

1 INTRODUCTION

1.1. Park - People

Wildlife is something people can enjoy and benefit from everyday, but wild animals can sometimes become a nuisance. As human populations expand and natural habitats shrink, people and animals are increasingly coming into conflict over living space and food. The problem is limited resource and population growth (Bhatta *et. al.*, 2064 B.S.).

In a world, where the biological environment and socio- cultural systems are changing rapidly, park conflicts are inevitable. In recent time, the advent of few resource intensive activities and the tremendous pressure exerted even by traditional activities because of an increased human population has contributed to the extensive destruction of wildlife (Dang, 1991). According to Lewis (1992), parks and protected areas are havens of tranquility and peace. Parks are also places where conflicts occur, often involving the protection of park resources on the one hand and local development needs or over use of the park on the other. The conflict between Cahuita National Park and local people in Costa Rica (Kutay, 1991), between Amboseli National Park and Masai Pastoralists in Kenya (Western, 1982), between Gir National Park and Maldhari people in India (Raval, 1991) are world famous. Not only in developing countries, but in most developed countries like USA, the conflict occurred between Havasupai people and Grand Canyon National park (Hough, 1991). In developed world, nature of conflict is different however; still there is conflict (Bhandari, 1998) due to poverty and population growth, protection laws have caused park- people conflicts (Heinen 1993; Lehmkuhl 1998).

Park- people conflict is not particular in Nepal; it can be seen in most of the developing countries. Although the country has been highly successful in conserving indigenous fauna and flora, most of the national parks and reserves of Nepal today suffer from the incipient conflict between local people and park management (Upreti, 1991), but the extent of conflicts vary among different reserves. Many of these conflicts are of natural as well as human origin. Crop damage, depredation of livestock, human toll and difficulties and resettlement arising from park regulation are the basic causes of park people conflicts (Mishra, 1980) which

jeopardize the accomplishment of set objectives to be met by park administration and management (Neumann and Machlis, 1989).

The local people who once were enjoying free access to areas henceforth covered by parks and were able to meet their needs from inside resources, now no longer have legal access. Local people have seen the park as an attempt by the government to curtail their access to their traditional rights of resource use (Nepal and Weber, 1992). However the park becomes a very good source for villagers to fulfill their resources needs through venturing into illegal poaching, logging and hunting, all of which are directly conflicting with the park's objectives (Mishra 1982; Milton and Binney 1980).

In Nepal, crop damage is very common along the immediate periphery of national parks and in the Terai. Crops damage by wildlife including birds is a common problem in the mid-hills of Nepal. News of monkeys raiding maize fields is commonly featured in local media. To date, concerned authority has not suggested a single viable solution to the crop raiding problem (Chalise 2001, 2005). Although Shivapuri National Park (ShNP) is not the only protected area in Nepal, where conflicts of a serious nature exist and hence put the areas natural resources at risk, it provides a classic example of disputes between people and administration over park resources for various kinds of use. Since such conflicts play a crucial role in the conservation of park resources, they can't be ignored. The locals living in and around the park have been complaining that they are being denied access to and use of natural resources. Caught between wildlife (wild boars, porcupines) wreaking havoc with their crops and the army protecting the park, they say, they increasingly feel like prisoners. Their mobility has been severely restricted after sunset and before dawn. Moreover the locals, who have depended on the nearby forests for wood and non-timber forest products for generations, can now be detained or/and fined, if caught doing so. Complaints have been lodged against the Shivapuri communities for polluting the water sources. It has been widely understood that the future of wildlife can only be safeguarded by striking a balance between conservation and human needs (Shrestha, 1994). It demands for considering alternative means to accommodate people's need by integrating conservation prescriptions in protected areas management.

People- park conflict has many dimensions. A number of different kinds of people- wildlife conflict can be distinguished. These include:

- J Attack on people (wild predators)
- J Attack on livestock (wild predators)
- J Crop- raiding (wild herbivores and birds)
- J Forestry damage (wild herbivores)
- J Competition for wild forage with human gathers, with livestock or with game animals (wild herbivores),
- J Competition for prey with human hunters (wild predators),
- J House and other building infestations (roosting birds, rats, mice etc., and threats to other natural species and to biodiversity, i.e. “environmental pests” (Knight 2002: 2).

1.2. Research Hypothesis

During this survey period, two different hypotheses were set. There was no association between the crop losses per wild pests and another there was significant damage seen inside and outside the study sites.

1.3. Objectives

The general objectives of the study are to explore the conflict between park and people and its management strategies applied to the Sundarijal VDC in and around the park. The specific objectives are,

- i. Identification of wild pests in different sites of the VDC,
- ii. Identification of park impacts,
- iii. Assessment of crop and livestock loss due to wildlife,
- iv. Identification of human impacts on the park,
- v. Identification of the protective measures applied by the locals.
- vi. Recommendation for the management and conservation program to reduce park people conflicts.

1.4. Justification and Limitation

Due to public pressures of heavy settlements within and around the ShNP, threats and challenges are found along with conflicts especially for forest products and water use, crop raiding, livestock grazing and their depredation due to soil erosion, road construction, excessive sand and stone quarrying etc. There have been plans, on and off, to relocate the settlements that remain inside the park boundaries, because human and agricultural waste (chemical fertilizers, insecticides etc) generated by the villages have polluted the water source in Sundarijal.

The aim of this study is the assessment of those factors that are raising the issues of conflicts between park and its people which is now a more severe problem in the conservation of biodiversity in ShNP. This complexity is emerging as a main factor of ecological deterioration in the conservation and protected areas. In fact, without the help of local people, no conservation areas can be saved. So the study of conflict and its management is necessary in order to suggest the key of the problems and build up a harmony between the park and the local people.

Constraints of funding and the circumstances of the country are the major limits of the study. The data is based only on diurnal survey. The distributions of pests only in certain sites and altitudes of the Sundarijal VDC were taken. Since the animals were not seen properly, field visit wasn't achievable during rainy seasons (August - September)

2 STUDY AREA

2.1. Location and Physiography

Shivapuri is the second highest peak among the hills surrounding the Kathmandu Valley. It is 2,732 m at its peak with numerous sharp ridges radiating to all sides. It is situated towards the north of the Valley, due to its strategic location and convenience, Shivapuri was proclaimed as a watershed area supplying more than a million liters of natural spring water to the city. After Shivapuri experienced several problems concerning soil erosion as a result of deforestation, over- grazing, cultivation on steep slopes etc.; reducing the quality and quantity of the water supplied, Government of Nepal initiated a program to protect Shivapuri and its adjoining areas as a watershed and wildlife reserve in 1975. ShNP, the youngest National Park in Nepal, initially was established as Shivapuri Watershed Reserve in 1976, in 1982 the Shivapuri Protected Watershed Area was declared under the Soil and Watershed Conservation Act, and in 1984 it was declared as the Shivapuri Watershed and Wildlife Reserve. At the same time the Shivapuri Watershed Area Development Board was converted to Shivapuri Watershed and Wildlife Reserve Development Board, which was abolished from the decision of Council of Ministers of Nepal's Government in 2000 and later on followed with the declaration of the National Park in 2002.

The total area of the park is 144 km². The park has average expansion of 9 km north-south and 22 km east-west. It ranges from 1,000 m (Likhu Khola) to 2,732 m (Shivapuri Peak) in elevation (SWWR, 2057). The park lies between 27° 45 ' to 27° 52 ' N Latitude and 85° 15 ' to 85° 30 ' E Longitude.

The park lies within three districts of Nepal's Central Development Region including the northern part of Kathmandu District, the southern part of Nuwakot and the western part of Sindhupalchowk (Bajracharya, 2005). The park is surrounded by 23 VDCs of Kathmandu (Bajrayogini, Baluwa, Chapali Bhadrakali, Gagalphedi, Jhor Mahankal, Jitpurphedi, Kabhresthali, Lapsiphedi, Nayapati, Sangla, Sundarijal and Budhanilkantha); Nuwakot (Chhap, Kakani, Samundra Devi, Likhu, Okharpauwa, Sikre, Sunkhani, Talakhu and Thanapati) and Sindhulipalchowk districts (Bhotechaur and Heibung). The settlements like

Mulkharka, Okhreni, Kune, Chilaune villages of Sundarijal VDC and Nagi Gumba Complex of Baluwa VDC lie inside the park (IUCN, 2004).

A boundary wall of 111 km was constructed around the reserve and settlements within the area evacuated, establishing the Nepal Army here to safeguard the reserve and the mixed hardwood forests of oak, pine, birch, rhododendron. The wall has collapsed or damaged at 514 sites mainly because people break them or hasten the process of collapse (Anon, 1992).

2.2. Physical Diversity

2.2.1. Geology

Shivapuri National Park is an excellent representative site of the ecosystems of middle hills of Nepal. Geologically the park lies in the inner Himalayan region. The dominant rocks are gneiss and migmatite 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. Entire area is characterized by its steep topography. More than 50% of the area has greater than 30% slopes. In several spots soil erosion is a serious problem. Erosion hazard is very high in the northern slope. Landslides, gullies and stream bank erosion, both natural and man-induced are found all over the area (SWWR, 1999).

2.2.2. Climate

Shivapuri lies in a transition zone between sub-tropical and temperate climates. Average monthly maximum temperature is 26 (°C) in mid May to mid June and minimum of 4.25 (°C) in mid December to mid January in ShNP (Fig. 3). Average monthly maximum relative humidity (morning) is 88.87% during August-September and maximum (evening) is 89.87% during July-August (Fig. 4). Average annual rainfall is 435.86 mm which is maximum during June-August in ShNP (Fig. 5). Typically over 80 % of the annual precipitation is received during the rainy season, which normally occurs between mid June and late September (Wildlife Week, 2061). Snow falls occasionally on the Shivapuri peak in January. Towering over the Kathmandu Valley, ShNP is a fog-free zone. It receives regular westerly winds blowing from the Trishuli River Valley (Paneru, 2004).

Figure3: Average monthly maximum and minimum temperature (°C) of the three meteorological stations of ShNP (2005-2006)

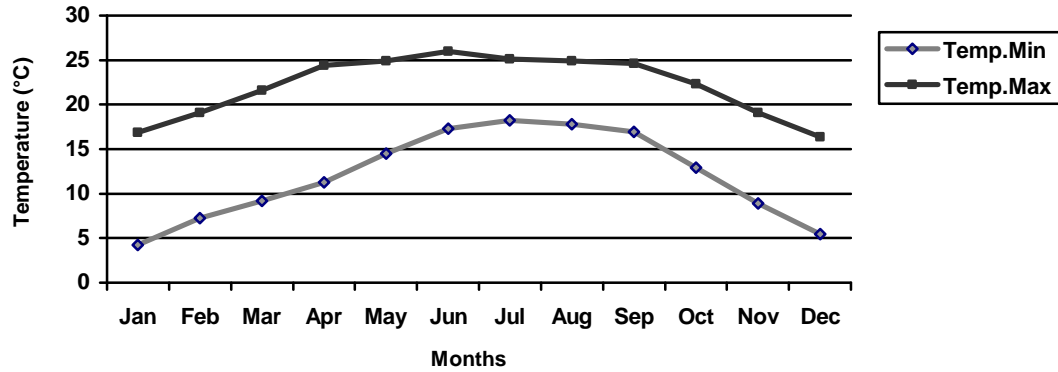


Figure 4: Average monthly morning and evening relative humidity of the three meteorological stations of ShNP (2005-2006)

