Baniatakari
Elaeagnus umbellata	Kankal	Autumn Olive
Erigeron multiradiatus		common fleaban
Euphorbia cognate	Neya-dungra	Hedge Euphorbia
Fragaria vesca		Wild Strawberry
Galium asperifolium	Vilayati shami	Morning Glory
Geranium wallichianum	Lal jari	Wallich Geranium
Geum elatum		Geum elatum
Hedychium spicatum	Sandharlika	Spiked Ginger Lily
Inula Cappa		Elecampane
Jasminum humile	Peeli chameli	Yellow Jasmine
Juglans regia	Akhrot	Walnut

Lactuca dissecta		
Leucas lanata	Dhurlu ghaas	Woolly Leucas
Persea duthiei		
Malva rotundifolia		
Malaxis muscifera	Rishbhak	Fly bearing malaxis
Mentha longifolia	Poudina	Himalayan Horsemint
Micromeria bifloria		
Myrica esculeuta	kaiphal	Bayberry
Myrsine africana	Chhota mehndru,banwan	Cape Myrtle
Nepeta erecta		
Olea cupsidata		Indian olive
Origanum vulagre	Ban tulsi	Wild marjoram
Oxalis corniculata	Amrul	Creeping Wood Sorrel
Paris polyphylla	Tow	Dudhiabauj
Pedicularis pectinata		Stewartii
Phragmites austrails		Common reed
Phyllanthus emblica	Amla	Amla
Pinus roxburghii	Chil	Chir pine
Plantago lanceolata		English plantain
Podophyllum hexandrum	Ban kakri	Himalayan May Apple
Polygonatum verticillatum		Whorled Solomon's Seal
Polyonum capitata		
Primula denticulata		Drumstick Primula
Punica granatum	Anar	Pomegranate
Randia tetrasperma		Himalayan Randia
Ranunculus diffusus		
Reinwardtia indica	Basanti	Yellow Flax
Rhamnus virgatus		Rhamnaceae
Rhododendron arboreum	Lal buransh	Rhododendron
Rosa macrophylla		Damask rose
Rubia cardiolia	Majith	Madder
Rumex nepalenis	Jangli palak	Nepal Dock
Salavia lanata		
Sarcococca saligna	Geru, Piruli, Tiliara	Willow-Leaf Sweet-Box
Sedum trifidum		
Senecio gracoliflours		
Smilax aspera	Kukurdara	Common Smilax
Solanum nigrum	Mokoi	Black nightshade
Solanum xanthocarpum		
Soludago virga-aurea	Pinja phool	European goldenrod
Tagetes minuta		Stinking Roger
Taraxacum officinale		
Taxus wallichiana	Barmi	Himalayan Yew
Thalictrum foliolosum	Mamera	Leafy Meadow-Rue
Thymus linerais	Jangli ajwain	Himalayan Thyme

Trifolium repens	Tripatra	Red Clover
Triumfetta rhombodiea	Chikti	Burr Bush
Urtica dioica	Bichchhu buti	Stinging Nettle
Valeriana jatamansii	Smak	Jatamansi
Verbascum thapus		Great Mullein
Viola Canescens	Banafsha	Himalayan White Viola
Vitex negundo	Nirgundi	Chaste Tree
Zanthoxylum armatum	Tejphal	Prickly ash, Tumbru
Source:- Himalayan Forest Research Institute, Shimla		
	Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)	

ANNEXURE-VIII

List of Common Birds

Sr. No	Common Name	Scientific Name	Order	Family	IUCN Status
1	Shikra	*Accipiter badius*	Accipitriformes	Accipitridae	Least Concern
2	Golden Eagle	*Aquila chrysaetos*	Accipitriformes	Accipitridae	Least Concern
3	King vulture	*Sarcoramphus papa*	Cathartiformes	Cathartidae	Least Concern
4	Chukor	*Alectoris chukar*	Galliformes	Phasianidae	Least Concern
5	Monal	*Lophophorus impejanus*	Galliformes	Phasianidae	Least Concern
6	Koklas	*Pucrasia macrolopha*	Galliformes	Phasianidae	Least Concern
8	Chir	*Catreus wallichii*	Galliformes	Phasianidae	Vulnerable
8	Spotted dove	*Spilopelia chinensis*	Columbiformes	Columbidae	Least Concern
9	Rock Pigeon	*Columba livia*	Columbiformes	Columbidae	Least Concern
10	Koel	*Eudynamys scolopaceus*	Cuculiformes	Cuculidae	Least Concern
11	Himalayan Wood Owl	*Strix nivicolum*	Strigiformes	Strigidae	Least Concern
12	Pied Woodpecker		Piciformes	Picidae	Least Concern
13	Scaly-Bellied Woodpecker	*Picus squamatus*	Piciformes	Picidae	Least Concern
14	Jungle Crow	*Corvus culminatus*	Passeriformes	Corvidae	Least Concern
15	Long-billed Crow	*Corvus validus*	Passeriformes	Corvidae	Near Threatened
16	Himalayan Bulbul	*Pycnonotus leucogenys*	Passeriformes	Pycnonotidae	Least Concern
17	Black Bulbul	*Hypsipetes leucocephalus*	Passeriformes	Pycnonotidae	Least Concern
18	Flycatcher	*Myiarchus crinitus*	Passeriformes	Tyrannidae	Least Concern
19	House Sparrow	*Passer domesticus*	Passeriformes	Passeridae	Least Concern
20	Russet Sparrow	*Passer rutilans*	Passeriformes	Passeridae	Least Concern

21	Kalij	*Lophura leucomelanos*	Galliformes	Phasianidae	Least Concern
22	White Wagtail	*Motacilla alba*	Passeriformes	Motacillidae	Least Concern
23	Certine Wagtail	*Motacilla citreola*	Passeriformes	Motacillidae	Least Concern
24	Yellow Wagtail	*Motacilla flava*	Passeriformes	Motacillidae	Least Concern
25	Cheer Pheasant	*Catreus wallichii*	Galliformes	Phasianidae	Vulnerable
26	Eurasian Jay	*Garrulus glandarius*	Passeriformes	Corvidae	Least Concern
27	Black Headed Jay	*Garrulus lanceolatus*	Passeriformes	Corvidae	Least Concern
28	Plum Headed Parakeet	*Psittacula cyanocephala*	Psittaciformes	Psittacidae	Least Concern

List of Migrated Birds

1.	Large Cormornet	*Phalacrocorax carbo*	Suliformes	Phalacrocoracidae	Least Concern
2.	Little grebe	*Tachybaptus ruficollis*	Podicipediformes	Podicipedidae	Least Concern
3.	Little Egret	*Egretta garzetta*	Pelecaniformes	Ardeidae	Least Concern
4.	Mallard	*Anas platyrhynchos*	Anseriformes	Anatidae	Least Concern
5.	Bar-headed goose	*Anser indicus*	Anseriformes	Anatidae	Least Concern
6.	Common Teal	*Anas crecca*	Anseriformes	Anatidae	Least Concern
7.	Common pochard	*Aythya ferina*	Anseriformes	Anatidae	Vulnerable
8.	Black-Winged Stily	*Himantopus himantopus*	Charadriiformes	Recurvirostridae	Least Concern

List of Butterflies Found in the Sanctuary

N.	Name of Butterfly	Family	Wing Size (in mm)	Conservation Status	Months of Dominance from-to
1	*Papilio protenor Cramer*	Papilionidae	100- 130	Common	March-September
2	*Papilio polyctor polyctor Boisduval*		90-130	Common	March-October
3	*Parnassius hardkwickei hardwickei*		50-65	Rare	May-September
4	*Delias belladonna horsfieldi*	Pieridae	70-96	Uncommon	April-July September-November
5	*Pieris canidia indica Evans*		45-55	Common	April-October
6	*Catopsillia crocale Cramer*		55-75	Common	May-October
7	*Gonepteryx rhamni nepalensis Doubleday*		60-70	Common	March-October
8	*Eurema hecabe fimbriata*		30-40	Common	April-November
9	*Colias electo fieldi Menetries*		42-45	Very common	February-November
1	*Danaus genutia*	Danaidae	70-78	Common	March-November
11	*Parantica sita sita*		85-105	Common	April-November
12	*Mycalesis perseus blasius*	Satyridae	38-55	Very common	March-November
13	*Lethe insane insane*		55-60	Rare	May-October
14	*Lethe scanda*		55-65	Rare	June-September
15	*Lethe verma verma*		55-60	Common	April-October
16	*Lasiommata schakra schakra*		45-60	Common	Apri-October
17	*Aulocera swaha swaha*		60-75	Common	May-September
18	*Aulocera saraswati saraswati*		60-75	Common	July-October
19	*Callerebia annada*		55-70	Common	April-October
20	*Ypthima nareda nareda*		30-32	Common	April-October
21	*Ypthima ceylonica hubneri*		30-40	Rare	April-October
22	*Ypthima sakra nikaea Moore,*		45-55	Very common	March-November
23	*Melanitis leda ismene*		60-80	Very common	March-November
24	*Athyma opalina*	Nymphalidae	55-70	Common	March-November
25	*Parathyma asura asura*		65-75	Uncommon	July-August
26	*Neptis mahendra Moore*		55-60	Common	April-October

27	*Neptis hylas astola Moore,*		50-60	Common	March-October
28	*Pseudergolis wedah Kollar*		55-65 r	Rare	April-November
29	*Precis iphita*		55-65	Uncommon	Jan-December
30	*Cynthia cardui*		55-70	Common	April-November
31	*Vanessa indica*		55-65	Common	March-December
32	*Kaniska canace*		60-75	Uncommon	March-November
33	*Aglais cashmirensis*		55-65	Common	March-November
34	*Childrena childreni*		75-100	Common	May-November
35	*Issoria lathonia*		55-60-78	Rare	February-October
36	*Acraea issoria anomala Kollar,*	Acraeidae	45-65	Common	April-September
37	*Libythea myrrha Godart*	Erycinidae	45-55	Common	March-October
38	*Libythea lepita*		55-60	Common	March-September
39	*Dodona durga*	Riodinidae	30-40	Common	March-October
40	*Pseudozizeeria maha*	Lycaenidae	20-30	Common	January-November
41	*Lampides boeticus*		24-36	Common	March-October
42	*Lycaena pavana*		37-40	Common	March-October
43	*Heliophorus sena*		28-33	Very common	March-October
44	*Castalius rosimon*		25-27	Common	January-November
45	*Rapala manea schistacea*		30-33	Common	June-October
46	*Coladenia dan*	Hesperiidae	35-45	Common	May-October
47	*Sarangesa purendra*		28	Uncommon	May-June
48	*Polytremis eltola*		32	Rare	March-November
49	*Borbo bevani*		30	Uncommon	April-October

Source:- Research Paper on Preliminary ecological studies on the Lepidoptera from Khajjiar lake catchment by Sh. Vikram Singh & Sh. Harjeet Singh Banyal Department of Biosciences, HPU Shimla.

SYSTEMATIC LIST OF MAMMALS OF KALATOP-KHAJJIAR WILDLIFE SANCTUARY

Sr. No	Common Name	Scientific Name	Order	Family	CITES	WPA 1972	National Red Data
1.	House Shrew	*Suncus murinus*	Insectivora	Soricidae	-	-	-
2.	Nepalese Whiskered bat	*Myotis muricola*	Chirptera	Vespertilionidae	-	-	-
3.	Lesser Mouse eared bat	*Myotis blythii*	Chirptera	Vespertilionidae	-	-	-
4.	Rhesus Monkey	*Macaca mulatta*	Primates	Cercopithecidae	II	II	-
5.	Hanuman Langur	*Semnopithecus ajax*		Cercopithecidae	I	II	-
6.	Himalayan Fox	*Vuples vulpes*	Carnivora	Canidae	III	II	-
7.	Yellow throated marten	*Martes flavigula*		Mustelidae	III	II	-
8.	Himalayan Weasel	*Mustela sibrica*		Mustelidae	III	II	-
9.	Black Bear	*Ursus thibetanus*		Ursidae	I	II	-
10.	Striped Hyena	*Hyaena hyaena*		Hynaeidae	-	III	-
11.	Leopard	*Panthera pardus*		Felidae	I	I	Vulnerable
12.	Barking deer	*Muntiacus muntjac*	Artiodactyla	Cervidae	-	III	-
13.	Serow	*Nemarhedus sumatraensis*		Bovidae	I	I	Vulnerable
14.	Goral	*Nemarhedus goral*		Bovidae	I	III	-
15.	Flying Squirrel	*Petaurista petaurista*	Rodentia	Sciuridae	-	II	-
16.	House Mouse	*Mus musculus*		Muridae	-	V	-

***Source**:- Research Paper on Diversity & Ecology of Mammals in Kalatop-Khajjiar Sanctuary By Sh. Vikram Singh & Banyal, H.S. Department of Biosciences, HPU, Shimla.*

ANNEXURE-IX

Sr. No.	Name of Nursery	Location	Area
1.	Miarigalla Nursery	Near Miarigalla Check Post	0.50hac.

ANNEXURE-X

LIST OF EXISTING BUILDINGS IN WILDLIFE RANGE KHAJJIAR:

1.	Range Office cum residence at Khajjiar	1 No.
2.	Block Officer quarters	2 Nos.
3.	Forest Guard Quarters	8 Nos.
4.	Trekker Hut	2 Nos.
5.	Forest Rest House	2 Nos.
6.	Chowkidar Quarters	2 Nos.
7.	Transit Huts	2 Nos.
8.	Patrolling Huts	2Nos.
9.	Souvenir Shop	1 No.
10.	Public Toilets	3 Nos.
11.	Check Posts	2 Nos.
12.	Dormitory at Khajjiar	1 No.

ANNEXURE-XI

LIST OF THE INSPECTION PATHS IN WILDLIFE RANGE KHJJIAR:

Sr. No.	Name of I/Path	Length. (Km.).
1.	I/Path L/Mandi to L/Mandi.	12
2.	I/Path Kalatop C-19 to Kalatop C-20.	2
3.	I/Path Kalatop to Talai-I.	4
4.	I/Path L/Mandi to Kalatop c-26 & 27.	2
5.	I/PathLakkar Mandi to Khajroth	5
6.	I/Path Kalatop C-I to Kalatop C-15.	15
7.	I/Path Kalatop C-13 to Kalatop C-16	1.50
8.	I/Path Sunil Lodge to Jhurdu	2
9.	I/Path Khajjiar around the Khajjiar.	6
10.	I/Path Khajroth to Mandrani.	5
11.	I/Path Devkugalli to Dibri.	4.5
12.	I/path Kalatop to Dibri.	5.5
13.	I/Path Dainkund to Pohlani	2
14.	I/Path Mokhu Nalla to Madrani	3
15.	I/Path Guptu Nalla to Madrani	5
	Total:-	**74.5**

LIST OF JEEPABLE ROAD/BRIDLE PATHS:

Sr. No.	Name of road.	Length. (Km.).
1.	L/Mandi to Kalatop (Jeepable road)	3
2.	Khajjiar tp Bangbehi (Bridle Path)	0.6
3.	Khajjiar to Pukhari (Bridle Path)	0.8

LIST OF TREKKING ROUTES:

Sr. No.	Name of Trekking Route.	Length. (Km.).
1.	Kalatop to Khajjiar.	12
2.	Khabbi Da Got tu Devkugalla	0.5
	Total:-	**12.5**

ANNEXURE-XII

GLOSSARY OF COMMON LOCAL TERMS:-

Local Name/term	Explanation
Behi	A Spur
Chak	small cultivated area within a forest
Dhar	A ridge
Dharamasala	an Inn
Dal	Lake
Dhaugries	A professional labour having sound knowledge of tree felling and charcoal burning
Ghareri tax	Grazing tax in state time
Gaddi	A professional grazier of sheep & Goats
Ghall	Timber floating in stream of river
Goth	A resting place of sheep and goats in the forests
Gujjar	Nomadic buffalo grazier
Ghar	A land ship
Ghasni	Grass land where form grass is cut
Jetty	A side check dam constructed to reduce the velocity of river
Karam	A unit of measurement use in Revenue department which is equal to 4 feet 8 inches i.e. 1.4224 meters.
Khad	A water stream
Nalla	A ravine with or without water
Panihara	A local water spring
Pargana	An unit of comprising of several villages
Rahdari	Grazing fee
Shikari	A hunter
Warhbandi	Construction of small wall around the field.

															ANNEXURE-XIII
Year Wise expenditure done under different heads (2005-06 to 2018-19)															
Sr. No	**Item of Work**	**2005-06**	**2006-07**	**2007-08**	**2008-09**	**2009-10**	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**
1	**Infrastructure Development**														
	Construction of New building & other structures	3.15	6.00	4.00	0.00	11.25	3.00	0.00	7.00	15.00	0.00	5.50	16.20	13.00	3.40
	Construction of New Roads/Paths	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Maintenance of Building	0.73	0.75	7.31	2.26	2.20	0.49	1.45	12.46	0.00	1.00	36.90	3.50	7.00	1.00
	Maintenance of Roads/Paths	5.56	0.40	0.81	0.18	1.00	0.84	0.72	0.20	2.95	7.92	8.66	3.57	6.40	0.00
2	**Habitat improvement**														
	New Plantation	1.52	0.36	2.32	0.39	0.00	0.00	0.00	0.51	0.00	0.00	0.00	6.50	0.00	0.00
	Nursery	0.75	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.43	0.00	0.00	0.00	4.00	0.90089
	Soil & moisture conservation	4.27	1.38	2.93	3.55	6.00		1.04	0.00	0.80	22.50	26.80	16.70	20.35	3.00
	Others	0.95	1.61	1.25	3.30	0.00	0.18	1.37	0.00	0.50	3.30	0.50	0.50	1.00	
3	**Capacity Building/Training/ Research & Monitoring**														
	Survey/Census/ Estimation of Flora & Fauna	0.05	0.25	0.30	0.00	0.25	0.00	0.20	0.00	0.50	1.00	1.75	3.20	1.50	0.00
	Research & Monitoring	0.00	0.00	0.00	0.00	0.10	0.10	0.50	0.00	0.00	0.00	0.00	0.25	0.00	0.00
	Training	0.45	0.00	0.54	0.00	1.20	0.00	0.00	0.90	0.80	0.50	1.50	1.80	0.50	0.00
	Staff welfare activities	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Hiring of staff	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.75	0.50	0.00
4	**Wildlife Protection and Conservation Activities**														
	Protection	1.60	1.76	1.22	1.43	1.68	1.31	2.36	0.00	3.03	19.91	9.00	9.63	6.65	0.00

5	**Education and Awareness Generation**	0.70	0.40	0.75	0.00	0.41	0.00	3.01	0.89	0.00	1.00	0.50	3.05	2.20	1.40
6	**Wildlife Tourism Management**	16.82	20.89	1.47	4.35	5.42	15.07	52.14	7.58	15.17	25.66	90.21	98.79	183.90	26.41
7	**Field equipment**														
	Monitoring	1.00	0.00	0.00	0.00	0.00	1.05	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Camping	0.00	0.00	0.65	0.00	0.00	0.00	0.15	0.00	0.00	0.00	0.00	0.85	0.30	0.00
	Protection	0.02	0.55	0.00	0.00	0.07	0.31	0.00	0.00	0.00	0.00	0.00	2.00	0.00	0.00
	Communication	0.00	0.00	0.00	0.00	0.10	0.00	0.14	0.30	0.00	0.00	0.00	1.00	0.51	0.00
8	**Office expenses**	1.24	1.24	2.15	2.11	2.84	3.63	3.04	1.07	0.00	0.00	0.00	1.65	0.68	0.00
9	**Community Development through Participation**	0.00	0.00	0.00	0.00	0.40	1.40	2.06	0.00	1.00	0.00	0.50	2.50	1.50	0.00
10	**Human-wild animal Conflict**	0.02	0.30	0.52	0.04	0.25	0.00	0.11	0.00	0.00	0.10	1.50	4.85	5.50	3.50
	Veterinary facilities	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.00	0.00	1.50	2.45	0.00	0.00
11	**Reclamation of Khajjiar Lake**	0.00	0.00	0.00	0.00	0.00	3.60	5.00	5.00	0.00	0.00	3.60	0.00	55.00	0.00
12	**Operational Support**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.00	1.80	0.79	0.42508
					Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)										

ANNEXURE-XIV

DRAFT PROPOSAL

1. Boundaries of Eco-sensitive Zone –

(i) The said Eco-sensitive Zone shall comprise of the area of 500 mtr. width from the boundary of the proposed rationalized area of Kalatop-Khajjiar Wild Life Sanctuary situated in the Chamba District of Himachal Pradesh. The Eco-sensitive Zone of the Sanctuary is proposed to be all around the boundary of the sanctuary with an average width of 500 mtr.The area of the Eco-sensitive zone is 9.95 sq.km.

(ii) The map of the Eco-sensitive Zone is at Annexure-I and the list of the forests within area of suitable width of the boundary of Kalatop-Khajjiar Wild Life Sanctuary in the Eco sensitive Zone are as follows:-

(a) List of Forests proposed for Eco- sensitive Zone:-

S. No.	Name of Division	Name of Range	Name of Beat	Name of Forest	Comptt.	Area
1.	Dalhousie	Dalhousie	Singhi	DPF Khajjiar	-	
		---do---	---do---	DPF Rotha	-	
		---do---	---do---	DPF Dhamgram	-	
		---do---	Chilbangla	DPF Lodhri	-	
		---do---	---do---	DPF Dibri	-	
		---do---	---do---	DPF Bhamrotha	-	
		---do---	Goli	DPF Gutheri	-	
		---do---	---do---	DPF Matola	-	
		---do---	Jandrighat	DPF Karailnu	-	
		---do---	Gharatgalla	DPF Alla	-	
		---do---	---do---	Dainkund dhar	-	
2.	Chamba	Lower Chamba	Karangarakh	DPF Karangarakh	-	
		---do---	Talai	DPF Miadi	-	
		---do---	---do---	DPF Chaanjuhi	-	
				TOTAL area including villages area	-	**995 Hac. (9.95 sq.km.)**

All the Forests listed above will be part of eco sensitive Zone of Kalatop-Khajjiar Wildlife Sanctuary.

(b) List of Gram Panchayats covered in the Eco – sensitive zone:

S. No.	Division	Gram Panchayat	Villages
1.	Chamba	Khajjiar	1.Bhathali 2.Gothlu 3.Bainska 4.Lahari 5.Rotta 6.Khajjiar 7. Lindi Behi 8. Darol 9. Bathli
2.	Chamba	Singi	10.Bangbehi.
3.	Chamba	Kohalri	11. Gharat Bahi 12. Khaltu 13. Lodhari 14. kut
4.	Dalhousie	Padhrotu	15. Matola
5.	Dalhousie	Osal	16. Lotanu
6.	Chamba	Rathiar	17. Bangotgala 18. Pohlani Devi

These villages are falling within the proposed eco sensitive zone.

(iii) All activities in the Kalatop-Khajjiar Wild Life Sanctuary are being governed by the provisions of the Wildlife (Protection) Act, 1972 (53 of 1972).

2. Zonal Master Plan for the Eco-sensitive Zone:-

a) A Zonal Master Plan for the Eco-sensitive Zone shall be prepared by the State Government within a period of one year from the date of publication of this notification in the Official Gazette and shall be submitted for approval to the Central Government in the Ministry of Environment and Forests, Government of India.

b) The Zonal Master Plan shall be prepared with due involvement of all concerned State Departments, such as Environment, Forest, Urban Development, Tourism, Municipal and Revenue Department and the Himachal Pradesh State Pollution Control Board for integrating environmental and ecological considerations into it and shall provide for restoration of denuded areas, conservation of existing water bodies, management of catchments areas, watershed management, groundwater management, soil and moisture conservation, needs of local community and such other aspects of the ecology and environment that need attention.

c) The Zonal Master Plan shall demarcate all the existing village settlements, types and kinds of forests, agricultural areas, fertile lands, green areas, horticultural areas, orchards, lakes and other water bodies and change of land use from green uses such as orchards, horticulture areas, agriculture parks and others like places to non green uses shall be permitted in the Zonal Master Plan, except that strictly limited conversion of agricultural lands may be permitted to meet the residential needs of the existing local residents together with natural growth of the existing local populations, without the prior approval of the State Government.

d) The Zonal Master Plan shall be a reference document for the State Level Monitoring Committee for any decision to be taken by them including consideration for relaxation.

e) The Zonal Master Plan shall indicate measures and lay down stipulations for regulation of traffic.

f) Pending the preparation of the Zonal Master Plan for Eco-sensitive Zone and approval thereof by the Central Government in the Ministry of Environment and Forests, all new constructions shall be allowed only after the proposals are scrutinized and approved by the Monitoring Committee as referred to in paragraph 4 and there shall be no consequential reduction in Forest, Green and Agricultural area.

g) The State Government shall prescribe additional measures, if necessary, in furtherance of the objectives and for giving effect to the provisions of this notification.

