

1. INTRODUCTION

1.1 General background

The largest land mammal which is globally endangered species (IUCN 1996) is *Elephas maximus*. *Elephas maximus* is listed in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). Three species of elephants have survived since origination, the two African and one Asian elephant. *Loxodonta africana* and *Loxodonta cyclotis* (Roca et al. 2001) are two African elephants and *Elephas maximus* is other one species of Asian Elephant.

The district of Jhapa in east Nepal is one of the most terrorized vicinity by frequent visit of wild elephants since a long time. This is because of its location at the south eastern end of the Nepalese border with India and it being an easy and first site for wild Asian elephants which move to and fro between Nepal and India, which destroy the human lives, crops and houses too. Furthermore, the area is supposed to be elephant country in the past with its natural setting suitable for elephant habitats within the district. Bahundangi is located at the eastern most part and is bordered with India towards east. Mechinagar municipality lies on the southern side with Erautar and Jirmale as the northern side.

1.2 Distribution

1.2.1 Global distribution

The distribution of elephant population often cuts across political boundaries over the continental mainland and also in some island of south and south-east Asia. The Asian elephants are found in thirteen countries in Asia as in Nepal, India, Bhutan, Bangladesh, China, Burma, Thailand, Cambodia, Laos, Vietnam, Malaysia, Sri Lanka, Sumatra (Indonesia) and Borneo (Malaysia and Indonesia) (Stromayer 2001).

Approximately in 436,230 km² of globally the wild Asian elephants are found, out this 131,820 km² is under protected Area system (Sukumar 1989). A total population of 38000 to 51000 Asian wild elephants are remaining today of which more than 16000 are domesticated (<http://www.elephant.net.co.th/index-29.1.html> 26.03.2004). Throughout

their range there may be fewer than ten separate populations of wild Asian elephant with more than 1000 individuals half of these are found in India (Stromayer-2001).

Table 1: Estimated number of Asian elephants and their distribution.

Name of regions	Minimum Numbers	Probable Numbers	Countries
Indian sub-continent	23647	28450	Nepal, Bhutan, Bangladesh, Sri Lanka, Pakistan
Indo-china and china	1807	2085	Laos, Cambodia, Vietnam, China
Indo-Malayan	11377	12445	Myanmar, Thailand, Malaysia, Brunei, Indonesia
Total	36831	42980	

Source: WWF

1.2.2 Elephants in Nepal

In Nepal, elephants are distributed in Jhapa, Morang, Sunsari, Saptari, Udaypur, Parsa, Chitwan, Bara, Rautahat, Bardia, Kailali and Kanchanpur districts.

The estimated population of Asian wild elephants in Nepal is about 87 to 108 and distributed in four geographical sub-divisions, 10 to 15 in eastern Terai, 25 in central Terai, 40-46 in mid western Terai and 12-28 in far western Terai in Nepal (Velde 1999)

The eastern Terai consists mainly of migratory herds from west Bengal which come mostly during the harvested seasons of maize and paddy from July to October. They cross the Mechi River to enter Bahundangi Village in Jhapa and then proceed westward along the Churia foothills to Morang, Sunsari, Saptari and Udaipur district (Velde 1999, Yadav 2002). The Eastern population of Elephants in Terai is considered to be doomed due to the Shrinkage of suitable habitats (Velde 1999). The elephants in Central Terai reside in Parsa Wildlife Reserve (PWR) and use the Chitwan National Park (CNP) as dispersal area and they occasionally move to Bara and Rautahat district (Velde 1999). These elephants have sufficient habitat available to them as they live mostly within the Protected Areas (PAs).

The largest herd of elephant resides in the mid western Terai in Bardiya National Park (BNP). This herd consists of migrants from both Dudhawa National Park (India) and Suklaphanta wildlife Reserve (SWR). In the Far Western Terai, Elephants reside along the Churia foothill forest in SWR. They make occasional trips to India by crossing the Mahakali River.

1.3 Conflict

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

1.3.1 Human-Elephant Conflict

The people exploited the elephants' for a variety of plants resources such as fruits, barks, fodder, fuel and timber (Sukumar 1992). The growing population collected the staple of food stuff like bananas, bamboos, climbers and wild cassava from the habitat of Elephants. Due to lack of foodstuffs in the forest, elephants come to the village to raid the crops, destroy properties and sometimes kill the humans.

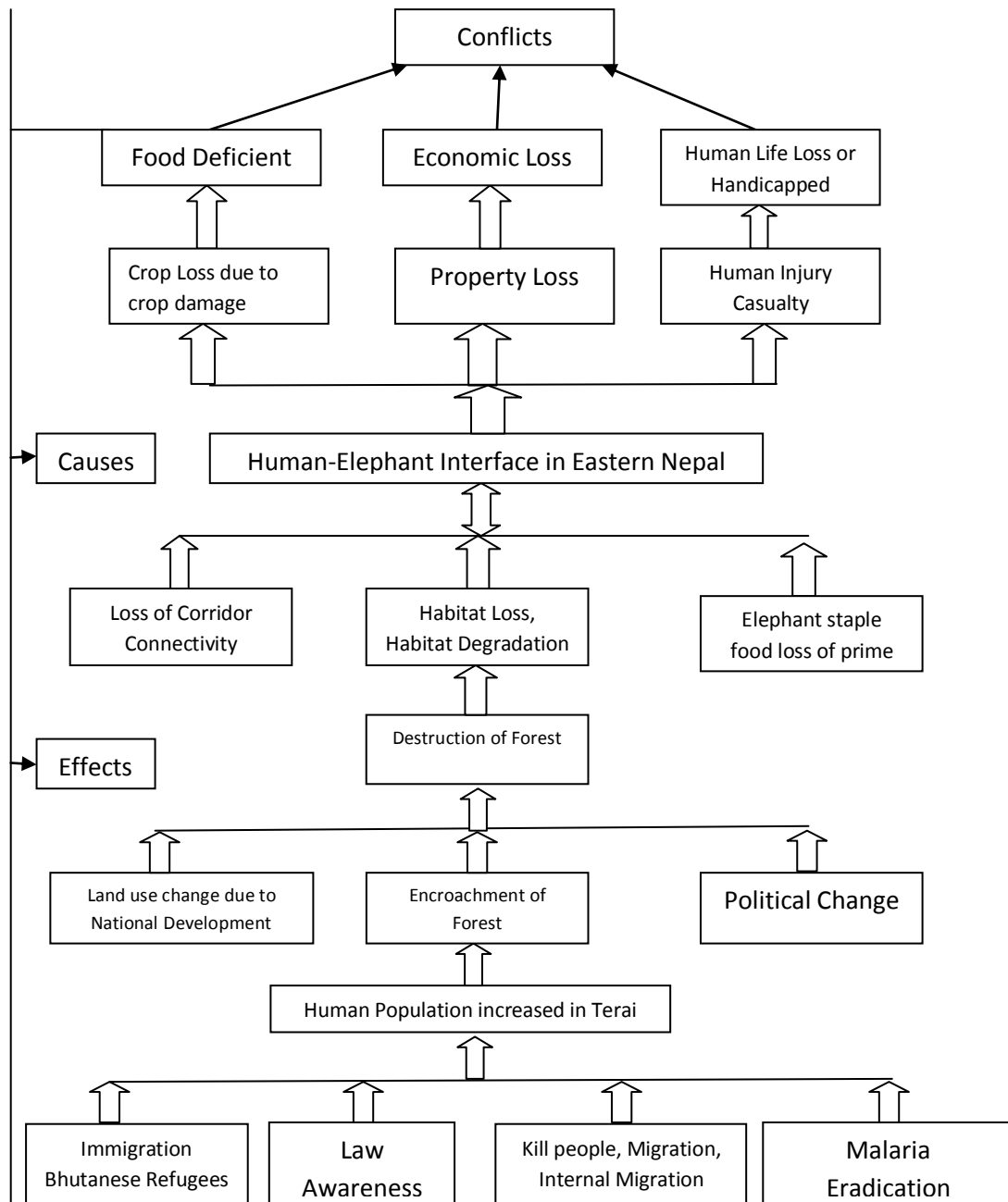
The conflict between people and elephants which result crops and property damage and killing humans is a serious conservation issue in part of Asia and Africa (Seidensticker 1984, Sukumar 1989). Conflict between wildlife and people is an important function affecting the relationship between protected areas and people who live near them (Studsord and Wegge 1995)

1.3.2. Elephant and Human Conflicts in Eastern Nepal:

The eastern Terai and inner Terai of Nepal were highly vegetated areas in the past and due to certain social development in the country after 1950, most of these areas were cleared for human settlements and these development activities fragmented the elephant's habitats. Precisely, the malaria eradication programme, resettlement of hill people to the Terai, construction of Mahendra highway (east west highway) linking western and eastern parts of the country and clearing forests for agriculture lands exploited the elephant territories (Shrestha 1979 and Sukumar 1992). Furthermore, the human population collected elephant's staple foods like bananas, bamboos, climbers and wild cassava from the remaining forests. Thus, in aspirations to get sufficient food, elephants were forced to

come to the human settlements, which often led to the destruction of human properties instigating the conflicts.

Table 2: Causes and effects of Human-Elephants conflicts.



Sources: Shrestha (1994)

1.3.3 Source of conflict

Protection of natural environment through the establishment of Reserves and parks is of great importance to mankind. But establishment of National Parks and Reserves becomes a matter of conflicts in developing countries as well as in most developed countries. National parks and wildlife Reserve of Nepal are no exception to this. The conflicts in

Bahundangi VDC are due to establishment of Indian Reserve in Nepal-Indian border. Crops depredations by elephants are very serious problems in the study area. Major crops like paddy and maize are affected severely. Every year local farmer lost substantial quantities of crops. Wild animals raid on crops especially during the maize harvesting season and attack the paddy field from starting to harvesting period. They prefer maize in harvesting period. Wild elephants raid on maize during the night time. Crop is also destroyed by heavy trampling during their movement. Most of the villagers spend over night in Machan (a small hut) built in the central part of the crop field to avoid crop depredation by wild elephants when the herds of wild elephant enter the field, the people drive them away by shouting with using foggy lights. Although their crops are damaged by wild elephants, they do not get compensation from the government.

People are also killed and injured by the wild elephants of conflict every year during harvesting period. The elephants also damage the houses. These are main sources of conflict.