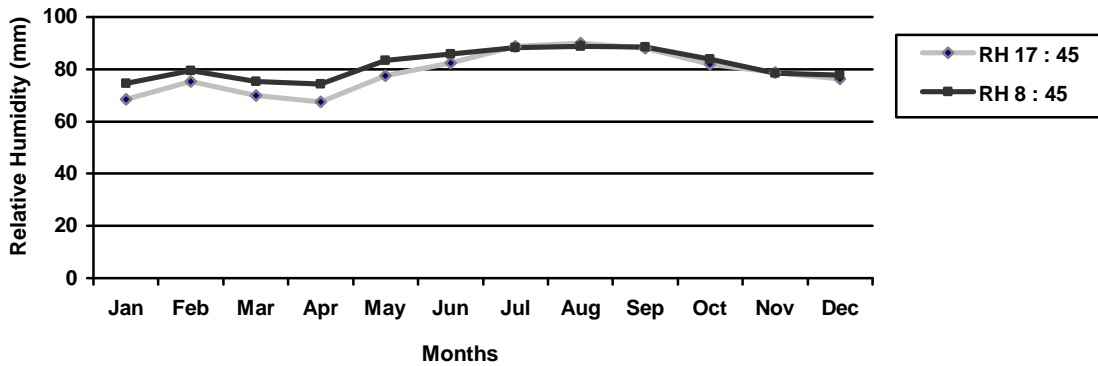
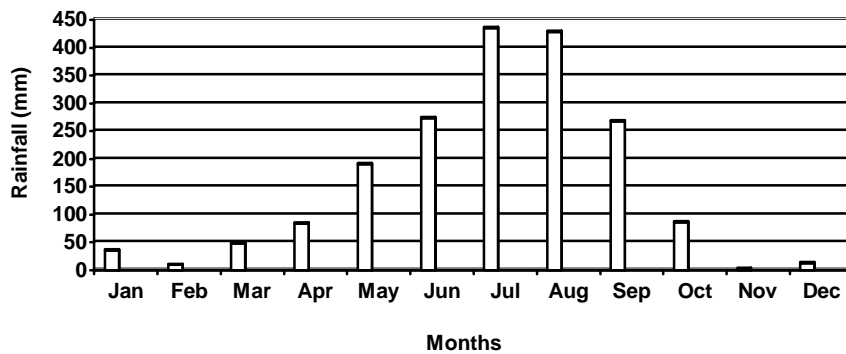


Figure 5: Average monthly rainfall of the three meteorological stations of ShNP (2005-2006)



2.3. Biological Diversity

2.3.1. Vegetation

The park comprises the sub-tropical to lower temperate vegetation. The park harbors 2,122 flowering plants (41% out of 5,067 identified in Nepal) with 16 endemic (Shakya *et.al*, 1997 and Shrestha and Joshi, 1996). Vegetation consists of a variety of natural forest depending on altitude and aspect including pine, oak, rhododendron and so on (DNPWC, 2004). The park comprises mainly four forest types (SWWR, 2002; Nepal, 2005) namely,

- a) Lower mixed hardwood forests of *Schima* and *Castanopsis* with *Alnus nepalensis* at the altitude ranging from 1,000-1,500 m.
- b) Chirpine forests dominated by *Pinus roxburghii* at the altitude ranging from 1,000-1,600 m. with other *Castanopsis indica*, *Myrica esculanta*, *Pyrus pashia*.
- c) Upper mixed hardwood forests of Rhododendron, *Aesculus* sp., *Betula* at the altitude ranging from 1,500-2,700 m. with other species, *Acer* sp., *Juglans regia*, *Fraxinus* sp., *Salix* sp., *Quercus* sp., *celtis* sp.
- d) Oak forests from 2,300-2,700 m. altitude with dominant plants *Quercus semicarpifolia*, *Michelia champaca*, *Eurya acuminata*, *Ilex dipyrens*, *Rhododendron arbreum*, *Symplocos* sp.

More than 35 species of NTFPs including 129 species of mushrooms including *Lactarius pleurotoideus* a new species to science identified by Hemanta Bhandari were recorded for the first time in Nepal (SWWR, 2002).

2.3.2. Wildlife

Mammals:

It is reported that the park harbors 20 species of mammals including 10 CITES listed Goral, jackal (*Canis aureus*), Rhesus Macaque (*Macaca mulatta*), Common Langur (*Presbytis entellus*), Common leopard (*Panthera pardus*), Clouded Leopard (*Neofelis nebulosa*), Yellow Throated Marten (*Martes flavigula*), Tibetan Black Bear, Wild Boar (*Sus scrofa*), Indian Crested Porcupine (BPP, 1995). The common species are Wild Boar, Indian Crested porcupine, Indian hare (*Lepus nigricollis*) and squirrel, pangolin (*Manis* sp.) etc.

Birds:

Altogether 311 species of endemic and migratory birds (117 species including 19 species are listed in CITES list named White Backed Vulture, Himalayan Griffon Black Vulture, beard Vulture (Nepali H. S. and Suwal R. 2007), Dark Kite, Hen Harrier, Northern Goshawk, Sparrow hawk, Sikhra, Common Buzzard, Asian Black Eagle, Steppe Eagle (BPP, 1995). More over Falcon severus, Common Tailor bird (*Orthotonus sutorious*), Orange- bellied Leaf bird (*Chloropsis hardwickii*) are found. The common birds are Green Magpie, Flycatcher, Bushchat, and White rumped vulture, Eagle, Cuckoo, Bulbul, Blue Robin, Swift, Warbler and Babbler, Kalij Pheasant.

Others:

Also Bhaiya Khanal identified 150 species of Butterfly mostly Nymphalids which includes *Ypthima confusa* which is endemic to Nepal Himalayan region along with several other rare and uncommon species such as *Troides aeacus*, listed on the IUCN's Red Data Book (Kattel, 1993). The rare relict Himalayan Dragonfly (*Epiphebia laidlaw*) is also found. Instead possibility of occurring several micro faunal resources is prominent in this park. Numerous lizards can be seen in around the 97.36 sq. km of SWWR. Thus making Shivapuri a paradise for flora and fauna and one of the few National Parks in the capital around the globe (SWWR, 2002).

2.4. Water Resources

Shivapuri is one of the main sources of drinking water for Kathmandu Valley and, of course, a quarter of the Valley's drinking water supply comes from here. About 30 million of the 200 million litres of water that flows out everyday from Shivapuri are tapped from numerous streams, including the Bagmati and Bishnumati, which originate in the Shivapuri hills. The water is collected into reservoirs and fed into pipelines to Kathmandu, and it is usually good, clean water compared with some of what passes for potable water in the capital. But that is starting to change, just as it did about 25 years ago. Most of the water originating from the headwaters in the Shivapuri watershed is clean and unpolluted, Hydrologically the park is important for irrigation; traditional grinding mills as well as it has wider scope for ecological value. Rivers, ponds, marshlands and reservoirs are the major wetlands in this park.

Preliminary visit shows that about 0.24 km² (0.17%) is covered by all the wetland in this park. The major wetlands contributing recharge of the fresh water to Bagmati, Sunkhosi and Trisuli rivers. The secondary streams of the Bagmati river systems are Kageshwori Khola, Nagmati Khola, Bagmati khola, Syalmati Khola, Manilingeshwori Khola, Dhunge Khola, Boudeshwor Khola, Alle Khola. Similarly Chisapani Khola, Rholche Khola, deurali khola, Kaknani khola are the major streams of the Likhu Khola (Trisuli river system) and Neu Khola, Thado Khola, Haibung khola, Chisapani Khola are the major streams of Indrawati (Sunkoshi river system) (SWWR, 2057).

2.5. Socio-culture and Socio-economic status

2.5.1. Land use

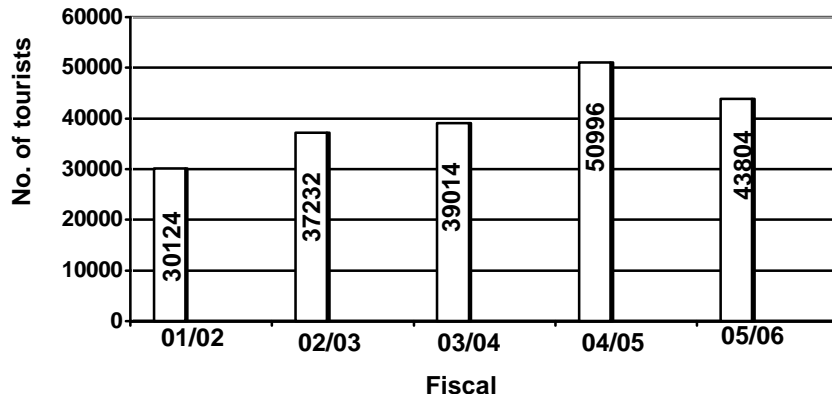
The land use pattern in and around ShNP is predominated by forest (36.6%), followed closely by agriculture (36.2%), shrubs (16.1%), grassland with shrubs (4.0%), landslides (0.4%), settlements (0.8%), riverine features (0.1%) and abandoned lands (0.9%). Settlements such as Kune, Okhrene, Chilaune and Mulkharka are within the park. The trouble is, the total population affected by or dependent on the ShNP is 95,837 from 18,235 HHs. It is a food shortage area with 25% population suffering from food deficiency for 4-10 months each year (IUCN, 2004).

2.5.2. Eco-tourism

Since Shivapuri National Park is easily accessible from Kathmandu city, it attracts many visitors and tourists. Trekking is the most common attraction for visitors and tourists. There are many popular trekking routes within the park. Trekking routes to Gosaikunda, Helambu, Nagarkot and Langtang National park also pass through the Shivapuri peak. Likewise, many visitors visit the park for religious purposes.

Almost 43,804 people including 39,208 Nepalese and 4,596 foreigners during the fiscal year (2005/06) visited the park which is an increase of previous years except 04/05 (DNPWC, 2005/06) (fig. 6).

Figure 6: Status of tourist flow in ShNP (2001-2006)



Economically, tourism is a major source of earning foreign currency in the developing country like Nepal. Protected areas in the country generate revenues from different sources such as by issuing filming license, entrance fees, and royalty from hotels and lodges and regulating hunting of wild animals.

2.6. Intensive study site (Sundarijal VDC)

2.6.1. Background

Sundarijal is one of the 57 VDCs of Kathmandu District. It is situated about 15 km north- east of Kathmandu Valley. The VDC is named after the Hindu goddess ‘Sundarimai’. It lies between 27° 46' N Latitude and 85° 25' E Longitude, at the elevation of 2,200 m of ShNP. The total area of this VDC is approximately 35 sq.km. The VDC contains altogether 9 wards and villages with (1-6) inside and (7-9) outside the park.

2.6.2. Human ecology, Agriculture and Land use patterns

The total population of the VDC is 2,499. There are only 491 households in the VDC (Tab.1). Households are not more than 3.6 km away from park edge. Ethnic groups are predominantly Tamang (64.10%) and majority of people (51.94%) are Hindu (CBS, 2001).

Table 1: Total population of Sundarijal VDC

Wards	Villages	Household	Total population	Male	Female
1.	Kune	32	167	78	89
2.	Okhreni	110	545	275	270
3.	Chilaune	51	236	116	120
4.	Mulkharka	56	255	124	131
5.	“	39	205	106	99
6.	“	33	172	90	82
7.	Mahankal	40	198	103	95
8.	“	43	303	171	132
9.	Ghattekholā	87	418	207	211
Total		491	2,499	1,270	1,229

Source: CBS, 2001

Table 2: Households operating small scale non-agricultural economic activity by type of activity for VDC

Total no. of households	Having economic activity	Not having economic activity
491	366	125

Types of economic activities

Manufacturing	13
Trade / business	91
Transport	5
Service	214
Others	43
Total	366

Source: CBS, 2001

90 % of the land of the VDC is covered by forests and hills while the rest 10 % is under the active cultivation (Tab. 3). Farming is also of two types depending upon the fertility of land. The fertile and more or less irrigable land pattern called as *khet* (some what flat and fertile land) and less fertile and sloppy land called as *bari*. In *khet*, paddy and wheat are cultivated in alternate fashion to each other where as in *bari*, maize and millet are cultivated alternatively. Different types of crops are grown in different months (Annex IV) (Local villagers).

