1. INTRODUCTION

1.1 Background

The first National Park, Yellowstone National Park in United States was a milestone in the evolution of the concept of national parks. It was established in 1872. Since its establishment, most countries have recognized the value of protected areas to their people. This resulted in the establishment of more than 2600 protected areas by 124 countries covering nearly four million sq. km of the world to the date of the Third National Park Congress, held in Bali Indonesia in 1982 (Mackinnon *et al.*, 1986). According to Majupuria and Majupuria (2006), there are more than 2670 National Parks and Wildlife Reserves all over the world covering about 3,397,316,382 hectares of the earth's land area. At present, there are 107,107 protected areas covering about 19,630,149 sq. km of the earth's land area (www.unep-wcmc.org/ wdpa/).

The concept of national parks and protected areas was developed for the preservation of living resources. In the United States, national parks were established for the protection of nature and natural resources. Today, all countries have designated protected areas for a variety of conservation objectives such as maintenance of the integrity and diversity of ecosystems, protection of flora and fauna, conservation of cultural heritage and soil regeneration and nutrient cycling. Protected areas are also home to communities of people with traditional cultures and irreplaceable knowledge of nature.

National Park is a protected area managed mainly for ecosystem protection and recreation. The objectives of the establishment and management of national park as given by International Union for Conservation of Nature and Natural Resources (IUCN, 1978) are:

i) to protect natural and scenic areas of National and International significance for spiritual, scientific, educational or tourism purposes

ii) to perpetuate in as natural state as possible, representative examples of physiographic regions, biotic communities, genetic resources and species, to provide ecological stability and diversity

iii) to manage visitor use for inspirational, educational, cultural and recreational purposes at a level, which will maintain the area in a natural or near natural state

iv) to eliminate and thereafter prevent exploitation or occupation inimical to the purposes of designation

v) to maintain respect for the ecological, geomorphologic, sacred or aesthetic attributes which warranted designation and

vi) to take into account the needs of indigenous people, including subsistence resources use, in so far as these will not adversely affect the other objectives of management.

1.2 Protected Areas of Nepal

In Nepal, Protected Areas were initially established for the protection of wildlife especially endangered wildlife. However, the objectives have since been broadened to include the preservation of natural, historic, scenic and cultural values (HMG, 2002). The conservation movement in Nepal was effectively initiated in 1970 when His Majesty the King Mahendra approved the principle of the establishment of Royal Chitwan National Park and Lantang National Park. In 1973, a National Park and Wildlife Conservation (NPWC) Act came into force providing a legal basis for the management of protected areas. The Act, subsequently amended four times in 1974, 1982, 1989, and 1994, recognizes the six categories of protected areas in Nepal namely National Park, Strict Nature Reserve, Wildlife Reserve, Hunting Reserve, Conservation Area and Buffer Zone (HMG, 2002) (Fig. 1). According to NPWC Act 1973, a national park is an area set aside for the conservation and management of the natural environment including the ecological, biological and geomorphologic associations of aesthetic importance. To develop the area for eco-tourism is the second objective, provided that this is compatible with sustainable conservation (HMG, 2002). According to the latest estimates, 28585.67 km^2 i.e. 19.42% of the total area of Nepal is now declared protected (DNPWC, 2005) (Fig. 2, Annex-3).

The Commission on National Park and Protected Areas (CNPPA) has defined national park as “Natural area of land or sea, designated

i) to protect the ecological integrity of one or more ecosystems for present and future generation

ii) to exclude exploitation or occupation inimical to purposes of designation of the area

iii) to provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.”

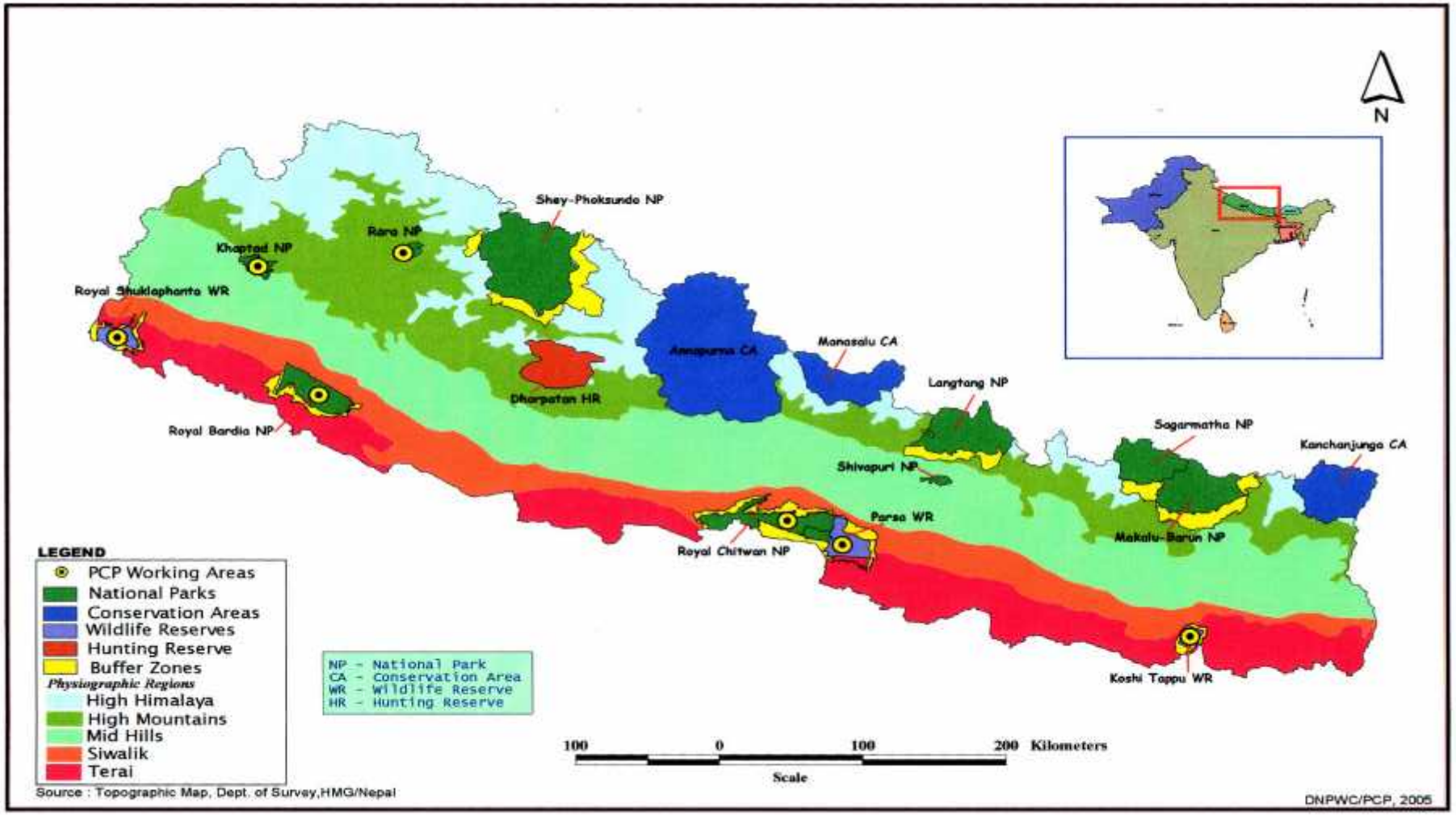

Fig 1: Protected Areas of Nepal

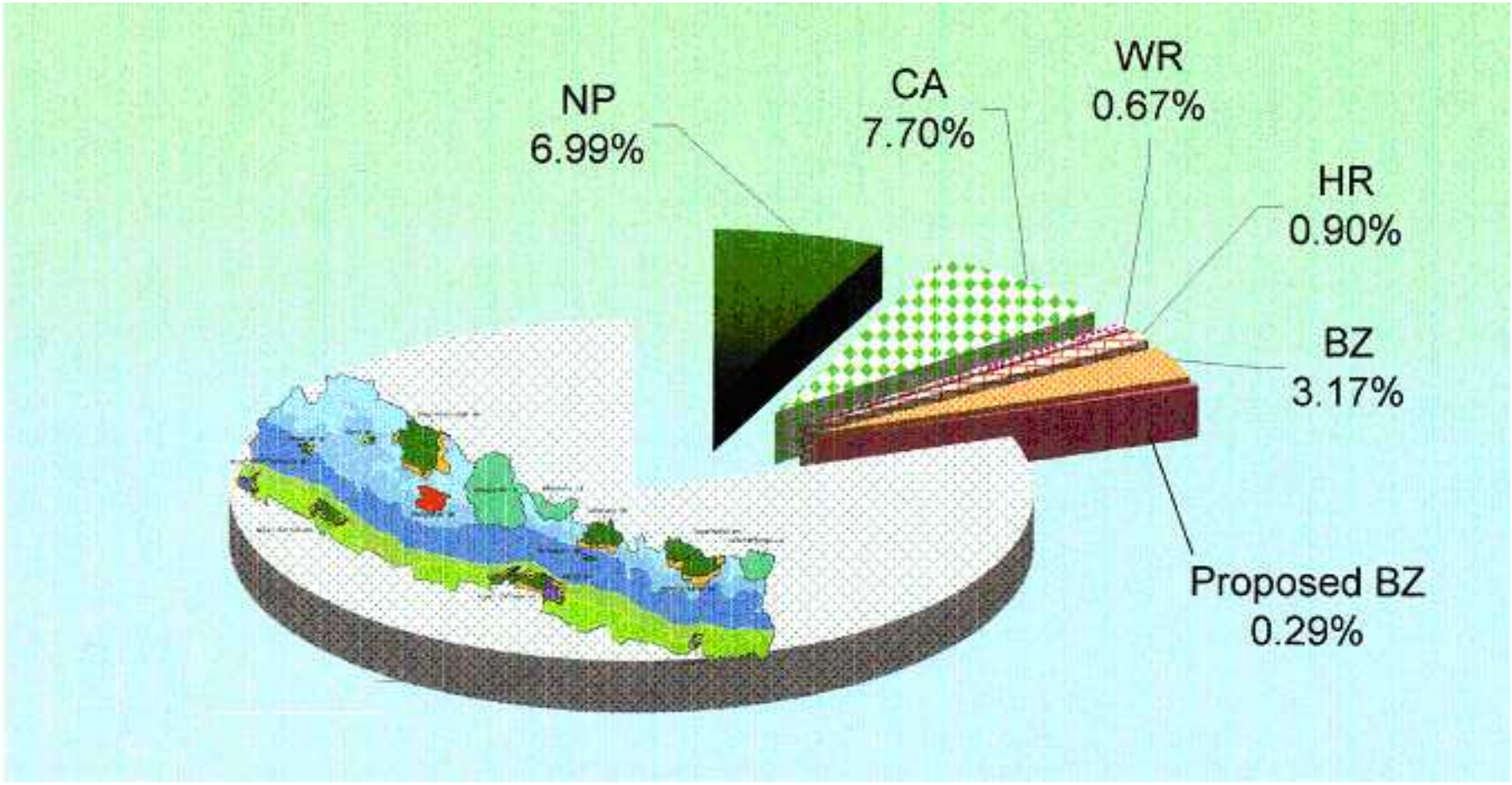

Fig 2: Protected Areas Coverage Within Country

1.3 Park-People Conflict

The concept of national park and protected areas developed with a philosophy of preservation of living resources. In United States, national parks were developed to protect the natural and cultural features by acknowledging that national parks reflect the common heritage of all people, where people were not permitted to harvest in any form from park resources or to live within the park (Frome *et al.*, 1990 cited in Kharel, 1993). This conservation philosophy of the United States was followed by the national park and protected areas system of different countries but many protected area management authorities failed to adopt appropriate principles and guidelines to protect their areas against the threats of inevitable human pressure for traditional exploitation of natural resources (Sharma, 1991 cited in Kharel, 1993) resulting conflict. The national park and protected areas system strictly prohibits all kinds of destruction, exploitation and removal of flora and fauna and damage to habitat. This active conservation of habitat has increased the population of wildlife within the protected areas which causes damage outside the park or the people living within the area. The restriction imposed on the resources use by the local people to meet their basic needs lead to the deterioration of the park-people relation. Crop damage, human harassment, injuries and death, livestock depredation, inappropriate compensation measures, illegal activities such as hunting, poaching are the issues raising conflict between the park and people (Sharma 1995, Jnawali 1989, Kasu 1996, Shrestha 1994, Solvia *et. al* 2003).

1.4 Shivapuri National Park

1.4.1 Location

Shivapuri National Park (ShNP) initially established as Shivapuri Watershed Reserve in 1976 and Shivapuri Watershed and Wildlife Reserve in 1984, was gazetted in 2002. The park is located between 27^0 45' and 27^0 52' North latitude and 85^0 15' and 85^0 30' East longitude. It covers an area of about 144 sq. km of Kathmandu, Nuwakot and Sindhupalchok districts of Central Development Region, stretching about 20-24 km from East to West and about 8-10 km from North to South (Fig. 3). The park boundary is well demarcated with a 111 km long wall around the park. The boundary wall runs along number of villages that include Talakhu, Chhap, Likhu,