1.4 Crops Depredation

Depredation of crops by elephants occurs to varying extents throughout their present range in Asia and Africa whenever cultivation about elephant's habitat Raiding of agricultural fields by elephants can be explained in terms of proximate factors such as contact with cultivation especially in fragmented habitats in the course of their movements for foraging or drinking. However, in ultimate terms crop raiding can be thought of as an extension of their natural optional foraging strategy (Sukumar 1990). It is not unusual to see why animals of the protected areas are attracted to areas with grains or other crops. Cultivated crops are richer in protein and carbohydrates as well as some mineral nutrients than most of the wild ones. Unlike forest plant species, many of which grow in isolated stands or scattered throughout the forest, agriculture crops occur in relatively large concentrated stands. For this, the animals of protected areas to have such items have not expended so much energy searching for food.

1.5 Elephants conservation:

In Nepal, elephants are protected under the National Park and Wildlife Conservation Act of 1973. For ex-situ conservation, an Elephant Breeding Centre (EBC) has been established at Royal Chitwan National Park in 1985.

Government of Nepal has passed a policy in September 2003 for the effective management of domesticated elephants in the country (DNPWC 2003). The policy in execution aims to:

- Improve the breeding of domesticated elephants by improving the food quality and hygienic conditions of the Hattisars (Domesticated elephants and their handlers).
- Register all domesticating elephants and reduce their impact in protected areas.
- Maximize economic and environmental benefits from the wise management of domestic elephants, conserve biodiversity and improve the living standards of the people by deriving benefits from domestic elephants.

1.6 Objectives of the study

From the time immemorial, elephants are affecting the local people of Bahundangi VDC either by killing the people or damaging their houses and crops. So the goals of research are as follows:

Specified objectives:

1. To know about the status of wild elephants in the Bahundangi VDC.
2. To assess the human and elephant conflict
3. To estimate the loss of agriculture and other domestic properties caused by wild elephants.
4. To analyze the preventive measures and evaluate their effectiveness.

1.7 Limitation of the study

The present study is entirely based on data collected from interviews applying schedule survey for crop degradation and human harassment by elephants. Only small area (2 kattha) at the middle part of the cropland which is not damaged by the wild life was used to estimate the total crop production. Similarly, other wild lives except elephants were ignored because there was not severe damage from other animals.

There are nine wards in Bahundangi VDC and the present study covered only wards 1, 2, 8 and 9 at eastern side of the VDC. These wards are seriously affected by the wild elephants. During the study period, the actual crop damaged field was visited with the local people during crop growing season. Different questions were asked to local people

(Appendix-I). Victims who had encountered elephant attack were formally interviewed in order to identify actual crop damage.

The study was continued starting from January 2014 to March 2015. The eastern part was visited three times during the crop raiding period. Financial constraint is the major limitation of the study.

1.8 Rationale of the study

The study provides data on crops depredation in eastern part of Bahundangi VDC in 2014/15. It also gives information on human harassment and impact on local people due to wild elephants. Conservation means not only to protect the natural resources but also its wise use. It also refers to ensure the greater benefits to the people at present by the use of natural resources without compromising the future needs and their supply. For the sound management of the terror of the elephants and secure settlement of the people, people participation and active roles of local are inevitable aspects. So, this study may help to provide guideline for policy-making and implementation of the programs to solve the related problems in various parts of the country.

2. LITERATURE REVIEW

The problem between wild animals and people is not a new issue instead of a study of conflict between them which is a relatively recent phenomenon that started after the establishment of the National parks and wildlife Reserve on the country. The study has even more recent origins in Nepal. Therefore, very few works are available on the topic.

Mishra, (1971) in the 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 mechanism processes. In all case studies, Mishra, (1971) 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.

Malaria eradication programme was initiated during the 1950's which allowed settlements to take place and almost the whole area was now under cultivation (Jackson 1987). Since the initiation of this programme was estimated that there has been a 50% decline in the extent of forest cover in the low lands causing loss of habitat for elephants (Smith and Mishra 1992).

Jnawali, (1989) studied the case of human harassment and damage to the crop by greater one-horned rhinoceros in Sauraha adjacent to CNP. The economic loss was reported as Rs. 172000 of which 68.6% occurred within a distance of 500 meters. The highest economic loss 27.6% occurred to less than 500 meters.

Sharma, (1991) studied crop loss in Chitwan National Park by two methods, namely interview and Net Area Damage (NAD). He found real crop damage was five times less by NAD methods than interview. He also reported that paddy was severely damaged followed by wheat, corn, oil seeds, lentil and vegetables.

Sharma, (1991) 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 tourists. Apart from them several infrastructure projects also impact the park environment. Similarly, crop damage, livestock depredation, loss of lives or injuries by both carnivorous and herbivorous animals is the perennial impact on the immediate vicinity of the human habitat of the BNP.

Tchamba and Seme (1993) indicated that elephant feeding on crop was related to seasonal movements and optimal foraging strategy. In the case of elephants, the optional foraging theory (Pyke, Pulliam and Chavnor 1977), assume that the fitness of the foraging animals in a function of the efficiency of foraging in terms of (i) Energy maximization, (ii) nutrient maximization and (iii) Secondary properties. (Succulence and Medicinal properties etc).

The involvement of local people in the management of protected areas for mutual benefits is widely accepted today. Wildlife conservation in Nepal has been quite successful from the view point of habitats of several threatened species. Park-People conflicts are prevalent in all the protected areas of Nepal, although the extent of conflict varies due to separated legislations (Heinen 1993)

Shrestha, (1994) 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 included that effective fencing could greatly minimize these problems. They also recommended launching a buffer zone programmed to reduce the impact of wild animals into the agricultural land.

The migratory route of elephants is also considered to be centre of anthropogenic distribution due to large concentration of human and livestock population inside as well as on the fringes of sanctuary (Silori and Mishra 1995).

Studsrod and Wegge, (1995) studied park people relationship and mentioned about serious crop damages caused by park animals around the Bardiya 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 damage the problems of securing a sustainable livelihood for the people living surrounding areas of national park. They also mentioned that wild animals entering to agricultural 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.

Kasu, (1996) identified two types of problems concerning conflict in Parsa Wildlife Reserve that were:

- Problems created due to reserve and
- Problems created due to local people.

He reported that wild elephants, wild Boar and Chital were the major pest animals. He reported paddy damage was 77.52% followed by wheat and maize. The average economic loss of each house hold due to crop damaged by wild animals amounted to Rs. 3191.48.

Crop loss by wildlife is a common phenomenon in the adjoining village of park and Reserve whereas human activities also exert pressure to the park and Reserve (Limbu 1998). So many protected areas of the country are in crisis due to expanding human activities and sometimes wild animals also interfere in the crop field.

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 serious problem among the south western boundary of BNP. He mentioned that not only crop damage is the cause of the conflict, but also human injuries, local harassment and livestock killing are the major causes 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.

The habitat of increased population has reduced along with a change in their migration pattern and their home range (Pamo and Tchamba 2001). This results in adaptation of

their feeding habits and competition for space with humans. If we want to maintain or restore animals, we must be prepared to leave them for a place to live (Hoare 1999).

Yadav, (2002) had indicated that small herds of elephants reside the whole year in Eastern Nepal. But he had not indicated their population size and distribution. Elephants were distributed in Bauban, Panchpokhari, Navajyoti, Magurnadi and Chulthe communities and forest of Jhapa. The distribution can be attributed to the lack of sufficient food and suitable habitat.

Studies of conservation of Asian wild elephants interface had been carried out by Yadav, (2002) in Eastern Nepal. The conflicts had created great problems between both the government and local people in relation to the management of wild elephants.

Bahundangi has lost 24 inhabitants to the unruly giants in the past 15 years. According to the Arjun Karki, the president of Nature Conservation Society this year 13 have been injured, 50 houses demolished and nearly 5 million worth's of crop has been destroyed (Adhikari 2009).

There are already as many as sixteen conservation areas in Nepal (DNPWC 2010) but not single one of them has ever been studied completely. So far Milton and Binny (1980), who submitted a report on resolving resources conflict between wildlife conservation and agricultural land used in Padampur Panchayat it was discovered that crop loss inflicted by the wildlife was the main problems of the inhabitants of the areas adjoining parks. He also found that economic loss ranges from 50% to 100% in the village. This was of course not a small loss.

3. METIERALS AND METHODS

3.1 Study Area:

Bahundangi area was selected as it has been frequently raided by wild Asian elephants. A residential small herd of 10 to 13 elephants are known to visit frequently and cause human properties damage from Jhapa to Udaipur districts and en route. Many agricultural products like paddy, maize, millet, cane sugar, banana, beetle nuts are known to have been damaged by several big herds of 50 to 74 individuals from India. It is not only the agricultural products but also other properties like houses, huts, carts, motorcycles and domestic households are heavily damaged after the rampage in Bahundangi. Many people are known to have been killed and handicapped.

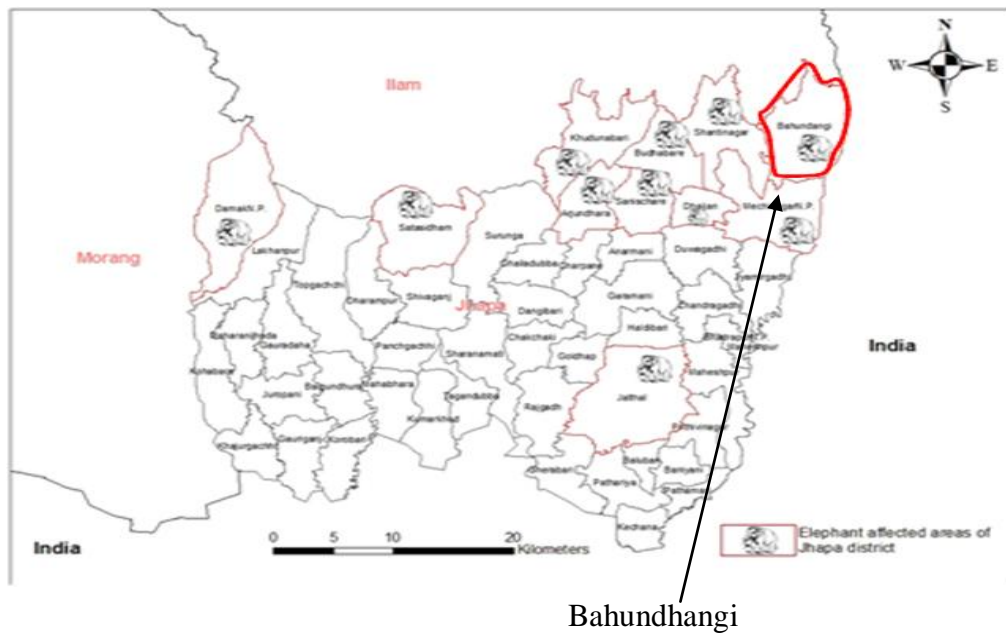


Fig. 1: Map of Jhapa District

3.2 Reconnaissance survey:

The reconnaissance survey of the proposed study was done before the data collection in the field in second week of January 2014. This survey was just for identifying so it did not take a long time. I made informal talks with local people, authorized persons of Bahundangi VDC and president of Natural Conservation Trust Bahundangi. So as to identify the potential site of elephant availability and their likely impact zone. After that only four wards, i.e. 1, 2, 8 and 9 were selected from Bahundangi VDC, where elephants frequently came. So, these wards were chosen to study a conflict between human and elephants.

