EXTENT OF HUMAN-ELEPHANT CONFLICTS AND THE THREAT TO ELEPHANT POPULATIONS IN SOUTHERN BHUTAN

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Abstract

The conservation of last elephant occurrences becomes increasingly a challenge in any agrarian populated country, where crop raiding and property damages is an increasing issue. In Bhutan, with only a minor and more mobile elephant population, according conflicts are only a more recent but an increasing problem. Corresponding experience and literature are still poor. Therefore, this study tried to find out – through questionnaire-based information – which damages dominate, which counter-measures are exhibited and with which (mostly not very long lasting) success, and which attitudes towards conflicts with elephants are evident, or may become a future problem for their survival. An initial literature review (from over the world) helped to discuss the results finally with regard to Bhutan and to make some preliminary suggestions.

Zusammenfassung (Abstract): Zum Ausmaß der Elefant-Mensch-Konflikte in Bhutan und die Bedrohung der dortigen Elefanten-Population

Die Erhaltung letzter Elefanten-Vorkommen wird zunehmend zu einer Herausforderung in jedem agrarisch genutzten Land, wo Ernte- und Eigentumsschäden durch Elefanten sich steigern. In Bhutan mit einer nur kleinen und eher mobilen Population sind Elefanten-Konflikte erst ein jüngeres, aber sich deutlich verstärkendes Problem; deshalb existiert hier noch kaum einschlägige Literatur dazu. Diese Arbeit versucht, an Hand einiger Beispielsgebiete in zwei grenznahen Distrikten mit Indien (durch Daten aus Befragungen in 107 Haushalten) herauszufinden, welche Schäden besopnders vorkommen, welche Abwehrmaßnahmen mit welchem – in der Regel nur vorübergehenden – Erfolg angewendet werden und wie sich die Einstellungen in der Bevölkerung zu diesem Problem darstellen. Dem ging eine ausführliche Literatur-Analyse (weltweit) voraus, an der sich dann auch die abschließende Diskusion und Empfehlungen (für Bhutan) orientierten.

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Summary

Conservation of elephants is becoming a challenge in any agrarian populated country, where crop raiding and property damage is an increasing issue. This paper describes a study conducted in a few Gewogs (villages) under two border-near districts with India, Samtse and Sarpang. The survey included individual interviews of 107 households to learn more about the attitude of the people towards elephant conservation and the extent of the problem. It also includes literature studies on cases from other countries with similar experiences. Although the present situation is still a bit relaxing with only less than 50% of the respondents showing a negative attitude towards the elephant. But with increasing human population and at the same time increasing conflicts the habitats of elephants are getting degraded and the human tolerance is being tested. Moreover, with agriculture being the major means of sustenance, the goal of conservation and at the same time poverty alleviation for all is a challenge. 97% said they would not think of harming elephants but the remaining response on wanting to kill the elephant, although not yet alarming at the moment, is a sign that peoples attitudes are changing. More than half of the responses (71%) was for compensation and regarded it as the only way to make up for their damages. The farmers responded that use of wooden torches and community guarding in groups would be effective in driving away the animals and prevent crop damage. Improving the already installed solar fences at some sites was also recommended although their preventive effects do not last very long. Culling would not be a solution to the problem. Therefore, adopting various methods and looking for the most suitable ones seems to be an option along with awareness and involvement of the farmers in co-management strategies which would be a step towards curbing the problem.

List of Abbreviations

CITES – Convention on International Trade in Endangered Species of Wild Flora and Fauna

DoF – Department of Forests

FNCA- Forest and Nature Conservation Act 1995

IUCN – International Union Conservation of Nature

MoA – Ministry of Agriculture

NCD – Nature Conservation Division

NFE – Non Formal Educations

RGOB – Royal Government of Bhutan

WWF – World Wide Fund of Nature

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1. Introduction

Bhutan a small landlocked country with an area of 38,394 sq kms (Nature Conservation Division 2004) is surrounded by two giant countries, with India in the south, east and west and China in the north. Although a small country it has different forest ecosystems such as the subtropical, the temperate and the alpine zone. The altitudinal variation is from 150 msal to more than 7000 masl (Ministry of Agriculture 2002). The country has a high forest cover of 70% with a correspondingly rich biodiversity. Conservation has always been a priority and this is in line with the goal of maintaining at least 60% of the forest for all times to come; a vision set by His Majesty the Fourth King of Bhutan. The dedication towards conservation can be clearly seen with the establishment of protected areas and biological corridors around the country. The Protected Area network consisting of 9 National Parks (6 fully operational) and Biological Corridors covers an area of 11,502 sq kms and 3660 sq kms respectively taking up 29.96% and 9.53% of the country's area. However unlike in other countries around the world settlements can be found in and around the Protected Areas. Although a small country with a small area, the diverse ecosystems boast about a rich diversity of both flora and fauna. 178 different mammals, over 770 birds, and more than 5,446 plant species, 49 fishes are found. The Royal Bengal Tiger, Asian Elephants, Snow leopard, Golden Langur, Black Necked Crane etc are some of the important species which are found among the many other species(Department of Forestry Services 2002). The population in Bhutan is 672,425 persons, with 69.1% living in the rural areas and 30.9 % in the urban areas(Population and Housing Census of Bhutan 2005), agriculture and livestock rearing is still a major means for sustenance.

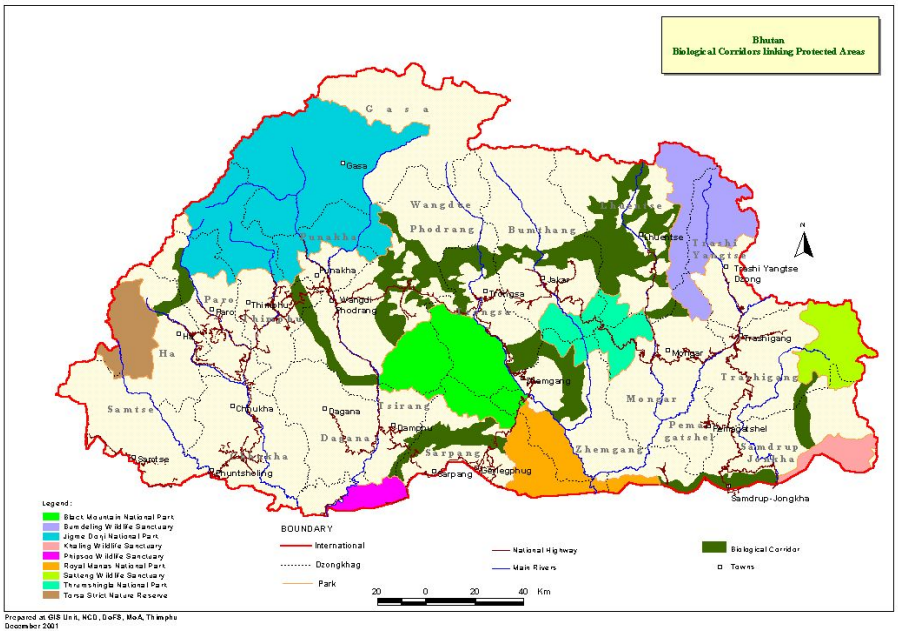

Figure 1 Bhutan map showing protected areas and biological corridors (Source, NCD, DoF)

Elephus maximus, the Asian elephant is distributed in the following regions:

- Indian sub-continent: India, Nepal, Bhutan, Bangladesh
- Continental South East Asia: China, Thailand, Burma, Malaysia,Indonesia, Cambodia and Vietnam.
- Island Asia: Andaman Islands(India), Sri Lanka, Sumatra (Indonesia) and Borneo (Malaysia and Indonesia)(Sukumar 1989)

In Bhutan the Asian Elephants are found in the foot hills along the Southern border of Bhutan, over a habitat range of about 1,500 sq km. Most of them migrate inside the country seasonally either north-south from or east-west along the border areas of neighbouring India. They can be found in the districts of Samdrup Jongkhar, Sarpang, Tsirang, Samtse, and Gedu. They are usually seen up to an attitude of about 300m.

With the population declining over the years, it is of national and international concern in all the range states. The conservation is also a key issue because it is an important species both of cultural and religious significance in the country as well as in the neighbouring subcontinent. In Bhutan it is an important flagship species and is highly protected and is listed as a Schedule I species in the Forest

and Nature Conservation Act 1995. Killing of all protected species under the act is strictly prohibited and strong regulations have been set up for any offences related to any illegal activity. It is also of international concern and listed in the Appendix I of the CITES and in the Endangered category of the IUCN Red list.

The Population of Asian Elephants in the country was once known to be quite high according to a report in 1997(Paljor, 1997) with an estimate of ranging from 700-800, however this has not been verified. However in recent times it has declined due to factors such as forest conversion, habitat destruction, poaching and maybe even retaliatory killing. The rough estimate of elephants could be around 200 to 300 as no population survey has been carried out yet. Migration is a common phenomenon because of the porous border with India in the Southern districts.

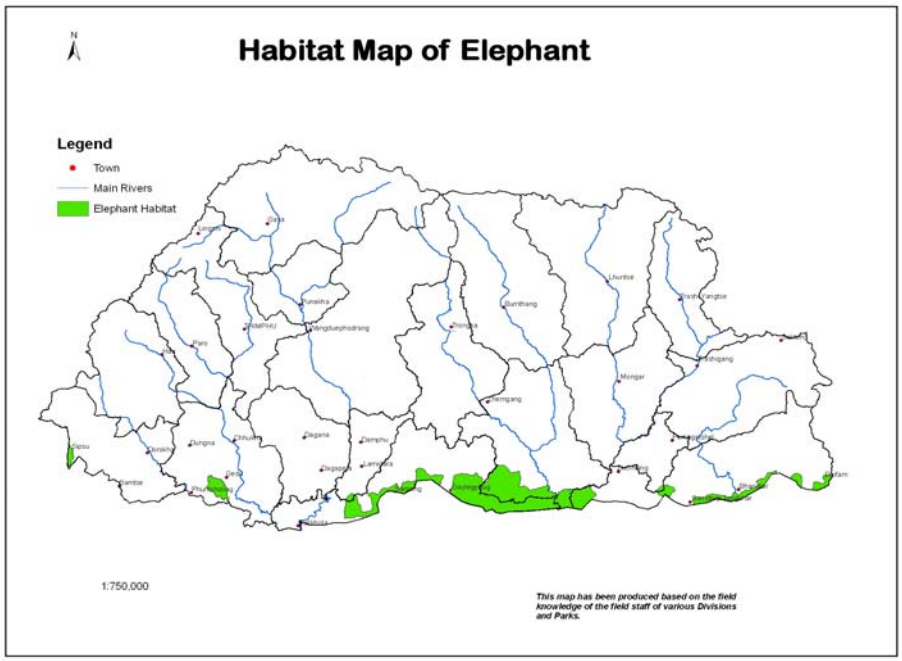

Figure 2 Map showing potential elephant habitat (Prepared by GIS section, NCD as per the information provided by the field staff)

The southern part of Bhutan has been facing severe crop and property damage by elephants and the concern is rising with the number of incidences increasing in the recent years. The distance between the agricultural fields and the forests is very low making the conflict an unavoidable situation. The frequency of damages in certain areas also seems to indicate that they move between the two countries

almost on a daily basis. Therefore this is becoming a key issue concerning their conservation. The conflicts results in a direct and indirect negative interaction between the people and the elephants and potentially may harm both. Crops damaged include maize, paddy, millet, and banana and areca nut trees and ginger which is not consumed but trampled in the crop raid process. The damage caused however varies from one place to the other with some areas being extensively damaged. The challenge faced by the conservationists now is the reduction of the economic impact on the humans and conserving a viable population of elephants.

We do not know clearly what factors threaten the elephant populations or the magnitude of the threats but it is definitely certain that the damages caused by them plays a significant role in creating animosity against them and that there is no easy way to deal with this complex issue. Increase in human population, competition for resources with change in land use pattern into agriculture and most importantly the porous border which allows free migration of the elephants between the two countries could be some of the reasons for increased incidences of elephant damages. The damages caused have a major effect on the livelihood of the people since most of the people in these areas are farmers who depend entirely on agriculture for their sustenance. There is no existing National policy on compensation and hence a concern for the conservation of these species.

Since elephant is a protected species and is also highly respected as a religious symbol so far there has been no retaliatory events against it. However with the increasing problem, the attitude of the people may change. In recent years with increased incidences of damage the Forest Department has been expected to find possible measures or solutions to fix the problem as they are also responsible for implementing the laws protecting the wildlife.

