CHAPTER I

1. Introduction

1.1 Conflict

Conflict is a situation in which opposing interests, views and activities come at a point. Such a situation can develop both in human and animal world, and among the humans and animals. Conflict between animals and humans emerge when humans act against the interest of the animals or vice versa.

1.2 Concept of National Park

The Yellowstone National Park in the United States created in 1872 was the first National Park ever established in the modern world (Mac Kinnon et al., 1986). This was a milestone in the evolution of the concept of national parks. National Parks in the developing countries, particularly in Asia, were established beginning in the second quarter of this century (Mishra 1991).

The Commission on National Parks and Protected Areas (CNPPA) has defined national park as "Natural areas of land or sea, designated to (a) Protect the ecological integrity of one or more ecosystems for present and future generation. (b) Exclude exploitation, or occupation inimical to purposes of designation of the area and (c) Provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible" (IUCN, 1978).

In Nepal a total of 16 protected areas covering a total land mass of about 19.42% have been established. Of these 9 are National Parks, 3 Wildlife Reserves, 3 Conservation areas, and 1 Hunting Reserve (NBS 2001).

Recently, government extended Bardia National Park and added Gaurishankar, Ramarosan and Nagarjun under the protected area system and now the system possesses around 25% of Nepal under protection (DNPWC, 2009).

1.3 The Buffer Zone Concept

A Buffer zone is one of six management zones in the protected area (Mackinnon et/al., 1986). Buffer zone has been defined as the area adjacent to the protected area on which land use is partially restricted to give an added layer of protection to area while providing valued benefit to neighboring rural communities (Mackinnon. et. al., 1986). Thus, it is an area of controlled and sustainable land use, which separates the protected area from direct human pressure (Ordsol, 1987).

World National Park Conference at Bali in 1982 focused on the relationship between protected areas and human needs stressed the relevance of integrating protected areas with other major development issues (Mishra, 1991). The message is that the needs of the Local people (Sayer, 1991). The involvement of Local People in the management of the protected areas for mutual benefits is widely accepted today (Oltied, 1988). These days the buffer zone concept has been widely accepted in protected area management in order to reduce conflict between protected areas authorities and the local people (Berkmuller et. al., 1990).

1.4 Background

Asian Elephant (*Elephas maximus*)

The elephant is an Elephantidae family in order "Proboscidea" and in class "Mammalia". Asian elephant (*Elephas Maximus*) is one of the three living species of elephants. Other two species, the African Savannah/bush elephant (*Loxodonta african*) and the African forest elephant (*Loxodonta cyclotis*) are confined in the African Continent (Asian Elephant- Wikipedia, the free encyclopedia, 2007).

Global distribution

The distribution of elephant population often cuts across political boundaries over the continental mainland and also in some islands of south and south-east Asia. The Asian elephant occurs in thirteen countries in Asia namely India. Nepal, Bhutan, Bangladesh, China, Burma, Thailand, Camodia, Laos, Vietnam, Malaysia, Srilanka, Sumatra and Borneo (Stromayer 2001).

In Nepal, Asian Elephants (*Elephas maximus*) inhabit the narrow strip of Tarai plain, covering approximately 2,500 km^2 of land and out of this area, 1,600 km^2 is under protected area management. In this belt, the major herd is found in Bardia National Park and in Chitwan National Park. There are records of stray wild elephants in Koshi Tappu Wildlife Reserve, Sunsari district and Morang as well. There are also transboundary herds that move form India to Nepal and vice versa; in eastern, mid-western and far- western Nepal. In eastern Nepal, two herds of residential elephants are identified. The big herd concentrates close to Bahundangi VDC, Jhapa, whereas, small herd usually roams from Jhapa to Udaypur district (Wildlife Conservation Nepal, 2007).

1.5 Statement of the problem

The elephants are large gregarious animals, protected species and worshiped by the Hindus as the symbol of Lord Ganesh. Elephants may not be harmed to the level of extinction in Nepal even in the face of receding forest. But their population may get suppressed eventually. Determining population size of different elephant herds and subsequent monitoring of their movements between Nepal and India will remain crucial. This also opens the window of opportunity for Nepali and Indian biologist of different institutions, to conduct a long term transboundary conservation research and facilitate the Asian elephants study and cooperation between Nepal and India (Yadav, 2005).

In Nepal, Wildlife's crop damage is very common along the immediate periphery of national parks and reserves in the Tarai. However, crop damage is not limited to the plains. Upreti (1985) noted that buckwheat and barley were repeatedly destroyed by wild pigs, Langurs, and macaque monkeys in Langtang and Rara National Parks. Little quantitative information on crop loss or damage is available for this study area on the edge between continuous forest and dense human habitation zones along the southern boundary of the national park area (Jackson, 1990). Chalise (2000-01) estimated crop loss due to wild animals for the two villages of Makalu-Barun conservation areas. In Lakuwa Village with 80 households, 39,699 kg of the agricultural produce, representing 496 kg for each household, was estimated to have been lost by different wild animals. Wild animals such as monkeys, deer, porcupines, squirrels, birds and other small mammals caused a total loss of 26,748 kg of cereals

per year with 334 kg per family due to their activities. Cereals such as maize, rice, finger millets, buckwheat, wheat and pulses were either eaten or standing crops were damaged by the animals' activities. A loss of 12,948 kg of tubers, rhizomes and fruits occurred in Lakuwa village, with 161.86 kg for each household caused by wild animals. In the Shiva village, crop damage exhibited a different pattern. Rice was the cereal most spoiled, followed by maize, millets, wheat, cardamom and pulse. Total loss of cereals was estimated to be 18,447.6 kg (56%) and fruits and tubers about 14,655 kg (44%). The total loss of cultivated food by Shiva's 38 households amounted to 33,102.58 kg, or 871.11 kg per household per year. The respondents were mainly concern with primate species and other wild animals such as squirrels, civets, porcupines and jackals as well as birds (Chalise, 2003).

Habitat of wildlife degradation in the study areas is significant. Every day much of the timbers are smuggled by transboundary poachers. The firewood and fodder collection have no alternative to local people in and around the park area. Conflict among protected area regulations and people are still unsolved due to the different interest and socio-economic condition of people. Furthermore a large size wild animal such as elephant consumes a lot food and use to invade cropland desperately due to lack of forage in the forest. Forest areas are decreasing due to status of common property and with no proper management plan for forest productivity. Remaining habitat of wild animals are also not protected and managed scientifically to meet the demand of existing number of animals. There is no program initiated to attract the elephant inside the forest that prohibit them not to wander outside the forest area. Rather degraded forest will not provide sufficient fodder for the animals and forced to move out of their area. They do a lot of damage to the human interest and also consume their properties. These procedures are likely to follow human harassments and killings to both sides. Bardia National Park provides a potential habitat for wild elephant. The annual home range for elephant of this region is assumed to be 188 to 400 sq.km. (Williams, 2003) and the Bardia provide nearly 60 sq.km. for the wild elephant which is too small (Pradhan & Wegge, 2007). The elephant number is increasing in shrinking habitat that forced the elephant to use areas outside the park. It eventually escalates the conflict between human and elephant for the space and food too.

This study, therefore, will also analyze the complex issues of human-elephant conflicts by focusing on the day-to-day problems faced by the local people of affected study areas. The results of the study would be a field tested reference to other similar habitat of the country and its recommendation can be utilized to reduce the complex issues of wild elephant and human conflicts.

1.6 Rationale

The study on conflict between human and wildlife is limited and existing data was basically from the protected area system. However, to acquaint the situation thoroughly in national level every corner of the country should be dealt properly and scientifically. It needs the info of core areas as well as surrounding buffer zone and corridor habitat. The feeding ecology and moving pattern of elephant should be assessed thoroughly to understand whether their activities as such is natural or initiated due to human rage. The information of a full year can reveal their annual cycle and also moving pattern around the targeted area.

Currently many protected areas are under controversy of their conservation efforts due to damage of human interest in buffer zone and sometime distant rural cropland. The study in detail framework of animal activities and human perception collection is the key that could result a solution for harmonious situation to park-people and wildlife-people coexistence in Nepal around protected areas.

1.7 Objectives of the study

The main objective of this study is to analyze the human and wild elephant conflict. The specific objectives of the study are as follows:

   To assess the damage caused by the wild elephants and explore measures taken by local people to reduce it and initiatives of concern institutions around BNP.
   To explore the suitable mitigation measures to minimize human-elephant conflict in and around Bardia National Park.