3. Regulated or restricted activities in the Eco-sensitive Zone

I. Industrial Units:-

a) New wood based industry in private area shall be allowed only after obtaining permission from the State Government and shall be operated as per rules and regulation framed by the state Government from time to time .

b) No new polluting industry shall be regulated as per relevant Act and rules within the eco sensitive zone of Kalatop-Khajjiar Wild Life Sanctuary.

c) No new highly polluting industry shall be set up within **eco sensitive zone area** of the Kalatop-Khajjiar Wild Life Sanctuary.

II. Construction Activities –

a) In Forest area no Commercial construction including Hotels / Resorts construction shall be allowed. Only listed activities will be allowed.

b) Domestic construction included housing small shop, Dhabas and small outlets shall be permitted only in private land.

c) Commercial construction including Hotels / Resorts shall not be in eco sensitive zone.

III. Quarrying and Mining –

a) No commercial Mining activities in the Forest area will be allowed except for domestic use as per record of rights as given in the Forest Settlement Report by H.M Glover, 1921

b) Mining activities in private area for domestic use shall be allowed subject to rules and regulations framed by the government from time to time.

c) Stone / mineral crushers for domestic use shall be allowed to be established within the eco-sensitive zone after taking permission from competent authority.

IV. Trees: - Felling of trees in the Forest area shall be allowed as per working plan. And felling of trees in private area shall be allowed under the provision of Land Preservation Act, 1978.

V. **Water: -**

a) Extraction of ground water in forest area for domestic use shall be permitted only with the permission of State Government.

b) Extraction of ground water in forest area for commercial use shall be prohibited.

c) Extraction of ground water in private area for bonafide domestic and agriculture use shall be permitted.

d) Extraction of ground water in private area for commercial use shall be permitted with permission of competent authority.

VI. **Noise pollution: -** The Environment Department or the State Forest Department, Himachal Pradesh shall be the authority to draw up guidelines and regulations for the control of noise in the Eco-sensitive Zone.

VII. **Discharge of effluents: -** No untreated or industrial effluent shall be permitted to be discharged into any water body within the Eco-sensitive Zone and treated effluent shall meet the provisions of the Water (Prevention and Control of Pollution) Act, 1974.

VIII. **Solid Wastes:-**

a) The solid waste disposal shall be carried out with prior permission of State Government.

b) The biodegradable material may be recycled preferably through composting or vermin-culture and the inorganic material may be disposed of in an environmentally acceptable manner at a site identified outside the Eco-sensitive Zone managed on scientific principles.

c) Solid wastes and other waste material shall not be allowed to be dumpt within the Eco-sensitive Zone.

IX. **Other: -**

a) **Rights: -** All rights of right holders shall remain continue as per settlement record.

b) **Migratory Graziers:** - All migratory Gaddis & Gujjars shall be allowed as per the provision of settlement Report of H.M. Glover, 1921.

c) **Sign Board and Hording**: - All Sign Boards and Hoardings shall be allowed after obtaining permission from competent authority**.**

d) **Hydro and Thermal Electric Projects: -**Existing Hydro- electric Project shall be permitted in a regulated way subject and regulation lay down by the state Government from time to time. No Thermal / Nuclear power projects and future Hydro- electric project shall be allowed within the Eco-sensitive Zone.

e) **Road: -** Construction and widening of road shall be allowed after obtaining permission under FCA Act, 1980 and muck management plan shall be strictly adhered to and un-scientific muck dumping shall not be permitted within the Eco-sensitive zone.

f) **Other Eco- friendly activities:-** Other friendly activities like organic and improved agricultural techniques rain water harvesting, soil and water conservation measures, plantation of native spps. Solar/ wind energy development and adoption of green technology shall be encouraged within Eco-sensitive Zone.

g) **Eco-tourism**: - Eco-tourism will be allowed in the Eco-sensitive Zones within the prior permission of Sate Government.

h) **Extraction of Medicinal Plant**: - Extraction of minor forest produce including medicinal plants will be allowed as per the provision of settlement Report of 1921.

X. **Governance of the ESZ: -** The ESZ shall be controlled by the Concerned DFOs (T) i.e.,DFO,Chamba and DFO,Dalhousie.

XI. **Monitoring Committee: -**

a) Under the provisions of sub-section (3) of section 3 of the Environment (Protection) Act, 1986 (29 of 1986), the Central Government hereby constitutes a committee to be called the Monitoring Committee to monitor the compliance with the provisions of this notification.

b) The Monitoring Committee shall consist of not more than ten members and the Chairman of the Monitoring Committee shall be an eminent person with proven having knowledge of ecology, managerial or administrative experience and understanding of local issues and the other members shall be: -

1. Divisional Forest Officer (Wild Life), will be as a Member Secretary and Divisional Forest Officer (Territorial) will be a Member.
2. A representative of the Ministry of Environment and Forests, Government of India.
3. One representative of Non-Governmental Organizations working in the field of environment (including heritage conservation) to be nominated by the Government of India.
4. XEN, HP Pollution Control Board, having jurisdiction of the area.
5. SDM,Chamba/Dalhousie or his representative.

c) The powers and functions of the Monitoring Committee shall be restricted to the compliance of the provisions of this notification only.

d) In case of activities requiring prior permission or environmental clearance, such activities shall be referred to the State Level Environment Impact Assessment Authority (SEIAA), which shall be the Competent Authority for grant of such clearances as per the provisions.

e) The Monitoring Committee may also invite representatives or experts from concerned Departments or Associations to assist in its deliberations depending on the requirements on issue to issue basis.

f) The Chairman or Member Secretary of Monitoring Committee shall be competent to file complaints under section 19 of the Environment (Protection) Act, 1986 for non-compliance of the provisions of this notification.

g) The Monitoring Committee shall submit its annual action taken reports by the 31st March of every year to the Ministry of Environment and Forests and the Central Government in the Ministry of Environment and Forests shall give its directions to the Monitoring Committee from time to time for effective discharge of the functions of the Committee.

Sd/-

Divisional Forest Officer
WildLife Division Chamba
(Member Secretary)

Sd/-	Sd/-	Sd/-
Divisional Forest Officer	Divisional Forest Officer	CF (T)-cum- Chairman
Forest Division Dalhousie	Forest Division Chamba	Chamba Forest Circle
(Member)	(Member)	Chamba, HP

ANNEXURE-XV

RULES AND REGULATIONS OF THE SOCIETY

"KHAJJIAR ECO – TOURISM SOCIETY"

KHAJJIAR- CHAMBA

SHORT TITLE

1. These rules and regulations may be called Rules and Regulations of the Khajjiar Eco tourism Society (hereinafter called the "Rules").

INTERPRETATION

2. Unless it is inconsistent with the subject or context

- The "Society".
- "Means the **Khajjiar Eco – Tourism Society".**
- **'**In writing 'means including printing, lithography and typewriting.
- 'Year' means the period commencing from the 1st April and ending with the March with the calendar year.
- Month 'means Calendar month.

PATRONS

3. Secretary (Forests) to the Government of Himachal Pradesh and Principal Chief Conservator of Forests, Himachal Pradesh shall be the ex-officio patrons of the society.

MEMBERS

4. For the purpose of registration of the Society, the number of members is declared to be seven, but the Society may at any time increase the number.

5. There shall be following classes of Members of the Society:

Official Members: They shall include Officers of the State Forest Department and the other related government departments/ corporations.

Non- Official Members: They shall be from amongst representatives of local panchayat, local NGO/VO engaged in rural development and representatives of local artisans body, local mahila mandal, local youth club, hoteliers association engaged in /or interested in promoting eco-tourism in the area.

6. Subject to the provisions on the Rule-7, non official member shall be eligible for admission to the society, if he / she is :
   i) Over 18 years of age and sound mind;
   ii) Ordinarily resident in the area of operation of the society.
   iii) Of good character
   iv) Interested in furthering the cause of the society.

7. No individual shall be eligible for admission as non–official member of the society, if –
   i) He/she has applied for bankruptcy; or
   ii) He/ she has been declared as an insolvent; or
   iii) He /she has been sentenced for any offence involving dishonesty or moral turpitude within 5 years preceding the date of hid application for admission as a member.

ORGANIZATIONAL STRUCTURE

8. The Society shall have two tiered structure as under:

   i) Governing Board.

   ii) Executive Committee. .

GOVERNING BOARD

9. The Governing Board shall consist of the following nine members, including the Chairman and the Member Secretary:

A) OFFICIAL MEMBERS

i) Chairman	Conservator of Forests (Wildlife), North Zone, Dharamshala.
ii) Executive Secretary	Divisional Forest Office (Wildlife), Chamba.
iii) Member	Representative of Secretary Finance
iv) Member	Representative of MD, HPTDC.
v) Member	Representative of Distt. Admn. / SADA

B) NON OFFICIAL MEMBERS

i) Member	Representative of local Panchayats
ii) Members(3)	Three from amongst representatives of local NGO, Mahila Mandal,Youth Club, Temple Trusts , Tour Operators , Hoteliers association etc.

Executive Secretary of the Governing Board shall also be the ex- officio Director of the Executive Committee.

10. The Governing Board shall be empowered to Co-opt a maximum of two members to act as experts on the subject, if required.

Whereas, all the official members shall be ex-officio members of the Governing Board, all the non-official members shall normally hold office for a period of one year from the date of their nomination to the Governing Board.

11. Any of the non- official members who fail to attend three consecutive meeting of the Governing Board without proper cause shall cease to be a member thereof.

12. The chairman shall preside over the meeting of the Governing Board. In his absence,the members present shall elect a Chairman for the meeting.

13. Two third members of the Governing Board present in person shall constitute the quorum at any meeting of Governing Board.

14. Not less than fifteen clear days no one of every meeting of the Governing Board shall be given to each member at his address.

15. The Governing Board shall meet at least four times every year.

16. Each member of the Governing Board, expect the Co-opted members if any, including the Chairman have one vote and majority decision shall prevail. In case of equality of votes on any question, the Chairman shall have the casting vote.

17. Any of the non- official members may be removed from the Society by resolution of the Governing Board passed by a majority of at least ¾ by the members present and voting at the special meeting of the Governing Board, of which no less than 21 days previous notice shall be given to the member whose removal is in question and to all members of the Governing Board. Such notice shall include a copy of the proposed resolution for removal of the member; however, the member against whom the action is envisaged will not be entitled to vote.

18. The Governing Board shall carry out the following functions:

i) To carry out the objectives of the Society as set forth in the Memorandum of Association of the Society.

ii) To manage the affairs and funds of the Society and exercise all powers of the Society in accordance with rules of the Society.

iii) To approve the annual profit and loss account and audited balance sheet of the Society.

iv) To look for other avenues to rise funds for the society and to accept grants or financial aid from the Government and donations from other public bodies, Cooperation,companies or persons, national or international for the purposes of the Society on such conditions as may be agreed to.

v) To borrow or raise funds that may be required by the Society on such terms and conditions as may be deemed advisable.

vi) To prescribe rates/ fees for the services provided to the eco-tourists including those account of Government assets, the use of the same.

vii) To approve the work programme and list of activities submitted by the Executive Committee of the Society and periodically monitor the same.

viii) To acquire for the Society any assets, moveable or immoveable, on such terms and conditions, as it deems fit, including by way of purchase or entering into agreements (MoUs) for the purpose. Chairman of the Governing Board Shall be authorized signatory for this purpose.

ix) To enter into and secure the fulfilment of any contracts/ engagements on behalf of the Society and to institute / defend/ compound or abandon any legal proceedings by or against the Society and to refer any matters, claims or demands to arbitration and observe and perform the Awards.

x) To set up, constitute and organize local branches of the society in such a manner and such a manner and no such terms as may be considers necessary in the interest of the society.

xi) To engage such persons as may be necessary to carry out the objects of the Society and to pay them such remuneration as may be considers expedient.

xii) To construct, erect, alter, improve and maintain any of its building and to manage, develop, sell, mortgage, all or part of society assets for each for cash or any other consideration to promote the objects of the Society.

xiii) To suggest and take up matter for exchange / or acquiring of animals/birds to and from other zoos in the country or abroad for the zoos falling in the area of operation, if any, subject, to the guidelines/ directions of the government from time to time.

19. The Governing Board shall constitute on Executive Committee and delegate to it such powers and functions, as it considers fit.

20. All Business discussed or decided at a meeting of the Governing Board shall be recorded in a proceeding book, shall be signed by the chairman of the meeting and all members present.

EXECUTIVE COMMITTEE

21. The Governing Board shall constitute an Executive Committee for day to day functioning of the Society.

22. The Executive Committee shall comprise of the following five members:

i) Divisional Forest Officer (Wildlife), Chamba	Director
ii) Range Forest Office (Wildlife) Chamba	Member
iii) Representative of local Panchayat	Member
iv) Nominee of the Director	Member
v) Range Forest Officer / Dy. Ranger	Member Secretary

The Director of the Executive Committee shall also be the Executive Secretary of the Governing Board.

23. The Executive Committee shall be responsible for:

a) Implementation of decisions taken by the Governing Board.

b) Preparing proposals for activities to be taken up by the society submitting the same to the Governing Board for approval and effectively carrying out approved activities.

c) Developing publicity and nature education material for the eco-tourists.

d) Maintenance of the assets, both moveable and immovable, of the society.

e) Capacity building of members of the society by organizing appropriate training programme for them in different disciplines via cooperative. Management, catering, guide, guest house management, porters management of the interpretation centres, nature park (zoo) management etc.

f) Maintenance of records related to the assets of the society and preparation of monthly cash counts periodical reports for the Governing Board annual balance sheet etc.

24. The Executive Committee shall meet at least once every month to take of the progress of various works.

25. It shall keep record of all such meetings in the prescribed format and sent minutes of these meeting to the Governing Board.

Funds of the Society

26. The Society shall raise funds as follows:

1) Retention of revenue generated out of government assets in its area of operations the use of which has been allowed to the society.

2) Revenue generated by the society out of its own assets, its activities and investments.

3) Grants made by the Government and donations and contributions from other sources.

4) Loans from financial institutions.

5) Projects based funding from national. /internationals donor agencies.

27. The society shall maintain proper accounts and other relevant records and papers and prepare an annual statement of accounts in such from as may be prescribed by the chartered accountant. The accounts of the society shall be audited by a charted Accountant and nay expenditure incurred in connection with the audit of accounts of the Society shall be payable by the Society.

ACCOUNTS AND AUDIT

28. The Society shall maintain such account and other records connected with accounts in such form or manner as may be directed by the authority competent to do so under the Co-operative Societies Act.

29. The Society shall prepare and submit returns and statement s as the Registrar may from time to time specify.

30. Accounts of the society shall be audited annually by Chartered Accountants. The Executive Committee shall records its observations on the audited accounts and forward these to the Governing Board for ratification.

ANNUAL REPORT

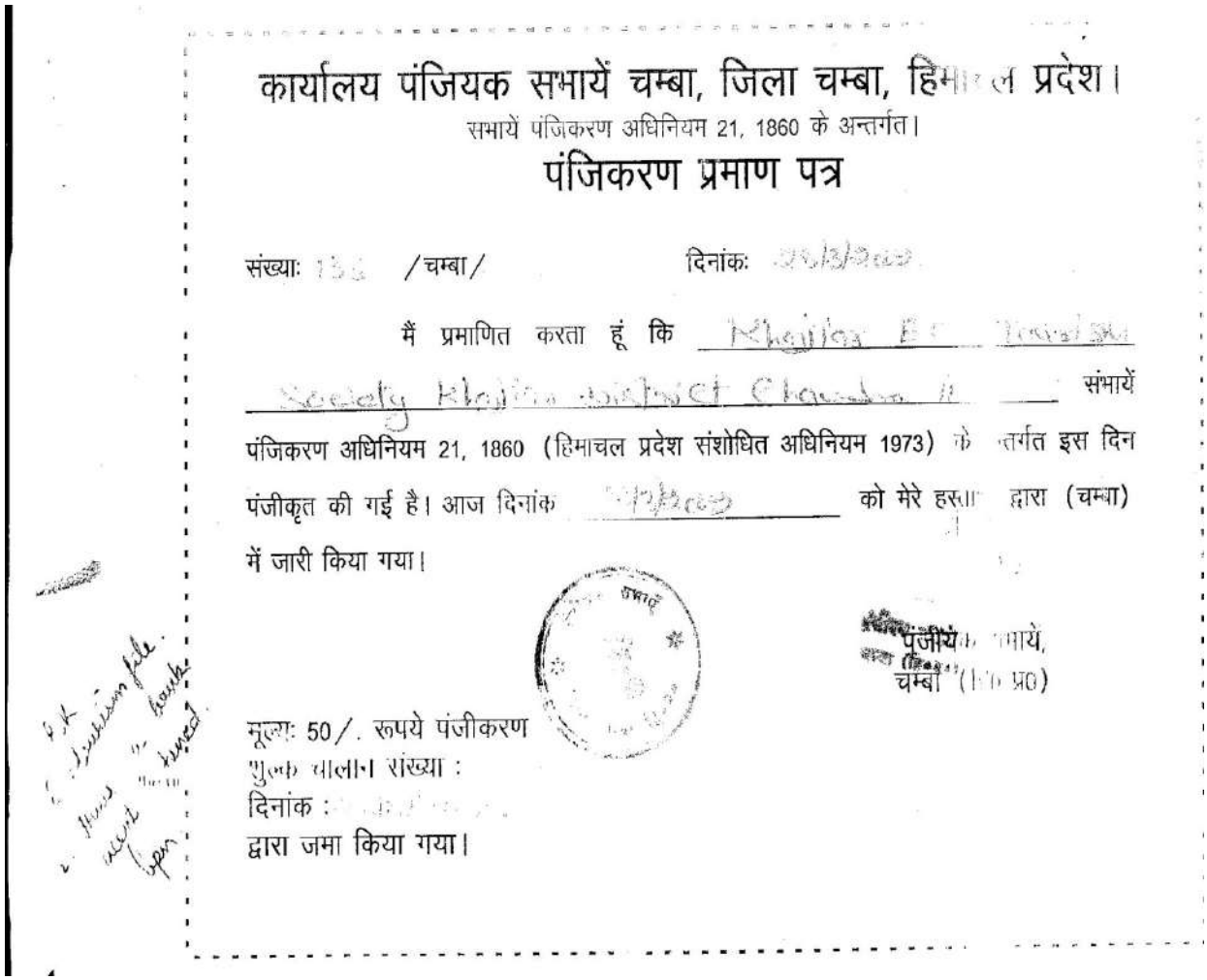
31. Draft Annual Report on the working of the society shall be prepared by the Executive Committee, and shall be placed before the Governing Board for consideration and approval. Copies of the approved Annual Plan shall be supplied to the members of the Society and other concerned.

MISCELLANEOUS

32. No addition, alteration or amendment shall be made to the Rules and Regulations of the Society in force, expert by regulations passed at a meeting of the Governing Body by as two third majorities of the members present.

33. Society may in the circumstances specified under the relevant provisions of the Co-operative Societies Act, 1860, be wound up and cancelled by the Registrar in accordance with the procedure laid down by such an act and the rules framed there under.

34. In case the Society is wound up or dissolved, the government assets taken over by the Society under MoU shall revert to the concerned department and any other assets, if remaining after clearing of all debts and liabilities, shall be vested in the Government.



कार्यालय पंजियक सभायें चम्बा, जिला चम्बा, हिमाचल प्रदेश।

सभायें पंजिकरण अधिनियम 21, 1860 के अन्तर्गत।

पंजिकरण प्रमाण पत्र

संख्याः 136 /चम्बा/ दिनांकः 20/3/2002

मैं प्रमाणित करता हूं कि Khajjiar Eco Tourism Society Khajjiar District Chamba H.P. सभायें पंजिकरण अधिनियम 21, 1860 (हिमाचल प्रदेश संशोधित अधिनियम 1973) के अन्तर्गत इस दिन पंजीकृत की गई है। आज दिनांक 20/3/2002 को मेरे हस्ता. द्वारा (चम्बा) में जारी किया गया।

पंजीयक सभायें, चम्बा (H.P.)

मूल्यः 50/. रूपये पंजीकरण
पुस्तक खाता संख्या :
दिनांक :
द्वारा जमा किया गया।

MEMORANDUM OF ASSOCIATION OF KHAJJIAR ECO- TOURISM SOCIETY,

KHAJJIAR, CHAMBA (H.P)

1. The name of the Society will be the Khajjiar Eco- tourism Society.

2. The registered office of the Society shall be as per the following address:

Range Forest Office, Wildlife Range, Khajjiar, Chamba.

3. The area of operation of the Society shall be State of Himachal Pradesh, with specific interest in the district of Chamba.

4. The Society has been set up with the primary objective to promote and manage eco-tourism activities in the area of operation to get optimum economic returns to the local people in an environmentally and culturally sustainable way.

The Society shall, for this purpose, retain the revenue receipts generated out of those government assets in its area of operation, the use of which has been allowed to the society, and utilize the same to fulfil the objectives of the society.

And in furtherance of the above primary objective:

a) To create awareness amongst the local people about the potential of eco- tourism in the area and its intimate linkages with conservation of natural resources.

b) To build capacity of the local people and concerned government officials in managing eco- tourism in their area.

c) To identify eco-trails and eco- parks in the area of operation and develop infrastructural facilities along these trails for such tourism.

d) To manage the infrastructure developed by the society and /or taken over by the society from other organizations under MoU if any.

e) To develop and enforce protocols to minimize the negative impacts of traditional tourism on ecology and social fabric of the area.

f) To set up nature interpretation centres and to develop educational material/ displays for benefits of tourists.

g) To develop ways and means to attract responsible nature and adventure tourists to the identified and developed eco-trails and eco-parks.

h) To promote cooperatives amongst local artisans for production and sale of handicrafts/ cottage level produce to get better returns to them.

i) To set up branches of the society for the said purposes at such places as may be decided by the Governing Body of the society from time to time.

j) To assist or take assistance from and collaborate with other institutions with similar activities in India or elsewhere.

k) To keep close liaison with State Level Eco-tourism Advisory Committee set up in the State Forest Department and work under its broad policy guidelines on the subject.

l) To engage persons for the purpose of the society.

m) To carry out all activities keeping in view various provisions of related Acts, Rules , regulations and guidelines issued by the government from time to time.

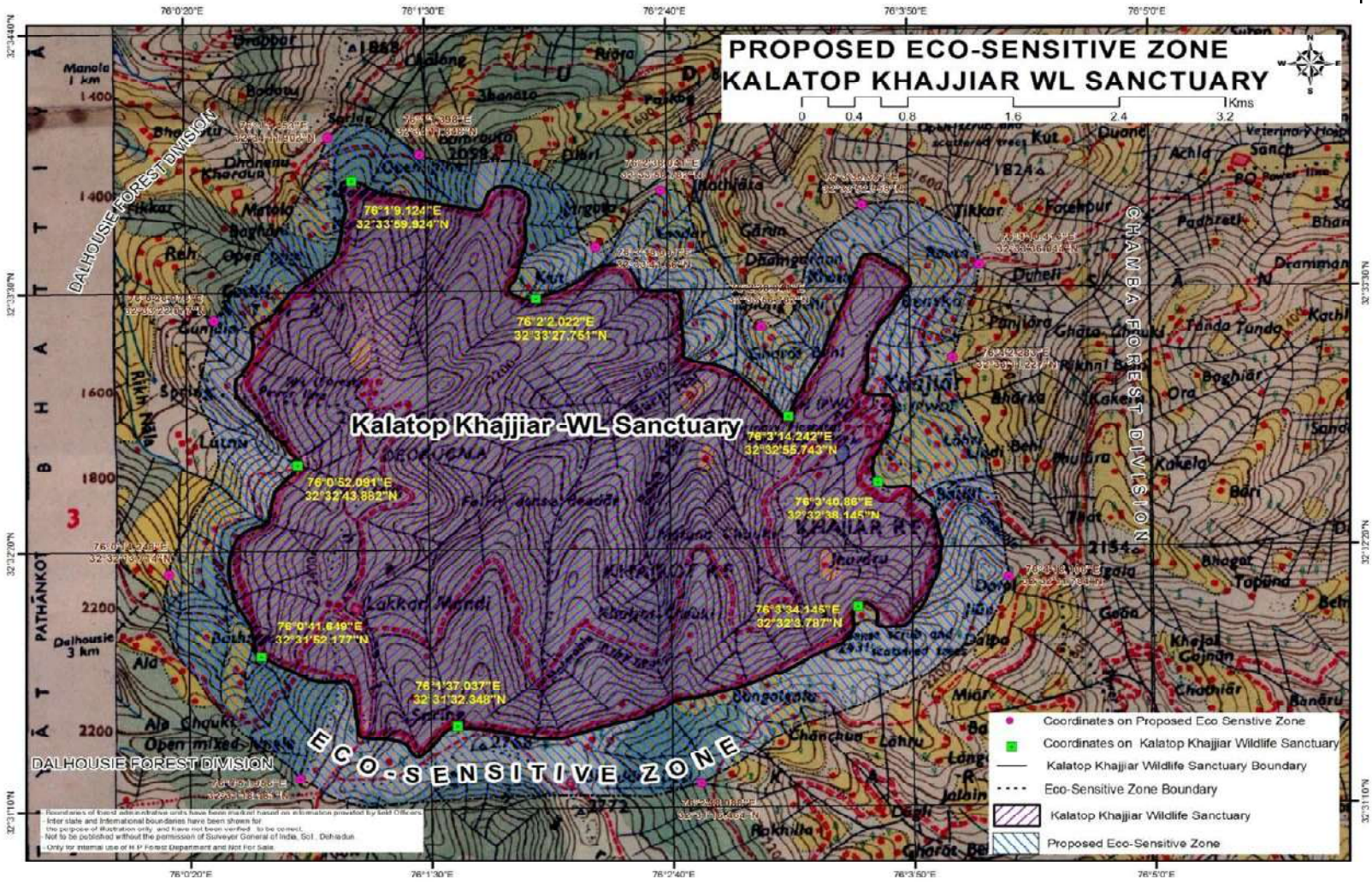
n) To do all other lawful things as may be incidental or conducive to the attainment of the above objects.