This is a small study which has been designed with a general objective to get a general idea of the extent of damage caused by elephants in some of the areas which have reported high conflict cases. At the same time to obtain a preliminary assessment of conservation and protection needs through socio-economic

surveys. Literature surveys and past experiences in other elephant range states will be studied to get management ideas and adopt successful mitigation measures address the human-elephant conflicts in the country. The study hoped to enable decision makers to determine priority areas where elephant populations are more liable to become vulnerable as a result of human-wildlife conflict. Since the elephants are mostly migratory as mentioned earlier another further detailed studies could be conducted to learn their migratory routes and patterns. The Primary questions that have been dealt with during the study are divided into 4 groups as (1) Characteristics of the human–elephant conflict zones.(2) Elephant damage incident (3)Perception of the people (4) Damage report

2. Literature Review

2.1 Human-Wildlife Conflicts

A human-wildlife conflict occurs whenever an action by humans or wildlife has an adverse impact upon the other. In actuality whenever a human-wildlife conflict occurs, both parties lose (Conover 2002). Wildlife are often subject to control if they are perceived to harm the livelihoods, lives or lifestyles of people (Woodroffe et al. 2005)

Human-wildlife conflict is one of the main threats to the continued survival of many species, in many parts of the world. People lose their crops, livestock, property; lives are endangered and sometimes even lost. Many of the animals are often killed in retaliation or to 'prevent' future conflicts. However this human-wildlife conflicts becomes an important issue when the animal concerned is threatened or endangered and is of high conservation value, whose existence is also of equal importance to the ecosystem. With inadequate solutions to address the conflicts when there is high risk to human lives and property then the local support for conservation of the animals also declines (Talukdar and Barman 2003)

There are two ways of the human wildlife conflicts one where habitat of the wildlife species concerned are lost or reduced, the decrease in population due to retaliatory killing and sometimes in severe cases also extinction. The other would be where human population is affected in terms of losses such as crop, property, injury and also death.

“Conflict between people and wildlife is ubiquitous, rats ruining rice harvest, elephants ploughing up crops, wild pigs trampling and damaging crops and fields, large cats attacking livestock etc. Human conflicts with wildlife assume a variety of forms and take up much of the time and energy; it is found universally on land, in rivers and seas, in the city as well as the country but tends to be specially marked in human settlements in the forest-edge regions. As a threat to agricultural production and an impediment to rural development wildlife depredations are an area of state concern and an object of expert intervention

but often overlap with the issue of wildlife conservation especially in the case of large mammals"(Knight 2000).

In the book "People and Wildlife, Conflict or Coexistence" by Woodroffe et al. (2005) it has been mentioned that killing of the problem wildlife concerned has been practised in many cases around the world. This practice has resulted to serious consequences such as extinctions, collapse of ranges, and decline in populations and on the whole it disrupts the whole ecosystem by bringing about changes in the natural food chain. Most conflict species especially the large carnivores and elephants are "keystone species" whose removal affects the structure of the entire ecosystem (Woodroffe et al. 2005). For instance the removal of large carnivores could lead to the increase in prey species like the smaller ungulates which could have further consequences.

According to Conover conflicts are known to persist in areas due to a combination of four factors, namely deficiencies in one of technical solutions, lack of farmer vigilance and cooperation, habituation of the animals to any one method and high human and social costs of living with wildlife. For wildlife damage to occur three elements must come together there must be a resource damaged, an animal causing the damage and an injured or damaged person. If no one has been injured or suffered a loss and then there has been no damage (Conover 2002).

Human wildlife interactions may be positive with humans using resources from the wild for food, clothing etc. in the process destroying and modifying the natural habitat of the wildlife. However when wildlife cause damage to the crops, kill livestock, damage property , cause injury or even death, the negative aspect arises raising issues of human wildlife conflicts. When it comes to losses we focus mainly on direct costs which focus directly on the stakeholders in terms of loss of human lives, livestock, wildlife resources, crops and also property which are calculated into financial terms. The indirect costs concern the time and money spent in preventing wildlife damage and then the opportunity costs in terms of the income lost from the activities that have been prevented due to the fear of wildlife damages (Thirgood et al. 2005).There are different ways that a

society can and does respond to complaints about wildlife damage. In some societies the injured persons may be given a free hand to deal with the wildlife problem in any way they prefer. But the government may restrict the use of some techniques for various reasons such as, threat to human safety, non target animals or environment, rare or valuable species involved. Compensation may also be provided at times to the land owners for their losses. But how a society responds to wildlife damage depends in part on the people's attitude about wildlife in general, or on specific and culturally valued species like the elephant.

The fear of being killed by a wildlife species is one of the most serious causes of human wildlife conflicts. Big cats, bears, wolves, mega herbivores such as elephants, rhinoceros, crocodiles or snakes contribute to the death of many humans around the world. In Asia hundreds of people have been killed after encounters with wild elephants. Wild animals are known to kill hundreds if not thousands of people globally every year (Thirgood et al. 2005). Although the number may not be alarming in context with the global population it is critical in determining the tolerance of local communities to wildlife and the fear it self may result in pre-emptive killing.

2.2 Human Dimensions in Wildlife Damages

"Wildlife damage managers are a professional 'buffer' between wildlife and humans, protecting humans from animals, while at the same time protecting wildlife from humans. The wildlife damage management professional needs to be able to understand humans as well as he or she understands wildlife. Ironically, this human element tends to be a weak link in our educational chain…(Damage Managers) tend to be well-trained in their technologies and in wildlife biology and not well trained in sociology, anthropology, economics, history, psychology or political science- the´ human dimensions' field" (Schmidt and Beach 1999 (Knight 2000).

Farmers throughout the world are faced with trying to reduce or eradicate the impact of crop damage by wildlife to their standing crops (Osborn and S.Anstey 2002). With birds and insects, rodents, invertebrates

causing multi million dollar damages they are given more attention within literature on pest management. However other animals such as primates and elephants, wild pigs etc also cause significant damage although it may not be so conspicuous the extent as the former, but nevertheless they still cause sporadic, chronic, predictable and sometimes unpredictable damages.

During the earlier times the reactions to problem wildlife were much harsher. Retaliatory killing was a common trend whenever wildlife was known to cause harm. Now at present with institutions, regulations and more conservation oriented goals being set up for endangered species, such practices have become illegal, have been stopped and are strongly opposed by the law. Most people, particularly in developing countries generally have the perception that most wildlife especially the protected species is the property of the state. They feel that the state is responsible for the animals so they should control them. There is no complete solution to a problem animal species or population if they cannot or should not be eradicated: therefore proper control measures are usually developed and tested for minimizing the impact of the damage to a limit which can be tolerated by the people.

2.3 Lethal Control Methods

The practices of killing wildlife which cause harm or are known to cause harm to humans are known as lethal control methods. This method is being used for those species which are common such as, rodents, some bird species etc. It is also being used on larger and more threatened species but at a more restricted level. Extreme use of this method has led extinctions and also collapse of ranges of many species which were initially found in large numbers but were perceived to be pests or problem animal. Species like thylacine or marsupial wolf (*Thylacinus cynocephalus*) in 1930 which was restricted to Tasmania became extinct as a result of retaliatory killing since it was known to attack the domestic sheep. African wild dogs (*Lycaon pictus*) were eradicated from 25 of the 39 countries they formally occupied not only because they were a threat to the livestock but also to the game species inside the protected

areas. Lions and Cheetahs were eradicated from Asia and are now sparsely distributed only in Africa in small stocks (Woodroffe et al. 2005).

In Africa centralized Problem Animal Control (PAC) units exist which react to the reports of crop raiding among the communities (Osborn and Hill 2005). They are responsible for assessing the damage caused and then attempt to kill one or more animal from the problem group. Shooting, trapping, use of snares, poisoned baits are some methods practiced on smaller and more common species at a larger scale to rid off the pest population and prevent damages. However there is hardly any published evidence that say lethal control reduces the impact of crop raiding unless all the pest animals are removed. Remember the saying: “Only Red Indians are good Red Indians”. Killing is only seen as a temporary measure and will not stop the new individuals of the animal from returning and causing problem all over again.

2.4 Non-lethal Control Methods

The use of repellent systems, fences and barriers, guarding and scaring are some of the non-lethal methods control methods used to drive away or prevent the problem animal from causing damage. Traditional methods like guarding and scaring the animals using noise repellents such as banging drums, using fires are some of the methods which are used commonly in developing countries. Use of stronger and more effective methods like fences and barriers cannot be afforded to be constructed as well as maintained if at all constructed, due of lack of resources.

2.5 Translocation

This method of removal of problem animal is largely used with large carnivores such as leopards and lions in Africa, tigers in Asia and bears in North America (Treves and Naughton-Treves 2005). This method can be effective in reducing the number of problem animal in a given area but the procedure can be an expensive affair and will also be a stressful process for the animal.

The operation also requires highly trained personnel and equipments. Besides resources and trained personnel more factors need to be considered before a translocation procedure, the new area selected should be a suitable habitat with all adequate natural conditions. There should be no cultivations which are likely to be raided in order to prevent problems in the new area. This method is usually kept as a last resort and is used only where endangered animals are concerned since it involves a lot of money and is a complicated process (Osborn and Hill 2005).

2.6 Attitudes towards Wildlife.

Wildlife damage can change a person's perception about wildlife especially when damage exceeds his or her tolerance. Attitudes of local people to wildlife and particularly to large animals are an increasingly important element of conservation work but attitudes may vary according to gender and prior experience of wildlife (Hill 1998).

Some wildlife species may have social and cultural significance in some countries therefore differentiating the attitudes towards the same animal irrespective of the damage it causes. However as mentioned earlier, when the damages exceed a certain limit perceptions may change and conservation issues hence arise. The propensity of respondents to exaggerate depredation by wildlife reflects important social dimensions to human wildlife conflict (Lee and Graham 2006). The perceptions of farmers reflect rare extreme damage incidents caused by large elephants rather than persistent, small losses caused by smaller wildlife that may actually cumulatively be greater (Naughton et al. 1999).

According to a study conducted on human attitudes towards large carnivores in Norway by Røskaft et al. (2007), safety was the major concern that changed the attitude of humans towards wildlife. The higher level of fear is seen to be associated with a more negative attitude, they also saw that age and education also influenced the attitude of a person. The older people had a more negative attitude and people with higher level of education had a more positive attitude.

Larger communities had a more positive attitude which could also be because of the sense of security among a bigger group of people. Therefore they say that the attitude people have towards carnivores is complex and it cannot be said whether it is more towards the negative side or positive. As in all cases the media always plays a role in drawing attention to any issue. The negative attitude towards any problem wildlife is further increased when the media emphasises on the issue for a long time. The way the problem is presented could also be an influential factor (Røskaft et al. 2007). Also Szinovatz (1997) for Norway, who found out that better information levels made many people also more critical in their attitudes, and also more willing in outing them.

According to another study on Brown Bears in Slovenia by Kaczensky et al(2004), the past negative experiences and fear of the animal created a more negative attitude. It was usually the women who had a more negative attitude possibly because they feared the bears more (Kaczensky et al. 2004). Hill (1998) in her study says that most people felt that elephants were dangerous and that they were known to cause harm to people as well as to property. However, some of the respondents also said that if not disturbed the elephants were not harmful animals. But only people with past experiences had a more negative attitude towards it like the case with studies on carnivores in Europe. The attitudes of the people on conservation was however mixed in the Hill study; some elders felt that the elephants should be conserved for the younger generation as elephants were symbolic of tradition and were a part of the Ugandan heritage.

Wang et al. (2006) says that Bhutan has now to deal with the issue of human wildlife conflict which was apparently absent till two decades ago. The farmers now demand more action from the government and the goal of conservation is at a stake for the future with more conflict issues arising in the recent times.Their study saw that most farmers had negative attitudes towards conservation in parks and they were linked to deterioration of the farm economy, crop and livestock damage, as well as restrictions on grazing, fuel wood collection and extractions of minor forest products. Gender and literacy saw no attitude differences but the age of the respondent did, the younger

respondents (≤ 45 years) had more negative attitude than the older group. (Wang et al. 2006b)

2.7 Significance of Elephants

Elephants have played an important role in human cultures in Asia as well as Africa for a very long time. Elephants were tamed in both the continents and used as beast of burdens for many centuries. They were used to transport timber and stones for constructions of buildings, stupas, and bridges in the past. Even at present in some countries they are used to transport timber and other materials especially on locations which are not accessible by road. Although the historical significance as working-elephants has more or less died down in Africa it still continues in many parts of the Asian countries. The earliest evidence for taming of the elephants comes from the seals of the Indus Valley civilization about 4000 years ago (Sukumar 2003).

In most Asian countries like India and Bhutan the animal has a sacred value and is highly respected hence considering it a taboo to consume the meat of the elephant. In Bhutan the animal symbolises peace and harmony as it is one of the four harmonious friends in the Buddhist context. People in Bhutan respect elephants since they are believed to be “The Precious Elephant,” a pachyderm associated with good luck and prosperity. It is also among Bhutan’s Seven Jewels (Gyalse Naduen) (Dema 2008). This is also one of the reasons for the absence of tamed elephants and use of it as beasts of burden in the country although it is also strictly prohibited by the law. In the Indian Subcontinent, the classic elephant-headed deity Ganesha is prayed to by many people and has been done so for a very long time. The ownership of elephants was more prominent during the rules of the Maharajas and the elite in India. They were used during the religious ceremonies and given as offerings to temples by the royals. Their use in weddings and ceremonies are also prevalent at present. This was also the same for the Thailand region(Sharma 2003). Even in the island state of Sri Lanka the State or Royal elephant as it was called was an essential requirement for a king during the earlier times (Wisumperuma 2003). The capturing of elephant and domesticating them was a lucrative business in the past in the North Eastern India before there were any concerns for their

conservation. Once they were included as a Schedule I species, the business has died down and along with it the art of capturing and taming them (Maunglang 2003).

