1. INTRODUCTION

1.1 Background

The Yellowstone National Park, in the United States created in 1872 was the first National Park ever established in the modern world (Mackinon et al.1986). This was the milestone in the evolution of concept of National Park. National Parks in the developing countries, particularly in Asia, were established in the second quarter of the twentieth century (Mishra and Jefferies1991). Nepal's rich biodiversity is a reflection of its unique geographical position as well as its altitudinal and climatic variation. It incorporates Palaearctic and Indo-Malayan biogeographical regions and major floristic provinces of Asia creating a unique and diversity of life.

Wildlife in Nepal is both varied and fascinating. Sir Brian Hodgson, the British Resident in Kathmandu during 1820-1843 published more than 100 papers dealing with reptiles, birds, and mammals of Nepal (Bhatt 1977). Nepal entered into the new era of conservation with the promulgation of National Parks and Wildlife Conservation Act 2029 (1973), which provided a basis for the establishment of protected areas and conservation of wildlife and their habitats. Since then 16 protected areas and 11 buffer zones have been declared in various parts of the country. Now protected areas cover more than 28,998.67 Km^2 (19.70 %) of the country's total land (DNPWC 2008). Though protected areas are one of the conservation's oldest devices and have become the cornerstone of biodiversity conservation they are continually under threat from growing human population (Wyne 1998). Biodiversity refers to the number, variety and variability of all life on the earth or in an area. Knowledge of the biodiversity of a region forms a sound basis for understanding and managing its natural resources and environment. The definition of conservation at international level entails that the maximum sustainable use of natural resources in benefit of mankind (Luna et al. 2007). Biodiversity conservation is very important to sustain life support system (Tiwari 1998). Although comprising only 0.03% of global land area, Nepal possesses a disproportionately large diversity of flora and fauna at genetic, species, and ecosystem levels (Kafle 2005). Eighty ecosystems are included in current protected areas of Nepal (HMGN/MFSC 2002). Nepal is signatory to

various international conventions and treaties including CITES, Convention on Biological Diversity (CBD), and the Ramsar Convention and has the responsibility of conserving and maintaining the country's major representative ecosystems, genetic diversity, unique natural and cultural heritage and giving protection to valuable and endangered species (DNPWC 2004).

Nepal has established extensive network of protected areas to conserve biodiversity. Since there are multitudes of benefits of biodiversity, the conservation of biodiversity has become a global concern. Establishment of national parks and reserves has played a crucial role in conserving the biological diversity but paid little attention to local people by putting restriction on the local use of resources (Wells and Brandon 1993). National Parks and Reserves have been suffering from the incipient conflict between local people and park management but the extent of conflict vary among different reserves (Heinen and Kattel 1992). The impact of biodiversity conservation on human wellbeing as a result of the creation of protected areas has become an important concern. Human beings have been dependent on natural resources since their advent on the Earth for the livelihood. After the declaration of protected areas the imposition of the park regulations on the use of those resources by the local people resulted in many conflicts between them and the park authority. The problem of park people conflict is not a new issue in Nepal. It has become more and more critical and can be observed anywhere in the parks and reserves.

1.2 Objectives

The main objective of the study was to assess the impacts of biodiversity conservation on the local community in the southern side of Shivapuri National Park (ShNP). Specific objectives were to:

- record the abundance and distribution of wild animals and their habitats
- examine the wildlife damage
- estimate the land abandonment, and
- analyze the impact of conservation on local livelihood

1.3 Justification and Limitation

The ShNP is one of the main sources of water for the Kathmandu metropolitans. Generally, the national parks and the wildlife reserves in developing countries befall a source of conflicts because the people inhabiting in and around the park have a direct relation with the parks. The conflict between the national park and the local people is rooted in the conception of parks as areas without human habitation. The relation between park and local people is dampened when the park animals damage the outer peripheral area and disturb the adjacent settlements. Crop raiding and livestock depredation, restriction over the firewood and timber collection are the major sources for park-people interface in the ShNP. Many studies had been conducted on crop damage and human-wildlife interaction. Very little work has been done on the impacts of conservation on the livelihood of the local people. Therefore, present study was conducted in the southern side of the ShNP, particularly in Nayapati and Gagalphedi Village Development Committees (VDCs) to analyze the impacts of conservation on the livelihood of the local people. The information on crop loss and livelihood options was mainly based on the questionnaire survey.

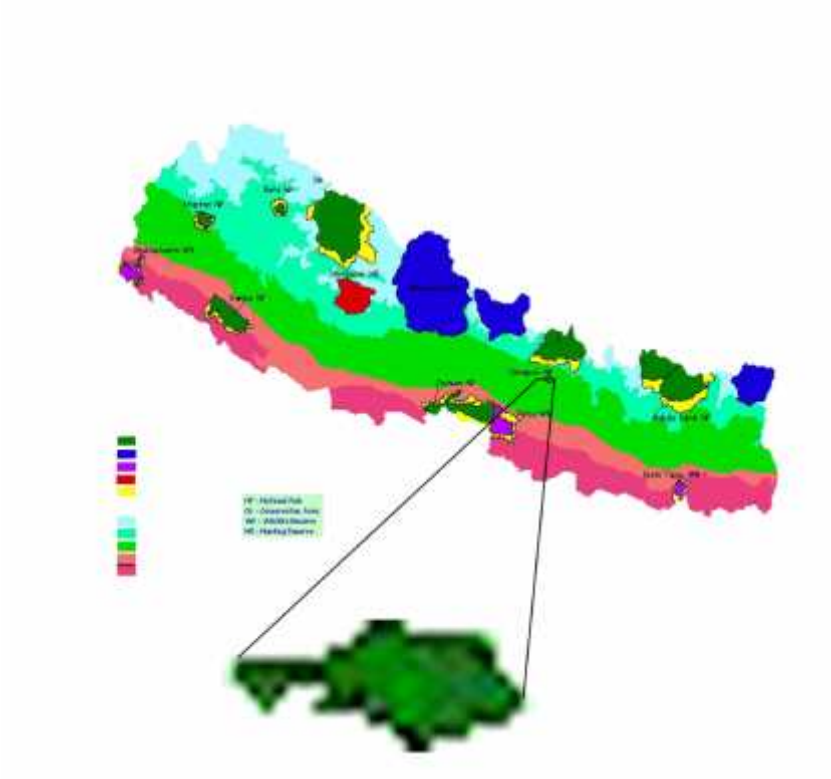

Figure 1.1 Protected Areas of Nepal Showing the position of Shivapuri National Park

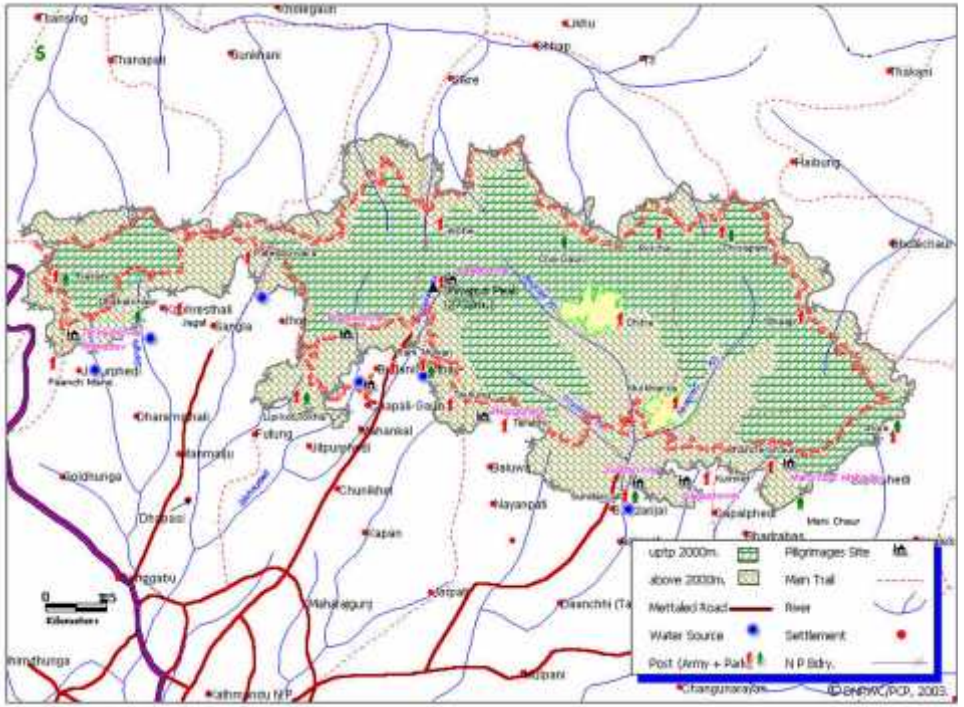

Figure 1.2 Map of Shivapuri National Park

2. STUDY AREA

2.1 Area and location

The ShNP is the only protected area lying entirely within Nepal's midhills ecosystem. The biodiversity contained in the midhills ecosystem is of international importance both in terms of the number of globally threatened wildlife and floral elements as well as diversity of ecosystems contained with in the area (BPP 1995b). The ShNP, initially established as Shivapuri Watershed Reserve in 1976, 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. The ShNP, the only stone walled protected area covers a total area of 144 km^2 and located in the northern fringe of Kathmandu valley. The well demarcated 111 km long boundary wall runs along 23 VDCs of Kathmandu (12), Nuwakot (9) and Sindhupalchowk (2) districts. The name of the park is derived from the ancient name "*Shiphuchd*" representing the holy peak of woods.