3.3 Data collection

This study was totally based on primary and secondary data

3.3.1 Primary Data Collection

A pre-tested semi-structural questionnaire was used to interview the respondents. A questionnaire containing information like the elephant visiting, elephant related problems, preventing methods used by the local, possible remedial measures of conflicts etc. was used to collect the information from respondents. The households' survey questionnaire was divided into two sections: problem associated with crop damage and remedial measures and problems human injury and harassment. Altogether twenty questions were asked to respondents, another set of questionnaire containing ten questions were asked to VDC authorities., The questionnaire set is given in Appendix [1-2]

3.3.2 Secondary data collection

Secondary data were collected from records and report from different sources of VDC and Natural conservation trust of Bahundangi VDC. Other secondary sources were journals, Books, articles and dissertation works.

3.4 Sampling:

The sample size for this study was determined on the basis of the number of household existing in the study area. The number of households was provided by VDC office. A simple random sampling method was adopted. Some information was taken from village secretary and local leaders. The number of sampled households is shown in the table3.

3.4.1 Selection of sampling wards and households

All the wards of Bahundangi VDC are not affected equally by the wild elephants. Only the ward no. 1, 2, 8 and 9 were seriously affected by the wild elephants. These wards were taken as the main affected area. Out of 1648, 13.71% household were selected randomly without replacement basis. Hence, altogether 226 households were selected from 4 wards of the VDC which are given in table 3.

Table 3. Household sampled

Ward No.	Total No. of household	Sampled HHs	No. of highly affected Sampled household	No. of occasionally visited sample household	No. of not affected HHs
1	683	63	43	12	8
2	320	62	27	15	20
3	758	-	-	-	-
4	801	-	-	-	-
5	506	-	-	-	-
6	495	-	-	-	-
7	370	-	-	-	-
8	427	52	42	7	3
9	218	49	30	8	11
Total	4578	226	142	42	42

3.5 Field Survey:

A structured questionnaire cannot cover aspect of the reality. Therefore, a field survey was conducted.

3.6 Total expended production survey

The expected production of crops was the production that could be harvest where there was no damage from wildlife for the calculation of expected production; one kattha land was taken separately for each crop. The land was fenced against depredation from wild elephants. The land was well irrigated and supplied with required fertilizer for paddy, maize and millet. The total expected production was calculated on the basis of a production in one kattha.

Mathematically,

Production of rice in one kattha = R kg

Production of rice in one bigha (0.66 ha) = R kg x 20 kattha

$$\therefore \text{Production of rice in one hectare} = \frac{R \text{ kg} \times 20 \text{ katt ha}}{0.66}$$

3.7 Data Analysis

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

Mathematically,

$$\text{Mean crop loss per household} = \frac{\text{Total crop loss}}{\text{Total No.of house hold}}$$

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

$$\therefore \text{Total crop loss of the village} = \text{Mean crop loss} \times \text{total household of the village}$$

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

$$\therefore \text{Economic loss of village} = \text{price of crop} \times \text{total crop loss of the village.}$$

4. RESULTS

4.1 Problems caused by Elephants.

The major problems caused by wild elephants in Bahundangi VDC were crop damage, human harassment, human injuries and killed. More than 47.83% of respondents reported crop damage, 22.36% reported harassment and 29.8% suffered both crop damage and harassments (Table 4).

Table 4. Response of households to problems by wild elephants (Bahundangi VDC)

Ward	Sample size	Crop damage	%	Harassment	%	Both Crop damage and Harassment	%
1	17	10	58.82	3	17.65	4	23.53
2	19	9	47.37	4	21.05	6	31.58
8	15	7	46.67	3	20	5	33.33
9	13	5	38.46	4	30.77	4	30.77
Average			47.83%		22.36%		29.8%

4.2 Analysis and Status of Land Composition.

4.2.1 Land composition

Out of 226 households questionnaire 11.95%, 20.35%, 19.03%, 26.10%, 13.71%, 5.31% and 3.54% of house owners landless, below 1 bigha, 1-2 Bigha, 2-3 Bigha, 3-4 Bigha, 4-5 Bigha and above 5 Bigha respectively.

Equivalent

16 Anna = 1 Ropani

13Ropani = 1 Bigha

1 Bigha = 0.66 Hectare

1 Bigha = 20 Kattha

1 Ropani = 0.0523076 Hectare

Table 5: Status of Land composition:

SN	Area of the field	No. of Responded	% of Responded	Total Responded
1	Landless	27	11.95	
2	Below 1 Bigha	46	20.35	
3	1-2 Bigha	43	19.03	
4	2-3Bigha	59	26.1	226
5	3-4 Bigha	31	13.71	
6	4-5 Bigha	12	5.31	
7	Above 5 Bigha	8	3.54	
	Total	226	100%	

So, the highest and lowest response was recorded in respondent having land of 2-3 Bigha and above 5 Bigha respectively.

4.2.2. Number of surveyed house hold and its percentage.

There were 1648 houses in the study area. Only 226 houses were taken as sample during study period. Population of sampled household was 987 (Table 6).

Table 6: Number of population in sampled households.

Ward no.	Total HH	Affected survey HHs	Percentage	No. of population in sampled HHS
1	683	63	27.87	257
2	320	62	27.43	283
8	427	52	23.01	209
9	218	49	21.68	238
Total		226	100%	987

4.2.3 Agriculture productivity:

Among 226 households responded on the agricultural productivity 8.41%, 80.97% and 10.62% were responded as increasing, decreasing and remaining same respectively (Table 7).

Table 7: Status of agricultural productivity:

S.N	Agricultural Productivity	No. of Respondent	Percent of Respondent	Total
1	Increasing	19	8.41%	
2	Decreasing	183	80.97%	226
3	Same	24	10.62%	
Total		226	100%	

According to this data, the highest response was recorded on decreasing (80.97%) and lowest on increasing (8.41%). Most of the people explained the cause of decreasing agricultural productivity was due to the damage caused by wild elephants, lack of irrigation and drought. People who responded to increasing agricultural productivity said it was due to availability of chemical Fertilizer and proper knowledge of cultivation.

4.2.4. Total cultivated land and land holding per family:

The total land in the study area is 1643.14 ha. This was calculated for the households which were in ward no. 1, 2, 8 and 9. Total land in the surveyed household was 297.38 ha (Table 8).

Table 8: Ward wise distribution of cultivated land.

Ward No.	Total Cultivation Land (ha)	% in terms of Cultivated land	Land holding per family (ha)
1	91.33	30.71	1.45
2	57.80	19.44	0.93
8	75.44	25.37	1.45
9	72.81	24.48	1.48
Total	297.38	100%	1.325 (Average)

4.2.5. Land coverage of different crop in different areas

The study was mainly focused on 3 different crops i.e. Paddy, Maize and Millet which were heavily damaged by frequent elephant attack. Beside these crops coconut, beetlenut, banana, ginger and different vegetables were also damaged by wild elephants. In the

study area about 100% of the total households cultivated paddy every year. Similarly 187 households (82.74%) cultivated maize and 61 households (26.99%) cultivated millet every year (Table 9).

Table 9: Area coverage in different households in number and land volume (Ha).

Ward No.	Paddy growing HH	Paddy Land(ha)	Maize growing HH	Maize Land(ha)	Millet growing HH	Millet land (Ha)
1	63	63.64	58	53.8	13	4.22
2	62	40.50	44	23.42	17	3.51
8	52	60.28	47	45.26	12	5.67
9	49	62.43	38	40.57	19	4.81
	226 (100%)	226.85 (76.28%)	187 (82.74%)	163.5 (54.83%)	61 (26.99%)	18.21 (6.12%)

Paddy was planted in summer and maize in winter. After harvesting maize, paddy was grown in the same field. Millet was planted in the rainy season. Most of the houses cultivated millet in the same field after harvesting paddy. Out of 297.38 ha land 226.85 ha (76.28%) land was used for paddy plantation, 163.05 ha (54.83%) for maize and 18.21 ha (6.12%) for millet (Table 9).

4.2.6. Crop Production

Paddy, Maize and Millet were the main crops in Bahundangi VDC. Beside this wheat, ginger, potato and green vegetables were also planted. The total production of Paddy, Maize and Millet in sampling households of wards 1, 2, 8 and 9 were 556590 kg, 215862 kg and 9977 kg respectively (Table 10).

Table 10: Total crop yield (kg) and its percentage from sample households.

Ward No.	Paddy		Maize		Millet	
	Yield (kg)	%	Yield (kg)	%	Yield (kg)	%
1	154574	27.77	71069	32.92	2312	23.17
2	152086	27.32	30937	14.33	1923	19.27
8	127556	22.92	60264	27.92	3107	31.14
9	122374	21.99	53592	24.83	2635	26.41
Total	556590	100%	215862	100%	9977	100%

Table 10 showed that the highest percent of paddy produced in ward no. 1 and lowest in ward no.9. The highest amount of maize is produced in ward no. 1 and the lowest in ward no. 9. Similarly the highest amount of Millet is produced in ward no. 8 and the lowest in ward no. 2.