2.8 Human Elephant Conflicts

Human elephant conflict is a key concern both in terms of conservation and socioeconomic significance. Elephants are mega-herbivores and commonly raid crops, causing economic losses, and death and injury to people. While ivory poaching is a major threat to some elephant populations in Africa, it is of lesser importance in Asia, as only male Asian elephants carry tusks.(Fernando et al. 2005). Elephants were known to coexist with humans for centuries but then there were fewer humans and more land and therefore more carrying capacity of habitats for elephants. Conflicts were known to be present in the past also due to agricultural damage and crop invasion: and written records of human- elephant conflicts are available from the 17th Century (Wisumperuma 2003).

In Africa dating back to the pre-colonial times crop depredation by elephants caused settlements to be displaced and food shortages. Some believe that human elephant conflict is as old as agriculture in Africa (Naughton et al. 1999). The increase in human population resulting in more land being used for cultivation as a result of forest conversion has led to the rising human elephant conflicts in the recent years in Asia as well as Africa. Elephants capture the imagination and unswerving affection of people worldwide but inspire animosity and fear among those sharing their land with these huge animals (Naughton et al. 1999). Sukumar(1989) has once pointed out that especially for the elephants once used to crop raiding, it becomes an optimal survival strategy(Silas et al. 1989). In the Simao region of Yunnan province, China elephants were responsible for large-scale crop and property damage, which caused serious human–elephant conflicts in the region (Zhang and Wang 2003).People–elephant conflict refers to a range of direct and indirect negative interaction between people and elephants which potentially harm both. With the loss of elephant damage being large scale and increased human deaths, the balance of co existence has been disturbed

and hence is a great concern for the conservation loving people in general (Talukdar and Barman 2003).

“Once worshipped as God, it is now considered an enemy, Considered as asset in the past it is now becoming a liability”(Maunglang 2003).

Translocation of the animal to protected areas to reduce conflict and ensure conservation of the species has not made any difference as the conflict with humans still exist. The individual economic losses suffered from crop raiding can be relatively high in developing countries, because farmers are poor and rarely compensated for their losses. Such losses can make communities aggressive and intolerant towards wildlife, which can result killing of problem species as well as undermining and impeding conservation strategies (Linkie et al. 2006). For instance in the year 2001- 2002, 21 cases of elephant poisoning as a result of retaliation has been reported from Assam, it is the highest case reported so far (Maunglang 2003).

Although the rural population is higher with more conversion of forests to agricultural land in Asia, there is much less information on crop raiding as compared to Africa. Very few studies have been carried out in regard to this. However irrespective of the location continuous damage by elephants tend to cause a negative attitude towards the animal in retribution. Across Africa human elephant conflicts are increasing and it has been observed that where elephants persist, contemporary physical conditions seem to draw them closer to human contact and contemporary social conditions lower human tolerance of their presence (Naughton et al. 1999).

Land use change due to increasing human population, where agricultural fields being expanded and spread to areas which were initially wildlife habitats, plays a major role in conflict development. This would result in landowners and elephants competing for the land. In some cases, abandoned land which would have already become a temporary elephant habitat, being reoccupied by people after a long period would also result in conflict. Secondary vegetation closer to the human settlements created largely because of human activities are known to

attract elephants thus brining them closer to the agricultural fields and increasing the risks of crop raiding (Naughton et al. 1999) Traditional migration routes may also be cut off or disrupted due to the increased human activities, traffic infrastructures and settlement.

Human intervention by increasing protection and implementing regulations has caused the number of elephants to increase in many parks and reserves in Africa. The larger groups tend not to fear people and to cause remarkable damages. Displacement of populations from the herds and larger group due to wars and culling are known to cause more damage to crops. Change in human land ownerships and traditional land use systems have led to more damage incidents. The communities not working together in terms of crop raid and damages having to be borne by a single household has become an increasing concern. With the rural-urban migration trend rapidly increasing, manpower to guard crops is drastically reduced. The former is the case in Africa but the later is true for Asia as well.

2.9 Threats to Asian Elephant Population

At one time believed to be in millions, it is estimated that there may be between 35,000 to 54,000 Asian elephants in Asia today (Barnes 1984; Chadwick 1992; Tudge 1992) however the more realistic estimate is probably closer to 25,000 to 35,000 (Croke 1997)and only a few of these are breeding or in a position to breed so therefore bringing down the effective population. It is sad to say that it is not only possible but probable that in the near two decades the population may decline and lead to extinction(Kirtland et al. 2003). 35-50% of all the Asian elephants are in India and amount of land of the total area dedicated as wildlife reserves and national park is not more than 1 percent(Chadwick 1992). The case is similar with Thailand which is estimated to have around 1,300 to 2,000 wild elephants. The wildlife reserves and open areas are much too small hence causing a crunch in habitat use of these large animals.

To add to this the increasing number of human population lead to more encroachment of forest land. Conversion for agriculture, infrastructure such as

road, railroad, etc cause displacement of populations, disrupt the migration routes, fragmentation of the surviving population of elephants, which furthermore increases their conflict with humans. Although due to the presence of tusks only in male elephants poaching is not as prominent as in the African elephants but however the killing of tuskers is still prevalent to a certain extent with the total cases in North India between 1991- 2002 being reported as 658 (Maunglang 2003). In the long run this would prove to be critical to the survival as there may not be enough old males left for breeding.

The number of elephants in Bhutan which was once known to be much higher in thousands and now reduced to a few hundreds is still at a risk of declining with the increasing conflict issue and also due to the decreasing size and fragmentation of its habitat. One of the reasons is also due to the common border with India and the free movement of the animal within the two countries. With settlement prevalent along the borders and the ever increasing incidents of crop raiding and attack on humans, retaliatory killing of the mega herbivore is one of the key concerns which could be a threat to the declining population of Asian elephants.

2.10 Measuring Losses due to Wildlife Damage

With very little information and resources and the pattern of damages it becomes difficult assess the extent of crop damage especially when it comes to comparing the economic impact of elephant damage losses to those of other wildlife pests. With more agricultural practices in the rural areas of developing countries significant losses to pests have been reported but they are rarely measured or, if they are then not in a accurately resulting in very minimal information and data base. This is mainly because of the presence of peasant agricultural systems. Crop yields and losses are difficult to measure and compare because farmers typically plant complex poly cultures in fields of ill defined acreage (Naughton et al. 1999). As mentioned by the author, most farmers who experience crop raiding are simple farmers who grow crops for their own sustenance and not on a commercial scale; therefore it becomes difficult to get the accurate information on how much is actually damaged. All data which can

be acquired are based on surveys conducted and some farmers could overestimate the damage. But we usually have to rely on such data for information and data base (Wang et al. 2006a).

2.11 Management Strategies for Human –Elephant Conflicts

2.11.1 Traditional methods used as deterrents

These methods are termed traditional as they have been used for centuries and are usually local methods used to deter problem elephants before the intervention on local authorities and before the evolution of more modern techniques (Nelson et al. 2003).

Crop guarding, noise, fire, airborne missiles, cleared field boundaries, simple barriers, decoy foods, traps, spikes or home made firearms are some of the methods used. However they are not very effective and can be used only to a limited extent. Being intelligent animals, elephants usually get habituated to these methods so they cannot be used in the long run. Nonetheless these methods show some degree of success as a counter measure. In Zimbabwe cheap farmer methods have been shown to be successful when used in combinations (Nelson et al. 2003).

One of the traditional barriers experimented by rural farmers are known to be effective is the use of thorn branches as barriers. Another method used is piling up of logs and sticks at the edge of the fields. These methods do not necessarily keep away the problem elephants but they act as a restricted boundary to some level(Osborn and S.Anstey 2002). Using noisemakers such as metals and drums accompanied with fire is another method of driving away the elephants. They are effective depending on how and when they are applied. The repeated use of such repellents is not effective in case of regular raiders who get used to the empty threats of the noise repellents. In some parts of Sri Lanka community based approaches have been set up to reduce the conflict and the rotation of duty to guard crops among the community is practiced. In Africa some farmers do not guard the crops at all. Osborn says that although

no deterrent efforts are entirely effective, they do considerably reduce the amount of crops lost.

2.11.2 Disturbance methods

Lights, thunder flashes and flares, firing weapons, trip wire alarms, driving with aircraft, vehicles or people are some disturbance methods being used in Africa. The use of these methods with combination of noise repellents are known to be effective up to some extent as in the case with most methods. Nelson et al. point out that these methods only provide short term relief until the elephants get habituated. These methods also do not have the ability to move elephants far enough away over a large enough area or prevent their return and resultant habituation. They require trained personnel and can be dangerous because of close proximity to the elephants. But they are generally cheap to apply (Nelson et al. 2003).

2.11.3 Killing elephants

Killing of selected problem elephants is used widely in Africa and used as a quick fix solution to provide instant relief. The affected farmers usually get a sense of satisfaction when the problem animal is killed and it also indicates the power of the concerned authority to deal with the situation. Culling to reduce the population is another method adopted. Although this method is beneficial in the short term the identification of the problem animal becomes a difficult process. Regular raiders could be easier to identify if this method has to be applied (Nelson et al. 2003; Osborn and S.Anstey 2002).

Killing the problem animal and culling to reduce the number of the herd is usually practiced only in case of African elephants where the numbers of herd sizes are much higher and also because they are known to be more of an itinerant. Partly, it is recommended and practiced to eradicate (cull) whole families instead of selectively killing only the most raiding individuals what might disturb social structures much more critically – and offers a more effective reduction in numbers and raid traditions. With the reducing population of Asian elephants

such practices are not present and recommendable in Asia. Moreover most Asian countries have strict laws protecting this animal and killing only single individuals them would not be the most appropriate measure to reduce the conflict.

2.11.4 Translocation

Although it seems to be the best solution to remove a problem animal it is usually kept as a last resort as it is an expensive process and involves various risks to the animals as concerned and for the herd as such; it also requires many expert suggestions. Preliminary studies need to be carried out before this method can be adopted to Asian countries. The health of the animal to be moved also need to be looked into as most translocation operations have resulted in the death of elephants due to drug related stress(5 out of 26 animals died in Kenya). Studies carried have also pointed out that translocation is not an appropriate measure in case of conflicts with migratory elephants. (Nelson et al. 2003) also point out that the use of this method would be successful in resolving a conflict only in the case of removal of entire population from a concerned area.

2.11.5 Repellent methods

Olfactory repellents such as oleo-resin capsicum spray, chilli grease on barriers, burning repellent and auditory repellents such as elephant distress calls and trip wire alarms are tried and used in some areas. They are still under experimental stage but use of oleo-resin capsicum spray only had some success as a short term repellent towards elephants (Nelson et al. 2003). In terms of costs the auditory repellents can be more expensive as they involve the use of sophisticated equipments for sound recording and also require technical expertise. The irritant in chillies (*Capsicum spp*) is being researched for its effectiveness as an olfactory elephant repellent. Capsicum-based repellents have a history of success in reducing bear attacks on humans in North America, on conditioning problem animals in captivity and in use against human criminals (Osborn and Rasmussen 1995). The atomised cloud is known to produce a severely irritating effect on any mucous membrane

(e.g. eyes, mouth, respiratory tract) (Nelson et al. 2003). This spray which was tested in Zimbabwe has seen some success in driving away problem animals. But it has to be used during the peak seasons, and as it has to be purchased it requires financial resources. Chilli grease which is used to smear on fences and barriers are also being tested and therefore the success rates are not known (Nelson et al. 2003). Noxious smokes which are produced by burning chilli powder or a seed with elephant dung is also being tested in Zimbabwe.

Research is being conducted on the use of auditory repellents, like elephant distress calls which are both audible to humans as well as infrasound are being attempted to be categorised. However in some cases where they have been tested, there has not been much success especially where smaller herd sizes were concerned. Use of trip wire alarms are effective only in warning the farmers but are not very successful in keeping away the elephants as they become habituated like with other deterrent measures (Nelson et al. 2003).

2.11.6 Physical barriers

Trenches and moats, stone walls, standard (un-electrified) fences, electrified fences are definitely important in managing conflict, but they do not work in isolation. They have to be a part of an integrated conflict management strategy to be successful (Nelson et al. 2003).

According to a document by Osborn and S.Anstey April (2002) for the Niassa Reserve in Mozambique, use of barriers have been known to be successful only in cases of small areas and cash crops but they come with their disadvantages as the costs involved for installation and maintenance at a larger scale will be impractical for developing countries with limited resources (Osborn and S.Anstey April 2002).

The use of strong non electrified fences built with wooden or steel poles or railroad tracks driven vertically into the ground with heavy gauge wires strung and drawn tightly in between are known to be successful in some parts of Asia and Africa to keep away elephants to a certain extent but they need a lot of

resources. But electrified fences are known to have more success rates. However the elephants can overcome these barriers and others at one point in time so it is more advisable to invest in low cost and low technology fences.

The main problem faced by electric fences in most areas is the maintenance which is usually associated with power supply, vegetation growth, and potential thefts of fence components. Trenches have been effective to some extent as elephants are not able to cross them but the intelligent animals as they are find solutions by filling up them up with soil especially if they are constructed on areas which have slopes. Ecological parameters need to be considered before constructing trenches so that soil erosion does not become another added problem to the farmers.

Stone-walls are expensive to construct and the availability of stones need to be considered as well. Past experiences from Africa have shown that the elephants are able to break the stone-walls. They are also expensive to construct where materials are not easily available but otherwise the maintenance cost is lower. Although effective, physical barriers on the whole involve more costs and technical expertise especially when it concerns electrified fences.