1.8 Theoretical Framework

A study on human-elephant interface has not been carried out in western Nepal so far. The existing information on the status of wild elephants and crop damage assementis very limited. The conflicts have created great problems between the government and local people in relation to the management of wild elephants. The people are not

satisfied with the politicians because they give their commitment to resolveelephant problems only for getting votes during the election time (pers.com,local famers). This study, therefore, analyses the complex issues of human- wild elephant interface by focusing on the day to day problem faced by the people in western Terai of Nepal (Fig. 1)
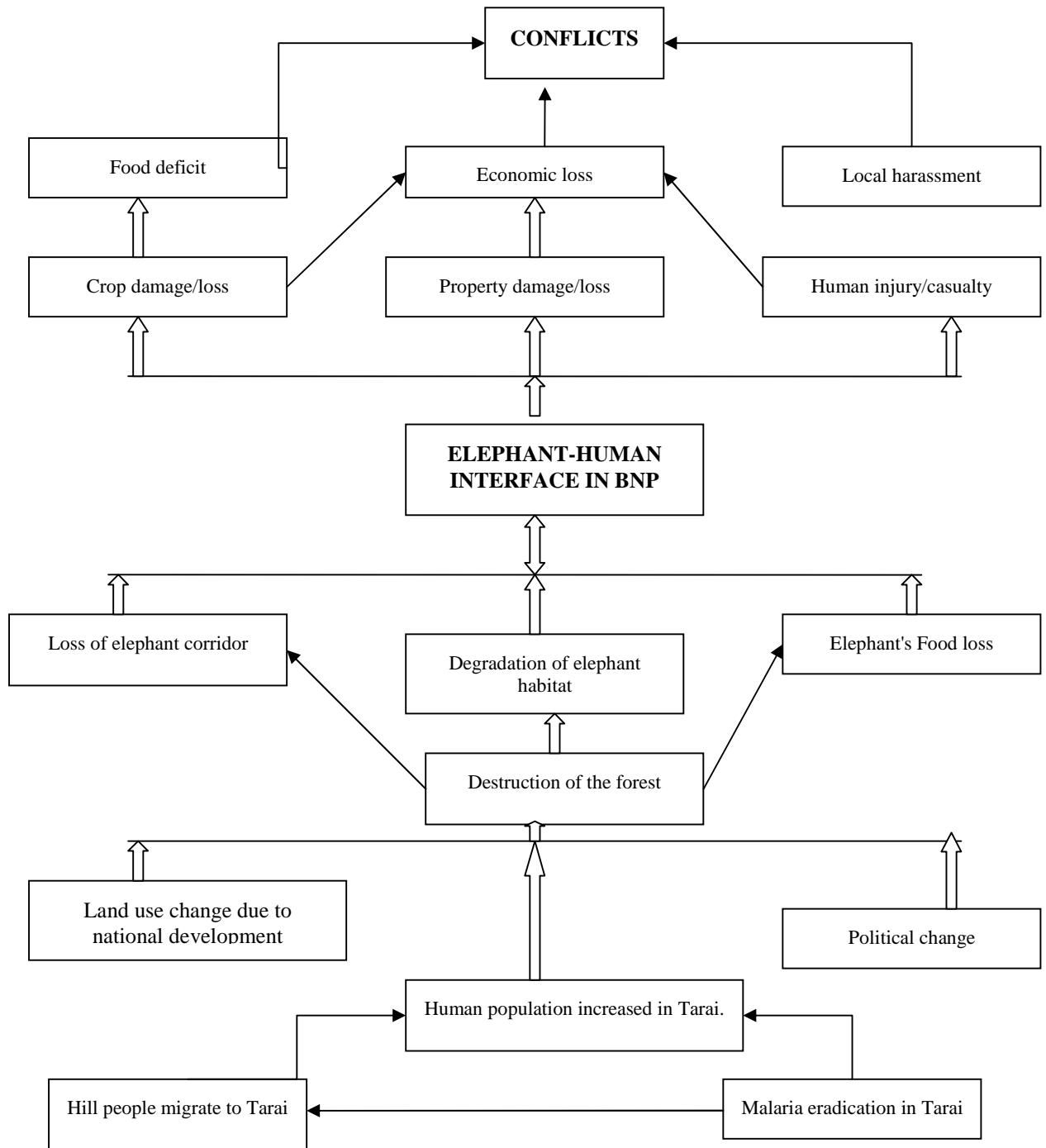

Figure 1: Human and elephant interface in BNP (modified from Yadav, 2005.)

1.9 Scope and Limitation of study

The study does not cover an extensive area. It was confined only the south western buffer zone of Bardia National Park. Due to the limitation of time, the study was not sufficient to cover the every facet of human-elephant conflict. The relevance of the study basically lies on the response of the respondents assuming they have truth. It was difficult to estimate to losses in quantitative value, because respondents were not found to keep such data and hence questionnaire regarding the crop loss in terms of percent.

The out-comes form the study will be helpful and valuable information for the researcher, organization and other concern persons for the relative field. It is hope that this research work will help to reduce the conflict between the park and people and enhance management of the protected areas.

CHAPTER II

2. Literature Review

Literature review includes review of concepts and theories of previous research findings about related fields and topics.

Asian elephants roamed most of the forest and savanna regions of Asia. Today only about 41,000 to 52,000 hold on precariously in the wild places of 13 elephants range state Bangladesh, Bhutan, Cambodia, China, India, Indonesia, Laos, Malaysia, Myanmar, Nepal, Sri Lanka, Thailand and Vietnam. Additionally an estimated 13,500-15,000 domesticated elephants, mostly wild caught, assist human in the region. In the past centuries, more than 100,000 wild elephants have domesticated in Asia to use in draft power and prestige (Kemf and Santiapillai, 2000; Sukumar 2003).

Nepal is a small country but rich in biological diversity due to its altitudinal variations (60m to 8848m within a horizontal distance of 150 km). Protected areas (PAs) have been established since 1973 which added regularly and now it covers about 25% of the total land areas of Nepal. A recent population estimation of 120-156 wild elephant is considered to be distributed as geographical sub-populations in Nepal. It is estimated that 10-13 wild elephants roam around in Eastern Nepal, 40-50 in Central Tarai, 60-75 in Mid-Western Tarai and 12-18 in Far-Western Tarai in Nepal (Smith & Mishra 1992, Yadav 2005, Chalise, 2008).

Habitat loss is the single greatest threat to the survival of substantial number of wild Asian elephants. Recent research at the Smithsonian Institutions Conservation and Research Center suggests that the Asian elephant's geographic range has declined by as much as 70 percent since 1960s. Relatively large number of herds in the forest indicated the presence of external disturbance. Presence of large number of herbs as compared to trees in the lower portion of the hill also reiterates the above fact. Such species composition, most probably was caused by human and animal disturbance originating from several villages in the area (Shrestha and Shrestha 1988).

"Human population density, guarding, hunting sight distance and distance from the forest are incorporated at two levels of analysis the field and the village. These analysis reveals how landscape features shaped by individual and collective action,

interact to affect the extent of damage" (Treves 1997). "Human wildlife conflict is a relatively new research subject for conservation biologist" (Dublin 1995; Tchamba 1996). At several sites investigations have revealed a disparity between reported and observed damage with farmers, most often overestimating the amount of crops loss due to the wildlife.

The study of feeding behavior is essential to the understanding of a species ecological adaptation to the environment, and it is also an important factor to be considered when examining the relationship between ecology and socio-biological problems. For the protected areas of Nepal, as the NTFP and other so called "Kukath" is still neglected and not strictly preserved. Many food plants in Tarai protected areas are either burnt in summer or smuggled away along with thatch cutting (Khar-khadai). Similarly, the existence of many plant species is questionable due to such activities in protected areas. Therefore, the protection and conservation of biodiversity of food plant species should be strictly enforced. The damage data would be beyond our assumption if we could take data of all herbivores. Besides that the need of NTFP and other wild fodder plants for domestic cattle created a sharp competition between human and wild herbivores (Chalise, 1995; 2000).

Nepal and Weber, (1993) have studied the park people conflicts in CNP, and found out that intensity and magnitude of conflicts were high in the settlements located near to the park and further added that people settled adjacent to the park are heavily dependent on the resources of the park. According to them, perception of local people about the conservation of National park was found significantly positive. They pointed out that crop damage was among the major issue of conflict and concluded that effective fencing could greatly minimize these problems. They also recommended launching a buffer zone programme to reduce the impact of wild animals into the agriculture land.

Studsrod and Wegge, (1995) studied park-people relationship and mentioned about serious crop damages caused by park animals around the Bardia National Park. According to them, villagers of developing countries are particularly vulnerable to the establishment of protected areas, as they depend primarily on locally available resources for their physical livelihood and spiritual needs. They mentioned that crop raiding and predation of livestock by park animals might further increase the

problems of securing a sustainable livelihood for people living-surrounding areas of national park. They also mentioned that wild animals entering to agriculture land may lead to various forms of damage, e.g. crop loss by raiding and destruction, livestock depredation, harassment and injuries to local people by wild animals.

Uprety, (1994) has mentioned human impact on the park as well as the impact of park on the local people. After the description about human impact on the park he concluded that the surrounding communities could impact to the park by poaching and hunting, fishing, firing and increasing number of tourist. Apart from them several infrastructure projects also impacts the park environment. Similarly, crop damage, livestock depredation, loss of live or injuries by both carnivorous and herbivorous animals is the perennial impacts on the immediate vicinity of the human habitat of the BNP.

