

Evaluation of Crop Damage in the
Eco-development Project Area to
Suggest Mitigation Measures

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TERMS OF REFERENCE

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The task has 3 components and is stated as follows:

Task No. 11: Evaluation of crop damage in the Eco-development Project area to suggest mitigating measures

- a) Evaluate current levels and causes of crop depredation by wild animals around the park.
- b. Suggest new and innovative methods of crop protection based on actual field situation e.g. artificial barriers, green fencing, cultural practices, comonstation or a combination of these methods.
- c) Besides presenting a formal report of the study, preliminary insights from the study will be shared with the officials of the Great Himalayan National Park and local officials (if any) in meetings. Such meetings will also be part of a process of creating a dialogue aimed at working out solutions and evolving feasible recommendations that can be incorporated expeditiously into the implementation of the Eco-development Project.

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EVALUATION OF CROP DAMAGE IN THE ECO-DEVELOPMENT PROJECT AREA TO SUGGEST MITIGATING MEASURES

1. INTRODUCTION

With increasing human and livestock populations, biotic pressures and encroachment on forests, bio-diversity is adversely affected in protected areas and managed forests. Most of the protected areas are fragmented and disturbed from human activities, livestock grazing and over-exploitation of resources. Vast areas of forests, marginal lands, pastures and wastelands were brought under cultivation in order to sustain increased demand of cereals and other food products. The irrational and unsustainable land-use pattern in rural areas have further added to this problem.

The situation in Great Himalayan National Park, Sainj and Tirthan Wildlife sanctuaries and Eco-development area is no different and here flora and fauna is greatly impacted. Due to disturbance, degradation, fragmentation, loss of habitats and habitat quality, many wildlife species have become ecological dislocates over the period of time. While some species have become locally over abundant and adapted to the man-altered habitat successfully, few others have started straying out of protected areas.

Wild animals increasingly venture into human settlement and cultivation areas in search of food and cause extensive damage to the agricultural and horticultural crops or injure or kill people due to mere confrontation. When prey population is less abundant and perhaps, unevenly distributed, leopard and bears resort to predate more and more on livestock population. As a result, livestock killings in and around protected areas and managed forests have become manifold.

Thus, human-wildlife conflicts have assumed different dimensions due to human casualties, livestock killings and agricultural and horticultural crop raiding at the interface of wildlife habitats and human use dominated landscape. Further as the conflicts are increasing, acceptance of conservation ideals by the local people is also greatly affected. Though improvement in agricultural technology and practices and rural community development, approaches to the Eco-development planning and integrated forest management practices are in progress in these areas, but these measures alone will not help attain the long term solution to the above conflicts. Under the circumstances, situation for both wildlife and rural people is rather tragic especially in the protected areas. Mitigation of wildlife damage problems in hilly areas is very complicated and therefore, scientists and wildlife managers are also in a precarious situation. However, there is an urgent need for the development of strategies that can minimise or reduce the man-wildlife conflicts to tolerable level.

In the Project area, important wildlife damage problems are human casualties, livestock predation, agricultural and horticultural crop depredation. Cattle-lifting by leopard and black and brown bears is quite common. In villages, crop damage is mainly caused by bear, langur, monkey, goral, jackal, porcupine, rodents, parrot and crow.



Very little scientific information is available on the genesis of wildlife damage problems and control aspects. Whatever little information on damage problems which has been documented is also not systematically elaborated. Even though damage causing species may be the same, problems vary from one state to another and at different locations in the same state depending on habitat types and prevailing circumstances. No information is available on ecology: habitat use, food habits and ranging pattern of problem species. At the present, various damage problems are subjectively and vaguely defined. Consequently developing problem mitigation strategies is becoming difficult. This all suggests that there is urgent need to study the nature and extent of wildlife damage problems and their control aspects, which will help in evolving better integrated, practical and rational management strategies to support conservation as well as interest of the local people.

The Report specifically deals with the evaluation of current levels of wildlife damage problems in the Eco-development Project area to suggest mitigatory measures. Information on human casualties and livestock killings has been collected, analysed and presented. Assessment of agricultural and horticultural crop has been done to suggest methods for reducing the problems.

2. REVIEW OF LITERATURE

Wild animal damage problems occur widely in and around protected areas and managed forests. Scientific information on the genesis of damage problems and their control aspects is not adequately documented in India. Some scattered information on human casualties, livestock predation and agricultural crop damage is available from different states and Union territories.

The problem of human-killing and livestock predation by tiger have been studied by Chaudhary and Chakrabarthy, 1972; Gopal and Kotwal, 1993; Khaire *et al.*, 1994; Koppikar and Sabnis, 1989; Sawarkar, 1979 and 1986; Schaller, 1967; Singh, 1994; Thosre and Mahajan, 1994; Wankhade and Mahajan, 1993 and Rajpurohit and Chauhan, 1996. Although the tiger population is only a fraction of what it is believed to have been at the turn of century, incidence of human-killing and cattle-lifting by tiger have continued (Gopal and Kotwal, 1993; Singh, 1994; Thorse and Mahajan, 1994 and Rajpurohit and Chauhan, 1996). Dwivedi (1982) reported that on an average 618 heads of cattle were killed by tigers annually in Bandhavgarh National park.

Lion in Gir takes heavy toll of cattle annually. Historical records show that lion in the Gir preyed mainly on the domestic livestock. However, studies conducted by Saberwal *et al.* (1994) have shown that only 36% of the kills were from domestic livestock. There has been a significant increase in human casualties by lion from 1988 onwards. There were 204 human casualties in Gir Conservation Unit from 1988 to 1997 over a period of nine years (Singh, 1997).

In many states, human casualties and livestock killing by leopard is a serious problem. Jim Corbett (1992) has documented it as a serious problem in the hills of Kumaon and Garhwal, Uttar Pradesh. Similarly cases of livestock-killing and human casualties by leopard have been reported from Maharashtra (Khaire *et al.*, 1994; Sawarkar, 1979; Thosre and Mahajan,

1994 and Wankhade and Mahajan, 1993); Madhya Pradesh, Bihar and Orissa (Rajpurohit and Chauhan, 1996); Uttar Pradesh (Mohan, 1994; Tiwari, 1994 and Banerjee, 1994) and the Gir Conservation Unit (Singh, 1997). In Sanjay Gandhi National Park, when the wild prey became scarce, the leopards survived by shifting to more or less exclusively on domestic dogs (Daniel, 1995).

Cases of child-lifting by wolves have been reported by Sengupta, 1985; Shahi, 1982 and Rajpurohit and Chauhan, 1996 from Hazaribagh, Koderma and Latehar divisions of Bihar. Wolf menace has also been reported from Anantapur, Andhra Pradesh (Shahi, 1982; Jhala, 1993); Pavagadha, Karnataka (Jhala, 1993) and Jaunpur, Pratapgarh and Sultanpur in Uttar Pradesh.

In many states, human casualties and crop depredation by sloth bear are serious problems. In Melghat Tiger Reserve, there has been 22 cases of bear attacks on human beings during 1986-92 (Pillarsett, 1993). Another study by Khaire *et al.* (1994) revealed 16 incidence of human casualties by sloth bear during 1988-93 over a period of five years in the same area. Information on sloth bear-human conflicts from 23 forest divisions and protected areas of Madhya Pradesh shows that 607 human casualties have occurred in the state during 1989-94 (Rajpurohit and Chauhan 1996).

Crop raiding by elephant is taking alarming proportion and number of people killed in encounter with elephant while protecting their crops seems to be increasing. In Bihar, 228 people were killed by elephants in 15 forest divisions and protected areas during 1989-94, whereas in Orissa 83 people were killed during 1990-95 (Rajpurohit and Chauhan, 1996). In Sarguja, Jashpur and Raigarh districts of Madhya Pradesh, 41 people were killed by elephant, and there was huge loss of property during 1988-93 (Murthy, 1994). Available data indicates that perhaps 200-250 people fall victim to killer elephants annually (Project Elephant Report, 1993). In Tamilnadu, Bihar, Orissa, Uttar Pradesh and Karnataka, incidence of crop raiding by elephants are increasing (Gupta, 1985; Daniel, 1985; Sanmuganathan, 1985; Shahi, 1985; Shahi, Daniel and Choudhary, 1985; Singh, 1978; Rajpurohit and Chauhan, 1996 and Sukumar, 1985). In Kerala, 548 cases of agricultural crop raiding have been reported from Wayanad, Palaghat and Tellicherry areas during 1985-89 (Nair, 1994). Crop raiding by elephants is also a serious problem in West Bengal (Mukherjee *et al.*, 1997), Arunachal Pradesh and Assam (Chaudhary Lahiri, 1985).

The problem of agricultural crop damage by deer, nilgai, blackbuck and wild pigs have been widely reported from Rajasthan (Rajpurohit, 1993), Haryana (Chauhan and Sawarkar, 1989; Chauhan and Singh, 1990 and Singh and Chauhan, 1994), Maharashtra (Ahmed, 1991; Indurkar *et al.*, 1994; Mankadan and Rahmani, 1994 and Sinha and Jha, 1994), Madhya Pradesh (Chandra, 1994; Dwivedi, 1994; Singh, 1994; Rajpurohit and Chauhan, 1996 and Sharma, 1995 and 1996), Gujarat and Punjab etc. but the data on nature and extent of damage are required to be documented scientifically. Crop depredation by wild animals in Kerala found to be very heavy (Veeramani and Jayson, 1995). In Peppara Wildlife sanctuary, 209 incidence of crop raiding were recorded by different wild animals in 9 human settlements studied during 1993-96 (Jayson, 1998).



Langur and monkey occur commonly in , forests, interface agricultural fields, orchards, villages, townships and cities. Both the species have adapted to human habitation and depend on agricultural and horticultural crops and food handouts by local people. In aggression or adaptive behaviour, sometimes they attack on human beings, and cause extensive to human property and agricultural and horticultural crops (Pers. Comm.)

3. STUDY AREA

The project area comprises of Great Himalayan National Park and adjoining Sainj Sanctuary, Tirthan Sanctuary, Jiwa Nal and Ecodevelopment area and is spread over an area of 1,17,100 ha (Map I). Recently some area has been carved out of the park and map has been updated. The Great Himalayan National Park (GHNP) is situated in the North-Western Himalayas in Kullu District of Himachal Pradesh, about 60 km to the South-East of Kullu. Its latitude and longitude are 31° 38' 16" to 31° 56' 41" North and 77° 20' to 77° 52' 11" East respectively. It is contiguous with Pin Valley National Park, Kanawar Wildlife Sanctuary, Roopi Bhaba Wildlife Sanctuary and the proposed Srikand National Park.

The Park falls on the junction of two great faunal realms; palaeartic to the North and Oriental to the South. Geographically the park covers the catchment area of upper Beas river in four valleys of Parvati, Jiwa, Sainj and Tirthan rivulets (Map 2). The Beas flows down from the snowy heights of the Beas Kund and joins its main tributaries: the Parvati at the town of Bhuntar; the Sainj and Tirthan near Largi viillage. Jiwa nal is a tributary of Sainj which meets it at village Suend. The main part of Parvati Pass rising gradually from the base of Mantali Lake, the source of Parvati river. Tirthan rises from the ice cold spring of Hamkund peak and flows down through a large and deep forested Rohla terrian rated as one of the best in Indian forests.