2.11.7 Compensation schemes

Compensation is a form of reimbursement given to people who have experienced wildlife damage to crops, livestock or property, experienced injury, death or are physically threatened by wildlife. They are either compensated in the form of cash or kind (Nyhus et al. 2005).

Such schemes have not worked out successfully and are usually seen as failures, they do not decrease the level of the problem since the root cause is not really tackled. Wildlife damage is not likely to disappear with time and therefore a compensation programme should have sufficient and sustainable funds. This is usually the problem in most developing countries as well as else where funds are the major drawback. Experiences from Kenya show that compensation was paid as a national policy until 1989, but was stopped because of widespread

cheating on claims, high administration costs and lack of disbursable funds made it unsustainable (Thouless 1994).Some of the factors why compensation is seen as a failure are because of the bureaucracy involved, unequal disbursement, the failure to decrease the actual problem and of course the most important is the availability of sustainable funds. However in most countries, compensation is awarded in case of loss of human lives. Compensation schemes if provided could help increase the tolerance level of the people to wildlife. They could also promote the support for conservation among the people who live close by especially to the endangered and dangerous species. The only other advantage of compensation schemes according to Nelson et al. (2003) is that they help to identify serious human–elephants conflict areas. However there is only little empirical evidence available, that document the success and failures of compensation programmes around the world (Nyhus et al. 2005) .

Compensating victims of wildlife damage may sound logical and appealing according to Nyhus et al. (2005) but there is a question of its efficiency. The funds could be used for alternative methods such as physical barriers, rather than invest in compensation programmes. If not carried out with adequate attention to certain key factors compensation schemes may be a waste of resources intending more harm than good (Nyhus et al. 2005).

2.11.8 Land use planning

Alastair has pointed out that land use planning could be the fundamental human elephant management strategy which could provide a success in overcoming the conflict. Some of the suggested land use changes for human-elephant conflict mitigation as indicated by Nelson et al. in their paper are categorised as follows, but their feasibility and efficacy appear mostly questionable.

a. *Reducing the conflict interface*

- Reduce human settlement encroachment into elephant range
- Relocate agricultural activity out of elephant range
- Consolidate human settlement patterns near elephant range

b. Facilitating defence against problem elephant

- Reduce the size of crop fields
- Change in the location of crop fields(e.g. to close proximity with dwellings)
- Change in cropping regime(e.g. to crops not affected by elephants, diversity into more crops possibly reducing overall exposure, use of intercropping layout, change timing of harvest)

c. Increasing efficiency in agricultural and economic production

- First two points of the previous
- Reducing the dependency of the local economy on agriculture

d. Modifying problem elephant movement

- Create or secure elephant movement routes/corridors.

Land use planning is a long-term process, but with the failure and low success rates of most of the other methods it could be applied with the help of government support as many policy changes and resources would be involved.

3. Study Objectives and Primary Questions

The study was primarily conducted to assess the extent of damage caused by the elephants yearly in the areas where conflicts are highly reported. It also covers the assessment of people's attitude towards the elephant conservation. The main aim is to study the extent of the damage and also get possible management solutions in order to reduce the conflicts and cause minimal damage to both parties.

This study was designed to meet the following objectives:

- Assess the extent of damage caused by elephants
- Study and evaluate the local mitigation measures used by the people
- Study the attitudes and perceptions of the people towards elephants
- Collect information on the incidences, past distribution and status of elephants
- Literature review on mitigation measures and management options in other areas with similar situations

4. Study Site and Method

A few Gewogs under Samtse and Sarpang which are indentified as the core conflict areas by the Divisional Forest Officers were selected for the study. One Gewog, Sibsoo under Samtse and 6, Umling, Chuzegang, Gelephug, Bhur, Dekiling and Singye under Sarpang were covered in the study (shown in Figure 3). As can be seen in the figure, the sites are located at the borders; therefore they are more susceptible to damages caused by migratory elephants to crops and property for many years. The sites are located at an altitude of up to 400 to 500m asl.

107 households in total, 57 from Samtse and 50 from Sarpang were randomly selected and one person from each household was interviewed using a structured questionnaire (See annex).The questionnaire was designed to meet the study objectives and was pretested with some officials working for the Forest

Department. Field staff assisting the survey was trained to use the questionnaire before the actual survey. Since it was a detailed survey each interview took more than an hour approximately therefore restricting the number of responses for the study.

The following information was obtained from the study

- Location and situation,
- Crops grown,
- Nature, extent and frequency of the damage,
- History of damage
- Different methods used by the farmers to deter the elephants and their results.
- The perceptions of elephant conservation and views and suggestions of minimizing the conflicts in the involved stakeholder and user groups.
- Data or information on the past distribution and status of elephants
- Literature reviews on the mitigation techniques used in other places with similar conflict problem

After the data collection, data was entered in SPSS. Due to less data and insignificant results for statistical analysis, cross tabulation tool was used for grouping the data and further analysis was done using Microsoft Excel.

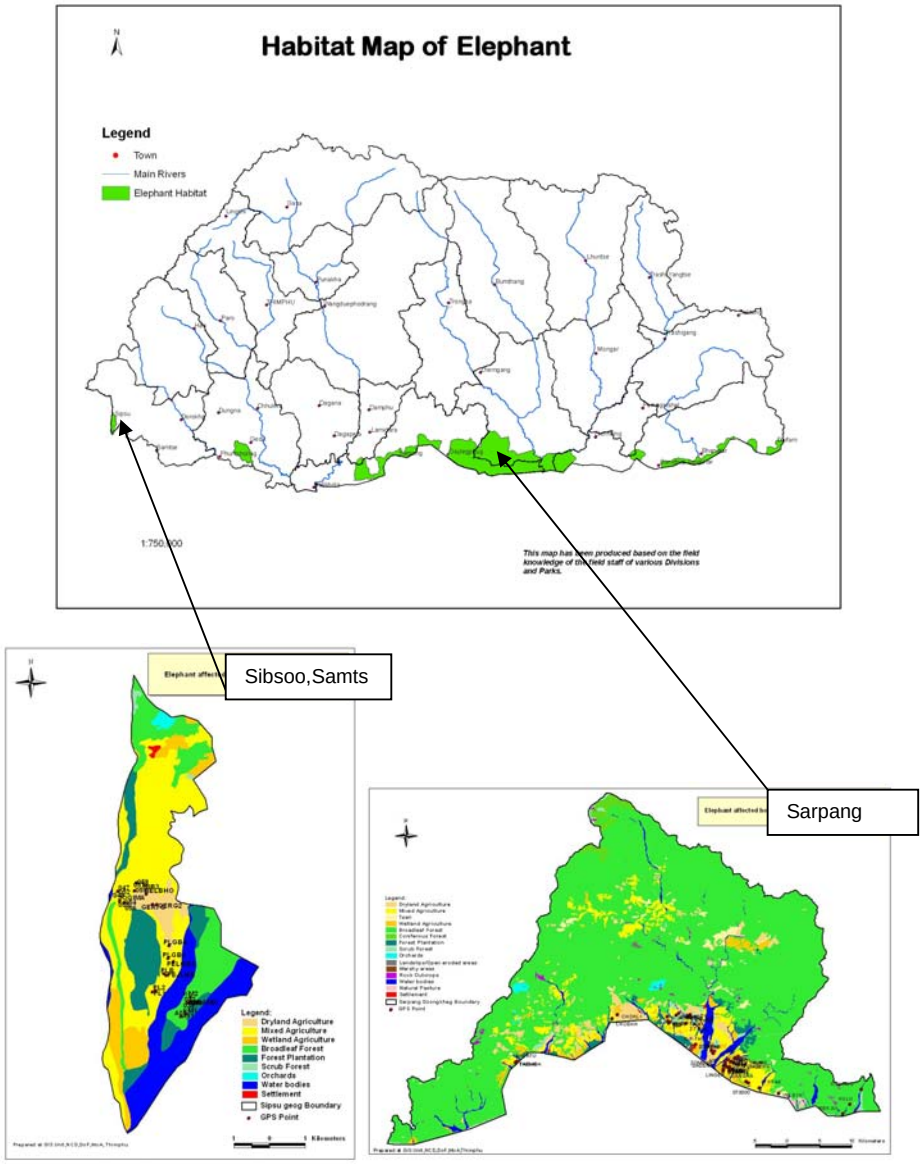

Figure 3 Maps of the two study sites, Samtse (Sibsoo Gewog) and Sarpang District. (Source, Nature Conservation Division, Department of Forests, MoA, Thimphu Bhutan)

5. Expected Outcome

The study is expected to give a detailed extent of the damage caused by the conflicts on crops as well as property. The study period having been only short, comparisons in the trends of long term damage was not possible. The findings of the different deterrents used can be evaluated and new mitigation measures can be recommended if feasible. This will be obtained through literature studies and success stories in other areas with similar problem.

People's perceptions towards the conservation of elephants can be ascertained which would give an idea on the threats faced by the remaining elephant populations and appropriate measures can be taken up towards its conservation and possible solutions to reduce the conflict situations can the recommended.

Information on past distribution and status of elephants will also allow in drawing conclusions on how the situation for elephants changed over the past years and which factors contributed in a major way to the current situation.

A map of the affected areas and if possible that of their migratory routes, entry and exit points can be produced which can be used for future management. This could not be addressed fully during the study and could be a way forward for future detailed research.

Overall the results of the study will be expected to provide some information to planners and conservationists to plan innovative approaches to reducing the human elephant conflict in Bhutan as there is a dearth of information at present.

6. Results

6.1 Characteristics of the Human –Elephant Conflict Zones

6.1.1 House hold composition by size

107 households were interviewed out of which 76 were male and 31 were female. The survey actually targeted to interview the head of the household as they were thought to be more informative and reliable source for data on crop damage incidences. However it was not possible to get hold of them in most cases, therefore in their absence the other members of the households were interviewed. But it is to be noted that they were also equally informative and confident in their responses. The age ranges of the respondents varied from 18 to 82 with a mean of 48 and standard deviation of 14.408. The average household size was 8 (Standard Dev of 4.9) with an average land holding of each farmer over the two study sites being 4.33 acres. The major crops grown in both the areas where the climatic conditions are similar are maize, paddy, millet, ginger, banana and areca nut.

6.1.2 Major income source

Farming was the main source of income with 36 %, followed by livestock rearing with 31% in all the households (n=107). The other sources were; going as wage labours to neighbours fields, small business, pension etc(Figure 4).By agriculture and livestock rearing we should also keep in mind that it is not practiced commercially in a large scale but only for their own consumption. Therefore any damages incurred after an elephant raid or damages by any other wildlife had a direct impact on the lives of the families.

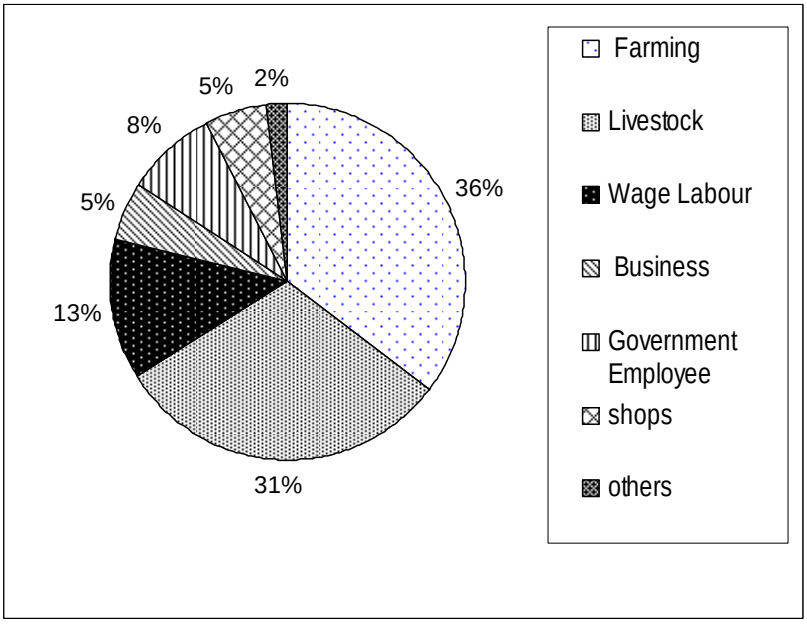

Figure 4 Percentages showing major income sources in Samtse and Sarpang (n= 107)

6.1.3 Education background

68% of the respondents were seen to have no education background and all of them were illiterate. Only 19 % had some level of education having attended secondary school (n=107). (Figure 5)The rest had some level of education in terms of having attended a Non Formal Education system, being an ex army and some having been monks as well. The education background of the respondents also could show to some extent their attitude towards the problem situation and the animal.