Baral, (1999) studied the wild boar and people conflict in the South-western section of the Bardia National Park. It is stated that, crop damage was the serious problem among of the south-western boundary of the BNP. He mentioned that not only crop damage is the causes of the conflict, but human injuries, local harassment, livestock kill are also the major cause of conflict between the park and people of the south-western boundary of BNP. He also mentioned that while pest ranking, wild boars become the second major wildlife pest species in the study area. He also focused that traditional preventive measures were partially successful to chase the wild boar. He suggested some effective techniques to minimize the problems.

Lewis, (1996) in his handbook described the conflict resolution overview and stated that conflict could be resolved in a variety of ways. A formal Legal or institutional mechanism such as, a court proceeding or legislative action has been suggested to resolve the conflict. He presented some case studies for conflict resolution orienting framework towards the informal, voluntary and collaborative approaches to supplement formal mechanisms processes. In all case studies, Lewis (1996) concludes that almost all conflicts are mainly due to a lack of attention to the process of involving local people and other who care about the protected area in planning, management and decision making for the area as well as nearby communities having needs for grazing land, fire wood, building materials fodder, medicinal plants, etc.

Shrestha and Kattel, (1996) studied the indigenous knowledge and attitude of women towards the conservation of flora and fauna in CNP. For study, they particularly selected the buffer zone area of CNP. In their study they also state that the interaction between women and the parks has existed since the park was established. Further, they stressed that women collected forest resources from the park, while animal from the park invaded their crops. They reported positive attitudes among majority of the respondents towards the economic, ecological and ethnic values of national park, while few women expressed negative attitudes and unhappiness because their livestock and crops were destroyed by wild animals and at the some time restriction is imposed on the use of park resources.

CHAPTER III

3. Study Area

Bardia National Park is located along the east bank of Karnali River in the Mid-western Development region of Nepal. It is about 400 km far from the capital city, Kathmandu. The park extends between 28^0 15' to 28^0 40' N to 80^0 10' to 81^0 15' E with 968 square kilometer area in two districts: Bardia in the west and Banke in the east. It was originally set as a Royal Hunting Reserve in 1969; gazetted as Royal Karnali Wildlife Reserve with an area of 350 square kilometer in 1976; as Royal Bardia Wildlife Reserve in 1982; extended to include the Babai River valley in 1984 and gazetted as Royal Bardia National Park in 1989 by the then His Majesty's Government of Nepal (HMGN). After the political movement of 2006, the park has been renamed as "Bardia National Park" (BNP) by the Nepal Government.

The crest of the Churiya range demarcates the northern boundary of BNP. The southern boundary follows the local limits of cultivation, part of east-west highway and forested buffer zones. Kohalpur-Surkhet Road forms the eastern boundary of the park. The Geruwa River, a branch of the Karnali River (the largest perennial river of Nepal) determines the western boundary of BNP (Map 1). This park occupies broad range of ecosystem such as flood plains, oxbow lakes, grasslands, sal forest and riverine forest in low land plain; while on the Churia range subtropical deciduous forest exists. Five major Phantas (Lamkauli, Upper Baghaura, Lower Baghaura, Upper Kahuraha and Lower Khauraha) are located in the south-western corner of the park (Parajuli, 2007).

Topography of BNP shows a distinct altitudinal gradient. The northern part forms the Churiya (Siwalik) ridge which rises quite steeply to the crest reaching an elevation of 1441 m at Sukarmala, the highest altitude of the park. The southern section is characterized by a low-lying unbroken terrain with the lowest elevation of 152 m (Dinerstein, 1979).
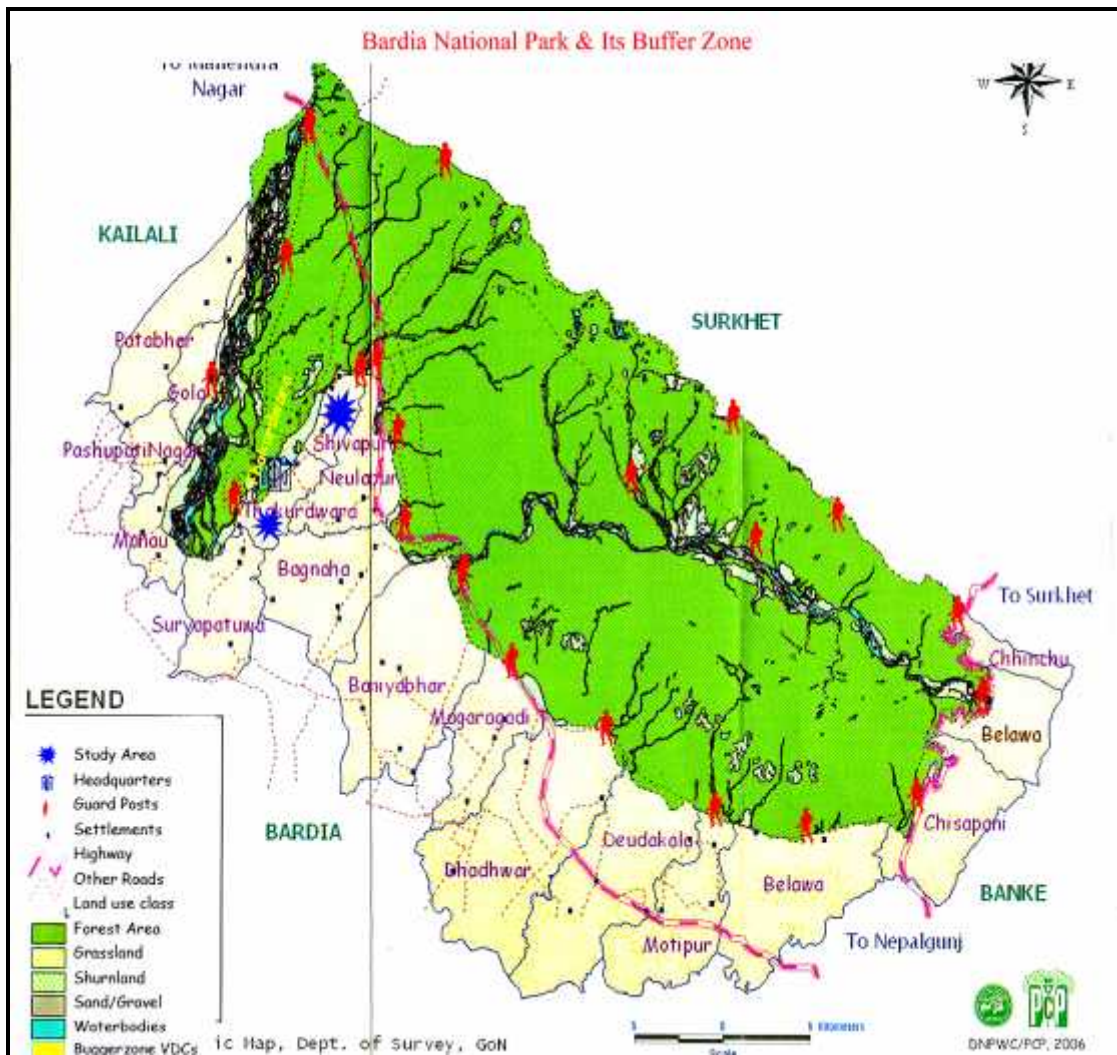
Map 1: Location of Bardia National Park.