Table 3: Major land use area of VDC

S.N.	Land use / type	Area (ropani)
1	agriculture	1,075.00
2	Forests & hills	9,676.13
	Total	10,752.13

Source: CBS, 2001

Almost 90% of the VDC comes under the upstream areas, where the Tamang communities predominate. They grow wheat, maize, millet, potato, arum and sweet potato in the upstream areas. However, some vegetables and barley are also cultivated. Most of them are engaged in agriculture, hoarding livestock. While some are seen involved in small business like shops, laborer and job holder in the service sector such as army.

In the downstream areas, paddy wheat, barley, maize, potato, vegetables and millet are grown. The majority of the people are Chhetris, Brahmins and Newars. Some of them are involved in governmental and non - governmental services while most of them are involved in agriculture, business, hotels and nursery, guide etc. The economic condition of the VDC is not strong. No major industry is present in this area. Animal hoarding is also not done in large farming scales. No modern technology of farming has been yet introduced. The people are using traditional means of farming agricultural land. Only 50% can read and write but they aren't fully literate. Thus lack of awareness about education is seen.

3 LITERATURE REVIEW

Wildlife - Human conflict is one of the main threats to the continued survival of many species, in many parts of the world; and is also a significant threat to many local human populations. Wherever there, establishment of protected area, there is conflict with local people. Local people are living in the nearby areas of wildlife habitat and the human population is increasing by 3.5% annually (Bhandari, 1995). According to Adhikari (1998), the local people's perceptions related to scarcity of firewood and lack of grazing land, fodder scarcity, food deficit, crop damage by wild animals, lack of agricultural land and irrigation, lack of timber, lack of settlement area are the main problems reported by the people. Death of animals and crops disease is other problem.

There are many wildlife-human conflict studies done in different national parks and conservation areas of Nepal, all of them show major problems like crop and livestock depredation, human harassments and the local people's impact on the parks.

3.1. Crop and livestock depredation

In Chitwan National Park, wild ungulates such as rhinoceros (*Rhinoceros unicornis*), wild boar (*Sus scrofa*) and spotted deer (*Axis axis*) are the chief depredators of rice, maize and mustard (Jnawali 1989, Mishra and Margaret 1991, Sharma 1991 and Regmi 1999). Upreti (1995) found rhinoceros as a number one crop raider followed by spotted deer (*Muntiacus muntjak*), wild boar and parakeet. (Bhattarai and Basnet, 2004) estimated that rhinoceros alone caused 70.7% crop damage and the lowest 0.2% by spotted deer (*Muntiacus muntjak*). Jnawali (1989) concluded one horned rhino in Sauraha caused the highest economic loss 27.6% of Rs. 17,200 within a distance of 500 m. to paddy. Tiger (*Panthera tigris*) and leopard (*Panthera pardus*) reported by (Mishra and Margaret 1991, Sharma 1991) and Upreti (1995) reported jackal, Indian fox (*Vulpes vulpes*), common mongoose (*Herpestes spp.*) and jungle cat (*Felis chaus*) as livestock lifter in Chitwan.

In Bardiya National Park, wild boar (Baral, 1999), rhinoceros, blue bull (*Boselaphus tragocamelus*) (Khatri, 1993), elephant (*Elephas maximus*) (Adhikari, 2000), monkey (*Macaca mulatta*) and spotted deer were crop raiders and raided varieties of crops, such as rice maize,

wheat, lentil and vegetables grown in kitchen garden (Jnawali, 2002). Khatri (1993) found crop damage by nilgai (*Boselaphus tragocamelus*) averaged to 8.3% of the total crop loss caused by wild animals. Baral (1999) found 52.73% crop loss in Thakurdwara and 47.27% loss in Shivapura with the highest crop raid occurred to paddy followed by potato, maize, wheat, musuro and yam. Tiger (*Panthera tigris*) and leopard (*Panthera pardus*) reported by Jnawali (2002).

In Koshi Tappu Wildlife Reserve, Sharma (1995) found wild buffalo (*Bubalus bubalis*) and wild boar (*Sus scrofa*) are important crop raiders. Limbu (1998) in Paschim Kusaha VDC concluded important crop raiders were wild buffalo mainly on paddy and wheat in young to adult milky stage and wild boar mainly on wheat in milky stage and potato in tuber stage. Adhikari (2000) in Paschim Kusaha, Madhuban and Haripur, reported the crops like paddy, wheat, potato, pulses, sugarcane, maize, oil seeds and jute were mostly raided by the animals and wild buffalo as a serious pest species responsible for 88.45% of total crop loss followed by wild boar 10.32%.

In Parsa Wildlife Reserve, Kasu (1996) found wild elephant, wild boar, chital were the major pest animals and the most affected crop was paddy the most followed by wheat and maize.

In Suklaphanta Wildlife Reserve, Gautam (1999) reported among wild animals 43.29% damage by wild elephant followed by wild boar (28.67%), chital (24.09%), blue bull (3.92%) and the crops raided were paddy and maize. Benu (1999) found wild elephant, wild boar and chital as main crop raiders in the park. According to Pande (2000), spotted deer, wild boar, elephant, blue bull, monkey, porcupine and peacock were the wild pests of crops.

In Shivapuri National Park, major crop raiders as wild boar, monkey, porcupine, bear and bird species (Ulak 1992, Kattel 1993, Soti 1995 and Poudyal 1995), along with Himalayan black bear (*Ursus thietanus*), squirrel (*Dremomys lokriah*) (Bajracharya, 2005) were identified as crop pests that affected crops like maize, millet, rooted crops, rice, wheat and paddy (Paneru 2004, Nepal 2005). Gurung (2002) reported wild boar, bear, monkey, deer, porcupine, rat and birds as crop raiders. Leopard, jungle cat, jackal and yellow-throated marten (*Martes flavigula*) were

predators in the park (Bajracharya, 2005). Gurung (1997) reported wild boar, monkey, porcupine and chital as major crop raiders and leopard, jackal, jungle cat and common mongoose as livestock predators in Gokarna Reserve Forest.

In Makalu-Barun National Park, Thapa (1995) estimated 55% of livestock lost attributed to leopard, 7.8% to grey wolf (*Canis lupus*), 10% to wild dog (*Cuon alpinus*), and 21.42% to jackal (*Canis aureus*) and remaining to unidentified predators, mainly predated sheep, goat, pig and the total monetary loss in livestock depredation was NRs. 58,380/ annum in Shankhuwa Valley and reported monkey, barking deer, goral, wild boar, Himalayan black bear and porcupine were the major crop raiders of maize and millet. Chalise (1997) reported that in Nepal, crop damage is very common along the edge between continuous forest and dense human habitation. Most of the pest animals are the species which are associated with successional or disturbed habitats. They are thus benefited by human actions. The pest animals in the study area were monkeys, goral and bears. The different species of birds were also common pests for agricultural crops.

In Langtang National Park, Kharel (1993, 1997) identified wild boar, Himalayan bear (*Selenarctos thibetanus*), monkey (*Macaca mulatta*) and deer (*Muntiacus muntjak*) species as major crop raiders of barley, buckwheat and fruits and mentioned leopard as livestock depredator. Similarly for Langtang National Park, Chalise (2003, 2003a) estimated 2,976 Kg. food lost by monkeys while 22,377 Kg. lost by wild boar, bear, porcupine, deer etc.

In Shey Phoksundo National Park, monkey, bear, musk deer (*Moschus chrysogaster*), blue sheep (*Pseudois nayaur*), porcupine and rodents were identified as major crop raiders and Tibetan wolf, snow leopard (*Panthera uncia*), common leopard, wild dog, jackal and the fox were reported as livestock predators (Basnet, 1998).

In Sagarmatha National park, Upreti (1985) found wild boar and langurs were the occasional destroyer of crops such as buckwheat and barley. Himalayan tahr (*Hemitragus jemlahicus*) was found as the crop raider (Shrestha 2004).

In Rara National park, wild boar and langurs were found as occasional crop destroyer of buckwheat and barley (Upreti, 1985).

In Annapurna Conservation Area, annually in Phoo village there is a 4.07% livestock loss because of snow leopard depredation (Gurung and Thapa, 2004). Leopard, jackal (*Canis aureus*), wild dog (*Cuon alpinus*), and grey wolf (*Canis lupus*) reported by (Shrestha *et. al.*, 1993).

In Kanchanjunga Conservation Area, sub adult yaks were the most vulnerable species to snow leopard depredation (Chalise and Khatiwada, 2006).

Chalise (2001, 2003) estimated crop loss due to different wild animals such as monkeys, deer, porcupines, squirrels, birds and small mammals for Lakuwa village 39,699 Kg. sharing 496 Kg. per household with 67.38% cereals and 32.62% fruits and tubers. Of the total cereals lost, 55.41% was attributed to monkey species and 25.71% to deer species. 11.26% porcupine, 3.99% birds and 3.63% others. Outside the protected areas such as in Palpa Survey was conducted that revealed 36,682 Kg. of food items were lost by wild animals such as rat, rabbit, porcupine, squirrels, birds and others (Chalise 2003a, 2005). Within the last 8 years, minimum 2,923 livestock (sheep, goat, pig, buffalo etc.) were killed by tiger, which is 1 livestock per day in the country (Bhatta *et. al.*, 2064).

In the United States, bird damage to fruits amounts to US \$19 million annually; in Tunisia it amounts to 15,000 tons in yields per year (Malhi, 2001). Black bucks were invariably observed eating domestic agricultural crops like wheat, jowar and paddy in and around the Kerera Sanctuary area (Chandra, 1997). Elephant was the major destructive agent followed by wild boar, porcupine, rhesus macaque, hoary-bellied squirrel, barking deer, red-breasted parakeet and wild dog and raided rice, banana, potato, pepper and vegetables with betel leaf vines and water melons etc. in Chunati Wildlife Sanctuary (Miah *et. al.*, 2001).

3.2. Human harassments

Encounter of rhinoceros with the local people in CNP, according to (Jnawali, 1989 and Shrestha, 2002, Sharma, 1991 and Nepal and Weber, 1993) reported the attack and death of humans by wild animals in CNP. Gautam (1999) reported during his study period, two persons were killed by huge bull elephant in SWR. Human injury and loss of property by elephant in SWR (Pande, 2000). Limbu (1998) found one man was killed and many people were seriously

injured in KTWR. In Shankhuwa Valley, MBNP, the most notorious animal was Himalayan black bear which attacked people, forest leopard and wild boar occasionally attacked human beings (Thapa, 1995). The problems of properties damage by wild elephants are very serious in the four development regions of Nepal; Eastern-population 12-13, Central-population 25-30, Mid-Western population 60-70 and Far- Western population 15-22. The wild elephants have also killed more than 70 people and more than 200-300 houses have been demolished within 3 year's period (Wildlife Week 2062). A total of 97 people lost their lives in last 27 years in Nepal of which 90% were killed in Chitwan alone (Bhatta *et. al.*, 2064).

In Kenya, where 119 local people were killed by elephants between 1990 and 1993 (Kiru, 1995). Rawal (2004) reported the cases of human injury and deaths due to attack of large felids in Gir-West and Gir- East. Mukherjee (2003) reported tiger attacks involved honey collectors, farmers, fishermen, crab collectors etc. in and outside of Sundarban Tiger Reserve.

3.3. People's impact on the park

The wildlife habitat and density are decreasing day by day due to over exploitation of forest resources by local people. Wild animals come in direct competition with livestock. Basnet (2002) also reported the presence of livestock grazing at ShNP. Local people in turn; have killed 25-35 wild elephants in Eastern Nepal during the period of 15 years (Wildlife Week, 2062). There is extreme pressure by domestic buffaloes on the park and they are creating unnecessary competition for the other wild animals in the reserve (Bhandari, 1994 and 1995). The food taken by the goats and sheep is almost same which is relished by markhor (*Capra falconeri*), the principal game animal in the sanctuary (Aleem, 1977).