2.2 Physiography

2.2.1 Geology, topography and elevation

Geologically, the area occupies the Inner Himalayan region and therefore the dominant rocks are Gneisis and Magmatite with mica schist and pegmatic granite. 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 >30% at least in 50% of the total area of the park. Landslides, gullies sheet erosion in the sloping terraces and streams bank erosion are common over Shivapuri. Elevation of the park ranges from 1360m to 2732m at Shivapuri peak. However, most of the park lies between 1600m and 2500m above the mean sea level.

2.2.2 Land use pattern

The land use pattern in and around the ShNP is predominated by forest (40.7%) followed by agriculture (35.3%), shrubs (14.8%), grassland (2.9%), grassland with shrubs (2.6%), landslides (0.5%), settlements (0.9%), riverine features (0.2%), and abandoned land (2.0%) .

2.2.3 Climate and weather

According to climatic data (2002-2006) of Department of Hydrology and Metrology, Babarmahal, the mean monthly minimum temperature at Budhanilkantha was 12.36^{o}c and maximum temperature was 23.76^{o}c (Figure 2.1). The mean relative humidity (morning) was 85.57% and (evening) was 73.79% (Figure 2.2). The mean annual precipitation was 179.39mm (Figure 2.3).

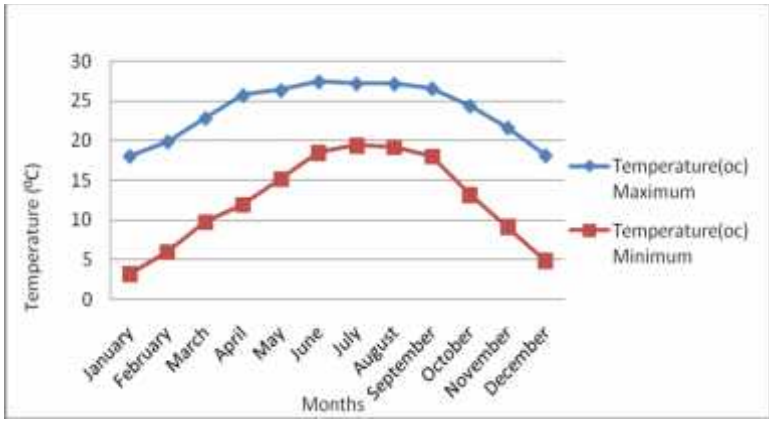

Figure 2.1 Average maximum and minimum temperature (^{o}c) of Budhanilkantha (2002-2006)

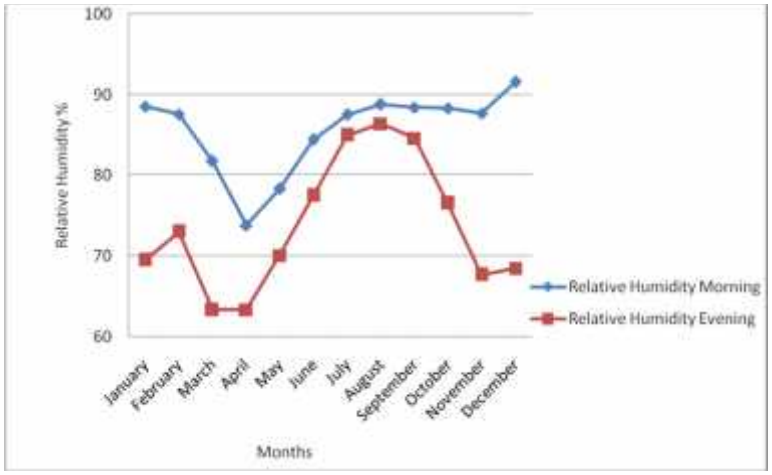

Figure 2.2 Average relative humidity morning and evening (%) at Budhanilkantha(2002-2006)

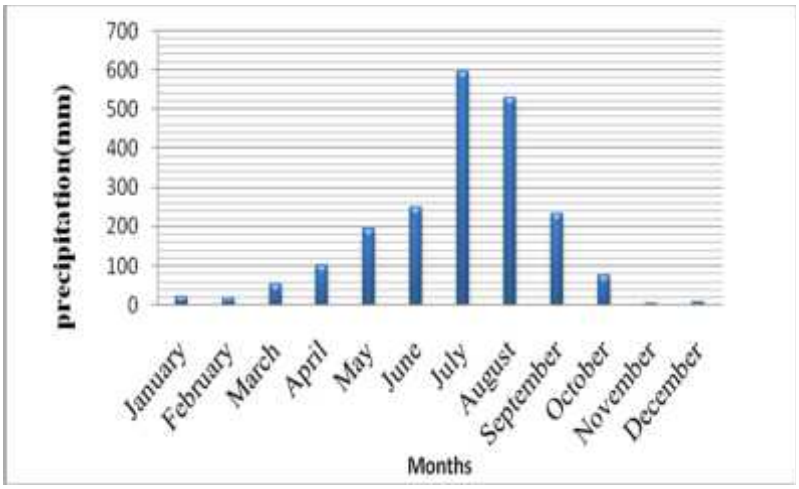

Figure 2.3 Average precipitations (mm) at Budhanilkantha (2002-2006)

2.3 Biological components

The ShNP has high floral diversity due to its location, altitudinal and climatic variations. There are four forest types (Amatya 1993) within the park. They include Lower mixed hardwood forest, Chir-pine forest, Oak forest, Upper mixed hardwood forest. There are more than 2,122 species of flora and 16 of them are endemic flowering plants. The ShNP provides important habitat for a variety of wildlife. There are 21 species of mammals out of which nine are threatened (BPP 1995a). Hanuman languor (*Presbytis entellus*), common leopard (*Panthera pardus*), Himalayan black bear (*Selenarctos thibetanus*), Yellow throated marten (*Martes flavigula* Boddaert), wild boar (*Sus scrofa* Linnaeus), Goral (*Nemorhaedus goral* Hardwike), Jungle cat (*Felis chaus* Guildenstaedt), Rhesus monkey (*Macacca mulatta* Zimmermann), Pangolin (*Manis pentadactyla* Linnaeus) are some of the common species of the park. A total of 318 bird species have been recorded in the ShNP. These include globally threatened species Oriental Hobby (*Falco severus* Horsfield), Grey-sided Laghing Thrush (*Garrulax caerulattus* Hodgson), and Cinerous Vulture (*Aegpius monachus* Linnaeus). More than 102 species of butterflies have been recorded from the park and its surrounding area (Smith 1996). This park is also important as one of the few sites where the rare relict Himalayan dragon fly (*Epiophlebia laidlawi*) was also reported from this part (HMG/FAO 1996).

2.4 Detailed sampling sites

Bajrayogini, Baluwa, ChapaliBhadrakali, Gagalphedi, JhorMahankal, Jitpurphedi, Kabresthali, Lapsiphedi, Nayapati, Sangla, Sundarijal and Vishnu Budhanilkantha are the VDCs lying in the southern side of the ShNP. The present study was mainly focused in two VDCs- Nayapati and Gagalphedi. These two VDCs are located between 27^0 45' and 27^0 46' North latitude and 85^0 24' and 85^0 26' East longitude and cover approximately 16 km^2, which is almost 11.11 % of total area of the ShNP.

According to 2001 census, Nayapati and Gagalphedi VDCs have the populations of 5228 and 5229 respectively. Different ethnic groups of these VDCs include Chhetri, Tamang , Newar, Brahman-Hill, Magar, Kami, Chepang Praja, Gurung, Rai, Damai/Dholi, Tharu, Sherpa, Sanyasi, Dhimal, Limbu, sarki, Sunuwar, Majhi, Koiri, Thakuri, Muslim and Yadhav and Unidentified casts (CBS 2001).

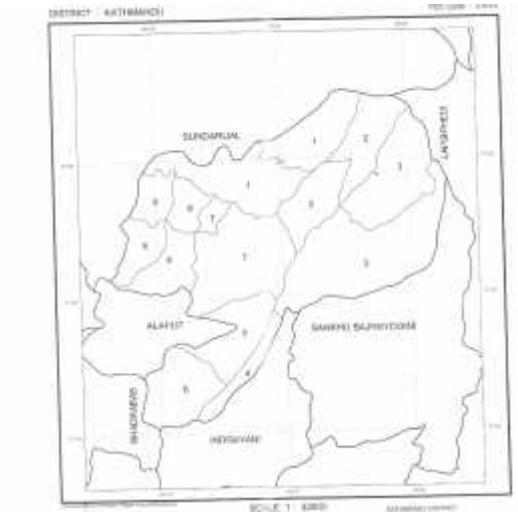

Figure 2.4 Map of Nayapati VDC showing its ward numbers.

Figure 2.5 Map of Gagalphedi VDC showing its ward numbers.

Agriculture is the key economic activity and a source of livelihood for the majority of the population of the study area. The major crops grown in the study area are paddy, wheat, maize, millet, potato, sweet potato, peanuts and seasonal vegetables which are grown by rotation cropping practices in different seasons.