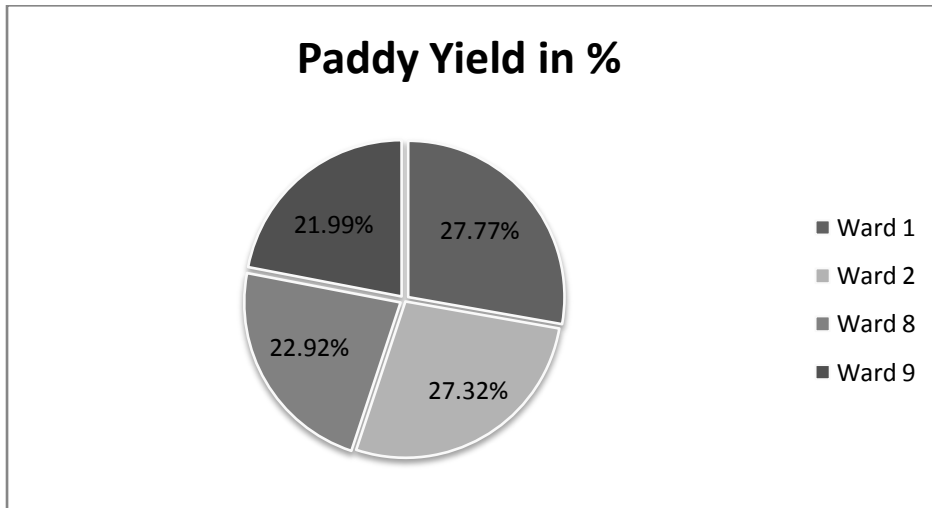


Figure 2: Paddy yield (%) in different wards of study area

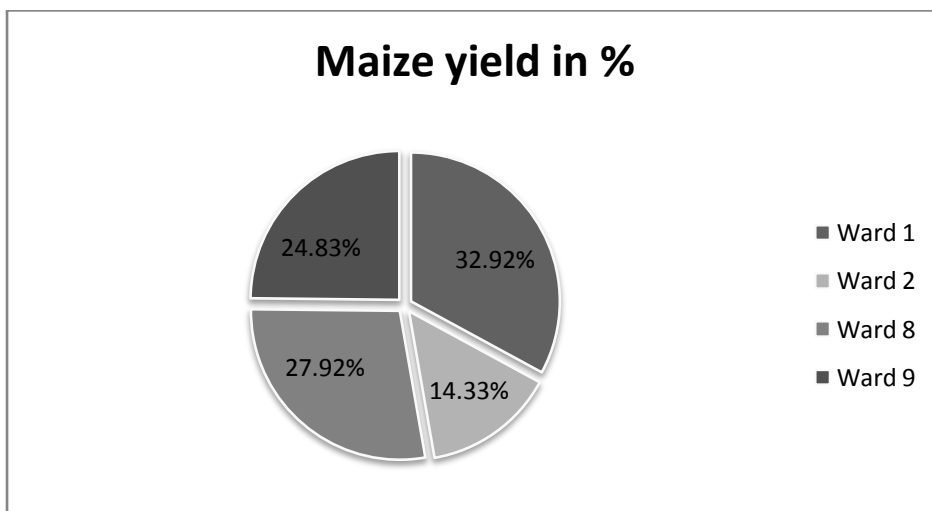


Figure 3: Maize yield (%) in different wards of study area

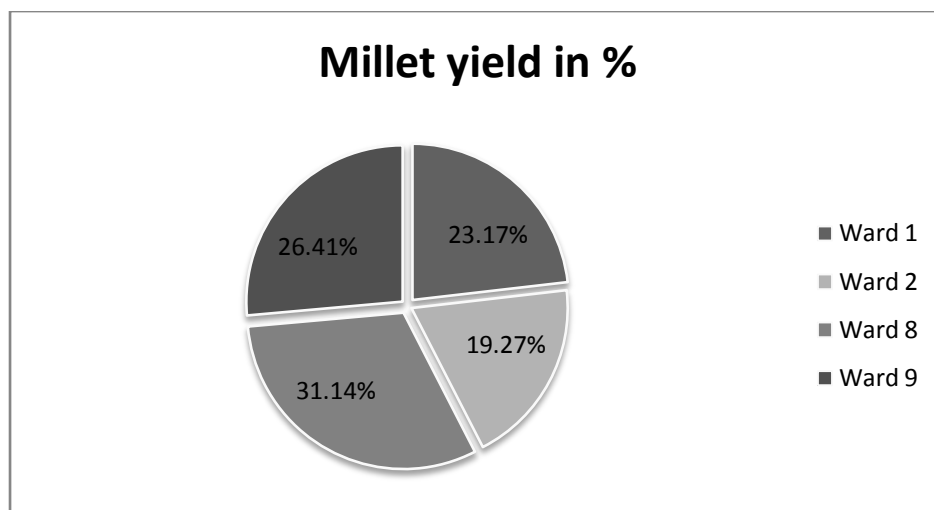


Figure 4: Millet yield (%) in different wards of study area

Table 11: The production and production percentage of the crops.

S.N	Crop	Total Production (Kg)	Percentage
1	Paddy	556590	71.13%
2	Maize	215862	27.58%
3	Millet	9977	1.27%
Total		782429	100%

From the research out of 782429 Kg. Production of crops 71.13 % is highest followed by maize 27.58 % and Millet 1.27% (Table 11).

4.2.7 Total expected production in comparison to previous year

Total expected production of the crop is the production that could be harvested when there had been no wild elephant damage.

Table 12: Expected production in Kg.

Ward No.	Paddy	Maize	Millet
1	179574	98099	3215
2	181426	55937	2927
8	155186	87375	3808
9	148039	82952	3435
Total	664225	324363	13385

Paddy is the dominant crop in the study area. Almost each household grow paddy, Maize, Millet. About 664225 kg of paddy is expected in a year to be harvested from the study area in 226.85 ha and 324363 kg of maize and 13385 kg millet are expected in 163.5 ha and 18.21 ha land respectively (Table 12).

4.2.8 Total loss of different crops in different Area:

The total loss is the difference between the expected production and actual production in different crops. The total loss of different crops is as follows.

Paddy: As mentioned earlier paddy was the dominant crop in the study area. The entire sampled households grew paddy in their whole land.

Table 13: Total loss of paddy (kg) in terms of expected production.

Ward No.	Total expected production (kg)	Total Actual Production (kg)	Total Loss (kg)	Percent
1	179574	141864	37710	20.99%
2	181426	133097	48329	26.64%
8	155186	125454	29732	19.16%
9	148039	119505	28534	19.27%
Total	664225	519920	144305	21.72% (Average)

In total 664225 kg of paddy was expected from 226.85 ha of land but farmers could only harvest 519920 kg of paddy. 144305 kg i.e. 21.72% of paddy was lost due to wild elephants (Table 13).

Maize: Maize was second major crop and the entire sampling households grew it in winter season.

Table 14: Total loss of Maize (kg) in terms of expected production.

Ward No.	Total expected production (kg)	Total Actual Production (kg)	Total loss (kg)	Percent
1	98099	65332	32767	33.40%
2	55937	41389	14548	26%
8	87375	59012	28363	32.46%
9	82952	58292	24660	29.73%
Total	324363	224025	100338	30.93% (Average)

The total expected production of maize was 324363 kg from 163.05 ha of land. But farmers could harvest only 224025 kg of maize only (Table 14).

Millet: About 6.12% of land was occupied by millet in rainy season.

Table 15: Total loss of millet (kg) in terms of expected production.

Ward No.	Total expected production (kg)	Total Actual Production (kg)	Total loss (kg)	Percent
1	3215	2177	1038	32.29
2	2927	1722	1205	41.67
8	3808	2465	1343	35.27
9	3435	2194	1241	36.13
Total	13385	8558	4827	36.06% (Average)

The total expected production of millet was 13385 kg from 18.21 ha of land but farmers could harvest only 8558 kg of millet (Table 15).

Table 16: Total loss of crops (kg) in sampled houses in respective wards.

Ward No.	Paddy Damaged(kg)	%	Maize Damaged(kg)	%	Millet Damaged (kg)	%
1	37710	26.13	32767	32.66	1038	21.50
2	48329	33.49	14548	14.50	1205	24.96
8	29732	20.60	28363	28.27	1343	27.82
9	28534	19.77	24660	24.58	1241	25.71
Total	144305	100%	100338	100%	4827	100%

Paddy, maize and millet damage are 144305 Kg., 100338 Kg. and 4827 Kg. respectively (Table 16).

Table 17: Total loss of crops (kg) in terms of expected production and loss percentage.

Crops	Expected production (kg)	Damaged crops (kg)	% loss in expected production	% loss in total damage
Paddy	664225	144305	21.73%	57.84%
Maize	324363	100338	30.93%	40.22%
Millet	13385	4827	36.06%	1.93%
Total	1001973	249470	24.89%	100%

Out of 249470 Kg. of damage crops, where paddy (57.84 %), maize (44.22 %) and millet (1.93%) are damaged (Table 17).

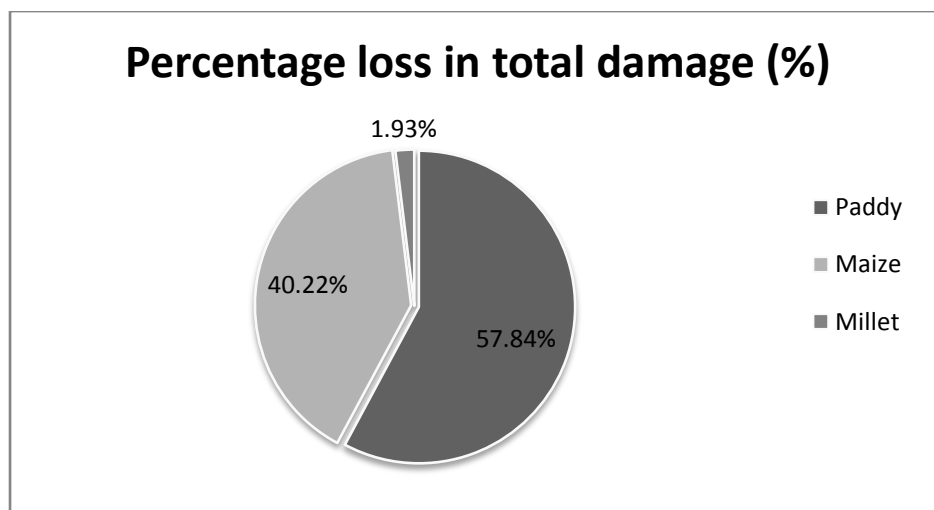


Figure 5: Percentage of crop loss in study area

4.2.9 Market price and monetary value of damaged crops.

The monetary value was calculated on the basis of market price of different crops. The market price of different crops was taken from Kakarbhitta bazaar. The table below shows the economic loss of crops in Bahundangi VDC.

Table 18: Economic loss of different crops:

S.N	Different Crops	Total Loss (kg)	Market Price (Rate)	Total loss in Rs.
1	Paddy	144305	Rs 22.5	Rs 3246862.5
2	Maize	100338	Rs 17.5	Rs 1755915
3	Millet	4827	Rs 26.25	Rs 126708.75
4	Bamboo	3340 trees	1 pole Rs 50	Rs 167000
5	Coconut	170 trees	70 fruits/ tree 1 fruit = Rs 15	Rs 178500
6	Beetlenut	408 trees	1 pole Rs 55	Rs 22440
7	Ginger	370	Rs 45	Rs 16650
Total				Rs 5514076.25

Table 19 showed that the total economic loss of crops was Rs. 5514076.25 due to crop raiding by wild elephants. In the study area Rs. 3246862.5 of paddy was lost. The monetary value of maize and millet loss was Rs. 1755915 and Rs 126708.75 respectively. Similarly the monetary value of Bamboo, coconut, Beetlenut and Ginger was Rs. 167000, Rs 178500, Rs 22440 and Rs 16650 respectively. On an average each household lost approximately Rs 24398.567 annually due to crop depredation by wild elephants.