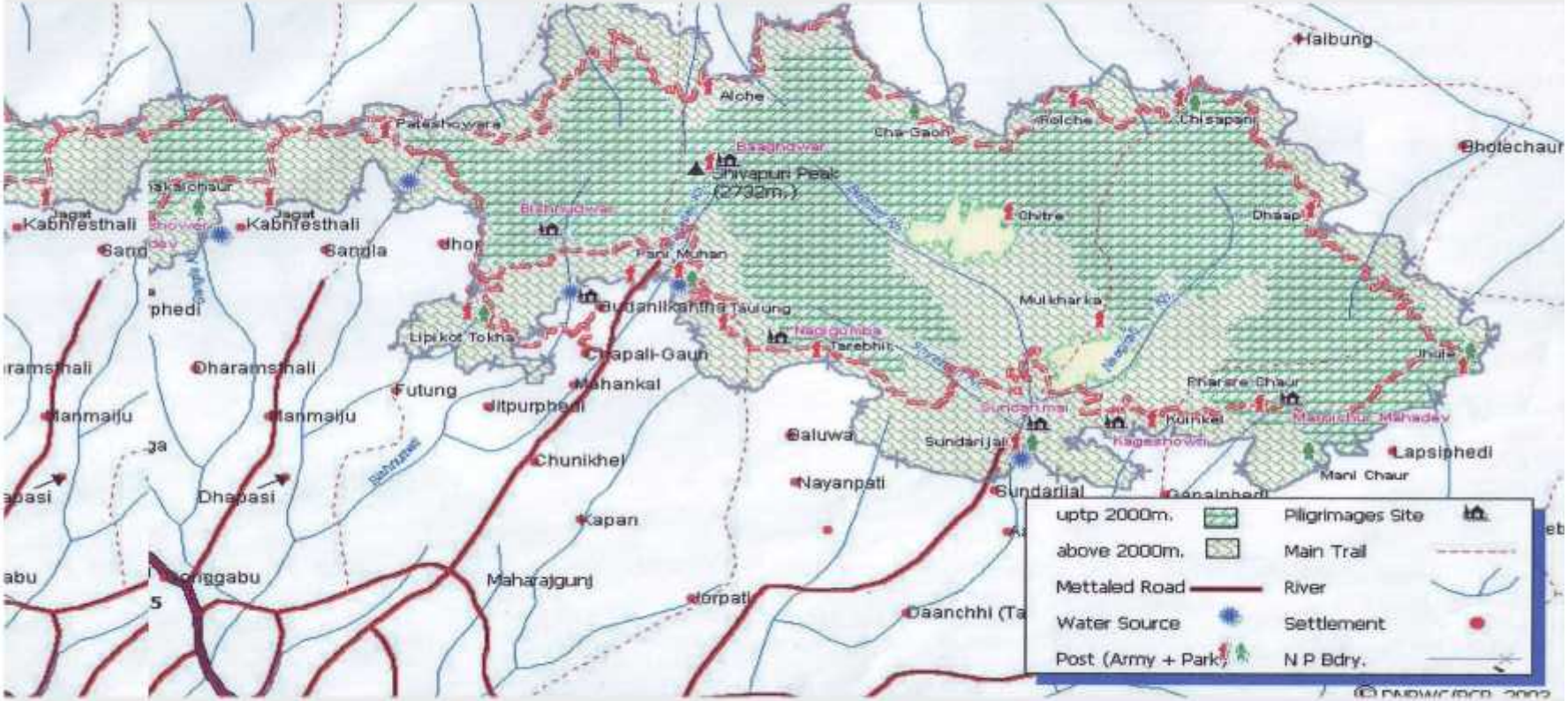

Fig 3: Shivapuri National Park

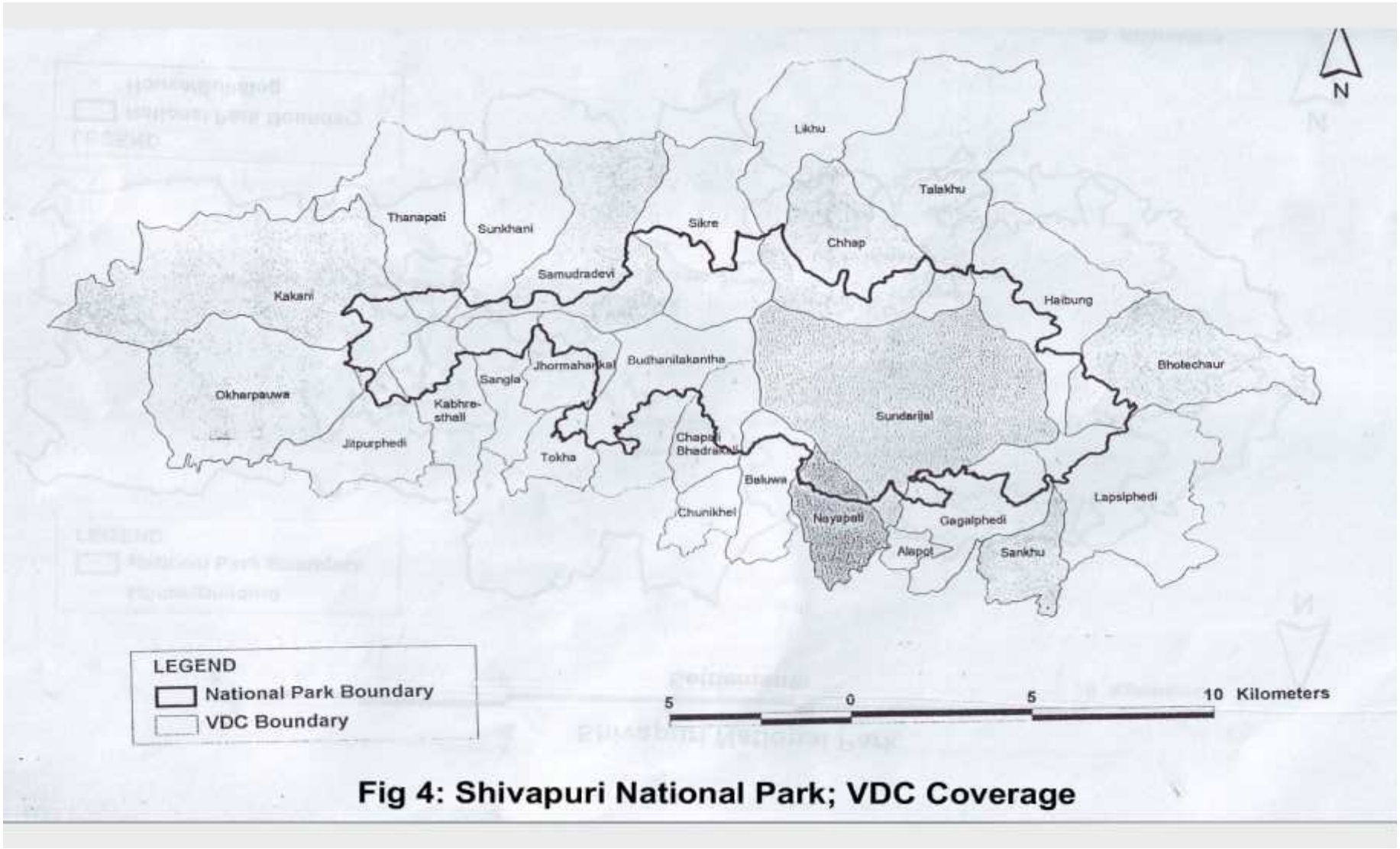

Fig 4: Shivapuri National Park; VDC Coverage

Samundradevi, Sikre, Sunkhani and Thanapati of Nuwakot district in the North, Bajrayogini, Baluwa, Chapali Bhadrakali, Gagalphedi, Jhor Mahankal, Jitpurphedi, Kavresthali, Lapsiphedi, Nayapati, Sundarijal and Vishnu Budanilkantha of Kathmandu district in the South, Bhotechaur, Haibung and Naglebare of Sindhupalchok district in the East and Okharpauwa and Kakani of Nuwakot district in the West (Fig. 4). It is the only protected area that falls entirely within the middle mountain range of Nepal. The name of the park is derived from the ancient name 'Shiphucho' representing the holly peak of woods.

1.4.2 Access to the Area

ShNP is linked by four major road networks from the Kathmandu Valley (Kathmandu to Budhanilkhantha, Sundarijal, Kakani and Tokha). The distance of the park is 25 to 45 minutes drive from Kathmandu, depending upon the entry point. The park headquarter, Panimuhan, is just 7 km from the city-ring road and 12 km from the city center. One can enter the park from a number of other points namely Jhule, Chisapani, Kakani, and Tokha. There are 95 km graveled road and 83 km foot trails (12 trails) inside the park for trekking and village walk.

1.4.3 Geology, Topography and Elevation

Geologically, ShNP falls in the Inner Himalayan Region. The gneiss and magmatite with mica schist and pegmatic granite are the dominant rocks. The soils of the area range from loamy sand on the northern side to sandy loam on the southern slope. Topography is mostly mountainous with steep slopes of more than 30^0 at least 50 % of the total area of the park (KMTNC, 2004). Soil erosion is very high in places particularly in the northern part of the park i.e. Samundradevi, Sikre and Talakhu villages because of the steep slopes and the nature of soil. Landslides, gullies, sheet erosion in the sloping terraces and stream bank erosion are common all over Shivapuri. Construction of roads on the steep southern and northern slopes, abandoned agriculture land and overgrazing are the major causes of hazards in the area. The elevation ranges from 1366 m to 2732 m at Shivapuri peak.

1.4.4 Climate

The climate of the ShNP lies in a transition zone between subtropical and warm temperate types. It has relatively high humidity all throughout the year. There is a high variation in the annual temperature and precipitation. For the period of 1995 - 2005, the highest maximum average temperature is 27.45^{0}C and the minimum average temperature is 3.35^{0}C (Fig. 5). The highest mean monthly rainfall of 590.85 mm occurs in July and the lowest monthly rainfall of 9.24 mm occurs on December (Fig. 6). The total rainfall is 2078.36 mm for the period of 1995 - 2005 and more than 80% of annual precipitation occurs during the rainy season i.e. between mid June through late September (Annex 5).

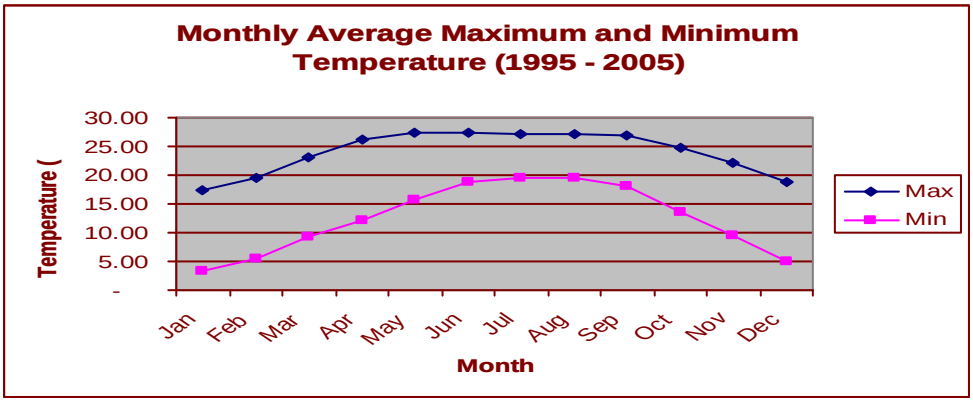

Fig.5 Monthly variations in mean maximum and mean minimum temperature for the year 1995-2005 recorded at Budhanilkantha Station.

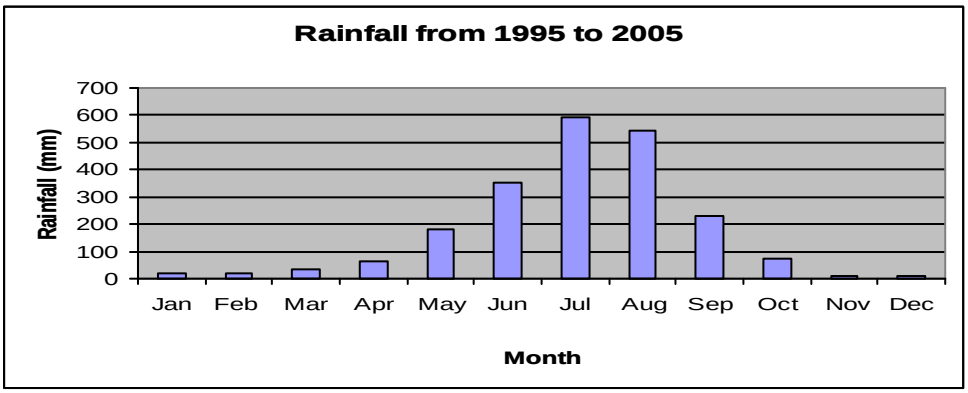

Fig.6 Monthly variations in average monthly rainfall (mm) for the year 1995-2005 recorded at Budhanilkantha Station.

Source: Department of Hydrology and Meteorology

1.4.5 Land Use Pattern

ShNP is predominated by forest, followed closely by agriculture, shrubs, grassland with shrubs, landslides, settlements, riverine features and abandoned lands.

Table 1: Land Use Pattern of ShNP

Forest	Agriculture	Shrubs	Grassland	Grassland with shrub	Landslides	Settlements	Riverine features	Abandoned land
40.7%	35.3%	14.8 %	2.9%	2.6%	0.5%	0.9%	0.2%	2.0%

Source: Shivapuri National Park A Draft Management Plan, 2004

1.4.6 Wildlife

The wildlife distribution depends on altitudinal range, habitats and forest types. Since the altitudinal variation in ShNP is not very high, the wildlife distribution depends more on the types of forest. ShNP is a suitable habitat for many wild animals. 21 species of mammals have been recorded from the park out of which 9 are threatened species (BPP, 1995). They include Pangolin (*Manis spp*.), leopard cat (*Prionailurus bengalensis*), clouded leopard (*Pardofelis nebulosa*), common leopard (*Panthera pardus*), langur (*Semnopithecus entellus*), rhesus monkey (*Macaca mulatta*), jungle cat (*Felis chaus*), ghoral (*Naemorhedus goral*) and himalayan bear (*Ursus thibetanus*). The park is also home to 177 species of birds, including at least 9 threatened species, oriental hobby (*Falco severus*), grey-sided laughing thrush (*Grarrulax caerulatus*) and cinerous vulture (*Aegpius monachus*). Only one species of reptilian i.e.*Oligoden arnensis* has been reported from ShNP (BPP, 1995). 102 species of butterflies have also been recorded. Shivapuri is the only habitat for relict Himalayan dragonfly (*Epiophlebia liadlawi*) in Nepal.

Table 2: Faunal Diversity in ShNP

Groups	Number of species	Status	Source
Mammals	21	Protected, Threatened (9)	BPP, 1995
Birds	177	Threatened (14), Endemic (1)	BPP, 1995
Herpatofauna	1	Under Explored	BPP, 1995
Butterflies	102	Endemic, susceptible species	Smith, 1996

Source: Shivapuri National Park A Draft Management Plan, 2004 (Annex 4).

1.4.7 Vegetation

ShNP has high floral diversity due to its location, altitudinal and climatic variations. ShNP has four types of forests, which are distributed along the altitudinal gradient (Amatya 1993, Kattel 1993, KMTNC, 2004). They include

i) Lower mixed hardwood (Schima-Castanopsis) forest at 1000-1500 m asl

ii) Chir pine forest at 1000-1600 m asl

iii) Upper mixed hardwood forest at 1500-2300 m asl and

iv) Oak forest at 2300-2700 m asl

There are more than 2122 species of flora and 16 of them are endemic flowering plants. About 129 species of mushroom has been identified in ShNP (BPP, 1995, KMTNC, 2004).

Table 3: Forest Habitats and Altitudinal Distribution of Flora

Forest type or Habitat	Lower mixed hardwood	Chir pine forest	Upper mixed hardwood forest	Oak forest
Altitude (m)	1000-1500	1000-1600	1500-2300	2300-2700
Flora	*Schima wallichi* *Castanopsis indica* *Alnus nepalensis* *Anthocephalus chinensis* *Prunus cerasoides*	*Pinus roxburghi* *Castanopsis indica* *Myrica esculenta* *Prunus pashia*	*Acer –Aesculus* *Juglans regia* *Betula sp.* *Fraxinus sp.* *Alnus nepalensis* *Salix sp.* *Quercus sp.* *Celtis sp.*	*Quercus semecarpifolia* *Eurya acuminate* *Ilex dipyrens* *Michelia champaca* *Rhododendron arboretum* *Symplocos sp*

Source: Shivapuri National Park A Draft Management Plan, 2004.

1.5 Study Area

This study was carried out in Sundarijal VDC since it covers an area of 32 sq. km which is the largest among 23 VDCs of ShNP (Soti, 1995). This study was especially carried out in Kunegaon, Chilaune, Okreni, Mulkharka villages of Sundarijal VDC which lie within the boundary of ShNP. Most of the population of the area is Tamang who are economically deprived, illiterate and have less access to better livelihood facilities. The people of the area are engaged in the agricultural activities. Besides agriculture, there is no other income generating activities. Majority of agricultural land is rain fed upland and less than 20% of total land is usable for paddy (Poudyal, 1995). Usual cropping sequence in the upland is maize, millet (intercropping) followed by wheat. In the rain fed lowland (less than 20%) also, only two crops are planted in a year i.e. paddy followed by wheat. The cropping time is given below:

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec.
Wheat	J----------				M							
Maize			M----------								S	
Millet										A----------		D
Paddy								J----------				D

1.6 Statement of Problem

Population pressure in the ShNP leads to the increased requirement of natural resources. Local people's access to the forest for firewood, fodder and grazing of livestock and NTFPs was their traditional right, but was denied later on after the establishment of National Park had been creating negative attitude towards National Park. Moreover, the wild animals of the park cause losses by damaging the local people's agriculture and predating on livestock, which further aggravate to the problem. The money collected as revenue in the National Park is not being utilized for the improvement of the livelihood of local people, which further creates the conflict between the park and people.

1.7 Objectives

General objective of the study is to know about the park - people relationship.

The specific objectives are

- To assess the quantity of crop loss by wildlife.
- To know about the most destructive wildlife.
- To identify the reasons of conflict between park authorities and local people.
- To study the impact of local people on park environment.

1.8 Justification

Habitat destruction, population pressure and food shortage are exerting tremendous pressure on the ecosystem and natural resources throughout the world including Nepal. Establishment of the protected areas is only a first step in the protection, conservation and maintenance of biodiversity. Protection and conservation of the natural resources by restricting the local people to use the natural resources, which was their traditional right and the damage caused by the wild animals inside the park have created negative attitude towards the park. Also, the illegal activities such as hunting, poaching by the local people create conflict between the local people and park. Park - people conflict is one of the most important topics, as all the protected areas have some sort of conflict between the local people and the park authorities. As the park - people conflict is one of the root causes of hindrances in the biodiversity conservation; it needs to be addressed in terms of spatial and temporal requirements. Hence, the present study was carried out to know the main cause of park - people conflict and to contribute for the sustainable biodiversity conservation.

2. LITERATURE REVIEW

Upreti (1985) reported in his work "Park - People Interface in Nepal: Problems and New Directions" that human wildlife interaction, antipathy toward park and resources and fishing and hunting are the main sources of conflicts, and forwards some solutions to these problems, such as access to park and reserves, economic incentives, development of community funds, complementary development schemes, local participation in decision making, conservation education and management of the total landscape in the region.

Gorkhali (1985) divided conflicts into three categories i.e. cognitive conflict, conflict in values or goals and relationship conflicts.

Prasai (1989) surveyed in four panchayat i.e. Bachhauli, Padampur, Kumroj and Ratnanagar of Royal Chitwan National Park (RCNP) and found that crop damage, cattle killed and people toll by wildlife were the consequent effects with the establishment of National Park, resulting conflict between park and local people.

Jnawali (1989) reported crop damage and human harassment by greater one horned rhinoceros (*Rhinoceros unicornis*) in Sauraha adjacent to RCNP.

Kattel (1993) identified two major causes of conflicts in Shivapuri Watershed and Wildlife Reserve (SWWR) i.e. (i) legal prohibition of the free use of forest resources including livestock grazing and (ii) crop depredation by wildlife. He recommended i) a periodic assessment of vegetative production in different habitat types and population estimate of wildlife ii) monitoring of crop and livestock depredation of wildlife; at least a year long study iii) wildlife in reserve should be completely protected, however wildlife management as a renewable natural resource in the buffer zone should be considered and iv) eco-tourism development should be given a serious consideration.

Nepal and Weber (1993) reported that rhinoceros (*Rhinoceros unicornis*), chital (*Axis axis*) and wild boar (*Sus scrofa*) as principal crop pest in RCNP. They also analyzed local people's perception, attitudes and motivation towards wildlife conservation and found that although local people disliked the restriction imposed on the use of park resources by park authority, they took a positive attitude to wildlife conservation.

Their active involvement in the protection and conservation could be secured if due consideration is given to their needs, which would have to be addressed on the planning and management of the park.

Shrestha (1994) found that there was a biodynamic competition between the park and people. Crop damage, livestock tolls, and local harassment by rhino, deers, boars, parakeets, tiger, and leopard were the main problems.

Jnawali (1994) assessed livestock management problems and the implication of a community forestry program on livestock management in Bachhauli VDC adjacent to RCNP. She reported a total of 3483.9 Livestock Units (LU) among a total of 1201 households and concluded that about 70% of the total grazing animals were grazed illegally inside the national park and government forest and the remaining 30% were grazed in the restricted areas available within the VDC boundary.

Soti (1995) found that the extent of damage done by wild boar ranged up to a distance of 5 km from reserve boundary in Shivapuri National Park. The degree of crop damage was highest in the farmland located within a distance of 1 km and the livestock loss inside 2 km area from the reserve's boundary wall. He reported maize as the most affected crop i.e. a huge quantity of loss (1051.92 quintal) in total land (972.79 ropani). Paddy and wheat loss was low in quantity (23.09 and 23.66 quintal respectively).