3.1 ALTITUDE

The mountain formation of the region is similar to other parts of the Himalayan tract composed of high ranges with sharp crests and steep terrain. The altitude of Project area varies from a minimum of 1344 M near Seund at the confluxion of Jiwa Nal and Sainj Khad to a maximum of 6248 m at an unnamed peak in Khirganga P.F. in the east of Mathaun Dhar.

3.2 GEOLOGY, ROCK AND SOIL

Geology, rock and soil effect the vegetation of a place by influencing the moisture regime, structure, texture and drainage of the soil. The underlying rock found in the area are quartzites, schists, phyllites, dolomites, limestones, shales, slates, gneisses and granites, which are responsible for a variety of coniferous and broad-leaved vegetation.



Alluvial soils are found deposited in the basins of rivers and along the banks of the rivers. Podsollic soils and brown soils are found developed in temperate climates. The soil is covered with thick layer of humus. The soil of almost entire tract has been formed *in situ* and belongs to podsollic group.

3.3 CLIMATE AND RAINFALL

There are distinct three seasons in the area viz. Summer from April to June, Rainy season from July to September and winter season from October to March. Depending on altitude, upper reaches are colder than the valleys. Winter is severe and main precipitation is received in the form of snow during winter. Rains are mostly confined to rainy season and heavy downpours in rainy season cause landslides and soil erosion.

3.4 LANDUSE

In the project area 2032 ha. (1.74%) area is under cultivation, 38092 ha. (32.53%) area is under forests, 45233 ha. (38.63%) area is blank, 12918 ha. (11.03%) area is rocky and 18825 ha. (16.07%) area is snow bound.

3.5 FLORA AND FAUNA

There are abundant semi-tropical forest vegetation including large tracts of dense pine woods, deciduous rhododendron and ever green oak, fir and spruce etc. in addition to large mountain meadows and pastures. The area is a rich bio-diversity zone of the western Himalayas.

The project area supports a rich diversity of flora and fauna.

Flora: A total of 309 species of trees and other plants have been reported from the park area. The GHNP has 17.0% of its area, Tirthan Sanctuary has 47.1%, Sainj Sanctuary has 35.1% and Eco-development area has 74.6% of their respective areas under forests.

Following Forest types based on Champion and Seth's classification, occur in the area: Ban Oak Forest, Moist Deodar Forest, Western Mixed Coniferous Forest, Moist Temperate Deciduous Forest, Kharsu Oak Forest, Western Himalayan Upper Oak-Fir Forest, Montane Bamboo Brakes, Himalayan Temperate Parkland, Himalayan Temperate Pastures, Western Himalayan Sub-Alpine Fir Forest, Sub-Alpine Pastures, Birch/ Rhododendron Scrub Forest, Deciduous Alpine Scrub and Alpine Pastures.

The villages, hamlets and cultivation are revenue lands under private ownership. Rest of the areas are either Reserve Forest (RF) or Protected Forest (PF).



Fauna and Avi-fauna: The project area has wide variety of fauna and avi-fauna which include about 31 species of mammals and over 300 species of birds. The Reptiles, Amphibians and numerous insects also occur in the area. Some of the important species of mammals and birds found in the area are Black bear (*Selenarctos thibetanus*), Brown bear (*Ursus arctos*), Snow leopard (*Panthera uncia*), Common leopard (*Panthera pardus*), Wolf (*Canis lupus*), Musk deer (*Moschus chrysogaster*), Barking deer (*Muntjac muntjak*), Serow (*Capricornis sumatraensis*), Himalayan Tahr (*Hemitragus jemlahicus*), Himalayan Ibex (*Capra ibex*), Blue sheep (*Pseudois nayaur*), Goral (*Nemorhaedus goral*), Langur (*Presbytis entellus*), Monkey (*Macaca mulata*), Porcupine (*Hystrix indica*), Jackal (*Canis aureus*) etc. among wild animals and Western Tragopan (*Tragopan melanocephalus*), Monal (*Lophophorus imperjanus*), Cheer (*Catreus wallichii*), Kalij (*Lophura leucomelana*), Koklas (*Pucrasia macrolopha*), Snow Cock (*Tetraogallus himalayensis*), Parrot (*Psittacula cyanocephala*), Jungle Crow (*Corvus macrorhynchos splendens*) and Common Crow (*Corvus splendens*) etc. among birds.

3.6 SOCIO-ECONOMICS

In the project area, most of the habitation is confined to the peripheral area i.e. Eco-development area. The number of villages in Great Himalayan National Park, Sainj and Tirthan Sanctuaries and Eco-development area is given in Table 1. The economy of the people living in Great Himalayan National Park, Tirthan and Sainj Wildlife sanctuaries and Eco-development area is mainly based on forest, agriculture and livestock.

Grazing is one of the major pressures on park resources. Since the park areas provide sufficient grazing land and moderate cool climate throughout the year, the flocks of sheep and goats are constantly on the move; a few are kept at home for domestic purposes. The winter livestock of the hamlets situated on higher altitudes are brought to areas on lower altitudes. When the cold decreases, they again come to spend the spring season in neighborhood of their native villages. They are then further drawn to forest areas near cultivation areas where they graze livestock for considerable time and walk further on pastures on higher altitudes as the rainy season commences in June - July. Till the end of rainy seasons (September) flocks of sheep and goat graze on various alpine pastures called thatches.

The grazing pressure reaches as its peak in May to September when in addition to local livestock, the right holders for outside areas (kothis and Tahsils) send their livestock for grazing in the park areas. About 10,000 migratory sheep and goat graze in the park in addition to 20 - 25 thousand local livestock in peak months. The rights for using thatches and places where sheep are panned are named and the times during which they are used specified; grazing of sheep and goats as specifically treated; time and place are almost fixed.

Table 1: Name of areas and villages in the Project area

SI No.	Name of area	No. of villages	Name of villages
1.	GHNP	2	Kundar and Manjhan
2.	Sainj Sanctuary	3	Shagor, Shakti and Maror
3.	Tirthan Sanctuary	-	-
4.	Ecodevelopment area	124	List of villages is given in Annexure I
	Total	129	

Any discrepancy in number of villages if any is attributable to inclusion of hamlets in the main village.

In Great Himalayan National Park, there are only two villages viz., Kundar and Manjhan which are situated at an altitude of about 2400 m. In Kundar village only one family lived and it was found that recently it has abandoned the village and shifted to a village down below. However, cultivation of land continues there. In Tirthan Sanctuary there are no villages inside the sanctuary. But in Sainj sanctuary there are 3 villages viz. Shagor, Shakti and Maror.

Most of the habitation in the project area is situated in the Eco-development area; there are 124 villages (Map 3). The list of villages is also appended as Annexure I.

3.6.1 Human Population: (Park authorities, Per.Com.)

Around the park, the human population exists only on the Western and North-western boundaries of the park, the other sides flanked by high ridges and peaks. In Great Himalayan National Park and Sainj and Tirthan Wildlife sanctuaries fall in the jurisdiction of 5 kothis among 25. The population of these 5 kothis and Raila phanti of kothi Banogi, Srikot and some hamlets of phanti Kalwari of kothi Plach and Sily phanti of kothi Sarchi in inner Sainj are very adjacent to the park boundaries, and included in the Eco-development project area. People are dependent on the forest resources.

Table 2 shows the population of various revenue villages or phanties in the Eco-development zone alongwith number of hamlets forming part of each revenue village. Human population of each hamlet is given in Appendix II.

Number of households and villages having traditional rights of grazing in the park are shown in Annexure III. Different areas and pastures of the park where each of them is going for livestock grazing are also indicated.



**Table 2: Population and Number of hamlets in the revenue villages of GHNP
Eco-development area.**

Tahils/ Waziri	Kothi	Phanti	No. of hamlets	No. of Households	Total Population
Banjar/inner Seraj	Tung	1.Chipni 2.Mashyar	5 8	245 220	1537 1280
"	Nohanda	1.Pekhri 2.Tinder	13 6	187 123	1098 677
"	Plach	1.Srikot 2.Kalwari	7 9	78 195	417 1132
"	Sarchi	1.Shili		137	812
Sainj/ inner Seraj	Banogi	1.Suchen	6	202	1212
"	Shangarh	1.Shangarh 2.Lapah	13 4	111 37	618 222
Sainj/ Rupi	Sainshar	1.Sainshar 2.Garaparli	22 3	302 116	1606 592
Kulu/ Rupi	Balhan	1.Railla	13	512	512
Total	8	13			11715

(Source: Census of India 1991 - Villages Census Hand Book)

3.6.2 Livestock Population

Cattle and livestock form the second most important component of traditional subsistence economy of the area. Domestication of animals is supposed to be one of the important component of agriculture and domestic sector. Almost every household has a pair of bullocks and own cows. Sheep and goats are mainly domesticated in remote villages purposely for wool production and distress selling.

There are about 27,700 sheep, goats, cow, bull, horse and mule (Park authority, Per. Com.) as given in the Table 4. The average number of livestock per household differ significantly and varies between 10 to 100 (Table 5). Most of the cattle and livestock are stall-fed with crop by-product supplemented with fodder from grazing in the forests and pastures.

**Table 4: Livestock Population**

Sl No.	Name of area	Sheep & Goat	Cow/Ox	Ponies	Total
1.	GHNP	369	153	-	522
2.	Sainj Sanctuary	360	133	-	493
3.	Tirthan Sanctuary	-	-	-	-
4.	Eco-development area	19916	6757	48	26721
	Total	20645	7043	48	27736

Table - 5: Number of Animals owned by the Households in Tirthan Valley of GHNP

Number of Animals	Number of Families (%)
1-10	11
11-20	23
21-30	20
31-40	16
41-50	7
51-60	6
61-70	5
71-80	3
81-90	3
91-100	2
100+	4
Total	100



Due to growing human and livestock population in the Eco-development area, there is increasing biotic pressure. Besides above existing livestock population of about 27,700 already in the area, a large number of sheep and goats (about 15000 to 20000) immigrate from outside the project area into Park area for summer grazing.

3.7 AGRICULTURE & HORTICULTURE PRACTICES:

Subsistence staple agricultural food crops are grown in this area. Recently profit making yielding horticulture inputs have been introduced. In low lying fertile valleys where irrigation facilities as well as roads are available, cultivation of vegetables and more of horticultural crops preferred. People have very small and fragmented land holdings for agriculture and horticulture farming. Irrigation facilities are scares and this to large extent depends on timely rainfall and favourable weather conditions. On an average two crops are harvested in a year but in villages at very high altitudes where snow remains for a considerable period of the year, only one crop is cultivated.

Crop diversity in upland agriculture is high compared to relatively low areas of the valley. A high level of crop diversity is maintained by a rotation of crops in time and space on small fields together with co-existence of mixed and mono cropping practices. Nearly 12 crops are grown in rainy season compared to only 3 crops in winter season. The major Kharif crops are maize, paddy, sariyara, rajma, potato, mash, vegetables such as cauliflower, cabbage, chilli. The Rabi crops include barley, wheat and bustard. The wheat and maize are the most dominant crops of winter and rainy seasons respectively. There is a trend in reduction in crop diversity. Major crops : maize, paddy, sariyara, rajma, potato, mash, vegetables such as cauliflower, cabbage, chilli etc. The rainy season crops : barley, wheat and bustard are winter season crops. Villagers mostly grow maize and kathu during rainy season. Maize is widely grown in the area and it seems to be the main food crop of the villagers. After rainy season, wheat and barley etc. are also grown in lower areas. However, agricultural production is poor and people also depend upon outside supplies.