Agriculture, livestock rearing, and poultry farming are the main sources of income in both VDCs. Few people are engaged in government services, business trade and wage labor work. The households engaged in different types of profession are given in the figure 2.6.

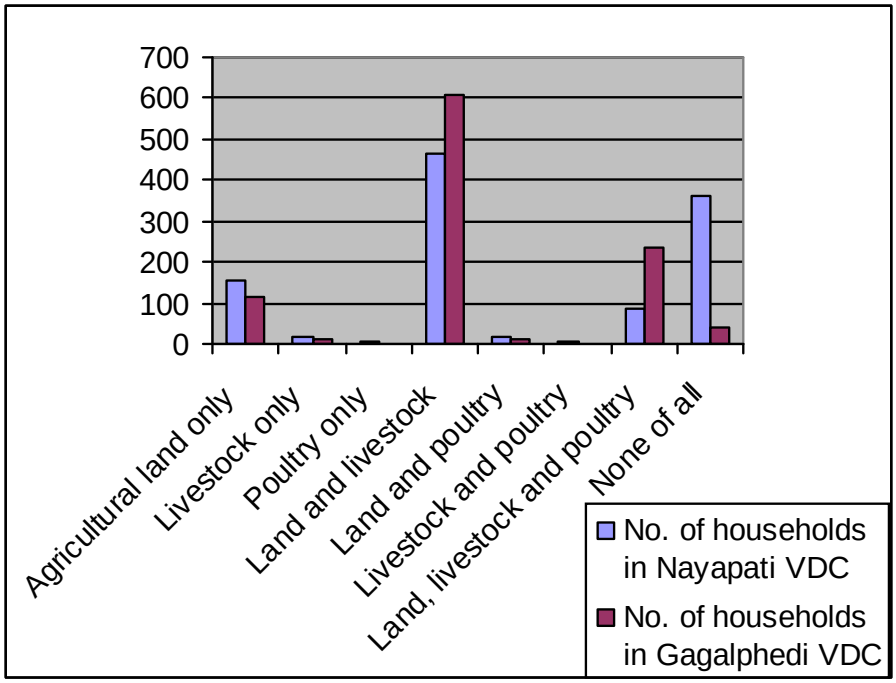

Figure 2.6 Engagement of people in different professions in two VDCs

3. LITERATURE REVIEW

3.1 Biodiversity Conservation

Biodiversity refers to the variation that exists at all levels of biological organization, individual, species and ecosystems. Biodiversity conservation involves maintaining the viable population of all species so they do not go up to extinction. The effect of human on biodiversity and landscapes has been widely recognized and many species are threatened with extinction (Wilson 1998). Biodiversity conservation in developing countries has been a challenge because of the combination of rising human populations, rapid technological advances, several social hardships and extreme poverty (Arian and Nepal 2006). Poverty, excessive population pressure, and negative consequences of unplanned development activities are the main threats to the biodiversity conservation. Information on Biodiversity such as wildlife status (abundance, distribution and home range) population and community interaction and their contribution to ecosystem development is essential for conservation and management of wildlife and protected area (Basnet 1998).Widespread declines in biodiversity at both global and local scales have motivated considerable research directed toward understanding how changes in biological diversity may effect the stability and function of the ecosystems on which we rely (Calimon et al. 2006). Efforts at mitigating global biodiversity loss have often focused on preserving large, intact natural habitats. However, preserving biodiversity should also been important goal in the urban environment especially in highly urbanized areas where little natural habitat remains (Alvey 2006). Public attitudes towards biodiversity issues and the value judgments underlying biodiversity management and conservation are still poorly understood (Anke et al. 2007).

3.2 Distribution and Habitats of Wild Animals

The altitudinal range of wild mammals in the ShNP is between 1500 to 2700 m with maximum number of species between 1700 to 2400m (Shrestha 2004). The signs of common leopard (*Panthera pardus* Linnaeus) are distributed from an altitudinal range of 1740 to 2600 m in this National Park. The distribution of Himalayan black bear

(*Selenarctos thibetanus* G. Cuvier) ranges from 3050 to 3660m (Prater 1998). The home range areas of the adults of Himalayan black bear varied from 16.6 to 130 km^2 (Amstrup and Beecham 1976). The Himalayan gorals preferred the steep slopes for their habitat Gaston et al. (1981). The altitudinal range of Himalayan goral lie between 1800 to 3700 m with an abundant peak between 2200 and 3400 m and south facing slopes in Himalchal Pradesh. The barking deers (*Muntiacus muntjak* Zimmarmann) are distributed in elevation ranging from 1500 to 3000 m in lower temperate broad leaved forest in Manang (Ale and Gurung 1995). The presence of wild boar increases from 1700 to 2100 m and their presence decreases with increasing altitude after 2100 m in the ShNP (Shrestha 2005 and Gurung 2002). The habitat of pangolin is in open forest with less coverage and red soil in Nagarjun forest (Gurung 1996). Porcupines (*Hystrix indica* Kerr) inhabit a wide variety of habitats from semi-arid scrublands to forested areas (Prater 1998). In the hill region of Karnataka, porcupines were found frequently feeding and damaging areca seedlings and coconut palms (Chakravarthy and Girish 2007).

3.3 Crop Depredation

Many of the national parks and wildlife reserves in developing countries have generated conflicts. They are in crisis due to the expansion or human activities and wild animals' time-to-time raid in the crop fields (Neumann 1992). Crop loss by wild animals is common problem in the adjoining village of park and reserve. The conflicts, which result from the destruction of crops and damage to property, are serious conservation issues inside and outside the Reserves (Miah et al. 2001). Most of the protected areas of Nepal either in Tarai regions or in mountain are also suffering the same type of conflicts. In Chitwan National Park (CNP), wild ungulates such as rhino (*Rhinoceros unicornis* Linnaeus), wild boar and spotted deer (*Axis axis* Erxleben) were the chief crop depredators of paddy, maize and mustard (Jnawali 1989 and Regmi 1999). The crop damage by rhino, chital and wild boar in CNP (Gitanagar and Patihani VDCs) were the major causes of conflict between the park and the people residing in that area (Subedi 1998). The study carried out in Padampur VDC adjacent to CNP showed rhino as the most destructive animal raiding the crops almost all the year (Milton and Binney 1980). Wild boar and languor (*Presbytis entellus* Dufresne) were found as the crop depredators

mainly in Langtang, Rara and Sagarmatha National Parks (Upreti 1985). These animals occasionally destroyed buck wheat and barley. The rate of crop loss exceeded fifty percent along the edge of the park due to these wild animals. In Parsa Wildlife Reserve spotted deer, wild boar, elephant (*Elephas maximus* Linnaeus), tiger (*Panthera tigris* Linnaeus), leopard, jackal (*Canis aureus* Linnaeus), jungle cat, mongoose (*Herpestes edwardsi* Geoffroy) and parakeet were found as the important trouble creator animals (Kasu 1996). In the ShNP wild boar (*Sus scrofa*), monkey *(Macaca* species) and porcupine *(Hystrix indica*) were the common wild animals usually raiding the crops (Poudyal 1995). Major crops raided by the animals were mainly maize, wheat and millet. In Kakani VDC adjacent to ShNP wild boar was the main crop depredator followed by porcupine, monkey and bear (Soti 1995). Crop depredation in Jitpurphedi, Chapali Bhadrakali and Baluwa VDCs adjacent to the ShNP, was by wild boar which was the most destructive than other wild animals like monkey, porcupine and birds (Paneru 2004). The study on crop damage by wild animals in Koshi Tappu Wildlife Reserve reported wild buffalo as a serious crop depredator responsible for 88.45% of total crop loss followed by wild boar, 10.32% (Adhikari 2000). Monkeys, bears (*Selenarctos thibetanus* G. Cuvier), musk deer (*Moschus chrysogaster* Linnaeus*)*, blue sheep (*Pseudois nayaur* Hodgson), porcupine and rodents were identified as major wildlife pest in Shey Phoksundo National Park (Basnet 1998) and Himalayan tahr (*Hemitragus jemlahicus*) at Sagarmatha National Park (Shrestha 2002 and Shrestha 2004). The crop damage by Nilgai in Lumbini was 6.6%, 17.97% and 15.84% for paddy, wheat and mustard respectively (Bagale 2003). The wildlife survey of Phakel, Purundi, Rakeshkhola and Dandakhola showed crop damage mainly done by rhesus macaques, porcupine and orange-bellied squirrel (*Dremomys lokriah* Hodgson) (Acharya 2002) and the major crops affected were maize, potato and soybean. The study on crop damage in Chunati Wildlife Sanctuary, Bangladesh identified the eight common species of wildlife causing crop damages as elephant, wild boar, and porcupine, and rhesus macaque, hoary-bellied squirrel (*Calloscinus pygerythrus lokroides* Hodgson), barking deer, red-breasted parakeet (*Psittacula alexandri* Linnaeus) and wild dog (*Cuon alpinus* Pallas) (Miah et al. 2001). Madusudan and Mishra (2003) identified wild deer, chital and wild boar as the crop depredators in Kanha National Park. The survey conducted on crop damage in

Himalchal Pradesh, India found rhesus monkeys and hanuman langor as crop raiders. The monkeys stray from the forest into the adjoining agricultural fields and orchards and damage a variety of crops in several pockets.