ANNEXURE-XVI

TENTATIVE APO OF KHAJJIAR KALATOP WILDLIFE SANCTUARY (2019-20 TO 2028-29)												
Sr. No.	**Item of Work**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	**2024-25**	**2025-26**	**2026-27**	**2027-28**	**2028-29**	**TOTAL**
		Rs. In Lac.	**Rs. In Lac.**	**Rs. In Lac.**	**Rs. In Lac.**	**Rs. In Lac.**	**Rs. In Lac.**	**Rs. In Lac.**	**Rs. In Lac.**	**Rs. In Lac.**	**Rs. In Lac.**	
A.I	**Infrastructure Development**	38.25	42.20	45.00	48.65	45.00	45.00	35.00	30.00	27.00	30.00	**386.10**
A.II	**Habitat improvement**	12.75	14.25	15.64	15.00	16.86	16.00	16.00	15.00	15.00	15.00	**151.50**
A.III	**Capacity Building/Training/ Research & Monitoring**	7.00	7.00	7.50	8.00	9.00	10.00	10.00	10.00	10.00	10.00	**88.50**
A.IV	**Wildlife Protection and Conservation Activities**	13.95	14.75	15.00	15.00	15.00	15.00	15.00	16.00	18.00	18.00	**155.70**
A. V	**Education and Awareness Generation**	4.00	4.25	4.75	5.00	5.50	6.00	7.00	8.00	9.00	8.00	**61.50**
A.VI	**Wildlife Tourism Management**	75.00	80.00	95.00	105.00	85.00	75.00	60.00	65.00	70.00	72.00	**782.00**
A.VII	**Field equipment**	5.50	7.25	8.00	8.50	9.25	8.00	8.00	8.00	8.00	8.00	**78.50**
A. VIII	**Office expenses**	1.00	1.50	1.75	2.00	2.00	2.00	2.00	2.50	2.50	2.50	**19.75**
A.IX	**Community Development through Participation**	2.50	2.75	3.00	3.25	3.50	3.50	3.50	4.00	4.00	4.00	**34.00**
A. X	**Human-wild animal Conflict**	6.50	6.50	6.50	6.50	6.75	6.75	6.00	6.00	6.00	6.00	**63.50**
A.XI	**Reclamation of Khajjiar Lake**	48.00	136.00	155.00	115.00	95.00	70.00	52.65	50.00	45.00	45.00	**811.65**
A.XII	**Operational Support**	1.75	2.50	3.25	3.50	3.50	3.50	3.50	3.00	3.00	3.00	**30.50**
	G.Total:-	**216.20**	**318.95**	**360.39**	**335.40**	**296.36**	**260.75**	**218.65**	**217.50**	**217.50**	**221.50**	**2663.20**

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

ANNEXURE-XVII

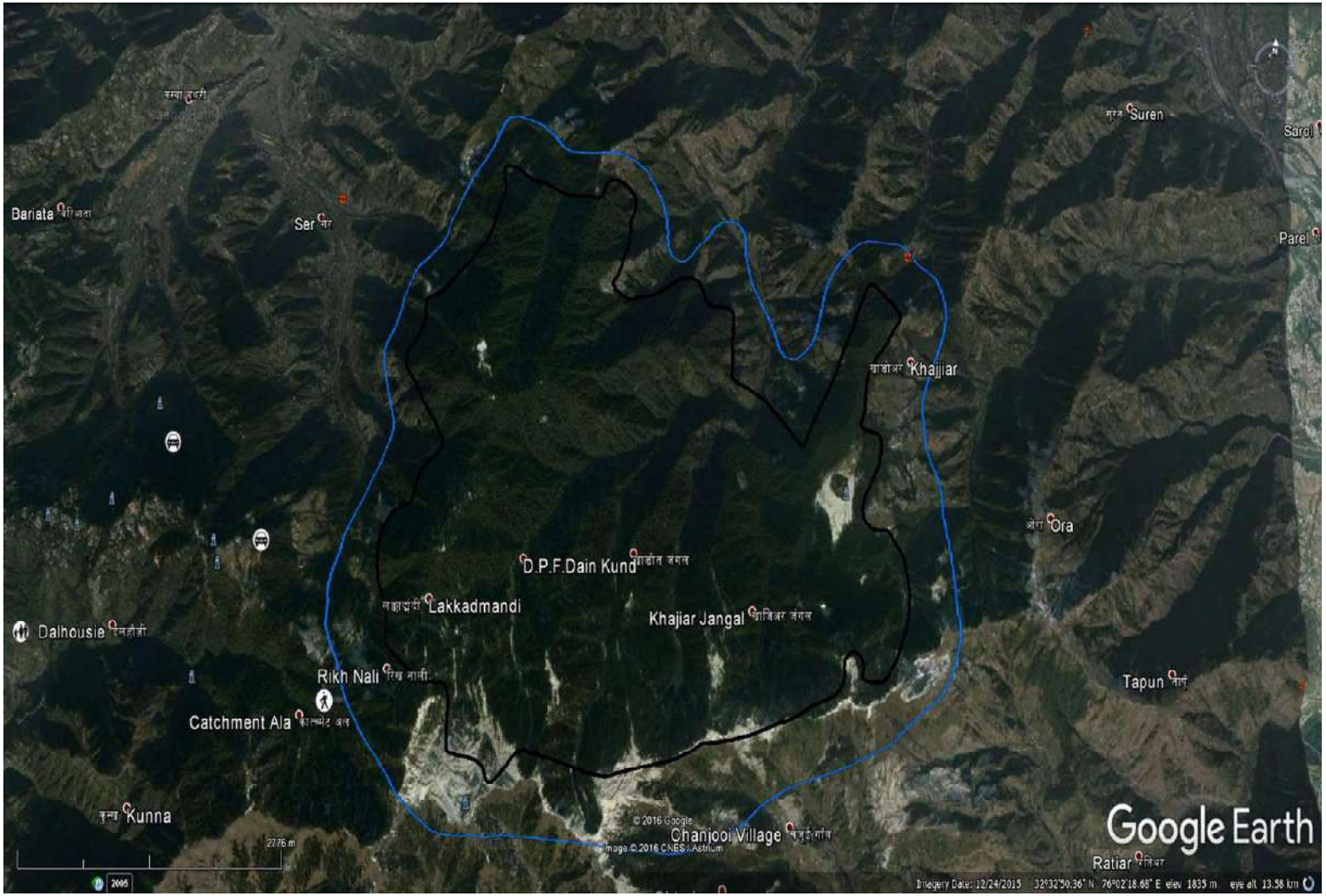


Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

ANNEXURE-XVIII

GOOGLE MAP OF KALATOP KHAJJIAR WILDLIFE SANCTUARY



Government of Himachal Pradesh
Forest Department

No. FFE-B-A (10)-1/2009 18 Dated Shimla-2, the

Notification

In supersession of all previous Notification Nos. Fts (F)6-7/82-Loose, Fts-B(B)-6-7/82-II, FFE-B-A(10)-2005 and FFE.B-A(10)-1/2009 dated 09.04.1996, 27.08.2001, 20.07.2006 and 04.03.2014 regarding relief due to losses caused to human beings and domestic livestock by the Wild animals as defined in Wildlife (Protection) Act, 1972, the Governor, Himachal Pradesh is pleased to notify the following enhanced relief rates as under:-

S.No	Particulars	Enhanced Rates (in Rupees)
1.	In case of death of human being.	4,00,000/-
2.	In case of permanent disability to human being.	2,00,000/-
3.	In case of grievous injuries/partial disability to human being.	75,000/-
4.	In case of simple injury to human being as per actual cost of medical treatment subject to maximum.	15,000/-
5.	In case of loss of Horse, Mule, Buffalo, Ox, Yak and Camel	30,000/-
6.	In case of loss of Cow Jersey and cross breed.	15,000/-
7.	In case of loss of Cow (local breed), Donkey, Churu, Churi & Pashmina Goat.	6,000/-
8.	In case of loss of Sheep, Goat and Pig.	3,000/-
9.	In case of loss of young ones of Buffalo, Cow Jersey and all other breeds, Mule, Yak, Horse, Camel, Churu, Churi, Donkey, Pashimna Goat, Sheep and Goat.	15,00/-

The following guidelines will be followed for grant of relief:-

i) Production of postmortem report in case of loss of human life, certificate in case of grievous injury, partial & permanent disability and prescription slip as well as verification of actual cost of Medical treatment in case of simple injury (including Monkey bites) from the Medical officer of a Government Institution/Govt. recognized Medical Institution, as the case may be.

ii) The verification of loss of cattle that was actually caused by wild animal can be done by the Pradhan/Up Pradhan of Panchayat/Patwari/President Notified Area Committee/ Chairman, Municipal Committee, Commissioner/ Mayor/Deputy Mayor, Municipal Corporation of the area/Elected Member of the Cantonment Board area/Councilor of the area, Range Officer/Deputy Ranger/Forest Guard or any other forest officer higher in rank than a Range Officer, Veterinary Officer or Veterinary Pharmacist or officer authorized by Veterinary officer of the area.

iii) All DFOs in HP shall be the final authority to sanction all cases of relief claims on account of losses caused by the wild animals to humans and domestic livestock.

iv) The DFOs shall release 25% of the amount of relief prescribed for human loss/permanent & partial disability/grievous injury on receipt of report as interim relief immediately to the family of the deceased/affected person after due

verification in anticipation of formal sanction without delay. The balance amount will be released after receipt of the complete relief claim.

v) For immediate disbursement of relief claim, a corpus fund will be created at the level of Principal Chief Conservator of Forests (Wildlife)-cum Chief Wildlife Warden. All the budget allocations from the state as well as from State CAMPA in respect of relief shall be deposited in the aforesaid corpus fund. The PCCF (WL) will ensure the disbursement of relief amount in respect of aforesaid categories of losses on the same day on receipt of a request from the concerned DFO. The DFO concerned will ensure to send such requests by E-mail/ Fax asking for funds of relief amount on the same day of incident or on the day of receipt of information of the incident from the claimant. DFO will make payment of aforesaid 25% of the relief amount immediately from the budget available with him under any scheme and same will be recouped on receipt of funds from the Chief Wildlife Warden.

vi) All claims in respect of simple injury to humans shall be restricted to actual cost of medical treatment verified by the Medical Officer of a Government Institution/Govt. recognized Medical Institution subject to maximum of Rupees 15,000/- as prescribed above in the categories of losses.

vii) All cases of losses caused by the wild animals should be reported by the applicant to the nearest Forest Office within seven days of the incident and claims for relief is filed within one month to the nearest Range Forest Office under control of Divisional Forest Officer (territorial or wildlife). The claim can be filed either at the place where the loss by wild animal has occurred/reported or where the applicant resides. All time barred cases shall be sent to Govt. of Himachal Pradesh for approval.

viii) The relief will be granted in case of loss of livestock to the owner of the livestock. These rates would be applicable for killing of domestic animals by wild animals as defined in Wildlife (Protection) Act, 1972 in cattlesheds/cowsheds, private land, private premises and forests.

ix) The relief in case of loss of the human being will be granted in the order of preference given below:-

(a) Wife or husband, as the case may be.
(b) Sons, unmarried or divorced daughters and children of predeceased son (equal share).
(c) Daughters. (equal share).
(d) Grand Children being children of his/her sons or daughters who died before him/her (equal share).
(e) Father or Mother.
(f) Brothers or sisters or children of the deceased brothers (equal share).
(g) Failing all above any other next of kin entitled to a share in the estate.

x) All the prescribed rates shall be made applicable with immediate effect.

By Order,

Tarun Kapoor
Additional Chief Secretary (Forests) to the Government of Himachal Pradesh

Endst. No. As above Dated Shimla-2 the 18 August, 2018

Copy forwarded to the following for information and necessary action:-

1. All the Additional Chief Secretaries/ Principal Secretaries /Secretaries to the Government of Himachal Pradesh.
2. All the Heads of Departments in Himachal Pradesh.
3. All the Deputy Commissioners in Himachal Pradesh.
4. The Principal Chief Conservator of Forests, (HoFF) HP Shimla-1.
5. The Principal Chief Conservator of Forests, (Wildlife) HP Shimla-1.
6. APCCFs (IT), CCFs/DFOs (Territorial & Wildlife).
7. Controller, HP Printing Press, Shimla for publication in H.P., Rajpatra.
8. Guard file.

(Sat Pal Dhiman)
Joint Secretary (Forests) to the
Government of Himachal Pradesh
Ph.No. 0177-2621874

Endst. No. WL/Compensation Rates/ WLM/ 3846-99 dated/ 25-07-2018

Copy is forwarded to all CCFs/CFs/DFOs (Territorial) and (Wildlife) in H.P. for information and necessary action please.

Chief Conservator of Forests (Wildlife)
O/o Principal Chief Conservator of Forests (Wildlife)
-cum-Chief Wildlife Warden, HP Shimla-171001

24/9/18

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BIRD SPECIES COMPOSITION ALONG THE ALTITUDINAL GRADIENT IN HIMACHAL PRADESH (WESTERN HIMALAYA), INDIA

M. L. Thakur*
Department of Biosciences, Himachal Pradesh University, Shimla-5 (HP), India
*Present address: Himachal Pradesh State Biodiversity Board, Department of Environment, Science and Technology, Shimla-2

ABSTRACT
Quantification of bird species composition along an elevational gradient in the western Himalayan region of Himachal Pradesh revealed that of a total of 322 species recorded during present investigations, maximum avifauna was observed in Pong Wetland (73.60% of the total), followed by Balh valley (59.32%) and Nalagarh areas (51.86%) of the Shiwalik zone, whereas, minimum diversity was seen in Kaza area (19.25%) of Trans-Himalayan region. Change in bird species composition along altitudinal gradient showed that there was a decrease in their diversity with increase in elevation. The avifaunal investigations further revealed a turnover of 93.48% from lower most to highest zone along the elevational gradient. Analysis of residential status showed that there was an overall decreasing trend in percentage of resident birds between localities along the altitudinal gradient. Moreover, it was very interesting to note that there was a significant increase in the percent composition of summer visitors from 7% in Pong Wetland to 68% in Kaza area. The explorations showed that there was a decrease in percentage of very common species across the Himalaya. However, percentage of uncommon showed an opposite trend. It increased from around 11% in Nalagarh (Shiwalik zone) to 32% in Kaza area (Trans-Himalayan zone).

KEYWORDS: Birds, change, altitudinal gradient, Himachal Pradesh, western Himalaya

INTRODUCTION

Historical influx of fauna from adjacent biogeographical regions and subsequent speciation in relation to local environment has greatly enriched the animal resources of the Himalayan region. There is a pronounced dominance of Palaearctic and endemic animals above timber line (3000 m), and largely Oriental and some Palaearctic and some Ethiopian elements at lower and middle altitudes (Mehta & Julka 2002). Bird communities separated by 1000 m altitude are different from one other mainly due to change in precipitation (Price *et al.,* 2003). Richness of bird diversity has been correlated with topography, precipitation and an interaction between topography and latitude (Rabhek & Graves 2001). One of the most general features of life on earth is changes of abundance and diversity of organisms along the earth's major environmental gradients, including elevation (Brown 2001). Most studies about change of bird species richness along elevational gradients have been carried out in different parts of the world mostly in tropical regions (Terborgh 1971, 1977; Navarro 1992; Blake & Loiselle 2000; Lee *et al.,* 2004; Herzog *et al.,* 2005; Paulsch & Muller-Hohenstein 2008) and a few studies have been undertaken in temperate zones (Rabhek 1995; Sergio & Pedrini 2007). In contradiction, studies on elevational changes of birds in Indian subcontinent are limited to a few studies (Price *et al.,* 2003; Raman *et al.,* 2005). Therefore, present study was designed to quantify avifaunal changes along an elevational gradient in the little explored western Himalayan region of Himachal Pradesh.

METHODOLOGY

Study area

Himachal Pradesh is mainly a hilly state of the Indian Himalayas lying between 30° 22' to 33° 12' North latitude and 75° 47' to 79° 04' East longitude. The physiography of this state is almost mountainous with elevations ranging from 350 to 6500 metres above mean sea level and total area of the state is 55,673 sq km. This hilly state is also divided by a general increase in elevation from west to east and from south to north into four biogeographical zones *viz.*, Shiwalik or Outer Himalayas, Lower or Lesser Himalayas, Higher or Greater Himalayas and Trans Himalayas. The Shiwalik ranges are the southern-most zone of about 40 to 60 km width, comprising several highly eroded low ridges. A zone of medium to high ranges (about 80 km wide), the Lesser Himalaya runs north of the Shiwalik and parallel to the main range. The Great Himalayan ranges lie just towards the north of the Chandrabhaga river in Lahaul-Spiti and Pangi regions of Himachal Pradesh. This range is nearly 24 km wide and comprises the great peaks rising up to an elevation of over 6000 metres amsl. Spiti area of the state constitutes a separate and distinct unit, *i.e.* Trans-Himalaya (Mehta & Julka 2002; Mahabal 2005; Mehta 2005).

Natural vegetation of the state is classified into six broad types of forests *viz.,* Tropical forests (confined to foothills), represented by two subtypes, namely thorn-scrub of *Acacia* and *Zizyphus,* and dry deciduous forests of *Shorea robusta;* Subtropical forests (500-1800 m), which are further composed of two subtypes *i.e.* subtropical dry evergreen forests of *Terminalia, Albizzia, Olea etc* (below

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

1200 m), and subtropical pine forests of chir pine (*Pinus roxburghii*) found upto 1800 m; Temperate forests (1500-3000 m) which are also divided into two subtypes *i.e.* Himalayan moist temperate covers areas between 1500 and 3000 m, where the flora is dominated by oaks (*Quercus* spp.), deodar (*Cedrus deodara*), fir (*Abies pindrow*), blue pine (*Pinus wallichiana*) and horse chestnut (*Aesculus indica*), and another is the Himalayan dry temperate subtype of Holm oak (*Quercus ilex*) and edible pine (*Pinus gerardiana*) which is best developed at 2000 to 3000 m in the greater Himalayan regions of upper Sutlej valley in Kinnaur district; and Sub-Alpine and Alpine vegetation (above 4000 m) which is dominated by birch and rhododendron and interspersed with high-altitude meadows, found in most parts of Lahaul, Spiti and Kinnaur districts of the state (Mehta 2005; Narwade *et al.* 2006). Present studies on change of bird species composition with altitude were conducted in different altitudinal zones of Himachal Pradesh on the following lines:

Site Selection

Present avian studies were conducted in seven selected study sites *viz.*, Nalagarh (350 m, Solan), Pong Wetland (430 m, Kangra), Balh Valley (800 m, Mandi), Dev Nagar (1530 m, Shimla), Shimla (2100 m, Shimla), Kalatop-Khajjiar (2300 m, Chamba) and Kaza (3500 m, Lahaul & Spiti) of Himachal Pradesh (Table I; Fig. I).

TABLE I: Sites of bird study in Himachal Pradesh

S.No.	Locality (District)	Latitude (North)	Longitude (East)	Altitude (Metre)	Biogeographic Zone
1.	Nalagarh (Solan)	31° 02′	76° 43′	350	Sub tropical (Shiwalik)
2.	Pong Wetland (Kangra)	31° 58′	75° 57′	430	Sub tropical (Shiwalik)
3.	Balh Valley (Mandi)	31° 35′	76° 54′	800	Sub tropical (Shiwalik)
4.	Dev Nagar (Shimla)	31° 09′	77° 05′	1530	Sub temperate, (Middle Himalaya)
5.	Shimla (Shimla)	31° 06′	77° 09′	2100	Temperate (Middle Himalaya)
6.	Kalatop-Khajjiar (Chamba)	32° 32′	76° 03′	2300	Temperate (Middle Himalaya)
7.	Kaza (Lahaul & Spiti)	32° 11′	78° 05′	3500	Cold desert (Trans Himalaya)

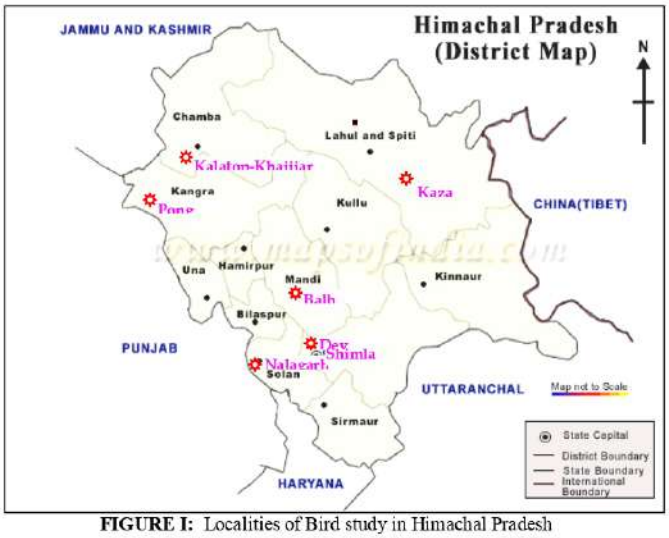

FIGURE I: Localities of Bird study in Himachal Pradesh
(Original source of map: www.mapsofindia.com)

These investigations were conducted during different seasons of the years 2002 to 2007 in various habitat types. Nalagarh site falls in the sub tropical zone of the Shiwalik hills and supports large scale agriculture with some scrub forest patches of *Acacia* spp., *Bauhinia variegata, Carissa opaca, Ficus reliogosa, Lantana* sp. etc., whereas, Pong

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

Wetland is a fresh water reservoir and has been declared as wetland of International Importance. This area has rugged ridges, forested glades and streams cutting through valleys and canyons. Forest patches of acacia and pines, marshes, agricultural fields and wasteland area are the main features of this area. Balh is a saucer shaped valley situated in the centre of Mandi district of Himachal Pradesh. The vegetation of the valley is subtropical type. It embraces agricultural land, a few forested patches and some fallow land. The area is drained by Suketi khud, which flows through middle of the valley alongwith a number of small seasonal and perennial streams. Besides, a few village ponds are also present in this valley. Dev Nagar is a small valley, surrounded by steep hills and falls in the middle Himalayan zone of Himachal Pradesh. The area supports sub-temperate type of forests of oak and rhododendron with few pine and deodar patches. Shimla, a hilly tract of temperate zone is situated in the lap of the northwest Himalayas and supports forests of deodar, pine, rhododendron, oak etc. The forest types vary with exposure and elevation. Moreover, this study site is one of the most populated zones of the state. Similarly, Kalatop-Khajjiar Wildlife Sanctuary in Chamba district of Himachal Pradesh harbors dense forests of deodar and oak, on a hilly tract. It is one of the oldest preserved forests in the state (notified on 01.07.1949). Geographically it is situated at the northwest termination of Dhauladhar range in the middle Himalayas. Khajjiar portion of the sanctuary is also known as mini Switzerland. However, Kaza area of Trans-Himalayan zone of the state has cold desert climate. Some of the forested and thorny patches of willow are found around villages only.

Sampling Strategies

Specific sampling strategies were adopted for studying the avifauna of various experimental sites as various localities selected were large enough and the target species were high in number. These strategies were mainly based upon the principle of exploration of a portion of the individuals in the whole population. Thus, Stratified Random Sampling Technique (Snedecore & Cochran 1993) was followed for studying the birds of each area, which involved the division of sites into different strata, based upon vegetation type and habitat.