3.1 Climate

The study area has subtropical monsoon climate with three distinct seasons (Dinersten, 1979). Hot Dry from mid February to mid June, Monsoon from mid June to late September and Cold Dry from late September to mid February. The temperature increases steadily during the hot season until the monthly maximum of 34.05C in May. Monsoon season most of the total annual rainfall (about 80-90%) occurs during three months (June, Jul and August) of the year. In the cool season temperatur decreases steadily until monthly minimum of 5.6 C in January (Fig 2). The highest mean monthly rainfall of 589.60mm occurs in Jul and lowest monthly rainfall of 7.70mm occurs in December (Fig 3).
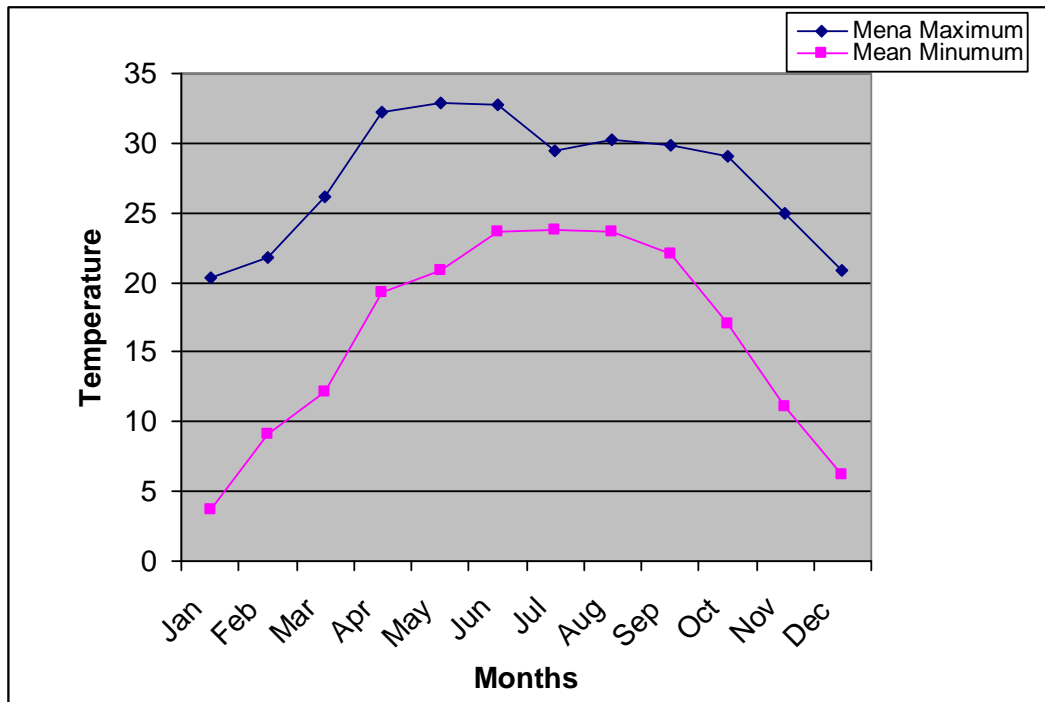
Figure 2: Mean monthly maximum and minimum temperature of Chisapani- Karnali.
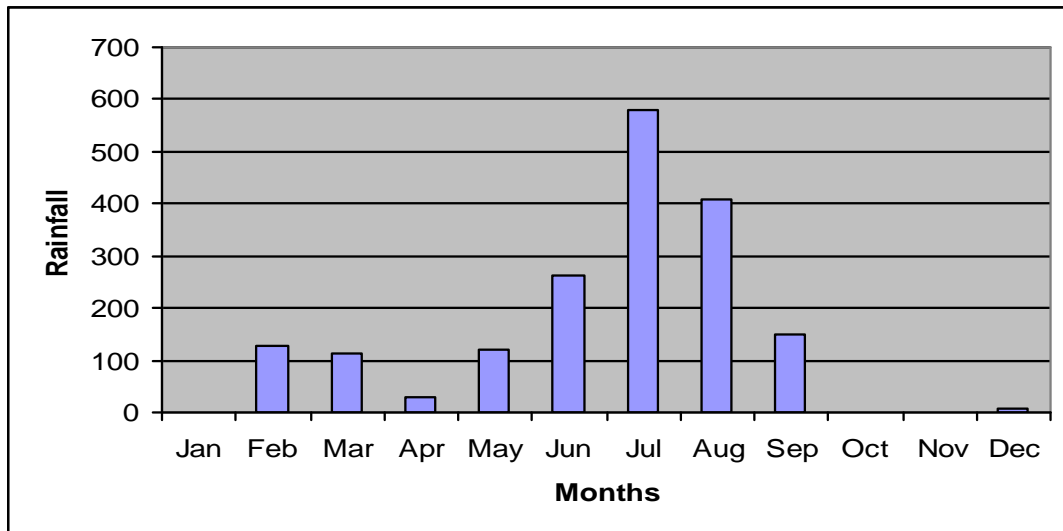

Figure 3: Mean monthly maximum and minimum rainfall of Chisapani- Karnali

3.2 Vegetation

Dinerstein (1979) classified six major vegetation types in BNP which were later modified by Jnawali and Wegge (1993) to seven major types:

⟩ Sal Forest is characterized by Sal *Shorea robusta* and covers about 70% of the total area.

⟩ The main associated species with Sal are *Terminalia tomentosa* and *Buchanania latifolia*.

⟩ Khair-Sissoo Forest is a pioneer association on riverside gravel. This forest type is dominated by Khair *Acacia catechu* and Sissoo *Dalbergia sissoo*. Two shrub species, *Murraya koenigii* and *Callicarpa macrophylla* form dense under-stories.

⟩ Moist Riverine Forest is distributed in patches along water courses and in depressions. This forest is characterized by evergreen species such as *Syzigium cuminii*, *Mallotus philippinensis*, *Ficus racemosa* and *Bombax ceiba*.

⟩ Mixed Hardwood Forests grow in well drained flat land. *Adina cordifolia*, *Casearia tomentosa*, *Garuga pinnata*, *Mitragyna parviflora* are some common tree species of this forest type.

⟩ Wooded Grasslands are grass-covered areas with sparsely distributed trees. *Imperata cylindrica*, *Saccharum spontaneum*, *Vetiveria zizanoides*, *Cyperus kyllingia* are the most common grasses. Tree species such as *Bombax ceiba*, *Adina cordifolia*, *Bahunia malbarica* and *Mallotus philippinensis* are also sparsely distributed in this habitat.

⟩ Phanta is short open grassland in previously cultivated fields. *Imperata cylindrica* is the dominating grass species in this vegetation type.

⟩ Flooded Grasslands are tall grasslands along floodplains. The dominant species are *Saccharum spontaneum*, *S. bengalensis*, *Phragmatis karka* and *Narenga phorphyrocoma*.

CHAPTER IV

4. Methodology

4.1 Reconnaissance Survey

The reconnaissance survey of the proposed study was done before the data collection in the field. I make informal talks with experts, park's related authorities and local communities so as to identify the potential site of elephant availability and their likely impact zones.

4.2 Survey Design

The preliminary survey was conducted in the Park and adjoining and local village selected for the household surveys in to them. Two VDCs were selected for this purpose. The Six/ six wards of Shivapur and Thakurdwara fall within the boundary of buffer zone. All 12 wards were selected for the present study. From each ward 10-20 households were selected randomly without replacement basis. Altogether 10% households were selected for questionnaire survey (Table 1 and 2).

4.3 Primary data collection

4.3.1 Household questionnaire

A pre-tested semi-structured questionnaire was used to interview the respondents. A questionnaire containing information like the elephant visitation, elephant related problem, preventing methods used by the locals, possible remedial measures of conflict etc. was used to collect the information from respondents. The households' survey questionnaire was divided into two sections problems associated with crop damage and remedial measures and problems human injury and harassment (Appendix 1). One local field assistant was employed for data collection. The assistant was given orientation in the purpose of the study and techniques of data collection. The randomly selected the households in six wards of Shivapur VDC and six wards of Thakurdwara VDC for questionnaire survey.

Table 1: Sample size in each affected ward of Shivapur VDC.

Strata of Words	1	2	3	7	8	9	Total
Total Households	81	88	116	78	211	367	N=941
No. of households sampled	8	9	12	8	22	37	Ni=96

Table 2: Sample size in each affected ward of Thakurdwara VDC.

Strata of Words	2	3	5	6	7	9	Total
Total Households	236	180	123	167	228	142	N=1076
No. of households sampled	24	18	13	17	23	14	Ni=109

4.3.2 Secondary data collection

Secondary data related to the study was reviewed from different books, annual reports, news article, research report, dissertation, journal, website, visiting different concern offices, and library.

4.4 Data analysis

Simple data analysis technique was done for this study. After conducting questionnaire survey mean crop loss per household was calculated.

$$\text{Mean crop loss per household} = \frac{TotalCropLoss}{TotalNoofHouseholds}$$

By multiplying mean crop loss and total households of the village, total crop loss of the village calculated.

Total crop loss of the village = mean crop loss x total households of the village loss.

Current local price of the crop was adapted from the local market and the total economic loss of the village calculated by the multiplication of total crop loss.

Therefore, economic loss of the village = price of crop x total crop loss of the village.

4.4.1 Statistics

The data obtained were analyzed by Pearson's Chi- Square Test (^{2}). This test was carried out to:

）Test regarding crop damage and harassment by wild elephants among Wards.

）Test regarding the intensity of crop damage in relation to calves with elephants.

CHAPTER IV

5.   RESULTS

5. 1. Problems Caused by elephants

The major problems caused by wild elephants in Shivapur VDC were crop damage and human harassments. More than sixty six point six percent of the respondents reported crop damage, 16.7% reported harassments and 16.7% suffered both crop damage and harassment (Table 3.).

Table 3: Response of households to problems by wild elephants (Shivapur VDC)

Wards	Sample size	Crop damage	%	Harassment	%	Both crop damage & Harassment	%
1	8	5	62.5	1	12.5	3	37.5
2	9	6	66.6	2	22.2	1	11.2
3	12	10	83.3	1	8.3	1	8.3
7	8	6	75.0	1	12.5	1	12.5
8	22	13	59.1	5	22.7	4	18.2
9	37	23	62.1	6	21.6	6	16.2
Mean	96	63	66.6	16	16.7	16	16.7

The major problems caused by wild elephants in Thakurdwara VDC were crop damage and human harassments. More than fifty-four point two percent of the respondents reported crop damage, 24.7% reported harassments and 21.1% suffered both crop damage and harassment. (Table 4)

Table 4: Response of households to problems by wild elephants (Thakurdwara VDC)

Wards	Sample size	Crop damage	%	Harassment	%	Both crop damage & Harassment	%
2	24	16	66.6	4	16.7	4	16.7
3	18	8	44.5	5	27.8	5	27.8
5	13	8	61.6	3	23.1	2	15.4
6	17	8	47.1	5	29.5	4	23.5
7	23	13	56.5	6	26.2	4	17.3
9	14	6	42.8	4	28.6	4	28.6
Mean	109	59	54.2	27	24.7	23	21.1

5.1.1 Crop loss

The measurement was carried out one time during the study period. The wards 9, 1 and 2 were severely damage while 7 and 8 were moderately and 3 was low (Table 5). Farmers were frightened from the elephant so they did not allow making sample plots for crop damage measurements. That is why measurements were carried out in the field immediately after raiding.