Sharma (1995) found that wild buffalo (*Bubalus bubalis*) and wild boar (*Sus scrofa*) as the main crop raiders in Koshi Tappu Wildlife Reserve (KTWR).

Poudyal (1995) found that 92.0% of household living in the settlement within the walled boundary of the SWWR was affected by wildlife and economic loss on an average was NRs. 3,132 per household annually. The loss was due to the crop depredation by wildlife especially the wild boar.

Connie (1996) in "Managing Conflicts in Protected Areas" stated that conflicts can represent the productive interaction of competing interests and values, an ever-present function in a dynamic society and conflicts can be resolved by i) focusing on underlying interests ii) involving all significantly affected stakeholders in a fair and respectful process iii) understanding the power that various stakeholders have and taking that into account when trying to resolve a conflict.

Kasu (1996) reported that wild elephant, wild boar, and chital were the major pest animals in Parsa Wildlife Reserve (PWR). He also reported that paddy damage was 77.52% followed by wheat and maize. The average economic loss of each household due to crop damage by wild animals was NRs. 3,191.48.

Shrestha *et al*. (1997) reported that crop and livestock depredation by wildlife is one of the key issues of predators and people conflict in most parts of the world. Conflicts between predator and people are more prominent in areas adjacent to and inside protected areas in Nepal due to serious financial losses by wildlife and denial of access to the resources. There is food deficit for two to four months every year, which thus also fuel the problem. Main predators responsible for livestock depredation include leopards, jackals, civet cats, wolves, dogs, and Himalayan black bear. At the same time there is a problem of crop damage by wildlife such as Himalayan black bear. It was reported that almost 71% of the sampled households experienced livestock depredation problem. Generally, small stock was most vulnerable to wildlife depredation. Casualties of large sized livestock (e.g. cattle, yak - chaunri) due to wildlife depredation were comparatively lower. The loss was high in the forest area between the high altitude pastures and the villages. Besides crops and livestock, there is a risk of wildlife related human injuries, which is mainly related to black bear.

Kafle (1998) studied the conflict between blackbuck and local people in Khairpur village, approximately 5 km Northwest of Guleria, the district headquarters of Bardia and divided the area into 3 different zones at a distance of half a km and found that the people living within 1km distance received the maximum loss. 91% of respondent claimed that pulses were totally destroyed by the blackbucks.

Limbu (1998) conducted the survey in Paschim Kusaha VDC, an adjoining village on eastern side of KTWR to study crop loss and human harassment. He found that the most notorious animals damaging the crops were wild boar and wild buffalo. The study also showed that the total loss of crops was 117,517 kg. The mostly damaged crop was paddy followed by wheat, and potato.

Rai (1998) found that illegal grazing as one of the factors contributing to ecological disturbances inside RBNP. The highest number (n = 860) of livestock was observed in Bankhet area and the smallest number (n = 442) of grazing animals were recorded in Shivapur area. Cattle made the highest bulk.

Rawal (1998) studied the problems faced by the local people by the establishment of Royal Bardia National Park and found that there was lack of interaction between the park authority and local people. The study showed that the local people were facing problems after the declaration of protected area. According to the locals, crop damage and scarcity of fuel wood were the major problems but according to park authorities, firewood problem was the most severe problem. She also reported that paddy was the crop most favoured by the wild animals. Deer, Antelope and wild elephants were the most crop damaging animals.

Regmi (1998) reported that the relation between RBNP and people was more critical when the local inhabitants use resources illegally. Cutting down trees for firewood and fodder, livestock grazing, poaching of animals and fishing were the common activities done by the local people inside the park. Due to the lack of grazing land, local people were forced to graze their animals inside the park, which exerted strong influence on grassland, forest structure and wildlife.

Baral (1999) showed a heavy economic loss at Thakurdwara and Shivapur VDCs of RBNP. He found that 52.73% of loss occurred in Thakurdwara and 47.27% in Shivapur. Highest economic loss occurred to paddy crop followed by potato, maize, wheat, mussuro and yam .The percent of potential crop yield damaged ranged from 9.59% to 16.88%. He reported the loss of crop to wild boar ranged from 166.39 kg to 205.51 kg per household. He reported wild boar as the second crop raider animal in Thakurdwara VDC and first major wildlife pest in Shivapur VDC.

Gautam (1999) studied the crop damage by wild animals in the time of proposed Buffer zone area of RSWR. He found paddy heavily damaged followed by wheat and maize and among the wild animals, the highest economic loss was caused by wild elephant followed by wild boar, chital and blue bull. He reported that loss of crop due to wild animals ranged from 61.62 kg to 126.33 kg per household.

Rai (1999) studied the sources of conflict in Kusaha VDC of Sunsari district adjacent to the eastern boundary of KTWR. He also found that the imposition of KTWR had badly affected the household economies of 86.92% of the respondents. He also reported that livestock grazing, fodder collection and logging had led to the loss of vegetation and change in vegetation composition. The integrity of the wild buffalo was threatened as they were freely out breeding with the domestic buffaloes.

Rayamajhi (2000) reported that Department of National Park and Wildlife Conservation (DNPWC) has implemented Park People Programme aiming to establish harmony in park-people relationship in the buffer zone. Through the Programme's support, the buffer zone population had been directed towards the self-reliance in fuel wood, fodder and timber resources by creating alternative resource base to reduce their dependency on park resources. Promotion of community based natural resource management programme in the buffer zone had also served as an added habitat for wildlife and important forestry resource base for the communities. Animal Preventive Infrastructure (API) established in 63 sites as 95-km trenching, 77-km fencing, 86-km biofencing and Erosion Preventive Infrastructure (EPI) established in 113 sites as check dams and spurs had significantly helped in controlling wildlife entrance to buffer zone and safeguarding the cultivated land and forest areas from erosion and subsequent loss of property. API had directly benefited about 4,800 households and conserved about 30,000 ha prime grassland and cultivated land from overgrazing. In Jagatpur in RCNP, API had substantially reduced crop damage up to 70%. EPI had benefited about 14,000 households.

Tamang (2000) studied the extent and actual loss of livestock depredation and frequency of predation by different predators. He found that the highest loss among the different animals was the cattle (cow and ox) that comprised 196 heads followed by goat, buffalo, calf and sheep. Tiger was the major predator and the highest loss was in hot dry season (201 heads) followed by monsoon (124 heads) and cool dry (117 heads). The highest number of loss was reported to be from the cattle shed. A total of 157 (35.52%) animals were killed in the shed followed by 149 (33.71%) animals killed inside the park and 136 (30.76%) animals killed outside the park for the year 1993-1998.

Bagale (2002) studied the population status of Nilgai and Nilgai- livestock- local people interaction in Lumbini. A total of 37 Nilgai were estimated. It was reported that the crop damage by the animal was 6.6%, 17.97% and 15.84% to paddy, wheat and mustard respectively and the loss per hectare being 1.42 quintals, 2.13 quintals and 0.42 quintal respectively for paddy, wheat and mustard in the year 2001-2002.

Gurung (2002) reported about the conflict between park and people in ShNP was due to wild boar (*Sus scrofa*). He found that the wild boar was distributed in a region

ranging from 1400-2700 m asl. The density of wild boar was maximum in a region from 1400-2100 m asl.

Paneru (2004) studied crop depredation due to wild animals in Jitpurphedi, Chapalibhadrakali and Baluwa VDCs of ShNP and found that wild boar was the major crop raider and monkey and porcupines were the minor crop raider. The animals were responsible for 1,303.24 quintals loss of crops and loss was high at 0-1 Km distances for paddy and wheat and 0-500 m for maize and millet. Besides crop depredation, grazing due to livestock and human encroachment for fodder and firewood collection were the causes for the conflict between the local people and park authorities.

Shrestha (2005) recorded 20 mammalian species from ShNP belonging to seven orders and 17 families among which large civet was a new record. Carnivore was dominant followed by artiodactyla, primates, lagomorpha, pholidotal and insectivore. The most abundant mammal was wild boar, followed by barking deer, common leopard, and jungle cat. Himalayan goral large civet, Indian hare and yellow throated marten, golden jackal and black bear were the least abundant species. Besides these mammals, he also found barking deer, common leopard, golden jackal, Indian hare and Himalayan squirrel were common in the western sector of the park. Jungle cat, large civet and wild boar were common in the middle sector of the ShNP. Common porcupine, pangolin and rhesus monkey were common in the eastern sector of the park. Himalayan goral, Himalayan black bear, hanuman langur and Royal's pika were mainly distributed in the northeastern part of the park. Yellow throated marten was common in both the western and middle sector. Small mongoose was distributed near park boundary in the middle and eastern sector of the park. Distribution of house rat and fawn coloured mice were mainly found in agriculture and open areas in the park. He also found that the ratio of herbivore species was 6:4 in the western, 7:6 in the middle and 5:5 in the eastern sector parts of the park.

Regmi (2006) studied the relation between park and local people and highlighted the real situation of problems and conflicts of the protected areas in Nepal. Analyzing the problems faced by protected area for the protection of the flora and fauna along with environment pointed out the major conflicting issues between protected areas and local people arising due to protection policy versus human need. He found that the

socio - economic activities have become the problematic issues to protect the areas. Poverty, population pressures, increasing number of tourists and industrial pollutants are the problematic issues. He also reported that in many protected areas, the conflict begins because of the encounter with wild animals and destruction of crops by them.

Dahal (2006) studied the extent of human wildlife conflict in Kanchanjunga Conservation Area (KCA) and indigenous management practices adopted by local communities to mitigate the impacts. He found that Muntjac as the major wildlife damaging crops followed by Rhesus monkey. Other animals such as common palm civet, upland pipit, Himalayan black bear, pheasant, porcupine, grey tree pie, goral, jackal, wild boar, langur were also found as crop raiders. Squirrel was found to be the least damaging wild animals. Major livestock killer of KCA was snow leopard. Jungle cat was the second carnivore that kills livestock followed by an unknown species. Leopard, wild dog, clouded leopard, crested serpent eagle were also the predator of the livestock. In the entire KCA, he found about 20 techniques used by the people on different sites but 4 - 5 techniques were used by a single farmer or cattle owner for the protection of crop and livestock.

3. MATERIALS AND METHODS

This study was entirely based on field survey. The field survey was conducted for one year from April 2005 to April 2006.

3.1 Sources of Data

Primary and secondary data were used for this study. To collect the primary data, household questionnaire survey was conducted. The secondary data like the Ward wise distribution of the households and the population for VDC as a whole was obtained from CBS office and VDC office. Since the data were not available for year 2005, an assumption was made that there has been no significant change in the distribution of households and population. The secondary data used in the study were also received from various books, journals, brochures and concerned departments' offices and also from published and unpublished reports.

Table 4: Ward wise Distribution of Household and Population in Sundarijal VDC

Ward No.	Village	Total Household	Total Population
1	Kunegaon	33	211
2	Okreni	103	525
3	Chilaune	49	254
4	Mulkharka	46	249
5	Mulkharka	31	197
6	Mulkharka	29	164
7	Manhankal	34	175
8	Manhankal	40	250
9	Manhankal	31	316
Total		**396**	**2341**

3.2 Survey Design and Sample Size

To assess the park and local people relationship, Ward No. 1, 2, 3, 4, 5, and 6 of Sundarijal VDC were selected since these areas are entirely located within the walled boundary of the ShNP and there is excessive loss of crops by the wild animals. The study of crop damage was mostly based on household questionnaire survey that is supported by field observation. The sample size was determined before going to the study area on the basis of total households. The existing number of households in each ward was considered one hundred and the total affected households in each wards represented the percentage of the total households. Simple Random Sampling method was conducted to determine households to be surveyed. The number of households sampled and the number of households surveyed are shown in table below:

Table 5: Number of Sampled and Surveyed Households in Sundarijal VDC

Ward No.	**Total Household**	**Sampled Households**	**Surveyed Households**	**Surveyed Percentage (%)**
1	33	11	11	33.33
2	103	35	35	33.98
3	49	17	17	34.69
4	46	16	16	34.78
5	31	11	11	35.48
6	29	10	10	34.48
Total	**291**	**100**	**100**	

3.3 Questionnaire Survey

To collect primary data, the structured questionnaires were developed and interviews were conducted in households, which were selected by random sampling method. The questionnaires were designed to receive information about crop damage and other local conflicts due to the wild animals (Annex 1). Another set of questionnaire was developed for National Park Officer (Annex 2).

3.4 Data Analysis Technique

The collected data were quantitatively analyzed. The crop damage i.e. the loss per unit area is calculated. The objective behind this was to calculate the total loss of different crops i.e. maize, millet, wheat and paddy. It defines the magnitude of the damage on different crops. It is defined as

i) $x = \frac{xE - xA}{xLC}$

where, x = loss per unit land

xE = expected yield before crop loss

xA = actual yield after crop depredation

xLC = total cropping land of that field

ii) xL = xE – xA

where, xL = total loss

iii) Loss percent (%) $= \frac{xL}{xE} X 100$

4. RESULTS

4.1 Total Cultivated Land and Land Holding per Household

Total cultivated land owned by the surveyed households in six wards of the Sundarijal VDC was 50.14 hectares. It was found that the cultivated land was 14.15 hectares in Ward No. 2 (the highest) and 5.07 hectares in Ward No. 1 (the lowest) (Fig. 7). The land holding per household was more in Ward No. 3 i.e. 0.74 hectare/ household and lowest in Ward No. 4 i.e. 0.38 hectare/ household. The average land holding per household in the surveyed household was 0.53 hectare/ household (Table 6.1).

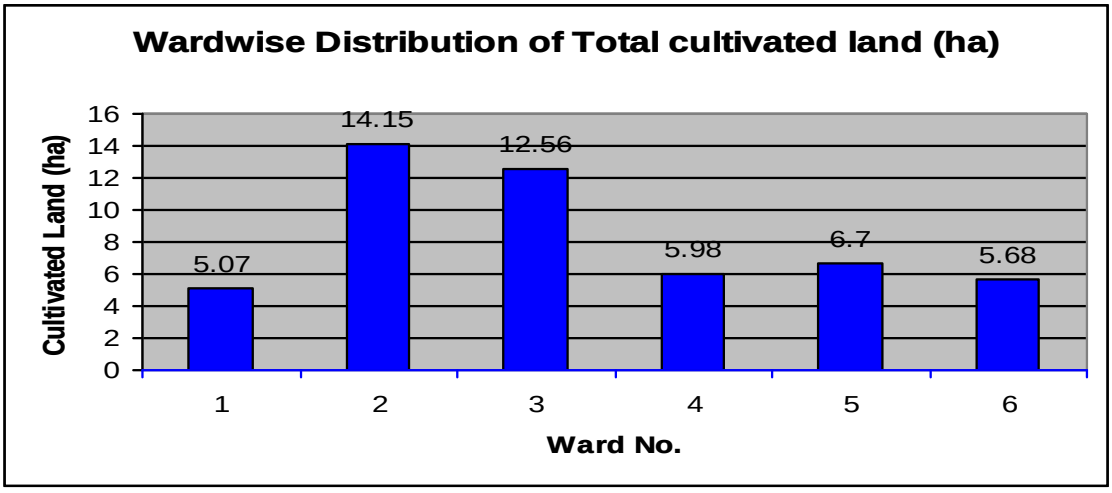

Fig. 7: Ward wise Distribution of Total Cultivated land

4.2 Crops Grown

The major crops grown in the study area were maize, millet, wheat and paddy. Other crops such as potato, buckwheat, mustard, vegetables etc were also grown in the area. The cropping sequence in the upland was maize- millet intercropping followed by wheat. The lowland was also cultivated by maize, millet, paddy followed by wheat. From the study, it was found that every household grows maize and millet i.e. 100% households grow maize, and millet. 41% of the households grow wheat, 11% of the households grow paddy and 68% of the households grow other crops (Table 6.2, 6.3, 6.4, 6.5, 6.6).

Maize: In the surveyed households, all households of every ward grow maize i.e. maize was the dominant crops grown in the study area (Fig. 8, Table 6.2).

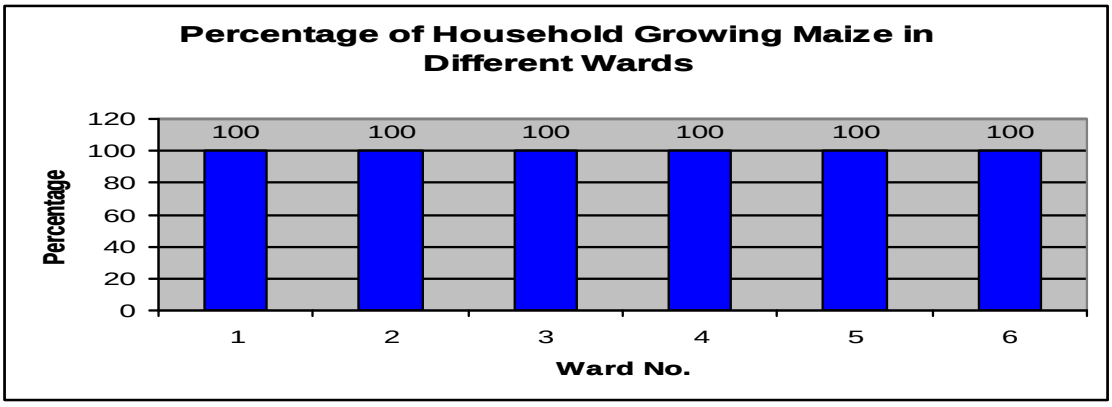

Fig. 8: Percentage of Household Growing Maize in Different Wards

Millet: Out of 100 surveyed households, all households of every ward grow millet i.e. 100% of households grow millet (Fig. 9, Table 6.3).