Study design

Intensive studies conducted in selected sites were based on Line Transect Method (Burnham *et al.* 1980). Keeping in view the hilly and more rugged terrain of the state, Piecewise Linear Line Transects were marked and monitored on monthly basis in various study sites except the Kaza area which remains inaccessible during winter months. Further, these transects were monitored as open width transects, where birds were recorded irrespective of their distance from transect. Almost equal numbers of field days were spent in each locality so as get the data viable for comparison purposes. The birds were observed with the help of a 10x50 super Zenith field binoculars and 1000 mm Tele-lens of Questar make (especially water birds). Field identifications were carried out with the help of various field guides (Ali & Ripley 1983; Grimmett *et al.* 1999; Kazmierczak 2000).

Analysis and interpretation of avian data

The avian data generated in each survey and each transect run was recorded on separate data sheets for different seasons, habitat types, climatic zones etc. Each list was kept independent of other one. Besides diversity, the data was also analyzed for relative abundance of each bird species on a relative frequency scale of occurrence depending upon the number of sightings (Mc Kinnon &Philip 1993).

Total number of sheets taken for analysis of relative abundance for each intensive study site was equal to:

2 sheets (each habitat) x 3 (major seasons) x types of habitat

Based upon these, different categories assigned were: Very Common (recorded in more than 45 % of data sheets), Common (between 25-45 % of data sheets), Uncommon (between 10-24 % of data sheets) and Rare (recorded once or twice). The relative frequency scale was fixed in such a way so as to include the migrant species sighted seasonally in good numbers (which visited the area for a brief period of time) to their respective category. This method was modified from Narayan *et al.* (1986). Similarly, residential status was worked into various categories like resident, winter visitor, summer visitor etc. on the basis of the presence or absence method (Mc Kinnon & Philip 1993; Mehta *et al.*, 2002).

Primary data is available in the form of following publications: Thakur *et al.* (2002, 2003, 2006, 2008, 2011); Mattu and Thakur (2006); Thakur (2008); Thakur and Mattu (2011).

RESULTS

Intensive studies on avifauna conducted in seven selected study sites of Himachal Pradesh revealed the presence of 322 species of birds belonging to 190 genera, spread over 60 families and 17 orders. These included 167 species of birds spread over 121 genera, 51 families and 17 orders from Nalagarh area of Solan district; 237 species of birds belonging to 153 genera spread over 54 families and 17 orders from Pong Wetland, Kangra; 191 species of resident, winter migrant and summer visitor birds belonging to 129 genera spread over 47 families and 16 orders from Balh valley of Mandi; 143 species of birds spread over 98 genera, 39 families and 13 orders from Dev Nagar area of Shimla hills; 134 species of resident and migrant birds belonging to 92 genera spread over 36 families and 11 orders from Shimla area; 110 species of birds belonging to 77 genera, 33 families and 13 orders from Kalatop-Khajjiar Wildlife sanctuary, Chamba; 62 species of birds belonging to 43 genera, 20 families and 7 orders from Kaza area of Lahoul & Spiti district (Table II). Present studies showed that family Muscicapidae was the most dominant family in all the study sites, as it formed around 16% of the total avifauna in Nalagarh, 16.87% in Pong Dam Wetland, 27.75% in Balh Valley, 32.88% in Dev Nagar, 27.61% in Shimla, 25.45% in Kalatop-Khajjiar Wildlife Sanctuary and 17.74% in Kaza area. Overall percentage of this family in Himachal Pradesh was 17%. However, the contribution of families like Podicipedidae, Phalacrocoracidae, Anhingidae, Falconidae, Jacanidae, Recurvirostridae, Burhindae, Glariolidae, Caprimulgidae, Coraciidae, Upupidae,

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

Bucerotidae, Irenidae *etc*. in avifauna was below 2% in all the study sites. Studies on avifauna along the altitudinal gradient showed that there was a decrease in diversity with increase in elevation. For example, study sites of Pong Wetland (73.60%), Balh Valley (59.32%) and Nalagarh (51.86%) situated at lower altitudes had maximum bird diversity, whereas, study site of Kaza located at the highest elevation showed the minimum diversity (19.25%) of the state. However, other study sites of Dev Nagar, Shimla and Kalatop-Khajjiar area showed 44.41%, 41.61% and 34.16% of the diversity of birds respectively (Table II). Inter locality variations showed that there was an increase of 21.73% in diversity of birdlife between Nalagarh and Pong Wetland (Table II). However, there was an overall decreasing trend in diversity with increase in altitude and there was a decrease of 14.28% between Pong Wetland and Balh Valley, 14.90% between Balh Valley and Dev Nagar, 2.79% between Dev Nagar and Shimla, 7.45% between Shimla and Kalatop-Khajjiar, and 14.90% between Kalatop-Khajjiar and Kaza area. From these studies it appeared that there is a negative change with increase in altitude, with regards to the number of species (Table II).

TABLE II: Bird species composition in different study sites

Locality (District)	Species (Genera, Families, Orders)	Relative Abundance	Residential Status						
			R	R/LM	WV	SV	R/WV	R/SV	Total
Nalagarh (Solan)	167 (121, 51, 17)	VC	13	48	14	7	8	0	90
		C	9	20	14	6	3	0	52
		UC	4	3	10	1	0	1	19
		Ra	2	3	1	0	0	0	6
		Total	28	74	39	14	11	1	167
Pong Wetland (Kangra)	237 (153, 54, 17)	VC	14	56	36	8	11	0	125
		C	11	20	24	7	3	0	65
		UC	4	6	16	1	1	1	29
		Ra	5	4	8	1	0	0	18
		Total	34	86	84	17	15	1	237
Balh Valley (Mandi)	191 (129, 47, 16)	VC	6	37	11	7	5	7	73
		C	10	17	27	20	5	2	81
		UC	6	9	10	6	2	1	34
		Ra	1	1	1	0	0	0	3
		Total	23	64	49	33	12	10	191
Dev Nagar (Shimla)	143 (98, 39, 13)	VC	5	28	1	4	6	4	48
		C	5	27	9	16	4	6	67
		UC	1	7	6	8	1	1	24
		Ra	1	2	0	1	0	0	4
		Total	12	64	16	29	11	11	143
Shimla (Shimla)	134 (92, 36, 11)	VC	3	21	1	3	0	6	34
		C	3	22	2	12	3	6	48
		UC	3	18	4	13	3	7	48
		Ra	1	3	0	0	0	0	4
		Total	10	64	7	28	6	19	134
Kalatop-Khajjiar (Chamba)	110 (77, 33, 13)	VC	1	19	0	2	0	4	26
		C	6	23	2	12	0	8	51
		UC	3	13	2	10	0	4	32
		Ra	0	0	1	0	0	0	1
		Total	10	55	5	24	0	16	110
Kaza (Lahaul & Spiti)	62 (43, 20, 7)	VC	0	7	0	7	0	1	15
		C	1	7	0	14	0	3	25
		UC	0	1	0	19	0	0	20
		Ra	0	0	0	2	0	0	2
		Total	1	15	0	42	0	4	62

Residential status: R= Resident, R/LM= Resident with local movements, R/WV= Resident, with winter influx, R/SV= Resident with summer influx, WV= Winter visitor, SV= Summer visitor

Relative abundance: VC= Very common, C= Common, UC= Uncommon, Ra= Rare

The avifaunal investigations further revealed a turnover of 93.48% from lower most to highest zone along the elevational gradient, as only 6.52% (21) of the species in Nalagarh area were also found in Kaza area, whereas, a majority i.e. 93.48% (301 species) do not extend their distribution range from Shiwalik to Trans-Himalayan region. An insight on the qualitative analysis of the bird diversity of the localities separated by elevational gradient revealed that the species present in one locality were replaced by the others. The study showed that 80 species

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

present in Pong Wetland were not found in Balh Valley, whereas, there was an addition of 34 new species in the diversity of Balh Valley. Similarly, 71 species found in Balh Valley were absent in Dev Nagar and an addition of 23 new species was found between the two areas. The study further revealed that on moving from Dev Nagar to Shimla area, there was an addition of 27 new species in place of 36 species. Moreover, there was deletion of 36 species and an addition of 12 new one's between Shimla and Kalatop-Khajjiar Wildlife Sanctuary. Further, on comparison of quality of bird diversity of Kalatop-Khajjiar and Kaza areas it was found that there were 80 such species which were present in the former area and absent from the later, and an additional 32 new species were added in Kaza area. Analysis of residential status showed that there was an overall decreasing trend in percentage of resident birds between localities along the altitudinal gradient. It varied from 16.2 % in Nalagarh to 2% in Kaza area. Similarly, an overall decreasing trend in percentage of winter visitors was also observed between different study sites. Moreover, it was very interesting to note that there was a significant increase in the percentage composition of summer visitors from 7% in Pong Wetland to 68% in Kaza area. Similarly, percentage of species with summer influx also showed an overall increasing trend along the altitudinal gradient. However, there was no regular inclination in composition of local migrant and the species with winter influx (Table II; Fig. II).

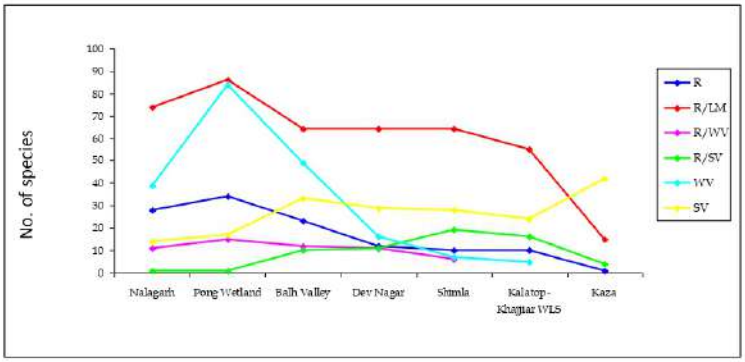

FIGURE II: Drift in residential status of birds in different study sites

The explorations showed that there was a decrease in the percentage of very common species across the Himalaya. It decreased from around 54% in Nalagarh to 24% in Kaza area. However, percentage of uncommon species of birds showed an opposite trend. It increased from around 11% in Nalagarh to 32% in Kaza area. Moreover, there was no regular increasing or decreasing tendency in percentage of common and rare bird species along the altitudinal gradient (Table II; Fig. III).

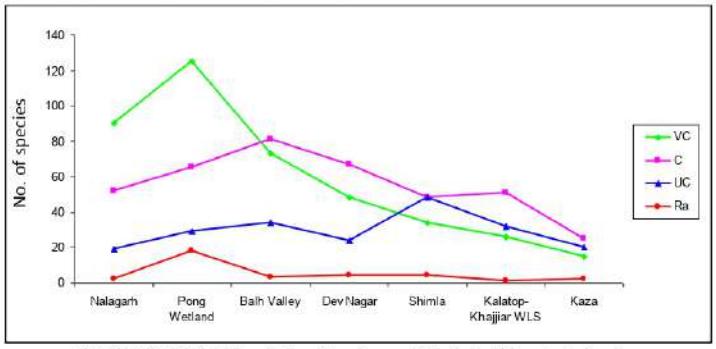

FIGURE III: Drift in relative abundance of birds in different study sites

DISCUSSION

Present investigation in overall sense reveals the presence of a continuously decreasing diversity type of pattern with increasing altitude (Sergio & Pedrini 2007). There is a close relationship between species richness and changing habitat complexity. This habitat complexity has been attributed to the decreasing height of woody vegetation, and differences of tree density and plant species richness between elevation belts (Rabhek 1995). Similar vegetation stratification is found in different zones of Himachal Pradesh (Narwade *et al.* 2006; Gaston 1995). Present account in a strict sense points towards hump-shaped

distributions of species richness with elevation (Rabhek 1995). Maximum values of precipitation, soil moisture and evapotranspiration at mid-elevation (Ding *et al.* 2005; Rabhek 2005; Lomolino *et al.* 2006) zones can be correlated with the presence of 59.32% of the total bird diversity in mid altitude area of Balh Valley as compared to 51.86% in Nalagarh (low altitude area). The hump-shaped distribution of species richness in the present case mainly arises due the presence of varied types of habitats in Pong Wetland which besides a number of winter visitors form north-central Asia, supports a number of resident and local migrant species due to the presence of marshes, agriculture fields, rugged ridges, forested glades and streams cutting through valleys and canyons.

Decrease in bird diversity from 167 species in Nalagarh to 62 species in Kaza area of Lahoul & Spiti can be explained with earlier work of Brown and Lomolino (1998) who emphasized that lower elevational zones as compared to higher altitudes usually have greater total amount of resources and population numbers, more refugia and space for species with larger home ranges, greater habitat diversity and greater potential for serving as target for potential immigrants. Moreover, earlier explorations (Gaston *et al.* 1993; Gaston 1995; Mahabal 2005) have also shown that the birdlife of two different altitudes are different from each other in Himachal Pradesh. A recent study showed that maximum number of bird species (313) were present in Kangra district and diversity decreased to 40 species in Kinnaur district of Himachal Pradesh therefore showing an overall decreasing trend in number of species with increase in altitude (Mahabal 2005). Similarly, maximum diversity (101 species) of birds was recorded in lowest zone of Kangra district of Himachal Pradesh (Mahabal & Sharma 1992). High turnover of 93.48% has been recorded during present study from lower most (350 m) to highest zone (3500 m) along the elevational gradient. This can be correlated with change in precipitation due to which the bird communities separated by 1000 m altitude in Himalayas are different from one other (Price *et al.* 2003). The bird diversity of South America has been correlated with topography, precipitation and an interaction between topography and latitude (Rabhek & Graves 2001).Predominance of resident and winter visitors in the lower areas of Himachal Pradesh, and increasing percentage of summer visitors and seasonal altitudinal migrants with altitude can be attributed to the abundance of feeding guilds which ultimately depends on habitat structure (Brunner 1998, 2001). The habitat structure in the present study area of Himachal Pradesh changes from sub-tropical type at lower elevations to dwarf alpine types at the highest zones (Narwade *et al.* 2006) which may influence species richness and composition by significantly affecting the abundance of feeding guilds.

Present study is in accordance with the earlier works of Mahabal (2005) who in his study on the birdlife of Himachal Pradesh observed that resident birds and winter visitors were predominantly observed in the Shiwalik Himalaya and showed subsequent decrease with corresponding increase in the altitude. However, percentage of summer visitors and seasonal altitudinal migrants was found to be in increasing order from Shiwalik to Trans-Himalayan region. Similarly, Gaston (1995) elucidated that in addition to the resident birds, Shiwalik Himalaya receives a flood of winter visitors from the adjacent high ranges and north and central Asia.

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Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

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Preliminary ecological studies on the Lepidoptera from Khajjiar lake catchment, Himachal Pradesh, India

Vikram Singh* & Harjeet Singh Banyal

Department of Biosciences, Himachal Pradesh University, Shimla -171005 (HP), India
*Corresponding author: proliterate@yahoo.com

ABSTRACT A study on the Lepidoptera from Khajjiar lake of District Chamba of Himachal Pradesh revealed the presence of 49 species of butterflies belonging to 41 genera and 10 families. Analysis of data revealed that family Nymphalidae and Satyridae (12 species each) dominated the Lepidoptera fauna of Khajjiar lake catchment, followed by Pieridae and Lycaenidae (6 species each), Hesperiidae (4 species), Papilionidae (3 species), Erycinidae and Danaidae (2 species each), and Acraeidae and Riodinidae (1 species each). Categorization of the species further revealed that of these 49 species, 5 were very common, 32 common, 5 uncommon and 7 were rare. Moreover, 3 species were listed in Indian Wildlife Protection Act (1972), *Lethe scanda* (Moore, 1857) and *Lampides boeticus* (Linnaeus, 1767) placed under scheduled II and *Castalius rosimon* (Fabricius, 1775) under scheduled IV of the Act. Our study revealed that forest area supports the highest diversity of butterflies followed by lake areas and human settlements.

KEY WORDS Butterflies; ecology; biodiversity; India.

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INTRODUCTION

A recent estimate shows the occurrence of about 142,500 species of Lepidoptera around the globe, but estimates within Lepidoptera from the Indian sub-continent revealed that the group comprises over 15,000 species and many more subspecies distributed over 84 families and 18 superfamilies (Alfred et al., 1998). In India nearly 1500 species of butterflies are reported (Gay et al., 1992). Many scientists have studied the butterflies from Himalayas including Moore (1882), Marshall & de Niceville (1890), Evans (1932), Talbot (1939; 1947), Wynter-Blyth (1940; 1945a, b; 1957), Mani (1986) and Thakur et al. (2002; 2006). Arora et al. (2005) listed 288 species from the recently created state of Himachal Pradesh distributed in 12 districts with altitudes ranging from 400-4500 m. However very few studies are there on the ecological aspects of the butterflies in Himachal Pradesh. Apart from Thakur et al. (2006) who have listed butterflies of Kalatop-Khajjiar wildlife sanctuary, there is little information about butterflies from Chamba district. However recently Singh & Banyal (2013) enlisted butterflies of Khajjiar along with insect fauna. But that work was focused only on presenting a checklist of insects and did not account the ecological aspects of butterflies. The area under investigation is one of the oldest conservation areas for wildlife in Himachal Pradesh and, being a favoured tourist destination, is also under remarkable anthropological pressure which may severely influence habitat conservation and egg laying habits of butterflies. Keeping this in mind we explored Khajjiar Lake to

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

assess ecological aspects of butterflies such as abundance, seasonal occurrence, habitat preference and conservation status. Besides, an effort was also made to identify the existing threats to the habitat of butterflies in the study area.

MATERIAL AND METHODS

Study Area. Khajjiar Lake "The Mini Switzerland of Himachal Pradesh" is situated in the western part of Chamba district of Himachal Pradesh. Khajjiar Lake lies 32°32′ North and 76°03′East about 1920 m above sea level between Chamba and Dalhousie (Fig. 1). The average depth of this lake is stated to be thirteen feet as per district gazetteer (Singh & Banyal, 2012). Khajjiar Lake has a clump of reeds and grasses exaggeratedly called an island in it. This lake is placed in the centre of large glade and is fed by slim streams. This glade is greenish in its turf and contains in its centre a small lake having an approximate area of 464.52 square meters. Khajjiar Lake has thick forest of Kala Top sanctuary (20.69 sq. km) surrounding the green grass. This small sanctuary lies in the catchments of the Ravi river, located in the western part of Chamba District. It is one of the oldest preserved forests of the state (notified on 01.07.1949). There is a 'golden' domed temple at the edge of this meadow, dedicated to the deity 'Khajjinag', from whom the area derives its name (Fig. 2). It experiences south-western monsoon rains in July-September and the average annual rainfall is about 800 mm. The climate of Khajjiar, summers being mild and winters cold and bitter, shows a temperature range from -10° C to 35°C. The vegetation consists of mature mixed Blue Pine (*Pinus wallichiana* A. B. Jacks.) and Deodar cedar forests (*Cedrus deodara* (Roxb.) G. Don), with some Green Oak and *Rhododendron* plants. Study area was broadly divided into three main types depending upon the vegetation and human intervention like dense forests, lake meadow and human settlements. Different butterfly species were sampled at regular intervals from all three localities.

Sampling of butterflies. Butterflies were sampled using the line transect walk method (Pollard &

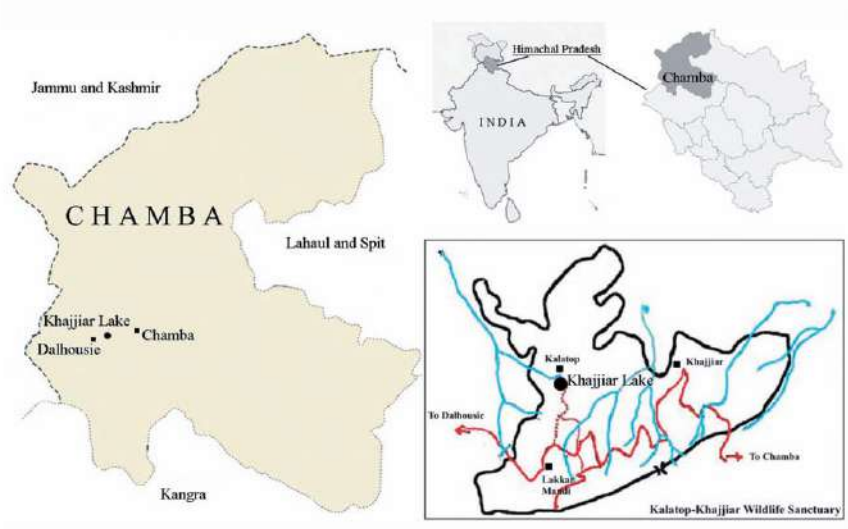

Figure 1. Study area: Khajjiar Lake, in the western part of Chamba district of Himachal Pradesh (India).

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

Yates, 1993). Six transects measuring 500 m each, were randomly laid for sampling (two in each site). Point counts were made after interval of 200 meters along each transect to record butterfly species and their number. All butterflies seen within two meters on either side of the transect were recorded. Transects were walked between 10:00 hrs and 13:00 hrs which corresponds to the peak activity period for most butterflies. Nylon net with long handle was used for sweeping free flying and free living butterflies. After collection specimens were put into killing bottles containing chloroform. These insects were transferred to paper envelops. Each envelop was numbered carefully and the details of specimen number, date, host etc. were written in a field notebook. Thereafter, insects were properly stretched and pinned by rust-free entomological pins. These stretched and pinned specimens were kept in wooden insect boxes in dry conditions providing naphthalene balls (Arora, 1990) to protect them from fungal infections and other attacks.

Butterfly Identification. Identification of species was done from description given by Marshall & de Niceville (1890), Evans (1932), Wynter-Blyth (1957). Some species were identified after comparison with reference collections housed at Indian Agriculture Research Institute (I.A.R.I.), New Delhi; High Altitude Regional Centre, Zoological Survey of India, Saproon, Solan; Himachal Pradesh and Forest Research Institute (F.R.I.), Dehradun. Dr. M.S. Thakur of Department of Biosciences, Himachal Pradesh University, Shimla was also consulted for authentication of identification.

Data analysis. Abundance status was assessed on an arbitrary frequency scale as: very common (VC), collected more than in eight spots from the three areas; common (C), collected from four to seven spots from the three areas; uncommon (UC), collected from two or three spots from the three areas; rare (Ra), collected from one spot from the three areas, according to Davidar et al. (1996).

RESULTS

Present study revealed the presence of 49 species of butterflies belonging to 41 genera and 10 families (Table 1). Analysis of data revealed that family Nymphalidae and Satyridae (12 species each) dominated the Lepidoptera fauna of Khajjiar area, followed by Pieridae and Lycaenidae (6 species each), Hesperiidae (4 species), Papilionidae (3 species), Erycinidae and Danaidae (2 species each), and Acraeidae and Riodinidae (1 species each) (Fig. 2). Analysis of these species for abundance revealed that of these 49 species, 5 were very common, 32 common, 5 uncommon and 7, namely *Parnassius hardkwickei hardwickei*, *Lethe insane insane*, *Lethe scanda*, *Ypthima ceylonica hubneri*, *Pseudergolis wedah*, *Issoria lathonia*, *Polytrema eltola*, were rare (Fig. 3). Moreover, three species were placed under Wildlife Protection Act (1972). These included *Lethe scanda* and *Lampides boeticus* placed under scheduled II and *Castalius rosimon* under scheduled IV of the Act.

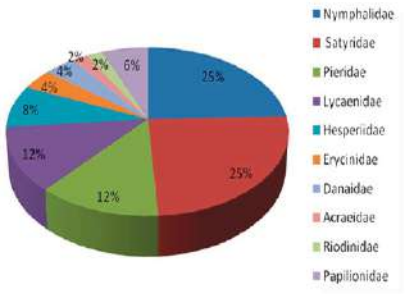

Figure 2. Lepidoptera diversity of the Khajjiar Lake,India.

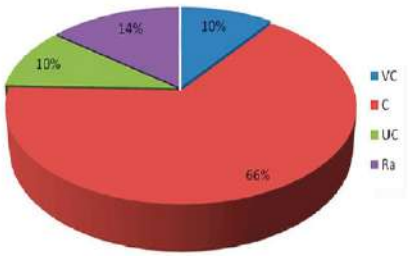

Figure 3. Lepidoptera abundance of the Khajjiar Lake, India; explanation in the text.