Every year, local farmers lose significant quantities of crops and livestock due to wild animals mostly by rhinos, wild boar, chital, monkey, rodents and birds in and around the protected areas in Nepal. Local people are also frequently killed or injured by the wild animals attack during the collection of park resources and trespassing the road inside the park. So it should lead sometimes in prioritizing the development activities in the protected areas with people's participation.

4 RESEARCH METHODOLOGY

A preliminary visit was done in May 2007. Nine wards in Sundarijal VDC were visited. Out of 491 households recorded in the VDC (CBS 2001), 90 households were chosen. The 10 heads of the households from each ward were selected randomly.

4.1. Site Selection

For the data collection and questionnaire survey, all the nine wards and villages of the VDC were surveyed. For the ease, the study area was divided into three sites according to the average altitudinal range and situation and named as Site A, Site B and Site C.

Site A: It contains the 1, 2 and 3 wards of the VDC, which lie inside the park area with the villages named as “Kune, Okhrene / Majhgaun, Chilaune”. In average, its altitude ranges from 1,710 – 2,200 m. Large area of these wards is surrounded by dense forests. It is nearly 2 Km inside, from the park boundary and the Sundarijal Army Post, the entrance for the park.

Site B: It contains the 4, 5 and 6 wards of the VDC, which lie inside the park area with the villages named as “Mulkharka”. In average, its altitude ranges from 1,600 -1,710 m. It is nearly 1 Km.inside, from the Army Post and the park boundary.

Site C: It contains the 7, 8 and 9 wards of the VDC, which lie outside the park area with the villages named as “Mahankal, Ghatte-khola”. In average, its altitude ranges from 1,390 – 1,600 m. This site is near to Sundarijal Bus Park and is a market place which touches the Army Post.

4.2. Methods of data collection

4.2.1. Direct Observation

A regular watching was conducted without disturbing natural setting. Repeated observations were made in different fields in different seasons (summer, rainy and winter). The frequency of animal visit and the best time they occurred in the field and villages were also known. It

was therefore necessary to rely on the experiences of local people, spoor, footprints, uprooted crops or other signs such as dung piles to identify the crop-raiding species. Photography also confirmed the presence of wild animals in the study area.

4.2.2. Questionnaire Survey

After selection of respondents from each ward by random sampling methods, they were questionnaired with set I (Annex I). The survey was conducted during the months of May-December 2007. During the survey, respondents were interviewed and a questionnaire set was prepared to gather information on the type of crops affected, crop raid behavior, seasonality of food preferences, crop protection strategies, economic loss of crop and livestock and other issue conserving peoples' livelihood and wildlife conservation issues. The average value was considered for the estimation of economic loss (Annex IV).

Park authorities were also interviewed with questionnaire set II (Annex II) in the same months. Information was collected of human impact on the park, total loss of wild animals due to locals' activities and immigrants those visited the park.

Similar techniques were used to examine the impacts of human activities on the wildlife. Human activities were described and analyzed. Available data was used for this purpose. The impact of these activities on the natural environment, mainly on animal, vegetation and water was described. Compensation claimed by farmers and the amount sanctioned by the forest department were also noticed.

4.2.3. Group Discussion

Group discussions were carried out with local villagers, farmers, shop owner, hotels, park authorities and staffs etc. whenever field visit was done.

4.2.4. Statistical Analysis

Descriptive analysis of collected data had been done in the study area. Quantitative data were presented in term of percentage. Frequencies and mean tables, charts, figures and plates were used for profound illustration.

Association between the crop loss and the wild pests was analyzed statistically using χ^2 - test at 5% level of significance.

$$\chi^2 = \frac{(O - E)^2}{E}$$

Where, O= observed value

E= expected value

Similarly, student's t - test was used to find out the significant difference between the crop loss of inside and outside the park at 5% level of significance.

H_0 : There is significant difference between the crop loss of inside and outside the park.

$$t = \frac{\bar{x}_1 - \bar{x}_2}{S \sqrt{1/n_1 + 1/n_2}}$$

Where, \bar{x}_1 = mean damage inside the park,

\bar{x}_2 = mean damage outside the park,

S = combined standard deviation.

$$S^2 = \frac{(\sum x_1 - \bar{x}_1)^2 + (\sum x_2 - \bar{x}_2)^2}{n_1 + n_2 - 2}$$

5 RESULTS

5.1. Occurrence and identification of wild pests in and around the VDC.

Three sites were visited mainly Site A (1-3 wards), Site B (4-6 wards) and Site C (7-9 wards). Some common species of wild pests such as wild boar (*Sus scrofa*), Rhesus monkey (*Macaca mulatta*), porcupine (*Hystrix indica*), birds and rats as crop depredators and common leopard (*Panthera pardus*), jungle cat (*Felis chaus*) and black kite (*Milvus migrans*) as livestock depredators were identified. Monkeys frequently visited each ward but mostly were found in Site B of Sundarijal VDC. Wild boars were mostly found in the vicinity forests around Site A. Porcupines, birds and rats were found near human habitat. While leopard, jungle cat and black kites were mostly found inside the park areas (Tab. 4).

Table 4: Major wild pests of crops and livestock depredation with raiding time in different altitude of the VDC

Wild pests with preferred crops/livestock	Site A	Site B	Site C	Raiding time
Wild Boar	Maize, millet, rooted crops	Maize, millet, paddy, wheat, arum, potato	-	Night
Rhesus monkey	Maize, Millet, rooted crops	Maize, millet, arum, potato, paddy, wheat	Maize, millet, paddy, wheat, potato	Day
Porcupine	Maize, millet, Potato, rooted crops	Maize, millet, paddy, wheat, potato, arum	-	Day / Night
Rat	Maize, millet	Maize, millet, paddy, wheat, potato, arum	Maize, millet, paddy, wheat, potato	Day / Night
Bird	Maize, millet	Maize, millet, paddy, wheat	Maize, millet, Paddy, wheat	Day
Common leopard	Goat	Cattle, Goat, Chicken	Goat	Night
jungle cat	Chicken	Chicken	Chicken	Day / Night
Black kite	Chicken	Chicken	-	Day

Monkeys were found in a group of (15-100) individuals, wild boar raided singly or in less number (2-50), porcupine (2-6) and others (2-9) in the crop fields.

5.2. Impacts of park and its animals

Many wild animals of the park were recorded causing considerable damage to the inhabitants within and around the park. The attraction of wild animals towards the human settlements was due to following reasons,

- i. Herbivores by the crops,
- ii. Carnivores by the livestock.

Local respondents had listed mainly two types of major problems. They were a) crop damage, b) livestock depredation. There were also certain cases of human harassments by wild animals in the park.

Altogether 18.87% of local respondents were questioned in the VDC. 100% respondents reported that the wildlife depredated their crops or livestock and affected their daily livelihood directly or indirectly (Tab. 5).

Table 5: Total percentage of respondents selected from each site.

Sites	Villages	Household (491)	No. of Respondents (90)	% of Respondents	Remarks
A	Kune Okhreni Chilaune	193	30	15.54	In average, 18.87 % of sample households were chosen from the VDC
B	Mulkharka	128	30	23.43	
C	Mahankal Ghattekhola	170	30	17.64	

5.2.1. Magnitude of damage by wild animals

Generally crop and livestock depredation were caused by wild animals in the villages of the VDC. Sampled households suffering from crop and livestock depredation was found the highest in Site B and the lowest in Site C (Tab. 6). 4-6 wards were mostly affected by the wild

animals due to extensive agricultural land and nearer to wild habitat. Similarly 7-9 wards had the least comments because they were nearer to market places and the locals were comparatively less engaged in farming. In average, 85.55% and 71.10% of the respondents were suffering from crop and livestock depredation respectively in the VDC.

Table 6: Nature of damage and trouble caused by wildlife

Sites	No. of respondents	Respondents for crop damage	Percentage (%)	Respondents for livestock /avian stock killed	Percentage (%)
A	30	26	86.66	23	76.66
B	30	29	96.66	25	83.33
C	30	22	73.33	16	53.33

As agriculture is one of the major occupations of the VDC, villagers had to depend most of the time on the agricultural land. Site A villagers mostly had *bari* and less *khet*. Site B had both *khet* and *bari* while Site C mostly had *khet* and less *bari* for growing crops. During the study period, 52.22% of villagers having 0-5 ropanis / 0-0.26 hectare of land and 1.11% having more than 31 ropanis / 1.62-above hectare of land in the VDC were recorded, which showed very poor economic status of people. In average, 0.31-0.52 hectare of agricultural land was hold by each household in the village (Tab. 7).

Table 7: Percentage of agricultural land in the sampled households in the VDC

Ropani	Hectare	No. of respondents bearing land in Sites			Total (90)	Percentage (%) of respondents bearing land
		A	B	C		
0 - 5	0 - 0.26	16	16	15	47	52.22
6 - 10	0.31 - 0.52	8	3	9	20	22.22
11 - 20	0.57 - 1.04	5	5	4	14	15.55
21 - 30	1.09 - 1.56	1	5	2	8	8.88
31 & above	1.62 & above	0	1	0	1	1.11

5.2.2. Crop preference by wild pests

The present study reveals that the number of wildlife species which were found to damage different crops at different stages varied considerably, possibly due to their food habits and food choices. Wild boars and monkeys were usually found raiding the crops such as maize, millet, potato, arum and others while porcupine, rats and birds were rarely seen raiding the crops in the field (Tab. 8).

Table 8: The stages of different crops preferred by wild pests

Stages	Paddy	Wheat	Maize	Millet	Potato	Arum	Sweet potato
Juvenile	M, P	-	Wb, M, P	Wb, M, P	-	-	-
Flowering	M, P	Wb	Wb, M, P	Wb, M, P	-	-	-
Tasselling	Wb, M, P B	M	Wb, M, P B	Wb, M, B	-	-	-
Mature	B, R	Wb, R	Wb, M B, R	R	Wb, M, P	Wb, M, P	Wb, M, P

M =Monkey W b =Wild boar P =Porcupine B =Birds R =Rats

Different wild pests preferred different types of crops which were easier for them to raid. Paddy, wheat, maize, millet, and rooted crops (potato, arum and sweet potato) were mostly raided by wild boar and monkey which was followed by porcupine, rats and birds. (Tab. 9).

Table 9: Percentage of different crop damage by wild pests

Wild pests	Paddy	Wheat	Maize	Millet	Rooted crops
Wild boar	33	35	34	43	25
Monkey	42	40	44	27	35
porcupine	10	-	13	15	25
Rats	3	10	9	10	15
Birds	12	15	-	5	-

χ^2 -test for the association between the crop losses per wild pest in the study site accepted the alternate hypothesis,

Calculated value of $\chi^2 = 52.26$

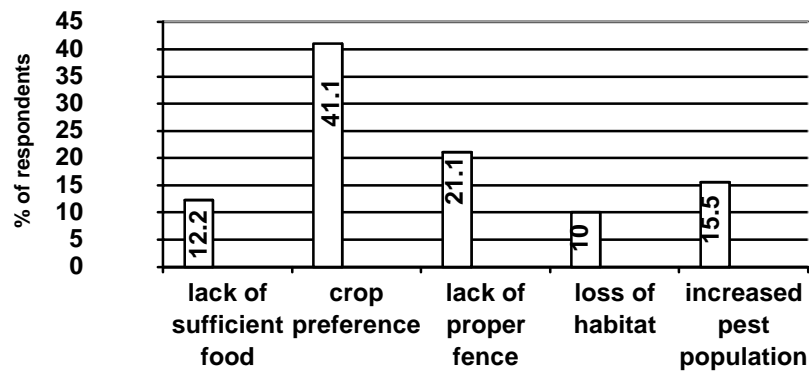
Tabulated value of $\chi^2_{(4, 0.05)} = 9.488$

Here, the calculated value is more than the tabulated value. Hence, there was association seen between the crop losses per wild animals.