In the Project area villages, major agricultural crops grown are shown in Table 6.

Table 6: Major agricultural crops grown in the Project area.

Name of the Crop	Area in Percentage
Rainy Crops	
1. Maize (Makki)	26
2. Kodra	0.5
3. Sariyara	14.5
4. Kathu	1.23
5. Mash	2.11
6. Razmas	10.55
7. Potato (Alu)	5.5
8. Cauliflower & Chilli	0.7
9. Other and vacant land	39.5
Total	100
Winter Season Crops	
1. Wheat	32.92
2. Barley & Paddy	16.77
3. Mustard	0.7
4. Other and vacant land	49.6
Total	100

Among horticultural crops, apple and plums are the important fruits grown in the area though horticulture is specifically lacking particularly due to poor horticulture and irrigation facilities. Pear, apricot, peach, cherry, jamu and almond are also grown in this area.

4. OBJECTIVES

The Task study on 'Evaluation of crop damage in the Eco-development Project area to suggest mitigating measures' has the following objectives:

- 1) Evaluate current levels and causes of crop depredation by wild animals around the park.
- 2) Suggest new and innovative methods of crop protection based on actual field situation e.g. artificial barriers, green fencing, cultural practices, compensation or a combination of these methods.
- 3) Besides presenting a formal report of the study, preliminary insights from the study will



be shared with the officials of the Great Himalayan National Park and local officials (if any) in meetings. Such meetings will also be part of a process of creating a dialogue aimed at working out solutions and evolving feasible recommendations that can be incorporated expeditiously into the implementation of the Eco-development Project.

5. METHODS

To study the nature and extent of wildlife damage problems in the Project area: Great Himalayan National Park, Sainj and Tirthan Wildlife sanctuaries and Eco-development area, following methods were used:.

1. From the Park Director and Divisional Forest (Territorial) offices, firstly, information about the occurrence of wildlife damage problems in the project area and affected villages located at low and high altitudes within the project area was collected. The Forest department records were seen and incidence of human casualties and livestock killings were noted. The compensation paid for various casualties were also recorded.
2. On the basis of above, 14,18 and 8 villages were selected in the Sainj valley, Tirthan valley and Jiwa Nal valley respectively of the project area to collect information on wildlife damage problems. human casualties, livestock killings, compensation relief measure, cropping pattern, nature and extent of agricultural and horticultural crop damage and traditional control methods etc. in the questionnaire formats.
3. The selected villages were visited and information on the number, place of occurrence, date and diurnal pattern of human casualties and cattle-lifting cases and predators was collected, and cross checked with the data of the forest department.
4. Various agricultural and horticultural crops grown in the project area villages, their sowing and harvesting time were recorded. For the assessment of damage to various 'Ravi' and 'kharif' agricultural crops, farmers were interviewed to collect information on the problem species, crop phenological stages affected, part eaten, quantum of damage, time of depredation and protection methods used by
5. them. Followed this, randomly few affected crop fields were visited and ocular estimation of damage was done.
6. Various horticultural crops : apple, pear, plum, apricot, peach, cherry, jamu and almond are grown in the Tirthan valley, Sainj valley and Jiwa Nal valley of the project area. Based on interviews and spot verification, information on problem species, fruit damage and time was recorded.

7. Data so generated were analysed and presented in the form of tables and discussed in the Report. Methods for reducing the human casualties and livestock killings, and crop damage are suggested.

6. RESULTS

Information on human casualties, livestock killings, compensation relief measure, cropping pattern, nature and extent of agricultural and horticultural crop damage and traditional control methods etc. has been collected from the Great Himalayan National Park and Tirthan valley, Sainj valley and Jiwa Nala villages of the Eco-development project area. The human casualties were caused by leopard and black bear (*Selenarctos thibetanus*), and livestock killings were mainly by leopard, black bear and brown bear (*Ursus arctos*) in these areas. There was varying extent of damage to agricultural and horticultural crops depending on low and high altitude located villages and was caused by bear, langur (*Presbytis entellus*), monkey (*Macaca mulata*), goral (*Nemorhaedus goral*), jackal (*Canis aureus*), porcupine (*Hystrix indica*), rodents (squirrel, rats, mice, voles, shrew), parrot (*Psittacula cyanocephala*) and crow (*Corvus macrorhynchos* & *Corvus splendens*) etc. The results are presented as below:

6.1 HUMAN CASUALTIES

In and around Great Himalayan National Park and buffer Eco-development project area, there were only 4 human casualties between 1989 and 1998, two cases occurred in 1995. (Table 8-10). Out of the total human and livestock casualties i.e. 1326, it constituted only 0.3%. Black bear is responsible for three cases, whereas leopard injured one person.

6.2 LIVESTOCK PREDATION

In the Great Himalayan National Park and Eco-development project area, there might be large number of cattle-lifting cases, which perhaps could not be reported timely. Amongst livestock, sheep, goat, cow, bull, horse, mule and dog were predated upon by leopard, black bear and brown bear.

6.2.1 Year-wise Cattle-lifting cases

A total of 1322 livestock killing cases have been reported to the park authorities during 1989-1998 (Table 8). During 1991, 1994 and 1995, livestock casualties were highest i.e. 292, 238 and 212 respectively. Predation on sheep and goat was maximum as compared to cow, bull, horse, mule and dog casualties. Out of 1322 casualties, sheep, goat, cow, bull, horse mule and dog were 652, 465, 85, 100, 12, 7 and 1 respectively, which constituted 49.2%, 35.2%, 7.6%, 6.5%, 0.9%, 0.5% and 0.1% respectively of the total killings.

Predation on sheep was highest (n = 217) in 1991, whereas goat killings were highest (n = 88) in 1994. Maximum killings of bull and cow were during 1994-95 and 1997 respectively.



Table - 8: Human casualties & livestock predation by Leopard and Bears in GHNP and Eco-development project area during 1989-98.

Species	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	Total (%)
Sheep	27	-	217	10	69	110	88	65	51	15	652 (49.2)
Goat	17	-	70	6	63	88	80	38	57	46	465 (35.1)
Bull	3	-	3	3	5	20	20	17	14	15	100 (7.5)
Cow	1	-	1	2	7	15	17	12	18	12	85 (6.4)
Horse	-	-	1	-	-	2	3	3	3	-	12 (0.9)
Mule	-	-	-	-	-	3	2	2	-	-	7 (0.53)
Dog	-	-	-	-	-	-	-	-	1	-	1 (0.1)
Human	1	-	-	-	-	-	2	-	1	-	4 (0.3)
Total	49	-	292	21	144	238	212	137	145	88	1326

As such there was no correlation of cattle killings and year of occurrence; number of these casualties fluctuated over the years. Horse and mule killed were few. There was only one case of dog predation by leopard registered with the forest department, although there might have been many cases of predation on dog by leopard in these years.

6.2.2 Predators & livestock killings

Number of livestock: sheep, goat, cow, bull, horse, mule and dog killings by leopard and black bear and brown bear occurred during 1989 to 1998 in GHNP and Eco-development project area is presented in Table 9. During these years, leopard injured one person and killed 993 cattle, whereas black bear and brown bear were responsible for 3 human casualties and 329 cattle killings. Predation on livestock was much more by leopard as compared to black bear and brown bear attacks. There was one case of dog killing by leopard. Out of total human casualties and livestock killings, sheep, goat, cow, bull, mule, horse and dog constituted 49.2% (652), 35.1% (465), 6.4% (85), 7.5% (100), 0.5% (7), 0.9% (12) and 0.1% (1). Amongst these livestock, sheep and goat suffered maximum casualties.

Because leopard is widespread in all hilly areas of the National Park and Eco-development project area outside, and remain active throughout the year in lower as well as higher altitudes. So the predation on cattle occurring and moving everywhere in the park and project area is very high. Since the brown bear remain at high altitude even during the intense winter and snow time and black bear slightly descends at the start of winter season, availability of cattle as prey to bears is less as compared to leopard. Therefore, the predation is less comparatively than the leopard killing cattle during 1989 - 98 in these areas.

6.2.3 Monthly variations in cattle-lifting

Livestock killings occurred in different months during 1989-98 in the National Park and Eco-development project area outside are shown in Table 10. Out of a total 1322 cattle-lifting cases, highest number of casualties occurred in August and September months; 27.8% (n=368) in August and 21% (n=278) in September. The livestock killings were less comparatively during November-December and January-April ranging from 27 to 53 casualties; except in March (n = 95). From May (n = 73) onwards, livestock killings started increasing and reached to maximum in August (n=368). Thereafter, the casualties slowly declined in the following months as shown in Table 10.

The monthly variations in livestock killings seem to be correlated with livestock movement from higher altitude thatches, villages and forests to lower altitude during winter season and back again to neighboring forest areas during spring time. The livestock graze in forest areas for considerable time and then move to pastures on higher altitudes on commencement of rainy season. Till the end of rains in September, the sheep and goats remain in alpine pastures. As the livestock move further up during rainy season, predation on them increases and the casualties attain maximum levels in August and September when they are in alpine pastures.

6.2.4 Place of cattle-lifting

A total of 1178 livestock killing cases have been reported to the Park Authorities. But there were large number of cattle-lifting cases which were perhaps not reported because of their own reasons.



Table - 9: Number of human casualties and livestock killings by Leopards and Bears in GHNP and Eco-development project area during 1989 -98.

	Human	Sheep	Goat	Bull	Cow	Horse	Mule	Dog	Total
Leopard	1	487	359	62	69	10	5	1	994 (75%)
Bear	3	165	106	38	16	2	2		332 (25%)
Total (%)	4 (0.3%)	652 (49.2%)	465 (35.1%)	100 (7.5%)	85 (6.4%)	12 (0.9%)	7 (0.5%)	1 (0.1%)	1326

Table - 10: Monthly variations in human casualties and livestock killings in GHNP and Eco-development project area outside.

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
1989				1		2	44			2			49
1991							4	272		16			292
1992			4				14		2		1		21
1993			1					2	110			9	144
1994			25	8			4	18	136	34	12	1	238
1995	1		23	11	68	20	19	13	27	7	17	6	212
1996						63	39	28	3			4	137
1997	5	3	29	7	5	5	13	35			23	20	145
1998	38	37	13										88
Total (%)	44 (3.3%)	40 (3%)	95 (7.2%)	27 (2%)	73 (5.5%)	90 (6.8%)	137 (10.3%)	368 (27.8%)	278 (21%)	81 (6.1%)	53 (4%)	40 (3%)	1326



Table - 11: Place of livestock killing cases in GHNP and Eco-development project area.

Place	No. of Cases (%)
Forest Beat (n = 49)	248 (36.3%)
Thatch (n = 39)	694 (58.9%)
Village	43 (3.7%)
Cow shed	12 (1%)
Crop field	1 (0.1%)
Total	1178



Table - 12: Names of Forest Beats and thatches where livestock killings occurred during 1989-1998.