3.4 Livelihood Options

A livelihood comprises the capabilities, assets and activities required for living.

Livelihood strategy is the process of adapting with the particular environment as friendly living (Bishop 1990). The assets that are the building blocks of livelihoods are not only natural, physical and financial capital but also social and human capital. The majority of South Asian poor people live in rural areas that depend heavily on the use of natural resources such as water, arable land forest resources for their livelihood. Nepal is predominantly an agrarian economy from where 78% people derive their livelihood from agriculture which contributes 38% to gross domestic product (GDP) (Karna 2007). Khanal (2007) approached community-based natural resource management to restructure social relations and governance and promote livelihoods of the local people. Dhakal et al. (2007) suggested achieving the Millennium Development Goals to increase household income and employment based on locally available natural resources. A decision to establish park and protected area has pushed the livelihood of the local people who were depending on the forest resources towards more vulnerability (Phuyal 2003). Forest occupies about 40% of Nepal's land area (CBS 2003) and has the potential to be an important complement to private agricultural land in providing for local communities. In Nepal, forest and tree resources almost always have a place in rural livelihoods (Malla 2000). More than 90% of the rural people rely on forests and trees for fodder and bedding materials for livestock.

4. MATERIALS AND METHODS

4.1. Field Survey and observation

Both direct and indirect methods were used to collect data. Direct method included field survey and observation while indirect method included questionnaire survey, interview and group discussion. The preliminary field survey was conducted in the month of November 2007 in the study area. Detail field survey was conducted from November 2007-August 2008. Both primary and secondary data were used for this study. The data for wild animals and their damage to crops were obtained from questionnaire survey among the sampled households. The ward-wise distribution of the households and population of the two VDCs were obtained from the Central Bureau of Statistics (CBS) and VDC offices. The secondary data used in present study were also collected from various published sources such as books, journals, articles, internet etc.

4.2 Survey Design and Sample Size

The two adjoining VDCs Nayapati and Gagalphedi in southern side of the ShNP were selected as the study area. The questionnaire survey of total 50 households of ward numbers 1,3,8,9 of Nayapati VDC and total 52 households of ward numbers1, 2, 3, 7, 8, 9, of Gagalphedi VDC was conducted. These wards were included in Proposed Buffer Zone by the Shivapuri Integrated Watershed Development Project (SIWDP) and the ShNP Management Plan Team. I selected four wards of Nayapati VDC and six wards of Gagalphedi VDC for the household questionnaire survey and the whole study was focused in these wards. Simple random sampling method was applied to determine households to be surveyed.

4.3 Floral and Faunal Sampling

Quadrat method was applied for floral and faunal sampling. A transect line was laid out for sampling 20m × 20m quadrats which ran in different direction from the park boundary into the park forest. These lines were not straight compass bearing but followed trails in the rugged and dense forest. A total of ten quadrats, five each in Nayapati VDC and Gagalphedi VDC were established. The quadrats were laid at approximate 100m

intervals at altitudinal gradient with the help of GPS. The tree species having the diameter more than 10cm was recorded and the diameter of each tree species was measured at breast height. For mammalian diversity direct observation method and indirect sign methods were used. The data forms (Annexes I and II) especially for recording signs, feces, scrapes, scratches and GPS readings were filled for each quadrat. These signs were identified by lab technician of NTNC, Central zoo Jwalakhel, Kathmandu. The individual question survey for wild mammals (Annex III) found in southern side of the ShNP was also carried out.

4.4 Questionnaire Survey

The structured questionnaires (Annex IV) were developed to collect primary data. The questionnaires were designed to receive information about crop damage and other local conflicts due to wild animals. The information about the land abandonment by the local people and their livelihood options were also obtained from the questionnaire survey. Another set of questionnaires (Annex V) was developed to ask the park authority to know the conflict due to local people and other necessary in formations.

4.5 Data Analysis

The statistical tools like correlation and Student's t-test were used for the data analysis.

The total loss of different crops like paddy, wheat, maize and millet by wild pests was calculated by using the following formula.

$$XL = XE - XA$$

Where, XL=Total loss

XE=Expected production

XA=Actual production

Correlation analysis between two variables i.e. distances and loss for the major crops (paddy, wheat, maize, and millet) was done to see the distance traveled by pest species from the boundary wall and crop loss in weight. The graph of correlation and regression lines was made by SPSS method version 11 programs in which distance is kept on X-axis and loss on Y-axis.

Student's t- test was used to find whether there was a significant difference in crop loss in Nayapati and Gagalphedi VDCs due to crop depredation by wildlife of the ShNP setting null hypothesis: Crop loss in two VDCs does not differ significantly.

The different characteristics of vegetation like the numerical strength of a species in relation to a definite unit space and the proportion of density of a species to that of stand as a whole, for that density and relative density was calculated. Similarly, to find the distribution pattern of individual species in terms of percentage occurrence, frequency of species in terms of percentage occurrence, and dispersion of species in relation to that of all the species, relative frequency was calculated. To know the coverage and ecological importance of species in community, relative dominance and important value index (IVI) of the species were calculated.

$$\text{Density / hectare} = \frac{\text{Number of individual of a species}}{\text{Size of plots} \times \text{total number of plot sampled}} \times 10{,}000$$

$$\text{Frequency} = \frac{\text{Total number of quadrats in which species occur}}{\text{Total number of quadrats sampled}} \times 100$$

$$\text{Relative density} = \frac{\text{Total individual of species}}{\text{Total individual of all species}} \times 100$$

$$\text{Relative Frequency} = \frac{\text{Total frequency of one species}}{\text{Sum of frequencies of all species}} \times 100$$

$$\text{Relative Dominance} = \frac{\text{Basal area of a species}}{\text{Total basal area of all species}} \times 100$$

Important value index (IVI) = Relative frequency + Relative density +Relative dominance

5. RESULTS

5.1 Wild animals in Nayapati and Gagalphedi VDCs

Five mammalian species belonging to three orders and five families were recorded (Table 1.1) in the study area. From Questionnaire survey and group discussion, the present study explored wild animals especially mammals like barking deer, wild boar, common leopard, rhesus monkey, Himalayan goral, pangolin, porcupine, jungle cat, golden jackal, and yellow throated marten in the study area. Two pellet groups of barking deer were observed at altitudes of 1806m and 2003m. Old scat of common leopard was found at an altitude of 2006m. At an altitude of 2005m, I observed a single individual of rhesus monkey. Two scratches of wild boar were observed at an altitude of 1859m and the habitat type was mixed hardwood forest. Two individuals of yellow throated martens were observed at an altitude of 1540m outside the park boundary.

Table 1.1 Distribution of wild animals in the study area

Species	Order	Family	Validated by
Barking deer	Artiodactyla	Cervidae	Pellets
Wild boar	Artiodactyla	Suidae	Extensive Digging
Common Leopard	Carnivora	Felidae	Scats
Yellow throated marten	Carnivora	Mustelidae	Direct observation
Rhesus monkey	Primate	Cercopithecidae	Direct observation

5.2 Vegetation Composition: Habitats

The total number of nineteen tree species was recorded during the study period. Among them 14 tree species were recorded at Nayapati VDC and 18 tree at Gagalphedi VDC. Forest resources outside the park were poorly developed. There was no community forest in these VDCs. People depended on the park forest for firewood, fodder, timber and grazing, which causes degradation of the park forest near the boundary.