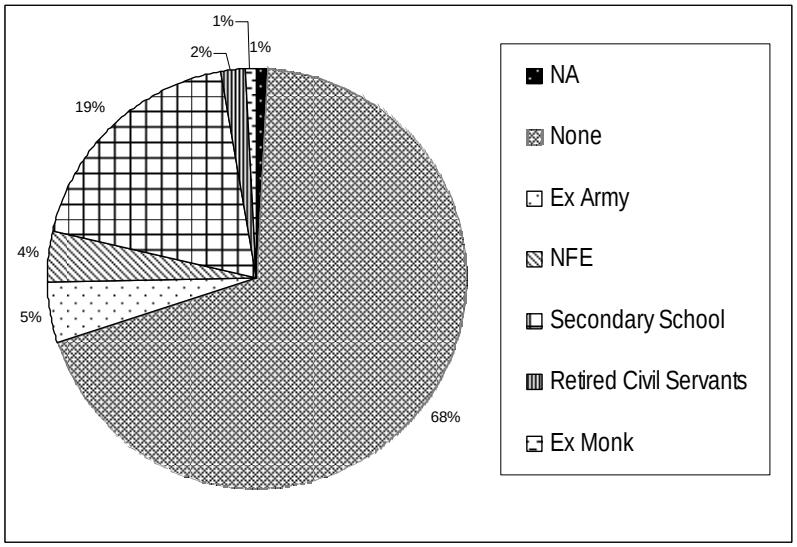

Figure 5 Percentages showing education background of the respondents (n=107)

6.1.4 Land use pattern and crops grown.

With maize and paddy being the major crop grown in two cropping seasons (Table 1), the land holding of each household was evident with 48% being *Kamzhing*, rain fed dry land and 41% *Chuzhing* or irrigated rice land. Only a few households owned *Tsheri* or shifting cultivation but in different areas at a much higher elevation (Figure 6). Orchards in terms of a few trees grown near the house were owned by a few of the households as well. Paddy was the highest cultivated crop that year with 187.18 acres followed by maize with 154.97 acres.

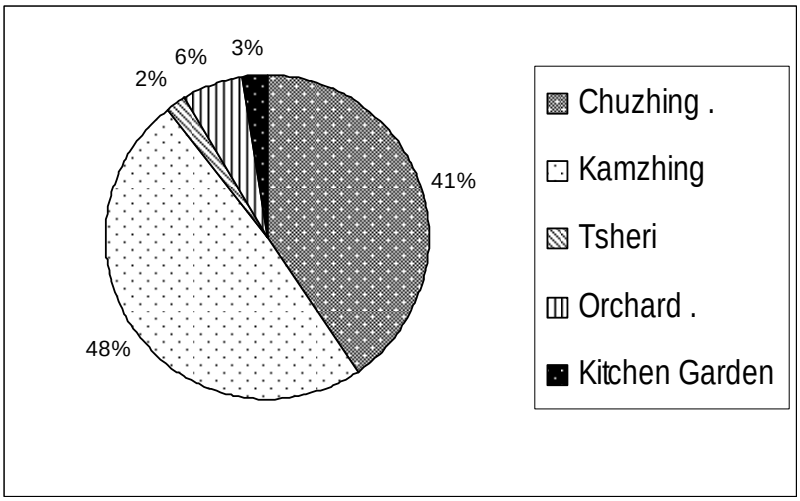

Figure 6 Percentages showing land use ownership in the two districts (n=107)

Table 1 Growing seasons of major crops

Major Crops Grown	Growing Season
Maize	Jan - Dec
Paddy	June - October
Millet	August – December
Ginger	April - December

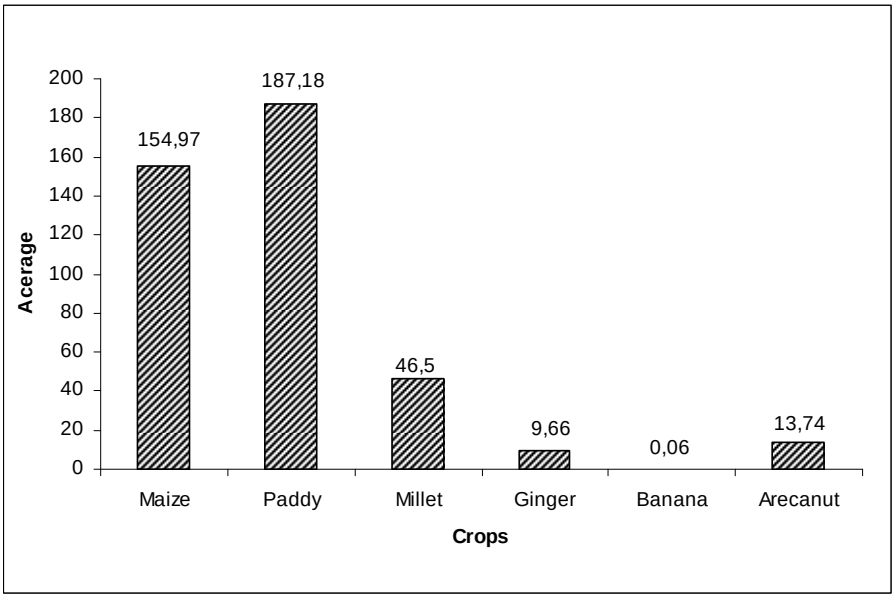

Figure 7 Area of each crop cultivated during the year 2006(the total area under cultivation that year was 412.11 acres.)

6.2 Elephant Damage Incident

6.2.1 Area of crop damaged

35% of the maize and 21% of paddy planted in the year 2005 was damaged by elephants, with 54 acres and 38 acres being destroyed (Table 2). This is also due to the fact that the main crop grown is maize and paddy as can be seen with the land use pattern and they are also the preferred crops for the elephants.

Ginger and areca nut were not the target crops but were either trampled or destroyed in the process. Likewise the farmers planted only a few banana trees around the house which were damaged in some cases.

Table 2 Extent of crop damaged in the year 2006(Total Cultivated area = 412.11 acres)

Crops	Total Area cultivated	Area damaged	%
Maize	154.97	54.42	35
Paddy	187.18	38.38	21
Millet	46.5	10.23	22
Ginger	9.66	1.25	13

6.2.2 Crop damage incident

The respondents were asked to rate the incidents of the crop damages over the past 2 to 3 years (Figure 8). More respondents from Sarpang say that the incident has increased as compared to respondents from Samtse. This could however be related to the fact that in Samtse had set up a fence powered by solar energy around the surveyed area in 2006. Many of the respondents have said that the fence was effective to a certain extent especially in the earlier stages in keeping away the problem animal. A few areas in Sarpang too were fenced with a similar technique but with poor maintenance, weather conditions and the also like most mitigation measures which become redundant over time to the elephants this too did not function in keeping away the problem elephants. 65% of the respondents said that they had faced major changes in the household in terms of food shortage and in some cases even had to sell a part of their property to meet their needs. The cases of property damaged were reported by 29% and only 6% reported incidences of human mortality.

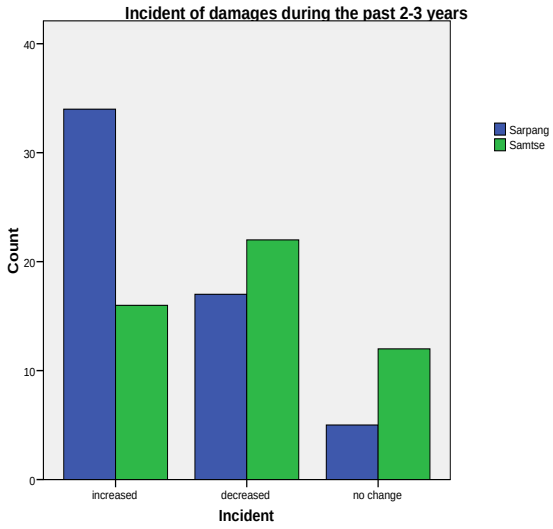

Figure 8 Spearman's chi square test showing significant relation between responses in the two districts on the damage incident

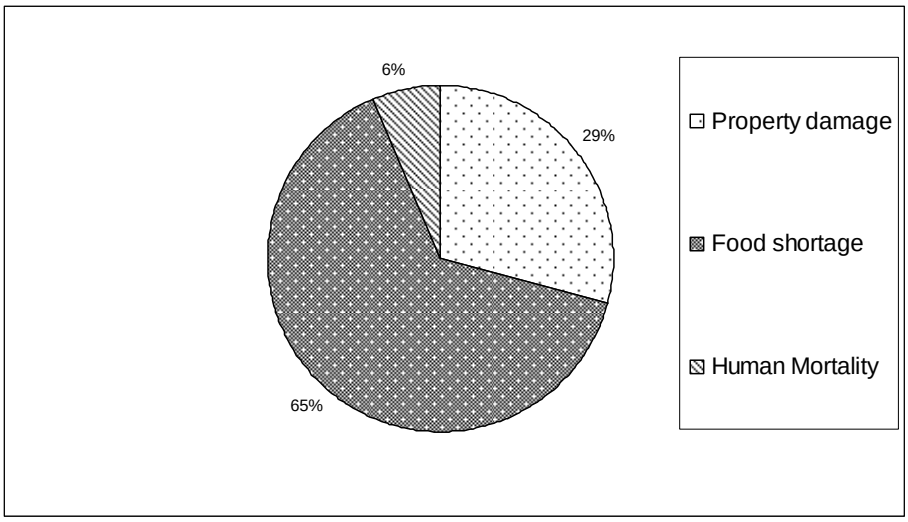

Figure 9 Percentages showing major changes in the HH after an elephant raid (n= 107)

One of the questions included the possible reasons for the increased incidences of damages over the recent years (Table 3). The respondents pointed out that the increased population, cropping pattern change in land use was some of the possible reasons.

Table 3 Percentages showing reasons of increase in crop damage incidents over the last 2-3 years

	Yes (%)	No (%)
Increased Agricultural Land	42	34
Decrease in Forest Area	46	26
Strict Forest Rules	56	11
Less Forest Fire	61	4
Cropping Pattern	58	7
Decrease in Tsheri	61	4
Increase in Population	56	9
Others	54	14

Most respondents who had been living in the area for more than 10 years said that the human elephant conflicts were seen since that time and was not a new problem which had arisen over the recent times (Figure 10)

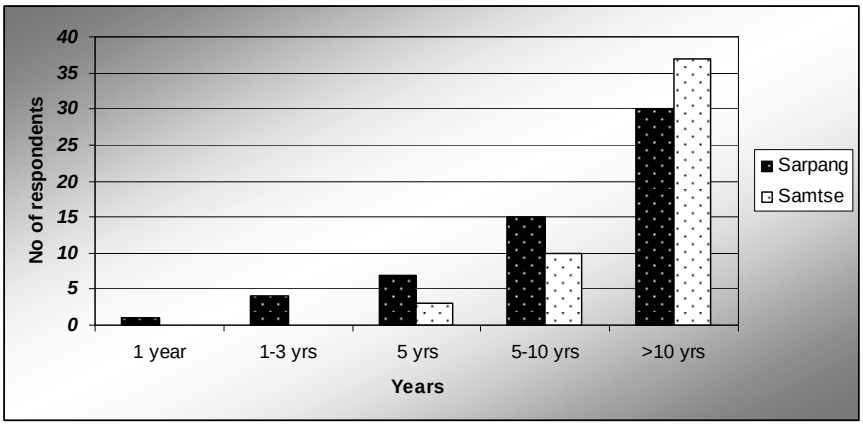

Figure 10 Trend of elephant damage during the past 10 years in the two districts (n=107)

6.2.3 Season of elephant arrival

A clear pattern of arrival can be seen in both the study sites where the frequency is increasing during the harvest season of maize and paddy in the months of June, July and also coinciding with the monsoon season (Figure 11). It also indicates that the availability of ready food source lures the animal to the agricultural fields. Sarpang sees fewer animals during the early time of the year with no incidences being reported although there are a few incidences in Samtse.

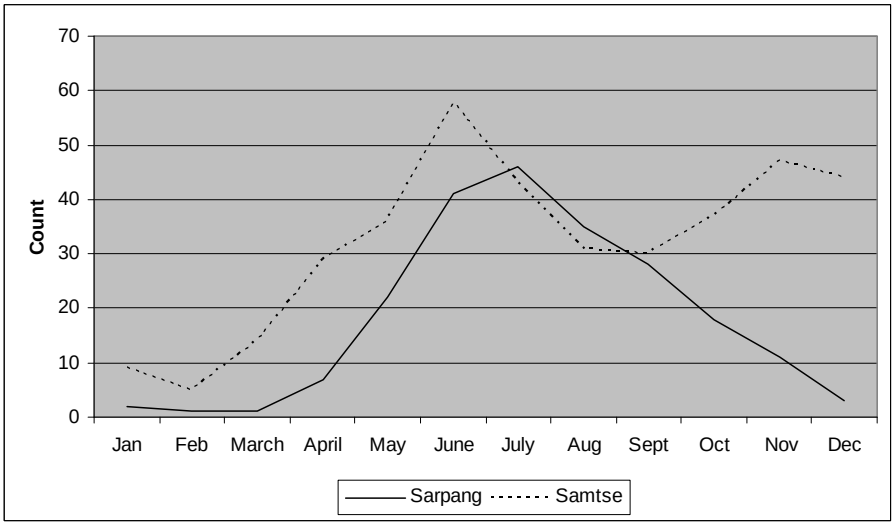

Figure 11 Comparison of the crop raiding frequency, in the year 2006 between the two districts Samtse and Sarpang.

50% of the respondents have clearly pointed out that the elephants are known to cause damage more during the night (Figure 12). Fewer incidences have taken place in the evenings and early mornings but no reports of raiding have occurred in the day light. Therefore there are no restrictions of movement in the afternoons but people are more cautious of moving around at night and other times where the elephants are supposedly active.