Table 5: Crop damage measurements in elephant affected wards of Shivapur and Thakurdwara VDC in 2008.

Wards	Crops	Households	Estimated Quantity (Kg)	Amount (NRs.)
1	Paddy	5	1500.00	31440.00
	Wheat	3	300.00	5100.00
	Maize	1	50.00	758.50
2	Paddy	4	900.00	18884.00
	Wheat	2	200.00	3400.00
3	Maize	6	200.00	3034.00
	Wheat	2	200.00	3400.00
7	Paddy	6	400.00	8384.00
8	Paddy	10	500.00	10480.00
9	Paddy	10	1950.00	40872.00
	Wheat	5	250.00	4250.00
Total	**-**	**54**	**6450.00**	**129982.50**

A total of NRs. 552366 of monetary loss was estimated due to crop damage by elephants in 2008. Paddy accounted 37.7% of the total loss followed by Wheat 25.2%, Maize 21.6% and Lentil 15.4%(Figure - 4)(Appendix II).
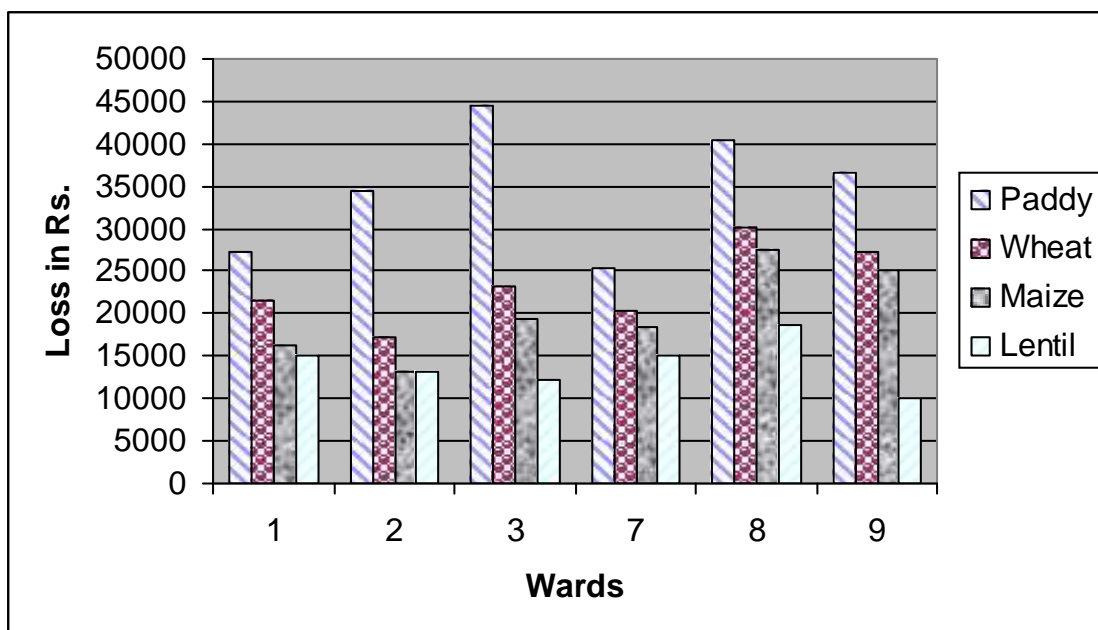
Figure 4: Estimated amount of crop loss by type affected wards of Shivapur VDC. 2008.

The affected wards of Thakurdwara VDC, a total of NRs. 594179 monetary loss was estimated due to crop damage by elephants. Paddy accounted for 39.9% of total loss followed by Wheat 32.4%, Maize 18.5% and Lentil 9.2% (Table-7).

Table 6: Ward wise loss (NRs.) in crops estimated by household survey in Thakurdwara VDC, 2008.

Ward	Paddy	Wheat	Maize	Lentil	Total
2	60550	42205	25156	10205	138116
3	52155	45203	15225	7775	120356
5	26135	19235	13155	5175	63700
6	30235	26255	20454	15105	92049
7	40255	35460	19165	10205	105085
9	28106	24555	17103	5107	74871
Total	**237436**	**192913**	**110258**	**53572**	**594179**

Majority of respondents (73.4%) said that elephants were mainly responsible for crop damage in Shivapur VDC, while very few respondents reported damage from Deer, Wild boar and other animals (Figure 6).
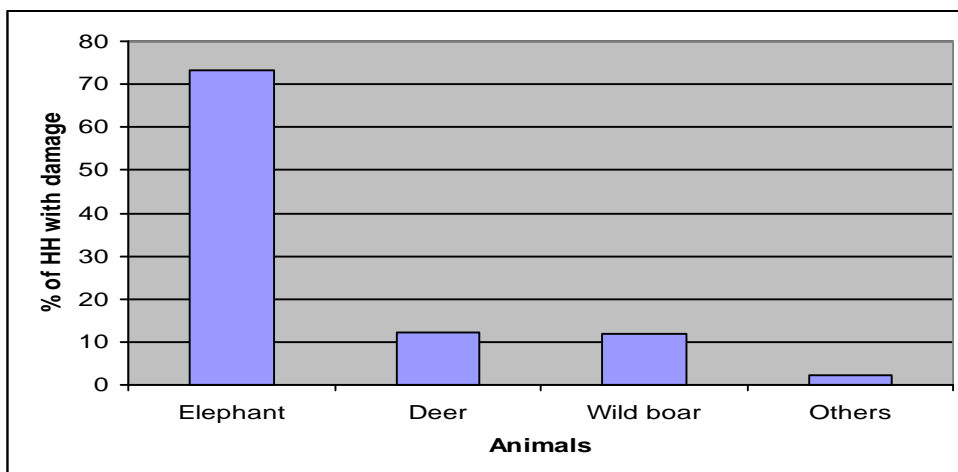
Figure 5: Corp damage problems by wild animals in Shivapur VDC and Thakurdwara VDC in 2008

Around 94% of the respondents replied that elephant entered the crop field during night and others responded the day. The frequency of crop raiding by elephants in Shivapur and Thakurdwara varied among wards. In Shivapur VDC. It was 1, 2, 3, 7 and 8 more frequented. These five wards adjacent to the National Parks. Remain of 9 ward is not joined to the national park. Similarly, wards 2, 3, 5, 6 and 9 of Thakurdwara are joined with National park so more frequented by elephants. But remain of ward 7 less frequented. However the frequency of elephants entering crop field 1-2 times a year (31.2%) was most common in all the wards (Figure 7).
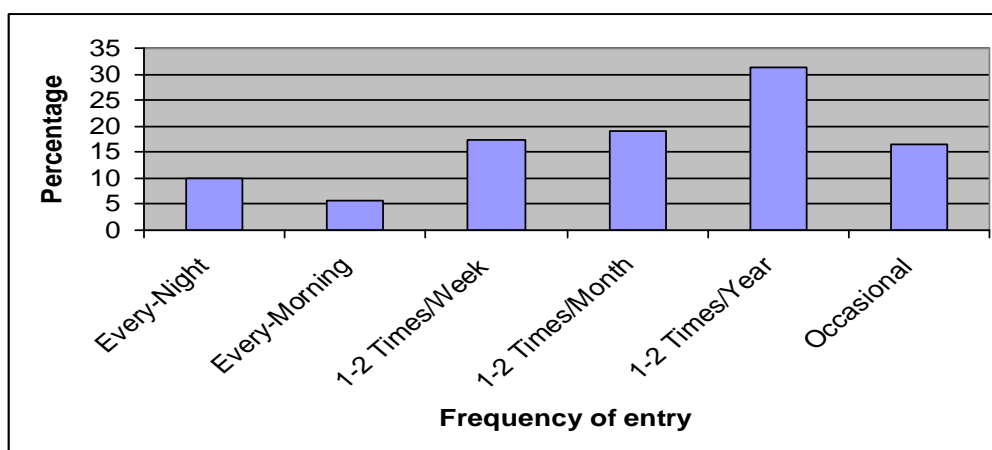
Figure 6: Perception of respondents regarding seasonal intensity of crop damage in Shivapur VDC and Thakurdwara VDC.

The incidences of crop fields during a year in Shivapur VDC and Thakurdwara VDC were high in the months of July-August and November- December. Medium intensity of damage occurred in March-April and September-October. Low intensity of crop damage occurred in February and May-June. (Table 7 and Figure 7). In Shivapur VDC, Sixty two percent of the respondents reported that crop damage was more when elephants came with calves compare to without calves. However, 18.3% respondents reported that crop damage was less with calves (Appendix IV). Chi –square test showed that there was significant difference among households in relation to crop damage by elephants with and without calves (x^2 = 133.54, P=0.05, df =11).