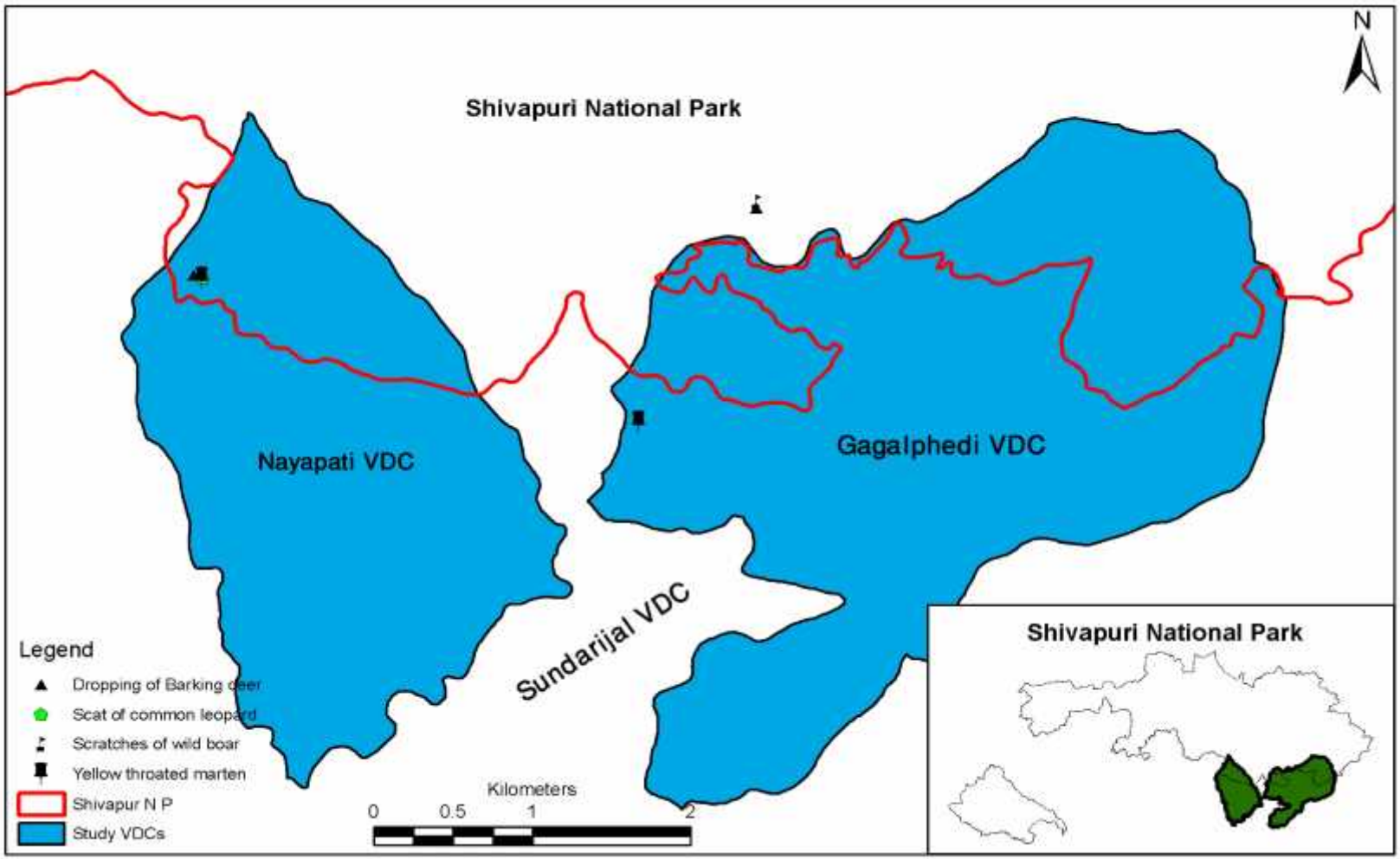

Figure 5.1 Distribution of mammals in Nayapati and Gagalphedi VDCs

a. Scat of common Leopard

b. Bones in the scat of Common Leopard

c. Pellet groups of Barking Deer

d. Rhesus Monkey behind the tree

e. Digging of soil by Wild boar

f. Vegetation sampling

Plate 5.1 Evidences of wildlife and Vegetation sampling

Table 1.2 Vegetation Characteristics of Nayapati VDC

SN	Name of species	F %	R.F	Density / ha	R.D	Relative dominane	IVI
1	*Alnus nepalensis*	20	2.94	15	4.05	8.467	15.457
2	*Myrsine capitellata*	20	2.94	5	1.35	1.605	5.895
3	*Schima wallichii*	100	14.70	70	18.91	15.02	48.63
4	*Engelhardia spicata*	20	2.94	5	1.35	2.766	7.056
5	*Lingustrum confusum*	60	8.82	15	4.05	1.883	14.753
6	*Lyonia ovalifolia*	20	2.94	5	1.35	0.80	5.09
7	*Rhus sps.*	40	5.88	10	2.70	1.927	10.507
8	*Quercus glauca*	80	11.76	20	5.40	2.335	19.495
9	*Quercus lanata*	80	11.76	120	32.43	19.08	63.27
10	*Rhododendron arboreum*	60	8.82	25	6.75	3.197	18.767
11	*Prunus cerasoides*	20	2.94	5	1.35	0.80	5.09
12	*Pinus roxburghii*	80	11.76	55	14.86	39.14	65.76
13	*Myrica esculenta*	60	8.82	15	4.05	1.883	14.753
14	*Castanopsis indica*	20	2.94	5	1.35	1.116	5.406

Table 1.3 Vegetation Characteristics of Gagalphedi VDC

S.N	Name of species	F %	R.F	Density/ ha	R.D	Relative dominance	IVI
1	*Pinus roxburghii*	80	12.90	335	56.77	66.21	135.88
2	*Alnus nepalensis*	40	6.45	10	1.69	1.10	9.24
3	*Myrica esculenta*	60	9.67	30	5.08	2.71	17.46
4	*Engelhardia spicata*	20	3.22	5	0.84	0.75	4.81
5	*Lyonia ovalifolia*	40	6.45	10	1.69	0.90	9.04
6	*Pyrus pashia*	20	3.22	15	2.54	1.35	7.11
7	*Rhododendron arboretum*	40	6.45	30	5.08	3.26	14.79
8	*Prunus cerasoides*	40	6.45	10	1.69	0.75	8.89
9	*Rhus species*	20	3.22	10	1.69	1.30	6.21
10	*Schima wallichii*	40	6.45	10	1.69	1.50	9.64
11	*Myrsine capitellata*	40	6.45	10	1.69	1.10	9.24
12	*Quercus lanata*	40	6.45	25	4.23	3.16	13.84
13	*Homalium napaulensis*	20	3.22	5	0.84	0.35	4.41
14	*Pinus wallichiana*	40	6.45	40	6.77	9.63	22.85
15	*Persea odoratissima*	20	3.22	5	0.84	0.55	4.61
16	*Castanopsis indica*	20	3.22	5	0.84	0.75	4.81
17	*Quercus glauca*	20	3.22	20	3.38	2.40	9
18	*Castanopsis tribuloides*	20	3.22	15	2.54	2.15	7.91

5.3 Total loss of crops in two VDCs: a comparison

The comparative study of major crop loss between two VDCs showed that the magnitude of crop loss was higher in Gagalphedi VDC with a total loss of Rs 58242.00 per annum - rice (Rs 28537.5), wheat (Rs 2835), maize (Rs 24822) and millet (Rs 2047.5) in Nayapati VDC. The total economic loss of Rs 93541.560 was found in Gagalphedi VDC- rice (Rs 39900), wheatA (Rs 8064), maize (Rs 33870.6) and millet (Rs 11707.5), which were the most raided crops.

Table 1.4 Comparative study of crop loss in two VDCs

	Nayapati VDC					Gagalphedi VDC				
Crop type	Total land(ha)	Expected yield (kg)	Actual yield (kg)	Loss (kg)	Loss in Rs.	Total land (ha)	Expected yield (kg)	Actual yield (kg)	Loss (kg)	Loss in Rs.
Paddy	10.47	35791	3649.5	1141.5	28537.5	8.707	21000	19404	1596	39900
Wheat	7.3	8508.5	8351	157.5	2835	8.446	9866.5	9418.5	448	8064
Maize	4.319	6429.5	5050.5	1379	24822	6.375	8155	6273.33	1881.67	33870.06
Millet	3.288	4095	3978	117	2047.5	6.11	5190	4521	669	11707.5

The correlation coefficient between distance and loss in two VDCs was negative. This showed that there was higher crop loss nearer the boundary wall and it decreased away from the boundary wall (Figures 5.2 and 5.3). Every increase in distance from boundary wall showed the decrease in loss of crop. The correlation and regression analysis of crop loss of two VDCs is shown as follows:

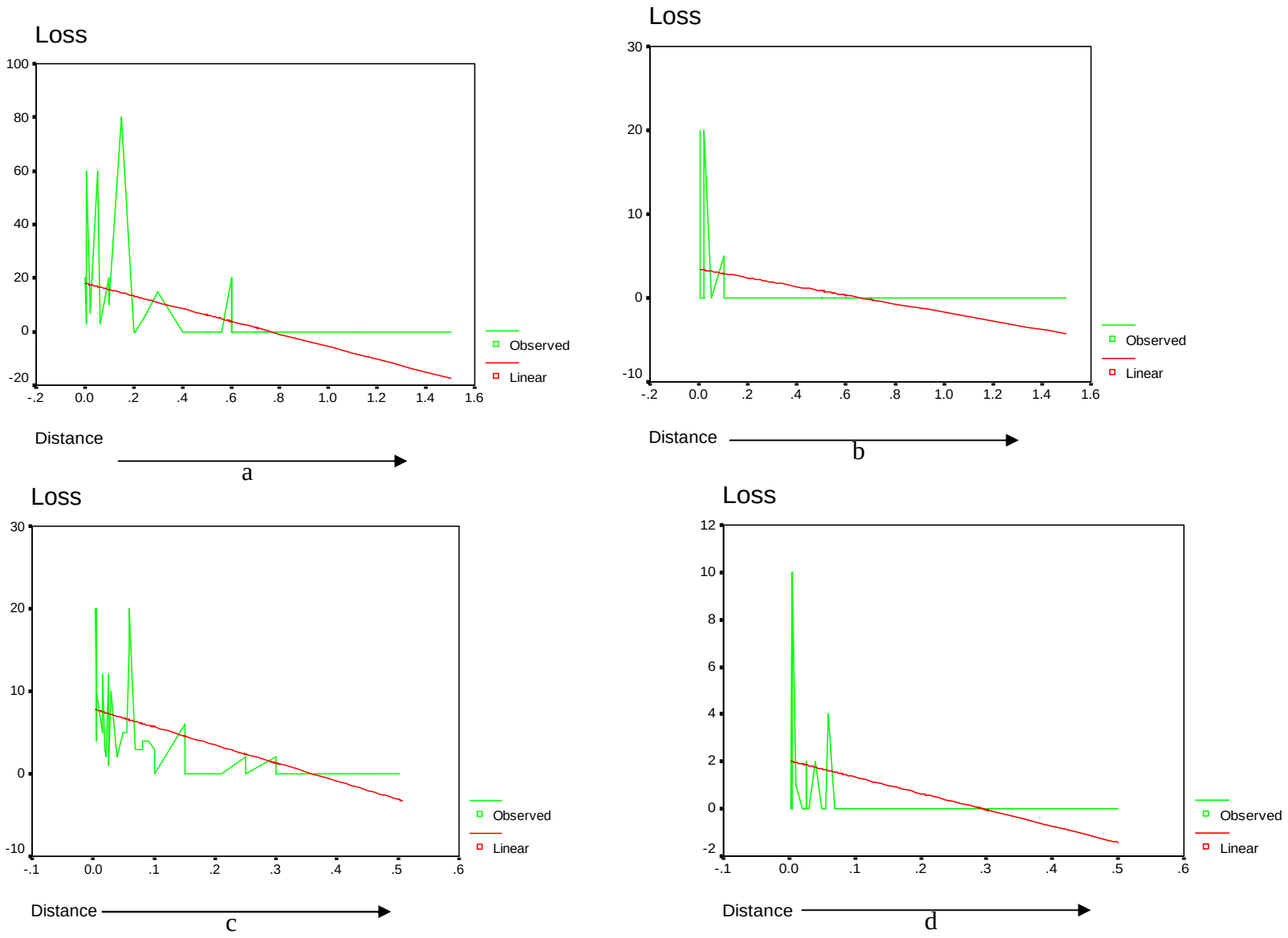

Figure 5.2 Correlation and regression analysis of Paddy (a), Wheat (b), Maize (c) and Millet (d) in Nayapati VDC

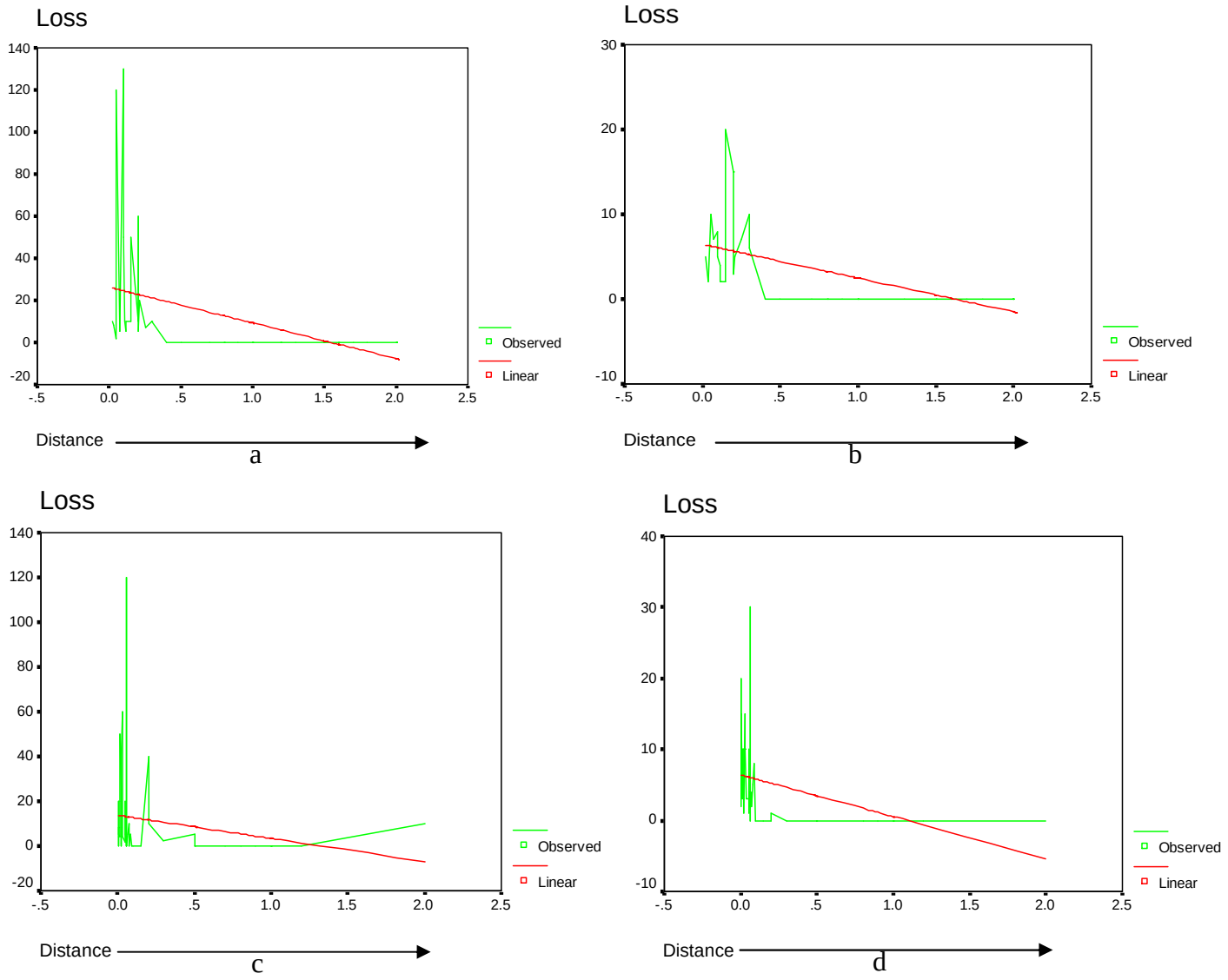

Figure 5.3 Correlation and regression analysis of Paddy (a), Wheat (b), Maize (c) and Millet (d) in Gagalphedi VDC

The student's t-test showed that there was no significant difference in crop loss for paddy, wheat and maize and significant difference in crop loss for millet at 95% confidence level.

Table 1.5 Results of Student's t-test of crop loss between two VDCs.

Name of crops	d.f	Calculated t values	P	Remarks
Paddy	85	0.7	0.05	Not significant
Wheat	77	1.929	0.05	Not significant
Maize	86	1.959	0.05	Not significant
Millet	74	3.173	0.00	Significant

5.4 Stages of Crop Damage by wild animals

The wild animals of the national park entered the crop field of farmers at different times and seasons of growing crops. The paddy was damaged by wild boar from milky stage to matured stage. Maize was damaged by wild boar and monkey when they were young. Wild boar damaged wheat from milky stage to adult stage. Porcupine finished three to four maize per day. Potato, sweet potato, yam, peanuts, millet were also eaten by wild boar.

Table 1.6 Stages of crops damaged by wild animals

S.N	Name of wild animals	crops	Stage of crop raiding	Months of attack
1.	Wild boar	Paddy	Milky to matured stage	Aug. to Sept.
		Wheat	Milky to adult stage	Apr. to May
		Maize	Milky grain to adult stage	July to Sept.
		Millet	Young to adult stage	Oct. to Dec.
		Potato	Adult stage	June to July
		Yam	Adult stage	June to July
2.	Porcupines	Maize	Shoot of adult maize plant	July to Aug.
3.	Monkey	Maize	Milky stage to ripen	July to Sept.
		Millet	Milky stage	Nov. to Dec.
		Yam	Adult stage	June to July
4.	Barking deer	Maize Millet Wheat Paddy	All stages	April to Dec.

5.5 Protection from crop depredation

In both VDCs, the local people had developed some preventive measures of crop damage from wild animals. Among the techniques the popular one was day night guard on the wood constructed locally called as chhapro. Sound production and chasing was second most applied technique.

Table 1.7 Techniques of crop protection

S.N	Preventive methods	Users (n=102)	Users %
1.	Day-night guard	40	39.22
2.	Use of fire flames	17	16.66
3.	Dog watch	27	26.47
4.	Sound production and chasing	31	30.39
5.	Trench construction	9	8.9
6.	Traps	10	9.8

5.6 Land Abandonment

The total land in Nayapati VDC was 14.789 ha and 15.0824 ha in Gagalphedi VDC among the surveyed households. The fallowing of land in Nayapati and Gagalphedi VDCs were 1.201 ha and 0.677 ha respectively among the surveyed households. Almost all land abandoned were sloppy upland locally called as Bhiralo pakho bari, where productivity was very low. There was no abandonment of land in ward number eight (Santari) of Gagalphedi VDC.

Table 1.8 Land abandoned in two VDCs

Nayapati Ward numbers and names	Land abandoned	Category of Land	Gagalphedi Ward numbers and names	Land abandoned	Category of Land
1.Raitar	0.078 ha	Sloppy land	1.Gagalphedi	0.156 ha	Sloppy land
3.Garhadol	0.339 ha	Sloppy land	2.Kuikelgau	0.104 ha	Sloppy land
8.Sanysitar	0.418 ha	Sloppy land	3.Adhikarigau	0.026 ha	Sloppy land
9.Pakhathok	0.366 ha	Sloppy land	7.Puwargau	0.313 ha	Sloppy land
			8.Santari	×	
			9.Dhakalgau	0.078 ha	Sloppy land
Total	1.201 ha		Total	0.677 ha	

Table 1.9 Percentage (%) of land abandonment due to different reasons

Reasons of land abandonment	Abandoned land in hectare	Remarks
Wildlife	1.096 (3.66%)	3.66% of land was abandoned due to wildlife
Lack of man power	0.652 (2.182%)	2.182% of land was abandoned due to lack of man power
Irrigation problem	0.078 (0.261%)	0.261% of land was abandoned due to irrigation problem
Erosion	0.052 (0.174%)	0.174% of land was abandoned due to erosion
Total	1.878 (6.286%)	

Due to different reasons 1.878 ha (6.286%) of land was abandoned among the total land 29.8714 ha of the sampled households. One of the major causes of abandonment of land was due to wildlife, which affected 3.66 % of the total land. Similarly, due to lack of man power 2.182 %, irrigation problem 0.261 %, and due to natural factor like erosion 0.17 % of lands were abandoned.