N.	Name of Butterfly	Family	Wing Size (in mm)	Conservation Status	Months of Dominance from-to
1	*Papilio protenor* Cramer, 1775	Papilionidae	100- 130	Common	March-September
2	*Papilio polyctor polyctor* Boisduval, 1836		90-130	Common	March-October
3	*Parnassius hardkwicket hardwicket* Gray, 1831		50-65	Rare	May-September
4	*Delias belladonna horsfieldi* (Gray, 1831)	Pieridae	70-96	Uncommon	April-July September-November
5	*Pieris canidia indica* Evans, 1926		45-55	Common	April-October
6	*Catopsilia crocale* Cramer, 1775		55-75	Common	May-October
7	*Gonepteryx rhamni nepalensis* Doubleday, 1847		60-70	Common	March-October
8	*Eurema hecabe fimbriata* (Wallace, 1867)		30-40	Common	April-November
9	*Colias electo fieldi* Menetries, 1885		42-45	Very common	February-November
10	*Danaus genutia* (Cramer, 1779)	Danaidae	70-78	Common	March-November
11	*Parantica sita sita* (Kollar, 1844)		85-105	Common	April-November
12	*Mycalesis perseus blasius* (Fabricius, 1798)	Satyridae	38-55	Very common	March-November
13	*Lethe insane insane* (Kollar, 1844)		55-60	Rare	May-October
14	*Lethe scanda** (Moore, 1857)		55-65	Rare	June-September
15	*Lethe verma verma* (Kollar, 1844)		55-60	Common	April-October
16	*Lasiommata schakra schakra* (Kollar, 1844)		45-60	Common	Apri-October
17	*Aulocera swaha swaha* (Kollar, 1844)		60-75	Common	May-September
18	*Aulocera saraswati saraswati* (Kollar, 1844)		60-75	Common	July-October
19	*Callerebia annada* (Moore, [1858])		55-70	Common	April-October
20	*Ypthima nareda nareda* (Kollar, 1844)		30-32	Common	April-October
21	*Ypthima ceylonica hubneri* Kirby, 1871		30-40	Rare	April-October
22	*Ypthima sakra nikaea* Moore, 1875		45-55	Very common	March-November
23	*Melanitis leda ismene* (Cramer, [1775])		60-80	Very common	March-November
24	*Athyma opalina* (Kollar, [1844])	Nymphalidae	55-70	Common	March-November
25	*Parathyma asura asura* (Moore, 1857)		65-75	Uncommon	July-August

Table 1. Check list and ecological data of the Lepidoptera from Khajjiar Lake, India (continued).

N.	Name of Butterfly	Family	Wing Size (in mm)	Conservation Status	Months of Dominance from-to
26	*Neptis mahendra* Moore, 1872		55-60	Common	April-October
27	*Neptis hylas astola* Moore, 1872		50-60	Common	March-October
28	*Pseudergolis wedah* Kollar, 1844		55-65	Rare	April-November
29	*Precis iphita* (Cramer , [1779])		55-65	Uncommon	Jan-December
30	*Cynthia cardui* (Linnaeus, 1758)		55-70	Common	April-November
31	*Vanessa indica* (Herbst, 1794))		55-65	Common	March-December
32	*Kaniska canace* (Linnaeus, 1763)		60-75	Uncommon	March-November
33	*Aglais cashmirensis* (Kollar, 1844)		55-65	Common	March-November
34	*Childrena childreni* (Gray, 1831)		75-100	Common	May-November
35	*Issoria lathonia* (Linnaeus, 1758)		55-60-78	Rare	February-October
36	*Acraea issoria anomala* Kollar, 1848	Acraeidae	45-65	Common	April-September
37	*Libythea myrrha* Godart, 1819	Erycinidae	45-55	Common	March-October
38	*Libythea lepita* (Moore, 1857)		55-60	Common	March-September
39	*Dodona durga* (Kollar, 1844)	Riodinidae	30-40	Common	March-October
40	*Pseudozizeeria maha* (Kollar, [1844])	Lycaenidae	20-30	Common	January-November
41	*Lampides boeticus** (Linnaeus, 1767)		24-36	Common	March-October
42	*Lycaena pavana* (Kollar, [1844])		37-40	Common	March-October
43	*Heliophorus sena* (Kollar, [1844])		28-33	Very common	March-October
44	*Castalius rosimon*** (Fabricius, 1775)		25-27	Common	January-November
45	*Rapala manea schistacea* (Moore, 1879)		30-33	Common	June-October
46	*Coladenia dan* (Fabricius, 1787)	Hesperiidae	35-45	Common	May-October
47	*Sarangesa purendra* (Moore, 1882)		28	Uncommon	May-June
48	*Polytremis eltola* (Hewitson, 1869)		32	Rare	March-November
49	*Borbo bevani* (Moore, 1878)		30	Uncommon	April-October

Table 1 (continued). Check list and ecological data of the Lepidoptera from Khajjiar Lake, India.

Maximum richness was observed in the forest area which is rich of trees with well developed undergrowth. Minimum richness was present in the human settlement of the study area which is a degraded habitat where continuous intervention of humans generated severe pollution. Intermediate values of species richness were observed in the lake meadow area.

DISCUSSION AND CONCLUSIONS

Khajjiar lake catchment, which is an important conserved area of Himalayas, supports a rich fauna of butterflies with 49 species. These records are in accordance with the previous study of Arora et al. (2005) who also recorded some butterfly species of conservation concern from the state of Himachal Pradesh. Similar studies were also conducted by Mehta et al. (2002) who studied butterflies of Pong Dam wetland in District Kangra (H.P.) and Thakur et al. (2006) who reported 50 species belonging to 37 genera under seven families; moreover distributional records of Rhopalocera from Pin Valley National Park were studied and 14 species belonging to 11 genera and four families were reported. Nymphalidae is the largest family of the butterflies in the study area represented by 12 species along with family Satyridae having the same number of species. Nymphalidae is the largest representative family of butterflies from India with 450 species (Varshney, 1993). This may be attributed to their polyphagous habits which probably helps these Lepidoptera to survive in a variety of habitats. Moreover, members of this species can forage in distant areas as they are active fliers.

Maximum numbers of species were observed from March to November and very few species were seen from December to February and only one species was noted in January in a human habitation far from frozen lake. Two species were present for a very short period of the year in the study area, i.e. *Parathyma asura asura* in July and August while the small-sized species *Sarangesa purendra* in May and June. Maximum abundance of butterflies in particular periods of the year (months) is related to seasonal variations and atmospheric temperature. From March to November the temperature of the area is favorable to lepidopterans. In the months from July to September Monsoon is active in this part of India which results in increased growth of various type of vegetation. Hence, during this time abundance of butterflies is more than in the months from December to February when climatic conditions in the area are very adverse. During this period the area is subject to heavy snow falls resulting in low temperatures and poor vegetation.

When relative abundance of these species was studied it was found that of these 49 species, 5 were very common, 32 common, 5 uncommon and 7 were rare. This shows that 10% species are very common, 66% species are common, 10% species uncommon and 14% are rare species of the total recorded species from the area. In addition, 3 species listed in Wildlife Protection Act (1972) viz., *Lethe scanda* and *Lampides boeticus* placed under scheduled II and *Castalius rosimon* under scheduled IV of the Act have also been reported from the Khajjiar area. The occurrence of three threatened species suggests the need of immediate need of implementation of strategies of sustainable conservation.

In this study it was revealed that maximum abundance was present in the forest areas of Khajjiar. Similar observations were made in previous studies on diversity and habitat preference of butterflies in various parts of India (Sreekumar & Balakrishnan, 2001; Ramesh et al., 2010; Sarma et al., 2012). Butterflies show distinct patterns of habitat utilization. The nature of vegetation is an important factor which determines the dependence and survival of a species on a particular habitat. Being highly sensitive to environmental changes, they are easily affected by even relatively minor disturbances in the habitat so much that they have been considered as indicators of environmental quality and are also treated as indicators of the health of an ecosystem. The presence of butterflies emphasizes availability of larval food plants. As stated before, most of the butterflies have specific habitat requirements, as females usually tend to lay eggs only on selective food plants occurring in the area (Thakur & Mattu, 2010).

With ever increasing number of tourists reaching Khajjiar every year the number of hotels in the area is increasing. This is good for general socio-economic development of the area but has adverse impacts on ecology. Many tourists visit deep in the forests and enjoy trekking in the hills. Hotels and tourists produce a large quantity of non-degradable garbage which accumulates in and around the lake

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

and also deep into the forest. These activities can affect sensitive microhabitat of butterflies. Present study revealed that Khajjiar Lake catchment area is very rich in lepidopteron fauna, which is depicted from the large number of variety of butterflies in term of large number of species. But at the same time 14% of the species comes under the category of rare species which means their specimens have been collected only from limited (single) place i.e. from grassland or dense forest or from human habitations. Additionally, 3 species were placed under Wildlife Protection Act (1972). Therefore this area needs intervention for implementation of measures of sustainable conservation.

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Study of *Rana liebigii* from Kalatop-Khajjiar Lake, Chamba, Himachal Pradesh, India

Vikram Singh and H.S. Banyal

Department of Biosciences, Himachal Pradesh University, Shimla-171 005 (HP), India

Abstract: A specimen of *Rana liebigii* was reported from the Khajjiar lake (Mini Switzerland) area of Khajjiar-Kalatop Wild life Sanctuary in district Chamba of Himachal Pradesh during the study of area from July, 2008 to November 2011.

Key words: Khajjiar Lake · *Rana liebigii* · Species · New Record

INTRODUCTION

Amphibians are the least in number amongst the vertebrates and comprise nearly 6.6% of the total life on the earth [1]. Total number of species in the world has been estimated around 3140 and in India 214 species are known, while in Himachal Pradesh only 17 species belonging to 4 families has been recorded [2]. This is 7.8 % of the total Indian species. Amphibians are ecological indicators and in recent decades there has been a dramatic decline in amphibian population. Many species are now threatened or extinct. Many workers have done important contributions to amphibian research in India [3-7].

India has the third largest amphibian population in Asia. The amphibian fauna of India comprises of 214 species of which 167 (66.3%) are endemic to the country. But many species are still being recorded for first time from many places of the country. Nine new species of frogs of the genus *Raorchestes* are described from the hill ranges of southern Western Ghats. [8]. A ground-dwelling rhacophorid frog was reported from the highest mountain peak of the Western Ghats of India [9]. A rare species of *Fejervarya cancrivora* (Amphibia: Ranidae) was reported for the first time in Pondicherry mangroves, southeastcoast of India [10].

Rana liebigii belongs to family Ranidae, of class Amphibia. This family belongs to order Anura which contail tailless and limbless animals. It is widely distributed throughout the Himalayas, between 4000 and 10,000 feet. Some authors consider *Rana liebigii* a similar species to *Rana vicina*. This species has been reported from many places in Himachal Pradesh but there is no record from the present study area i.e. Khajjiar Lake. So it is a new record from this area which under immense pressure of human intervention.

Methodology: Study area was visited from 2008 to 2011at least once a month. A single specimen was found around Khajjiar lake in the month of July, 2011. Identification was done on the basis of these photographs. Further identification was authenticated from High Altitude Regional Centre, Zoological Survey of India, Saproon, Solan, Himachal Pradesh-173211.

Khajjiar Lake "The Mini Switzerland of Himachal Pradesh" is present in the western part of Chamba district of Himachal Pradesh. Khajjiar Lake has a clump of reeds and grasses exaggeratedly called an island in it (Fig. 1). This glade is greenish in its turf and contains in its centre a small lake having approximate area of 5000 sq. yards. Khajjiar Lake lies 32° 26′ north and 76° 32′east about 6300 feet (1920 meters) above sea level between Chamba and Dalhousie. Khajjiar Lake is situated in the centre of Khajjiar- Kalatop wild life sanctuary (Fig. 2). This small sanctuary lies in the catchments of the Ravi River, located in western part of Chamba District. It is one of the oldest preserved forests of state (notified on 01.07.1949. The climate of Khajjiar alpine summers (April-June) is mild and winters (November-February) are cold and bitter. It experiences south-western monsoon rains in July-September [11].

Corresponding Author: Vikram Singh, Department of Biosciences, Himachal Pradesh University, Shimla-171 005 (HP) India.

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

Fig. 1: Khajjiar lake

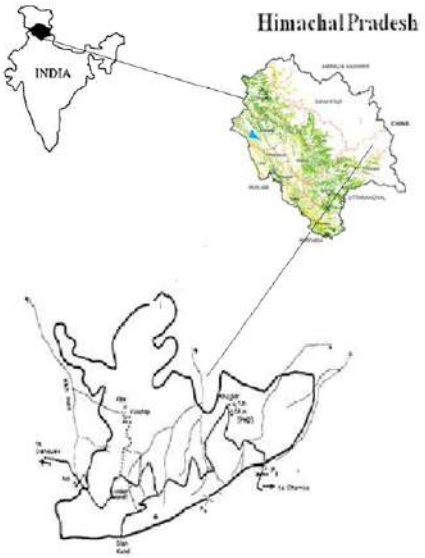

Fig. 2: Kalatop Khajjiar Wildlife Sanctuary

RESULTS AND DISCUSSION

Systematic Part:

Kingdom: Animalia, Linnaeus, 1758

Phylum: Chordata, Bateson, 1885

Fig. 3: *Rana liebigii* Gunther, 1830.

Class: Amphibia, Linnaeus, 1758.

Order: Anura, merren, 1820.

Family: Ranidae, Rafinesque, 1814

Genus Rana, Linniaus, 1700.
Rana liebigii Gunther, 1830.
1830. *Rana liebigii*, Gunth. *P. Z.S.* p. 157.
1830. *Rana liebigii* Bouleng. *Cat. Batr. Sal.* p. 21.

Diagnostic Character: Head of this Rana is moderate and much depressed. Snout is very short and rounded (Fig. 3). Inter orbital space nearly as broad as the upper eyelid and tympanum is small and hidden. Canthus rostralis are indistinct. Fingers are moderate, first finger not extending beyond second. Toes are also moderate, truncated or slightly swollen at the end. Toes are entirely webbed and don't have any tarsal fold. Nuptial excrescences of this species are developed; inner metatarsal tubercle oval, not very prominent; no outer tubercle is present. The tibio-tarsal articulation reaches the tip of the snout. On dorsal side skin is smooth. Colour is Brown above and a black line on the canthus rostralis and on the temporal region. Lateral folds black-margined, legs indistinctly cross-barred. Male are with internal vocal sacs. During the breeding season remarkable on account of the extreme thickness of the arms and of the patches of spinose warts on the breast, the inner side of the arms, and the inner fingers.

Status and Distribution: found in Sikkim, and in states of western Himalayas.

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

Habit and Habitat: Lives in a damp climate in the Western Himalayas, it is not so essentially aquatic in its habits but is found in damp jungle.

Rana liebigii is widely distributed species and is not an endanged species and is least concerned according to conservation policies. Still only one specimen was found from the present study area. This area is under the pressure of immense human intervention especially tourism industry. So in spite of being under Wild life sanctuary the ecological equilibrium is disturbed of this area [12]. This may possess a threat to this animal in this particular area.

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Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

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Assessment of Floristic Diversity in Khajjiar beat of Kalatop Khajjiar wild life sanctuary of district Chamba, Himachal Pradesh

R. K. Verma
Himalayan Forest Research Institute,
Conifer Campus, Panthaghati, Shimla, (H.P.),INDIA

(Corresponding author: R. K. Verma)
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ABSTRACT: A study was carried out to know the floristic diversity along an altitudinal gradient varying from 2000-2400m above msl in Khajjair beat of Kalatop Khajjair wild life sanctuary of district Chamba, Himachal Pradesh during 2011. Total number of plant species was 101 belonging to 54 families and 95 genera. The dominant families were Asteraceae, Rosaceae, Polygonaceae and Lamiaceae. The number of trees species was 6 and 11 with the dominance of *Persea duthiei* and *Picea smithiana* at 2000-2200m and 2200-2400m elevation ranges respectively. The number of shrub species was 9 and 22 with the dominance of *Sarcococca saligna* and *Vibernum erubescens* at 2000-2200m and 2200-2400m elevations respectively. The number of herb species was 60 and 54 with the dominance of *Polygonum capitata* and *Bergenia ciliata* at 2000-2200m and 2200-2400m elevation ranges respectively. The distribution pattern of most of the plant species was contiguous in all altitudes. Index of diversity for herb species in these elevations ranges was 3.498 and 3.457. Out of 48 medicinal plant species recorded from the area, 2 species viz; *Dioscorea deltoidea* and *Podophyllum hexandrum* fall in the threatened category. The better conservation of natural resources can be done through promotion of community based conservation, *ex-situ* conservation through tissue culture, developing cultivation technologies and nurseries of medicinal plants and conducting of regular training on the procedure of medicinal plants collection and processing among the end users.

Key Words: Dominance, distribution pattern, diversity index, conservation, dominance.

INTRODUCTION

The variations in terms of its size, climate and altitudinal ranges have created environments those are unique and characteristic to this region only. The diverse climate and the varied environmental conditions prevailing in Himalayas support diverse habitat and ecosystems with equally diverse life forms. It provides an important habitat to the flora and fauna including 9,000 species of angiosperms and hence, is considered as the hot spot of biodiversity. There are about 3,470 species considered exclusively endemic to the Himalayas. Himalayas, otherwise known for its rich and diverse plant wealth is showing a rapid decline in population of many plant species in recent past. Some of them have already been lost whereas many of them are on the verge of extinction. If suitable steps to conserve the Himalayan flora not taken well in time, the delay may lead to total extinction of rare and valuable plants. The current decline in biodiversity largely through human activities is a serious threat to our ecosystem.

Kalatop Khajjiar wildlife sanctuary which covers an area of about 20.27 sq km was established in

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

1958 in Chamba district of Himachal Pradesh. The altitude of this sanctuary varies from 1185 to 2800m above msl whereas the climate ranges from sub -temperate to alpine. The sanctuary represents flora of sub-temperate to alpine climate and inhabitants of villages in and around the sanctuary are utilizing the sanctuary areas for grazing, collection of timber, fuel wood, fodder and other minor forest produce. The continuous removal of plant species for various uses and overgrazing by migratory and other livestock seems to have resulted in loss of biodiversity in this sanctuary. If these naturally occurring plant resources are not conserved timely then they may soon become extinct. Accordingly, the wealth needs to be protected from further degradation so as to conserve the endemic diversity in the medicinal plants before it is completely wiped out from nature. Keeping this in view attempts were made to assess the plant diversity including documentation of the medicinal plants found in Khajjiar Beat of Kalatop Khajjiar wild life sanctuary of district Chamba, Himachal Pradesh.

MATERIALS AND METHODS

The present study was conducted in Khajjiar beat of Kalatop Khajjiar wild life sanctuary in district Chamba of Himachal Pradesh during, 2011 at an elevation of 2000-2400m. The study site was situated at N 32° 32.202' to N 32° 31.798' latitude and E 76° 02.438' to E 76° 02.617' longitudes. The whole area of the valley was divided into two altitudes i.e. 2000-2200m and 2200-2400m for conducting the phyto-sociological study. Quadrats of size 10mx10m, 3mx3m and 1mx1m laid out randomly for enumerating trees, shrubs and herbs + regeneration respectively. The seedlings were considered as herbs whereas saplings as shrubs. The vegetation data was analysed for density, frequency and abundance as per Curtis and McIntosh (1950). The relative values of density, frequency and dominance were summed to get Importance Value Index (IVI) of individual species. The abundance to frequency ratio (A/F) of different species was determined for eliciting the distribution pattern of the floral elements.

This ratio indicates regular (<0.025), random (0.025 to 0.050) and contiguous (>0.050) distribution (Curtis and Cottam, 1956). The plant species diversity was calculated following Shannon-Wiener diversity Index (H) (Shannon-Wiener 1963).

$$H = -\sum_{i=1}^{S} (Ni/N) \ln (Ni/N)$$

Where Ni = Number of individuals of species i and N= Total number of individuals of all the species.

Concentration of dominance (C) was measured by Simpson's Index (Simpson, 1949).

$$C = \sum_{i=1}^{S} (Ni/N)^2$$

Where Ni = Importance value of species i and N= Total importance value of all the species.

Richness Index was estimated as per Margalef (1958) *i .e.* R = S-1/ln N

Evenness Index was calculated as per Hill (1973) *i. e.* E = H/ ln S

Where S= Total number of species, N= Total number of individuals of all the species, H = Index of diversity.

RESULTS AND DISCUSSION

The total number of plant species was 101 belonging to 54 families and 95 genera. The dominant families were Asteraceae, Rosaceae, Polygonaceae and Lamiaceae. At an elevation of 2000m-2200m, total number of tree species was 6 (Table 1), *Persea duthiei* was the dominant species having highest density (275 ha^{-1}) and frequency (60%).

Table 1: Phytosciological attributes of tree species in Khajjiar beat at an altitudinal zonation of 2000m-2200m.

S. No.	Species	Density (ha^{-1})	Frequency (%)	Abundance	A/F	IVI
1.	*Abies pindrow* Royle.	50.00	10.00	5.00	0.500	38.18
2.	*Cedrus deodara* (Roxb. ex D. Don) G. Don f.	195.00	35.00	5.57	0.159	83.01
3.	*Neolitsea pallens* (D.Don.) Momiyama & Hara	35.00	35.00	1.00	0.029	26.44
4.	*Persea duthiei* (King. ex Hook.f.) Kostern	275.00	60.00	4.58	0.076	99.29
5.	*Picea smithiana* (Wall.) Boiss	55.00	35.00	1.57	0.045	45.75
6.	*Pyrus pashia* Buch.-Ham.ex D.Don.	10.00	10.00	1.00	0.100	7.30

This was followed by *Cedrus deodara* (195.00 ha^{-1}) and *Picea smithiana* (55.00ha^{-1}) in terms of density. *Cedrus deodara* recorded the highest value of abundance (5.57) followed by *Abies pindrow* (5.00) and *Persea duthiei* (4.58). *Persea duthiei* recorded the highest value of IVI (99.29) followed by *Cedrus deodara* (83.01) and *Picea smithiana* (45.75). The lowest value of IVI (7.30) was observed for *Pyrus pashia*. The community identified was *Persea duthiei - Cedrus deodara*.

The distribution pattern of all the species except *Picea smithiana and Neolitsea pallens* was contiguous. The contiguous distribution is the commonest pattern in nature, random distribution is found in very uniform environment. The general preponderance of contiguous distribution in vegetation has been reported by several workers (Kershaw, 1973; Singh and Yadava, 1974; Kunhikannan *et al*, 1998). Among 9 species of shrubs including sapling at elevation 2000m-2200m (Table 2), *Sarcococca saligna* was the dominant species having highest value for density (11333.33 ha^{-1}), abundance (12.75) and frequency (80%). This was followed by *Viburnum erubescens* (3444.44ha^{-1}) and *Neolitsea pallens* (2444.44ha^{-1}) in terms of density. On the basis of IVI, *Sarcococca saligna* recorded the highest value (168.83) followed by *Viburnum erubescens* (43.69) and *Neolitsea pallens* (31.83).The lowest value of IVI (4.21) was observed for *Ilex dipyrena*. The distribution pattern of all the species was contiguous except *Sarcococca saligna*.

In case of herbs including regeneration, total number of herb species was 60 at an elevation of 2000m-2200m (Table 3). *Trifolium repens* was the dominant species having highest value for density (5.83) followed by *Polygonum capitata* (5.25m^{-2}), *Oxalis corniculata* (5.16m^{-2}) and *Fragaria vesca* (2.58m^{-2}). In term of frequency, *Oplismenus compositus* recorded the highest value (66.67%) followed by *Fagaria vesca* (58.33%) and *Oxalis corniculata* (58.33%). *Polygonum capitata* recorded the maximum value of abundance (21.00) followed by *Equisetum arvense* (15.00), *Acorus calamus* (14.00) and *Trifolium repens* (11.67). *Polygonum capitata* (18.40) recorded the highest value of IVI followed by *Trifolium repens* (17.28) and *Oxalis corniculata* (14.34). The lowest value of IVI (0.83) was observed for *Geranium wallichianum*. The distribution pattern of all the species was contiguous.

Table 2: Phytosciological attributes of shrub species in Khajjiar beat at an altitudinal zonation of 2000m-2200m.

S.No.	Species	Density (ha^{-1})	Frequ-ency(%)	Abund-ance	A/F	IVI
1.	*Berberis lycium* Royle	333.33	10.00	3.00	0.300	4.84
2.	*Daphne cannabina* Lour.ex Wall.	777.78	30.00	2.33	0.078	13.23
3.	*Ilex dipyrena** Wall.	222.22	10.00	2.00	0.200	4.21
4.	*Neolitsea pallens** (D.Don.) Momiyama & Hara	2444.44	60.00	3.67	0.061	31.83
5.	*Persea duthiei** (King. ex Hook.f.) Kostern	666.67	20.00	3.00	0.150	9.67
6.	*Prinsepia utilis* Royle.	555.56	10.00	5.00	0.500	6.41
7.	*Rubus niveus* Wall.	1555.56	20.00	7.00	0.350	17.29
8.	*Sarcococca saligna* (D.Don.) Muell.Arg	11333.33	80.00	12.75	0.159	168.83
9	*Viburnum erubescens* Wall.ex DC	3444.44	80.00	3.88	0.048	43.69

*Saplings

Table 3: Phytosciological attributes of herb species in Khajjiar beat at an altitudinal zonation of 2000m-2200m.