5.2.3. Frequency

According to the local respondents, the main reasons for the field raid by wild animals was crops being soft, palatable and of different tastes and variety (41.1%). The other reasons were lack of proper fence (21.1%), increased pest population (15.5%), scarcity of food (12.2%) and loss of habitat inside the forest (10%) (Fig. 7). The animals did not have to move in search of scattered food which was easily available in the farm land.

Figure 7: Reasons of animal visit to human settlements and percentage of respondents



Summer season was seen the most favorable for all kinds of pest species than winter or rainy seasons. Effects of wild animals were recorded in different months (Annex V). The number of individuals of a species group varied due to species-specific habits. Among the crop raiders, monkey was found in all the wards and very frequently raided the crops at day time. The

highest, 100% was raided by monkey in Site B, 92.7% was by wild boar in Site A but absent in Site C. Porcupines raided the crops in Site A and Site B but not in Site C. Birds and rats were found in every sites (Tab. 10).

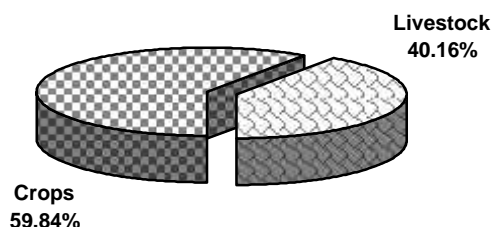
Table 10: Frequency of park animals visiting villages

Animal type	Visit frequency	Percentage (%) of respondents in sites		
		Site A	Site B	Site C
Monkey	Every day	74	100	70.6
	Every evening	26	-	29.4
	Every night	-	-	-
	Every week	-	-	-
Wild boar	Every day	-	-	-
	Every evening	7.3	15.1	-
	Every night	92.7	84.9	-
	Every week	-	-	-
Porcupine	Every day	32.3	30	-
	Every evening	-	-	-
	Every night	67.7	70	-
	Every week	-	-	-
Birds	Every day	100	100	100
	Every evening	-	-	-
	Every night	-	-	-
	Every week	-	-	-
Rat	Every day	50	50	50
	Every evening	-	-	-
	Every night	50	50	50
	Every week	-	-	-

5.3. Estimation of economic loss by wild animals

After the questionnaires and data analysis, the depredation percentage of crops (59.84%) and livestock (40.16%) by wild animals were recorded in the sampled households of the VDC (Fig. 8).

Figure 8: Percentage of crops and livestock depredation in the VDC



5.3.1. Total crop loss

The total loss of crops was the quantity of crops which had been damaged by the wild animals in the crop field. The annual quantity and amount lost in paddy, wheat, maize, millet, potato, arum and sweet potato were 2,895 Kg, 2,967.8 Kg, 8,243.8 Kg, 4,170.4 Kg, 361 Kg, 240 Kg, 133.4 Kg and Rs. 72,375, Rs. 54,310.74, Rs. 1,40,144.6, Rs. 70,896.8, Rs.8,664, Rs.3,360 and Rs.1, 867.6 respectively. The total loss in crop depredation was of Rs. 3,51,618.74 (Tab. 11).

Table 11: Annual quantity and amount lost in crop damage in Sundarijal VDC

Crops damaged in all wards	Crop damage (Kg)	Amount lost (Rs.)
Paddy	2,895	72,375
Wheat	2,967.8	54,310.74
Maize	8,243.8	1,40,144.6
Millet	4,170.4	70,896.8
Potato	361	8,664
Arum	240	3,360
Sweet potato	133.4	1,867.6
Total	19,011.4	3,51,618.74

Site B had the highest crop depredation by wild animals i.e. Rs. 1,84,820.9 followed by Site A of Rs. 96,679.44, due to less damage of paddy and rooted crops while Site C had the least of Rs. 70,118.4 because the crops like maize and millet along with rooted crops were less grown in the farm land (Tab. 12).

Table 12: Crop loss in sampled households

Sites	Types of crops	Crop damage (Kg)	Amount lost (Rs.)
A	Paddy	-	-
	Wheat	967.8	17,710.74
	Maize	2,848.3	48,421.1
	Millet	1,226	20,842
	Potato	327.4	7,857.6
	Arum	132	1,848
	Sweet potato	-	-
	Total	5,501.5	96,679.44
B	Paddy	1,459	36,475
	Wheat	700	12,810
	Maize	5,085.5	86,453.5
	Millet	2,688.4	45,702.8
	Potato	-	-
	Arum	108	1,512
	Sweet potato	133.4	1,867.6
	Total	10,174.3	1,84,820.9
C	Paddy	1,436	35,900
	Wheat	1,300	23,790
	Maize	310	5,270
	Millet	256	4,352
	Potato	33.6	806.4
	Arum	-	-
	Sweet potato	-	-
	Total	3,335.6	70,118.4

The null hypothesis set between the crop loss value of inside and outside the park area of Sundarijal VDC was accepted.

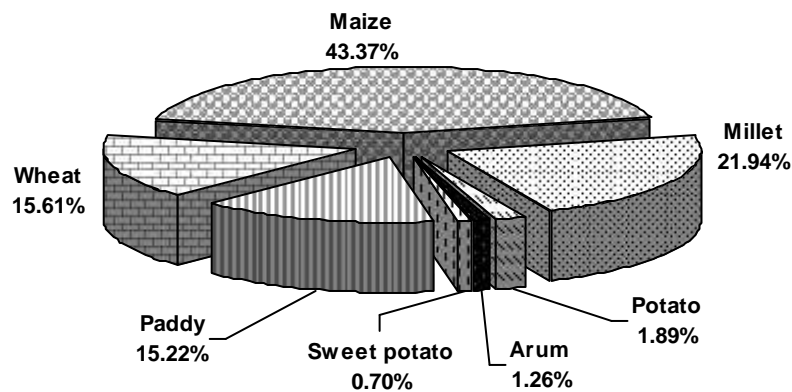
Calculated value of t-test = 0.609

Tabulated value of $t_{(10, 0.05)} = 2.228$

The calculated value is less than the tabulated value. Hence, there was significant difference between the loss of inside and outside damage of crops in the VDC.

Maize loss was the highest (43.37%) and sweet potato the lowest (0.70%) in the VDC (Fig. 9).

Figure 9: Percentage of crop damage in Sundarijal VDC



5.3.2. Actual crop production

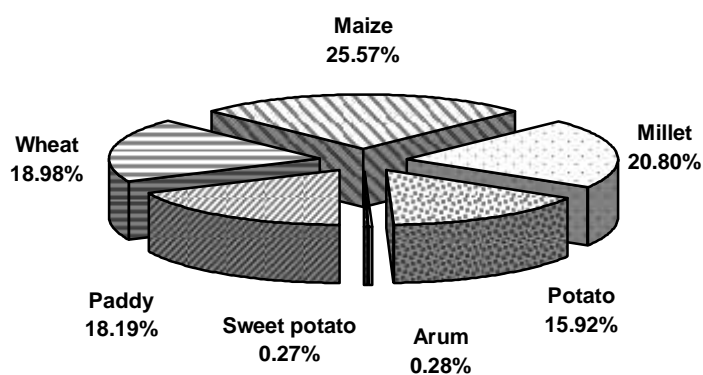
The term actual crop production refers to the left over grain harvested after being raid by wild animals in the field. Maize and millet were the two major crops planted in the study areas. Beside these, paddy, wheat, potato, arum, sweet potato, fruits, spices and green vegetables were also cultivated. The annual quantity and income of paddy, wheat, maize, millet, potato, arum and sweet potato production were 11,238 Kg, 11,729.5 Kg, 15,800 Kg, 12,852 Kg, 9,842.8 Kg, 173.7 Kg and 167 Kg and Rs. 2,80,950, Rs. 2,14,649.85, Rs. 2,68,600, Rs. 2,18,484, Rs. 2,36,227.2, Rs. 2,426.2 and Rs. 2,338 respectively. The total crop production in the VDC was Rs. 12,23,675.25 (Tab. 13).

Table 13: Annual crop produced and income in Sundarijal VDC

Crops production in all sites	Crop produced (Kg)	Annual income (Rs.)
Paddy	11,238	2,80,950
Wheat	11,729.5	2,14,649.85
Maize	15,800	2,68,600
Millet	12,852	2,18,484
Potato	9,842.8	2,36,227.2
Arum	173.3	2,426.2
Sweet potato	167	2,338
Total	61,802.6	12,23,675.25

Maize hold the highest (25.57%) and sweet potato the lowest (0.27%) of production (Fig. 10).

Figure 10: Percentage of crop production in Sundarijal VDC



Due to steep land and insufficient *khet* in Site A (wards 1-3), production of paddy was not in practice. Agricultural crops were produced in higher quantity in Site B (wards 4-6). Due to lack of *bari* in Site C (wards 7-9), paddy and wheat were usually produced but maize, millet and other rooted crops were rare.

The highest crop production was found in Site C i.e. Rs.5,71,589.9 due to less conflict in the field and moreover the crops grown in *khet* were less preferred by wild animals and Site A had the lowest of Rs. 3,01,308.65 (Tab. 14).

Table 14: Crop production in sampled households

Sites	Types of crops	Crop production (Kg)	Annual Income (Rs.)
A	Paddy	-	-
	Wheat	1,704.5	31,192.35
	Maize	8,487.5	1,44,287.5
	Millet	6,855	1,16,535
	Potato	280.2	6,724.8
	Arum	116.5	1,631
	Sweet potato	67	938
	Total	17,510.7	3,01,308.65
B	Paddy	2,668	66,700
	Wheat	4,985	91,225.5
	Maize	6,000	1,02,000
	Millet	5,064	86,088
	Potato	107	2,568
	Arum	56.8	795.2
	Sweet potato	100	1,400
	Total	18,980.8	3,50,776.7
C	Paddy	8570	214250
	Wheat	5,040	92,232
	Maize	1,312.5	22,312.5
	Millet	933	15,861
	Potato	9,455.6	2,26,934.4
	Arum	-	-
	Sweet potato	-	-
	Total	25,311.1	5,71,589.9

5.3.3. Expected crop production and income in samples households

The expected crop production was the quantity of crops which was obtained by adjusting the total actual production and total loss of crops in the field. The expected income of the VDC was found to be Rs. 15, 75,293.99 (Tab. 15) which seemed to be a great amount. If this amount could have been saved, the economy of the villager's would have raised.

Table 15: Expected Income of sampled households in Sundarijal VDC

Name of crops	Total crop loss (Kg.)	Amount lost (Rs.)	Total crop production (Kg.)	Annual income (Rs.)	Expected crop production (Kg.)	Expected income (Rs.)
Paddy	2,895	72,375	11,238	2,80,950	14,133	3,53,325
Wheat	2,967.8	54,310.74	11,729.5	2,14,649.85	14,697.3	2,68,960.59
Maize	8,243.8	1,40,144.6	15,800	2,68,600	24,043.8	4,08,744.6
Millet	4,170.4	70,896.8	12,852	2,18,484	17,022.4	2,89,380.8
Potato	361	8,664	9,842.8	2,36,227.2	10,203.8	2,44,891.2
Arum	240	3,360	173.3	2,426.2	413.3	5,786.2
Sweet potato	133.4	1,867.6	167	2,338	300.4	4,205.6
Total	19,011.4	3,51,618.74	61,802.6	12,23,675.25	80,814	15,75,293.99

5.3.4. Livestock Loss

The carnivores visited the villages in the park, in search of food. Since the villagers were engaged in livestock and poultry farming, the level of conflict was fairly high. Both small and large sized livestock/avian stock easily became the prey for those predators. Leopard depredated the livestock during the day time while they grazed inside the park. Some avian stocks were attacked by jungle cat and black kite. Even the dogs that were kept to guard the livestock and the crops were lifted away by leopards.

During the research period, these predators involved in killing the prey (Tab. 16).