Similarly, in Thakurdwara VDC, More than sixty two point percent of the respondents reported that crop damage was more when elephants came with calves compare to without calves. However, 18.7% respondents reported that crop damage was less with calves (Appendix IV). Chi –square test revealed that there was significant difference among households in relation to crop damage by elephants with and without calves. (x^2 = 165.7, P=0.05, df =11).

Table 7: Seasonal intensity of crop damage (%) based on questionnaire (N=205)

Month	High	Medium	Low
Jan			19.5
Feb			24.3
Mar		31.7	
Apr		36.0	
May			20.0
Jun			22.0
Jul	72.0		
Aug	65.5		
Sep		30.2	
Oct		29.0	
Nov	70.2		
Dec	73.3		
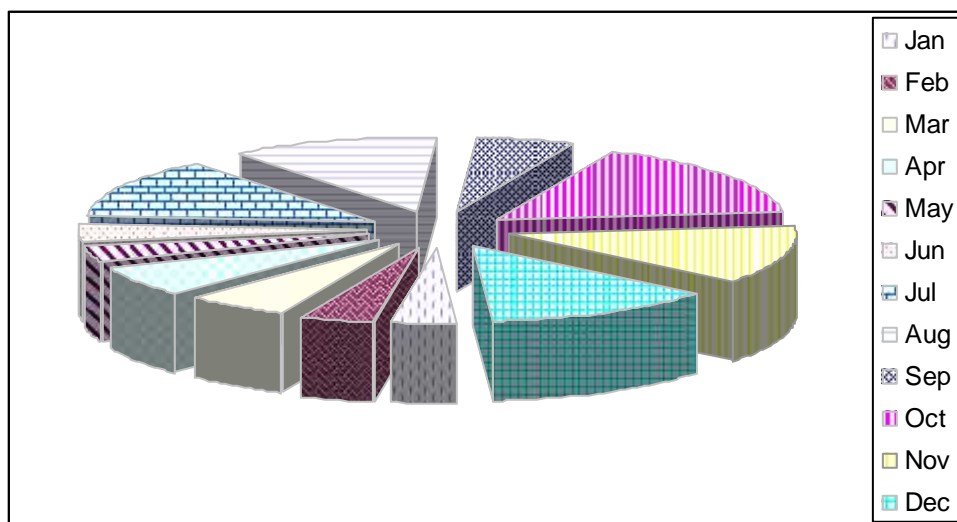
Figure 7: **Perception of respondents regarding seasonal intensity of Crop damage in Shivapur and Thakurdwara VDC.**

Thirty-eight percent respondents replied that elephants prefer Paddy, 26.5% of Wheat and 28% both Paddy and Wheat, 4.4% Maize, 2.4% Lentil and 2.6% others crops such as Mustard, Banana and Bamboo. Paddy, Maize and Wheat were heavily damage in teaseling and mature stages while little damage in juvenile and medium stages (Figure 9).
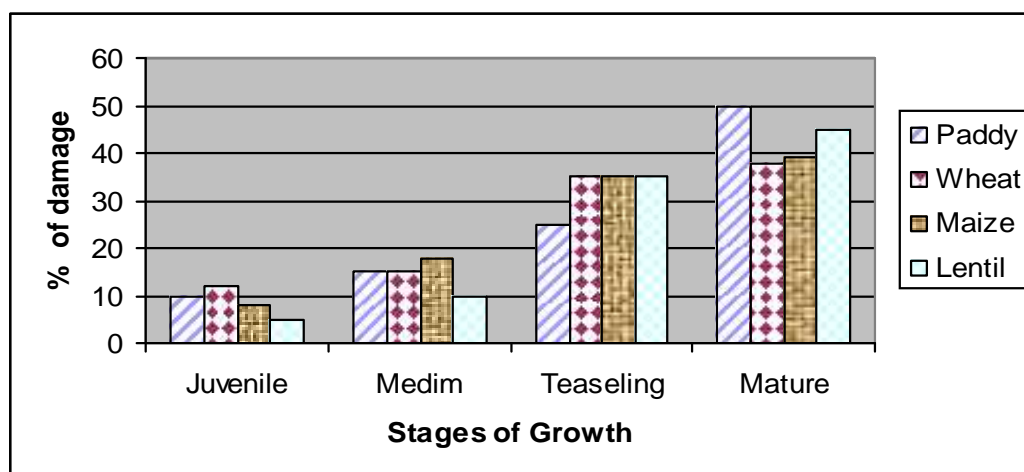
Figure 8: Crop preference and damage at different stages of growth

Sixty three point three percent of the farmers in Shivapur VDC had shortage of food due to crop damage by elephants and thirty six percent did not have this problem. The

perceptions among households were significant difference (x^2 = 61.64, P=0.05, df =11).

Similarly, Sixty five point five percent of the farmers in Thakurdwara VDC had shortage of food due to crop damage by elephants and thirty four percent did not have this problem. The perceptions among households were significant difference (x^2 = 68.53, P=0.05, df =11).

5.1.2. Property loss.

Elephants damage mostly houses, probably when agricultural crops are not available in the field. House damage mostly occurred after paddy, maize and wheat were harvested. After the harvest, corn is usually hanged outside the houses whereas paddy and wheat are stored inside. In Shivapur VDC, the houses were destroyed 25.3%, followed cowshed damage 10.0% and thatch damage 2.6% in 2007/2008(Table- 8)

Table 8: Percent of Property damage in affected wards of Shivapur VDC.

Wards	Sample size	House damage	%	Cowshed Damage	%	Thatch Damage	%
1	8	3	37.3	2	25.0	0	0
2	9	3	33.3	1	11.1	1	11.1
3	12	4	33.3	1	8.3	0	0
7	18	3	16.6	2	11.1	0	0
8	22	4	18.0	1	4.5	1	4.5
9	37	5	13.5	0	0	0	0
Total	**96**	**22**	**25.3**	**7**	**10.0**	**2**	**2.6**

Similarly in Thakurdwara VDC, the houses were damaged 19.6%, followed cowshed damaged 4.5% and thatch damaged 1.8% in 2007/2008(table-9)

Table 9: Percent of Property damage in affected wards of Thakurdwara VDC.

Wards	Sample size	House Damage	%	Cowshed Damage	%	Thatch Damage	%
2	24	5	20.8	1	4.1	0	0
3	18	3	16.6	1	5.5	1	5.5
5	13	2	15.3	0	0	0	0
6	17	4	23.5	2	11.7	1	5.8
7	23	3	13.0	0	0	0	0
9	14	4	28.5	1	7.1	0	0
Total	**109**	**21**	**19.6**	**5**	**4.5**	**2**	**1.8**

5. 2. Human- Elephant Conflict (HEC)

This Study identified two types of human-elephant conflicts; problems created by wild elephants to people and problems created to elephants by local people. Elephant caused problems are crop damage, human harassment and casualties, completion with livestock for food and damage of properties.

5. 2.1. Causes and effects of HEC

1. **Porous border**

The Tarai belt, the IndoNepal border was highly porous. There was no effective physical barrier to stop the free movement of elephants to Nepal.

2. **Taste of agricultural crops**

Cereals are regarded as wild elephant attractants. Varieties of seasonal crops contained large percent of taste and clumped in one place than wild plants that often attract wild elephants.

3. **Deforestation**

Massive scales deforestation in Tarai resulted in the degradation, fragmentation and loss of suitable elephant habitat in western Tarai. May be crop damage villages are enrooted and forest areas previously.

4. Chasing practice

During chasing practices (stones fire flames) elephants trampled and destroyed crops with their heavy feet. In such situation they destroyed more crops by trampling than by eating.

CHAPTER V

6. Traditional Means for Conflict Resolution

Methods applied to minimize the conflict caused elephants by the local people include:

1) Machan
2) Fencing Trenching
3) Community protection.
4) Tin hitting.
5) Other devices.

6.1 Machan

Machan is one of the most popular means used by the local farmers. A small cottage (platform with roof), locally known as Machan and shaded with thatch grass, is erected prior to the maturity of the crop for guarding purpose. Machans are built generally in the farm where one or more people can stay and watch the wild animal entering in to the crop fields. The wild animals generally visit the field at night starting from 6-7 PM, and some time spend for whole night. The sound produced during grazing and movements alert people. Once the animal is confirmed, whistling and shouting is done as a signal to alert other guards and to make a joint effort to chase animals. Fire bundles are commonly used to chase animals out of the fields.

6.1.1 Watchtower

About 20-25m in height watches towers are commonly seen along the south western border of the Park. Watchtowers are made up of wooden posts. There are stairs to go up and a platform with a roof. This type of Machans is constructed with the help of Park and different projects mainly WWF, PPP and CARE Nepal. These types of Machans are usually built along the park boundary. These towers can accommodate 5-7 persons at a time (see photo plates)

6.1.2 Atuwas

Aatuwas are offenly built on tress. It is one of the traditional types of Machan built to guard the crops. Locally made bed (khatiya) is hung up on the tree branches or bed is adjusted in wooden pole with a roof of thatch grass. Only one to two guards can be accommodated on this type of Machan. A number of accidents caused due to bed falling have been reported. Atuwas are common along the eastern bank of Khauraha River, little south of park head quarter.