Table 19: Per head loss (NC) hectare due to crop damage by wild elephants.

S.N	Crops	Estimated loss per/ha (kg)	Market Rate per kg	Total loss/ha (Nc)	Per head loss/ha (Nc)
1	Paddy	636.125	Rs 22.5	Rs 14312.813	Rs 3277.301
2	Maize	615.38	Rs 17.5	Rs 10769.15	Rs 2465.884
3	Millet	265.07	Rs 26.25	Rs 6958.08	Rs 1593.238

Source: field report

Table 20, showed that per head loss/ha for paddy, maize and millet was Rs 3277.301, Rs 2465.884 and Rs 1593.238 respectively. Where,

$$\text{Per head loss/hectare (NC)} = \frac{\text{Total loss/ha} \times \text{total sampled house hold}}{\text{Total population of sampled house hold}}$$

4.2.10 Frequency and Seasonality of raiding:

Bull elephant did most of the raiding, but cows and calves were found to join them during the peak season. Elephants spend the day time close to the edge of the crop field in Kolabari forest across the border in India and came to field after dark.

Elephants enter into the field from 6:30 – 7:00 pm and stay in the field whole night. Incident of crop damage in ward no 1, 2, 8 and 9 of Bahundangi VDC was higher in June – July and November – December, which medium intensity of damages occurred in January, May, August, September and October and less in February, March and April.

Table 20: Seasonal intensity of crop damage (%) based on Questionnaire.

Months	High	Medium	Low
January		23.45	
February			16.37
March			21.68
April			18.14
May		28.31	
June	73.89		
July	69.91		
August		43.8	
September		37.61	
October		34.51	
November	82.30		
December	89.82		

There are two peak seasons for crop raiding in this VDC and across the Nepal-India border. In June-July, the elephants raid maize and Barkhe Dhan and dry season paddy is damaged in October-December.

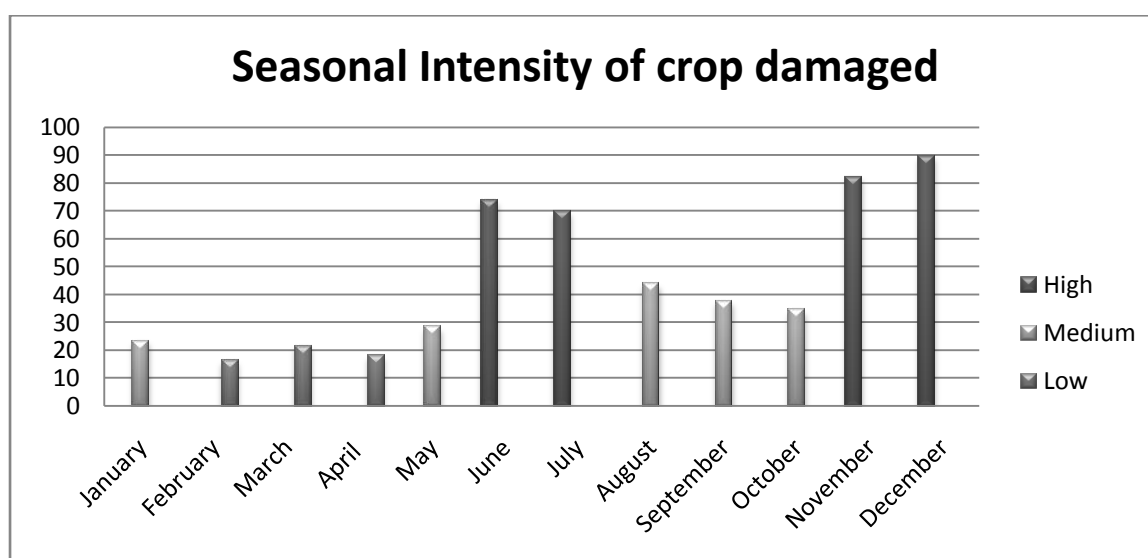


Figure 6: Seasonal intensity of crop damaged in Bahundangi VDC in different month

4.2.11. Extent of crop damage by elephant with calves.

About 60.17% of the respondents reported that crop was damaged more when elephants came with calves compared to without calves. However, some of the respondent disagreed with them. 19.91% respondent reported that crop damage was less with calves, 10.62% reported almost equal damage with and without their calves and 9.29% of respondents did not have any idea. The reason for more damage was the calves were usually very active.

Table 21: Response of elephants with baby.

Ward No.	Sampled HH	Loss	Percent	More	Percent	Equal	Percent	Do not Know	Percent
1	63	11	17.46	43	68.25	5	7.94	4	6.35
2	62	13	20.97	38	61.29	6	9.67	5	8.06
8	52	12	23.08	29	55.77	5	9.62	6	11.54
9	49	9	18.37	26	53.06	8	16.33	6	12.24
Total	226	45	19.91	136	60.17	24	10.62	21	9.29

It was obvious from the above table that elephants with babies damaged the crop more than without babies.

4.2.12 Crop damage and crop preference at different stage of growth.

The survey showed that 70.35% of respondent replied that elephants prefer Maize, while 19.71% and 9.73% reported the paddy and Millet respectively. Harassment problems and night guarding for crops were found to be serious. They do not sleep whole night for guarding field. During the day, they have to work in their field. These make them tired and sick. Farmers are so reluctant that they even do not want to talk about their problems of harassment, property loss and crop damage since they believe that nobody is taking these as serious problems.

Table 22: Crop preference by elephants at different stages of growth:

Ward No.	Sampled HH	Paddy	%	Maize	%	Millet	%
1	63	11	17.46	47	74.60	5	7.94
2	62	13	20.97	42	67.74	7	11.29
8	52	9	17.31	38	73.08	5	9.61
9	49	12	24.49	32	65.31	5	10.20
	226	45	19.91(Ave)	159	70.35(Ave)	22	9.73(Ave)

4.2.13 Household food sufficiency

Out of the total sampled households, 96 (42.47%) respondents had sufficient food from own production while 130 (57.52%) had food deficient. In spite of knowing the severe problems of elephant, they cultivated land for their livelihood as the majority of them were farmers.

Table 23: Responding household food sufficiency:

Ward No.	Sample Size	Sufficient	Percentage	Deficient	Percentage
1	63	29	46.03	34	53.97
2	62	25	40.32	37	59.68
8	52	20	38.46	32	61.54
9	49	22	44.89	27	55.10
Total	226	96	42.47(Ave)	130	57.52(Ave)

4.2.14 Reason for elephants visiting in Bahundangi

The attraction of wild elephants towards human settlement was due to crop fields. The main reasons for the field raiding were due to the lack of sufficient food in the jungle. Food in the jungle could not fulfil all their food requirement due to flooding in rainy seasons because of Mechi River is near to the jungle. The reason for elephants visiting settlement cited by respondent was given below:

Table 24: Reasons and percentage of elephant visiting in settlements

S.N	Reasons	No. of respondents	Percentage
1	Lack of food in their habitat	87	38.5
2	Liking of field crop	43	19.03
3	Lack of proper fence in the border	41	18.14
4	Lack of suitable habitat	27	11.95
5	To change the taste	28	12.39
	Total	226	100%

4.2.15 Human Harassment in Bahundangi

Another serious problem experienced by the local people was fear of wild elephants attack. Quite a number of people were chased, attacked and even killed by wild elephants. This problem was most acute in the areas adjoining jungle site of Bahundangi VDC.

No such accidents occurred during my visit to the study area. But according to the villagers, many accidents had occurred in the previous year. In the study area, 26 people were attacked by wild elephants from 1992 to 2015. Among 26 people 12 people were killed in Bahundangi VDC of Jhapa District.

Table 25: Number of Victims attacked by Elephants.

S.N	Names	Age	Consequences of attack	Mode of attack	Date
1	Devi Guragain	38	Killed	While chasing	1992
2	Tara Dahal	45	Killed	While chasing	1992
3	Lal Bdr. B.k.	40	Killed	Suddenly attack	1992
4	Prem Baral	35	Killed	During encounter	1995
5	Shyam Adhikari	46	Injured	While chasing	1999
6	Saraswati Kafle	39	Injured	While chasing	2000
7	Yubraj Dahal	42	Injured	While chasing	2000
8	Rana Bdr. Diyali	62	Killed	During Encounter	2002
9	Shambhu Thapa	22	Killed	Sleeping inside the house	2002
10	Durga Thapa	16	Killed	Sleeping inside the house	2002
11	Diwakar Neupane	42	Injured	Chasing away the elephant	2002
12	Moti lal Bhujel	37	Injured	Chasing away the elephant	2003
13	Dhan Bdr. Rai	65	Killed	Crushing by elephant leg	2003
14	Prem Khadka	19	Injured	While guarding of crops	2004
15	Sabina Rai	13	Killed	while escaping from elephant	2006
16	Chandra Bdr. Dangi	22	Killed	While chasing away	2007
17	Rina Bhujel	26	Killed	Throwing by elephant	2009
18	Sagar B.K	46	Injured	By crushing elephant legs	2009
19	Sita Thapa	32	Injured	While escaping	2010
20	Shankar Diyali	43	Injured	While guarding crops	2010
21	Ambika Neupane	26	Injured	Suddenly attack	2011
22	Mahendra Dangi	61	Injured	Attack but elephant ran away after people shouting	2011
23	Ram Bdr. Karki	43	Injured	Chasing away the elephant	2013
24	Khagendra Gautam	33	Injured	While guarding crops	2014
25	Rudraman B.K.	49	Injured	While chasing	2014
26	Sita Ram Bista	58	killed	Suddenly attack	2014

Source: From the report of Bahundangi VDC (2014/2015)

4.2.16 Local preventive Measures

Farmers are not allowed to kill the elephant while raiding the crops. They are only allowed to chase away them. The problems created due to wild elephants have become serious every day. Wild elephants damage the crop every year. Thus, local people have developed some preventative methods to distract the wild animals feeding on crop and to drive them away so as to save their crops. Though, they have tried from some preventive methods, they do not seem to have any significant effects as they are mostly laborious, intensive and primitive.

Table 26: Number of respondent and percent of local preventive techniques used by the local villagers.