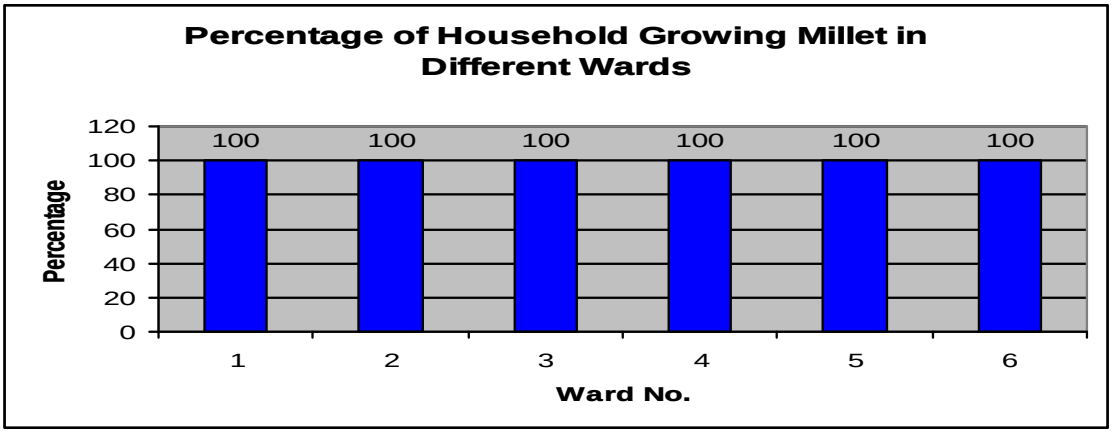

Fig. 9: Percentage of Household Growing Millet in Different Wards

Wheat: Out of 100 surveyed households, only 41 households grow wheat i.e. 41% of the households grow wheat. In Ward No. 3, wheat was not grown but in Ward No. 2, 80% of the households grow wheat (Fig. 10, Table 6.4).

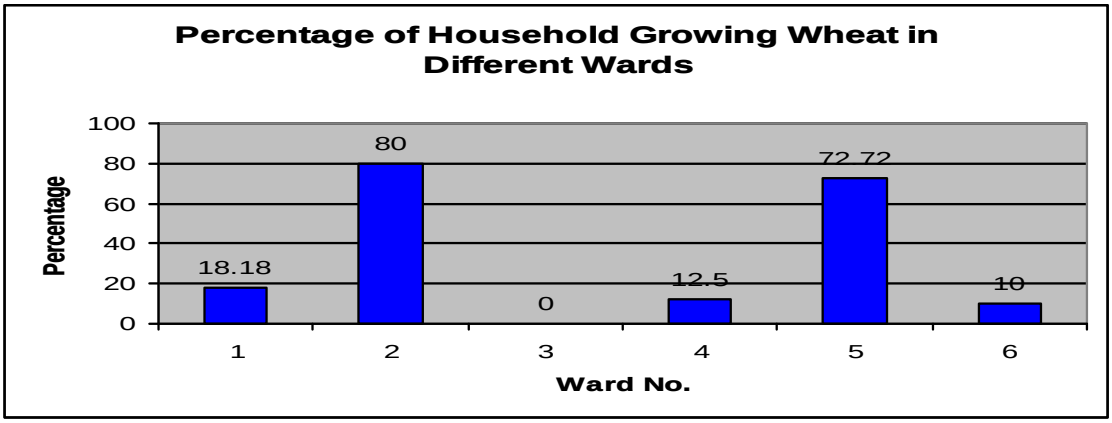

Fig. 10: Percentage of Household Growing Wheat in Different Wards

Paddy: The study revealed that only 11 households grow paddy out of 100 surveyed households i.e. 11% of households grow paddy. This was because of less area which is suitable for paddy cultivation. It was found that in Ward No. 1, 2, 3, there was no cultivation of paddy and the highest paddy area was found in Ward No. 5 (Fig. 11, Table 6.5).

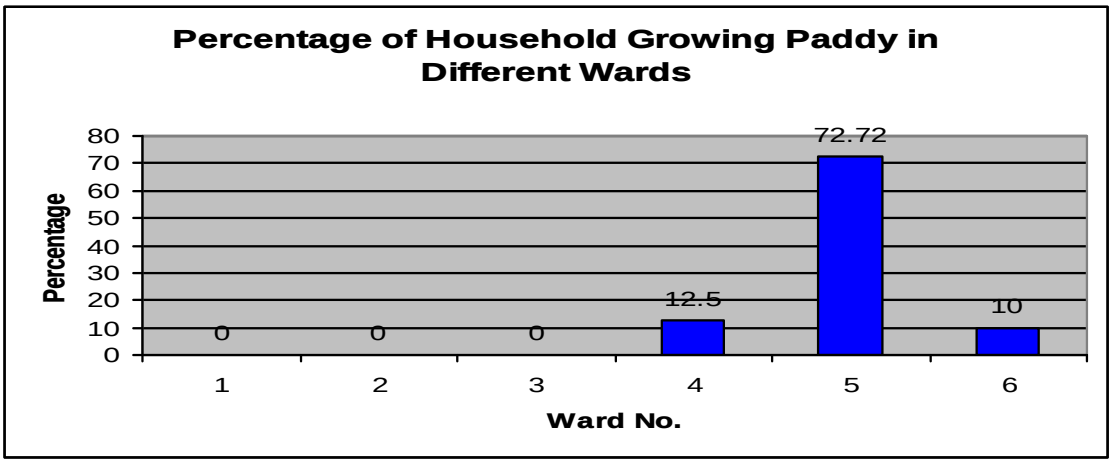

Fig. 11: Percentage of Household Growing Paddy in Different Wards

Other Crops: Although 68% of the households grow buckwheat, mustard, vegetables and potato etc, the area covered by these crops were very small (Table 6.6, Fig.12)

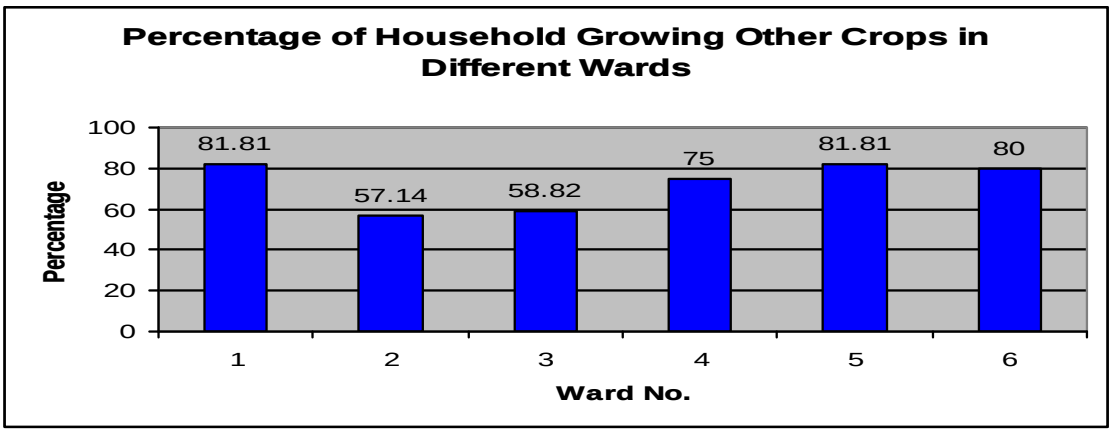

Fig. 12: Percentage of Household Growing Other Crops in Different Wards

4.3 Land Coverage by Major Crops

Maize and millet were the dominant crops grown in the study area followed by wheat and paddy. Besides these crops, potato, buckwheat, mustard, vegetables etc. were also cultivated in small amount. The total land coverage by major crops in the surveyed households is shown in figures 13, 14, 15 and 16 (Table 6.7, 6.8, 6.9 and 6.10).

Maize: The study showed that maize was grown in 42.71 hectares out of the total cultivated land 50.14 hectare. About 85% of the land was cultivated by maize (Table 6.7). It means that local people in the study area heavily depend on maize. Approximately 97% of the total cultivated land was occupied by maize in Ward No. 6 which was the largest area among the six wards and about 59.40 % of the total cultivated land was covered by maize in Ward No.5 which was the smallest (Fig.13).

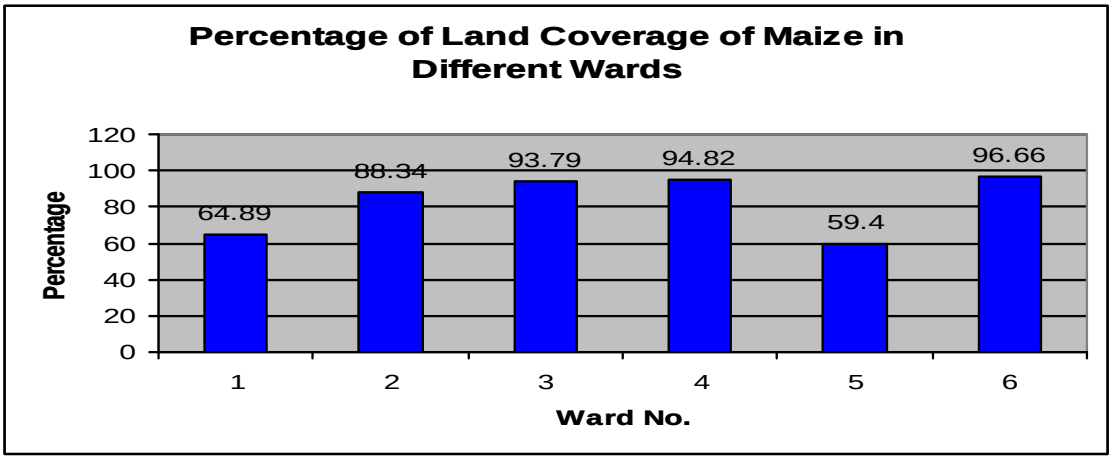

Fig. 13: Percentage of Land Coverage of Maize in Different Wards

Millet: From this study, it was found that millet was grown in 38.44 hectare out of the total cultivated land 50.14 hectare. Ward No. 6 had high percentage approximately 97% of millet land. In Ward No. 5, only 59.40% land was cultivated with millet (Fig.14, Table 6.8).

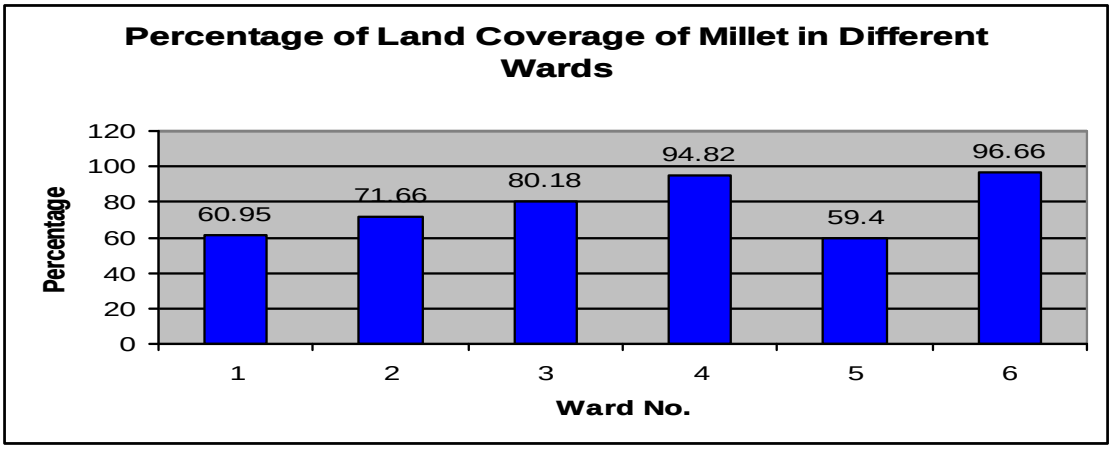

Fig. 14: Percentage of Land Coverage of Millet in Different Wards

Wheat: It was also found that only 13.15 hectare i.e. 26.23% of land was cultivated with wheat out of 50.14 hectares of total cultivated land. In Ward No. 3, there was no

cultivation of wheat at all. In Ward No. 1 and 2, there was high percentage of land cultivated with wheat (Fig.15, Table 6.9).

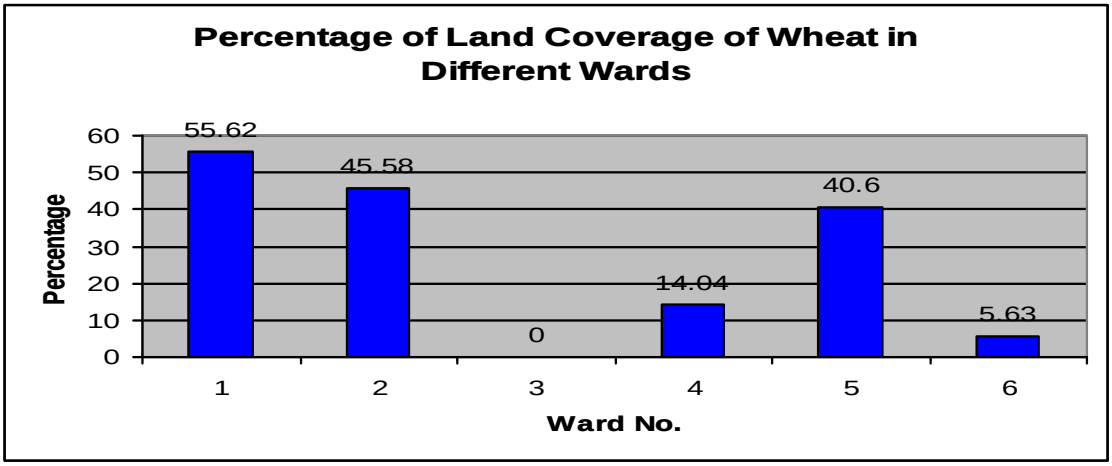

Fig. 15: Percentage of Land Coverage of Wheat in Different Wards

Paddy: This study indicated that only 3.88 hectares of land was cultivated with paddy. In Ward No. 1, 2 and 3, there was no paddy cultivation because the area was not suitable for paddy. The percentage of land cultivated with paddy was high in Ward No. 5 (Fig. 16, Table 6.10).

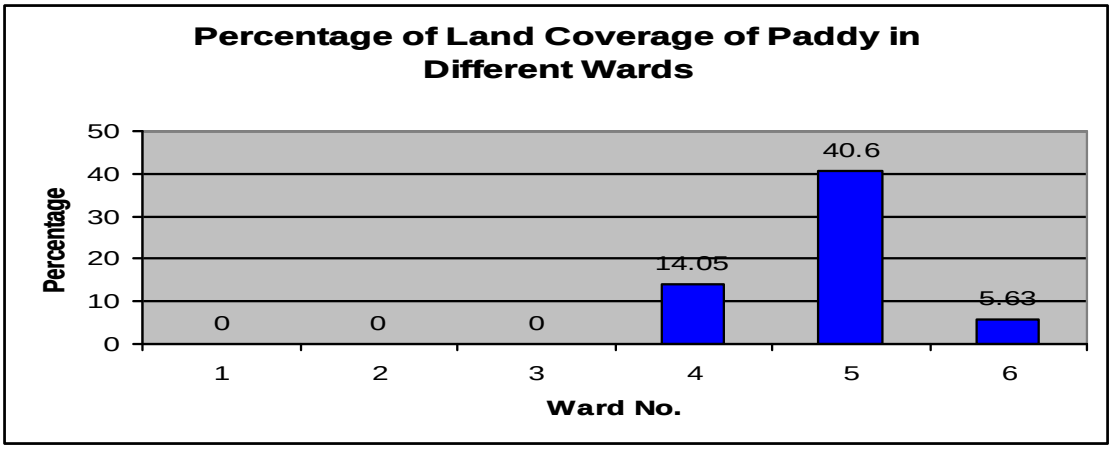

Fig. 16: Percentage of Land Coverage of Paddy in Different Wards

4.4 Types of Problem

Different types of problems were found in the study area. Crop damage, human harassment and livestock depredation were the problems faced by the local people living inside the national park. Among the surveyed households, 94.53% households reported that crop damage by the wild animals was the main problem. Only 16.52% households reported livestock depredation as the second problem caused by the wild

animals. The major livestock at risk includes goats, cattle and sometimes chickens. Human harassment was not the serious problem, only 6.15% reported about the human harassment by the wild animals (Fig. 17, Table 6.11).

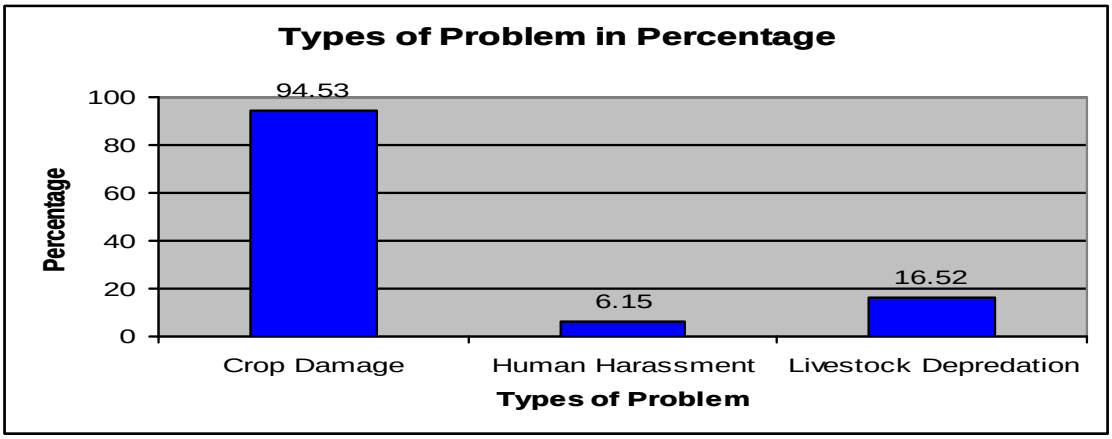

Fig. 17: Types of Problem in Percentage

4.5 Loss of Major Crops

Maize: As mentioned earlier, maize was the major crop in Sundarijal VDC covering 42.71 hectares of land. The expected production of maize was 2,428.47 quintals whereas the amount harvested by farmers was 1,702.41 quintals. There was an estimated loss of 726.06 quintals of maize in the surveyed households. Average loss per hectare was found to be 18.76 quintals. The study showed that 29.90% of the expected production of maize was lost. The loss percentage of maize was highest in Ward No. 6 (Fig. 18, Table 6.12). The loss might be due to depredation by wild animals, low irrigation facility, less fertilizer application and poor soil type.