6.2. Trench / Fencing

Deep and long trenches (1-1.5m deep) are common along the park boundary. Trenches are dug by local people to stop the elephants from entering the agricultural fields. These trenches were deep enough to prevent wild elephant. As reported, after the completion of trench the problem of crop damage reduced sharply. However, due to lack of proper maintenance these trenches are no longer useful to serve as an effective barrier to stop wild elephants. Moreover, there are many passages made by locals over the trench to enter into the park from which wild animals can easily walk into the crop fields at night.

The southern boundary of the Park is fenced with barbed wire. In study area the fence was found trampled by wild elephants and in some places the fence was found destroyed by illegal intruder. The barbed wire fence needs regular maintenance to be effective in keeping wildlife inside, livestock and people, outside the park. Fencing is another means used to protect crops. Most of the villagers are fascinated by the idea of erecting electric fence because they have heard it was quite successful in Thakurdwara VDC. Electric fence is still in trail and has so fare, yielded satisfactory result, as a barrier for elephant and big animals, but inadequate management in some areas has resulted poor performance.

6.3 Community Protection

The local people used to chase wild elephants by combined efforts of all members of the community. Whenever the presence of wild elephant was noticed, all villagers were informed and chased the elephant by carrying fire bundles and making noises. They believed that the sound and the smell of smoke are unpleasant to the wild elephants and claimed it as and effective method in protecting crops. The respondents

of two VDCs Thakurdwara and Shivapur claimed that they had protected their crops by combined efforts of the community machan guarding people in the machan produce sound to inform the people about the presence of wild elephant as well as back up to community.

People of the study area believe that the elephant get scared with fire. So, people, usually burn the wood log at the entrance point and chase them with flames when animals appear entering the fields. The respondents near the park boundary also considered the use of fire as an effective means of protecting crops from wild animals.

6.4 Tin-Hitting

Noises produced by hitting the empty tin or aluminum boxes are another common technique used by the farmers in the area. Empty metal boxes are connected with strings in some places in the field or in the surrounding of the houses from where it is operated by the guards.

6.5 Other Devices

Other means of repellant used by the villagers were loud shouts charging with stones and sticks, hanging the lantern in the houses. These techniques however weren't reported effective.

According to respondents of Shivapur Thakurdwara VDC, the effectiveness of electric fence (56.2%), Community protection (19.5%), Uses of fire (14.6%) Barbed wire fences (7.3%) and Machan Guard (2.4%) (Fig-13).
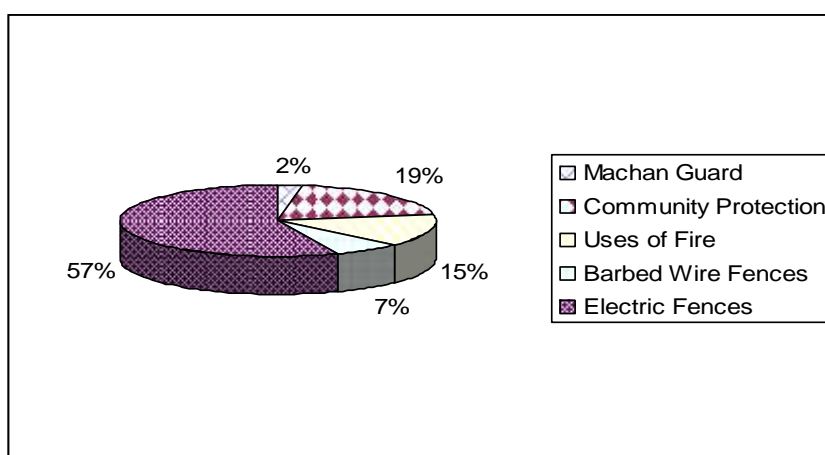

Figure 9: Various traditional means and there effectiveness

CHAPTER VI

DISCUSSION

The elephants like other wildlife have lost so much of their former habitat they are often forced to invade the communities that have displaced them (Caufield 1984). Here lies the crux of the elephant crop raiding problem. Elephants are main wild animals causing crop damage in Western Nepal, similar observation was made by Bist (2002) in India

Majority of people of Shivapur and Thakudwara had food shortage due to crop destroyed by elephants. The level of poverty was almost same in all the affected wards. The wards close to the elephant's habitats had more food deficiency than wards far away from it due to crop raiding and damage by elephants. Hence crop damage by elephant was significant in wards 2, 3 and 5 but not significant in ward 7 and 9 in Thakurdwara VDC. Although ward 9 is close to the Park, the damage was less significant. It is due to the mitigation method in where electric fence is highly effective. Similarly, the crop damage by elephant was significant in wards 1,2,3,7 and 8 but not significant in 9. Similar observation was made by Studsrood and Wegge (1995) in Bardia National Park that wards close to wild elephants habitat had high crop damage.

Upreti, (1985) has explained the main source park people conflict on his paper "Park People Interference problem and New direction". The paper concluded that, crop damage encountered with wild animals and loss of livestock by predator as the maim problems for people and points out the illegal activities of people like grazing encroachment, collection of natural resources, fishing hunting of wildlife as the impact of local people on park conservation. Mishra, (1984) enumerates four basic causes of conflict between the Park authorities and local people i.e. loss of life, livestock and crop depredation by wild animals from park and difficulties and emphasizes crop loss is the main serious problem. My study also reveals that around Bardia National Park, three is also the similar type of causes responsible for raising the conflict with park wildlife including the loss of life.

Elephants consume large quantities of food and spend a major portion of their time on feeding . (Olivier 1978; Ishwarn 1979, Seidensticker 1984). So they damage a lot of crops. Elephants are generalized feeders with a poor capacity to digest food (Samansiri and Weerakoon 2000). The quantification of economic loss due to crop damage by elephants was difficult to estimate by household survey and adhoc claims of local farmers as there was exaggeration of damage of staple crops. The direct measurement of crop loss was found most effective method compared to household survey and adhoc estimate of the sufferers.

Elephants with calves damaged more crops than without calves. The basic reason for high damage by elephant with calves is calves are very innocent and active and usually enter in to the houses and fields randomly. The cow elephant usually comes to search, protect and rescue her calf. In the process elephant may cause a lot of damage to crops, destroy houses and sometimes even cause human casualties.

Generally, 2-3 bulls caused damage to the agricultural crops in the study area. During the month June, July and August elephant graze on the maize plants and move to feed on young paddy crops from August through November till the paddy is harvested. During December and January they mostly attack on the houses to raid the stored grains destroyed vegetable and fruits. During these months no preferable crop are grown in the field, where harvesting of maize, paddy is completed. The wheat remains in its sapling stages in the field that is not preferred by elephant. Wild bulls trample on the crops and often charge the farmers would trying to chase them from the field.

Methods adopted to deter elephants in Shivspur and Thakurdwara VDC are inefficient and inadequate. Chasing elephant with stones, pointed spears and uses of fire on them are highly lethal from conservation point of view. Elephants have learnt to recognize fire crackers and ignore these displays and continue their crop raiding activities.

Guarding crops from thatched huts and tree towers is unsafe. During chasing elephant on foot people fell insecure, get disturbed and lose their sleep. Most of the devices and methods used for deterring elephants are traditional and elephant ignored them and continue their raids.

The barbered wire and electric fence are highly effective to restrict the elephants within the community forest and also protects the wild flora and fauna.

Compensation schemes for damage done by elephants may mitigate HEC to some extent but they can not be a permanent solution to HEC due to numerous practical problems in paying it. Compensation makes people more positive towards the conservation of wild elephants and reduces hostility with the elephants. But over dependence on compensation may reduce people's initiative to guard crops and properties. Sometimes the compensation schemes for crop damage by elephants are abused as people seem to exaggerate the amount of crop loss. Similar study in northern India, for example shows that thirty percent of claims were found false (Wiliam, 2003, William and Johnsingh 1996).

Most people preferred the user group to estimate the amount of damage in crops and properties for payment of compensation. The reason is that it is their own group, and is easily accessible and solves their problem promptly. People did not prefer the district forest officer and policeman as they are not available in the VDC and their reporting may be unauthentic. Farmers were reluctant to complain because every year they lodge complaints but they do not get any compensation.

In order to avoid attracting elephants and consequent crop damage, crops like sunflower, mulberry, tobacco, mentha etc can be raised as alternative to sugarcane, paddy, banana etc. (Bist 2002).

CHAPTER VII

CONCLUSION AND RECOMMENDATIONS

Elephants live in highly depleted and fragmented habitats lacking proper corridors and connectivity. As human population in Bardia is increasing rapidly, there is fast conversion of forest to agricultural and settlements use. Thus the elephant habitat has been shrinking in size as well as diversity. With habitat shrinking elephants are forced to wander long distances to meets their needs. This has resulted increased level of human elephant conflicts.