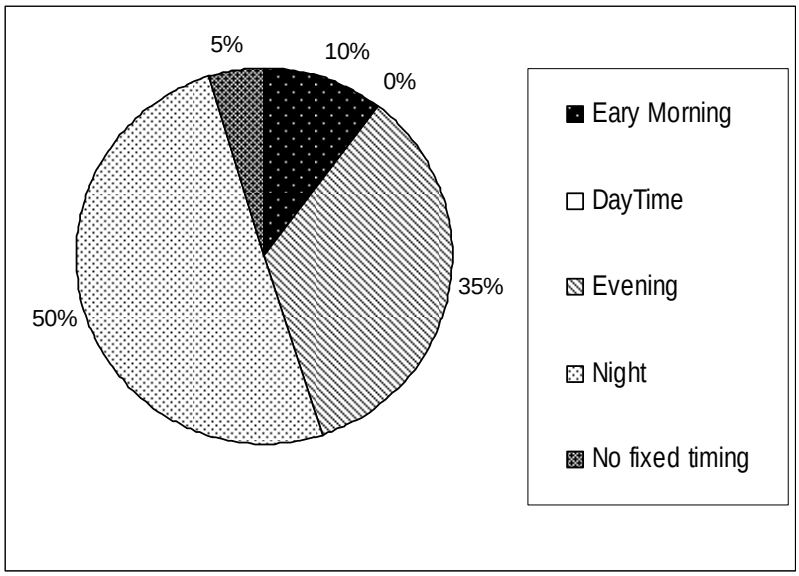

Figure 12 Percentages showing the elephant arrival time (n= 107)

6.2.4 Local mitigation measures used

The most common mitigation measures used by the farmers to keep away elephants are the burning of wooden kerosene torches, shouting, rattling tins and drums, guarding crops at night on guard houses, torches, fences etc. The most effective as said by the respondents are use of kerosene torches, banging tins and drums and use of fire crackers. Firecrackers are not allowed to be used in some of the Gewogs of Sarpang District due to border security reasons but the respondents say that they have heard that it is effective. The other Gewogs in Samtse where firecrackers have been used as auditory repellents have said that they are effective but expensive to purchase. However these methods are only effective if used in combination and more the number of people the more effective they are. The use of an individual method is not known to be effective. (Table 4&Table 5).

77% of the respondents said that even though crops are guarded the elephants raid the crops while the rest said that crop guarding keeps away the animals to a certain extent. The respondents also mentioned that it was mostly left to an individual household to guard and chase away the elephants and this proved more dangerous and less effective. Only in a few households they practiced group guarding where the mitigation measures proved more effective. 58% of the respondents also said that crop raiding still occurred in spite of crops being guarded.

Table 4 Responses to the common mitigation measures used to prevent crop raiding by elephants. (n= 107)

Common Mitigation Measures	Responses	(%)
Shouting	91	20
Kerosene Torches	45	10
Banging Tins and drums	73	16
Pakshing	18	4
Fences	27	6
Rattling Tins	27	6
Born Fires	65	14
Torches & Spot lights	48	10
Scarecrows	15	3
No Guarding	4	1
Throwing Stones	34	7
Bow and Arrows	2	0
Night Guarding on Guard houses	11	2
Firecrackers	6	1

Table 5 Most effective and frequently used mitigation measures according to respondents (n=107)

Effective Mitigation measures	Responses (%)
Shouting	23
Kerosene Torches	21
Fences	6
Rattling Tins	17
Born Fires	28
Torches & Spot lights	8
Firecrackers	50

Suggestions on how guarding techniques can be enhanced further for more efficiency were listed in the questionnaire and the respondents were asked how they felt about them (Table 6). Most respondents thought that it would not be possible for any improvement as elephants were difficult to chase away once they had entered the fields.

Table 6 Responses on measures to improve and strengthen the existing guarding techniques (n=107)

Improved Guarding Methods	Yes (%)	No (%)
Community Guarding	63	36
Electric Fences	66	34
Periodically Chasing Elephants	88	11
Improved Guarding Techniques	76	23
Not Possible	98	2

6.2.5 Reasons for crop damage in 2005- 2006

Elephant damage is seen to be the main reason for decline in harvest during the last harvest season of 2005 and 2006 for all the crops grown. The other reasons to name a few are irrigation problems (9%), no cultivation during that year (9%) shortage of labour(3%) and additional wildlife damages (7%) Figure 13). The respondents said that damages by other wild animals are also experienced regularly; the damage is not as significant as done by the elephants that large foragers hence cause more extensive damage.

Table 7 Difference in quantity of harvest between the year 2005 and 2006, total harvest of all the respondents (n=107)

Crop	Qty harvested in 2006(kgs)	Qty harvested in 2005(kgs)	Difference (kgs)
Paddy	75,058	62,915	12,143
Maize	35,073	28,703	6,370
Millet	11,542	9,337	2,205
Ginger	12,995	6.515	6,480
Areca Nut	7,140	4,520	2,620

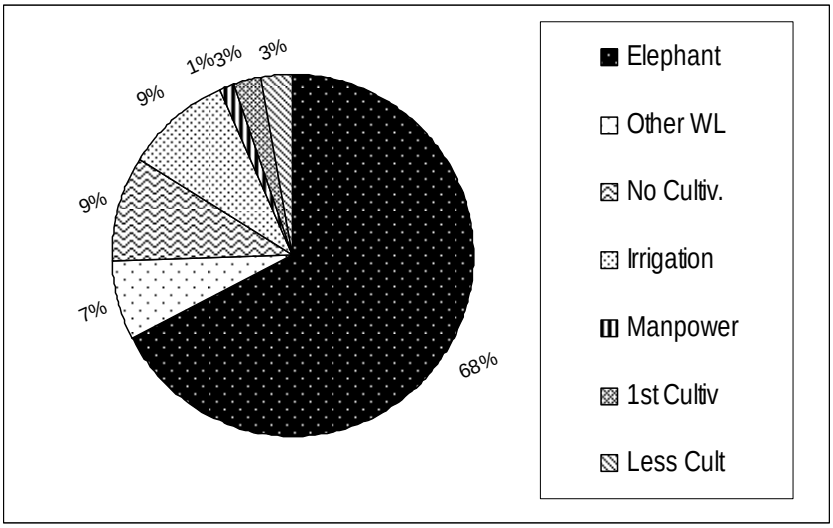

Figure 13 Percentages showing crop damage reasons for the year 2005-2006 (n=107)

6.2.6 Damage by other wildlife

Although other common wildlife pests like wild pigs and monkeys were also frequently known to cause damage, elephant damage was perceived to be much higher due to greater extent of damage, therefore they were frequently reported to the authorities and the other damages were comparatively negligible. Wild pigs were the next in line terms in of damage caused (Figure 14).

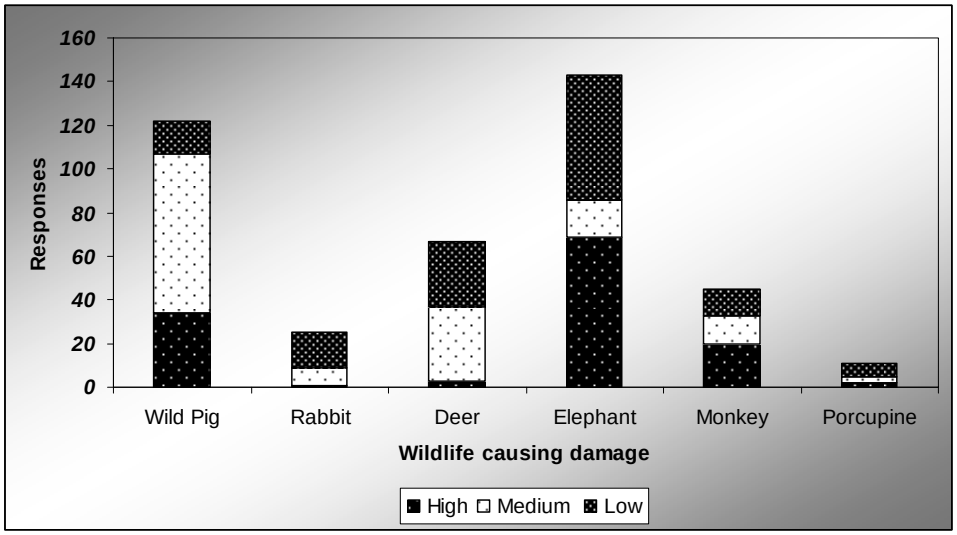

Figure 14 Comparison of crop damages by other common wildlife pests and elephant

6.3 Attitude and Perceptions of the People

6.3.1 Attitude towards the elephant

Being a culturally important species and having a religious status among the people, the elephant is highly respected among the people of Bhutan. Respondents were asked to choose between Like, Fear, Hate, and Respect towards the animal in order to see the attitude towards the animal. 42% of the male and 39% of the female respondents saying that they respect the animal as a religious figure and pray to the animal although at the same time they also fear the animal (Figure 15). It can be seen that the female have a stronger negative attitude towards elephants. Most of the respondents have referred to the animal as a religious figure but at the same time they also seemed a bit frustrated with the problems of crop damage being incurred each year. The people although

aggravated by the damage still do not have an aversion to elephants and only 3 male respondents out of the 107 said that they would kill the animal if possible. 82% of the respondents (n=107) were aware of the Forest and Nature Conservation Act of 1995 and 94% knew that elephant was protected and any illegal activity was strictly offensive.

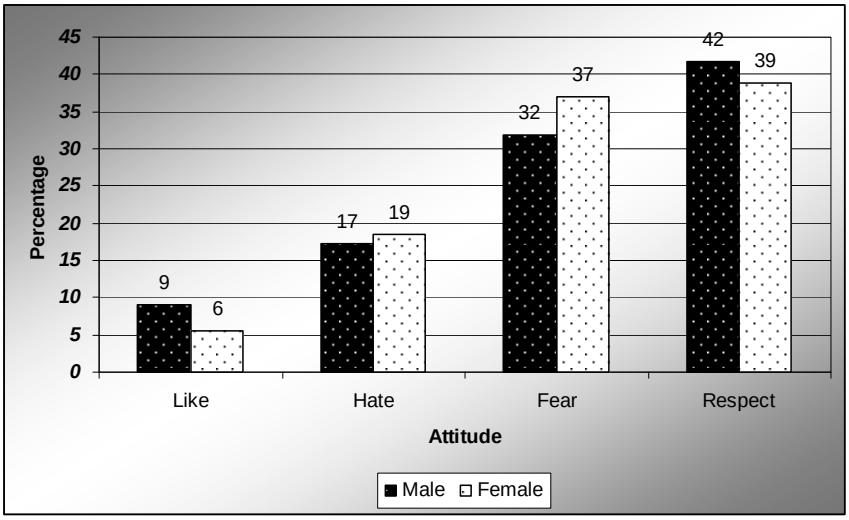

Figure 15 Percentages showing attitude towards the elephant according to gender n=107, male= 76, female = 31)

6.3.2 Views on compensation

To learn how the farmers who experience loss directly felt about compensation, the study included a few questions. 76 respondents (n=107) said that compensation was necessary for those who had experienced crop and property damages. However 35% (n=76) of the respondents felt that compensation should be awarded only in cases of severe damage (Table 8).

Table 8 Responses saying what for conditions compensations should be awarded (n=76)

	Response (%)
Up to the Govt	17
Severe damage	47
According to damage	9
All damages	5
5-25%	8
No Response	14

Respondents were of the view that compensation can be awarded in any forms as long as their loss was compensated after a sever damage case (Table 9). But 68% felt that compensation would not be the best idea as the funds would not be sustainable (Table 10).

Table 9 Responses on preference of kind of compensation to be awarded (n= 76)

Compensation in Terms of	Response (%)
No Response	35
Money	20
Grains, crop	8
Any	34
Improved Electric Fence	3

Table 10 Responses on what difficulties would be faced by the Government if compensation was to be awarded (n=76)

Reason	Response (%)
No Response	5
Not Sustainable	68
Asessment of damage	8
Dependant on Compensation	3
No Difficulties	16

6.3.3 Electric fences

18 households in Sarpang and the 49 in Samtse were benefitted by the Electric fences (n=107). These fences were set up by the Government, with funding from the WWF Bhutan Programme. The fences were then handed over to the people for maintenance which was usually done on a rotational basis in order to involve everyone's participations. However the fence in Sarpang was not functional any more. 61 %(n=67) of these respondents said that the solar fences were effective but only up to a certain extent.

7. Discussions

7.1 Characteristics of the Conflict Zones

The 107 households that were interviewed were randomly selected along the route in the study site. It is to be noted that in Bhutan there is no gender discrimination against women. But the number of female respondents being much less is because most of the women who we came across during the study were not very confident they were a little inhibited and did not think they would be able to answer the questions. However the women that have been interviewed were in the contrast, equally informative as their male counterparts.

The average land holding of each household was seen to be 4.44 acres but it is to be noted that 63 of the respondents have been living in their present location for < 10 years and they are the new settlers. Originally from other regions, these families have been conferred an area of 5 acres by the Government and have settled permanently on land that was occupied by previous residents. As pointed out by Naughton et.al (1999) land use change where abandoned land which has already been temporarily inhabited by elephants are being reoccupied after a long period by people, being one of the main reasons for conflict. This result in elephants and the farmers competing for the land which eventually means frequent conflict cases of crop raiding. This statement was also agreed upon by some of the farmers themselves. They had to say that being initial habitats of the land, the elephants had the right to come to the land.