S.No.	Species	Density (m^{-2})	Frequency(%)	Abundance	A/F	IVI
1.	*Achillea millefolium* Linn.	0.66	25.00	2.67	0.107	8.57
2.	*Achyranthes aspera* Linn.	0.41	16.67	2.50	0.150	2.29
3.	*Acorus calamus* Linn.	1.16	8.33	14.00	1.680	9.83
4.	*Ainsliaea latifolia* (D. Don) Sch. Bip	0.41	16.67	2.50	0.150	3.41
5.	*Ajuga bracteosa* Wall.ex Benth.	0.66	41.67	1.60	0.038	7.07
6.	*Anaphalis contorta* D.Don. (Hook.f.)	0.50	8.33	6.00	0.720	2.02
7.	*Anemone obtusiloba* D.Don.	0.25	16.67	1.50	0.090	1.92
8.	*Aquilegia fragrens* Benth.	0.50	25.00	2.00	0.080	3.88
9	*Arisaema flavum* (Forsskal) Schott (Forsk.) Scott.	0.33	16.67	2.00	0.120	4.90
10.	*Arisaema intermedium* Blume.	0.25	8.33	3.00	0.360	3.22
11.	*Artemisia parviflora* Roxb.	0.91	25.00	3.67	0.147	5.28
12.	*Aster molliusculus* Wall	0.41	16.67	2.50	0.150	2.20
13	*Bidens pillosa* Linn	0.50	16.67	3.00	0.180	3.24
14.	*Bistorta amplexicaulis* (D. Don) Green	0.43	16.67	2.60	0.156	3.70
15.	*Boenninghausenia abiflora* (Hook.) Reichb. ex Meissner.	0.58	16.67	3.50	0.210	3.32
16.	*Calanthe tricarinata* Lindey	0.66	33.33	2.00	0.060	10.57
17.	*Cedrus deodara* * *(Roxb. ex D. Don) G. Don f.	0.16	8.33	2.00	0.240	3.28
18.	*Cirsium wallichii* DC.	0.16	8.33	2.00	0.240	1.85
19.	*Commelina paludosa* Blume.	0.83	25.00	3.33	0.133	4.65
20.	*Conyza stricta* Willd.	0.20	8.33	2.40	0.288	1.10
21.	*Cynoglossum micranthum* Desf.	0.16	16.67	1.00	0.060	1.85
22.	*Digitalis purpurea* Linn.	0.41	16.67	2.50	0.150	3.75
23.	*Dioscorea deltoidea* Wall.	0.08	8.33	1.00	0.120	0.88
24.	*Epilobium laxum* Royle.	0.58	25.00	2.33	0.093	3.23
25.	*Equisetum arvense* Linn.	2.50	16.67	15.00	0.900	7.37
26.	*Erigeron multiradiatus* Benth.	1.25	25.00	5.00	0.200	5.08
27.	*Fragaria vesca* Coville.	2.58	58.33	4.43	0.076	9.72
28.	*Galium asperifolium* Wall. ex Roxb.	0.50	25.00	2.00	0.080	3.01
29.	*Geranium wallichianum* D.Don ex Sweet.	0.08	8.33	1.00	0.120	0.83
30.	*Girardinia diversifolia* (Linn) Friis	0.83	33.33	2.50	0.075	12.25
31.	*Gnaphalium hypoleucum* DC.	0.58	16.67	3.50	0.210	4.14
32.	*Gypsophila cerastioides* D. Don.	0.75	16.67	4.50	0.270	3.74
33.	*Hedychium spicatum* Smith.	0.16	8.33	2.00	0.240	2.42
34.	*Ilex dipyrena* ** Wall.	0.08	8.33	1.00	0.120	2.68
35.	*Impatiens sulcata* - Wall.	0.50	16.67	3.00	0.180	4.01
36.	*Lactuca dissecta* D.Don.	0.41	16.67	2.50	0.150	2.40
37.	*Lecanthus peduncularis* (Royle) Wedd.	0.91	25.00	3.67	0.147	4.33

S.No.	Species	Density (m^{-2})	Frequency(%)	Abundance	A/F	IVI
38.	*Melilotus alba* Lam.	0.33	16.67	2.00	0.120	2.16
39.	*Micromeria biflora* - (Buch.-Ham. ex D.Don.)Benth	0.66	16.67	4.00	0.240	2.93
40.	*Oplismenus compositus* (Linn.) P.Beauv.	4.00	66.67	6.00	0.090	13.14
41.	*Oxalis corniculata* Linn.	5.16	58.33	8.86	0.152	14.34
42.	*Paris polyphylla* Smith.	0.50	33.33	1.50	0.045	6.41
43.	*Persea duthiei*** (King ex Hook.f.) Kosterm.	0.08	8.33	1.00	0.120	1.74
44.	*Pilea scripta* (Buch.-Ham. ex D.Don.) Wedd.	2.41	50.00	4.83	0.097	11.25
45.	*Plantago lanceolata* Linn.	1.25	41.67	3.00	0.072	6.36
46.	*Podophyllum hexandrum* Royle	0.41	25.00	1.67	0.067	5.52
47.	*Polygonum capitata* Buch.-Ham. ex D. Don	5.25	25.00	21.00	0.840	18.40
48.	*Pteracanthus urticifolious* (Kuntze.)Bremek.	0.33	8.33	4.00	0.480	2.17
49.	*Ranunculus diffusus* DC.	0.58	25.00	2.33	0.093	3.33
50	*Rubia cordifolia* (Hook.f.) Linn.	0.41	16.67	2.50	0.150	2.40
51.	*Rubus niveus*** Wall.	0.16	8.33	2.00	0.240	1.26
52.	*Rumex nepalensis* Spemg.	0.33	16.67	2.00	0.120	5.03
53.	*Smilacina purpurea* Wall.	0.16	16.67	1.00	0.060	1.72
54.	*Smilax aspera* Linn.	0.08	8.33	1.00	0.120	0.88
55.	*Taraxacum officinale* F.H. Wigg	0.41	16.67	2.50	0.150	2.84
56.	*Trichidium pedicellatum* J.M.Noble & Kraft.	0.58	33.33	1.75	0.053	4.79
57.	*Trifolium repens Linn.*	5.83	50.00	11.67	0.233	17.28
58.	*Urtica dioica* Linn.	0.45	16.67	2.70	0.162	6.18
59.	*Valeriana jatamansii* Jones.	0.66	25.00	2.67	0.107	7.26
60.	*Viola canescens* Wall. ex Roxb.	1.41	25.00	5.67	0.227	4.62

**Regeneration

Table 4: Phytosciological attributes of tree species in Khajjiar beat at an altitudinal zonation of 2200m-2400m.

S. No.	Species	Density (ha^{-1})	Frequ-ency(%)	Abund-ance	A/F	IVI
1.	*Abies pindrow* Royle.	25.00	20.00	1.25	0.060	20.10
2.	*Aesculus indica* (Colebr. ex Combess.) Hook.f.	5.00	5.00	1.00	0.200	4.53
3.	*Cedrus deodara* (Roxb. ex D. Don) G. Don f.	15.00	10.00	1.50	0.150	11.71
4.	*Celtis australis Linn.*	10.00	5.00	2.00	0.400	4.71
5.	*Neolitsea pallens* (D.Don.)Momiyama & Hara	25.00	20.00	1.25	0.060	15.95
6.	*Persea duthiei* (King. ex Hook.f.) Kostern	10.00	10.00	1.00	0.100	7.30
7.	*Picea smithiana* (Wall.)Boiss	385.00	100.00	3.85	0.040	206.45
8.	*Populus ciliata* Wall. ex Royle.	15.00	5.00	3.00	0.600	5.85
9.	*Quercus dilatata* Lindl.	5.00	5.00	1.00	0.200	3.75
10.	*Quercus leucotrichophora* A.Camus.	10.00	5.00	2.00	0.400	11.66
11.	*Rhus wallichii* Hook.f.	10.00	10.00	1.00	0.100	7.94

At an elevation of 2200m-2400m, total number of tree species was 11 (Table 4). *Picea smithiana* was the dominant species having highest value for density (385.00ha^{-1}), frequency (100%) and abundance (3.85). This was followed by *Neolitsea pallens* (25.00ha^{-1}), *Abies pindrow* (25.00ha^{-1}) and *Populus ciliata* (15.00ha^{-1}). On the basis of IVI, *Picea smithiana* recorded the highest value (206.45) followed by *Abies pindrow* (20.10), *Neolitsea pallens* (15.95) and *Cedrus deodara* (11.71). The lowest value of IVI (3.75) was observed for *Quercus dilatata*. The community identified was *Picea smithiana* - *Abies pindrow*. The distribution pattern of all the species except *Picea smithiana* was contiguous.

Among 22 species of shrubs including sapling (Table 5, *Viburnum erubescens* was the dominant species having highest value for density (300 ha^{-1}) and frequency (52.50%) at elevation of 2200m-2400m. This was followed by *Sarcococca saligna* (2555.56ha^{-1}) and *Indigofera heterantha* (2472.22ha^{-1}) in term of density. In case of abundance, *Sarcococca saligna* recorded the highest value (9.20) followed by *Indigofera heterantha* (8.09), *Rosa macrophylla* (7.11) and *Salix tetrasperma* (6.00). *Viburnum erubescens* recorded the highest value of IVI (44.97) followed by *Rosa macrophylla* (34.58), *Indegofera heterantha* (29.84) and *Sarcococca saligna* (27.44). The lowest value of IVI (0.92) was observed for *Hypericum oblongifolium*. The distribution pattern of all the species was contiguous.

Table 5: Phytosciological attributes of shrub species in Khajjiar beat at an altitudinal zonation of 2200-2400m.

S.No.	Species	Density (m^{-2})	Frequency(%)	Abundance	A/F	IVI
1.	*Berberis lycium* Royle	1250.00	30.00	3.75	0.125	19.69
2.	*Buddleja paniculata* Wall.	194.44	5.00	3.50	0.700	3.20
3.	*Cotoneaster microphyllus* Wall.ex Lindley.	1361.11	30.00	4.08	0.136	26.56
4.	*Daphne cannabina*. Lour.ex Wall.	611.11	22.50	2.44	0.109	11.50
5.	*Desmodium tiliaefolium* Don.	83.33	2.50	3.00	1.200	1.55
6.	*Hypericum oblongifolium* Choisy	27.78	2.50	1.00	0.400	0.92
7.	*Ilex dipyrena* *Wall.	83.33	5.00	1.50	0.300	2.24
8.	*Indigofera heterantha* Wall ex Brandis.	2472.22	27.50	8.09	0.294	29.84
9	*Neolitsea pallens** (D.Don.)Momiyama & Hara	305.56	10.00	2.75	0.275	5.57
10.	*Persea duthiei** (King. ex Hook.f.) Kostern	83.33	2.50	3.00	1.200	1.65
11.	*Quercus dilatata* *Lindl.	527.78	15.00	3.16	0.211	9.32
12.	*Quercus leucotrichophora* *A.Camus.	27.78	2.50	1.00	0.400	1.20
13	*Rabdosia rugosa* (Wall ex Benth.) Hara.	555.56	10.00	5.00	0.500	6.67
14.	*Rhamnus virgatus* (Roxb.) Lawson.	166.67	10.00	1.50	0.150	4.48
15.	*Rosa macrophylla* Lindley.	1777.78	22.50	7.11	0.316	34.58
16.	*Rubus niveus* Wall.	805.56	25.00	2.90	0.116	13.54
17.	*Salix tetrasperma* *Roxb.	333.33	5.00	6.00	1.200	5.64
18.	*Sarcococca saligna* (D.Don.) Muell.Arg	2555.56	25.00	9.20	0.368	27.44
19.	*Sorbaria tomentosa* (Lindley) Rehder.	1277.78	17.50	6.57	0.376	21.13
20.	*Spiraea canescens* D.Don.	1222.22	25.00	4.40	0.176	26.50
21.	*Ventilago denticulata* Willd.	111.11	2.50	4.00	1.600	1.82
22.	*Viburnum erubescens* Wall.ex DC	3000.00	52.50	5.14	0.098	44.97

*Saplings

Table 6: Phytosciological attributes of herb species in Khajjiar beat at an altitudinal zonation of 2200m-2400m.

S.No.	Species	Density (m^{-2})	Frequency(%)	Abundance	A/F	IVI
1.	*Achillea millefolium* Linn.	0.23	10.00	2.3	0.233	3.12
2.	*Ainsliaea latifolia* (D.Don.) Sch.Bip.	0.10	3.33	3.0	0.900	1.26
3.	*Ajuga bracteosa* Wall.ex Benth.	0.30	13.33	2.3	0.169	7.95
4.	*Amaranthus paniculatus* Linn.	0.10	3.33	3.0	0.900	1.71
5.	*Anaphalis triplinervis* (Sims) C.B.Clarke	1.93	40.00	4.8	0.121	14.08
6.	*Androsace lanuginosa* Hardw.	0.20	6.67	3.0	0.450	1.85
7.	*Anemone obtusiloba* D.Don.	0.03	3.33	1.0	0.300	0.80
8.	*Aquilegia pubiflora* Wall.	0.23	10.00	2.3	0.233	3.12
9	*Arisaema intermedium* Blume	0.60	33.33	1.8	0.054	15.68
10.	*Artemisia parviflora* Roxb.	0.37	10.00	3.7	0.367	4.12
11.	*Aster molliusculus* Wall	0.17	6.67	2.5	0.375	1.53
12.	*Bergenia ciliata* (Haw.)Sternb.	1.17	20.00	5.8	0.292	19.19
13	*Bidens pilosa* Linn.	0.17	6.67	2.5	0.375	1.68
14.	*Bistorta amplexicaulis* (D.*Don.) Greene.*	0.73	30.00	2.4	0.081	10.34
15.	*Boenninghausenia albiflora* (Hook.) Reichb ex Meissner.	0.50	13.33	3.8	0.281	4.28
16.	*Cirsium wallichii* DC.	0.13	10.00	1.3	0.133	4.35
17.	*Commelina paludosa* Blume.	0.27	6.67	4.0	0.600	2.31
18.	*Conyza stricta* Willd.	0.10	6.67	1.5	0.225	1.36
19.	*Digitalis purpurea* Linn.	0.17	6.67	2.5	0.375	2.33
20.	*Epilobium laxum* Royle.	0.30	6.67	4.5	0.675	2.43
21.	*Erigeron alpinus* Linn.	3.45	70.00	4.9	0.070	22.36
22.	*Euphorbia cognata* (Klotzsch & Garcke) Boiss.	0.17	6.67	2.5	0.375	2.51
23.	*Fragaria vesca* Coville.	1.23	33.33	3.7	0.111	8.89
24.	*Galium rotundifolium* Linn.	2.50	50.00	5.0	0.100	16.49
25.	*Geranium wallichianum* D.Don ex Sweet.	0.93	36.67	2.5	0.069	10.17
26.	*Geum elatum* Wall. ex G. Don	0.17	6.67	2.5	0.375	2.12
27.	*Gnaphalium hypoleuceum* DC.	0.17	6.67	2.5	0.375	1.73
28.	*Gypsophila cerastioides*.D.Don.	0.60	13.33	4.5	0.338	5.31
29.	*Habenaria pectinata* D. Don.	0.13	6.67	2.0	0.300	1.73
30.	*Hedychium spicatum* Smith.	0.10	3.33	3.0	0.900	2.19
31.	*Impatiens sulcata* Wall.	0.17	6.67	2.5	0.375	2.14
32.	*Lactuca dissecta* D. Don	1.48	43.33	3.4	0.079	12.29
33.	*Lecanthus peduncularis* (Royle) Wedd.	0.23	6.67	3.5	0.525	2.23
34.	*Micromeria biflora* (Buch.-Ham. ex D.Don.)Benth.	0.42	6.67	6.3	0.938	2.79
35.	*Oplismenus compositus* (Linn.) Beauv.	0.83	16.67	5.0	0.300	5.23
36.	*Persea duthiei*** (King ex Hook.f.) Kosterm.	0.08	3.33	2.5	0.750	2.09

Continued....

S.No.	Species	Density (m^{-2})	Frequency(%)	Abundance	A/F	IVI
37.	*Lecanthus peduncularis* (Royle) Wedd.	0.91	25.00	3.67	0.147	4.33
38.	*Melilotus alba* Lam.	0.33	16.67	2.00	0.120	2.16
39.	*Micromeria biflora* - (Buch.-Ham. ex D.Don.)Benth	0.66	16.67	4.00	0.240	2.93
40.	*Oplismenus compositus* (Linn.) P.Beauv.	4.00	66.67	6.00	0.090	13.14
41.	*Oxalis corniculata* Linn.	5.16	58.33	8.86	0.152	14.34
42.	*Paris polyphylla* Smith.	0.50	33.33	1.50	0.045	6.41
43.	*Persea duthiei*** (King ex Hook.f.) Kosterm.	0.08	8.33	1.00	0.120	1.74
44.	*Pilea scripta* (Buch.-Ham. ex D.Don.) Wedd.	2.41	50.00	4.83	0.097	11.25
45.	*Plantago lanceolata* Linn.	1.25	41.67	3.00	0.072	6.36
46.	*Podophyllum hexandrum* Royle	0.41	25.00	1.67	0.067	5.52
47.	*Polygonum capitata* Buch.-Ham. ex D. Don	5.25	25.00	21.00	0.840	18.40
48.	*Pteracanthus urticifolious* (Kuntze.)Bremek.	0.33	8.33	4.00	0.480	2.17
49.	*Ranunculus diffusus* DC.	0.58	25.00	2.33	0.093	3.33
50	*Rubia cordifolia* (Hook.f.) Linn.	0.41	16.67	2.50	0.150	2.40
51.	*Rubus niveus*** Wall.	0.16	8.33	2.00	0.240	1.26
52.	*Rumex nepalensis* Spreng.	0.33	16.67	2.00	0.120	5.03
53.	*Smilacina purpurea* Wall.	0.16	16.67	1.00	0.060	1.72
54.	*Smilax aspera* Linn.	0.08	8.33	1.00	0.120	0.88

**Regeneration

In case of herbs including regeneration, total number of herb species was 54 (Table 6) at elevation of 2200m-2400m. *Erigeron alpinus* was the dominant species having highest value for density (3.45m^{-2}) and frequency (70.0%) followed by *Galium rotundifolium* (2.50m^{-2}) and *Anaphalis triplinervis* (1.93m^{-2}). In case of abundance, *Trifolium repens* recorded the maximum value (7.2) followed by *Bergenia ciliata* (5.80), *Galium rotundifolium* (5.00) and *Oplismenus composites* (5.00). *Erigeron alpinus* recorded the highest value of IVI (22.36) followed by *Bergenia ciliata* (19.19) and *Rumex nepalensis* (18.92). The lowest value of IVI (0.80) was observed for *Anemone obtusiloba*. The distribution pattern of all the species was contiguous. The value of concentration of dominance (C), index of diversity (H), richness index (R) and evenness index (E) for trees, shrubs and herbs at different altitudes is given in Table 7. The higher the value of concentration of dominance, the greater is the homogenous nature of the community and vice-versa (Kohli *et al*., 2004). The lower value of dominance shows that dominance of plants is shared by many species.

The species diversity is regulated by long term factors like community stability and evolutionary time as heterogeneity of both macro and micro environment affects the diversification among different communities. The higher values of index of diversity indicate the variability in the type of species and heterogeneity in the communities, whereas, the lesser values point to the homogeneity in the community. The higher value of evenness indices indicates that species are evenly distributed in this region. The nature of plant community at a place is determined by the species that grow and develop in such environment (Bliss, 1962).

Table 7: Concentration of dominance (C), diversity index (H), richness index (R) and evenness index (E) for tree, shrub and herb at different elevations in Khajjiar beat of the sanctuary.

Altitude	Plant Category	Concentration of Dominance (C)	Diversity Index (H)	Richness Index (R)	Evenness Index (E)
2000-2200m	Tree	0.239	1.371	1.037	0.765
	Shrub	0.356	1.506	1.204	0.685
	Herb	0.014	3.498	7.298	0.543
2200-2400m	Tree	0.486	1.113	2.157	0.464
	Shrub	0.085	2.581	3.221	0.818
	Herb	0.037	3.457	7.119	0.866

Index of similarity and dissimilarity for trees, shrubs and herbs at different altitudes of Khajjiar beat in Kalatop Wildlife sanctuary of District Chamba (H.P.).

Altitudes		2200-2400
Trees	2000-2200	0.58(0.42)
Shrubs	2000-2200	0.51(0.49)
Herbs	2000-2200	0.68(0.32)

MEDICINAL AND THREATENED PLANTS

The important plants of medicinal value found in Khajjiar beat of Kalatop-Khajjiar wild life sanctuary in district Chamba of Himachal Pradesh were compiled following Chopra *et al* (1956), Kirtikar and Basu (1987) and Kala (2002). These include; *Achillea millefolium, Achyranthes aspera, Acorus calamus,Aesculus indica, Ajuga bracteosa, Anaphalis contorta, Anaphalis triplinervis, Anemone obtusiloba, Aquilegia pubiflora, Artemisia parviflora, Aster molliusculus, Berberis lycium, Bergenia ciliata, Boenninghausenia albiflora, Cirsium wallichii, Cynoglossum micranthum, Digitalis purpurea, Dioscorea deltoidea, Erigeron alpinus, Erigeron multiradiatus, Euphorbia cognata, Fragaria vesca, Galium asperifolium, Geum elatum, Geranium wallichianum, Hedychium spicatum, Lactuca dissecta, Micromeria biflora, Oxalis corniculata, Paris polyphylla, Plantago lanceolata, Podophyllum hexandrum, Polygonum capitata, Primula denticulata, Ranunculus diffusus, Rhamnus virgatus, Rosa macrophylla, Rubia cordifolia, Rumex nepalensis, Salvia lanata, Sarcococca saligna, Senecio graciliflora, Smilax aspera, Taraxacum officinale, Trifolium repens, Urtica dioica, Valeriana jatamansii* and *Viola canescens* . Out of 48 medicinal plant species recorded from the area, 2 species i.e. *Dioscorea deltoidea* and *Podophyllum hexandrum* fall in the category of threatened plants when compared with the available literature like Red Data Book and CAMP Reports. The rarity in these medicinal plants is due to habitat alteration, narrow range of distribution along with other factors. A major threat is for the species those are uprooted and their underground parts such as rhizomes, tubers, bulbs and roots are used in medicine. The habitat of most of the plant species have shrunk due to expansion of human population and environmental degradation primarily due to heavy live stock grazing, uncontrolled and unscientific harvest of species, unregulated tourism and construction of roads etc. The better conservation of natural resources can be done by inclusion of a section on the plant conservation especially of rare and endangered medicinal plants in the wild life protection act, promotion of community based conservation, *ex-situ* conservation through tissue culture, developing cultivation technologies and nurseries of medicinal plants and conducting of regular training on the procedure of medicinal plants collection, processing among the local people, traders and real stake holders.

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A RAPID ECOLOGICAL ASSESSMENT OF KHAJJIAR LAKE, HIMACHAL PRADESH FOR CONSERVATION INTERVENTIONS

Submitted to

Himachal Pradesh Forest Department

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भारतीय वन्यजीव संस्थान
Wildlife Institute of India

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Editor
Dr. S. A. Hussain

Field survey, data analysis and text
Dr. Niladri Dasgupta, Sk. Zeeshan Ali

GIS mapping
Ms. Aishwarya Ramachandran, Sk. Zeeshan Ali

Ganga Aqualife Conservation Monitoring Centre
Wildlife Institute of India, Dehra Dun, Uttarakhand
Pin – 248002
Website: www.wii.gov.in, Email: gacmc@wii.gov.in
Tel.: +91 135 2646480

Content

Executive summary

Flourishing and well-functioning natural wetlands are important for human well-being as they provide important ecosystem services. Wetlands are most productive ecosystems of the world, and are also one of the most imperiled by a myriad of anthropogenic threats. Globally wetlands are declining rapidly, threatening biodiversity as well as the dependent communities. India has lost an estimated 38% of its wetlands and continues to lose its wetlands mainly due to rapid urbanization, changing land-use and land-cover, agricultural conversion, pollution, unregulated tourism, and inadequate legal and policy support to protect wetlands.