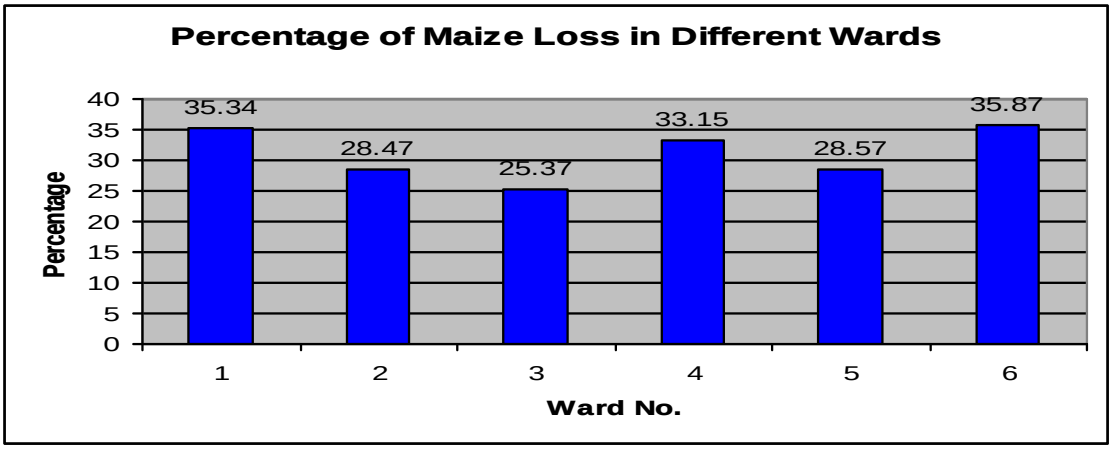

Fig. 18: Percentage of Maize Loss in Different Wards

Millet: Millet was grown in 38.44 hectares of total cultivated land of 50.14 hectare and the expected production of millet was 2,356.0 quintals whereas the actual production was only 1,684.4 quintals. The loss of millet was 671.6 quintals. Average loss of millet per hectare was found to be 17.92 quintals. This means that 28.51% of the expected production of millet was lost due to depredation. The loss percentage of millet was highest in Ward No. 6 and lowest in Ward No. 2 (Fig. 19, Table 6.13).

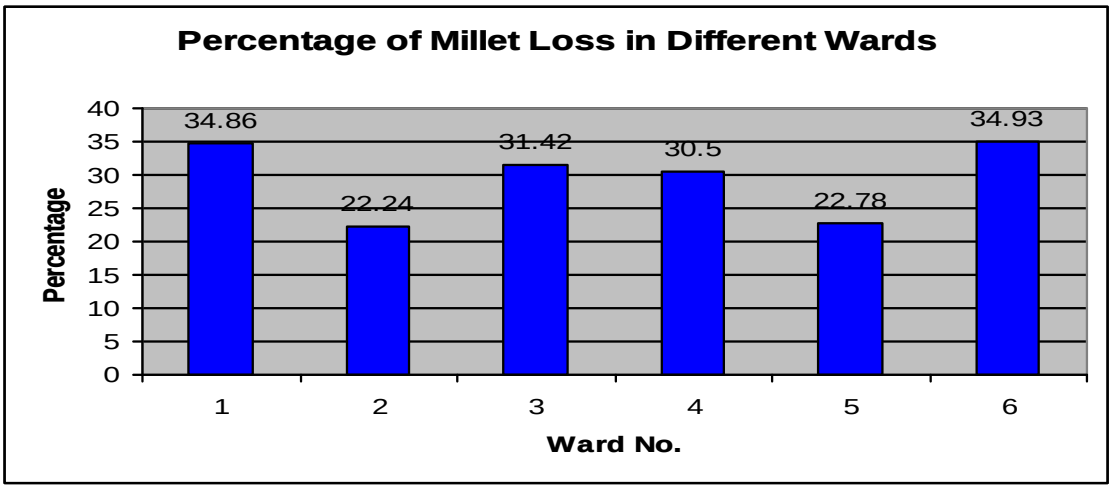

Fig. 19: Percentage of Millet Loss in Different Wards

Wheat: Wheat was grown in 13.15 hectares area. The expected production of wheat was 627.38 quintals but only 375.55 quintals of wheat was harvested in the surveyed households and 251.83 quintals were lost. Average loss per hectare was 19.15 quintals. This showed that 40.13% of the expected production of wheat was lost. The loss percentage (55.55%) of wheat was highest in Ward No. 6 and there was no loss in Ward No. 3 since there was no cultivation of wheat (Fig. 20, Table 6.14).

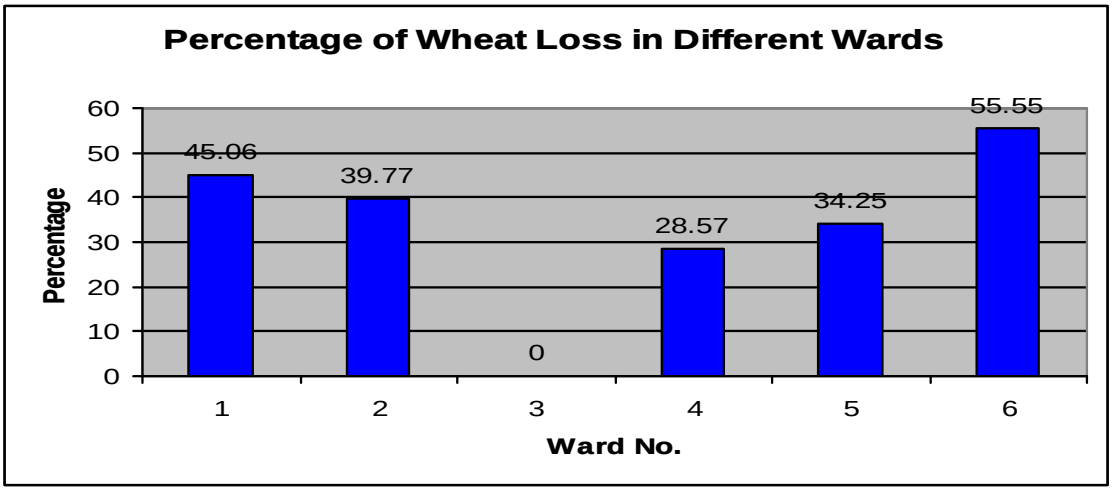

Fig. 20: Percentage of Wheat Loss in Different Wards

Paddy: Paddy was grown only in 3.88 hectares land. The expected production of paddy was 171.25 quintals but only 120 quintals was produced and the loss was 51.25 quintals. Average loss per hectare was 13.21 quintals. This means that 29.92% of the expected production of paddy was lost. The loss percentage (40.0%) of paddy was also highest in Ward No. 6 (Fig. 21, Table 6.15)

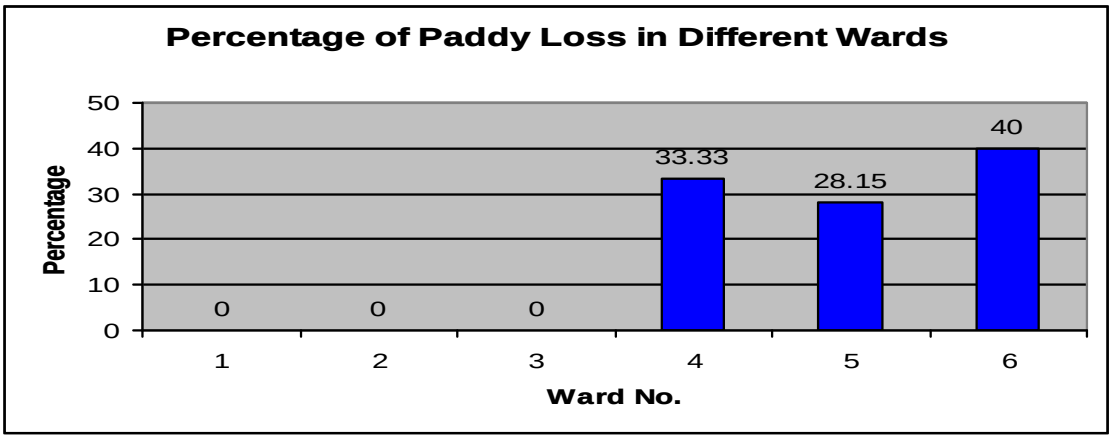

Fig. 21: Percentage of Paddy Loss in Different Wards

4.6 Loss of Crops by Different Animals

Wild boar, monkey and porcupines were found to be the common wild animals that usually raid on crops. The most destructive wild animal damaging the crops was the wild boar. Other wild animals including rat, bear, deer, rabbit etc. also damaged the crops. The study showed that 88.95% of the household reported wild boar as the main crop raider followed by monkey (74.82%). 44.48% of the households said that porcupines also damaged the crops (Fig.22, Table 6.16).

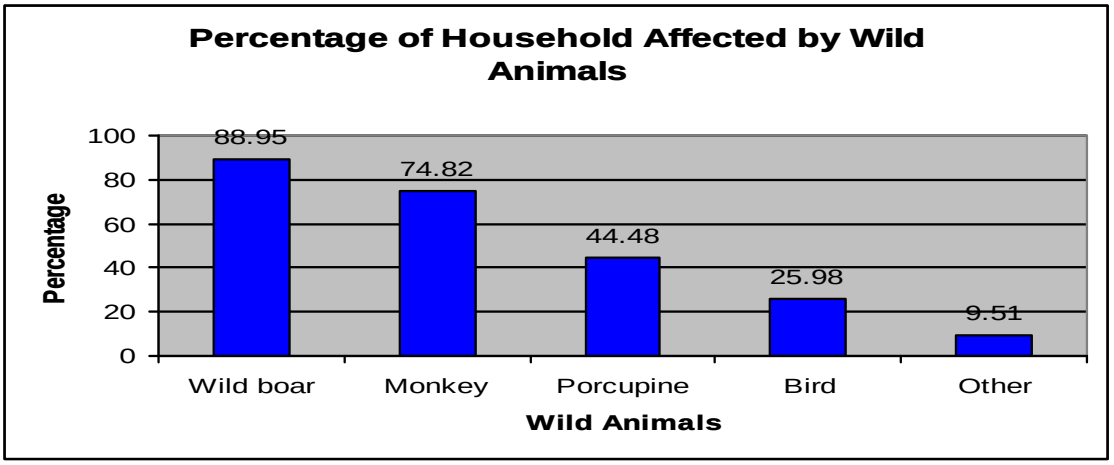

Fig. 22: Percentage of Household Affected by Wild Animals

4.7 Wild Animals Damaging Crops

Maize: In the 100 surveyed households, 79 households reported that the wild boar as a serious maize raider animal. 68 households told that the monkey also heavily damages the maize. It was also found that porcupines, birds and other animals including rat, rabbit and bear also damage maize (Fig. 23, Table 6.17).

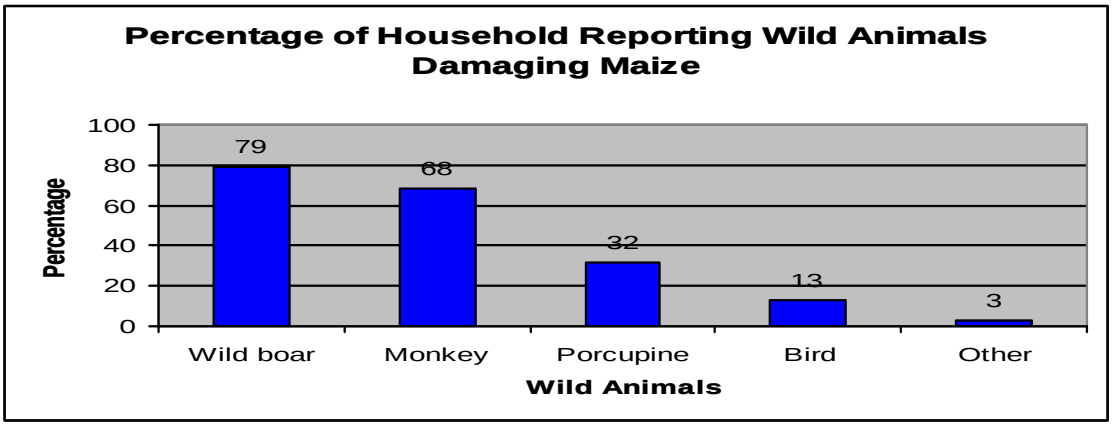

Fig. 23: Percentage of Household Reporting Wild Animals Damaging Maize

Millet: In the 100 surveyed households, 62 households told that wild boar damages the millet. 53% of households told that the monkeys are also serious millet raider. 22% of households reported that the porcupines damage millet. 11% of household told bird also damages the millet and 6% reported other animals also damage the millet (Fig. 24, Table 6.18).

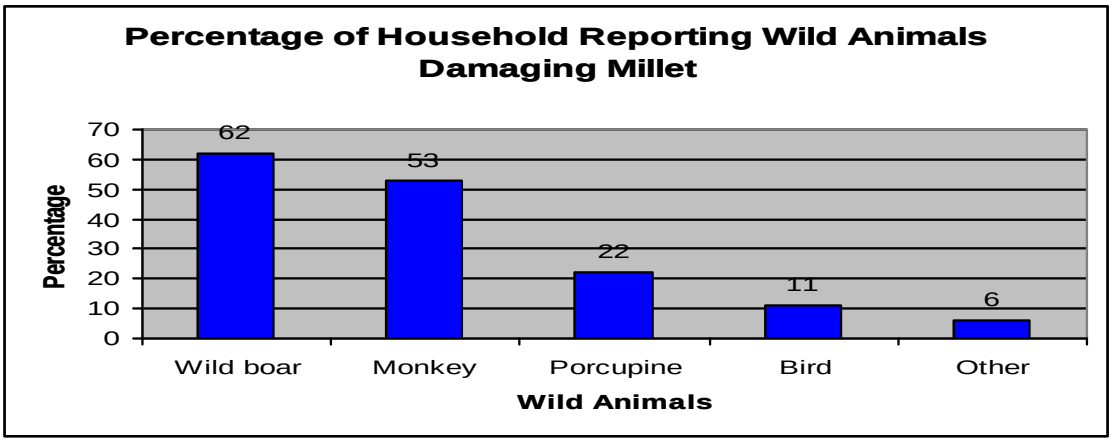

Fig. 24: Percentage of Household Reporting Wild Animals Damaging Millet

Wheat: In 100 surveyed households, 41 households had grown wheat in their field. It was found that 58.54% of households said that wild boar damages the wheat mostly. 48.78% of household told that monkey also damage the wheat. Wild boar and monkey

damage the wheat at the milky stage. 17% of households told that porcupines damage the wheat and 14.64% of households told bird and other animals also damage the wheat (Fig. 25, Table 6.19).

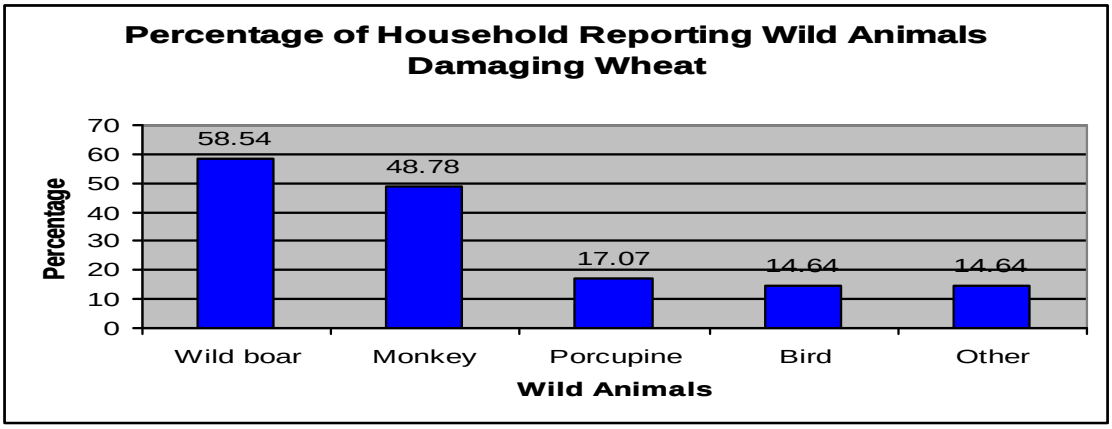

Fig. 25: Percentage of Household Reporting Wild Animals Damaging Wheat

Paddy: In 100 households surveyed, only 11 households had grown paddy in their field and it was found that 63.64% of households reported monkey damages the paddy most. 54.55% of households reported that wild boar and bird damage the paddy. 27.27% of households said porcupines damage the paddy and only 9.09% of household told other animals also damage the paddy (Fig. 26, Table 6.20).