Forest Beat	Thatch
6 Madrachi	1. Gurinal Kachanga
7 Shangarh	2. Masum Fhatu
8 Mahachi	3. Mahu
9 Dolan	4. Kulchi
10 Karechar	5. Bung
11 Sarudaga	6. Thirni
12 Simgi	7. Tiranga
13 Chaniyara	8. Bhithu
14 Maringa	9. Bhahli
15 Natiphat	10. Shagoh
16 Hada Duar	11. Kharshu
17 Duar Bud	12. Asar Bagh
18 Nayagadhar	13. Thindi
19 Majhan Nala	14. Rasi
20 Doinu	15. Sari
21 Nohanda	16. Parwadi
22 Jagnahu	17. Nada
23 Tandi Dhar	18. Paatal
24 Dhanohar	19. Bathach
25 Palach III	20. Dhela
26 Palach Maringa	21. Ghabra
27 Bung	22. Malera
28 Kali Kanda	23. Karash
29 Barmod III	24. Gradha
30 Ghudku	25. Maroharhi
31 Rakhundi	26. Jamu
32 Naish	27. Bischul
33 Shensar	28. Manhani
34 Ori	29. Mandror
35 Paheli Ghad	30. Tiua
36 Karital	31. Bhati
37 Pwuna Sangar	32. Socha
38 Dupaga	33. Murda
39 Bariithalah	34. Galu
40 Hrinal	35. Dabsa
41 Dhiri	36. Maghrach
42 Sharenga	37. Gati
43 Tung	38. Truchi Phathu
44 Poshu Kharu	39. Thachi Gouhar
45 Sangeliyala Nal	

Table 11 shows the place of livestock killings occurred in the National Park and Eco-development project area during 1989-98. Out of 1178 cattle killings, maximum casualties (694) occurred in different thatches. In forest areas, there were 428 cattle killing cases over 10 years. A list of the names of thatches (49) and forest beats (39) where livestock killing incidence took place is appended (Table 12). Whereas in the vicinity of villages and cowsheds, there were 43 and 12 cattle-lifting cases respectively. Only one case of cattle killing occurred in the crop field.

In thatches and forests, cattle stay for long time i.e. 3-5 months a year, without any grazier for most of the time. Consequently, they fall easy prey to leopard and black and brown bears in pastures and forests.

6.2.5 Time of livestock killings

Diurnal pattern of occurrence of cattle-lifting cases has been compiled as given in Table 13. Out of 144 incidence, maximum cases of sheep, goat, bull, cow, horse and mule by leopard, black bear and brown bear occurred between 1600-2200h; 270 cattle-lifting cases took place in 77 different incidence. Followed this, 233 cattle killings took place in 31 incidence between 2200-0400h. This showed that during evening and early night hours, there were more attacks on livestock by predators. And during late night, perhaps when cattle group together and rest, the frequency of attack was less comparatively, but many casualties took place. In the morning and day time, there were few attacks; in 36 incidence 121 livestock killings took place.

6.2.6 Guarding of cattle

Number of times when the cattle herd(s) and individual attended by graziers or without graziers and fell into predation are shown in Table 14. Though livestock casualties took place in both situations when attended by graziers and not attended by graziers, casualties were many more when unattended by graziers as compared to cases when cattle were with graziers. Out of total 403 cattle-lifting cases, 236 cattle got killed in 78 incidence when there were no graziers. On contrary, when cattle were attended by graziers, there were 125 cattle killings in 26 incidence

6.2.7 Compensation for human injury & cattle-lifting

Table 15 shows the number of livestock killings and compensation paid in Eco-development project area of the National Park during 1989-98. Out of total 1326 casualties, 841 cases (63.4%) received the compensation, whereas 485 cases (36.5%) did not receive the



Table - 13: Occurrence of livestock cattle killing cases and time period in and around Great Himalayan National Park

Time Period (n)	Incidence	No. of Cases (%)
4 AM - 10 AM	12	45 (7.2)
10 AM - 4 PM	24	76 (12.2)
4 PM - 10 PM	77	270 (43.3)
10 PM - 4 PM	31	233 (37.3)
Total	144	624

Table - 14: Number of incidence and killed livestock with or without grazier(s) in GHNP and Eco-development project area outside.

With or without grazier(s)	No. of Incidence	No. of Cattle
Attended	26	125
Not Attended	78	236
Ran away	4	42
Total	108	403



Table - 15: Human casualties, livestock killings and compensation paid during 1989 - 98 in the Project area.

Year	Livestock killings			Compensation received		Compensation not received		Amount (Rs.)	
	Species	No. of cases	Total	No. of cases	Total	No. of cases	Total	Compensation	Total
1989	Human	1	49	-	39	1	10	-	6200
	Sheep & Goat	44		37		7		5400	
	Bull	3		1		2		500	
	Cow	1		1		-		300	
	Horse	-		-		-		-	
	Mule	-		-		-		-	
1991	Sheep & Goeat	287	292	241	246	46	46	36150	39150
	Bull	3		3		-		1500	
	Cow	1		1		-		300	
	Horse	1		1		-		1200	
1992	Sheep & Goat	16	21	2	7	14	14	300	2400
	Bull	3		3		-		1500	
	Cow	2		2		-		600	
1993	Sheep & Goat	132	144	52	54	80	90	7350	8150
	Bull	5		1		4		500	
	Cow	7		1		6		300	
1994	Sheep & Goat	207	238	84	96	123	142	12600	21000
	Bull	17		6		11		3000	
	Cow	9		2		7		600	
	Horse	2		1		1		1200	
	Mule	3		3		-		3600	
1995	Human	2	212	1	144	1	68	1000	36350
	Sheep & Goat	168		115		53		15750	
	Bull	20		14		6		7300	
	Cow	17		11		6		8700	
	Horse	3		1		2		1200	
	Mule	2		2		-		2400	
1996	Sheep & Goat	103		75		28		11102	
	Bull	17		14		3		7050	
	Cow	12		9		3		2550	
	Horse	3		2		1		3200	



	Mule	2		1		1		1200	
1997	Human	1		-		1		-	
	Sheep & Goat	108		74		34		13615	
	Bull	14		8		6		5125	
	Cow	18		11		7		6525	
	Horse	3		3		-		5000	
	Dog	1	145	-	96	1	49	-	30265
1998	Sheep & Goat	61		35		26		6156	
	Bull	15		15		-		7875	
	Cow	12	88	8	58	4	30	8400	22431
	Total		1326		841 (63.4%)		485 (36.6%)		191048

Table - 16: Compensation scheme for human and livestock casualties of Government of Himachal Pradesh.

Item	Amount Payable
In case of death of human beings	Rs.25000/-
In a case of killing of horses/mules (all breeds) by snow leopard in shed	Rs.4000/-
In case of killing of horses/mule (all breeds) by snow leopard in jungle	Rs.2500/-
In case of permanent disability to human beings	Rs.6250/-
In case of injury to human beings	Rs.1875/-
Loss of buffalo, Jersey cow and mule (adult) (special breed) in cow shed	Rs.2500/-
Loss of cow, buffalo, ox and mule (adults) (special breed) in cow shed	Rs.625/-
Loss of cow (local breed) in jungle	Rs.375/-
Loss of ox (local breed) in jungle	Rs.1250/-
Loss of ox (local breed) in jungle	Rs.625/-
Loss of young one of buffalo cow (jersey) ox and mule (special breed) in shed	Rs.250/-
Loss of young ones of buffalo cow (jersey ox and mule special breed in jungle	Rs.188/-
Loss of young ones of buffalo (local breed) ox and mule (local breed) in shed as well as in jungle	Rs.125/-
Loss of sheep and goat in shed	Rs.375/-
Loss of young ones of sheep and goat in shed	Rs.312.50/-
Loss of sheep and goat in jungle	Rs.188/-
Loss of young one sheep and goat in jungle	Rs.186/-
Loss of Yak, horse/mule and camel in shed	Rs.2500/-
Loss of Yak, horse/mule camel in jungle	Rs.1500/-
Loss of churu/churi in shed	Rs.1250/-
Loss of churu/churi in jungle	Rs.625/-
Loss of donkey in shed	Rs.875/-
Loss of donkey in jungle	Rs.500/-
Loss of Pashmina goat in shed	Rs.800/-
Loss of Pashmina goat in jungle	Rs.375/-
Loss of young ones of Yak Horse, camel, churu/churi, donkey and pashmina goat in shed	Rs.250/-
Loss of young ones of Yak, horse, camel, churu/churi, donkey, Pashmina goat in jungle	Rs.125/-
Pigs in shed	Rs.312.50/-
Pigs in jungle	Rs.168/-



compensation. An amount of Rs.1,91,048 was paid as compensation for 841 cases as per the prescribed rates shown in Table 16. During the years 1989, 91, 95, 96, 97 and 98, the compensation was paid to more than 65% livestock killing cases. While during 1992, 93 and 94, the compensation was paid only up to 40% of the livestock killing cases. All the above compensation payments were made following the verification procedure as indicated in Annexure III after 3 months and before one year or so.

6.3 CROP DAMAGE BY WILD ANIMALS

In the villages of Great Himalayan National Park buffer areas: Tirthan valley, Sainj valley and Jiwa Nala or the Eco-development project area, about 85% of the cultivated land is under agriculture and 15% under orchards. There is varying extent of damage to agricultural and horticultural crops depending on low and high altitude located villages. Major damage causing species are black bear (*Selenarctos thibetanus*), langur (*Presbytis entellus*), monkey (*Macaca mulata*), goral (*Nemorhaedus goral*), jackal (*Canis aureus*), porcupine (*Hystrix indica*), rodents (squirrel, rats, mice, voles, shrew), parrot (*Psittacula cyanocephala*) and crow (*Corvus macrorhynchos* & *Corvus splendens*) etc.

6.3.1 Agricultural crops

Various agricultural crops grown in Eco-development project villages cultivation areas, and their sowing and harvesting periods are shown in Table (17). In this region, the Kharif crops cultivated are maize (*Zea mays*), paddy (*Oryza sativa*), sariyara (*Amaranthus hybridus* (L)), kodra (*Fagopurum esculentum*), rajma (*Phaseolus sativus*), potato (*Solanum tuberosum*), mash (*Phaseolus radiatus*) and vegetables such as tomato (*Lycopersicum esculentum*), cauliflower (*Brassica oleracea* var.), cabbage and chilli etc. The Rabi crops include barley (*Hordeum vulgare*), wheat (*Triticum aestivum*) and mustard. The wheat and maize are the most dominant crops of winter and rainy seasons respectively. The sowing and harvesting periods of these agricultural crops including a few affected vegetable crops indicated in the table showed slight differences between villages located as low altitude and high altitude villages. In the latter case, sowing and harvesting periods were 15 days or one month earlier than the low lying villages because of the early low temperature and snowing.

Table - 17: Agricultural crops and their sowing and harvesting periods in Eco- development project villages cultivation areas of GHNP.

Common Name	Botanical Name	Sowing Time	Harvesting Time
Wheat	<i>Triticum aestivum</i>	October- November* August - October**	May - June* June - July**
Maize	<i>Zea mays</i>	May - June* April - May**	August* September**
Barley	<i>Hordeum vulgare</i>	October - November* September**	May - June* May - June**
Sariyara	<i>Amaranthus hybridus</i> (L)	May - June*	September- October*
Kodra	<i>Fagopurum esculentum</i>	May - June*	September*
Kathu	<i>Sp?</i>	March - April*	September*

- At low altitude villages
- At high altitude villages



Table - 18: Agricultural crops depredated species and activity and nature and time of damage in Eco-development project villages cultivation areas of GHNP.