Khajjiar Lake is a National Wetland situated in the Khajjiar-Kala Top Wildlife Sanctuary in Chamba District of Himachal Pradesh. Designated as 'Mini Switzerland', the Lake is inhabited by fish species such as Common and Mirror carps, 77 species of birds and support tourism and offer employment opportunities for the local communities. The Lake ecosystem is threatened due to rapid anthropogenic alterations and losing its waterspread area. Siltation, weed infestation, faulty flushing mechanism, indiscriminate grazing and subsequent soil erosion has shrunk the lake to one fourth of its original size. The National Green Tribunal (NGT) ordered the Union and Himachal Pradesh governments, to take effective steps to revive the wetland and ensure its restoration to the 'original status'. In this context, the Wildlife Institute of India was approached by Himachal Pradesh Forest Department for scientific interventions for the rejuvenation of the Lake.

A rapid ecological assessment was carried out at Khajjiar Lake to assess the current status with the objectives, (1) To assess the hydrology and water quality of the Lake, (2) To assess the habitat complexity and biodiversity of the Lake, and (3) To recommend strategies to improve the hydrology regime of the Lake. Information were collected on the hydrology regime of the Lake, identification of inflow and outflow channel, water quality, aquatic vegetation and anthropogenic influences. The bathymetry data was collected by Acoustic Doppler Current Profiler (ADCP) in two transects. The water quality parameters such as pH, Total dissolved solid (TDS), Dissolved oxygen (DO) and Nitrate (NO_3) were collected at eight random sites through a probe based water quality testing kit. A stratified random quadrate method was adopted to quantify the wetland vegetation. The species were identified and coded in the field. Every species were counted in a quadrate and their abundance and distribution were assessed.

It was observed that the waterspread area of the Lake can be divided into three sections. Section A was represented by open water, Section B comprised of floating island and Section C was marshy area with submerged and emergent vegetation. The depth of the open water area varied from 0.17 m to 5.66 m. The shallow water was predominant in the northern fringe and deep water pool was present at the western boundary of the open water area. The floating dead biomass accumulated towards the northern boundary and near outlet of the lake, however it changed its location with wind and water flow. The floating islands were 0.7- 1.3 m deep. There were six inlets to the Lake which originated in the surrounding forest, cut through the meadow and enter the Lake at various points. The runoff from the forest flow through these channels and contributed to the hydrology regime of the Lake. The pH ranged from 7.5 to 8.9. The TDS was uniform throughout the Lake and varied between 28.6 to 29.9 mg/L. The DO ranged from 5.4 to 9.1 mg/L. The NO_3 was prominent and contributed to most of the TDS. It ranged from 15.8 to 23.8 mg/L. High nitrate value indicate eutrophic condition. The wetland vegetation of the Lake consisted of 15 species of emergent, floating, submerged-emergent and submerged types. The species *Myriophyllum pinnatum* dominated the vegetation followed by *Marsilea minuta*, *Eleocharis geniculate*, *Eleocharis palustris* and *Cynodon dactylon*. The *M. pinnatum* was an invasive species and

was predominant in most of the quadrate. The filamentous algae *Pithophora* sp. was observed at Belt 4, and near Inlets 4, 5 and 6. The algae was an indicator of nitrate enrichment and poor water quality. Tourism in and around the Lake provided local livelihoods. The major footfall occurred in the surrounding meadow and *Khajjinag* Temple. The meadow was used for various recreational activities, as pasture by local grazers and temporary retail shops. Boating ceased to be a part of the tourism activities as Lake became shallower.

Khajjiar Lake play an important role in ecological and economic security of the region through wide range of ecosystem services, including supporting local livelihoods, regulation of hydrological regimes, carbon sequestration and support to biodiversity. The Lake is a natural depression basin and receives runoffs from adjoining area. The leaf-litters from forest, grassland and other point and non-point sources accumulate in the Lake and low degradation rate due to lower water temperature enable formation of floating decaying biomass. The nutrient enrichment and lack of flushing mechanism enabled algal bloom, deterioration of water quality and reduction in depth. A six point scientific intervention was suggested as priority counteractive measures for the conservation of the Lake ecosystem, viz. manual and mechanised de-siltation upto 1 m at identified locations in Section A, manual de-weeding of aquatic vegetation at Sections B and C, mechanism to reduce influx of nutrient and floating debris in inlet channels, maintenance of water level, management of the meadow, and a comprehensive ecological assessment to frame management plan.

On the basis of the ecological assessment, it was recognized that a management plan is needed for the long-term sustenance of the ecological functions of the Lake. It is recommended that monthly ecological surveys including assessment of bathymetry, biodiversity, water quality and socio-economic status shall be conducted for one year to establish baseline. On the basis of the spatial information of bathymetry, biodiversity and water quality, and resource dependency of the community, the management objectives shall be identified. Conservation aim, goals and targets with specific timeframe shall be defined by consulting relevant stakeholders. Accordingly, a management plan shall be prepared for the conservation of the Lake ecosystem and maintenance of its ecosystem services. A system of management effectiveness evaluation shall be put in place in line with the Ramsar Management Effectiveness Tracking Tool (R-METT) to assess the progress of the conservation interventions, identifying areas of improvement and mid-term course correction.

A RAPID ECOLOGICAL ASSESSMENT OF KHAJJIAR LAKE, HIMACHAL PRADESH FOR CONSERVATION INTERVENTIONS

1. Background

The Khajjiar Lake in the Chamba district is a renowned tourist destination in Himachal Pradesh and a unique high-altitude lacustrine wetland in the catchment of the Rabi River. It is also a part of Khajjiar-Kala Top Wildlife Sanctuary. Listed as a National Wetland in December 2006, the Lake ecosystem is threatened due to rapid anthropogenic alterations and losing its waterspread area. Siltation, weed infestation, faulty flushing mechanism, indiscriminate grazing and subsequent soil erosion has shrunk the lake to one fourth of its original size. The National Green Tribunal (NGT) ordered the Union and Himachal Pradesh governments, to take effective steps to revive the wetland and ensure its restoration to the 'original status'. In this context, the Wildlife Institute of India was approached by Himachal Pradesh Forest Department for scientific interventions for the rejuvenation of the Lake. A rapid ecological assessment was conducted at Khajjiar Lake during 11th-14th September 2019 to formulate strategies for conservation.

1.1 Introduction

Flourishing and well-functioning natural wetlands are important for human well-being as they provide important ecosystem services like fish and fiber, water recharge and purification, flood regulation, carbon sequestration, climate regulation, habitat for biodiversity, recreation among many others (MEA, 2005; Turner et al., 2000). Wetlands are also an important contributor in accomplishing the Sustainable Development Goals (SDGs) whether directly or indirectly (The Ramsar Convention on Wetlands 2018, Seifollahi-Aghmiuni et al. 2019). Despite being one of the most productive ecosystems of the world, they are also one of the most imperiled by a myriad of anthropogenic threats. Although scientific community, policy makers and civil society alike are increasingly putting more effort towards wetland conservation in last few years, wetlands all over the world continue to decline rapidly. Globally, wetlands have been reported to shrink by 64 - 71% during 20th century (Davidson, 2014). Another study by Hu et al. (2017) reported at least 33 per cent of global wetlands lost due to human activity until 2009 and Asia to have lost the largest area among all the continents i.e. about 2.65 million km^2.

India has lost an estimated 38% of its wetlands (Vijayan et al., 2004) and continues to lose its wetlands mainly due to rapid urbanization, changing land-use and land-cover, agricultural conversion, pollution from agricultural run-off, sewage and industrial waste, unregulated tourism, and inadequate legal and policy support to protect wetlands (Bassi et al., 2014). It is estimated that wetlands cover 1 to 5 % of India's geographical area (Space Applications Centre, 2011) and are spread in a wide range of geographical regions resulting in a diverse and unique wetland habitats (Prasad et al., 2002). About 20 percent of the known biodiversity of India is reported to be supported by wetlands alone (Space Applications Centre, 2011). They also provide a wide range of ecosystem services including irrigation, domestic water supply and freshwater fisheries which contribute to food, water and livelihood security of many in the

Kalatop Khajjiar Wildlife Sanctuary, Chamba (H.P.)

country (Bassi et al., 2014; Kumar et al., 2017). Wetlands also have a huge social value as religious centre and tourist destination.

To conserve the important inland freshwater resources of the country, the Ministry of Jal Shakti, Government of India has taken up a number of water conservation initiatives at national level. The wetland conservation is one of the important strategies under National Water Mission which implement and promote wetland conservation through National Plan for Conservation of Aquatic Eco-Systems (NPCA). The Ministry has identified 115 wetlands in 24 States and 2 Union Territories of the country for conservation and management. 27 wetlands in 15 States have been designated as Ramsar Sites of International Importance in India.

1.1.1 A brief account of Khajjiar Lake

The Khajjiar Lake, a National Wetland in Himachal Pradesh is a high altitude wetland with unique geo-climatic features and biodiversity. The Lake is also culturally important to locals and a prominent tourist destination that significantly contribute to local economy. Khajjiar town was christened 'mini-Switzerland' by Swiss envoy Willy P. Blazer July 7, 1992. He put up a signboard which indicates the distance from Swiss capital Berne to Khajjiar is 6,194 km. The lack of systematic management of the Lake and increasing tourist footfall has threatened the Lake ecosystem over the years. There has been a substantial increase in anthropogenic pressure on the Lake and surrounding area, mainly due to a boom in tourism and increase in local population. This has led to an increase in pollution, siltation and eutrophication in the lake which in turn has led to decline in water quality and waterspread area of the lake (Saini et al., 2008; Singh and Banyal, 2014). Few studies have focused on faunal diversity of the lake, particularly on insects (Singh and Banyal, 2013a), birds (Singh and Banyal, 2013b), and fishes (Singh and Banyal, 2013c). After Saini et al. 2008, there has been few attempts on examining the hydrology of the Lake.

1.1.2 Existing management practices

The Khajjiar Eco-tourism Society with the Conservator of Forests (Wildlife), North Zone, Dharamsala, as its Chairman was established in 2002 and de-weeding and de-siltation activities were carried out. Khajjiar Lake has been designated as a 'special development area' under the Town and Country Planning Act and to conduct cleanliness and development of Khajjiar, the Khajjiar Development Board has been constituted of members of various departments under the chairmanship of the Deputy Commissioner of Chamba (Attri, 2017).

A proposal for readdressing the grazing rights of people was prepared in 1993. A two-course action was suggested, firstly, to close the area to graziers for 30 years provided that an alternative grazing site is designated and, secondly, to acquire rights of the people while providing an alternative common pasture. A viable alternative grazing site was identified in the Jhurdu forests 6 km away from the site. It was proposed to divert runoff from drain and catchment and desilt the lake and provide drainage away from approach road. It is also proposed to fence the lake so that soil erosion due to over-grazing and tourist footfall in its immediate periphery could be regulated. Manual removal of floating hydrophytes and non-

degraded biomass in the lake was also suggested. Lack of continued studies on state of hydrology and water quality, there is a knowledge gap to successfully address systematic conservation planning to sustain ecological and hydrological integrity of the Lake (Attri, 2017).

1.1.3 Objectives

In this context, a rapid ecological assessment was carried out at Khajjiar Lake to assess the current status with the following objectives,

1. To assess the hydrology and water quality of the Lake
2. To assess the habitat complexity and biodiversity of the Lake
3. To recommend strategies to improve the hydrology regime of the Lake

2. Study Area

Khajjiar Lake, situated between 32°26 N latitude and 76°32 E longitude at an elevation of 1920 meters, is a natural depression basin and a lacustrine wetland in the Chamba district of Himachal Pradesh. Wetlands occupy approximately 1.77% of the total area of Himachal Pradesh. The saucer shaped Khajjiar Lake is 1.5 km long and 1 km wide and lies in the middle of a glade which is part of the Khajjiar-Kala Top Wildlife Sanctuary. The Lake is surrounded by dense Deodar forest. This Sanctuary lies in the catchments of the Ravi River, located in western part of Chamba District. It is one of the oldest preserved forests of state (notified on 01.07.1949). Total area of sanctuary is 2,026.89 hectares (20.69 sq. km.). Its mean annual rainfall is 800 mm. Temperature varies from -10° C to 35°C. The climate of Khajjiar in summers is mild and very cold winters. It experiences southwestern monsoon rains in July-September (Singh and Banyal, 2013b).

The area falls under Himalayan Biogeographic Zone and features unique geo-climatic and biodiversity characteristics. The sanctuary supports wild animals like the musk deer, black bear, leopard, barking deer and goral. Pheasant species like the monal, koklas and kaleej are also in abundance. The area around lake is marshy and lined with vegetation mainly *Acarus* sp., *Cyperus* sp., *Phragmites* sp., *Scirpus* sp. which contributes to the peat formation in the lake. In between the lake there is also a clump of weeds and grasses which appear to float and hence, called as floating island (Attri, 2017). Fish species such as *Cyprinus carpio communis* (Common Carp) and *Cyprinus carpio specularis* (Mirror Carp) have been recorded from the Lake. Khajjiar Lake also support a diverse array of birds which include 77 species belonging to 62 genera, 12 orders and 31 families. In this area Muscicapidae is the most represented family with 22 species belonging to 15 genera followed by Accipitridae and Corvidae (six species each), Paridae, Phasianidae, Columbidae and Picidae (three species each). 20 species of birds were local and the rest 57 seasonal-local and long range migrants (Singh and Banyal, 2013 a,b,c).

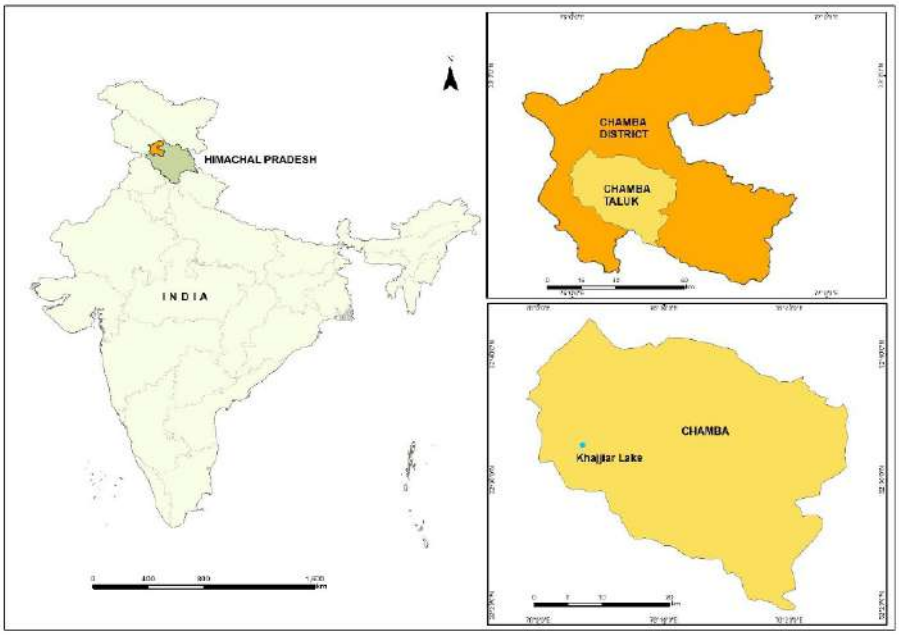


Figure 1. Map showing the location of the Khajjiar Lake

The Lake is mainly fed by streams and run-off from the surrounding forest. The average depth of the lake was last estimated to be about 13 feet as per the district gazetteer (Singh and Banyal, 2013). A temple dedicated to a local deity by the name of *Khajjinag*, after which the lake has been named, is situated at the edge of the meadow. The lake is linked with tales from Mahabharata and hence, considered sacred by the locals. The tourism supports their economy as well as offered employment opportunities.

3. Methodology

The ecological survey was conducted during 11th – 14th September, 2019. Information were collected on the hydrology regime of the Lake, identification of inflow and outflow channel, water quality, aquatic vegetation and anthropogenic influences (Figure 2).

3.1 Bathymetric survey

The bathymetry data was collected by Acoustic Doppler Current Profiler (ADCP). The ADCP was dragged by a paddle boat and continuous survey was conducted in two transects (Figure 3a, b). The depth information was extrapolated through kriging in GIS platform and bathymetric profile was generated.

3.2 Water quality assessment

The water quality parameters such as pH, Total dissolved solid (TDS), Dissolved oxygen (DO) and Nitrate (NO_3) were collected through a probe based water quality testing kit. Eight random sites were selected inside the Lake (Figure 4). The water quality for the whole Lake was extrapolated using kriging in GIS platform.

3.3 Wetland vegetation assessment

A stratified random quadrate method (Krebs, 1999) was adopted to quantify the wetland vegetation. A total of five radiating bels were selected and 1 m^2 quadrates were laid randomly according to the length of the belt (Figure 5). The species were identified and coded in the field. Every species were counted in a quadrate and their abundance and distribution were assessed.

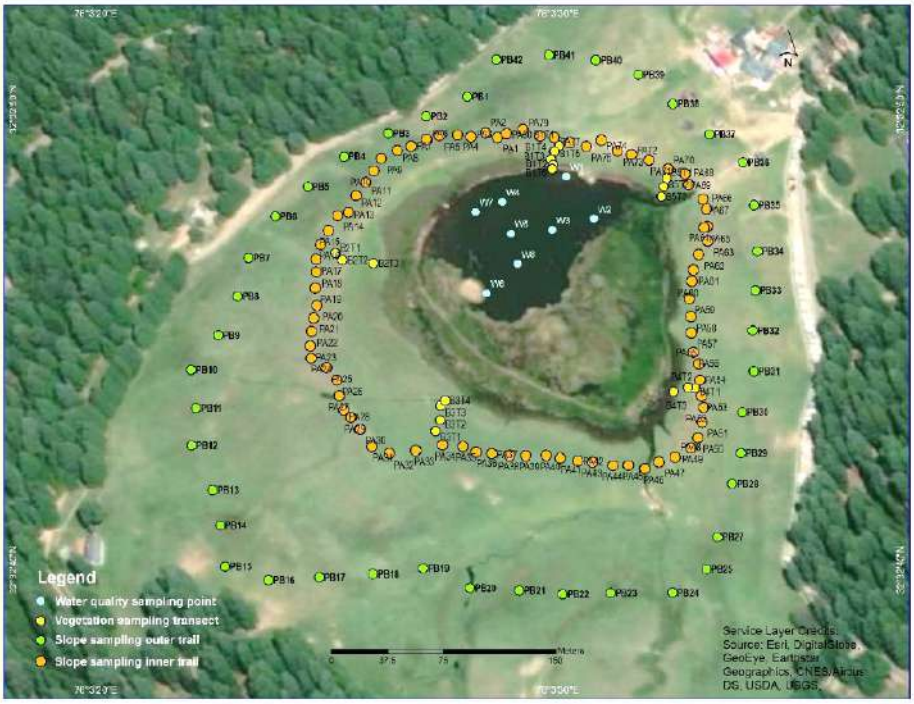


Figure 2. Sampling locations at the Khajjiar Lake and the surrounding meadow

Figure 3a. Bathymetric sampling at the Khajjiar Lake

Figure 3b. Bathymetric sampling transects conducted by ADCP

Figure 4. Water quality assessment at randomly selected sites

Figure 5. Assessment of wetland vegetation

4. Findings of the study

4.1 The bathymetry of the Lake

The waterspread area of the Lake could be divided into three sections. The Section A (Figure 6) was open water area with intermittent shallow and deep water pools. Section B comprised of floating island of dead and growing vegetative structures. Section C was marshy area with submerged and emergent vegetation. The depth of the open water area varied from 0.17 m to 5.66 m. The shallow water was predominant in the northern fringe and deep water pool was present at the western boundary of the open water area.

The floating dead biomass accumulated towards the northern boundary and near outlet of the lake, however it changed its location with wind and water flow. The floating islands were 0.7-1.3 m deep (mean 0.9 ± 0.1 m). A large floating island settled at the southern part of the Lake (Section B) and was now rooted to the ground at all seasons. There were six inlets to the Lake which originated in the surrounding forest. The natural channels cut through the meadow and enter the Lake at various points (Figure 6). The runoff from the forest flow through these channels and contributed to the hydrology regime of the Lake. During study period, the channels were almost dry and water was stagnant. There was one outlet to the Lake which was controlled by a sluice gate. To maintain the water level in the Lake the sluice was operated during monsoon season. However, for rest of the season, the sluice remained closed and the water level remained static.

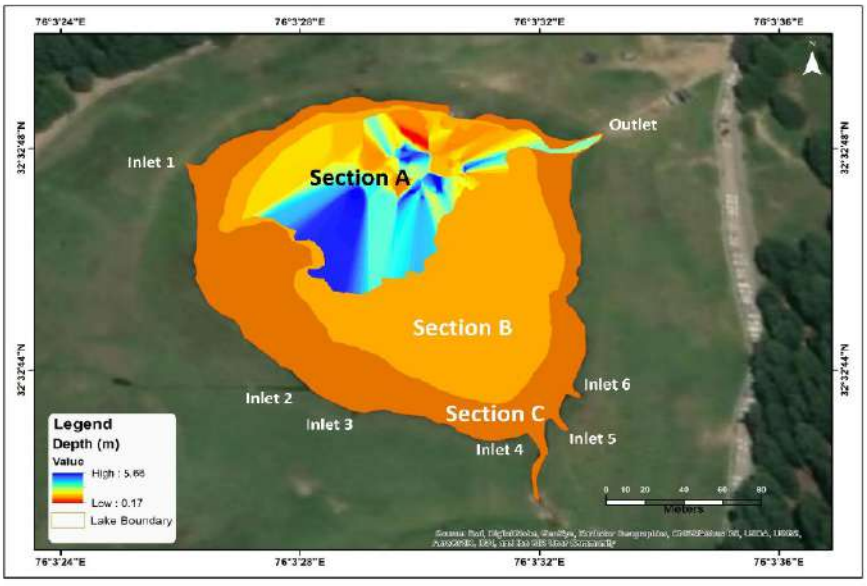


Figure 6. Depth profile of Khajjiar Lake, Section A: open water, Section B: Floating and emergent vegetation area, Section C: shallow water area with emergent vegetation; and location of inflow and outflow channels

PLATE 1

Section A, deep pool

Section A, shallow area

Section B, floating and emergent vegetation

Section C, marsh (wet meadow)

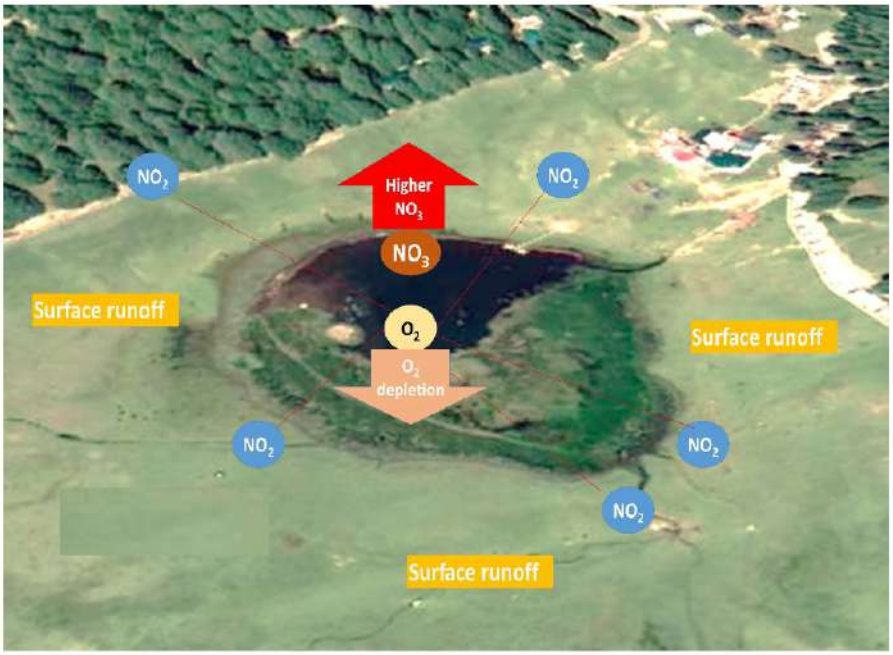
Inlet 4 with backwaters from the Lake

Sluice gate at the outlet

4.2 Water quality

The waterquality of the open water area was assessed in terms of pH, TDS, DO and NO_3. The pH ranged from 7.5 to 8.9. The shallow areas showed a near-neutral pH whereas the deeper sections showed alkaline condition (Figure 7). The TDS was uniform throughout the Lake and varied between 28.6 to 29.9 mg/L (Figure 8). The DO ranged from 5.4 to 9.1 mg/L. The shallow areas showed low DO and deep pool had a higher DO concentration (Figure 9). The NO_3 was prominent and contributed to most of the TDS. It ranged from 15.8 to 23.8 mg/L. The deep pool had higher NO_3 concentration (Figure 10).