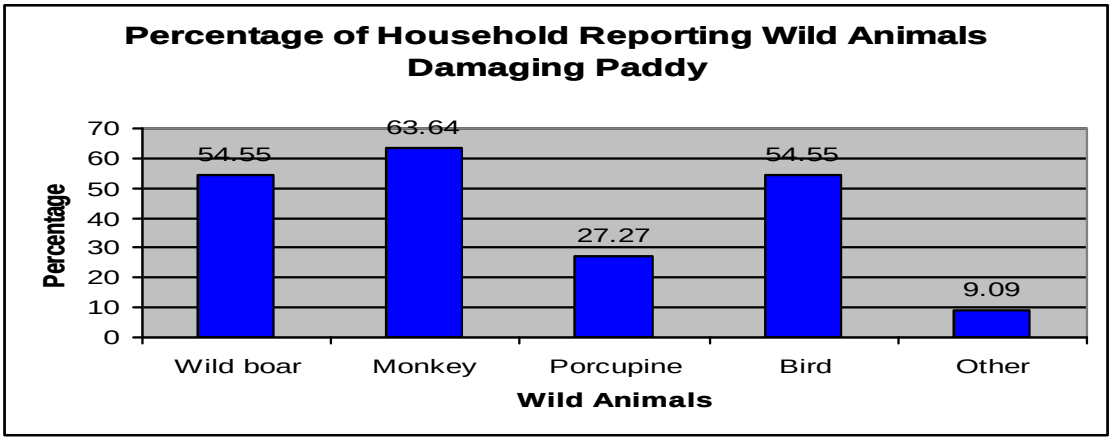

Fig. 26: Percentage of Household Reporting Wild Animals Damaging Paddy

4.8 Stages of Crop Damage by Wild animals

Loss of crops due to wild animals varied in different stages of crops. Maize was found to be damaged by wild boar and monkey from milky grain stage to maturity stage. The milky grain stage was preferred the most. Wheat was destroyed in milky stage

and maturity stage and sometimes milky shoot was preferred by wild boar. Millet was found to be damaged from young to maturity stage and paddy was damaged from milky stage to matured stage.

Table 6: Stages of Crop Damage

S.N.	Name of Wild animals	Crops	Stage of Crop Raiding
1	Wild boar Monkey Porcupines Birds	Maize	Milky to maturity stage Milky to ripen stage Milky to maturity stage Seedlings
2	Wild boar Monkey Porcupines Birds	Millet	Young to maturity stage Milky stage Young shoot Maturity stage
3	Wild boar Monkey Porcupines Birds	Wheat	Young to maturity stage Maturity stage Young to maturity stage Seedlings
4	Wild boar Monkey Porcupines Birds	Paddy	Young to maturity stage Maturity stage Young to maturity stage Maturity stage

4.9 Techniques of Crop Protection

Wild animals damage the crops every year. The problem created by the wild animal has become severe day by day. To reduce the crop damage by the wild animals, the local people of the every ward have adopted some preventive measures i.e. more than 70% of the households in every ward have adopted the preventive measures (Table 6.21, Fig. 27). In the surveyed households, only some households had not used the preventive techniques. Though the people of every ward had tried the preventive method, it did not seem to be effective in controlling the loss as it was labour intensive and primitive (Table 6.22). These preventive methods were less effective since the people chase the wild animals when they saw them in their field. Wild boar was the most destructive since it is nocturnal animal and damages the crops at night as

the farmers cannot wake up whole night. The preventive methods include spending night on machan, shouting and clapping in day time, making noise by beating empty tin. In the study, it was found that 89% of the households use shouting and clapping method during day time, 64% of households making noise by beating empty tin. 23 households had also kept dogs in their field for watching and chasing the wild animals away from their field (Fig. 28). Scare crew was also used to chase the wild animals.

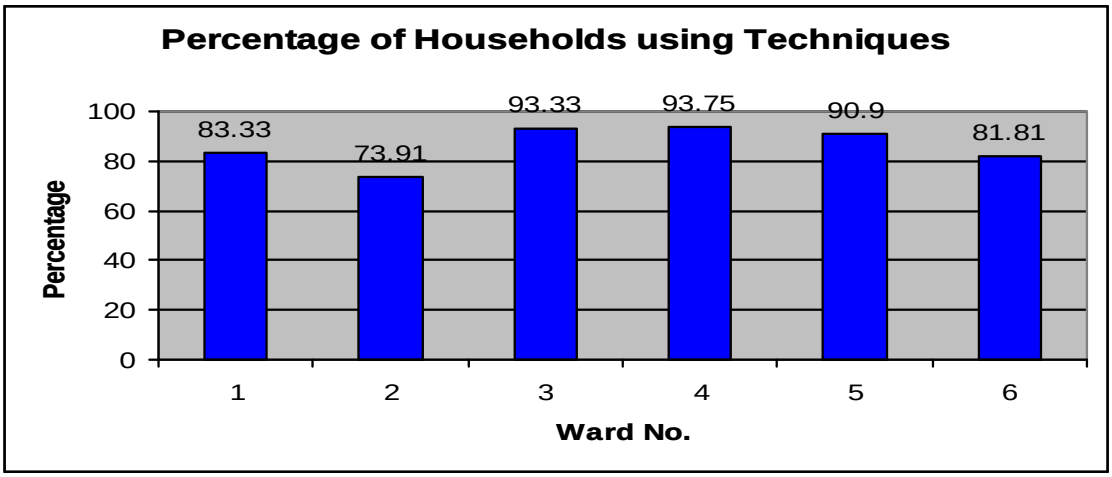

Fig. 27: Percentage of Household Using Techniques

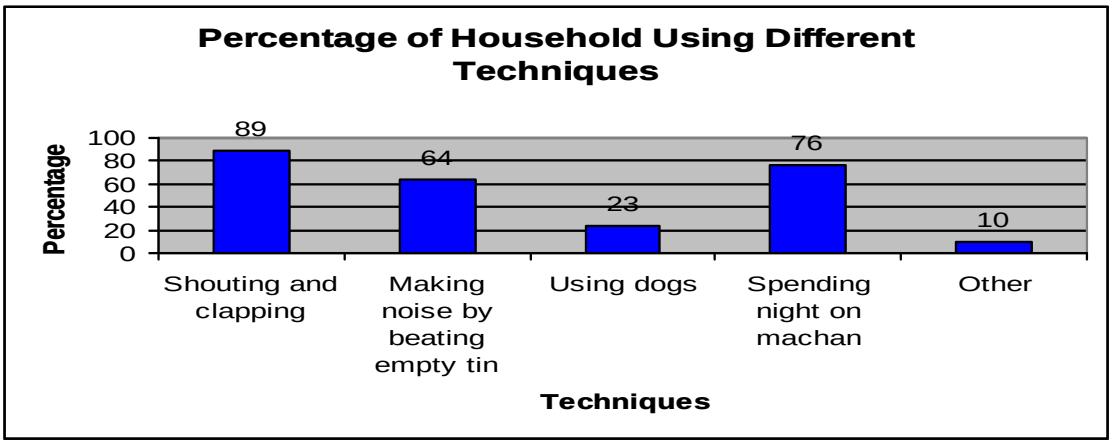

Fig. 28: Percentage of Household Using Different Techniques

4.10 Livestock Reared

Livestock rearing is another major activity next to crop production and is taken as a supplementary income source of the households. Livestock play a significant role in household's income and food supply, as it provides valuable food and have selling values of animal products such as milk, meat, egg etc. in the market. It was found that

all households have their own livestock. The number of goat was high in the study area. The number of goat was 561 i.e. 65.84% of the total livestock. Cow constituted the smallest number only 25 i.e. 2.93% of the total livestock. Similarly ox constituted 4.46%, buffalo constituted 16.31% and others constitute 10.44% of the total livestock. Others include pig, chicken, duck etc. (Table 6.23). In Ward No. 2, there was the highest number of livestock and in Ward No. 4, it was the lowest (Table 6.24).

4.11 Livestock Loss

From the study, it was found that Ward No. 1 was the most affected area by the wild animals. 33.33% of the household reported that they had lost their livestock to predators from the national park. Ward No. 2 was the least affected area where only 9.09% of the households reported the loss of livestock. The local people reported that mostly goats were killed by leopard (Table 6.25). Livestock were killed in jungle while grazing but sometime they were lost from the house.

4.12 Wildlife Attack on Human

There was no record of people killed by wildlife in the study area but the wildlife, mainly monkey, sometimes teased the local people inside the national park.

4.13 Fuel Wood and Fodder Collection

The study showed that all the local people were dependent on national park for fire wood and fodder. Agricultural residues fulfill only the little percentage of total fire wood and fodder requirements. Due to the lack of community forest and private forest in the study area, local people were compelled to enter the national park for the collection of firewood and fodder which is illegal according to the rules of Protected Areas. According to the park staff, the local people lop off green branches of the trees, bushes and grass for fodder, the most serious problem causing the conflict. Along with the fodder, firewood was also collected by the people. Not only fodder and firewood but also timber poaching was serious problem.

4.14 Livestock Grazing

Livestock grazing was also one of the sources of conflict between the park and local people because local people leave their livestock inside the national park for free grazing. The livestock number was high in the study area and the livestock grazing inside the park may have adverse consequences to wildlife because they may transmit different diseases to wildlife and reduce available food supply for wildlife.

4.15 Hunting

According to the park staff, in the earlier days the local people used to hunt wild boar but now days, wild boars as well as other wild animals were not hunted. The park has no data of the wild animals hunted by the local people.

4.16 People's Perception

Local people reported that there is no difference in the management after it has been converted into national park. The revenue collected has not been used for the betterment of the local people. The park collects money as entry fee, camping fee, vehicle fee, penalties, tender form and filming etc. In the fiscal year 060/061, NRs. 233,7615 revenue was collected by the ShNP (Annual Report, 2005) and the money collected was not used for the betterment of the local people. The local people reported either they should be shifted to other place or they should be compensated or they should be allowed to enter the forest for fodder, firewood, timber and NTFPs collection to minimize the conflict between the national park and local people (Fig. 29, Table 6.26).

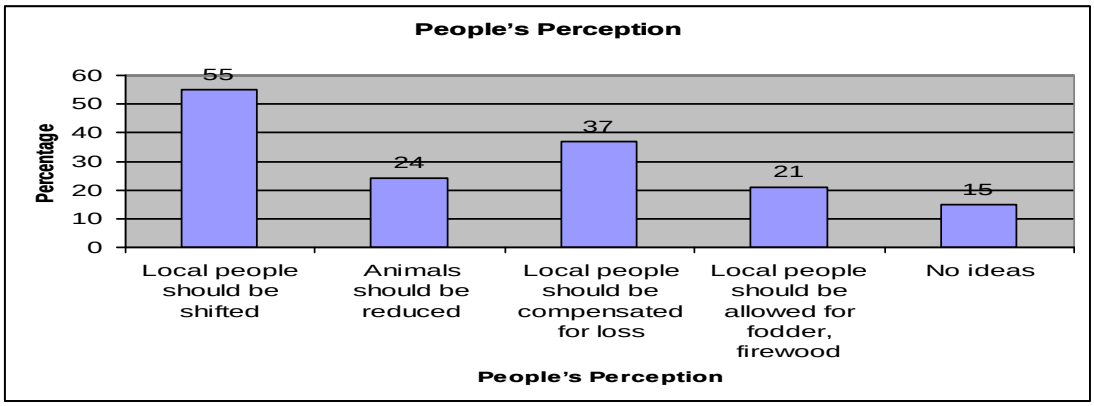

Fig. 29: People's Perception

5. DISCUSSION

This study was conducted in six wards of Sundarijal VDC of ShNP, one of the national parks, which is only 13 km from the core city of Kathmandu. Crop damage, livestock depredation and human harassment by the wildlife and the illegal activities such as hunting, fodder and firewood collection by the local people are the main issues leading to the conflict. The aim of this study was to assess the quantity of crop loss by the wild animals, to know about the most destructive wild animal and to know the consequence of park - people conflict.

Simple random sampling method was applied for the study. The total number of surveyed households was 100. Total cultivated land and average land holding per household were 50.14 hectares and 0.53 hectares respectively.

Poudyal (1995) calculated 122.39 hectares of the total cultivated land and the average land holding per household of 0.51 hectares in Sundarijal VDC of ShNP. Paneru (2004) calculated 32.2 hectares, 29.631 hectares and 27.693 hactares of the total cultivated land and the average land holding per household was 0.383 hectares, 0.395 hectares and 0.396 hactares in Jitpurphedi, Baluwa and Chapalibhadrakali VDCs respectively of ShNP.

The study showed that the total cultivated land has decreased by 72.25 hectares as compared to 1995. It may be due to the abandonment of arable land because of the heavy damage caused by wild animals. Other reasons like shortage of irrigation facility, soil quality degradation, lack of agricultural inputs etc. also play important role in the decrease of the cultivated land. According to GIS database of Protected Areas Nepal (1998), about 65% of the households in the buffer zone suffer from crop raiding and 25% of households have stopped farming.

Maize and millet were the major crops of the study area. All the households grow maize and millet. Wheat, paddy and other crops such as potato, buckwheat, mustard, vegetables etc. were also grown in the study area. Poudyal (1995) reported that cereal crops such as maize, millet, wheat, paddy and other crops such as potato, buckwheat, mustard, vegetables were grown in Sundarijaj VDC of ShNP. People had not changed the cropping pattern for many years. Maize was grown in 42.71 ha, millet in 38.44 ha, wheat in 13.15 ha and paddy in 3.88 ha of land.

Poudyal (1995) also reported 100.58 ha, 103.04 ha, 82.4 ha and 22.48 ha of land was covered by maize, millet, wheat and paddy respectively. Paneru (2004) found that the percentage of paddy and wheat grown land was high in Baluwa VDC i.e. 67.07% and 67.07% respectively and maize and millet grown land was high in Chapalibhadrakali VDC i.e. 37.46% and 31.22% respectively. There was also decrease in the land cultivated with maize, millet, wheat and paddy because there was decrease in the total cultivated land. People had left the land uncultivated as the wildlife of the park had created the problem (Plate 5).

This study showed that the loss of major crops by wild animals was 1700.74 quintals. The percentage of wheat loss was the highest among the crops i.e. 40.13% of the expected production, maize loss was 29.90% of the expected production, millet loss was 28.51% of the expected production and paddy loss was 29.92% of the expected production.

Poudyal (1995) showed that the loss of wheat was 30.47% of the expected production, maize was 35.12% of the expected production, millet was 47.35% of the expected production and paddy was 2.1% of the expected production in Sundarijal VDC of ShNP. Soti (1995) calculated the percentage of millet loss was higher than other crops like maize, wheat and paddy in ShNP. Paneru (2004) calculated the percentage of maize loss was the highest in the three adjoining VDCs of ShNP.

Shrestha (1994) found that the most affected crops were paddy (32%) and maize (60%) in the adjoining settlement area of RCNP. Kafle (1998) reported 91% of respondent claimed that pulses were totally destroyed by the blackbucks in Khairpur village of Bardia. Baral (1999) reported that paddy was heavily damaged by wild animals followed by potato, maize and wheat. He found 52.73% of loss occurred in Thakurdwara and 47.27% in Shivapur of RBNP. Highest economic loss (28.32%) occurred to paddy crop, followed by potato (15.40%), maize (15.21%), wheat (13.80%), mussuro (12.42%) and yam (7.57%).The percent of potential crop yield damaged ranged from 9.59% to 16.88%. He reported the loss of crop due to wild boar ranged from 166.39 kg to 205.51 kg per household.

Shrestha (1994) showed the economic loss in crop damage amounted NRs. 26,396 in the year 2048-2049. Bodreni was found to be the most affected area i.e. 28.8% loss in its total production. The most affected crops were rice (32%) and maize (60%).

Gautam (1999) found that the highest economic loss was 74.28% to paddy followed by wheat (17.08%) and maize (8.62%) in RSWR. He reported that loss of crop due to wild animals ranged from 61.62 kg to 126.33 kg per household. Shrestha (2005) also showed that carnivore (40.9%) was dominant followed by artiodactyla (13.6%), primates (9%), lagomorpha (9%), pholidotal (4.5%) and insectivore (4.5%) in ShNP. The most abundant mammal was wild boar, followed by barking deer, common leopard, and jungle cat. He also reported that rhesus monkey were common in the eastern sector of the park. The percentage of wheat loss was found to be high with respect of the expected production. It may be due to the increasing number of wild animals especially monkey and wild boar. It may be also due to the high expectation of the production.

In the study, it was also found that in the past, the local people used to report about the crop damage to the park headquarter but they were not compensated and nowadays they had left to report about the crop loss. The national park is governed by Ministry of Forest, HMG and buffer zone has not been declared as it is gazetted only in 2002. Since ShNP has no buffer zone area and the study area lie within the national park, there is no provision of compensation and the local people have no rights to claim compensation for the damage to their crops by wildlife (Joshi, 2002). Increasing number of wild animals, insufficient food, habitat destruction etc. cause the wild animals to move outside the protected areas and cause crop damage (Plate 3 and 4). Buffer Zone concept was initiated to reduce the crop damage by wild animals and the movement of wild animals to the community and this buffer zone concept was applied first in RCNP and RBNP in 1996.