Table 16: Varied diet preference of wild predators in Sundarijal VDC

Wild predators	Prey
Common leopard	Cattle, calf, buffalo, goat, kid, chicken, pig, dog
Jungle cat	hen, chicken, pigeon, bird
Black kite	chicken, pigeon

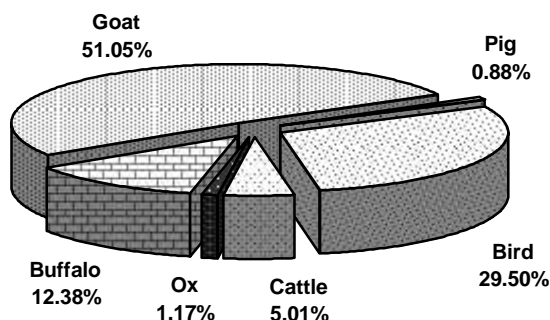
During the research period, the number of livestock/avian stock was found the highest in Site B (300) i.e. (44.24%), which was followed by Site A (249) (36.72%) and Site C (129) (19.02%). Deducting the loss, total number of livestock/avian stock in the sampled households was 678 (Tab. 17).

Table 17: Presence of total livestock/avian stock in sampled households

Livestock/avian stock	Sites			Total
	A	B	C	
Cattle	3	13	18	34
Ox	4	4	-	8
Buffalo	37	31	16	84
Goat	134	144	68	346
Pig	-	6	-	6
Bird (hen, chicken, pigeon)	71	102	27	200
Total	249	300	129	678

The presence of goats in all the sites was the highest i.e. 51.05% followed by domestic birds 29.50%, buffaloes 12.38%, cattle 5.01%, ox 1.17 % and pigs 0.88% (Fig. 11).

Figure 11: Percentage of total livestock in sampled households



Altogether 248 livestock/avian stock were lost during the study period. Out of the animals depredated, 3 were cattle, 2 calves, 73 goats, 3 kids, 7 hens, 3 cocks and 157 chickens. Total loss in livestock and avian stock was Rs 2,36,000 (Tab. 18). The loss found in goats and cattle were more nerve-racking to the villagers ahead of domestic birds. It can be concluded that, this was due to the increment of wild pest like leopard in the park which was really troubling the livelihood of the villagers of Sundarijal VDC. Beside these, villagers lost their guard dogs which also cost approximately Rs.1,500.

Table 18. Total livestock / avian stock lost in Sundarijal VDC

Livestock/avian stock	No. killed	Total loss (Rs.)	Remarks
Cattle	3	42,000	Heaviest toll in avian stock (chicken 63.33% of total loss)
Calf	2	10,000	
Goat	73	1,46,000	
Kid	3	3,000	
Hen	7	2,100	
Cock	3	1,500	
Chicken	157	31,400	
Total	248	2,36,000	

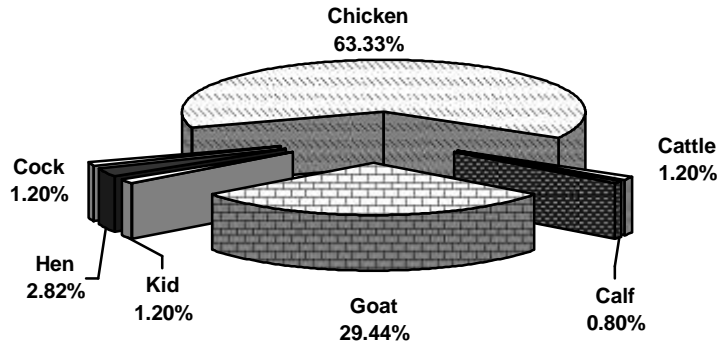
The amount lost per annum in those poor families was incredible. The highest loss was found in Site B (Mulkharka) of Rs. 1, 06,300 because the rate of attack by wild animals and number of domestic animals was the highest which was followed by the loss in Site A of Rs 73,300 because of less cattle and livestock and finally Site C Rs. 56,400 due to less attack of wild animals and less number of cattle (Tab. 19).

Table 19: Amount lost in different categories of livestock/avian stock killed by wild animals in sampled households

Sites	Livestock/avian stock	No. killed	Market rate (Rs.)	Total cost in monetary value
A	Cattle	-	14,000	-
	Calf	-	5,000	-
	Goat	23	2,000	64,000
	Kid	2	1,000	2,000
	Hen	1	300	300
	Cock	-	500	-
	Chicken	125	200	25,000
	Total	151		73,300
B	Cattle	3	14,000	42,000
	Calf (buffalo)	2	5,000	10,000
	Goat	22	2,000	44,000
	Kid	1	1,000	1,000
	Hen	6	300	1,800
	Cock	3	500	1,500
	Chicken	30	200	6,000
	Total	67		1,06,300
C	Cattle	-	14,000	-
	Calf	-	5,000	-
	Goat	28	2,000	56,000
	Kid	-	1,000	-
	Hen	-	300	-
	Cock	-	500	-
	Chicken	2	200	400
	Total	30		56,400

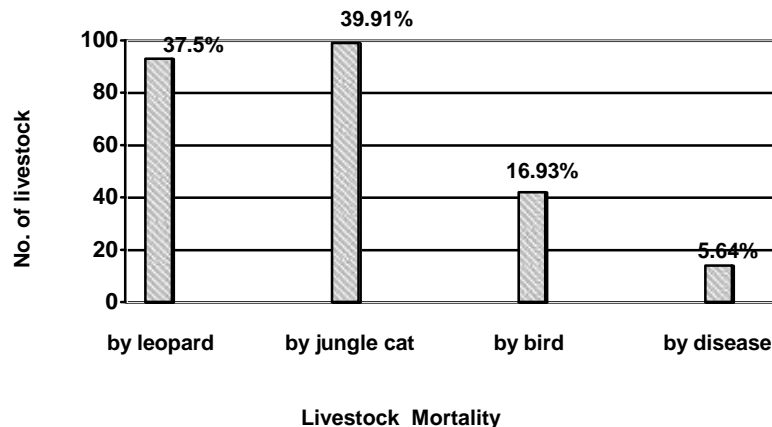
Although the highest (%) of loss was found in chicken i.e. 63.33% (Fig. 12) but the highest amount lost was found in goat with kid of Rs. 1,49,000 followed by cattle with calves of Rs. 52,000, domestic birds of Rs. 35,000.

Figure 12: Percentage of livestock/avian stock killed by wild animals in Sundarijal VDC



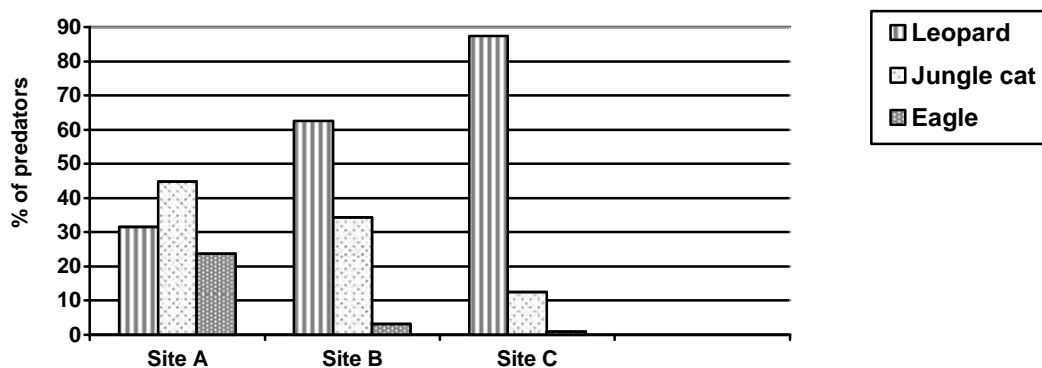
The total number of domestic animals and birds depredated by jungle cat was (99) i.e. (39.91%), followed by leopard (93) (37.5%), black kite (42) (16.93%) and finally by disease (14) (5.64%) in the VDC. Leopard was found attacking chickens in the lack of goats and cattle in the villages (Fig. 13).

Figure 13: Livestock/avian stock mortality due to different reasons in Sundarijal VDC



The percentage of wild predators found in different sites was also noticed. The attack of jungle cat was the highest followed by leopard and black kite in Site A. Similarly leopard followed by jungle cat and black kite in Site B and Site C. The presence of leopard in and outside the park was 60.52%, followed by jungle cat 30.53% and eagle 8.93%. Leopard attack was the highest (87.50%) and black kites the least (0.0%) in Site C (Fig. 14).

Figure14: Percentage of depredators found in each sites



Total economic loss in crop and livestock depredation was estimated as Rs. 3,51,618.74 and Rs. 2,36,000 per annum and Rs. 3,906.87 and Rs. 2,622.22 per household respectively. The total economic loss was estimated of Rs. 5,87,618.74 (Tab. 20).

Table 20: Average economic loss in each sampled household

No. of sampled household	Total loss of crop (Rs)	Average loss of crop (Rs)	Total loss of livestock (Rs)	Average loss of livestock (Rs)
90	3,51,618.74	3,906.87	2,36,000	2,622.22

5.3.5. Impact on livelihood

During the research period, no record of human attack by wild animals was found. There were cases of human injury by wildlife like leopard, bear, and wild boar before one to two years ago. Almost 95% of people said that they were not attacked by wild animals and remaining 5% commented on attacking was possible if they visited the forest area in the late evening. Beside this, people were benefited by the park in many ways like irrigation and drinking, sand, stone or soil collection, resource utilization, rights of way and religious activities and generating their economic source from tourism inside the park areas. During my study period, some NGOs through support from other INGO, operated saving / credit programs, training on skill development were recorded. However sex wise more of the village females had received the training on income generating activities than the males. Beside these, more than 50% of locals inside the park were found complaining about the muddy roads, unemployment and better schools for their kids in the same village.

5.4. Impact of locals on the park

As the villagers settled inside the park before the establishment ShNP, they fulfilled their basic needs from the forests. My observation and analysis of data showed that the main threats to bio-diversity influenced by human activities and according to the information obtained are as follows;

5.4.1. Garbage accumulation and water pollution

About 10% of the land of Sundarijal VDC lied under active cultivation and the rest was occupied by forests and hills. There were some degraded lands as well. 65% of the farmers used Potash, Urea, DAP with some agricultural chemicals and pesticides in their farm lands. Human stool was observed mixing with water resources, trekking tourists and urban tourists had resulted into unmanaged garbage which directly or indirectly polluted the drinking water of human and wild life as well.

5.4.2. Livestock grazing

There was no separate rule and regulation followed by the villagers for the last one and half years. The biomass density of domestic animals was noticed to be higher in the vicinity of the

park area during the day time and was stall-fed during night. Almost 85% of the total sampled household heads found frequently grazing their livestock inside the park. The grazing at the inner edge of the park showed there would be more chances of disease transmission, soil erosion and siltation problems later on.

5.4.3. Firewood, fodder collection and grass cutting

Fire wood, fodder and grass were extracted throughout the year, mainly during winter. The villagers collected the logs in the grass loads and later the logs were sawn in the back yard to produce building materials, furniture and agricultural tools. About 76.66% of the villagers depended upon fuel wood for cooking, 23.34% of them used bio-gas, kerosene or LP gas for cooking. 80% villagers also informed that, the forest had become denser after the establishment of the Shivapuri forest as ShNP. The amounts sanctioned by the forest department were also noticed (Tab. 21).

Table 21: Persons charged for firewood and fodder collection

Sundarijal VDC	Year	Activity	Punishment
<u>Ward-2</u>			
Buddhiman Lama	2004	Firewood collection	10-15 days imprisonment with fine Rs.28,250
Gyan Bh. Tamang	2007	Medicinal plant collection	Fine Rs. 25,000
<u>Ward-6</u>			
Ambare Tamang	2006	Firewood collection	3-4 days Imprisonment
Narayan Shrestha	2006	Firewood collection	Fine Rs.4,000

5.4.4. Trail and tourism

There were certain trails, motor roads and pilgrimages like Bag Dwar and Bishnu Dwar inside the park. So the visitors and tourists used those routes to visit different places of their interests. The villagers were compelled to trespass the park boundaries quite frequently. They

continuously disturbed the wildlife habitat by breaking the rules and regulations and creating noise, air pollution in the park.