Only 19 of the respondents have been living here for > 50 years and the land has been their ancestral property. 5 of the respondents are landless and are cultivating on lands that have been leased and practicing share cropping with the land owners who are living in other districts. Only 2 people out of the 107 had a complete education degree and were retired government employees. 68% of the respondents had no education and the rest had a certain amount as they had been in the armed forces, served as monks, a few had attended school till the secondary level and a few of the women had attended the non formal education system. The education background did not significantly have any relation to the

attitude of the people towards the elephant conservation; in fact one of the 2 educated people pointed out that the problem elephant should be killed to reduce the conflicts.

Maize, paddy, millet, ginger and areca are the main crops grown at a larger scale compared to the few others like banana and tapioca. The cultivation pattern clearly explains the high consumption rate of rice among the Bhutanese people. Areca has been recently planted in most of the houses which will add additional income source for a few farmers. Maize is grown the whole year round in two growing seasons. Only ginger is cultivated for commercial purpose.

Farming and owning a few heads of livestock was the main source of income for most, a few owned small shops or had a small business and some of them had family members in the civil service who provided them with financial assistance. A few of the respondents who did not have any additional source as mentioned earlier went to work as wage labourers in the neighbouring areas. The major land holding is *Chuzhing* or irrigated rice land, followed by *Kamzhing*, rain fed dry land. Only 2 households own *Tsheri* or shifting cultivation which is situated at a different place at a much higher altitudes. Only a small amount of land is used as orchards which have a few areca trees.

Most of the land owned by the farmers is located near their houses but these houses are situated in the vicinity of the forest with the closest distance being only a few hundred metres (Table 11). Therefore as it can be seen from cases in other conflict areas, location of the farmlands in close proximity to the forests is one of the main reasons of conflicts and why this is an unavoidable situation. Even though the fields are located near the houses, they are not spared from being raided. On the other hand fields which were located in the middle of the other fields escaped from damage. The fields on the edges were most affected.

Table 11 Distance distributions of agricultural fields.

	No of response	%
Near the house	45	37
Middle of agricultural area	34	28
Near the forest	42	35

7.2 Elephant Damage Incidents

The crop preferences for the elephants were maize, paddy and millet. The areca trees and ginger were just damaged and trampled over as it just happened to be on the way. Only a few of the respondents experienced property damage, these were mainly storage areas inside the houses which indicated that the elephants came specifically in search of food. The trend of elephant arrival as seen in Figure 11 clearly shows that in both Samtse and Sarpang the crop raiding is highest during the months of May to July which coincides with the harvesting of Maize and Paddy. Samtse experiences more cases as they are reported to be seen throughout the year with increasing incidences during the harvest season. Apart from these peak months, a few herds and individuals have been reported and although the crop cannot be consumed damages occur in terms of trampled seedlings and young plants. As pointed out by Sukumar(1989) the elephants use crop raiding as an optimum survival strategy once it gets used to it, which seems to relate to these incidents. A few of the farmers also was of the opinion that the elephants were used to the taste of the crops; and it was an easy source of food hence they became regular visitors. The elephant becoming a regular visitor could also relate to the fact that their habitat is degrading and food in the near by forests is not sufficient therefore leading the animal to a better and easy food source. The people also have a hand in contributing to the degradation of the habitat as Bhutan is a country where especially the rural people have the right to use the forest resources up to a certain extent. On the other hand, these elephants are not residents in Bhutan and are migratory sharing habitats between India and Bhutan. It is known that villages exist on the other side of the border and resources are also being depleted which adds to the problem. Moreover, people living in India who are also facing the human elephant conflicts, are more severe in terms of retaliation. They have been known to use locally handmade guns to get rid of the problem animals. This practice is strictly prohibited in Bhutan as owing of any armed weapons without a licence is against the law.

The greatest consequence after a severe damage incident was food shortage. With most of the respondents practicing sustenance farming and no source of additional income, these times were most difficult situations for them.

One respondent had to resort to selling a part of his property to meet the food shortage problem. Human mortality has not been reported whilst guarding crops or in times of attack but only 2 cases was reported a few years ago. Both incidences occurred due to accidental encounters with the elephants inside the forest areas, none have taken place in the villages. Elephants are reported to raid more frequently at nights and early morning hours thus making it more difficult for the farmers to guard their crops. No elephants have been sighted or no incidences elephant related damages have been reported to have occurred during the day time. The respondents said that as soon as it gets dark they confined to their houses and movement is restricted as there is a high risk of encounters with the elephants. This continues until the early morning hours (Figure 12).

More respondents from Sarpang have said that the incidences of damages in the last 2 to 3 years have increased whereas in Samtse they have pointed out that the incidences have decreased. This case from Samtse could relate to the fact that the electrified fences had been set up in the Sibsoo in the year 2006 which has considerably helped in keeping away the elephants during the initial stages. Some of the Gewogs in Sarpang also had electrified fences set up much earlier but the farmers did not find them as effective. One common observation made during the survey was that most respondents who were not benefitted by the electric fences had the notion that the fences were very effective and that they should also be supplied with it to protect their crops. But those respondents, who already had these fences, did not think the same. In fact a few of them even pointed out that they were a waste of resources as the elephants became habituated and the fences became obsolete. Moreover maintenance of the fence was another issue by itself.

Apart from elephants other wildlife pests are also known to cause damage to crops as shown in Figure 13. Wild pigs, monkeys and deer which are common pests in other parts of the country also cause considerable damage to crops such as maize and paddy. They are also seen almost throughout the year although not regularly. Although these pests also cause substantial damage if calculated generally, the volume of one time damage is seen to be much larger

in the case of elephant damage. Therefore the extent of damage is seen to be much greater for elephant damage although it may be the same with wild pigs and other pests. However with elephants being a bigger issue here mitigation against these other wildlife is minimal. Farmers guard crops at night before harvest seasons to prevent wild pig damage and traditional mitigation measures are also used for chasing away monkeys and other smaller pests.

As mentioned earlier, elephant damage is perceived to be higher than the damage by other pests; this can be clearly seen in Figure 14, which states the main reasons for differences in harvest between the years 2005 and 2006. Farmers were asked how much harvest they had for each crop during the two years and the reason for the change in harvest which was used to get the following data. In a study by Naughton-Treves and Treves (2005) they say that tolerance is apparently shaped more by amount of crops lost than frequency of raids. This supports the results showing that the people perceive elephants to be larger damager than other wildlife.

7.3 Mitigation Measures

Most of the mitigation measures practiced by the farmers until date (Table 4&Table 5) are traditional methods apart from the electric fences which have been set up in a few areas. Most farmers have resorted to using almost all the methods that have been listed down in search of the most effective. However they face a problem in terms of resources needed for purchasing equipments for mitigation measures. The time and energy spent in terms of guarding crops during the harvest seasons also is a high price to pay that cannot be measured. Households where female members are larger in number face difficulties in terms of night guarding duties. It becomes a difficulty for them to guard the crops and therefore most of the times their crops are left unguarded. The respondents however felt that crop loss was still more of a problem than guarding crops; they said that in terms of crop loss the whole household was effected (Table 12).

Table 12.People's response on what they felt was a bigger problem between Crop Loss (in terms of actual loss) and Guarding (in terms of effort and resources)

	Response	%
Crop Loss	83	78
Guarding	19	18
No response	5	5

Most of the mitigation measures used are known to be effective only if used in combination for example shouting along with burning of wooden torches, producing noise with tins and drums have been known to work in chasing away elephant herds. As pointed out by (Nelson et al. 2003), elephants are intelligent animals that get habituated to a mitigation measure in due course of time. Therefore mitigation measures that were once effective no longer have the same effect after passage of time. This can be said for blank firing used by the forestry officials. Initially it was very effective and could scare away elephants in herds, but has now become redundant. In fact as some field staff has reported that now the sound of blank fires agitates elephants and they aggressively turn to the source of the sound, thus endangering the lives of the people. Spotlights and torches which were used earlier were no longer effective too. The forest staff working under Sarpang District had a few powerful spot lights which seemed to be functioning well at chasing away the problem elephants. With the measures becoming redundant after some time it therefore becomes necessary to keep looking for new measures. The farmers pointed out that presently, the use of wooden, kerosene torches, which was the latest measure seemed to be the most effective. But for how long?

77% of the respondents said that elephants raided crops regardless of guarding and said it was a waste of time, energy and resources since it did little to deter the problem elephants. Most farmers in both the study sites said that guarding the crops were left to the individual households. This was difficult as since less people or sometimes even a single person would make no difference. Rather they would be more at a risk of being attacked. Even in rural Africa, communities are not known to work together in times of crop raid. Forestry field staffs that live nearby have been notified for most incidences to help chase away the problem elephants. They have also mentioned that most farmers do not come out to help

their neighbours when needed; the reason could be because of fear for their lives and property. However a few of the respondents did have a community guarding system established at their own incentive. They said it was effective in chasing away the elephants since more people in a group meant more noise hence more efficiency. As Osborn (1995) as pointed out, using deterrents may not be effective in solving the problem and it may reduce the amount of crops lost. Therefore if such systems are established it would definitely help in chasing away the elephants to a certain extent and reduce the crop damage considerably. It would also benefit those households which had less people or a female dominated one, which at present has difficulty in guarding crops. The respondents were asked to suggest some possible mitigation measures and they came up with a few those are listed and grouped in Table 13.

Table 13 Some mitigation measures suggested by the respondents

Suggested Mitigation Measures.	Responses
Improved EF	23
Community Guarding	6
Walls and Trenches	11
Kill	1
Blank firing	1
Rituals	1
Possible Solution from Government	2
Clearing Forests	6
Not Possible	2
No idea	22
No Response	32

7.4 Electric Fences

One of the physical barriers which are known to keep away problem animals is electrified fences. In both of the study sites, these fences have been constructed by the Government, with financial assistance from the WWF Bhutan Program. These fences have been constructed at sites which have been identified as entry points of the elephants from the forests. In Sarpang where 18 of the household interviewed were benefitted, the fence was set up in the year 2004. The fences in Sarpang no longer function as it has been damaged. In Samtse it was set up more recently in 2006, with the intention to benefit all the affected households of Sibsoo Gewog. In Sibsoo it was constructed as a pilot project and the efficiency

is being monitored. The fences function using solar energy, a converter which to convert 24 Volts to 180 Volts of power and the current used in the fence is 46 pulses per minute. As with other conflict areas construction of physical barriers is not an easy option due to limited resources.

The fences were seen to be effective in keeping away the animals in the initial stages when it was newly set up. Ultimately with the wires getting rusty and the unfavourable weather conditions their efficiency deteriorated. Frequency of crop raiding was much higher during the rainy season therefore; the solar power couldn't be charged sufficiently further adding to the inefficiency of the fences. As with all other measures, and having to deal with intelligent animals, this form of barrier also was easily overcome by the elephants. They have been reported to cross over after damaging the fences by throwing over trees or branches; in some cases the tuskers were also seen to lift the wires and create an entry point followed by the rest of the herd. Another reason why this barrier fails is because of the theft of the wires and other parts. Both these study sites are in close proximity to the neighbouring state of India and share an open border, at certain times theft of the wires have also been reported. Maintenance of the fence for long term use is another concern. Because of the climatic conditions, the wires tend to rust easily; regular clearing of the vegetation near the fence is also required. In Sibsoo, the Government has handed over the fence to the community for maintenance, so it has been organised that each household gets its turn for a month. However whether it is the lack of civic duty or genuine fear it is not clear, but the some of the people have said that they fear going near the fenced areas in case they encounter with the elephants. With personal experience the latter does not seem to be true as the fenced area has been visited during the daytime. Also due to lack of resources the fences are not entirely constructed with the best materials and equipments. The batteries and wires often break down and the need for constant repair arises.

The people especially in Sarpang where the fence is no longer functioning did no seem to think that the setting up more of these fences would be effective in reducing the conflict in the future. They think on the contrary that the fences made the elephants more agitated and increased the incidences of damages.

However, people who do not have the fences have all said that fences would be one of the options for reducing the conflict incidents. Some of the people had the idea that the fences would be more effective if the power was increased, they think that since the elephants are bigger animals the present current used does not seem to have any effect. What remains an open question?

7.5 Human Perceptions

The strong positive attitude towards the elephants as a religious figure is still encouraging for conservationists especially at a time when conflict is a major concern. More than half of the respondent's perceived that the conflict was increasing over the years and the 3 responses towards the inclination to kill the animal is something which was still disturbing where mainstream religion practiced is Buddhism. As seen in many studies conducted on attitudes, the notion of fear of a wild animal, which is inflicted in a persons mind, inclines them towards having a stronger negative attitude. The safety issue was the major concern bringing about changes in attitudes of a person (Røskaft et al. 2007). Therefore this could be the reason that the female respondents are more afraid of elephants and seem to have a more negative attitude than the males as seen in Figure 15(Kaczensky et al. 2004). Most of the respondents who said that they fear or hate the animals at the same time had respect for the animal as well, many apart from the 3 would not even think of harming let alone killing the animal.

In a country with religion, strict regulations and a strong dedication towards conservation, till date no retaliatory killing of the animal has taken place. Nevertheless as said by Graham (2006), perceptions may change when damages exceed a certain limit hence generating conservation issues. All the farmers had experienced some extent of damage by elephants and therefore were more inclined to a negative attitude as studies by Hill (1998) points out. In Bhutan where the media has recently become stronger and increased in number, the elephant damage cases are being covered even more frequently than it was in the past. This has led to the increase in negative attitude towards the animal and the situation on the whole, by many people living in the urban

area as well. The media has been known to contribute largely in influencing the people's attitude, as pointed out by Røskaft et al.(2007). As mentioned earlier, Buddhism has had major role in conservation which has also influenced the tolerance capacity of the people so far. Rituals being conducted and prayers being said prior to planning or harvest was also one of the common practices among the farmers.