To minimize the problem, Park People Programme (PPP) had made API; trenching, fencing and bio-fencing (Rayamajhi, 2000 and Joshi, 2002). API had substantially reduced crop damage up to 70% in Jagatpur RCNP (Rayamajhi, 2000). Trenching implemented in RSWR was found not much effective for the crop raider wild boar, elephant, blue bull, chital etc. (Joshi, 2002). Multiple use forestry management practices in RCNP had also helped to return wild animals; rhinoceros, tiger and elephants to Baghmara community forest, once it was turned over to local communities (Khanal and Sigdel, 2004).

The study also showed that the wild boar was the most destructive wild animals and monkey was found to be the second crop raiding animals. Other animals like porcupines, birds, bears, rats etc. also damage the crops but in small quantity. 88.95% of households said that the wild boar as the main crop raider and monkey (74.82%) was reported as the second crop raider.

Soti (1995), Poudyal (1995) and Paneru (2004) found wild boar as the most notorious and destructive animal among the animals in ShNP. Paneru (2004) also found the attacking frequency was also highest to the crops than other wild animals (monkey, porcupines, birds etc.) in ShNP. Jnawali (1989) and Shrestha (1994) reported rhino as number one crop raider in RCNP.

Gautam (1999) found elephant as the main crop raider followed by wild boar in RSWR and reported the highest economic loss 43.29% was caused by wild elephant followed by wild boar (28.67%), chital (24.09%) and blue bull (3.92%). Kattel (1993) found that maize was the most affected crop by wild boar. Birds, monkeys and porcupines were also important pests to crops.

Khatri (1993) found nilgai as main crop raider in RBNP and found that 8.3% of the total crop loss was caused by wild animals in RBNP. Sharma (1995) reported wild buffalo and wild boar as main crop raiders in KTWR. Baral (1999) found wild elephant, wild boar and chital as the major wild pest in Thakurdwara and Shivapuri of RBNP. Rai (1999) observed wild buffalo and wild boar as the most destructive to crops in Kusaha VDC of KTWR and reported 26.30% of paddy loss due to wild buffalo, 52.73% of wheat loss due to wild buffalo and wild boar, and 28.05% of potato loss due to wild boar.

Poudel (2001) reported that Himalayan tahr and pheasants raid potato and other hardy crops in the mountains while rhinoceros, wild elephant, chital and wild boar frequently damage the crops close to the park. The wild boar and monkey were found to be the most destructive wild animals, it may be due to the increasing numbers and there is no any research about the carrying capacity of wild animals in ShNP and the wild boar being notorious animal.

The study also showed that the maize, millet, wheat and paddy all were affected by the wild animals like wild boar, monkey, porcupines, birds and other animals.

Kattel (1993) also identified wild boar, monkey, porcupines and birds as the crop raiders in SWWR. Poudyal (1995), Soti (1995) and Paneru (2004) also found wild boar, monkey, porcupines, birds and other animals as the crop damaging animals. Prasai (1989) found rhinoceros, tiger, leopard, bear, jackal, and fox as the crop damaging animals in RCNP.

Kasu (1996) reported that deer as the wheat raider and he found that wheat and maize was not destroyed by elephant in PWR. Dahal (2006) found muntjac and rhesus monkey as the crop damaging animals in KCA. There was no change in the crop damaging wild animals, it may be due the forest type, climatic condition favouring in the survival of the wild animals etc.

Loss of crops due to wild animals varied in different stages of crops and it depends on the availability of palatable food in adjoining areas. Different animals preferred different stages of same crop. Wild boar preferred the crop mostly at milky stage while monkey and porcupine preferred the crop at the milky grain stage. Birds damage the crops at seedling stage and at the ripening time. According to Soti (1995), Poudyal (1995), Gurung (2002) and Paneru (2004), wild boar raid wheat at milky stage, but monkey prefer often earlier than that and porcupines are however not interested in wheat in ShNP. In the study, porcupines were also found damaging the crops. It may be due to the shortage of the crops.

According to NPWC Act Section 5, the activities like fuel wood, timber, fodder and NTFPs collection, poaching, animal grazing etc. are not allowed inside the park. Though these activities are prohibited, most of the people inside the park have to rely upon the resources. In the study, it was observed that local people collecting firewood, fodder and timber from the forest and taking their livestock for free grazing inside the national park. Though there is no solid data about these illegal activities, almost all people in the study area had reared livestock and were dependent on the park resources. It may be due to poverty, lack of alternatives, less knowledge about the conservation.

Sharma and Shaw (1993) reported that 45% of the respondents had acquired firewood illegally from RCNP. Joshi (2002) reported that 92% of the households used firewood as the source of energy and most of the firewood was collected illegally from the

RSWR. Bhatta (1994) showed poor people generally prefer to collect firewood rather than buying from the market. The park can charge for the illegal activities.

Kasu (1996) showed that PWR had collected NRs. 17,810 in three years from fiscal year 1992/93 -1994/95 from fines of illegal activities. ShNP has collected NRs. 78,155 as penalties in the fiscal year 2060/061 (Annual Report, 2003 -2004) and in the fiscal year 2061/062, NRs. 62,842 was collected as penalties (Park Headquarter).

The animal grazing, firewood, timber and fodder collection activities can be minimized by alternative natural resource creation and use activities as it enables the communities to be self – reliant in fuel, fodder and timber resources and reduces dependency on the park resources. Rayamajhi (2000) reported that plantation activities have substantially reduced the pressure on forest resources. Rayamajhi (2000) and Bajimaya (2004) reported that Biogas installation and Improved Cooking Stoves (ICS) had reduced consumption of fuel wood considerably.

Ali and Butz. (2005) described that to protect the habitat of the endangered Macro Polo sheep (*Ovis ammom polii*) Shimshal Nature Trust was emerged with Khunjerab National Park in 1975 as a result economics associated with traditional grazing became illegal. Several affected communities outside Shimshal agreed to such restriction and were compensated for the loss of their access to pastures. Joshi (2002) reported that PPP/RSWR had provided few fodder tree seedlings and livestock management training only to few people which seemed to be not much effective.

The study also showed that there was no record of attack of wild animals on the local people but wild animals sometimes killed the livestock in the study area. It was found that goat was usually killed by the wild animals since the number was high in the study area.

Tamang (2000) found that the highest loss among the different animals was the cattle (cow and ox) that comprised 196 heads (44.34%) followed by goat (19%), buffalo (11.99%), calf (8.59%) and sheep (2.48%). Tiger was the major predator and the highest loss was in hot dry season (201 heads) followed by monsoon (124 heads) and cool dry (117 heads). The highest number of loss was reported to be from the cattle shed. A total of 157 (35.52%) animals were killed in the shed followed by 149 (33.71%) animals killed inside the park and 136 (30.76%) animals killed outside the

park for the year 1993-1998. The total economic loss was found to be NRs. 772,590. Prasai (1989) found that tiger constituted 50% attack on human beings, followed by rhino 30%, leopard, bear, and jackal 20% attack respectively in RCNP. Padampur panchayat comprised 37.25% losses which were the highest and Ratnanagar panchayat comprised 11.50% losses which was the lowest. The Bachhauli and Kumroj comprised 26.66% and 24.58% losses respectively. The monetary loss of domestic animal by wildlife was NRs. 429,350.

Local people had adopted different kinds of preventive measures. Among the techniques used, the mostly used was making chhapro in the field and guarding the crops by shouting and clapping and chasing the wild animals. Making noise by beating empty tin for chasing wild animals was also used by the local people. Some households had also kept dogs in their field for watching the crops and chasing the wild animals away from their field (Plate 5). 89% of the households were found using the shouting and clapping method for preventing the damage caused the wild animals which was the highest.

Poudyal (1995) found 81.81% of household using the method noise making by beating empty canister. Kasu (1996) reported that machan as the most common method used and flame and drum beating method, most effective for elephant and parakeet in PWR. Paneru (2004) reported that highest percentage 45.85% of household using the techniques i.e. overnight guarding in the field which was labour intensive and primitive.

Namgay (2005) reported that Bhutan Biological Conservation Complex (B_2C_2) strategy is being implemented in Bhutan to reduce the conflict between human and nature. B_2C_2 strategy is a partnership for governance where local governments, development agencies, industries and local communities work together for conservation. In Nepal, the DNPWC has been developing innovative park management strategies in collaboration with local residents, Non Government Organisations, International Non Government Organisations and donars. Major programmes include the Makalu – Barun National Park and Buffer Zone, the Terai Arc Landscape Project, the Norhtern Mountain Conservation Project, the World Wide Fund for Nature's Kanchenjunga Conservation Area Project, CARE International's Buffer Zone Development etc. The Buffer Zone Management Regulations, 1996 and

Buffer Zone Management Guidelines, 1999 were approved to design programmes compatible with national park management and to facilitate public participation in the conservation, design and management of buffer zones. The amended NPWC Act makes provision for 30% - 50% of the park revenues to be retained for community development activities in the buffer zone. The Buffer Zone Management Regulations are the only regulations to promote community forestry programmes in the buffer zone and to improve the regeneration of forests by the community.

According to ShNP Management Plan, ShNP will be brought under the National Trust for Nature Conservation's general administration policy. Park management programmes include i) hatbitat conservation such as grassland, forest and aquatic habitats ii) species conservation iii) preservation of culture and tradition iv) capacity building and conservation education v) promotion of tourism etc.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This study was conducted in the six wards of the Sundarijal VDC within the boundary wall of ShNP. The local people of these wards are mostly engaged in agriculture and livestock farming.

In the study, crop damage was found to be the serious problem and the total crop damage by the wild animals was found to be 1700.74 quintals. Mainly the percentage of wheat loss with respect to expected production (40.13%) was the highest among the crops and the percentage of maize, millet and paddy loss with respect to the expected production was found to be 29.90%, 28.51% and 29.92% respectively. The loss of maize, millet, wheat and paddy was found to be 726.06 quintals, 671.6 quintals, 251.825 quintals and 51.25 quintals respectively. The cultivated land has decreased as compared to 1995 since the local people had left the land uncultivated due to the damage caused by wild animals.

Wild boar was found to be the most destructive animals that damage crops mostly in night whereas monkey, porcupines, birds and other animals damage crops mostly in morning and day time. Wild animals damage the crop at different stages; heavily from milky stage to ripening stage. Local preventive method adopted for the protection `of the crop was little effective since the method was labour intensive and primitive.

The study also showed that 20.895% of households had reported livestock loss due to the wild animals. Livestock grazing, collection of firewood and fodder by the local people from the national park was also leading cause of conflict.

6.2 Recommendations

Following recommendations are proposed to resolve the conflict:

1. Local people should be compensated directly in cash for their loss.
2. Employment activities like Off- farm Employment Opportunities should be given to the villagers to combat the economic loss due to depredation.

3. Local people should be encouraged to grow the crops less preferable to the wild animals which could reduce the loss due to wild animals.

4. Increasing number of wild boar should be maintained within the certain level by species population management program.

5. Local people's participation should be given due importance in park planning and management activities.

6. Conservation education for the villagers should be given from time to time so that they could know the importance of national park.

7. The national park should be advertised among the tourists.

8. Part of the revenue collected by the national park should be utilized for the betterment of the local people.

9. Local people should be shifted from the national park to another place for the sustainable biodiversity conservation.

10. Planning, Monitoring and Evaluation activities in the park should be done at regular intervals. Traditional resource management systems, such as community controlled grazing and forest guardianship should be strengthened and low-level technologies should be introduced where appropriate.

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ANNEX-1

Questionnaire for the Local Villagers

Village:

Ward No.:

House Owner's Name:

Age:

1. How much land do you have?

a. ….. Ropani b. …... Ana

2. How much is khet and how much is bari?

Khet	a. …….Ropani	b. …… Ana
Bari	a. ……. Ropani	b. …… Ana

3. What kind of crops do you grow in your field?

Maize/ Wheat/ Rice/ Millet/ Others

4. Which crops do you grow in how much land?

a. Paddy	……. Ropani	……. Ana
b. Maize	……. Ropani	……. Ana
c. Millet	……. Ropani	……. Ana
d. Wheat	……. Ropani	……. Ana
e. Others	……. Ropani	……. Ana

5. What is their average yield?

(Pathi/ Ropani)

a. Paddy

b. Maize

c. Millet

d. Wheat

e. Others

6. Do you have any problem from park animals?

a. Yes ….. b. No …….

7. If yes, which are the main wild animals?

Wild boar/ Monkey/ Porcupines/ Birds/ Others

8. What kind of problems do the wild animals create?

a. Crop damage

b. Human Harassment

c. Livestock Depredation

d. Others

9. How much damages do the animals do?

Kg/ Ropani

a. Paddy

b. Maize

c. Millet

d. Wheat

e. Others

10. Which animal damages the most and in which crop?

Wild boar/ Monkey/ Porcupines/ Birds/ Others

a. Paddy

b. Maize

c. Millet

d. Wheat

e. Others

11. When do they damage most?

Wild boar/ Monkey/ Porcupines/ Birds/ Others

a. Young plants (just two leafed)

b. Matured plants (green crops)

c. Plants beginning to produce seed

d. Ripening time (Ready to harvest)

12. Do you apply any technique to protect the crops from damage?

a. Yes …… b. No ……..

13. If yes, which techniques do you apply?

a. Shouting and clapping

b. Making noise by beating empty tin

c. Spending night on machan

d. Using dog

e. Other

14. How much they are effective?

a. Very effective b. Little effective c. Ineffective

15. Is there any attack from the park animal to the people?

a. Yes …… b. No ……

16. If yes, which animal attack the people?

……

17. Do you receive any help or medical facilities from the park authorities when injured by the park animal?

a. Yes ……. b. No ……..

18. Do you have cattle?

a. Yes …….. b. No ……

19. What types of cattle do you have?

a. Cow b. Ox c. Buffalo d. Goat e. Others

20. Do the park animals attack your cattle?

a. Yes …….. b. No …….

21. Which animal mostly attack your cattle and the number of the cattle killed?

…….

22. Does the park give the compensation to your loss?

a. Yes ……. b. No …….

23 If yes, what kind of compensation do they give?

24. Do you have access to use forest products?

a. Yes …….. b. No ……

25. If yes, what kind of forest products you are allowed to collect?

……..

26. Do you find any difference in the management after it has been converted into National Park?

a. Yes ……. b. No ……..

27. If yes, what kind of differences do you find?

…….

28. Do you have any suggestion to improve the situation?

a. Government should compensate loss

b. Local people should be shifted

c. Number of animals should be reduced

d. Others i…… ii. …….....

ANNEX-2

Questionnaire for Park Authority

1. Is there any problem the government has to face due to the habitation of the local people inside and around the national park?

2. What are the problems faced by ShNP due to the local people?

3. Have you got any complains of crop damage, human harassment, livestock depredation by the local people?

4. If yes, does the park make any compensation for the loss?

5. Are the people allowed to enter into the national park?

6. If no, how do they affect the national park?

7. Do the local people know entering the park and collecting the materials and killing wild animals from the park is illegal?

8. If yes, why do they get involved in such activities?

9. What action do the park authorities take when they get hold of people involved in such activities inside the park?

10. Does the park call the public for discussing any issues related to park management?

11. What suggestions do you give to avoid damage caused by the wild animals?

12. The park is being handed over to KMTNC, can KMTNC resolve the problems?

ANNEX- 3

Protected Areas of Nepal

S.No	Name of Protected Areas	Gazetted Year	Area (sq.km)
	National Parks		
1.	Chitwan National Park (World Heritage Site 1984)	1973	932
2.	Langtang National Park	1976	1710
3.	Rara National Park	1976	106
4.	Sagarmatha National Park (World Heritage Site 1979)	1976	1148
5.	Shey-Phoksundo National Park	1984	3555
6.	Khaptad National Park	1984	225
7.	Bardia National Park	1984	968
8.	Makalu-Barun National Park	1991	1500
9.	Shivapuri National Park	2002	144
	Total		**10288**
	Wildlife Reserves		
1.	Suklaphanta Wildlife Reserve	1976	305
2.	Koshi Tappu Wildlife Reserve	1976	175
3.	Parsa Wildlife Reserve	1984	499
	Total		**979**
	Hunting Reserve		
1.	Dhorpatan Hunting Reserve	1987	1325
	Total		**1325**
	Consevation Areas		
1.	Annapurna Conservation Area	1992	7629
2.	Kanchanjunga Conservation Area	1997	2035
3.	Manasulu Conservation Area	1998	1663
	Total		**11327**

S.No	Name of Protected Areas	Gazetted Year	Area (sq.km)
	Buffer Zones		
1.	Chitwan National Park	1996	750
2.	Bardia National Park	1996	328
3.	Langtang National Park	1998	420
4.	Shey-Phoksundo National Park	1998	1349
5.	Makalu-Barun National Park	1999	830
6.	Sagarmatha National Park	2002	275
7.	Suklaphanta Wildlife Reserve	2004	243.5
8.	Koshi Tappu Wildlife Reserve	2004	173
9.	Parsa Wildlife Reserve	2005	298.17
	Total		**4666.67**