5.4.5. Other activities

Poaching and hunting were found to the lesser magnitude. Certain punishment rules were applied for killing wild animals. The villagers could not kill the wild animals while raiding their crops in the field. In certain cases, villagers tired of chasing wild boars in the field, killed them for the meat value. Some people relied on various wild edibles such as mushroom and edible fern.

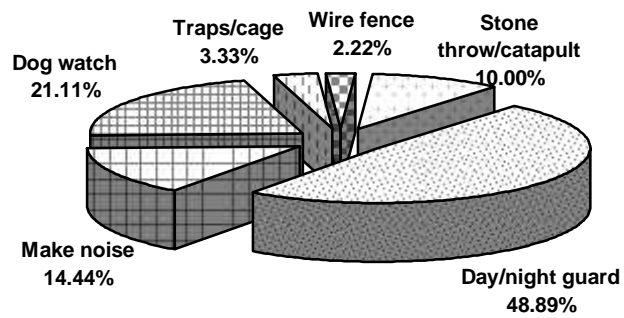
5.4.6. Park-People's perception

Park authorities accused the local people of illegal grazing within forest land, lifting of timber and fuel wood, encroachment, polluting water resources etc; whereas the local people complaint that, the park authorities were depriving them of their traditional rights of livelihood. Under my study period it was seen that, park authorities had punished, imprisoned, grabbed their agricultural tools like '*Kodalo*', '*Hasiya*' and fined the villagers for illegal works but the villagers had never been compensated or paid with the amount in spite of crop damage or livestock depredation in the VDC. However, almost all the villagers expressed their dissatisfaction against the authorities for not taking any actions in favor of their complaints.

5.5. Protection strategies and management

From interviews and questionnaires, it was concluded that, they had developed a variety of traditional methods of minimizing human-wildlife conflict. Guarding day/night (48.89%) in the field by local farmers were mostly found which was followed by dog watch (21.11%), making noise (14.44%), throwing stone and using catapult (10.00%), using traps/cages (3.33%) and fencing the crop field (2.22%) (Fig. 15).

Figure 15: Percentage of protective methods for depredation



Further, it was observed that, stall-feeding of livestock at home had also decreased predators to some extent wandering around the villages.

6 DISCUSSION

6.1. Identification of wild pests

In the research period in Sundarijal VDC, in all the nine wards in and outside the park area, 8 wild pests were identified such as, 2 major (wild boar, monkey), 3 minor (porcupine rat, birds) as crop raiders along with 3 (leopard, jungle cat, black kite) as livestock/avian stock depredators. Among the crop raiders, wild boar was mostly found in 1,2,3,4 wards and raided 5, 6 seldom in a week but never disturbed 7, 8 and 9. It was found at the altitude around 1,710-2,200 m inside the park area. Monkey was found very frequently in all the wards but mostly in 4, 5 and 6 and was found at the altitude of 1,390-2,200 m. Whereas the other crop raiders were found nearer to the local habitats but raided the crops to the tolerance level of local farmers. They raided the crops maize, millet, paddy, wheat and rooted crops such as potato, arum and sweet potato. While describing about predators, leopard and jungle cat were the most notorious wild animals in all the wards but black kite's fear was not found in 7, 8 and 9. Leopard killed mostly the cattle, buffaloes, goats, pigs, dogs and chickens whereas jungle cat and black kite fed upon birds like chicken and pigeons etc. (Tab. 4). Poudyal (1995) found the wards 7, 8 and 9 outside the park were unaffected which is dissimilar to this research because these wards are too in the vicinity of the forest and are less affected. Bajracharya (2005) reported nine pest species in ShNP and two crop raiders wild boar and monkey in Sundarijal VDC which is different from this research.

(Ulak 1992, Kattel 1993, Soti 1995 and Poudyal 1995) identified wild boar as the main frequent crop raider and maize was the most raided crop by wildlife in ShNP. While Gurung (2002) identified wild boar (major) and bear, monkey, deer, porcupine, rat and birds (minor) crop raiders and raided the crops like paddy, wheat, maize, millet, potato and mustard and rooted crops in ShNP.

6.2. Amount lost in crop and livestock depredation

The crop and livestock depredation were found as the major problems due to wildlife in the VDC. After surveying 90 households, in average, 0.31-0.52 hectare of agricultural land was hold by each household in the village (Tab. 7) which seems similar to that of (Poudyal, 1995)

i.e. 0.51 hectare in Sundarijal VDC but according to Khatri-Chhetri (1993) average holding of household in buffer zone of SWWR was 0.76 hectare. I estimated the economic loss due to crop depredation of Rs.3,51,618.74 per annum and Rs. 3,906.87 per household (Tab. 11). Poudyal (1995) estimated total loss of Rs. 7,58,070 per annum and Rs. 3,132 per household in Sundarijal VDC which is lesser than this research because Poudyal (1995) surveyed more number of households and only the loss of four crops (paddy, wheat, maize and millet). Bajracharya (2005) estimated the total loss of Rs. 1,90,314.04 per annum and Rs.13,593 per household in Sundarijal VDC and which is higher than this research because Bajracharya (2005) surveyed less households.

Maize was the crop found in the first category of loss in all the studies. Soti (1995) estimated the total loss in crops of Rs. 11,59,999.45 in Kakani VDC. Gurung (2002) estimated total loss of Rs. 5,54,989.31 in Sunkhani VDC and the crops mostly raided by wild animals were maize, millet, paddy, wheat and rooted crops like potato, arum and sweet potato. Rice, maize, millet and wheat are four main preferred crops as main food by middle hill population (Mahat *et. al.*, 1987).

During this research period, for the crop depredation the highest economic loss of maize with Rs. 1,40,144.6 (43.37%) of followed by millet (21.94%), wheat (15.61%), paddy (15.22%), potato (1.89%), arum (1.26%) and sweet potato (0.70%) was estimated (Fig. 9). Poudyal (1995) reported excessive loss occurred to maize followed by millet, wheat and paddy subjected to almost negligible loss in the VDC. Bajracharya (2005) estimated the highest crop raided was maize followed by arum, millet, potato, paddy, wheat and sweet potato in the VDC. Nepal (2005) estimated maize (35.29%) the highest proportion raided by monkey which is followed by wheat (30.25%), millet (16.35%), mustard (6.35%), paddy (5.92%), fruits (3.92%) and vegetables (1.92%) in Sundarijal VDC, the estimation was different from present research because Nepal (2005) estimated only the monkey' attack on crops. Millet in 1 Km. area had maximum damage followed by maize, wheat, paddy in ShNP (Soti, 1995). Gurung (2002) estimated loss in millet followed by maize, potato, mustard, wheat and paddy by wild animals. Rooted crops like potato arum and sweet potato were mostly abandoned growing in wards 1,2,3 due to attack of wild animals. Rooted crops were abandoned by farmers because of high depredation by wildlife (Soti 1995).

The economic loss due to livestock depredation by wild pests was Rs. 2,36,000 per annum and Rs. 2,622.22 per household was estimated with the predators like leopard, jungle cat and black kite in Sundarijal VDC (Tab. 18). Bajracharya (2005) calculated the loss of Rs. 14,000 per annum, which is lesser than this research and the predators were leopard, jungle cat and mongoose. I estimated domestic animals lifted by leopard 93 (37.5%), jungle cat 99 (39.91%) and black kite 42 (16.93%) and remaining 14 (5.64%) killed by disease. Bajracharya (2005) calculated by leopard 12, by jungle cat 9 and by mongoose 4 in the VDC. It is found lesser than this research estimation because of increased livestock grazing and pest population in the park. I recorded wild pests entering villages due to the choices of crops grown in the field and broken boundary wall around the park and (Paneru 2004) also reported the same in ShNP.

Soti (1995) calculated the loss of Rs. 15,200 per annum in Kakani VDC of the park. Gurung (2002) calculated total 279 domestic livestock and avian stock killed by wildlife with the loss of Rs. 48,355 per annum and Rs. 399.62 per household in Sunkhani VDC. Bajracharya (2005) calculated the total loss of Rs. 46,000 due to livestock depredation in ShNP. The domestic animals were easily lifted from the grazing land, pen, shed etc. Natural grazers such as goral and barking deer are fast, active and clever creature, compared to domestic animals which tend to be docile (Shrestha *et.al.*, 1993). According to the villagers, leopard, bear and wild boar were the main cause of human harassments but I recorded no wildlife attack to human in the VDC.

The amounts mentioned above in crop and livestock depredation seemed very substantial for poor rural people in the park. It is therefore, the damage and disturbance caused by wildlife has far exceeded the normal limit of tolerance thus, evoking the strongly negative attitude towards wildlife and conservation approach. According to park regulation, park authorities have fined, punished, imprisoned and grabbed their agricultural tools like '*Kodalo*', '*Hasiya*' (Tab. 21) but the villagers have never been compensated or paid with the amount in spite of crop damage or livestock depredation. Bajracharya (2005) also reported no any compensation paid to villagers. The management can not ignore such incidents without giving due attention to the suffering for local population or the means of pacifying the disgruntled villagers (Upreti, 1990). Beside these, some I/NGOs were found operating saving/credit programs,

organizing women empowerment programs on skill development. They even launched an income generating program for the males in the village.

6.3. Human impacts

Human impacts on the park were found most of the time. 85% of the villagers, who owned livestock, grazed their animals in the nearby jungle. 76.66% depended on park resources for fuel wood, fodder and grass. The presence of grazing and illegal resource utilization was reported in ShNP (Nepal 2005, Bajracharya 2005). The increased forest encroachment and exploitation by growing population result in a direct negative impact on bio-diversity of the region. The indigenous wildlife loses their habitat and move out to other suitable habitat or are killed in the process (Giri *et. al.*, 1992).

6.4. Protective methods

The six types of traditional protective methods were applied by the villagers to get rid of wild animals in their field and on the livestock. They were day/night guarding in the field, keeping guard dog, making noise and harassing animals, throwing stone and using catapult, using traps/cages and fencing the crop field with wire etc (Fig. 15). But these were just partial solutions of the problems created by wild animals. Kattel (1993) recorded of using traps/snares, digging and hire hunters. Hunters are not used nowadays in Sundarijal because of poor economic condition of the villagers. Nepal (2005) reported charge threat was maximum towards monkey in Sundarijal. For successful protection, it would require that people be in the fields throughout the day during the seasons when the crops are most vulnerable. Obviously, this is not possible because the farmers have other works to do. Growing tensions in ShNP created an atmosphere of mistrust among people of different wards of the VDC. Such mistrust will be so blatant gradually between wild animals and human so, a sustainable wildlife management and different planning should be applied for the benefit of local communities by the government sector.

7 CONCLUSION

This study was conducted in 2007 and Sundarijal VDC was chosen as the study area, which is situated occupying the land in and around ShNP. In spite of being, one of the VDC of the capital city, Kathmandu, it is suffering from wild animals facing two major problems like crop and livestock depredation. The aim of my study was to identify the wild pests and park - people's impact on the VDC. The wild pests identified as crop raiders were wild boar, monkey, porcupine, rats and birds. Whereas leopard, jungle cat and black kite were the livestock depredators.

The total economic loss in crop and livestock depredation was Rs. 5,87,618.74. Among the crops grown, maize loss was found the highest followed by millet, wheat, paddy, potato, arum and sweet potato and the total loss in livestock depredation. The domestic birds were mostly observed preying by predators which were followed by goats, cattle and others. Among the wards of the VDC, 4,5,6 had the highest crop and livestock depredation followed by 1,2,3 and 7,8,9 wards.