S.N	Methods	Users N= 226	Percentage
1	Shouting and Chasing with fire and foggy lights	109	48.23
2	Vehicles	18	7.96
3	Chasing with stone	32	14.16
4	Beating Tin and Boxes	27	11.95
5	Watching tower and Machan	25	11.06
6	Others (electric fences or planting thorny barriers around houses)	15	6.64
	Total	N=226	100%

Among the local preventive techniques 48.23% respondent use shouting and chasing with fire and foggy lights and 6.64% of respondents use other electric fences or planting thorny barriers around houses (Table 26).

4.2.17 Economic support from different organization.

The Jhapa district office had allocated Rs.1, 50,000 for elephant control and crop protection every year. This money had been spent on purchasing scaring devices such as foggy lights and alkaline batteries. The district forest office had distributed 50-60 foggy lights in Bahundangi VDC. The DFO had formed elephant controlling group in the past but that group did not work well. That's why elephant scaring devices had been distributed from 2005 to the affected areas.

In 2002, the Ministry of Forest and Soil Conservation (MFSC) allocated Rs.1000000 to Bahundangi VDC to construct 17 concrete watch view tower at the passes (gauda) of Mechi River enroute to Bahundangi to scare and drive away the Indian elephants. Recently Bahundangi VDC had come up with a new idea to manage elephant through the plantation of *Agava americana indica* (hattibar) along the entry point of elephants between Bahundangi and Mechi River. More than 2500 samplings of Hattibar were brought from India (Sikkim) by the VDC office and planted along the entry points in ward 1, 2, 8 and 9 of the VDC. The idea was to deter the elephants with the pricking of the thorns. It was expected that if the hattibar grew well within a year time they would attain a height of over 4 feet and provide a formidable barrier for the entry of elephants.

4.2.18 Compensation and evaluation of effectiveness.

Bahundangi VDC office had been providing financial support of Rs.1500 to people whose houses had been damaged by the elephants and Rs 5000 to families whose members had been killed by elephants but it was not in regular budget of the VDC. Mechinagar Municipality had also been contributing to houses dismantled by elephants. The UNHCR and Nepal Red Cross Society had provided clothes, tents and money to families of elephant victims in Bahundangi since 2002, but it was only an emergency support and not a continuous aid. The forest user group (FUG) of Panchpokhari Community Forest had been giving Rs 1000 to every houses damaged by elephants and ten cubic meter of timber.

The raiding of crops by elephants is one of the major components of human-elephants conflict, causing loss of livelihood and retaliation against elephants. To mitigate the conflicts, various intervention methods were used by the farmers, yet there have been few rigorous assessments of their effectiveness. An assessment of efficiency of intervention in use by community in Bahundangi VDC. The most effective methods were shouting and chasing with fire and foggy light according to my study and findings. My study highlights the importance of evaluate on of intervention methods to determine effectiveness. I proposed the use of fences, spotlights and chilli fences to be promoted in that area in conjugation with long term habitat protection.

4.2.19 Mode of wild elephants Incursion:

On seeing a person, most of the elephants stand for a while then they charge towards the person with their trunks and lift the victim up and throw away. Again, they move towards the victim and trample the victim over. In most cases, wild elephants attacked only when they were annoyed. Sometimes they also attacked inside the houses.

5. DISSCUSSION

Bahundangi VDC is facing the problem of elephant for many years. Bahundangi VDC was the migratory routes in the past for elephant. They are coming even nowadays, not by the migratory nature but due to scarcity of food in the Indian Reserve. The incursion of elephants in recent years is increasing due to the increment of the reserve area by the Indian government towards the Mechi river. Local people reported that during the rainy season, flooding in the reserves caused elephant to move in other places for feeding. So they come to the Bahundangi VDC which lies near to the forest.

The elephants are categorized as two types as residents and migratory elephants. Local elephants live in the jungle for whole year near by the Mechi River. They do not damage severely. Local troops of such elephants are 8 to 10 in numbers. They usually come singly. They are also larger in size than migratory elephants. Migratory forms are smaller than local ones but they are very destructive. They usually come during harvesting period of maize, paddy, and millet etc. they cannot be case easily as their troops are larger. They exceed 70 and sometimes near 100 too. So, the elephant's problem is being serious every day. Among paddy, maize and millet the most affected crop was paddy (57.84%) followed by maize (40.22%) and millet (1.93%).

The study calculated that the total economic loss of crops is Rs. 5514076.25/- due to crop raiding by wild elephants. In the study area Rs. 3246862.5/- of paddy is lost. The monitory value of maize and millet loss are Rs. 1755915/- and Rs. 126708.75/- respectively. Similarly, the monitory value of a Bamboo, coconut, beetlenut and ginger are Rs. 167000/-, Rs. 178500/-, Rs. 22440/- and Rs. 16650/- respectively. On an average each household lost approximately is Rs. 24398.567/- annually due to crop depredation by wild elephants. From the research, it was also found that per head loss in NC/hectare of paddy, maize and millet are Rs. 3277.301/-, Rs. 2465.884/-, Rs. 1593.238/- respectively, which is greater than the data of Kasu 1996. The total paddy loss was 144305 kg (57.84%), Maize 100338 kg (40.22%) and millet 4827 kg (1.93%).

Similarly, Kasu (1996) in Parsa Wildlife Reserve calculated the loss as 23857 kg for paddy which was 77.52 % of the total paddy damaged. Similarly total loss of wheat and maize were 4896 kg and 2022 kg or 15.91% and 6.57% respectively. This amount is damaged only by elephants but there is also possibility of destruction from Deer and Boar. And Kasu 1996 found that Elephant, Deer and Boar destroyed 15.19%, 52.20% and

32.61% respectively of total crops damaged. Sharma (1991) calculated by NAD (Net Area Damage) method that Rhino (*Rhinoceros unicornis*), Wild Boar (*Sos scrofa*) and Chital (*Axis axis*) destroyed 43.7%, 28.3% and 18.3% of total crops damaged respectively in Chitwan National Park.

From this study, it was found that most damaged crop is paddy, followed by maize and millet. Crop damage depends on various factors like nature of crop and preventive measures used by farmers, the number of crop riding elephants and distance from the jungle boundary.

Local villagers had adopted different kinds of preventive measures. For instance, spending night in watch towers and machan, use of noise making tools, use of foggy lights and fire, beating tins and boxes, chasing with stones to deter the elephants etc. shouting and chasing with fires and foggy lights, beating tins and boxes, spending whole night in watch towers and machan were more popular methods. But they did not practice on plantation of alternative crops like sunflower, mulberry, tobacco in the area to avoid elephants and consequent crops damage. Chemical repellents can be effective against elephants. Natural chemical that can deter elephants should be identified.

Human harassment is another serious problem in the Bahundangi VDC. During the study period, it was found that an elephant killed 2 persons during study period Rudraman B.K. aged 49 years and Sitaram Bista aged 58 years were killed by elephants. Besides three other cases of accident took place in 2014/2015 but no one lost their lives. They were only injured.

The study done by Jnawali (1989) shows 78 accidents occurred in 1978-1988. Among them 8 people were attacked by wild animals, 23 were killed and 55 injured. According to Shrestha (1994) 10 people were attacked in which 2 victims were killed 8 victims were seriously injured.

The main reason of agricultural loss and harassment to the local people occurred due to lack of any effective physical barrier between private areas and jungle. Bad planning, ignoring people's needs are responsible for today's problem in Bahundangi VDC. So, the problems are growing more serious than ever.

Most of the farmers depend upon the agricultural products for the continuation of their life. But due to crop depredation by wild elephants, it has adversely affected the economy

of the local people and has increased poverty in the region. Again, no improvement and no techniques have been developed to solve the problems and it remains unsolved for the local farmers.

The problems created by elephant are spreading to other VDC too. So as to eliminate the problems, Nepal and Indian governments have to develop an idea along with the participation of local people of both countries.

6. CONCLUSION AND RECOMMENDATION

6.1 Conclusion

People are severely affected by the protected areas due to the establishment of parks and Reserves. People are prohibited to hunt animals, graze domestic animals, use tree or timbers, fodder, log etc. on the other hand, people have also created problem through hunting and poaching to the wild elephants. Livestock grazing inside the protected area, timber, fodder, firewood cutting etc is also serious problems created by the people. So there is always conflict between local people and reserve.

Humans never realized that they have destroyed the habitat of wild elephants and created conflict. On the other hand, rapidly increasing human population in developing countries in search of space has damaged the habitat of wildlife, forest. The same problems have occurred in the Bahundangi VDC. It's the reason why people are facing problem with elephants and vice-versa.

Crop depredation is very serious problem in Bahundangi VDC. The total loss of Rs. 5514076.25/- is estimated from my study. Paddy, maize and millet are the severely damaged crops.

Human harassment is another serious problem in the study area. Many people have been injured by wild elephants. But people get only little amount (Rs.1500) cash compensation for their treatment from the VDC. Most of the families of my study area are economically poor. So they feel difficult to live a sustainable life. As a rural area with illiterate people, their economic status is falling further below due to these problems.

6.2 Recommendation

From the present day, one can suggest the following recommendation as a solution to the problems.

1. **Watch tower:-**

Many crop fields of wards 1, 2, 8 and 9 are situated on the bank of Mechi river. These crop fields are far from home to take care. The guarding group needs some place to stay in the night. 28 permanent and safe towers for guarding groups are built recently along the Mechi river on the entry points of the elephants. The number of these towers should be increased.

2. Tea-cultivation along the Mechi River side:-

Establishment of physical infrastructures is very expensive and these are not sustainable in our country. It needs maintenance cost every year, which cannot be afforded by our government. Tea cultivation along Mechi river is an alternative means to deter the elephant in Bahundangi VDC. The root stock of tea plants is very hard that it hurts the elephant legs. This might reduce the problem.

3. Training to local farmers:

For guarding crops, it should be made compulsory that everybody should gather and guard. 20-25 guarding groups should be formed for the affected wards 1, 2, 8 and 9. All persons in the groups should be trained. At least 10 days of training should be given to the leaders of each group by other trained persons.

4. Management of staple foods for elephants:-

The elephants knew most of the plants which we cultivated in our own fields (Sukumar, 1989). So the concerned authorities should cultivate palatable plants like banana, cassava, broom grass, bamboo etc. as elephant fodder in the forest.

5. Provision of equipments and materials for elephant control:-

The district forest offices of eastern Nepal should be provided with vehicles with special siren, special torch light, night vision binoculars, shotgun with bullets, field gears such as tents, sleeping bag and utensils etc. for patrolling and chasing elephants.

6. Bee-hive keeping:-

Bee-hive keeping in the elephant affected area is practiced in Bahundangi VDC, the hive is kept in such a way that when elephants touch the strings connected to hives, the hives fall down on the ground and bees coming out from the hive start to sting the elephant.