Compensation which is not available for crop damage incidences is one of the critical issues that are being debated among senior officials. The sustainability issue being the major concern, there has been no compensation awarded for any form of crop damage by any wildlife till date. Compensation is only being given for livestock depredation cases by endangered wildlife species such as tigers and snow leopards. Being entirely dependant on their seasonal harvest for food or income, the farmers suffer huge losses; therefore it was evident when 71 % of the respondents felt the need for compensation. 35% mentioned however that it should be given only in terms of severe damages and not for any random case. As pointed out by Nyhus et al. (2005) prompt and accurate verification of damage is one of the key determinants of a success of compensation scheme. The respondents also had similar concerns and expressed that difficulties in measuring the actual loss could be used to an advantage by some farmers as an opportunity, and thus there would be disparity among the benefactors. 34% felt that compensation could be given in any form of cash or crop but 20% preferred money. However, 68% were also empathetic and mentioned that sustainability of funds would be the main problem if compensation was adopted. This can be supported with what Nyhs et al. (2005) has mentioned that with the wildlife damages to continue in the future, sustained and sufficient funds would be required for a compensation programme.

In Africa the killing of problem animal and culling to reduce the size of the problem animals is a common management practice(Nelson et al. 2003). The authorities concerned are known to be seen as a powerful figure in terms of being able to deal with the situation, and there is some sense of satisfaction among the farmers as well. However the case in Africa and Asia differs, making this practice more common there. This is so because, the elephant population of

the former is much higher as compared to their Asian counterpart and also because the animal is more of a rogue there. A study in Africa pointed out in some elephants responded to intense hunting by moving into protected areas and other secure regions thus introducing or increasing the incidences of conflict in these new areas (Lee and Graham 2006). This study supports what the respondents say of the activities across the borders where settlements also faced similar problems with elephant damage. The people were retaliating against the animals using weapons, and there have been a few reports of killings. They feel that it could be one of the reasons why the elephants frequently come towards Bhutan where there is less danger and no retaliation. This behaviour has been also seen in the study by Graham(2006) This case can also be supported by the fact that in Assam, which has a contiguous elephant habitat, 21 cases of elephant poisoning in the year 2001-2002, was reported as a result of retaliation(Maunglang 2003).

Moreover in Asia, population of elephants is seen to be declining at an alarming rate over the few decades and are still at a threat of going extinct (Kirtland et al. 2003). 50% of the Asian elephants are in India and the habitat available is very small in terms of their number. In Africa, most of the wildlife especially the protected wildlife are perceived by the rural people as property of the state which is almost similar to the situation in Bhutan, the only difference being that here they think that it is particularly the property of the Department of Forests since they implement the rules regarding wildlife. Therefore they are expected to control the wildlife and assist the people in times of conflict.

8. Management Options

Increasing conflicts have an impact on both farmer's livelihood and the elephants. With not much probability of finding a definite solution to the problem, the immediate need would be to develop the management strategies which will give equal importance to both the parties and also possible adoption of improved and successful mitigation measures.

Exploring funding sources for the construction of electrified fences and stronger physical barriers should be a priority. Although the present fences constructed has not proven to be very effective, new improved and stronger fences can be constructed after detailed research and studies in other similar and successful conflict zones. Numerous experiments in Africa and Malaysia have shown that electric fencing is generally effective. In Malaysia a few thousand kilometres of electric fencing have been erected around rubber and oil palm plantations which have reported success rates of 80%(Sukumar 1989). The cases of failures reported was due to design and improper maintenance which is also the case for the failures in Bhutan. Habituation is also one of the reasons for the failure of many mitigation measures.

Construction of trenches in India has been given up because of failures to keep away the elephants. The wet climatic conditions and loose soil were not favourable and trenches constructed in these sites were easily filled up by the elephants. Therefore with similar site conditions also in Bhutan the adoption of this method should be avoided although it has been suggested by a few of the respondents. Walls and other fences would involve a lot of materials and they are not known to be very effective either as elephants are known to destroy them as well.

Some disturbance methods to chase them away in times of crop raiding which can be easily adopted by the farmers could be introduced. Creating buffer zones between the forests and the settlement area could help to a certain extent but the feasibility need to be studied. This would lead to further destruction of habitat and should be carried out only after careful planning has been carried out.

Using repellents to chase away elephants such as chilli grease on fences and oleo resin sprays can be experimented as it has seen to have some success rates in Africa although the study is still going. However currently there are no concrete empirical evidences that show the success rates of these methods. Burning of chillies with elephant dung has also known to be effective. Further more repellents which are being used elsewhere can be explored and implemented.

With many studies showing that the educated people have a more positive attitude towards wildlife and conservation, education and awareness programmes could be conducted for the rest of the people on a regular basis. Use of funds for other alternatives to manage the human-elephant conflicts would be a better investment than to start compensation schemes in the future.

Wildlife managers and other forestry officials should also introduce the system of community guarding in severely effected areas. This method has been seen some success in chasing away animals in Africa and has also been pointed out by some of the respondent. This system which is lacking could be one effective measure of reducing the extent of crop damaged during the peak seasons. Including benefits from the governments to such community groups for the purchase of materials could also be used as an incentive.

Transboundary talks with neighbouring India for conservation and protection of the elephant habitat in the core zones should also be addressed in the future. Further research needs and long term studies on the migratory pattern of the elephants would also play a vital role in establishing core zones for elephant habitat and distinguishing migratory routes which are not disturbed or do not fall in the way of settlements to minimize conflicts and further damages.

Measures that could improve the socioeconomic conditions of the people so that they do not always have to be at the losing end would certainly help in bringing a change towards the positive attitude towards the elephants. As Conover (2002) has pointed out unless farmers concerns are resolved, efforts to ensure wildlife conservation are likely to fail.

9. Conclusions

Elephants are considered as highly social and intelligent animals and their excellent communication and cognitive skills combined with dietary and behavioural flexibility make them extremely adaptable and effective crop raiders (Woodroffe et al. 2005) Their more frequent role as a crop raider recently has lead to their increased media coverage and has lead more people to perceive this animal as a rogue and fear it rather than respect it as a saintlike in earlier times. Although the responses from the survey showed that the positive attitude towards the animal is still strong, the conflict is increasing rapidly with reports on crop damage being covered by the media each year and could reverse the present situation. Increased conflict incidents and most people being victims of damage, the negative attitude could take over in a short time. Having strong legislation over the illegal activities on threatened wildlife has also made a huge contribution to the conservation of elephants. The encroachment of its natural habitat and conversion to recent settlement is already a concern and seems to cultivate the conflict. In a country where conservation and the socioeconomic needs of the rural people have equal priority growing conflicts are impacting both farmer's livelihoods and conservation efforts. With the increase in population and land use changes resulting in further conversion of elephant habitat into agricultural land, there would not be an end to the problem.

Strategies which would concentrate on improving lives of those people affected by the problem in order to change their attitude towards the elephants could address the situation. Involving them in interactive co management decisions and educating them on importance of conservation would possibly help in maintaining their positive attitude and strengthen the conservation of elephants. Economic incentives given to farmers to increase their tolerance, such insurance schemes, performance payments would be important components of future conservation strategies for conflict species.

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11. Annex

Questionnaire

Human- Elephant Conflict Survey

Date:
Name of Interviewee:
Dzongkhag/ Geog/ Village:

Characteristics of Human-Elephant Conflict Zones

1. Number of village households:

2. Name of respondent/Age/Sex:

3. No of people in the HH:

4. Marital Status:

5. Education Background:

6. What are the main sources of income for the household? (More answers possible, rank in order of importance, double-check one by one)

Type of activity	High (1)	Medium (2)	Low (3)
Farming			
Livestock rearing			
Wage labour			
Business/ contractor			
Government employees			
Shop owner			
Other (specify……..)			

7. Land use in Langdo for last growing season(1 acre Chhuzing=4 langdo, 1 acre kamzing=3 langdo)

Land type	Land owned by family (Registered) in %	Land leased in	Land kept fallow	Total cultivated land
Chhuzing				
Kamzing				
Tsheri				
Orchard				
Grazing land				
Kitchen garden				
Other land type				

8. Types of the crop grown by your family

Type of crop	Area(Ac/Langdo/Dc)	Growing season	Quantity harvested last year	Quantity harvested year before	What is the reason for the differences in harvest

9. During which season is the elephant seen in your village? (Please Specify the Months)

Jan	Feb	Mar	April	May	June	Jul	Aug	Sept	Oct	Nov	Dec

10. What time of the day is the elephant seen in your village?

1.	Early morning	
2.	Day time	
3.	Evening	
4.	Night	
5.	No Fixed Timing	

Elephant Damage Incidents

1. Since when have elephants been coming to your village?

1.	Year ago	
2.	1-3 years ago	
3.	5 years ago	
4.	5-10 years ago	
5.	>10 years ago	

2. Have incidences of elephant damages compared to the past 2-3 years

1.	Increased	
2.	Decreased	
3.	No Change	

3. If you feel that the incidence of elephant crop damage has increased: Why do you think so? (More answers possible, rank in order of importance)

1.	Increase in agricultural land	
2.	Decrease/ degeneration of forest resources (food and / or habitat)	
3.	Strict forest rules	
4.	Less forest fire cases	
5.	Change in crops grown	
6.	Decrease of Tseri practices	
7.	Increase in human population	
8.	Others (specify……..)	

4. Please rank the last 5 years according to severity of crop damage severity by elephants (1 for least affected year, 5 for most affected year)

Year	Severity (1-5 scale)	Remarks
2007		
2006		
2005		
2004		
2003		

5. What other pest species destroy crops in your village? Rank elephant with others

Type of land uses	Type of crop damaged	Rank the pest (1-high, 2 medium & 3-low)	
		Pests type	Rank
Orchard			
Grazing land			
Kitchen garden			
Other land type			

6. What method do you use for guarding and protecting your crop against elephants? (More answers possible, rank in order of importance, double-check one by one)

1. No guarding	
2. Scare crow	
3. Bonfires	
4. Shouting	
5. Banging tins or drums	
6. Fire crackers	
7. Rattling tins by pulling ropes connected to the tins	
8. Rattling bamboo (pakshing) by pulling ropes connected to them	
9. Walking around the field with wooden torches	
10. Walking around the field with battery operated torches	
11. Throwing stones	
12. Spears	
13. Bow and arrow	
14. Fencing (made of……..)	
15. Other (specify……)	

7. Which of these methods appear as the most effective?

8. Do elephant still attack and destroy your crops when they are guarded?

1.	Yes	
2.	No	

9. If Yes. How can you improve guarding so that crops are better saved? (More answers possible, rank in order of importance)

1. Community guarding	
2. Fencing (specify……..)	

3. Periodically chasing elephants back into the forest	
4. Improved guarding techniques or tools (specify……..)	
5. Not Possible	
6. Other specify	

10. Does your village have any form of organization for the guarding of crops?

1. Yes (Please Specify)	
2. No	

11. How long have you been using the Electric Fences? (No of Years)

12. Do you think they are affective in keeping away the elephants?

1. Yes	
2. No(why)	

13. Would you prefer to have more of these fences set up around your fields and properties?

1. Yes	
2. No(why)	

14. Can you think of any (other) community organisation methods for improving the effectiveness of guarding or scaring elephants?

1.Yes(Please Specify)	
2.No	

Elephant Perception Survey.

1. What is you attitude about elephant?

1.Like them	
2.Hate them	
3.Fear them	
4.Respect them as religious symbols	
5.Other feelings……	

2. Do you want to kill the animal? If so for what reason:

1. Retaliatory killing	
2. Consumption of meat	
3. For sale	

3. Have you heard about the Forest and Nature Conservation Act of 1995 and Forest & Nature Conservation Rules of Bhutan 2006 (Vol I & II)?

1. Yes	
2. No	

4. Do you know whether elephant is protected animal?

1. Yes	
2. No	

5. Which one is a bigger problem; crop losses or the time spent guarding at night?

1. Crop losses	
2. Guarding	

6. Were there any major changes or problems in you or your household because of the elephant?

1.Yes	
2.No	

7. If Yes, Please explain
8. What do you think about the elephant problem?
9. What constraints/ problem have been created for you or the community by elephants? (Controversial attitudes and awareness)

1. Restriction of movement at night	
2. Restriction of movement at daytime	
3. Restriction of movement at night and daytime	
4. Competition for water sources	
5. Crop damage	
6. Attack on humans	
7. Night guarding required	

10. Do you think it is necessary that those should be compensated who are affected by wildlife damages?

1.Yes	
2.No	

11. If so

a.How?

b.To what extent?

c.In terms of:

12. What might be the difficulties with wildlife damage compensation?
13. Do you have any suggestions to reduce the human-elephant conflict in your locality?

Elephant Damage Report

Crop Type	Quality Before Damage			Age/Stage of Crop			Crop Stand per SQM	Area In Deci. (damaged)	Total Area (cultivated)
	Good	Medium	Poor	Seedling	Intermediate	Mature			