Common Name	Botanical Name	Problem Species	Damage Time	Part Eaten	Activity
Wheat	<i>Triticum aestivum</i>	Bear	June - July	Grains	Trampling, feeding
		Goral	June - July	Young shoots	Feeding
		Monkey	January - February June - July	Young shoots, grains	Feeding
		Rodent	June - July	Grains	Hoarding, feeding
		Porcupine	January - February June - July	Roots, grains	Feeding
		Parrot	June - July	Grains	Feeding
Maize	<i>Zea mays</i>	Bear	August - September	Corn	Trampling, feeding
		Monkey	May - June August - September	Young shoots, corn	Feeding
		Jackal	August - September	Corn	Feeding
		Rodent	July - September	Corn	Hoarding, feeding
		Porcupine	May - June August - September	Roots, flowers, corn	Feeding
		Parrot	August - September	Corn	Feeding
Barley	<i>Hordeum vulgare</i>	Monkey	November - December	Young shoots, grains	Feeding
		Rodent	May - June October - November	Roots, grains	Hoarding, feeding
		Goral	May - June November - December	Young shoots, grains	Feeding
Sariyara	<i>Amaranthus hybridus</i>	Monkey	September - October	Grains	Feeding
Kodra	<i>Fagopurum esculentum</i>	Monkey	August - September	Young shoots, grains	Feeding
Kathu	?	Bear	July - August	Grains	Trampling, feeding

The damage caused to these various crops is of varying extent and the results are presented as below:

6.3.1.1 *Nature of crop damage, time & problem species*

Table 18 shows various agricultural crops, depredating species, damage time, part eaten or damaged and activities of animals resulting into the damage. Animal species responsible for damage to agricultural crops were black bear, monkey, langur, jackal, goral, porcupine, rodent species such as squirrel, vole and shrew; parrot and crow. Different plant species, phenological stages and their parts were preferred by these depredating species. Black bear caused damage mainly by its trampling and feeding activities and fed on maize corn, barley grains and kathu spike seeds. Langur and monkey consumed young shoots and corn, grains of wheat, maize, barley, sariyara, kodra, pea, rajmas and potato tubers. There were reports of goral feeding on young shoots and seeds of wheat and barley, and jackal feeding on maize corn.

Tender shoots, root portions and grains and corn of wheat and maize, peas, rajmas and potato tubers were found to be eaten by porcupine. Wheat, maize and barley seeds, seedlings and root system were fed by rodents. The damage by rodents was mainly due to feeding and hoarding activities.

6.3.1.2 *Monthly variations in crop damage*

In Eco-development project villages cultivation areas damage to agricultural crops by wild animals showed marked monthly variations depending on various phenological stages of crops (Table 19).

Damage to wheat, maize, barley and kathu crops was maximum during the seeding stage and seed formation stage when corn in spikes developed. Maize and wheat plants were trampled more than eaten. In other crops: sariyara, kodra and mash, damage was more during the fruiting phase (seed formation stage). Pea seedling and potato seeds were increasingly damaged during the sowing period April-May and during the seed or tuber formation time in September-October and August-September respectively.



6.3.1.3 *Percentage crop damage: Sainj valley villages*

In Sainj valley, Shakti (Shansher), Maror in Sainj wildlife sanctuary, Shengcha (Shangrah), Kotlu, Dharali, Ghosti, Ropa, Kot, Suchen, Shengch, Sundarnagar, Lapah, Dagahra and Tathora villages were surveyed and the farmers were interviewed to collect information on the nature and extent of agricultural crop damage in their fields. Following this, a few crop fields were randomly selected and crop damage was verified and compared with ocular estimation of on the spot. Based on village interview, crop damage verification and ocular estimation, range of percentage damage to various agricultural crops was assessed is above 16 villages (Table 20).

Damage was recorded for almost all agricultural crops sown in these villages, but the quantum of damage varied considerably in these villages located at low and high altitudes. Species responsible for the damage were black bear, langur, monkey, goral, jackal, porcupine, rodent, parrot and crow.

In low lying villages, crop damage was less as compared to villages located at higher altitudes. In Ghosti village, wheat crop had significant level of damage (20-25%). In Shakti, Maror, Lapah and Dagahra villages, damage to wheat was 10-15%. Damage to wheat crop was less than 12% in rest of the villages surveyed.

Amongst all the crops, maize suffered highest level of damage by bear, langur, monkey, jackal, porcupine, rodent, parrot etc. Shakti, Maror and Lapah had 30-40% damage to maize crop, whereas, Dharali, Ghosti, Suchen, Shengcha, Dagahra and Tathora had 20-25% damage to maize. Damage to maize was 15-20% in Shengcha and Kotlu. In rest of the villages, damage to maize crop was less than 15%.

Damage to barley crop was 20-25% and 25-30% in Dharali and Ghosti villages respectively. In Shengcha, Dagahra, Suchen and Lapah villages, damage to barley crop was between 10-20%, whereas in Shakti, Maror, Kotlu and Tathora villages, damage to barley was 10-15%. In rest 3 villages, damage was less than 10%.

Damage to sariyara crop was highest (20-30%) in Shengcha village, followed by 15-20% damage in Dharali village. Shakti village had 10-15% damage to sariyara crop. In rest of the villages, damage to this crop was less than 10%. In Dharali village, damage to kodra crop was highest (15-20%). In rest of the villages, damage to kodra crop was between 5-10%.

Shakti and Maror villages had maximum damage (30-40%) to kathu crop. In Shengcha, Kotlu, Ghosti and Tathora villages, damage to kathu crop was 15-20%. There was less than 10% damage to kathu crop in rest of the villages. Tathora village had maximum damage (20-25%) to potato crop. Damage to potato was 10-15% in Kotlu, Ghosti, Kot and Sundarnagar villages, whereas the potato damage was 15-20% in Suchen and Dagahra villages.



Table - 19: Damage to agricultural crops in different months in the Eco-development villages cultivation areas in GHNP.

Crop	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wheat	+	+			+	++	++					
Maize				+	+			++	++			
Barley				+	++	++				+	+	
Sariyara					+				++	++		
Kodra					+			++	++			
Kathu			+	+				++	+			
Potato				+				++	++			
Peas				+	+				+	++		
Rajmas					+	+			++	++		
Mash					+				+			



Table - 20 Damage to agricultural crops by wild animals in Project villages cultivation areas in Sainj Valley.

Village/ Phanti	Wheat	Maize	Barely	Sariyara	Kodra	Kathu	Potato	Peas	Rajmas
Shakti (Shansher)	10-15%	30-40%	10-15%	10-15%	5-10%	30-40%	5-10%	2-5%	5-10%
Maror (SWS)	10-15%	30-40%	10-15%	8-10%	5-10%	30-40%	-	-	5-8%
Shengcha (Shangrah)	10-12%	15-20%	15-20%	20-30%	5-10%	15-20%	5-8%	5-8%	5-10%
Kotlu (Shangrah)	10-12%	15-20%	10-15%	5-10%	5-10%	15-20%	10-15%	2-5%	5-10%
Dharali (Shangrah)	15-20%	20-25%	20-25%	15-20%	15-20%	5-10%	5-10%	-	10-15%
Ghosti (Shangrah)	20-25%	20-25%	25-30%	-	-	15-20%	10-15%	2-5%	10-15%
Ropa	5-8%	5-10%	5-10%	-	5-8%	5-10%	5-10%	-	2-5%
Kot	5-10%	10-15%	5-10%	2-5%	5-10%	5-10%	10-15%	-	5-8%
Suchen	5-8%	20-25%	15-20%	8-10%	-	10-15%	15-20%	2-5%	5-10%
Shengch									
Sundarnag ar	5-10%	10-15%	5-10%	2-5%	5-8%	5-10%	10-15%	5-8%	5-8%
Lapah	10-15%	30-35%	15-20%	5-10%	5-8%	10-15%	-	-	5-10%
Dagahra	10-15%	20-25%	10-20%	-	-	10-15%	15-20%	-	5-10%
Tathora (Shangrah)	8-10%	20-25%	10-15%	2-5%	5-10%	15-20%	20-25%	2-5%	5-10%

(Assessment based on village interview, crop damage verification & ocular estimation)

Table - 21: Damage to agricultural crops by wild animals in Project villages cultivation areas in Tirthan Valley.

Village	Wheat	Maize	Barley	Sariyara	Kodra	Kathu	Potato	Peas	Rajma
Chipni	5-10%	10-15%	5-10%	5-10%	5-8%	10-15%	5-10%	5-8%	10-12%
Bathad	5-10%	10-15%	5-10%	5-10%	5-10%	5-10%	8-10%	3-5%	8-10%
Tung Srikot	5-10%	5-8%	-	5-8%	5-10%	5-10%	5-10%	3-5%	5-8%
Ghatlacha	5-10%	5-8%	8-10%	2-5%	-	3-5%	5-8%	-	5-10%
Daran	5-8%	5-8%	8-10%	5-8%	5-8%	-	5-8%	-	5-8%
Shungcha	5-10%	5-8%	10-12%	-	5-8%	5-10%	5-10%	3-5%	5-8%
Kharongcha	5-10%	5-8%	8-10%	5-10%	-	5-8%	5-8%	5-8%	-
Shil	5-8%	8-10%	5-10%	5-10%	5-10%	5-8%	3-5%	-	5-8%
Banagi	5-8%	10-12%	5-8%	5-10%	5-8%	5-10%	5-10%	5-10%	5-10%
Shalinga	5-10%	10-15%	5-10%	5-10%	3-8%	5-8%	5-10%	5-10%	5-10%
Farari	5-10%	10-15%	5-8%	-	-	10-15%	5-10%	-	5-10%
Dhingcha	10-15%	10-12%	5-8%	8-10%	5-8%	5-10%	5-10%	5-8%	5-10%
Tinder	15-20%	15-20%	10-20%	10-15%	5-10%	10-15%	5-10%	-	5-10%
Kauncha	20-25%	20-30%	10-20%	5-10%	5-8%	15-20%	15-20%	-	10-12%
Kharongcha	5-10%	5-8%	10-15%	5-10%	-	5-8%	5-10%	-	8-10%
Dhara	10-15%	15-20%	10-15%	10-12%	5-10%	10-20%	5-10%	5-8%	8-10%
Talinga	15-20%	20-30%	20-30%	10-15%	5-10%	15-20%	10-15%	5-8%	5-10%

(Assessment based on village interview, crop damage verification & ocular estimation)



Damage to pea crop was not significant, it was less than 8% in these 16 villages. Damage to rajmas crop was highest (10-15%) in Dharali and Ghosti villages. Damage was less 10% in rest of the villages.

6.3.1.4 *Percentage crop damage: Tirthan valley villages*

In Tirthan valley, assessment of damage to agricultural crops: wheat, maize, barley, sariyara, kodra, kathu, potato peas and rajmas was done in 17 villages, namely, Chipni, Bathad, Tung Srikot, Ghatlacha, Daran, Shungcha, Kharongcha, Shil, Banagi, Shalinga, Farari, Dhingcha, Tinder, Kauncha, Kharongcha, Dhara and Talinga villages (Table 21) The farmers were interviewed to collect information on the nature and extent of agricultural crop damage in their fields and then a few crop fields were randomly selected and crop damage was verified and compared with ocular estimation of on the spot. Based on village interview, crop damage verification and ocular estimation, range of percentage damage to various agricultural crops was assessed and presented below.