7. Chilly plantation:-

Chilly plantation in the elephant affected area may be another measure to distract elephant incursion. This practice was used in Africa to distract the African elephant. The hot tastes of chilly help to distract the elephant when it is taken as food.

8. Cactus plantation:-

Cactus plantation in the elephant affected area may also be other measure to deter elephants. Special type of cactus plant called "Hattibar" in Nepal is being used as fence to deter elephants in elephant affected area.

9. Management of forest corridors:-

The forest corridor in eastern Nepal has been broken at several places. Government should protect the corridors and check their encroachment for the conservation of elephants and other fauna and flora.

10. Trans boundary cooperation between India and Nepal: - Elephants know the borders, thus trans boundary cooperation between India and Nepal should be initiated to manage the migratory elephant herd.

11. Effective compensation scheme:-

To create positive attitude among the local people towards elephants, the government should provide compensation to the victims of elephant terror. Compensation should be based on actual quantities of crop damaged, houses and properties destroyed and the nature of human injures and casualties. A local committee should be formed with local leaders and government representatives to evaluate the damage and recommend compensation.

PHOTOGRAPHS



Photograph 1 : Discussion of villagers regarding controlling of Elephants



Photograph 2 : Discussion of villagers regarding controlling of Elephants



Photograph 3 : Nut plant damaged by Elephants.



Photograph 4 : Wall of house destroyed by Elephants.



Photograph 5 : Door of the house destroyed by Elephants.



Photograph 6 : Destroyed floor.



Photograph 7 : Pillars damaged house.



Photograph 8 : Destruction caused by Elephants in search of grains.



Photograph 9 : Cottage destruction by Elephants.



Photograph 10 : Elephant dead after electric shock.



Photograph 11 : Photograph taken by villagers of dead Elephant.



Photograph 12 : People Looking the dead Elephant.



Photograph 13 : Small kids enjoying by looking dead Calf.



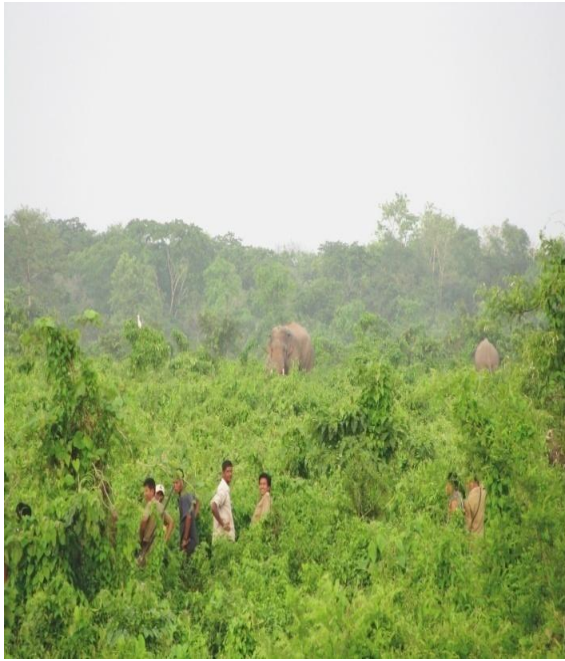
Photograph 14 : Villagers looking dead Calf.



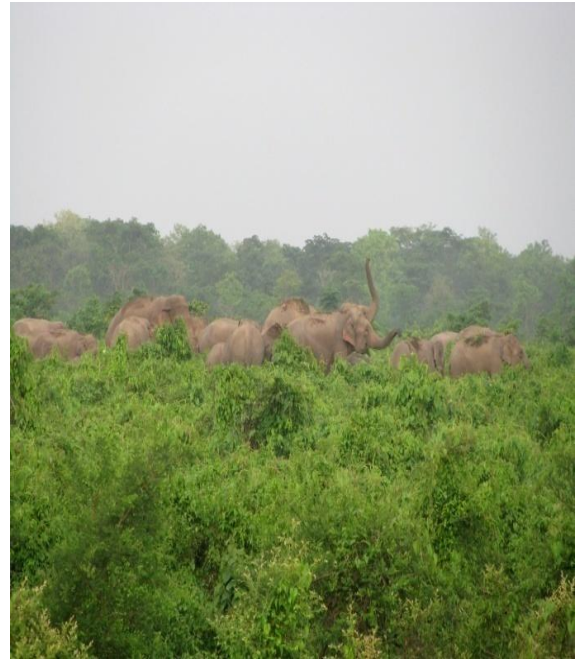
Photograph 15 : People are patrolling with Vehicles .



Photograph 16 : Indian police chasing the Elephants towards Nepal.



Photograph 17 : People guarding Elephants



Photograph 18: Herd of Elephant coming toward Nepal.



Photograph 19: Bee hive Keeping

REFERENCES

- Adhikari, D. 2009. Human-Elephant conflict in Indo-Nepal Border. Journal of a Nepali Journalist published in the KTM post.
- Baral, N. 1999. Wild boar – Man conflict. Assessment of crop damage by wild boar (*Sus Scrofa*) in the South – Western. Section of Bardia National Park, Nepal . M.Sc. Thesis in Zoology, Tribhuvan University, Nepal. 43pp.
- Bista, S.S. 2002. An overview of Elephant Conservation in India. *The Indian Forester*, Vol. 128, No.2. Dehra Dun (Uttaranchal), India.
- Caufield, V. 1984. Indonesia's great exodus. *New scientist*. 11:25-27 pp.
- CBS.2001. National Population Census 2001, Nepal, Kathmandu.
- Craig, G.C. 1992. A simple model of tree/elephant Equilibrium. In: Martin R.B. and Corybeare, A.M.G. 1989. *Elephant Management* in Zimbabwe, Department of National Park and Wildlife management, 81-86 pp.
- DFRS. 2001. Forest Resource Information System Project. GoN/N, Babarmahal, Kathmandu, Nepal.
- DNPWC. 2003. Domesticated Elephant Management policy *Samrakshan Samachar* 23 (3) 4-7 pp. DNPWC and WWF, Nepal.
- DNPWC. 2010. *Protected Areas of Nepal*. Department of National Parks and Wildlife Conservation, Babarmahal, Kathmandu, Nepal.
- Elephant Site, Surf the Intern ate online, visited 26.03.2004 [http:// wwf.Elephant.net.co.th/index-29.1.html](http://wwf.Elephant.net.co.th/index-29.1.html)
- Heinin, J.T. 1993. *Park- People conflict in Koshi Tappu Wildlife Reserve*, Nepal: a socio-economic analysis. *Environment Conservation* 20 (1) 25-34 pp.
- Hoare, R.E. 1999. Determinants of Human-Elephant conflict in a land- use *mosaic journal of Applied Ecology* 36:689-700 pp.
- IUCN 1996. IUCN Red list of Threatened Animals. IUCN, Gland Switzerland and Cambridge, U.K.
- Jackson. J.K. 1989. Manual of Afforestation in Nepal. Nepal- U.K. Forestry survey and Research office, Department of Forest, Kathmandu, Nepal.

- Jnawali, S.R. 1989. *Park-People Conflict: Assessment of crop damage and human harassment by Rhinoceros in Sauraha areas adjacent to the Chitwan National Park*, M.Sc. Thesis, Agriculture University of Norway, 102 pp.
- Johsingh, A.J.T. and Williams, A.C. 1999. Elephant's corridor in India: Lessons for other elephant range countries. *Oryx* 33:210–214 pp.
- Joshi, D.P. 1986. The Climate of Terai and inner Terai of Nepal: A Bio-Climatic Analysis. Proceeding of First conference on Science and Technology, Vol. VI, 14-29 pp, Kathmandu, Nepal.
- Kasu, B.S. 1996. Studied on Park-People conflict in Parsa wildlife Reserve, M.Sc. Thesis Submitted to Central Department of Zoology, Tribhuvan University, Kritipur, Kathmandu, Nepal.
- Khatri, T.B. 1993. Status and food habitats of Nilgai (*Boselaphus tragocamelus*), in Bardia National Park, Nepal. M.Sc. Thesis, Agriculture University of Norway. 65 pp.
- Limbu, K.P. 1998. An assessment of crop damage depredation and human harassment due to wild animals in Koshi Tappu Wildlife Reserve, M.Sc. Thesis Submitted to Central Department of Zoology, Tribhuvan University, Kritipur, Kathmandu, Nepal.
- Lindsay, K. 1993. *Elephant and habitants: The need for clear objectives*. *Panchyderm*, 16:34 – 40 pp.
- McKay, G.M. 1973. The ecology and behavior of the Asiatic elephant in southeastern Ceylon. *Smithsonian Contributions to Zoology* 125, 1- 113 pp.
- Milton, J.P. and Binney, G.A. 1980. Ecological Planning in the Nepal Terai. A report on Resource conflicts between Wildlife Conservation and Agricultural land use in Padampur Panchyat Washington D.C. Transhold, International Centre for Environment Renewal, 35 pp.
- Mishra, J. 1971. An Assessment of Annual Damage due to Crops by Elephants in Palamu District, in Bihar. *Journal of Bombay Natural History Society*, 68: 307-310 pp.
- Mishra, H.R. 1980. *Status of Asian Elephants in Nepal*. The Asian Elephant in the Indian Sub- Continent, IUCN/SSC report, J.C. Daniel (ed.) Bombay. Natural History Society, Bombay.

- MPFS. 1988. Master Plan for Forestry sector Nepal, Soil Conservation and Watershed management plan. GoN Ministry of forests and Soil Conservation/ FINNIDA, Kathmandu, Nepal.
- Osborn, F.V. and Rasmussen, L.E.L. 1995. Evidence for the effectiveness of an *Oleoresin capsicum* aerosol as a repellent against wild elephants in Zimbabwe. *Pachyderm* 20:55-64 pp.
- Pamo, E.T. and Tchamba, M.N. 2001. Elephant and Vegetation change in the Sahelo-Soudanian region of Cameroon, *Journal of Arid Environment*, 48: 243-253 pp.
- Pullium, H.R. and Charnov, E.L. 1973. Optimal Foraging: A Selective Review of Theory and Test. *Quarterly Review of Biology*, **52**, 137-153 pp.
- Pyke, G.H. 1983. Animal movement: An optimal foraging approach. The Ecology of Animal Movement, ed. I.R. Swing land and P.J. Green wood, 7 – 31 pp. Oxford: Clarendon Press.
- Roca, A.L., Georgiadis, N., Slattery, J.P. and O' Brien, S.J. 2001. Genetic evidence for two species of elephants in Africa, *Science*; **293**; 1473- 1477 pp.
- Silori, C.S. and Mishra, B.K. 1995. Pressure and Resources development of Masinagudi group of Villages on the surrounding elephant habitat. *A work with Elephant*, Oxford University Press, Bombay. 270-278 pp.
- Seidensticker, J. 1984. *Managing elephant depredations in agriculture and forestry projects*, Technical Paper. The World Bank, Washington D.C.
- Sharma, U.R. 1991. Park- People interaction in Chitwan National Park. Ph.D. Thesis. University of Arizon, U.S.A. 275 pp.
- Shrestha, B. 1994. Studies on Park- People conflict of Chitwan National Park: M.Sc. Thesis Submitted to Central Department of Zoology, Tribhuvan University, Kritipur, Nepal.
- Smith, J.D. and Mishra, H.R. 1992. Status and Distribution of Asian elephants in Centre Nepal: *Oxys* **26**(1): 34-38 pp.
- Stromayer, K. 2001. Summary Report 1999 – 2001. Asian Elephant Conservation Act. U.S. Fish and Wildlife Service. 37 pp.