5.7 Livelihood options

The livelihood of the people of the area was based on subsistence practices. Agriculture was the main production, occupation, and source of income of 94.11% of the sampled households (n=102). But no household was self- sufficient in food crops. There were different sources of income-agriculture, livestock rearing (cow, buffalo, goat, chicken, and duck), laboring, service, business, remittance. More than 96 % of the people of the study area engaged in livestock rearing which was one of the important sources of income. About 12.74% of the people were benefited from the cash crops like potato, chayote (iskus), radish and other green seasonal vegetables. Almost 11 % of the people had jobs in government and private sectors and the same number of people had their business work like small tea shops, retailer shops and repairing shops. About 2 % of the people were involved in driving occupation and same number of people was compelled to do the labor work for the single meal.

a. Maize damaged by wild boar

b. Groundnut damaged by wild boar

c. Cutting trees inside the park

d. Reserved firewood at Tamang's house

e. Collecting firewood from the park forest

f. Cattles grazing inside the park

Plate 5.2 Crops damaged by Wild boar and impacts of locals in the park fores

a. Abandoned land

b. Questionnaire survey

c. Old man weaving hand made ghum

d. Method of night guard and sound production

e. Broken wall of the park

f. Rearing of livestock

Plate 5.3 Abandoned land, performing questionnaire survey, and mode of supplementary income, crop protection method, broken boundary wall and livestock rearing

Especially, the Tamang ethnic groups 7.84% made liquor (locally called Rakshi and chhang) and sold at Rs 600 per gallon, which was one of their income sources. The non-agricultural products such as bamboo baskets, nanglo, ghum, forest wood based utensils and other products making and selling in the market was the income source of 0.98% of the people. There was also the trend of out-migration. Especially the younger ones about 12.74% moved towards the city area in search of work But new trend of out-migration was still found low (only 2.94 %) among the sampled households.

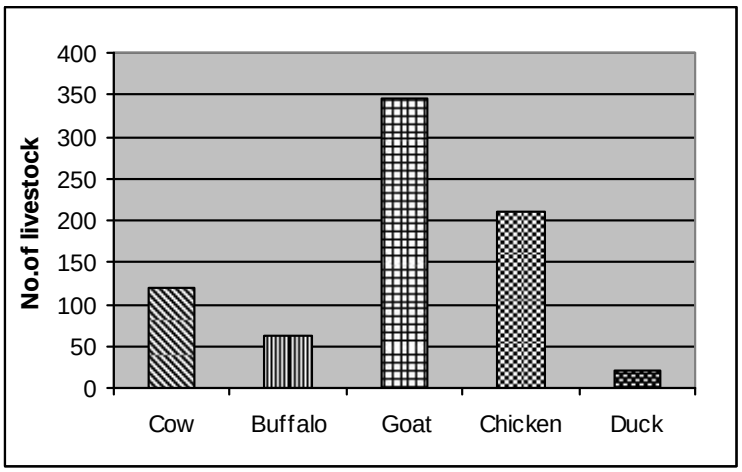

Figure 5.4 Presence of total livestock in sampled households

5.8 Impacts of locals on the park

The residents of the study area were highly dependent on the forest resources for the collection of fodder, firewood, timber and bedding materials for livestock. The imposition of the park regulations on the use of these resources by the local people had resulted in many conflicts between the local people and the park authority. These activities of the locals led to the destruction of the forest which ultimately resulted in the habitat loss of the wild animal. Livestock grazing and burning inside the park were negative impacts of locals on the park .The owners of the livestock grazing inside the park were charged of Rs 100 to 200. In 2007, 33 people were charged for their illegal activities inside the park and a total of Rs 1, 33,000 was collected from the charge according to the park authority during questionnaire.

6. DISCUSSION

6.1. Abundance and distribution of wild animals and their habitats

The present study showed the presence of lower number of mammalian species from an altitudinal range of 1540 to 2006m. Shrestha (2005) recorded a total of 22 mammalian species in the ShNP. The lower number of mammalian species in the present research could be due to human disturbances such as habitat destruction and insufficient food for the mammals. During the field survey, activities like grazing of livestock, fodder and timber collection, degradation of forest floor by making foot trail were observed. The destruction of even small forest area can push certain species into core areas, where there is less or no disturbance (Wilson 1998).

I found higher tree density per hectare in Gagalphedi VDC than in Nayapati VDC (Tables 1.2 and 1.3). In both the VDCs the species diversity was less than one by small quantity i.e. 0.963 and 0.913 in Nayapati and Gagalphedi, respectively indicating low tree diversity in both the VDCs. The difference in structure and composition of vegetation in two VDCs might be due to disturbance regimes. The area closer to the human settlements experienced more pressure in resource extraction such as firewood and fodder collection. These activities could be one of the important reasons for the loss of habitat of wild animals. In lack of adequate food and suitable habitat, the number of mammalian species was lower. To maintain viable population, large carnivores need large area with adequate prey densities and are therefore, threatened by habitat loss and fragmentation (Woodroffe and Ginsberg 1998). Chhetri et.al (2002) concluded that the collection of fodder, firewood and timber from forest led to the loss of tree species richness and tree density. The different activities of human like timber harvesting animal grazing and deforestation of forests for making agricultural land cause adverse impact on vegetation structure (Basnet 1992).

6.2 Crop Loss

Conducting the questionnaire survey in 102 households, an annual loss of Rs 1,51,783.56 was estimated. The economic loss due to crop depredation was Rs 58242.00 in Nayapati

VDC and Rs 93541.560 in Gagalphedi VDC. Soti (1995) estimated the total loss of Rs 11, 59,999.45 in Kakani VDC. Bajracharya (2005) estimated the total loss of Rs 5, 03,655.90 in Kakani, Sundarijal and Bajrayogini VDC. Bajracharya's estimation was higher than in this present study (Rs 1,51,783.00) as I concentrated my research only in two VDCs and I estimated the loss of just four crops (paddy, wheat, maize and millet). Poudyal (1995) in adjoining VDCs of the ShNP calculated that percentage of millet loss was high than other crops like maize, wheat and paddy. Purkait (2008) estimated the total economic loss of Rs 3,51,618.74 per annum in Sundarijal VDC due to crop depredation by wild pests.

The correlation coefficient (r) between two variables i.e distance and loss in two VDCs was found to be negative for all the crops that means distance and loss were in inverse relationship. There was no significant difference in crop loss for paddy ($t = 0.7$, $d.f = 85$, $P > 0.05$), wheat ($t = 1.929$, $d.f = 77$, $P > 0.05$) and maize ($t = 1.959$, $d.f = 86$, $P > 0.05$).But the analysis showed a significant difference ($t = 3.173$, $d.f = 74$, $P < 0.00$) in loss of millet between the two VDCs.

From the present study it was found that wild boar, monkey and porcupine were the main crop raiders in Nayapati and Gagalphedi VDCs. Wild boar has been described as the most notorious and destructive animal among other wild animals (Paneru 2004, Soti 1995 and Poudyal 1995) . Gurung (1997) found monkey, chital, wild boar and porcupine as major crop raiders around Gokarna forest. Adhikari (2000) reported wild buffalo and wild boar as main crop raiders in Koshi Tappu Wildlife Reserve. General lack of active defense of crop fields, and less height of boundary wall had offered easy opportunities for wildlife to raid the crops. This was because crop fields were often fully unprotected, frequently far from villages and located on forest edges. Thus, they were highly vulnerable to crop raiding by a variety of animals. The park officers also agreed with this reason to some extent and added that habit of wild animals to change the food taste during different seasons was also another cause for wild animals coming out from the park. Due to the lack of preferred food inside the park the wild animals move towards the agricultural fields which were due to livestock grazing, collection of fodder and firewood

and harvesting of timber by the locals. The locals said that they detect the loss of crops by seeing damage pattern than other methods like footprints, feces etc. The local people had adopted different techniques of crop protection from wild animals which were found less effective (Table 1.7).The day night guarding was labor intensive and one had to give up their whole night sleep. The local people reported many complaints about crop loss in the ShNP office. However, all the villagers expressed their dissatisfaction against the park authorities for not taking any action in favor of their complaints. There was no compensation given to the people whose crop had been lost due to park animals. According to the park authority, there cannot be compensation program implemented before the declaration of buffer zones in the ShNP.