The levels of damage to agricultural crops was comparatively less as compared to the damages recorded in Sainj valley villages. Similarly, the damage in villages located at high altitude was more than the villages located at low altitude.

Damage to wheat crop was highest (20-25%) in Kauncha village, followed by 15-20% damage in Tinder and Talinga villages. In Dhara and Dhingcha, wheat crop suffered 10-15% damage. In rest of the villages, damage to wheat crop was less than 10%. There was 70-80% damage to wheat crop in two fields located far off from Tinder village.

In Kaunch and Talinga villages, damage to maize crop was 25-30% and 20-30% respectively. Damage to maize was 15-20% in Tinder and Dhara villages. Chipni, Bathad, Shalinga, Farari, Banagi and Dhingcha had 10-15% damage to maize crop. There was less than 10% damage to maize crop in rest of the villages.

Damage to barley crop was highest i.e. 20-30% in Talinga village, followed by 10-20% damage in Tinder and Kauncha villages. A few maize fields away from the village had 30-40% damage. Shungcha, Kharongcha and Dhara villages had 10-15% damage to maize crop. In rest of the villages, damage to maize crop was less than 10%.

In Tinder, Dhara and Talinga villages, sariyara crop suffered 10-15% damage. In the remaining 14 villages, damage to sariyara was less than 10%. Damage to kodra crop was between 5-10% in all the 17 villages. Kauncha, Talinga and Dhara villages had 10-20% damage to kathu crop. There was 10-15% damage to kathu crop in Chipni, Farari and Tinder villages.

Table - 22: Damage to agriculture crops by wild animals in Project villages cultivation areas in Jiwa Nal valley.

Village	Wheat	Maize	Barley	Sariyara	Kodra	Kathu	Potato	Peas	Rajma
Khanyari	10-15%	20-25%	15-20%	5-8%	15-20%	10-15%	10-15%	-	5-10%
Patahra	15-20%	25-30%	10-20%	10-15%	5-10%	10-15%	15-20	2-5	5-8
Karehla	10-15%	20-25%	15-20%	-	5-10%	15-20%	5-10%	-	5-10%
Majhgran	10-15%	20-25%	20-25%	15-20%	-	10-15%	5-10%	2-5%	-
Manjhan	8-10%	15-20%	10-15%	10-15%	8-10%	-	8-10%	-	-
Neoli	5-10%	10-15%	10-15%	-	10-15%	10-20%	10-12%	2-5%	5-10%
Niharni	10-12%	10-15%	8-10%	5-10%	5-10%	10-15%	5-10%	5-8%	8-10%
Sharan	10-15%	20-25%	10-20%	5-8%	5-10%	10-15%	5-10%	-	5-10%

(Assessment based on village interview, crop damage verification & ocular estimation)



Damage to potato crop was highest i.e. 15-20% in Kauncha village, followed by 10-15% in Talinga villages. There was 5-10% damage to potato crop in rest of the 15 villages. Damage to pea crop was between 5-10% in most of these villages. Chipni and Kauncha villages had 10-12% damage to rajmas crop, whereas, damage to rajmas was between 5-10% in rest of the 15 villages.

6.3.1.5 Percentage crop damage: Jiwa Nala villages

In Jiwa valley, agricultural crop damage assessment done in Khanyari, Patahra, Karchla, Majhgran, Manjhan, Neoli, Niharni and Sharan villages and percentage damage to various crops are presented in Table 22.

Damage to wheat crop was highest (15-20%) in Patahra village, followed by 10-15% damage in Khanyari, Karehla, Niharni, Majhgran and Sharan villages. There was less than 10% damage in rest of the 3 villages. Patahra village had 25-30% damage to maize crop. Khanyari, Karehla, Majhgran and Sharan villages had 20-25% damage to maize crop. Damage to maize crop was between 15-20% in rest of the villages.

Majhgran village had 20-25% damage to barley crop. Damage to barley crop was between 15-20% in Khanyari, Patahra, Karehla and Sharan villages. In Majhgran village, sariyara crop suffered 15-20% damage, whereas it was 10-15% in Patahra and Manjhan villages. In rest of the villages, the damage to sariyara crop was less than 10%.

Kodra crop suffered highest level 10-15% damage in Neoli village. Whereas in rest of the villages, the damage to kodra crop was 5-10%. In Karehla and Neoli villages, highest level of damage to kathu crop was 15-20%. There was 10-15% damage to kathu crop in rest of the villages, namely, Khanyari, Patahra, Majhgran, Niharni and Sharan.

Damage to potato crop was maximum (15-20%) in Patahra village. In Khanyari and Neoli villages, damage to potato was between 10-15%, whereas it was less than 10% in rest of the villages.

Table - 23: Crop yield per unit area and the market rates.

Crop	Yield	Rate (Minimum)	Rate (Maximum)
Wheat	100 kg per bigha	Rs.200/ 40 kg	Rs.400/40 kg
Barley	100 kg per bigha	Rs.200/40 kg	Rs.400/40 kg
Maize	2-3 Qnt per bigha	Rs.350/40 kg	
Sariyara	1-2 Qnt per bigha	Rs.400/40 kg	Rs.250/40 kg (sell)
Kathu	-	Rs.150-200/40 kg	
Aloo	3.5-4 Qnt per bigha	Rs.3-4/kg(Sell)	7-8-9/kg (buy)
Razma	60 kg per bigha	Rs.12-14/kg	Rs.25/kg

Table - 24 : Horticultural crops, depredating species and part eaten by wild animals in Eco-development project orchards in GHNP:

Common Name	Botanical Name	Problem Species	Part Eaten
Apple	<i>Pyrus malus</i>	Langur, Monkey	Fruit, bark
Pear (Nashpati)	<i>Pyrus communis</i>	Langur, Monkey	Fruit
Plum	<i>Prunus armeniaca</i>	Langur, Monkey	Fruit
Apricot (Khumani)	<i>Prunus padus</i>	Langur, Monkey	Fruit
Peach (Adu)	<i>Prunus persica</i>	Bear, Langur, Monkey	Fruit, bark
Cherry	<i>Prunus cerasoides</i>	Parrot	Fruit
Jamu	<i>Prunus cornuta</i>	Bear, Monkey, Parrot	Fruit
Almond	<i>Prunus amygdalus</i>	Rodent	Fruit



The economics of crop damage can be computed by looking into the total cultivation area under one crop village-wise of individual farmer, quantity and frequency of crop damage, yield per unit area and the market rate. Under normal crop season, yield per bigha of major crops and market rates are given in Table 23.

6.3.2 Horticultural crops

In the villages of the Eco-development project area: Tirthan valley, Sainj valley and Jiwa Nal, various horticultural crops : apple, pear, plum, apricot, peach, cherry, jamu and almond are grown. There is varying extent of damage to horticultural crops depending on low and high altitude located villages. Major damage causing species are black bear, langur, monkey, rodents: squirrel, rats, mice, voles, shrew, and parrot etc.

Information on damage to various horticultural crops: apple pear, plum, apricot, peach, cherry, jamu and almond with respect to the nature of damage and depredating species was collected and presented in Table 24.

Apple, pear, plum and apricot were mainly damaged by langur and monkey. Apples and tree bark were eaten by langur and monkey. Fruits of pear, plum and apricot were also damaged by langur and monkey. Bear, langur and monkey fed on peach fruits and bark. Jamu fruits were damaged and fed upon by bear, monkey and parrot. Cherry fruits and almond were eaten by parrots and rodents respectively.

7. ECONOMIC IMPLICATIONS OF DAMAGE PROBLEMS

In the Project area: Great Himalayan National Park, Sainj and Tirthan Wildlife Sanctuaries and Eco-development area villages In the Eco-development project area villages, human settlements are closely interspersed with forests, and wild animals share the forest resources with local inhabitants. Leopard and bear have occasional encounters with human beings resulting into serious human injury or death.

Leopard and bears are responsible for high livestock killings in thatches, forests and cow sheds from cattle-sheds or while grazing in the wilderness and less human casualties. Due to hilly terrain and remoteness of the grazing areas, many cases of livestock killings are not reported and people face economic losses. Agricultural and horticultural crops are mainly damaged by black bear, monkey, langur, porcupine, rodent, parrot and crow. In some villages quantum of crop damage is high.

Economic losses incurred in the form of livestock killings and crop damage are the causes of hardship for the people living in these areas. The human-wildlife conflicts arising due to these damage problems can not be contained fully because the wild animals frequently invade human settlements and cultivation area located on fringes of forest areas and cause damage.

To provide relief for the losses occurring in the form of human casualties and cattle-lifting, the forest department is paying compensation. Verification of incidence and post-mortem report in case of human death is essentially required for processing of case for seeking compensation which is a matter of concern for affected people.

Although human-wildlife conflicts can not be resolved completely but the extent of occurrence of problems can be reduced by taking effective wildlife damage control measures and the conflicts can be reduced by making simple compensation procedures for the losses. At present, there is no provision of compensation for crop damage. Even no crop insurance scheme is introduced as prevailing in a few states.



8. CONCLUSIONS AND SUGGESTIONS

In the Project area: Great Himalayan National Park, Sainj and Tirthan Wildlife Sanctuaries and Eco-development area villages, human population is about 10,000 people. More than 27,000 sheep, goat, cow, bull, horse and mule of only villages graze on pastures and forest land. There are sheep and goat immigrating into the park for summer grazing.

Human casualties

1. In The Project area: Great Himalayan National Park, Sainj and Tirthan Wildlife sanctuaries and Eco-development area, human casualties occur when villagers ventured into the forests for collecting fuel, fodder, some medicinal plants and to graze their livestock. There were only one case of human injury by leopard and 3 cases of mauling by bear between 1989 and 1998, which were accidental. The problem here is not significant, however people should be alert and vigilant moving in wildlife areas.

Livestock killings

2. In all 1322 livestock sheep, goat, cow, bull, horse, mule and dog were killed by leopard and bears during 1989-1998 and reported to the forest department, which is 13.2 % of the total villages livestock population. There might be large number of cattle-lifting cases, which perhaps could not be reported timely. Predation was more by leopard occurring widely in all hilly areas. Brown and black bears also caused several killings.

Most incidence of leopard and bears attacks on livestock killings occurred on thatches, followed by forests. Further, maximum cases of livestock killings occurred between 1600-2200h and between 2200-0400h. This showed that during evening and early night hours, there were more attacks on livestock by predators.

Based on the above, it is suggested that livestock grazing should be restricted in protected areas and fringes of forests. The graziers should avoid livestock grazing in forests in the evening hours and avoid their night time stay in forests.

3. Leopards are in the habit of raiding livestock - sheds, incidence of livestock killing by leopard can be reduced if cattle-sheds are fabricated properly with strong timber-wood with gate and bushes if any near cattle-sheds are cleared regularly. To scare away leopards from cattle-sheds, fire should be lit inside the shed or light arrangement should be made all through the night.