It can be deduced that decaying algal biomass and runoffs contributed to the high nitrate level and alkaline pH in the Lake. The high nitrate and rise in water temperature in the shallow areas depleted the DO. Whereas, the photosynthetic activity and algal bloom increase the DO in the deep pool. High nitrate value indicate eutrophic condition. A nitrate concentration of more than 10 mg/L is an indication of oxidation reaction and transformation of nitrite to nitrate. This might be detrimental for the aquatic fauna as it may deplete dissolved oxygen rapidly and cause asphyxiation.



Input of nitrite to the Lake system through surface runoffs and channels. The nitrite though oxidation reaction was converted to nitrate and in turn, dissolved oxygen may deplete.

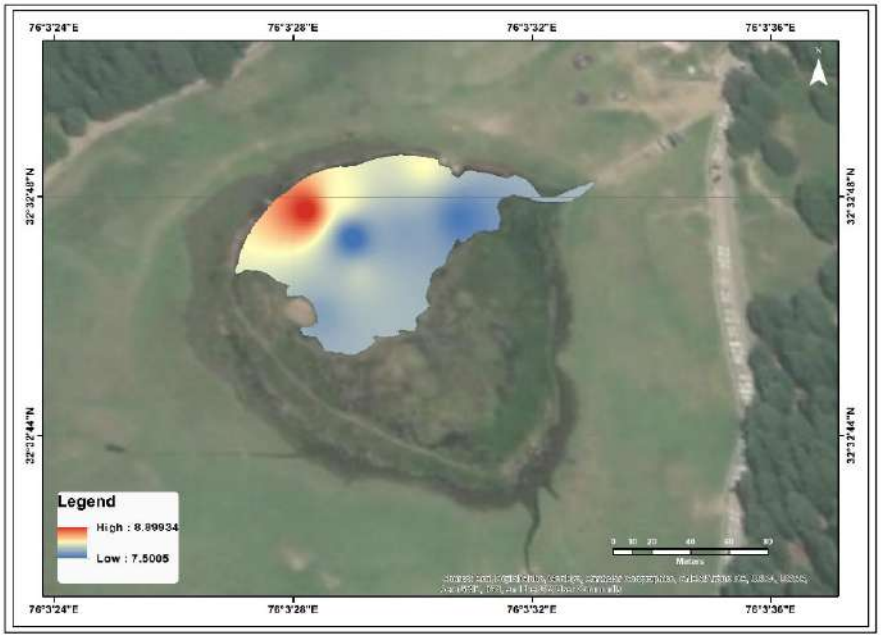


Figure 7. pH profile of the open water area

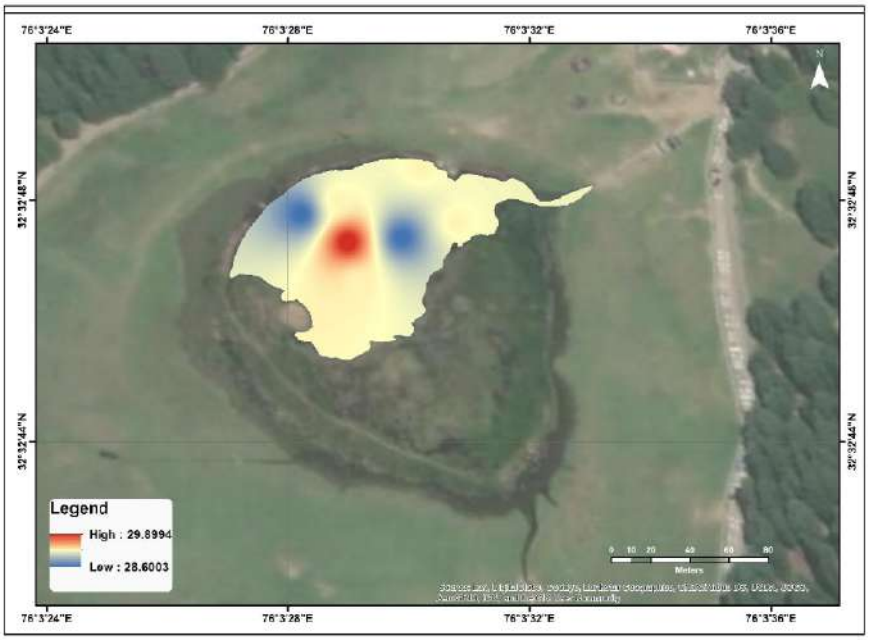


Figure 8. TDS profile of the open water area

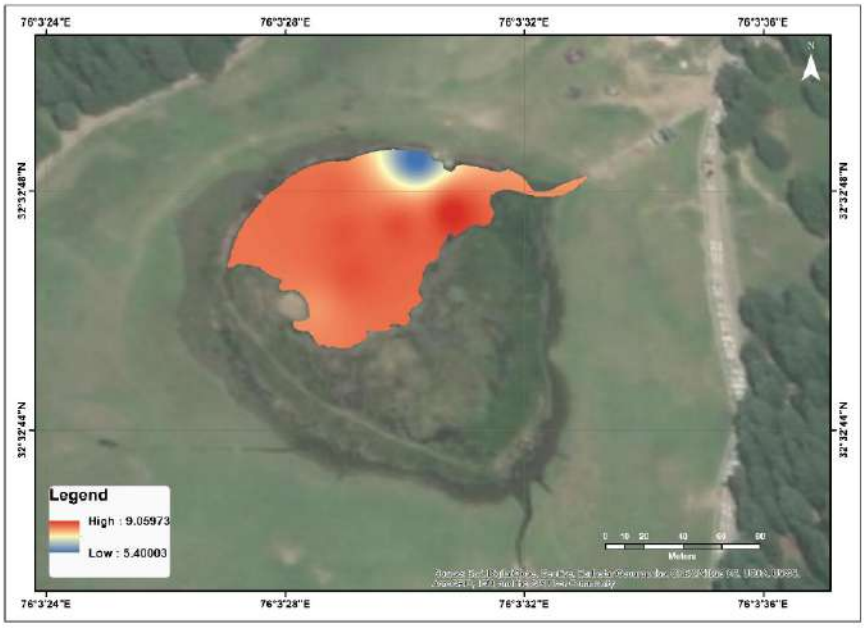


Figure 9. DO profile of the open water area

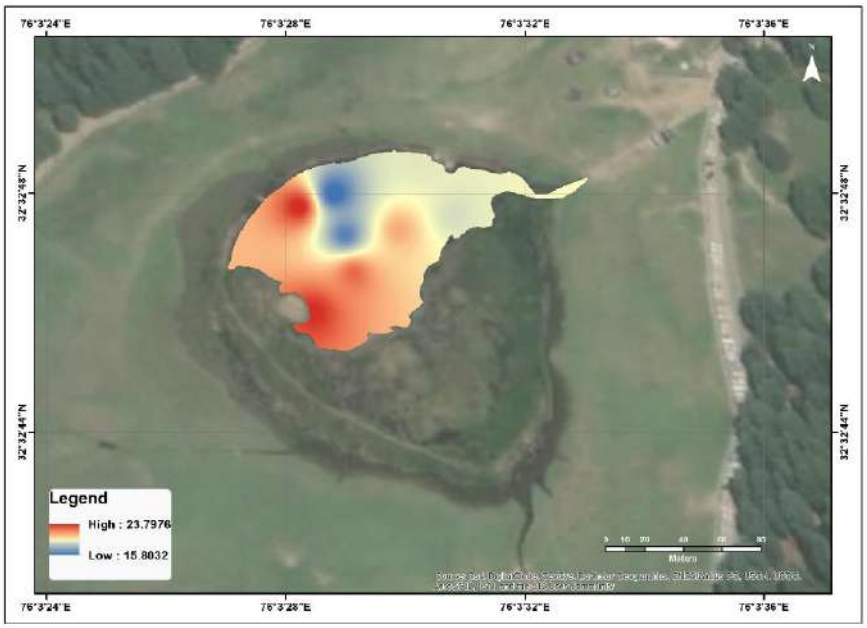


Figure 10. NO_3 profile of the open water area

4.3 Assessment of aquatic vegetation

The wetland vegetation of the Lake consisted of 15 species of emergent, floating, submerged-emergent and submerged types (Table 1). The species *Myriophyllum pinnatum* dominated the vegetation followed by *Marsilea minuta*, *Eleocharis geniculate*, *Eleocharis palustris* and *Cynodon dactylon* (Table 2). The *M. pinnatum* was an invasive species and was predominant in most of the quadrate.

The decaying floating biomass in the open water area (Section A) (Figure 11) supported growth of *M. pinnatum* and *Phragmites karka*. The floating island, dominated by *P. karka* settled down at southern part of Section B2. The rest of the Section B1 was dominated by *P. karka* and *Scirpus mucronatus*. The *M. pinnatum*, *Marsilea minuta* and *Isolepis cernua* were dominant species in Section C1. Section C2 was dominated by *Polygonum hydropiper*, *M. minuta* and *S. mucronatus*. The Section C3, at the eastern edge of the wetland, was dominated by *P. karka*, *S. mucronatus*, *M. pinnatum* and *M. minuta*. The filamentous algae *Pithophora* sp. was observed at Belt 4, and near Inlets 4, 5 and 6. The algae was an indicator of nitrate enrichment and poor water quality.

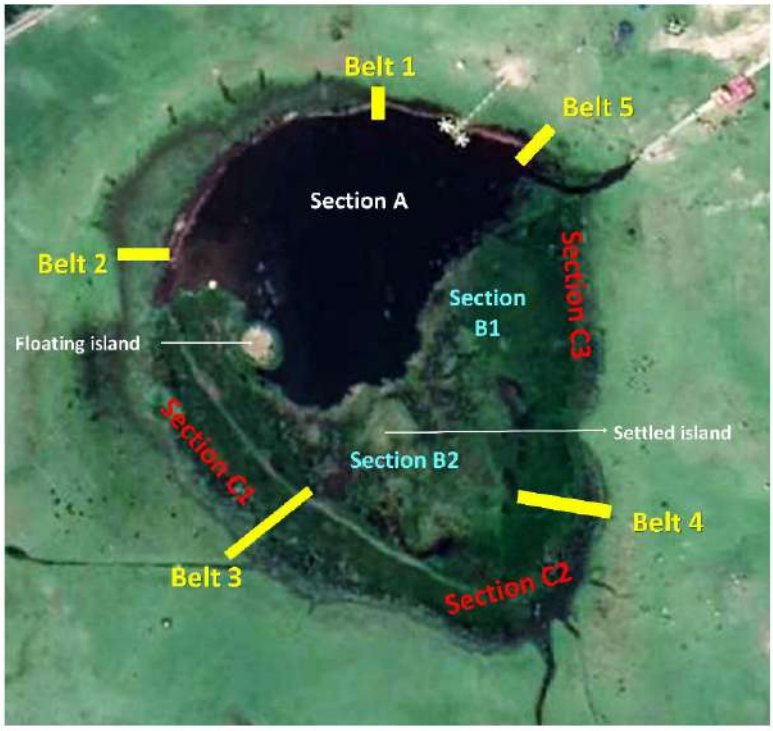


Figure 11. Transect belts for wetland vegetation assessment and distinctive sections in terms of hydrology and vegetation community structure

Table 1. List of wetland vegetation encountered during survey

Species Code	Scientific Name	Common Name	Status
S1	*Eleocharis geniculata* (Linnacus) Roem. & Schult	Bent spike-rush	Native
S2	*Eleocharis palustris*	Common Spike-rush	Native
S3	*Cynodon dactylon*	Dhoob grass	Native
S4	*Myriophyllum pinnatum* (Walter) Britton	Cutleaf Watermillfoil	Invasive
S5	*Polygonum hydropiper* Linn.	Water Pepper/ Marsh-pepper	Native
S6	*Marsilea minuta*	Pepperwort/ Chaupatira	Native
S7	*Isolepis cernua*	Low Bullrush	Native
S8	*Scirpus mucronatus* Linn.	Bulrush	Native
S9	*Alisma lanceolatum* With.	Lanceleaf	Naturalized
S10	*Cyperus flavidus* Retz.	Yellow Flatsedge	Native
S11	*Echinochloa crus-galli* (Linn.) P. Beauv.	Barnyard grass / Sanwak	Native
S12	*Cardamine hirsuta* L.	Hairy Bittercress	Native
S13	*Polygonum hydropiper* Linn.	Water Pepper/ Marsh-pepper	Native
S14	*Pithophora* sp.	Filamentous algae	Native
S15	*Phragmites karka* (Retz.) Trin. ex Steud.	Tall Reed	Native

Table 2. Abundance of species at transect belts

Species code	Belt 1	Belt 2	Belt 3	Belt 4	Belt 5	Total numbers
S1	37	7	14	25	31	114
S2	85	4	21	0	0	110
S3	80	16	0	14	0	110
S4	79	117	65	45	6	312
S5	21	10	5	4	2	42
S6	64	41	79	41	19	244
S7	11	6	1	0	0	18
S8	6	0	2	4	3	15
S9	2	0	0	0	2	4
S10	1	0	0	0	0	1
S11	0	1	0	0	0	1
S12	0	1	0	0	0	1
S13	0	0	0	6	0	6
S14	0	0	0	1	0	1
S15	0	0	0	13	7	20

PLATE 2

Floating decaying biomass with *M. pinnatum* as pioneering vegetation at Section A

Section B2 with *P. karka*

Section B1 with marshy area

Section C1 with emergent vegetation

Section C2 with *P. karka*, *S. mucronatus*, *M. pinnatum* and *M. minuta*

Section C3 with profuse growth of filamentous algae *Pithophora* sp.

4.4 Anthropogenic activities

Tourism in and around the Lake provided local livelihoods. The major footfall occurred in the surrounding meadow and Khajjinag Temple. The meadow was used for various recreational activities and the locals installed temporary retail shops. Boating was also a part of the tourism activities, however, it was now restricted as the Lake became shallow. It was observed that, locals sell puffed rice to the tourists who feed the fish in the Lake. The meadow was extensively used as pasture land by local grazers.

Biodegradable solid waste such as corncobs, food remains and non-biodegradable plastic waste, bottles and pouches were observed at a few places in the periphery of the meadow towards the forest area. The local retailers have adopted sustainable waste disposal practices around the Lake and also insist tourists to use bins to dispose waste. Bins and signage were installed near the boating facility by the Forest Department, Himachal Pradesh to manage waste and spread awareness.

Boating facility

Bins and information signage

Recreational activities

Khajjinag Temple and hotels

Cattle grazing in the meadow surrounding the Lake

5. Recommendations for conservation intervention

High altitude wetlands such as Khajjiar Lake play an important role in ecological and economic security of the region through its wide range of ecosystem services, including supporting local livelihoods, regulation of hydrological regimes, carbon sequestration and support to biodiversity. Scientific interventions shall be based on integrate wetland conservation and wise-use concept as prescribed by Ramsar Convention.

The Khajjiar Lake is a natural depression basin and receives runoffs from adjoining area. There were five inflow channels that drain from the surrounding forest. The outflow of the water was regulated by a sluice gate and a minimum level was maintained in non-monsoon periods. The leaf-litters from forest, grassland and other non-point sources accumulate in the Lake and low degradation rate due to lower water temperature enable formation of floating decaying biomass (floating islands). The nutrient enrichment and lack of flushing mechanism enabled algal bloom, deterioration of water quality and reduction in depth. The following activities are suggested as priority counteractive measures for the conservation of the Lake ecosystem.

1. De-siltation
2. De-weeding
3. Reduce influx of nutrient and floating debris
4. Maintenance of water level
5. Management of the meadow
6. Comprehensive ecological assessment to frame management plan

5.1 De-siltation

De-siltation can restore natural topography and elevations of a wetland in order to intercept groundwater, to reach an intertidal level or to rejuvenate wetland hydrology. In some cases, sediment previously deposited in a wetland can be removed to rehabilitate the wetland.

1. De-siltation activities shall be carried out manually and/or mechanically where necessary.

2. The settled biomass in Section A shall be removed through mechanised means at least upto 1 m, once in a year in summer or in post-monsoon.

3. The floating biomass from the deep water area in Section A shall be removed manually by netting in post monsoon when the water level is high. Precaution may be taken to avoid accidental capture of fish species. If fishes are entangled in the net, they may immediately be released in the Lake.

4. The Lake basin has natural undulations and that provide habitat complexity. The natural bathymetry of the Lake shall be maintained and de-siltation shall be done accordingly.

5. Excavation to subsoil leaves poor substrate for plant growth. Dredging of bed material shall be avoided in the drawdown zones in the Lake boundary.

6. No scrapping shall be done in the drawdown level of the Lake (Section C1), so as to maintain the natural succession of wetland vegetation, avoid siltation and conservation of seed bank. Removal of dead organic matter and silt can be removed from the C2 and C3 upto 1 m mechanically or manually to increase the waterspread area.

7. The dredge materials shall be disposed away from the Lake in an environment friendly manner. The biomass material shall not be burned, and could be used for composting.

5.2 De-weeding

Aquatic weeds have the potential to threaten irrigation channels and to block inlet and outlet channels. They can spread rapidly and form dense mats above or below the water. These results in a reduction in light entering the wetland and depletion in oxygen levels in some cases causing death of aquatic fauna such as fish.

1. The de-weeding activities shall be conducted in Sections B and C through mechanical and/or manual means where necessary with removal of settles biomass upto 1 m.

2. The de-weeding shall be carried out before the onset of monsoon and after the migratory season for the wetland birds.

3. Complete removal of filamentous algae shall be conducted twice in a year in pre- and post-monsoon seasons. Use of mosquito net is effective in removal of the algae. Precaution may be taken to avoid accidental capture of fish fauna. If fishes are entangled in the net, they may immediately be released in the Lake.

4. *Phragmites karka* shall be removed manually from Section B1 and Section C2. In Section B2, only 20-30% of the old growth of *P. karka* shall be removed, as the island may provide habitat for wintering migratory birds. The removal shall be carried out in post monsoon to promote new growth during growing season.

5. The species *Myriophyllum pinnatum*, *Isolepis cernua*, *Scirpus mucronatus* are rapid growing and inhabit most of the wetland. These could also be manually removed from Sections B and C in a periodic manner. It shall be noted that 60-70% of the vegetation shall be retained in the wetland for regeneration.

6. The vegetation that is removed from the wetland, shall be disposed in environment friendly manner away from the Lake. Burning of any dry biomass shall strictly be avoided.

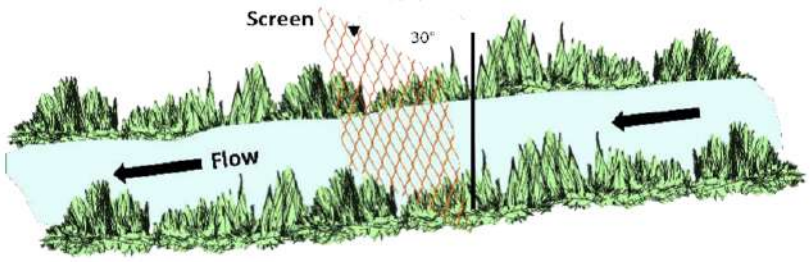
7. Control of weeds through chemical means shall be avoided as it may abolish the native species and degrade water quality.

Filamentous algae can clog and choke the inlet and outlet of the lake. It can also rapidly deplete oxygen in water. These highly proliferating species shall be removed completely from the wetland. Control of nutrient influx can reduce the proliferation of this species.

5.3 Reduce influx of nutrient and floating debris

The surface runoffs from the surrounding area of the Lake and inlet channels provide biodegradable organic material in terms of silt, leaf litters and wooden debris. The decay of the organic material increase the organic load in the water in terms of nitrate. Reduction in the entry of floating organic debris will reduce influx of nutrients.

1. Fixed, fine iron screen of 10 mm mesh size may be installed at strategic locations in the inlet points before entering into the Lake. The screens shall cover the width of the channels and shall be installed at a 30° slope from horizontal position towards the flow direction.



2. The screens shall be cleaned manually as and when required to avoid choking. The screened debris shall be segregated in biodegradable and non-biodegradable material and put away in an environment friendly manner and away from the Lake.

3. The aquatic vegetation in the channel shall not be removed. The vegetation perform natural filtering functions. The morphology of the natural channels shall not be altered through any excavation activity.

4. An artificial soil bund of 30-35 height cm may be created around the Lake at least 10 m away from Section C boundary with intermittent cut-channels at every 100 meters. The native grass species *Eleocharis geniculate* shall be planted to maintain the integrity of the bund. The activities may be finished before the onset of monsoon to enable growth of grasses and avoid siltation.

5.4 Maintenance of water level

The hydrology regime of a wetland is critical to maintain ecosystem functions. The water regime determine the productivity, biotic assemblage, rate of removal of nutrient from the system and physio-chemical characteristics. As a natural depression basin, Khajjiar Lake receive runoffs from adjoining areas and the water level is maintained by a single outlet with sluice gate. The stagnancy in the Lake deteriorated the water quality due to nutrient enrichment. The following measures are required to manage the hydrology regime.

1. A water gauge pole with level indicator in meter may be installed at North-west of Section A in the shallow zone, and conspicuous for the observer. The pole shall be fixed in the base soil and the head of the pole shall remain 2 meters above the high water level.

2. Sluice gate shall be operated during monsoon months to flush water from the Lake and to allow fresh water inflow.

3. A minimum of 0.3 m water level shall be maintained at Section C1 during pre-monsoon.

4. The existing mean water level during pre-monsoon month shall be maintained as critical minimum level for the Lake.

5.5 Management of the meadow

The meadow around the Lake is a grassland of medium slope towards the Lake and is dominated by *Eleocharis geniculate* and *Eleocharis palustris*. The meadow provide pasture land for local grazers and over-grazing may cause soil erosion, degeneration of grassland and provide additional organic matter to the Lake as dung. Tourism at peak season contribute significant amount of solid waste to the Lake and surroundings. The following measure are suggested to manage the meadow and in turn the water quality of the Lake.

1. Grazing often provide solution to management of wetland vegetation. The grazing rights of the locals shall be settled and guidelines shall be made to control the grazing pressure.

2. Education and awareness programmes shall be taken up by the local administration and Forest Department periodically round the year to garner support from local community and tourists for sustainable tourism, waste management and conservation of the Lake ecosystem.

3. More signage shall be installed in the periphery of the meadow and around the Lake about the historic, mythological and ecological significance of the Lake. Signage regarding the DO's and DON'Ts related to waste disposal shall be installed at strategic locations.

4. A consortium of Forest Officials and staffs, local community members, Temple committee members of Khajjinag Temple, District Administration and research institute such as the Wildlife Institute of India may be created as *Task Force* to carryout long-term monitoring and management of the Lake.

5.6 Comprehensive ecological assessment to frame management plan

The NPCA promote and implement conservation of wetlands in India so as to prevent their further degradation and ensuring their wise use for the benefit of local communities and overall conservation of biodiversity. As directed by the Ramsar Convention, conservation and wise use of wetlands is being ensured in India through the Wetlands (Conservation and Management) Rules, 2017. Wetlands also receive incidental protection through the Indian Forest Act, 1927; Forest (Conservation) Act, 1980; Wild Life (Protection) Act, 1972; Water (Prevention and Control of Pollution) Act, 1974; Water Cess Act, 1977; Environment (Protection) Act, 1986; Biological Diversity Act, 2002; Coastal Regulation Zone Notification, 1991; and their respective amendments; National Environment Policy, 2006; and National Biodiversity Action Plan, 2008.

The NPCA directed States to make inventory of important wetlands and prepare management plan for wetlands of National Importance. A 'Guidelines for Conservation and Management of Wetlands in India' is being notified under Environment (Protection) Act, 1986. The Khajjiar

Lake is declared as National Wetland in 2006 and a comprehensive management plan is needed for conservation of the Lake. In this regard following activities are suggested;

A. *Ecological monitoring to establish baseline*

Monthly ecological surveys including assessment of bathymetry, biodiversity, water quality and socio-economic status shall be conducted for one year to establish baseline. The data shall be further supported with secondary information.

B. *Setting up management objectives*

On the basis of the spatial information of bathymetry, biodiversity and water quality, and resource dependency of the community, the management objectives shall be identified.

C. *Prepare Management Plan*

Conservation aim, goals and targets with specific timeframe shall be defined by consulting relevant stakeholders. Accordingly, a management plan shall be prepared for the conservation of the Lake ecosystem and maintenance of its ecosystem services.

D. *Management effectiveness evaluation*

A system of management effectiveness evaluation shall be put in place in line with the Ramsar Management Effectiveness Tracking Tool (R-METT) to assess the progress of the conservation interventions, identifying areas of improvement and mid-term course correction.

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