6.3 Land Abandonment

A total of 1.878 ha of land was abandoned in the Nayapati and Gagalphedi VDCs. There were direct and indirect factors behind the abandonment of land. Since the ShNP lies in the midhill, almost all the land adjacent to the boundary line of the ShNP was sloppy. In sloppy area, there were both irrigation and erosion problems which caused 4.15 % and 2.77 % of land abandonment of Nayapati and Gagalphedi VDCs. The low height stone walled boundary wall broken at many places made the wildlife easier to enter the village. Almost 3.66 % of the land was abandoned due to crop depredation by wildlife. There was no maintenance of the broken wall which indicated lack of effective conservation management of the park. New generations had left their parents alone at home. Being old they could not work in the field, more than 2.182 % of the abandoned land was due to the lack of man power. Indirect reason such as shady effect could be one of the reasons for the land abandonment but people did not want to show this reason. Though there was loss of crops by the wild animals, some of the local people did not abandon their land because of limited or insufficient agricultural land.

6.4 Impact of conservation on livelihoods options

The people living in and around national parks and protected areas have interacted with them in multifarious ways. Some of them have built an ecological relationship with the park, where as in certain other cases the existence of these conservation areas has been

questioned because of the growing conflict over different matters. People of the study area were largely dependent on the forest resources. The local people entered into the park forest for collecting firewood, fodder, and bedding materials. The local people use more forest resources than from their farm field. If the park staff found them collecting the firewood, they were charged Rs 500. Mostly, the ethnic group, such as Tamang was found frequently visiting the forest because almost 8 % of their livelihood option was making liquor, which required a large amount of firewood. Government service, labor work and business / trade of each of 11% of the households were the next sources of income. Livestock rearing and agriculture were the main occupation of more than 96% and 94%, respectively of the household. Overall, the conservation programs of the ShNP have not changed the livelihood of the people of Nayapati and Gagalphedi VDCs. Unlike, some people have claimed that a decision to establish park and protected areas has pushed the livelihood of the local people who were depending on the forest resources towards more vulnerability (Phuyal 2003).

7. CONCLUSION AND RECOMMENDATIONS

The study conducted during November 2007-August 2008 in two adjoining VDCs-Nayapati and Gagalphedi of the ShNP showed few mammalian species as I recorded five mammalian species belonging to three orders and five families. The main wildlife species included barking deer, common leopard, wild boar, rhesus monkey, and yellow throated marten. From the vegetation sampling in their habitats nineteen tree species were recorded. Crop depredation was the major problem affecting the local people particularly living adjacent to the ShNP. Wild boar, monkey and porcupine were the main crop raiders in Nayapati and Gagalphedi VDCs. An annual loss of Rs 1,51,783.56 due to the crop depredation by wild herbivores was estimated. The comparison of the crude economic loss between two VDCs showed that people living in Gagalphedi lost more than those in Nayapati. A total of 1.878 ha of land was abandoned due to different reasons in these VDCs, where the loss of crops such as paddy ($t = 0.7$, $d.f = 85$, $P > 0.05$), wheat ($t = 1.929$, $d.f = 77$, $P > 0.05$) and maize ($t = 1.959$, $d.f = 86$, $P > 0.05$) did not differ significantly. However, there was a ($t = 3.173$, $d.f = 74$, $P < 0.00$) significant difference in loss of millet between the VDCs. People were applying different conventional methods of crop protection from wild animals but none of them was effective.

Agriculture and livestock rearing were the main livelihood options adopted by 94.11% and 96.07% of the local people. Other supplementary activities such as government services, labor work, and business / trade supported their livelihood. The collection of firewood, fodder, timber, bedding materials, and livestock grazing inside the park forest was the main issues of conflict between the locals and the park authority. These sorts of activities severely damaged the park resources and jeopardized the accomplishment of the set objectives of the park management. The participation of the local people in biodiversity conservation was important particularly in designating the adjacent areas as buffer zone to maintain the wildlife habitat intact and to meet the legitimate and growing need of the local people on sustainable basis.

The Present study derives following recommendations;

- Declare buffer zones in the ShNP to reduce conflict between the local people and wildlife.

- Increase the height of boundary wall around the park with immediate maintenance in broken places.
- Resolve the wildlife-people conflict by compensation programs for the crop loss due to wildlife.
- Encourage local people to grow less preferable crops and other varieties of unpalatable crops to reduce the crop loss from wildlife.
- Alternative sources of energy like biogas, solar energy, improved chullho etc should be introduced in order to reduce firewood consumption.
- Identify alternative sources of income generation especially for ethnic groups to uplift their livelihood status.
- Provide technical support to farm medicinal plants and Non Timber Forest Products in the abandoned land.

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9. ANNEXES

I. Vegetation: Sample Survey Data Sheet

(Shanta Adhikari 2007/2008)

Serial no.:…..

Location…… Plot code…….

Aspect……. Latitude……..

Altitude……. Longitude……

Vegetation type……. Management type……

Table. Tree (DBH >10 cm)

SN	Name of species	DBH cm	Height (m)	Stem	Stand	Remarks

II. Indirect Signs of Mammals: Data Sheet

(Shanta Adhikari 2007/2008)

Date……..

Serial no. ……

Location……

Aspect……..

Disturbance Gradient……

SN	Sign type	Sign site	Age	Number	Habitat type	GPS reading	Elevation	Remark

III. Individual Questionnaire Survey For wild Mammal

(Shanta Ahikari 2007/2008)

Date……..

Serial no……..

Name: ……..

Sex: ……. Age: …… VDC: ……. ward no…….

Education: Agriculture:

1. What wild mammals have you seen in Southern side of Shivapuri National Park?

SN	Name of mammal species	Abundance	Location	Remark
1.	Barking deer			
2.	Wild boar			
3.	Common leopard			
4.	Clouded leopard			
5.	Jungle cat			
6.	Leopard cat			
7.	Large civet			
8.	Himalayan black bear			
9.	Hanuman languor			
10.	Rhesus monkey			
11.	Himalayan Goral			
12.	Brown - toothed shrew			
13.	Chinese pangolin			
14.	Fawn colored mouse			
15.	Golden Jackal			
16.	Himalayan Squirrel			
17.	House rat			
18	Indian Hare			
19.	Porcupine			
20.	Royal's pica			
21.	Small Indian mongoose			
22.	Yellow throated marten			

IV. Questionnaires for Household Survey

(Shanta Adhikari 2007/2008)

Respondent Name…….

Age: ……..

Sex: ……..

Occupation: ……..

VDC:……Ward no: ……..

Education: ……

1. How much land do you own?(Ropani /Anna)

   Khet ……. Bari…….

2. How far is your land from the Park boundary?.....

3. Do the wild animals of the Park raid crop in your land? Yes /No. If yes

Which wildlife	Raid crops	Most preferred crop	Time of raiding	Unpreferred crop	Frequency of visit	
Wild boar						
Monkey						
porcupine						

4. Which crops do you grow in your land? And what is their average yield?

Crop types	Season	Expected yield	Actual yield	Loss due to wildlife	Damage stage
Paddy					
Wheat					
Maize					
Millet					

5. Have you abandoned any land due to wildlife? If yes how much……..and the land is either productive or not?

6. What are your main livelihood options?

   a ……..

b ……..

c ……..

6. Do you raise livestock? Yes /no. If yes

Types of livestock	Numbers
1.Cow	
2.Buffalo	
3.Goat	
4.Chicken	
5.Duck	

7. How you raise your livestock?

a. stall feeding b. Open grazing with attendant c. Open grazing without attendant

8. Do you get compensation for the crop loss from the Park?

9. What are the preventive measures you are using to control the wildlife damage?

a. Guarding day night

b. Use of wire flames

c. Dog watch

d. Sound production and chasing

e. pit construction

f. trap

10. Are these techniques effective?

11. How did you know the crop damage by wild animals?

a. Footprint

b. Feces

c. Damage pattern

12. Where do you complain this problem?

13. Do you have community forest?

a. Yes b. No

14. In your view why do the animals from the Park enter the crop field?

a. Low quality of boundary wall

b. open fencing

c. inadequate food inside the park

d. liking of field crop

15. What do you suggest to control this problem?

a. Translocation of the animal

b. Compensation

c. Others

16. Do you enter the Park Forest for fodder, firewood and timber?

17. What are the impacts of this National Park in your livelihood?

18. What you would like to suggest give for the Park Management?

V. Questionnaires for the officials

1. What is the condition of Shivapuri National Park? What types of improvements have been done since its establishment?

2. What are the main reasons to create conflict between park authorities and local people?

3. What are the problems faced by the Shivapuri National Park due to local people?

4. Have you got any complains of crop damage by wild animals from adjoining villagers?

5. In your view why do the park animals come out of the park and do the damage?

6. Does the park give any compensation for the loss of the crop?

7. What kind of action do you take when the local people entered into the Park Forest?

8. In order to reduce the wildlife damage what are the control measures adopted by the park management?

9. What suggestions would you like to give to avoid damage caused by wild animals?

10. Is Shivapuri National Park providing alternate sources of livelihood options to the local people?

11. When will be the declaration of buffer zone areas of the Shivapuri National park?

VI. Unit conversion

1 Ropani = 0.0523076 Hectare

1 muri = 20 pathi

Paddy = 1 pathi = 3 kg

Wheat = 1 pathi = 3.5 kg

Maize = 1 pathi =3.5 kg

Millet = 1 pathi = 3 kg

VII. Monetary value of different crops in the study area (2007/2008)

1 kg of paddy = Rs 25

1 kg of wheat = Rs 18

1 kg of maize = Rs 18

1 kg of millet = Rs 17.50