4. Though livestock casualties took place in both situations when attended by graziers and not attended by graziers, casualties were many more when unattended by graziers as compared to cases when cattle were with graziers. So the livestock when taken to thatches in higher altitude for more time or forests for grazing, the cattle must be attended by 2-3 graziers or more depending on herd size and location. During evening and night hours, the attendants should lit fire at 3-4 sites in thatches, again depending on number of cattle they accompany in thatches to scare away predators. This will help a lot in reducing their killings by leopard and bears.
5. **These graziers should also keep 2-3 Bhutia dogs with their herds and also licensed sound producing fire-arms to scare away leopard and bears.**
6. Out of total 1326 casualties, 841 cases received the compensation, whereas 485 cases did not receive the compensation. An amount of Rs.1,91,048 was paid as compensation for 841 cases as per the prescribed rates.

Payment of compensation scheme by the state forest department for human casualties, livestock-killings, crop damage and property damage by wild animals is a good gesture. This would help develop understanding between affected people and forest department and help conserving wildlife. But the compensation procedure for livestock should be simplified. Procedural requirements to obtain a post-mortem report of the killed animal from veterinary doctor or pharmacist should be abolished for the payment of compensation.

7. Allowing Eco-regeneration of the forest either by reduction or complete ban on grazing of cattle, sheep and goats over a long period of time will help replenishment of habitat and increase in prey-base. Apart from this cattle population of the state could be reduced by the way of introducing selectively breeding of high yielding local breeds, which could be stall-fed. This will help check the population of dry cattle, leading to the reduction of unwanted pressure on wildlife habitat. It can only reduce livestock killing incidence by leopard and bears could only be reduced but can not control.
8. In order to suggest long-term measures to mitigate the human-bear and human-leopard conflicts, detailed studies on ecology and management of leopard and black and brown bears in problem areas of the Himachal Pradesh to collect information on their habitat quality and use, food habits, human and cattle pressures on their habitat is suggested.

Agricultural crop damage

9. Tirthan Wildlife sanctuaries and Eco-development area, about 85% of the cultivated land is under agriculture and 15% under orchards. There is varying extent of damage



to all agricultural crops depending on low and high altitude located villages. The unprotected agricultural crop fields are easily raided by black bear, monkey, langur, jackal, goral, porcupine, rodent species such as squirrel, vole and shrew; parrot and crow.

In most of the villages, damage to maize crop is significant, whereas damage to wheat, sariyara, kathu and potato crops was also quite high especially during the sowing period and maturation phase in villages located in higher altitudes. Damage to wheat, maize, barley and kathu crops was maximum during the seeding stage and seed formation stage when corn in spikes developed. Sariyara, kodra and mash crops were damaged more during the fruiting phase. Pea seedling and potato seeds were increasingly damaged during the sowing period and during the seed or tuber formation time.

Although in hilly terrain, it is very difficult to protect crops. But since it is a matter of great concern, remedial measures to minimize the problem are required to be taken. Protection measures such as use of live fences and wire fence with flying white coloured ribbons which flashes with wind in sun or moon light or plastic strips which produces scaring sounds should be encouraged.

Crop raiding monkeys are scared away by farmers, but their troops move from one crop field to another. When the crops are vulnerable to damage, farmers need to keep strict and constant vigil in the crop fields for protection of crops. At the time of spike formation and maturation of crops, frightening devices: scare-crows and dummies should be used in crop fields. Use of Gandhi gun and fire crackers should be encouraged to scare away langur, monkey, parrot and crow. During night, using of mashaal will greatly help in keeping depredating animals away.

10. There are some repellents tried on monkey like 10 Thymate-G to keep them away from the crops. Likewise several compounds have been found effective to repel birds from crop areas in other countries. Registered birds repellents: Mesurol, Anthraquinone, ReJeX-it AG-145, Lindane, Captan, Methyl Anthranilate, Polybutene, Thiram, 4-Aminopyridine, 3-Chloro-Toluidine hydrochloride and MA Aerosol and mammal repellents such as Denatonium benzoate, Capsaicin, Paradichlorobenzene etc, are frequently used in other countries. There are also sonic and ultrasonic deterrent being used on animals. We need to experiment these repellents against problematic species in crop fields to see cost-effectiveness in reducing damage in our own situation prior making any suggestion of this nature.

Although the Forest department, Himachal Pradesh has introduced a scheme for elimination of monkey by capture and trans-location with the help of professional monkey tamers, but it is very cumbersome.

Ordinance issued by the state government to kill the crop depredating nilgai or monkeys is uncalled for and so far, it has not helped much in containing crop damage problem. There is a need of amendment of the state wildlife laws to declare monkey as crop pest for their population control, wherever they are causing heavy damage to the crops. Possibility of scientific culling of monkeys should be considered looking in to the sensitivity of local people and by taking them into confidence.

11. **In the areas where wild animals are causing significant crop damage, short term measure such as co-operative crop guarding especially during the sowing period and spike/seed formation stage when crop maturation takes place with the help of torches or mashals and crackers is suggested.**
12. At present, there is no provision for compensation of crop losses and no crop insurance scheme in the state. With the crop insurance scheme, villagers will be benefited.
13. Public education and awareness with respect to species conservation, natural history and wild animal damage and control etc will be helpful in understanding the practical problems in the field.

Horticulture Crop Damage

14. In the orchards of the Project area: Tirthan valley, Sainj valley and Jiwa Nal, apple, pear, plum, apricot, peach, cherry, jamu and almond are grown. There is varying extent of damage to these horticultural crops depending on low and high altitude located villages. Major damage causing species are black bear, langur, monkey, squirrel, and parrot etc.

To protect these fruit crops, use of sound and frightening devices is encouraged in these hilly areas. Birds repellents: Mesurol, ReJeX-it AG-145, Lindane, Captan, methyl Anthranilate, Polybutene, Thiram, 4-Aminopyridine, 3-Chloro-Toluidine hydrochloride and MA Aerosol and mammal repellents and sonic and ultrasonic deterrent frequently used in other countries need to be experimented in our situations to find out the cost-effectiveness in reducing the damage.

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**ANNEXURE - I****List of Villages**

Name of Area	Sl. No.	Name of Village
GHNP	1	Kundar
	2	Majhan
Sainj Sanctuary	1	Shagor
	2	Shakti
	3	Maror
Ecodevelopment Area	1	Bupan
	2	Bajahra
	3	Bhagi-Kashari
	4	Baretha-Saryer
	5	Banaugi
	6	Bah
	7	Chinari
	8	Dhatidhar
	9	Dalhiyar
	10	Darmera
	11	Dhartha
	12	Damiari
	13	Ghatseri
	14	Ghat
	15	Goransari
	16	Guhri
	17	Jalahra



	18	Jangla
	19	Kharangcha
	20	Khanyari
	21	Kothiyari
	22	Karehla
	23	Khainth
	24	Khain
	25	Majharna
	26	Majhgran
	27	Manahra
	28	Mail
	29	Manjhan
	30	Nadahra
	31	Neoli
	32	Niharni
	33	Pashi
	34	Patahra
	35	Pachari
	36	Riari
	37	Sharan
	38	Shaindhar
	39	Sharoh



	40	Sharan
	41	Setitol
	42	Sambha
	43	Shikari
	44	Sin
	45	Sohan
	46	Sambha
	47	Tiali
	48	Telehra
	49	Tung
	50	Gaul
	51	Nunuribahli
	52	Satesh
	53	Sambha
	54	Bhaludwar
	55	Compton
	56	Jiwa
	57	Chenga
	58	Bhathar
	59	Birashangar
	60	Chamarda
	61	Dharali



	62	Dagahra
	63	Dhara
	64	Goshti
	65	Kutwali
	66	Kahna
	67	Lapah
	68	Nawwali
	69	Pubna
	70	Ropa
	71	Suchen
	72	Shigaira
	73	Thachan
	74	Madana
	75	Barshangar
	76	Titri
	77	Kotlu
	78	Shengcha
	79	Dhara
	80	Kot
	81	Sundarnagar
	82	Banagi
	83	Bathad



	84	Chipni
	85	Daran
	86	Dingcha
	87	Farari
	88	Gushaini
	89	Ghat
	90	Galingcha
	91	Guruli
	92	Huri
	93	Kanon
	94	Khatkeri
	95	Kulthi
	96	Kharongcha
	97	Kamera
	98	Loharda
	99	Lagcha
	100	Malwani
	101	Manjaili
	102	Mashiyar
	103	Nadahar
	104	Nah
	105	Nadahra



	106	Nahin
	107	Pekhri
	108	Parwari
	109	Rogut
	110	Shirachi
	111	Shanar
	112	Shungcha
	113	Shalinga
	114	Shil
	115	Sharangar
	116	Thanach
	117	Tindar
	118	Talinga
	119	Thari
	120	Thanegad
	121	Tung
	122	Ropa
	123	Bhaliyar
	124	Gadingcha
Grand Total	129	

ANNEXURE - II
Hamlets and their population in Great Himalayan National Park Eco-development zone

Tahsil & Waziri	Kothi, Revenue estate	Phanti/ Revenue village	Name of Hamlets	Number of Households	Total Population	Eco-development Unit
Banjar, Inner Seraj (Sub The. Sainj)	Shaughar	Shangarh	Birashanagar	7	58	6
			Chamarda	14	82	
			Dharali	22	84	
			Dagahra	4	31	
			Goshti	7	78	
			Dhara	8	24	
			Kulwali	8	65	
			Madana	5	62	
			Kahna	6	53	
			Kotlu	7	25	
			Shengcha	6	44	
			Lot	5	23	
			Sundarnagar	7	22	
		Total	13	106	651	
Banjar, Inner Seraj (Sub The. Sainj)	Shunghar	Lapah	Lapah	15	113	Village Bar Shanghur and Tirti has been included in Unit 6
			Barshanagar	14	55	
			Titri	8	51	
			Dhara	8	24	
					Total	



Banjar, Inner Seraj (Sub The. Sainj)	Banogi	Shehan	Nanwali			
			Puna	5	14	9
			Ropa	11	61	
			Suchen	21	108	
			Shigaira	5	28	
			Thachan	10	44	
		Total	5	52	255	
Banjar, Inner Seraj	Tung	Chipni	Chipni	35	329	13& 14
			Banogi	8	65	Thari & Manwani included in Unit 14 alongwith Farwari
			Thari	5	25	
			Tung	6	35	
			Mulwani	11	114	
			Farwari	22	208	
		Total	6	87	776	
Banjar, Inner Seraj	Tung	Mashiyar	Mashiyar	11	110	5
			Manjaili	20	170	
			Kamera	15	164	
			Gulingcha	22	205	
			Thanegad	14	70	
			Ghaliyed	40	200	
			Gadingcha	8	48	
			Bathad	18	178	
		Total	8	138	1145	



Banjar, Inner Seraj	Nohanda	Pekhri	Duran	5	50	
			Ghat	6	45	
			Kuthi	25	120	
			Loharda	3	23	
			Lagcha	12	120	
			Nadahar	5	30	
			Nahin	45	400	
			Pekhri	80	500	
			Talinga	5	35	
			Shungcha	8	102	
			Shalinga	12	115	
			Byte	30	250	
			Ludhar	3	18	
			Burnga	5	32	
			Gaded	7	40	
			Manahar	10	90	
		Total	16	261	1540	
Banjar, Inner Seraj	Nohanda	Tinder	Dingcha	11	105	11
			Gushaini	12	160	Gushaini included in Unit 14
			Karongcha	3	30	
			Tinder	40	380	
			Ropa	10	60	
			Lajhari	5	30	
		Total	6	81	765	
Banjar, Inner Seraj	Plach	Shri Kot	Huri	4	20	15