Source: Department of National Park and Wildlife Conservation

ANNEX- 4

List of Mammals of ShNP

Family	Scientific Name	Common name	Local Name
CANIDAE	*Canis aureus*	Jackal	Syal
CALLOSCICURINAE	*Drenomys lokriah*	Orange bellied H.Squirrel	Sunaulo lokharkee
FELIDAE	*Felis bengalensis*	Lepoard cat	Chari bagh
FELIDAE	*Felis chaus*	Jungle cat	Ban Biralo
HYSTRICIDAE	*Hystrix indica*	Porcupine	Dumsi
LEPORIDAE	*Lepus nigricolls*	Hare	Kharayo
CERCOPITHECIDAE	*Macaca mulatta*	Assamese monkey	Bandar
CERCOPITHECIDAE	*Macaca mulatta*	Rhesus monkey	Bandar
	Manis spp.	Pangolin	
MUSTELIDAE	*Martes flavigula*	Yellow throated Himalyan marten	Malsapro
CERVIDAE	*Muntiacus muntjak*	Barking Deer	Ratuwa Migra
MURIDAE	*Mus cervicolor*	Fawn-Clouded mouse	Khathe musa
BOVIDAE	*Naemorhedus goral*	Grey H.Ghoral	Ghoral
OCLIOTONIDAE	*Octotona royali*	Royel's Pika	Musae Kharayo
FELIDAE	*Panthera pardus*	Leopard	Chituwa
FELIDAE	*Pardofelis nubolosa*	Clouded Leopard	Dwanse Chitwa
MURIDAE	*Rattus rattus*	Khumbu rat	Himali Musa
CERCOPITHECIDAE	*Semnopithecithecus entellus*	Langur	Dheduwa
SORICIDAE	*Soriculus caudatus*	Horsefield Serew	Chuchundro
SORICIDAE	*Soriculus nigrescene*	Sikkim large clawed serew	Chuchundro
SUIDAE	*Sus scrofa*	Wild Boar	Bandel
URSIDAE	*Ursus thibetanus*	Himalyan black bear	Kalo Bhalu
VIVERRIDAE	*Viverra zibetta*	Large Civet	Zik/Sili/Bhavan
PHOLIDOTAE	*Manis spp*	Pangolin	Salak
MURIDAE	*MUS musculus*	Mouse	

Source: Shivapuri National Park Headquarter

ANNEX -5

Meteorological Data

Rainfall of Budhanilkanthal Station for the Year 1995 to 2005

Latitude: 27° 47'N

Longitude: 85° 22' E

Elevation: 1490 m

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1995	6.60	30.80	34.00	6.00	232.20	562.00	498.20	460.60	139.20	21.80	49.40	7.00	2,047.80
1996	66.80	12.40	2.60	52.20	72.00	451.40	384.00	637.60	344.40	79.70	-	-	2,103.10
1997	21.20	10.60	16.00	166.00	95.60	241.80	756.80	491.00	177.60	17.80	22.70	76.00	2,093.10
1998	-	34.20	84.80	50.00	183.00	339.40	505.90	520.20	257.80	38.20	10.40	-	2,023.90
1999	5.60	1.40	-	8.80	194.00	426.60	639.20	555.20	305.50	198.00	-	-	2,334.30
2000	-	9.40	14.00	69.80	282.40	415.40	684.00	474.00	203.90	13.20	-	-	2,166.10
2001	-	13.60	-	11.40	212.00	532.00	465.80	538.60	226.50	83.40	-	-	2,083.30
2002	-	-	13.70	120.00	330.20	242.80	791.20	721.20	200.20	DNA	9.20	-	2,428.50
2003	19.80	64.20	73.60	75.80	82.80	206.80	716.40	536.10	DNA	DNA	3.80	18.60	1,797.90
2004	31.40	-	48.20	117.80	236.20	203.00	651.10	591.40	226.50	DNA	DNA	-	2,105.60
2005	61.20	17.80	63.40	30.80	64.20	257.80	406.80	440.40	211.20	124.80	-	-	1,678.40
Average	**19.33**	**17.67**	**31.85**	**64.42**	**180.42**	**352.64**	**590.85**	**542.39**	**229.28**	**72.11**	**9.55**	**9.24**	**2,078.36**

Source: Department of Hydrology and Meteorology

Maximum Temperature of Budhanilkantha Station for the Year 1995 to 2005

Latitude: 27°47' N Longitude: 85° 22' E Elevation: 1350 m

year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Maximum
1995	16.10	18.10	23.30	27.20	29.80	26.70	26.60	27.80	27.10	25.20	22.20	18.30	29.80
1996	16.90	19.40	24.00	27.20	29.00	26.60	26.70	27.20	26.90	24.90	22.20	18.90	29.00
1997	15.80	17.30	22.90	23.00	27.00	27.60	27.60	27.40	26.30	23.50	21.00	17.00	27.60
1998	16.80	19.30	20.90	25.00	27.70	28.80	27.00	26.80	27.40	26.00	23.20	20.20	28.80
1999	18.90	23.20	25.50	29.80	27.70	27.10	26.20	26.70	27.10	24.90	22.20	19.30	29.80
2000	17.90	17.60	22.90	26.70	27.70	27.50	27.00	27.60	26.40	25.10	22.50	18.50	27.70
2001	18.00	21.10	23.90	25.20	26.70	28.10	27.80	28.00	26.90	25.90	23.20	20.50	28.10
2002	19.70	20.80	21.10	24.70	24.20	26.30	27.60	27.50	26.60	DNA	22.40	18.10	27.60
2003	17.60	18.20	21.50	26.40	27.30	27.30	27.30	27.20	DNA	DNA	21.70	17.80	27.30
2004	16.70	19.60	25.30	25.40	26.90	27.10	26.40	27.30	26.10	24.10	DNA	18.80	27.30
2005	16.30	19.20	23.00	26.40	26.70	28.80	27.20	26.30	27.50	24.20	21.20	18.90	28.80
Average	**17.34**	**19.44**	**23.12**	**26.09**	**27.34**	**27.45**	**27.04**	**27.25**	**26.83**	**24.87**	**22.18**	**18.75**	

Minimum Temperature of Budhanilkantha Station for the Year 1995 to 2005

Latitude: 27°47' N Longitude: 85° 22' E Elevation: 1350 m

year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Yearly Minimum
1995	3.40	5.30	8.90	12.70	17.60	20.10	20.00	19.50	18.00	13.90	9.10	5.10	3.40
1996	3.40	5.90	10.80	12.40	16.40	18.30	20.10	19.10	17.70	13.70	8.80	4.90	3.40
1997	3.40	4.00	9.60	10.70	14.20	17.80	19.70	19.60	18.30	11.30	8.50	4.70	3.40
1998	3.40	5.70	7.70	12.50	16.40	19.80	20.10	19.90	18.40	16.00	10.50	5.70	3.40
1999	3.90	7.90	9.70	14.20	16.00	18.70	19.50	19.60	17.40	13.80	9.10	6.30	3.90
2000	2.90	3.50	6.10	11.70	15.50	18.30	19.50	19.60	17.90	13.70	10.70	4.30	2.90
2001	3.50	7.20	8.30	12.30	15.10	19.90	19.90	19.90	18.20	14.20	12.40	5.30	3.50
2002	3.60	4.40	10.00	11.90	16.10	17.90	18.30	19.10	17.40	DNA	9.00	5.10	3.60
2003	3.60	4.40	10.00	11.90	16.10	17.90	18.30	19.10	17.40	DNA	9.00	5.10	3.60
2004	3.20	6.10	11.80	12.90	15.70	18.30	19.30	19.40	18.30	12.80	DNA	4.20	3.20
2005	2.60	5.70	9.50	10.50	14.30	18.90	19.90	19.50	19.10	13.30	8.70	4.10	2.60
Average	**3.35**	**5.46**	**9.31**	**12.15**	**15.76**	**18.72**	**19.51**	**19.48**	**18.01**	**13.63**	**9.58**	**4.98**	

Source Department of Hydrology and Meteorology

ANNEX-6

Tabular Representation of Data

Table 6.1: Ward wise Distribution of Cultivated Land and Land Holding per Household

Ward No.	No. of surveyed household	Total cultivated land (ha)	% in terms of total cultivated land	Land holding per Household
1	11	5.07	10.11	0.461
2	35	14.15	28.22	0.404
3	17	12.56	25.05	0.739
4	16	5.98	11.93	0.374
5	11	6.7	13.36	0.610
6	10	5.68	11.33	0.568
Total		**50.14**	**100.00**	**0.526**

Table 6.2: Ward wise Distribution of Households growing Maize

Ward No.	Household Surveyed	Household growing Maize	Percentage (%)
1	11	11	100
2	35	35	100
3	17	17	100
4	16	16	100
5	11	11	100
6	10	10	100
Total	**100**	**100**	**100**

Table 6.3: Ward wise Distribution of Households growing Millet

Ward No.	Household Surveyed	Household growing Millet	Percentage (%)
1	11	11	100
2	35	35	100
3	17	17	100
4	16	16	100
5	11	11	100
6	10	10	100
Total	**100**	**100**	**100**

Table 6.4: Ward wise Distribution of Households growing Wheat

Ward No.	Household Surveyed	Household growing Wheat	Percentage (%)
1	11	2	18.18
2	35	28	80.00
3	17	0	0.00
4	16	2	12.50
5	11	8	72.72
6	10	1	10.00
Total	**100**	**41**	**41.00**

Table 6.5: Ward wise Distribution of Households growing Paddy

Ward No.	Household Surveyed	Household growing Paddy	Percentage (%)
1	11	0	0.00
2	35	0	0.00
3	17	0	0.00
4	16	2	12.50
5	11	8	72.72
6	10	1	10.00
Total	**100**	**11**	**11.00**

Table 6.6: Ward wise Distribution of Households growing Other Crops

Ward No.	Household Surveyed	Household growing Other Crops	Percentage (%)
1	11	9	81.81
2	35	20	57.14
3	17	10	58.82
4	16	12	75.00
5	11	9	81.81
6	10	8	80.00
Total	**100**	**68**	**68.00**

Table 6.7: Land Coverage of Maize in Different Wards

Ward No.	Total cultivated land (ha)	Maize grown (ha)	Percentage (%)
1	5.07	3.29	64.89
2	14.15	12.50	88.34
3	12.56	11.78	93.79
4	5.98	5.67	94.82
5	6.70	3.98	59.40
6	5.68	5.49	96.66
Total	**50.14**	**42.71**	**85.18**

Table 6.8: Land Coverage of Millet in Different Wards

Ward No.	Total cultivated land (ha)	Millet grown (ha)	Percentage (%)
1	5.07	3.09	60.95
2	14.15	10.14	71.66
3	12.56	10.07	80.18
4	5.98	5.67	94.82
5	6.70	3.98	59.40
6	5.68	5.49	96.66
Total	**50.14**	**38.44**	**76.67**

Table 6.9: Land Coverage of Wheat in Different Wards

Ward No.	Total cultivated land (ha)	Wheat grown (ha)	Percentage (%)
1	5.07	2.82	55.62
2	14.15	6.45	45.58
3	12.56	0.00	00.00
4	5.98	0.84	14.04
5	6.70	2.72	40.60
6	5.68	0.32	5.63
Total	**50.14**	**13.15**	**26.23**

Table 6.10: Land Coverage of Paddy in Different Wards

Ward No.	Total cultivated land (ha)	Paddy grown (ha)	Percentage (%)
1	5.07	0.00	00.00
2	14.15	0.00	00.00
3	12.56	0.00	00.00
4	5.98	0.84	14.05
5	6.70	2.72	40.60
6	5.68	0.32	5.63
Total	**50.14**	**3.88**	**7.74**

Table 6.11: Types of Problem in Percentage

Ward No.	Crop Damage	Human Harassment	Livestock Depredation
1	91.66	0.00	23.00
2	100.00	0.00	08.70
3	93.75	18.75	18.75
4	100.00	9.09	12.50
5	100.00	0.00	16.00
6	81.81	9.09	20.18
Total	**94.53**	**6.15**	**16.52**

Table 6.12: Loss of Maize

Ward No.	Maize grown (ha)	Expected Production (quintal))	Actual Production (quintal)	Loss in quintal	Percentage (%)	Loss per ha
1	3.29	203.00	131.25	71.75	35.34	21.81
2	12.50	666.22	476.53	189.69	28.47	15.18
3	11.78	596.75	445.38	151.37	25.37	12.85
4	5.67	322.00	215.25	106.75	33.15	18.83
5	3.98	318.50	227.50	91.00	28.57	22.86
6	5.49	322.00	206.50	115.50	35.87	21.04
Total	**42.71**	**2428.47**	**1702.41**	**726.06**	**29.90**	**18.76**

Table 6.13: Loss of Millet

Ward No.	Millet grown (ha)	Expected Production (quintal)	Actual Production (quintal)	Loss in quintal	Percentage (%)	Loss per ha
1	3.09	175.00	114.00	61.00	34.86	19.74
2	10.14	607.00	472.00	135.00	22.24	13.31
3	10.07	638.00	437.40	200.60	31.42	19.92
4	5.67	308.00	214.00	94.00	30.50	16.58
5	3.98	316.00	244.00	72.00	22.78	18.09
6	5.49	312.00	203.00	109.00	34.93	19.85
Total	**38.44**	**2356.00**	**1684.40**	**671.60**	**28.51**	**17.915**

Table 6.14: Loss of Wheat

Ward No.	Wheat grown (ha)	Expected Production (quintal)	Actual Production (quintal)	Loss in quintal	Percentage (%)	Loss per ha
1	2.82	134.75	74.025	60.725	45.06	21.53
2	6.45	308.875	186.025	122.85	39.77	19.05
3	0.00	0.00	0.00	0.00	0.00	0.00
4	0.84	24.50	17.50	7.00	28.57	8.33
5	2.72	127.75	84.00	43.75	34.25	12.59
6	0.32	31.50	14.00	17.50	55.55	0.56
Total	**13.15**	**627.375**	**375.55**	**251.825**	**40.13**	**19.15**

Table 6.15: Loss of Paddy

Ward No.	Paddy grown (ha)	Expected Production (quintal)	Actual Production (quintal)	Loss in quintal	Percentage (%)	Loss per ha
1	0.00	0.00	0.00	00.00	00.00	00.00
2	0.00	0.00	0.00	00.00	00.00	00.00
3	0.00	0.00	0.00	00.00	00.00	00.00
4	0.84	30.00	20.00	10.00	33.33	11.91
5	2.72	128.75	92.50	36.25	28.15	13.33
6	0.32	12.50	7.50	5.00	40.00	15.63
Total	**3.88**	**171.25**	**120.00**	**51.25**	**29.92**	**13.21**

Table 6.16: Percentage of Household affected by Wild animals

Ward No.	Wild boar	Monkey	Porcupines	Birds	Others
1	91.66	66.66	83.33	25.00	20.83
2	100.00	65.22	56.52	8.70	6.52
3	93.75	75.00	62.50	12.50	6.25
4	93.75	87.50	0.00	18.75	6.25
5	90.90	72.72	64.54	63.63	8.14
6	63.63	81.81	0.00	27.27	9.09
Total	**88.95**	**74.82**	**44.48**	**25.98**	**9.51**

Table 6.17: Wild Animals Damaging Maize

Animal	Household Growing Maize	Percentage (%)
Wild boar	79	79
Monkey	68	68
Porcupine	32	32
Bird	13	13
Other	3	3

Table 6.18: Wild Animals Damaging Millet

Animal	Household Growing Millet	Percentage (%)
Wild boar	62	62
Monkey	53	53
Porcupine	22	22
Bird	11	11
Other	6	6

Table 6.19: Wild Animals Damaging Wheat

Animal	Household Growing Wheat	Percentage (%)
Wild boar	24	58.54
Monkey	20	48.78
Porcupine	7	17.07
Bird	6	14.64
Other	6	14.64

Table 6.20: Wild Animals Damaging Paddy

Animal	Household Growing Paddy	Percentage (%)
Wild boar	6	54.55
Monkey	7	63.64
Porcupine	3	27.27
Bird	6	54.55
Other	1	9.09

Table 6.21: Percentage of Households Using Techniques

Ward No.	% of Households using Techniques
1	83.33
2	73.91
3	93.33
4	93.75
5	90.90
6	81.81

Table 6.22: Preventive Methods Used by Local People

S. No.	Methods	Household No.	Percentage (%)
1	Shouting and clapping	89	89
2	Making noise by beating empty tin	64	64
3	Using dogs	23	23
4	Spending night on machan	76	76
5	Other	10	10

Table 6.23: Total Livestock and their Percentage in Surveyed Household

Livestock	Ward No.1	Ward No. 2	Ward No. 3	Ward No. 4	Ward No. 5	Ward No. 6	Total	Percentage (%)
Cow	0	11	3	2	3	6	25	2.93
Ox	7	13	4	6	4	4	38	4.46
Buffalo	15	49	24	15	21	15	139	16.31
Goat	75	136	82	69	106	93	561	65.84
Others	0	9	7	0	68	5	89	10.44
Total	**97**	**218**	**120**	**92**	**202**	**123**	**852**	**99.98**

Table 6.24: Percentage of Livestock in Different Wards

Livestock	Ward No. 1	Ward No. 2	Ward No. 3	Ward No. 4	Ward No. 5	Ward No. 6
Cow	0.00	44.00	12.00	8.00	12.00	24.00
Ox	18.42	34.21	10.52	15.78	10.52	10.52
Buffalo	10.79	35.25	17.26	10.79	15.10	10.79
Goat	13.36	24.24	14.61	12.29	18.89	16.57
Others	0.00	10.11	7.86	0.00	76.40	5.61

Table 6.25: Percentage of Household losing Livestock

Ward No.	1	2	3	4	5	6	Total
Attacked	33.33	9.09	18.75	18.75	18.18	27.27	20.895

Table 6.26: People's Perception

S. No.	Methods	Household No.	Percentage (%)
1	Local people should be shifted	55	55
2	Number of animals should be reduced	24	24
3	Local people should be compensated for loss	37	37
4	Local people should be allowed for fodder, firewood	21	21
5	No ideas	15	15

ANNEX-7

Plates

Plate 1: Researcher at Shivapuri National Park, Entry Point

Plate 2: Collected Firewood and Researcher Asking Questions to Respondent

Plate 3: Maize Destroyed by Wild Animals

Plate 4: Maize Destroyed by Monkey

Plate 5: Land Left Uncultivated (Left) and Dog Guarding Wheat (Right)