The negative interfaces that exist between the National Park and the people have adversely affected the livelihood of local communities. On the other hand illegal human activities inside the Park have affected unique biological diversity of the Park.

Some recommendations have been put forwarded for the improvement of the Park relation as well as the sustainable Conservation.

1. The effective physical barrier should be developed to stop the freely movement from park to agriculture land.
2. Habitat of elephant should be well managed.
3. The periodic study on human-Elephant conflict should be done in more adjacent areas of BNP on the research level such as analysis and measurement of the habitat so that the factors governing alteration of habitat which affects fluctuation of the population ecologically could be known.
4. Alternative ways of income source to the local people from the park revenue or from government should be provided to damage.
5. Community outreach program for local people and conservation education for local school children should be carried out periodically in the area. Outreach materials like posters, pamphlets, leaflets, stickers should be published and distributed to the local residents around elephant-habitat. Periodic workshops and meetings with local stakeholders should be carried out in the area.
6. It is strongly recommended that a national level policy and control mechanism should be prepared for the control and management of vulnerable species.

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APPENDIX I

Household Questionnaire

Respondent no: ………………..

Group A: General

1.   How many members are in your family? ………M ………F……….

2.   What are your sources of income?

   a. Agriculture b. service   c. business   d. …………….

Group B: Problem associated with crop damage

3.   How much land do you have?

   ………………………………

4.   What kinds of crops do you grow in your field?

Crops   growing season

………………   ……………………..

………………..   ……………………

……………….   ……………………….

5.   Do the wild animals destroy your crops?

      a) Yes   b) No

6.   If yes, in which season do the animal mostly destroy which crops?

Animal	Crop	Season
……………	…………….	……………
……………..	……………..	……………...
……………	………………	………………

1.   How often do they enter the field?

      a) Everyday

      b) 1-2 days in week

c) Occasionally

d) never

8. Do you have any problem from wild animals?

a) Yes   b) No

9. If yes, what kinds of problem do you have?

a) Crop damage   b) Harassment   c) House damage   d) oters

10. If yes, which animals mostly damage your crops?

a) Elephant   b) Dears   c) Wild boars   d) Others

11. During which months are elephants causing problems and which months are worse?

a) Aug-Sept   b) Oct-Nov   c) February-March

12. How do you identify the damage done by elephant?

a) Last night you saw an elephants entering the fields.

b) Last night you heard elephant noise in fields.

c) Foot prints.   d) Grazing patterns.

d) Others

13. Are elephant selective on crop?

a) Yes   No

14. If yes, which crops do they prefer most?

a) Rice   b) Maize   c) Mustard

d) Lentil   e) Wheat   f) Others

15. Do elephants damage equally in all growing periods?

a) Yes   b) No

16. If yes, what stage do they damage most?

i) Juvenile   ii) Medium stage   iii) Mature stage

a) Rice ………………………..

b) Wheat …………………………

c) Maize …………………………

d) Lentil ………………………..

e) Mustard ………………………..

f) Others …………………………

17. How much crops was lost from elephant damage this year?

0-10% 10-15%   15-25%   25-50%   50-75%   75-100%

a) Rice……………………………

b) Wheat …………………………

c) Maize …………………………..

d) Mustard …………………………

e) Lentil ……………………………

f) Others ……………………………

18. Do you apply some technique to chase elephant from field?

    a) Yes   b) No

19. If yes, what kind of technique do you apply?

a) Machan   b) Fence

c) Burning of wood log   d) Community protection

e) Drum hitting   f) Others (……………..)

20. Which is the most effective?

a) …………………………….

b) ………………………………

c) …………………………………

d) ………………………..

e) …………………………..

f) …………………………….

21. Is there any other measure?

    ……………………………………………………………

22.   What is your perception towards the elephant conservation?

Advantage   Disadvantage

…………………   ……………………………

…………………   …………………………………

…………………   …………………………….

23. Which traditional methods are more effective for wild elephant in study area?

SN	Remedy Measures	Effectiveness				Reason
		3	2	1	0	
1	Machan Guard					
2	Community Protection					
3	Uses of fire					
4	Barbed wire Fences					
5	Electric Fences					
6	Trench					
7	Madal/Tin Hitting/ Others					

24.   Do you like to express anything?

…………………………..

…………………………..

Group C: Problem associated with Properties damage

1.   Ethnicity …………………………………………………….

2.   Sex   Male/ Female

3.   Have you suffered from property damage by wild elephant?

a) Yes   b) No

4.   If yes,

Type of property	Amounts of loss
a) …………........	……………….
b) …………………	…………………
c) ………………..	…………………..

5.   If yes, did you have compensation?

       a) Yes   b) No

6.   If yes, how much?

       Rs ………………………

7.   If yes, who provided?

a)   National park

b)   User group

c)   Buffer zone management committee

d)   NGOs

e)   Others

8.   Do you think compensation is sufficient to the damage?

     …………………………………………………………………..

9.   If not what should be the compensation?

Group D: Problem of injury and harassment

1.   Name

2.   Ethnicity

3.   Sex: Male/Female

4.   Do the wild animals attack upon human beings?

    Yes   No

5.   a. Elephant   b. Rhino   c.Tiger d. Leopard   e. Others

6.   How often do elephant's attack and chase people in this particular area?

    a. Every month   b. only some month   c. Every year

7. Was anybody in your family chased bye elephant and when it was happened?

   a. This year　　　b. Last year　　c. 2 years ago　d. 3 years ago　e. 4 years ago

2. How was he/she outside the forest

   a. Grazing cattle outside the forest

   b. Grazing cattle inside the forest

   c. Collecting firewood/fodder outside the forest

   d. When just moving around

   e. When disturbing elephant

   f. Any other reason

3. If injured by elephant, do you receive any help or medical facilities form related authority?

   ………………………………………………………….

   …………………………………………………………...

4. Is the aggressive behavior differs when alone or in a social groups?

   a. Yes.　　　　　　　　　　b. No.

5. If yes, which social group reacts aggressive by?

   a.　　Male

   b.　　Female

   c.　　Male with Female

   d.　　Female with calf

   e.　　Large social groups

Table 6: Ward wise loss in crops (NRs.) estimated by household survey in Shivapur VDC, 2008.

Ward	Paddy	Wheat	Maize	Lentil	Total
1	27232	21530	16205	15150	80117
2	34392	17250	13152	13250	78044
3	44476	23150	19260	12260	99146
7	25340	20355	18350	15050	79095
8	40541	30105	27560	18680	116886
9	36535	27203	25235	10105	99078
Total	**208516**	**139593**	**119762**	**84492**	**552366**

APPENDIX III

Perception of local farmers regarding the frequency of elephants entering crop fields during a year in Thakurdwara VDC.

Ward	Sampled size	Every night	Every Morning	1-2 Times/Week	1-2 Times/Month	1-2 Times/Year	Occasional
2	24	4	1	3	4	8	4
3	18	1	1	3	4	7	2
5	13	2	0	3	3	3	2
6	17	1	1	3	3	5	4
7	23	2	2	4	4	7	4
9	14	1	1	3	3	4	2
Total	**109**	**11**	**6**	**19**	**21**	**34**	**18**

APPENDIX IV

Do you think elephants with calves damage more?

Shivapur VDC

Wards	Sample size	More	%	Less	%	Equal	%	Don't know	%
1	8	4	50.0	2	25.0	1	12.5	1	12.5
2	9	5	55.5	2	22.2	1	11.1	1	11.1
3	12	7	58.3	3	25.0	2	16.6	0	0
7	8	4	50.0	2	25.0	1	12.5	1	12.5
8	22	15	68.1	3	13.6	3	13.6	1	4.5
9	37	25	67.5	5	13.5	5	13.5	2	5.4
Total	**96**	**60**	**62.5**	**17**	**17.5**	**13**	**13.5**	**6**	**6.3**

APPENDIX V

Do you think elephants with calves damage more?

Thakurdwara VDC

Wards	Sample size	More	%	Less	%	Equal	%	Don't know	%
2	24	20	83.8	2	8.3	2	8.3	0	0
3	18	12	66.6	3	16.6	2	11.1	1	5.5
5	13	8	61.5	2	15.3	2	15.3	1	7.6
6	17	10	58.8	3	17.6	2	11.7	2	11.7
7	23	13	56.5	6	26.0	3	13.0	1	4.3
9	14	7	50.0	4	28.5	3	21.4	0	0
Total	**109**	**70**	**64.2**	**20**	**18.5**	**14**	**12.8**	**5**	**4.5**

Table no. Various traditional means and there effectiveness

S.N.	Methods	Response	
		No.	**%**
1	Machan Guard	5	2.5
2	Community Protection	40	19.5
3	Uses of Fire	30	14.6
4	Barbed Wire Fences	15	7.3
5	Electric Fences	115	56.2
Total	-	**205**	**100**

PHOTO PLATE

House damaged by wild elephant in Shivapur V.D.C.

Crops and Thatch damaged by wild elephant.

Damaged thatch and herds of wild elephants.

Machan and Electric fence around National Park.

Researcher asking Questionnaire in the field and damaged cottage.

Elephant inside the Park and damaged house.