			Kanon	103	944	
			Khatheri	8	40	
			Nah	5	45	
			Ragut	7	35	
			Shirachi	90	450	
			Shanar	5	25	
		Total	7	222	1559	
Banjar, Inner Seraj	Sharchi	Shilhi	Guruli	25	320	12
			Parwali	17	120	
			Shil	21	260	
			Shurangar	22	220	
		Total	4	85	920	
Banjar, Rupi	Shansher	Shansher	Pathara	10	58	50% of villages, in unit 7
						7 rest 50% villages in units 16, 10 & 4 respectively.
			Bhagi-Kashari	15	69	
			Chinari	25	95	
			Darmera	11	71	
			Dhartha	4	42	
			Damiari	6	30	
			Guhri	13	65	
			Julahro	4	30	
			Jangler	9	33	
			Karehla	8	26	
			Khainth	8	33	



			Khain	36	161	
			Manahra	28	198	
			Mail	17	108	
			Nadohra	7	32	
			Niharni	3	16	
			Pathara	7	43	
			Pachari	4	30	
			Riari	7	38	
			Sumbha	17	95	
			Siri	9	40	
			Sumbho	4	18	
			Tiali	5	35	
			Telehra	4	19	
			Tung	29	187	
			Gaul	6	24	
			Namuribahli	3	20	
			Satesh	14	64	
			Bhaludwar	3	11	
		Total	29	321	1641	
Banjar (Rupi)	Shansher	Garaparli	Baretha-Sanyer	15	106	10 and 4 Neeli included in Unit 16
			Banaugi	9	48	
			Bah	7	35	
			Munjhan	26	205	
			Neoli	13	30	
			Sohan	3	15	
			Chenga	3	15	
		Total	7	74	448	
Kullu, Rupi	Balahan	Rala	Bupan	11	59	2 & 8



			Dhatidhar	4	25	
			Dalhiyar	4	26	
			Ghatsiri	7	60	
			Ghat	10	67	
			Gorunsari	3	16	
			Kharongcha	7	50	
			Khanyari	1	5	
			Kathiyari	3	26	
			Majharna	7	47	
			Majhgran	4	21	
			Pashi	13	111	
			Sharan	11	64	
			Shaindhar	5	27	
			Sharoh	8	47	
			Setitol	1	16	
			Shikari	8	65	
			Jiwa	16	89	
			Sharan	42	247	
		Total	19	165	1068	
Banjar, Inner Seraj	Plach	Kalwari	Nadahar	7	32	Both have been included in unit 13 with Siri Kot
			Thunach	7	30	
		Total	2	14	62	

(Source: Report on 'Assessment of the Social Context and Socio-economic conditions of people using GHNP and Wildlife Sanctuaries

by Shri Pradeep Kumar, Sudesh Nangia and B.M.S. Rathore)

**ANNEXURE - III**

Traditional Rights of Grazing in the Project area, Right of way is also indicated

Name of Forest	Description of the right holder	Name of the thatches on which grazing is permitted	Right of way
Reserved 1. Rolla			Only for men along the Tirthan stream
2. Humkani	Lapa and Darai Hamlets	40 days in Khori Thatch and 20 days in Khumi Thatch	1. Majan Gulu to Humkani 2. Lata to Khoru Thatch and kDhara 3. Patu from Shakti to Maror
3. Gatipat			1. Sheep path only
4. Deun		A.	
Protected lind 1. Basu	Negi Anant Ram of Nohanda and with him and Laule S/o Dhani Hukma Patwari of Shikari Kothi, Rasu, Negi Devi Ram of Shikari Kothi. Thatch Hamlet, Tinder Phanti of Nohanda and Shalinga and Malaun villages of Tung Kothi.	Benuuli Chan B. Mandereun C. B. Bishul	
2. Bandhar	Piari Ram and Jagar Ram, Rasus for Manja desh Phanti of Narangarh	a. Phupha b. Ueegahr c. Deobiball d, Bhilisaketi e. Parli Sakti	



	<p>Jeru Deun of Khani Phanti of Jalori Kothi, Chipni Phanit of Tung Kothi.</p> <p>Hukuma Patwari of Shakti Kothi, Rasu, Negi, Negi Dev Ram of Shikar and Thatch Hamlet, Tinder Phani and Salingarh Malami village of Tung Kothi</p>	<p>a. Shagat b. Chanand c. Jatholi d. Dharach e. Pagora f. Bahama g. Khor h. Kukri i. Banaugi j. Khorli Poi</p> <p>a. Asarbagh b. Deosu</p>	
3. Rakhundi	<p>Dhar, Sungcha and Shamira Hamlets, also Gatlinga</p> <p>Sangat Ram, Negi of Chini and with him Rolu, Shewgi and Chet villages. Also Anant Ram Negi of Nohanda</p>	<p>1.Karshu and Pangch 2.Rakti and Bhan 3.Sakilinga 4.Shilut, Pardi, kGoga, kShanka, Chakera, Hoda, Hur, Manjhuri, Sainori</p> <p>All the Thatches are mentioned in No.4</p>	
4. Drashar	<p>Pashi, Majham, Krangcha, Majan and Gohi Hamlets</p>	<p>Bakha Gahr, Drishar Ghar, Bakra Chuman Gahr, Rati Thathi</p>	



	Sharam, Patmohi, Kchiari, Jakrugraon, Snroha and Bagshal Hamlets	Gahr, Dwara Gahr, Kamersu Dotula Gahr. Chiaru Gahr, Shillar Gahr, Kasal Gahr, Gara - dwar dotula, Maili Dwar, Lauribatti and Phangachi Thatches	
5. Kanda Dhar	Tilara Hamlet of Sanisa Kashmiri Khalam village and Manar and Bajahar villages of Sainsar Tung of Sainsar	Dwara Dotula I, Rialu or Ropru, Bugri dwari dothla, Junda Dhear and Bun Dwara II Dothlu Batii Nigahr 6 Umla-Rewar Dathulu 7 Ram dothla 8 Raticha Nighur 9 Kanda Dhar 10 Uperala Nighr Chung Nighr	Raila, Upraila, Karoa, Bunta, Kauhara, Rulani, Tungwacha, Rakasukal, Sulga and Jiwa Hamlets.
6. Ranihuri	Kanda, Dhara, Pihali, Babiharji Gari, Baila of Rot Panti of Bahlam Banangi Kothi and the people of Bunga and Gopalpur Tung Village Jaulio, Tharer,	Pan Sharu Nigahr Rankabam Nigahr Kuto-ris ban Nigahr Kandidothlu Sobli	Passed through



	Hurcha, Chamrra under Dila Ram Rasu	Majann	
7. Kamba	<p>Chukurtha Phanti</p> <p>Dara and Lapa Hamlets, and Parmanand Raju of Kothi Mangolize</p> <p>Manohar, Negi of Plach, Rasu for Janad Jugala and other villages of Plach and Kalwari Phatis.</p> <p>Het Ram Rasu of Gopalpur and with him Chaman and Seoli, Jauri Thathi- beer Phatis.</p> <p>Kahami Ram, Rasu of Digahr, Kotwali, Kahna and Chamarda</p> <p>Ses Ram, Rasu of Jamod and Shapnil Phanti, Kothi Palach.</p> <p>Kalu of Darwali and with him Darwalim Birshanagar and Mohanda.</p>	<p>Tithla Nigahr</p> <p>Dela Nigahr</p> <p>Nasrapa Nigahr, Bujurar</p> <p>Dothla and Charidwar</p> <p>Kamba Nigahr, Dara Thach detula, Shil- swaru</p> <p>Kilib Nigahr Dialu Dothla</p> <p>Reriman Nigahr</p> <p>Two Thatches</p> <p>Six Thatches</p>	



8. Parli	Sheepheads from outer Seraj who pay dues to Ram of Rupi Parmanand of Warahiarh Bija Ram of Gahr in Haraya Garh Tulsu of Dogi in Haraya Garh Dharm of Suket Kalu Kanet of Dagi of Narangarh Maror village Hardu of Dogi in Narangarh Thali of Sri garh Devi Ram of Himiri	Dulo gahr, Bemsu gahr Nainphuma garh Bramshuli Moti gahr, Rai Dhothla, Parli Dansuati nigahr Jaula Dothla (I). Manja Tatri Nigahr, Brimchuli Hochi gahr. Jawar dofula, Guguman nigahr. Kaili Hunch garh. Jawara dotula, Suchainga Wigahr. Gartagarh. Rati dwan dothla Mathann nigahr. Bakrachi gahr. Parta dothe Jaula Dotula II. Rakti Nighar (of Siroj)	
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Reserved Forest Nila Thotha	Kiru, Kanet of Majan	Paths: 6 Dalangcha Path for men 7 Munishini used by livestock 8 Kailikanda Path used by cattle and livestock	
Protected II Kali Kanda	Devi Ram of Himri	Sainjat gahr	
	Dhil of Suket	Sheagai gahr	
	Grazed by Narayangarh	Pangata garhr, Galu Thatch Dothla, Gulwar nigahr	
	Sakti Village	Waili Thatch garh. Hochi Sitogana dotula Duditalra nigahr	
	Dila Ram of Narayangarh	Bali Nigahr, Baunli dofula and Thrain gahr	
	Ablu of Kuthua Nigarh	Lakhcha gahr, Moti Sitogana Nighar	
	Majan and Majeli	Chinsoti Nigahr	
	Thakura of Kathaogi	Kali Kanda Nigahr I	
	Naranyan of Kathaogi	Kalikanda Nigahr II	
	Jan li, Tharer, Hurcha and Chamerem under Dila Ram	Tilara Nigith	
Protected II Class Deoridhar	Gallhar Bathad Tung	Bajaha Jamu	



	Pharidi Gathus Phanti of N. Garh Kothi		
Bungdhar	Munjali Galingcha	Mandrach Bahmls Nali	
Ghurko	Tinger Phanti Salinga Vill. Malwani Vill.	Ghurko Devkanda	
	Hukna, Patwari of Shikari Kothi, Rasu and with him Negi Devi Ram of Shikar Kothi, Thatch village	Ghorka Devkanda	

(Source: Reoprt on 'Assessment of the Social Context and Socio-economic conditions of people using GHNP and Wildlife Sanctuaries
by Shri Pradeep Kumar, Sudesh Nangia and B.M.S. Rathore)



ANNEXURE IV

Processing Cases For Grant Of Compensation

Instructions issued by CWLW and provisions of the notification No.Fts(F)6-7/82-Loose dated 13.8.1986 are not followed strictly.

I. The Range officer should inspect spot for:

Reported date of occurrence

Date of receipt of application

Date of spot inspection

Description of the animal killed or wounded i.e. whether the carcass was lying on the spot and in what condition.

Identification of wild animals which caused the damage

Evidence of the attack by wild animal such as scratches, blood trails, dragging trails etc.

II Post-mortem report from Veterinary assistant surgeon should be attached.

Sometimes only death certificate issued by pharmacist is attached which is wrong. If no veterinary surgeon is available within 10 km from spot, Range officer should submit a certificate to this fact and specifying that postmortem report was not been dispensed with and veterinary Dispensary is not available within 10 km radius.

III Report of President Gram Panchayat should be attached

IV Sketch map of the site should be attached.