No any human attack by wild animals was recorded in the villages during the study period. The village people inside and outside were benefited from the natural resources such as drinking water and irrigation, bio-gas, sand, soil and stone quarries, fodder and grass cutting and generating income from tourism related activities. They were provided with skill development trainings and saving / credit programs by I/NGOs for generating income. Beside these, locals of Site A and Site B were complaining of the jungle roads, unemployment and improper schooling for their kids. Similarly, firewood collection, livestock grazing, polluting the water resources, continuous disturbance of wild habitat by trespassing the jungle roads and foot trails were the impacts of the locals in the park.

To prevent their crops and livestock, the villagers applied some of the traditional protective methods such as day and night guarding in the field, dog watch, throwing stones and using catapults, making noise, using traps and cages, and fencing the crop fields to get rid of the wild animals. But these methods were found successful to some extent.

8 RECOMMENDATION

When the protected area system came as blessing for the wild life, several restrictions and regulations imposed on the people living in and around these protected areas gave away to large scale conflicts between the park management and local communities living nearby. The major issues that surfaced included resource use, livestock grazing pressure, wildlife human encounters and poaching. It soon becomes apparent that, unless these issues are properly addressed, the government's conservation efforts will not be balanced and sustained. Therefore, a transformation in policy and programs is needed to win the heart and mind of the people in and around the protected areas. Based on my research, I have some recommendations below:

1. The boundary wall of the park should be stone walled properly and completely blocked where incursions are more likely.
2. Alternative cropping of aromatic grasses should be introduced to reduce wildlife crop depredation around the park, which are remarkably free of grazing damage by stray cattle as these grasses are not palatable.
3. The patchy, peripheral forest areas can be developed as nurseries for herbal plants, spices, commercial plants and local tree varieties which will help fulfill the people's economic and fuel wood needs. This also lessens the wild crop raiders in the field.
4. Considering the limited grazing area and more number of cattle than the capacity of the area, nurseries could be also established for productive local grass species and used for grazing on a rotation basis.
5. Regarding wildlife human conflicts, the compensation plan along with village-level group insurance scheme should be introduced for immediate relief from the loss.
6. The local villagers residing inside the forest areas need to be made aware of the pollution and safety of having toilets located in the house.
7. People should stop chasing and harassing the wild animals that have strayed outside the park areas.
8. The tourists should be acknowledged of the pollution and disturbances created to the nature.

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Annex I

Questionnaires for the locals

Group A: Related to socio- economic condition

Date:

Name of the Head.....
Age Male/ Female
Ethnicities VDC
Village Ward no.

1. What is your occupation
Agriculture..... labor.....
Services..... Others.....
2. How much bari and khet do you have? (in ropani)
0 – 5 6 – 10 11 – 20
21 – 30 31 & above
3. What is the average production of crops in your field? (in muri)
Paddy
Wheat
Millet
Maize
Mustard
Potato
Radish
Other
4. Do you use any kind of fertilizers in your field? (Mention)
Yes..... No.....

Group B: Related to conflict

1. How much time does it take to reach the nearest jungle from your home? (in minutes)
.....
2. Which are the wild animals that attack your crops? (most or least)
.....

3. Which animals attack which crops?

Wild animals	crops						
	paddy	maize	millet	wheat	mustard	potato	others
Wild boar							
Monkey							
Porcupine							
Bear							
Deer							
Birds							
Rats							
Others							

4. What is the frequency of their visit round the year in your field?

Wild boar..... monkey..... porcupine.....
 Bear..... Deer..... Birds.....
 Rats..... Others

5. At what stage which Reserve animal damage the crops?

Stage	Paddy	Wheat	Maize	Millet	Potato	Arum	Sweet potato	Others
Juvenile								
Flowering								
Tasselling								
Mature								

6. What is the total loss of crops of your family? (in Muri)

Paddy.....
 Wheat.....
 Maize.....
 Millet.....
 Potato.....
 Mustard.....
 Others.....

7. Do you apply any methods to protect your crops from wild animals?

a.....
 b.....
 c.....
 d.....

8. Are there any kind human harassment or injuries in your family due to wildlife?

Yes..... No.....

9. Do you have any livestock/ avian stock? (How many)

- Cattle.....
- Buffalo.....
- Goat.....
- Pig.....
- Chicken.....
- Duck.....
- Pigeon.....
- Others.....

10 How many livestock/ avian stock were lost due to wild animals?

Wild animals	Domestic animals							
	cattle	buffalo	goat	pig	chicken	duck	pigeon	others
Tiger								
Leopard								
Jackal								
Wild cat								
Mongoose								
Bird								
Others								

Group c: Related to resource utilization

1. Do you collect firewood fro the park?
Yes..... No
2. Where do you graze your animals?
Within the park..... Outside the park.....
3. What was the situation of the forest before the establishment of national park?(why)
Dense..... Sparse.....
Same.....
4. What are the responses of the park authorities when your animals or you enter the park areas? (if fine, how much)
a..... b..... c.....
5. Have you planted / managed forest of your own? (how much area)
Yes..... No.....

6. In your opinion, what are the causes of conflict between national park and local people?
 - a.....
 - b.
 - c.....

7. Are there anything (complaints) against park authorities?

Yes..... No.....

8. Has the government sector given any kind of compensation for damage? (Mention)

Yes..... No.....

9. What are the facilities that park has provided to villagers?
 - a. Resource utilization
 - b. Compensation for the damage
 - c. Training of different skills
 - d. Other facility

10. Do you think the park and its natural resources should be protected from the point of biodiversity conservation?

Yes No

Annex II

Questionnaires for the Park Authority

1. What are the problems faced by ShNP due to locals?
2. What are the main causes of conflict between park authorities and local people?
3. In your opinion, why do park animals come out of jungle and do the damage?
4. When will be the park refenced?
5. What are the illegal activities within the park area?
6. Is the park always within the sight of the authorities?
7. What action do the park authorities take when they get hold of people involved in illegal activities inside the park?
8. Are there any government policies to resolve the problem of park-people conflict?
9. Has the government sector given any kind of compensation to local people in spite of crop damage or livestock depredation?
10. Does the government have any new kind of techniques under consideration for the future?

Annex III

Different types of crops and plants cultivated in the study area

Local name	Common name	Scientific name
Crops		
Dhan	Paddy/rice	<i>Oryza sativa</i>
Ganhu	Wheat	<i>Triticumaestivum</i>
Jaun	Barley	<i>Hordeum vulgare</i>
Makai	Maize	<i>Zea mays</i>
Kodo	Millet	<i>Eleusine coracana</i>
Mithe fapar	Common buckwheat	<i>Fagopyrus esculentum</i>
Mash	Black gram	<i>Phaseolus mungo</i>
Tori	Indian mustard	<i>Brassica juncea</i>
Sano Kerau	Field pea	<i>Pisum arvanse</i>
Simi	Common field beans	<i>Phaseolus sp.</i>
Bodi	Cow pea	<i>Vigna sinesis</i>
Matar	Garden pea	<i>Pisum sativum</i>
Bhatmas	Soya bean	<i>Glycine max</i>
Vegetables		
Alu	Potato	<i>Solanum tuberosum</i>
Banda gobi	Cabbage	<i>Brassica oleraca</i>
Kauli	Cauliflower	<i>Brassica oleracia</i>
Mula	Radish	<i>Raphanus sativus</i>
Gajar	Carrot	<i>Daucus carota</i>
Bhanta	Brinjal	<i>Solanum melongena</i>
Iskus	Chayote	<i>Sechium edule</i>
Karkalo	Co-co yam	<i>Colocasia antiquorum</i>
Pharsi	Pumpkin	<i>Cucurbita pepo</i>
Lauka	Bottle gourd	<i>Lagenaria siceraria</i>
Golbhenda	Tomato	<i>Lycopersicum esculentum</i>
Rukh tamatar	Tree tomato	<i>Cyphomandra betacea</i>
Pindalu	Arum	<i>Colocasia indicum</i>
Sakharkhanda	Sweet potato	<i>Ipomoea batatas</i>
Ramtoria	Lady's finger	<i>Hibiscus esculentus</i>
Kakro	Cucumber	<i>Cucumis sativys</i>
Chamsur	Garden cress	<i>Lepidium</i>
Latte sag	Amaranth	<i>Amaranthus leucocarpus</i>
Niuro	Edible fern shoot	<i>Dryopteris cochleata</i>
Rayo ko sag	Broad-leaved mustard	<i>Brassica juncea</i>
Sisnu	Stinging nettle	<i>Urtica ardens</i>
Khursani	Chilli	<i>Capasicum annum</i>
Aduwa	Ginger	<i>Gingiber officinale</i>
Besar	Turmeric	<i>Curcuma domestica</i>
Fruits		
Mewa	Papaya	<i>Carica papaya</i>
Kera	Banana	<i>Musa sp.</i>
Naspati	Sand pear	<i>Pyrus pyrifolia</i>

Annex IV

Unit Conversion

1 ropani	=	0.0523076 Hectare
100 Kg.	=	1 Quintal
1 Muri	=	20 Pathi
Wheat	= 1 Pathi	= 3.5 Kg
Paddy	= 1 Pathi	= 3 Kg
Maize	= 1 Pathi	= 3.5 Kg
Millet	=1 Pathi	= 3 Kg
Potato	=1 Pathi	= 2.8 Kg
Arum (<i>Pindalu</i>)	=1 Pathi	= 2.7 Kg
Sweet potato	=1 Pathi	= 2.8 Kg

Local Rates of different crops (Kg)

Wheat	=	Rs. 18.30
Paddy	=	Rs. 25.00
Maize	=	Rs. 17.00
Millet	=	Rs. 17.00
Potato	=	Rs. 24.00
Arum	=	Rs. 14.00
Sweet potato	=	Rs. 14.00
Garlic	=	Rs. 80.00
Onion	=	Rs. 50.00
Buck wheat	=	Rs. 20.00

Source: Local Respondents, 2007

Annex V

Effect of wild animals on crops in different months

Wild animals	Paddy	Wheat	Maize	Millet	Potato	Yam
Rhesus monkey	Sept-Oct	-	Jul-Sept	Nov-Dec	Jan	Jun-Jul
Wild boar	Aug-Oct	Apr-May	Jul-Sept	Oct-Dec	Jun-Jul	-
Porcupine	Sept-Oct	-	Jul-Aug	Oct-Dec	-	-
Birds	-	-	May	-	-	-

Cropping calendar of different Nepali months

Crops	Fal	Cha	Bai	Jes	Asa	Shr	Bha	Aso	Kar	Man	Pou	Ma	Fal	Cha	Bai
Paddy															
Wheat															
Maize															
Millet															
Potato															
Arum															
Sweet potato															
Radish															
Bean															
Cucumber															
Pumpkin															
Yam															
Turmeric															
Mustard															

Source: Field survey, 2007

Annex VI

List of recorded threats observed at ShNP

S.N.	Types of threat	Impact on wildlife	Degree
1	Grazing of livestock	-Disease might be introduced -Continued degradation of habitat -Soil erosion	Very high
2	Encroachment (agricultural)	-Habitat area reduced -Indirect pesticide effects	Moderate
3	Illegal forest products collection (firewood, timber, grasses, medicinal plants, herbs)	-Habitat destruction	Moderate
4	Poaching	-Loss of wild stock	Low
5	Transport and communication (motor bike, jeep)	-Continued disturbances -Small vertebrates killed -Large and small mammals killed	Very high
6	Pilgrimages (large temples)	-Continued disturbances -Noise and air pollution increased -Implication of laws and rules	Very high
7	Tourism development	-Continued disturbances	Moderate
8	Forest fires	-Loss of forest -Degradation of habitat -Loss of small animals like reptiles, nests of ground dwellers	Low
9	Man-wildlife conflict - attack by large mammals - depredation of domestic animals - agricultural crop damage	-Creating problems -Conflict with forest department and staffs -Adverse effects on conservation -Punishment to villagers	Very high

Source: Field survey, 2007