- Studsord; J.E. and Wegge, P. 1995. Park – People relationship: the case of damage caused by park animals around the Bardia National Park, Nepal. *Environmental Conservation* **22**: 13-142 pp.
- Sukumar, R. 1989. *The Asian elephant. Ecology and Management*. Cambridge University Press, Cambridge.
- Sukumar, R. 1990. Ecology of the Asian Elephant in Southern India. Feeding habits and crop raiding patterns. *Journal of Tropical ecology*. 6: 33-53 pp.
- Sukumar, R. 1992. *The Asian Elephant: Ecology and Management; in centre for ecological sciences*, Indian Institute of Science, Bangalore India 255 pp.
- Sukumar, R. and Santosh, J.A. 1991. Censuing: *Elephants in Forests*. Technical Report No. 2, Asian Elephant Conservation Centre, Bangalore, India.
- Tchamba, M.N. and Seme, P. 1993. Diet and feeding behavior of the forest elephant in Santchu Reserve. *African Journal of Ecology*, **31**: 165-117 pp.
- Thouless, C.R. and Sakwa, J. 1994. Shocking elephants: Fences and Raiders in Laikipa district, Kenya. *Biological Conservation* **72**:99 – 107 pp.
- Velde,P.F.T. 1999. Transboundary Elephant, Corridors, Protecting the Wild elephant, Dispersal pattern of the Far Western Terai Region through corridors linking. WWF Nepal Program, Report series.
- Wegge, 1976. Terai Shikar Reserve: Survey and Management Proposals. National Parks and Wildlife Conservation Project, FAO Document No.4, Kathmandu, Nepal.
- Williams, A.C. and Johnsingh, A.J.T. 1996. Status Survey of Elephants and their habitats in Garro Hills, North- East India, *Gajah* **16**: 19– 29 pp.
- WWF. Nepal, 2007. A Case Study on Human– Wildlife conflict in Nepal. A report Submitted to species Program, WWF international.
- Yadav, B.R. 2002. Elephant (*Elephas maximus*) People Interface in East Nepal. M.Sc. Thesis, Agricultural University of Norway. 111 pp.

APPENDIX I

HOUSEHOLD QUESTIONNAIRE

Name: Age:.....

Sex: village/Tole:.....

Group-A (General)

1. How many members are there in your family?
2. Do you have land?
 - a. Yes
 - b. No
3. How much land do you have?
 - a. Bigha.....
 - b. Kattha.....
4. What are the sources of income?
 - a. Agriculture
 - b. Service
 - c. Business
 - d. Others

Group-B (Crop damage and Local Harassment)

1. In which season the elephants come most?
2. How many elephants come at a time?
3. Do elephants come from east at same time every year?
 - a. Yes
 - b. No
4. What is the reason of easy arrival of elephants from India?
 - a. Regular migration
 - b. Lack of Food in Reserve
 - c. To change the taste
 - d. Lack of complete fence in the boarder
 - e. Liking of crop field
 - e. Others
5. At what time do elephants destroy the crops?
 - a. Evening
 - b. Night
 - c. Dawn
 - d. Others

6. What types of crops do elephants destroy and in which season?

<u>Seasons</u>	<u>Damage crop types</u>
a.
b.
c.
d.

7. How much crops do you produce in a year?

<u>Seasons</u>	<u>Production</u>
a.
b.
c.
d.

8. Do you think elephants with babies damage more?

- a. Yes b. No c. Equal d. Do not know

9. Have you applied any techniques for the protection of crops and houses?

- a. Yes b. No

10. If yes, what are the techniques that you apply?

- a. Shouting and chasing with fire and foggy light
- b. Beating tins and boxes
- c. Chasing with stones
- d. Watch tower and Machan
- e. Vehicles
- f. Others

11. Which techniques are most effective?

12. Is the damage increasing in spite of applying techniques?

- a. Yes b. No

13. What types of Crops do you plant in growing seasons?

<u>Seasons</u>	<u>Crop types</u>
a.
b.
c.
d.

14. Do the elephants damage your crops?

- a. Yes b. No

15. How much crops did elephants destroy in this year?

Seasons	Production	Loss in Kg.	Amount in NRs
a.			
b.			
c.			
d.			

16. Do elephants attack local people?

- a. Yes b. No

17. If yes, what is the name of the person and date of attack?

Name..... Date.....

18. What was the incident?

.....

19. If injured by elephant, do you receive any compensation or medical help from concerned authorities?

- a. Yes b. No

20. What are the least and the highest number of elephants damaging crop at one time?

Number

APPENDIX II

C. INSTUTIONAL QUESTIONNAIRE

Interviews with concerned intuitions regarding Crop damage by elephants.

1. Name:Age:.....Sex:.....
Intuitions: VDC DDC DFO CDO
2. Do the affected people come to complain about crop damage?
 - a. Yes b. No
3. If yes, how many times do they come with complaints in a year?
 - a. 2 times b. 3 times c. 4 times
4. How often elephants attack and chase people?
 - a. Very often b. Seldom
5. Has any controlling measure or protection been adapted by Government authorities?
 - a. Yes b. No
6. If yes, what types of control measures have been adapted?
 - a. Construction of watch tower and machan
 - b. Hattibar plantation
 - c. Army patrolling
 - d. Electric fences
 - e. Trenches
 - f. Bee-Keeping programme
 - g. Others
7. Do you know how many elephants come every year in the crop field?
 - a. Below 5 b. 5—10 c. 10—15 d. 15—20 e. above 20
8. How can conflict between human and wild elephants be solved?
9. What is your opinion about compensation?
10. Any suggestion would you like to give?

APPENDIX III

Table 27: Main Flora of the Study Area

Common Name	Scientific Name
Sal	<i>Shorea robusta</i>
Sisoau	<i>Dalbergia silo</i>
Simal	<i>Bombax ceiba</i>
Haldu/Karma	<i>Adina cordifolia</i>
Barro	<i>Terminalia belerica</i>
Harro	<i>T. chebula</i>
Saj or Asna	<i>Terminalia elliptica</i>
Kusum	<i>Schleicheria trijunga</i>
Kabhro	<i>Ficus lacor</i>
Timilo	<i>Ficus auriculata</i>
Khanayo	<i>Ficus semecordata</i>
Kimbu	<i>Morus rubra</i>
Bayar	<i>Zizyphus mauritiana</i>
Amala	<i>Phyllanthus emblica</i>
Chilaune	<i>Schima wallichii</i>
Bot dhayaro	<i>Lagerstromia parviflora</i>
Kumhi	<i>Careya arborea</i>
Bhoral	<i>Bauhinia valhii</i>
Kutmero	<i>Listea monopelata</i>
Koiralo	<i>Bauhinia variegata</i>
Khari	<i>Celtis australis</i>
Pipala	<i>Piper langum</i>
Tama bans	<i>Dendrocalamus hamiltonii</i>
Banana	<i>Musa Balbisiana</i>
Kans	<i>Saccharum spontaneum</i>
Boruwa	<i>S. munja</i>
Bhalaya	<i>Semicarpus anacardium</i>

APPENDIX IV

Table 28: Main Fauna of the Study Area

Common Name	Scientific Name
Rhesus Monkey	<i>Macaca mulatta</i>
Terai Grey Langur	<i>Simmopithecus hector</i>
Asian Wild Elephant	<i>Elephas maximus</i>
Golden Jackal	<i>Canis aureus</i>
Indian Fox	<i>Vulpes bengalensis</i>
Squirrel	<i>Ratufa spp.</i>
Jungle Cat	<i>Felis chaus</i>
Barking Deer	<i>Muntiacus muntjak</i>
Hog Deer	<i>Axis porcinus</i>
Indian Hare	<i>Lepus nigricallis</i>
Indian Porcupine	<i>Histris indica</i>
Indian Spotted Deer	<i>Axis axis</i>
Small Indian Mongoose	<i>Herpestes auropunctatus</i>
Indian Flying Fox	<i>Pteropus gigantes</i>
Woodpecker	<i>Dendrocopus spp.</i>
Bulbul	<i>Pyconomatus jacosus</i>
Kalij Peasant	<i>Lophusa leucomeluna</i>
Swam Patridge	<i>Francolinus gularis</i>
Yellow Vented Warbler	<i>Phylloscopus cantator</i>
Mountain Imperial Pigeon	<i>Ducula badia</i>
Great Tit	<i>Alauda arvemsis</i>
Indian Bull Frog	<i>Rana tigrina</i>
Cattle Egret	<i>Bubulcus ibis</i>
Common Crane	<i>Grus antigone</i>
Sarus Crane	<i>Grus antigone</i>
Cobra	<i>Naja naja</i>
Monitor Lizard	<i>Varanus bengalensis</i>
Garden Lizard	<i>Calotes versicolor</i>
Asiatic Rock Python	<i>Python molurus</i>
Common Krait	<i>Bungarus caeruleus</i>
Banded Krait	<i>Bungarus fasciatus</i>

APPENDIX V

Table 30: Local market price for the year 2014/2015 in Jhapa district

Crops	Local Market price (Rs./Kg)
Paddy	Rs. 22.5
Maize	Rs. 17.5
Millet	Rs. 26.5
Ginger	Rs. 45
Mustard	Rs. 120
Wheat	Rs. 23.75
Potato	Rs. 20
Beetle nut	1 pole = Rs. 55
Coconut	1 fruit = Rs. 55
Bamboo	1 pole = Rs. 50
Banana	1 dozen = Rs. 50
Tea	Rs. 600

Source: GON/Khadya Sasthan, Kakarbhitta.