

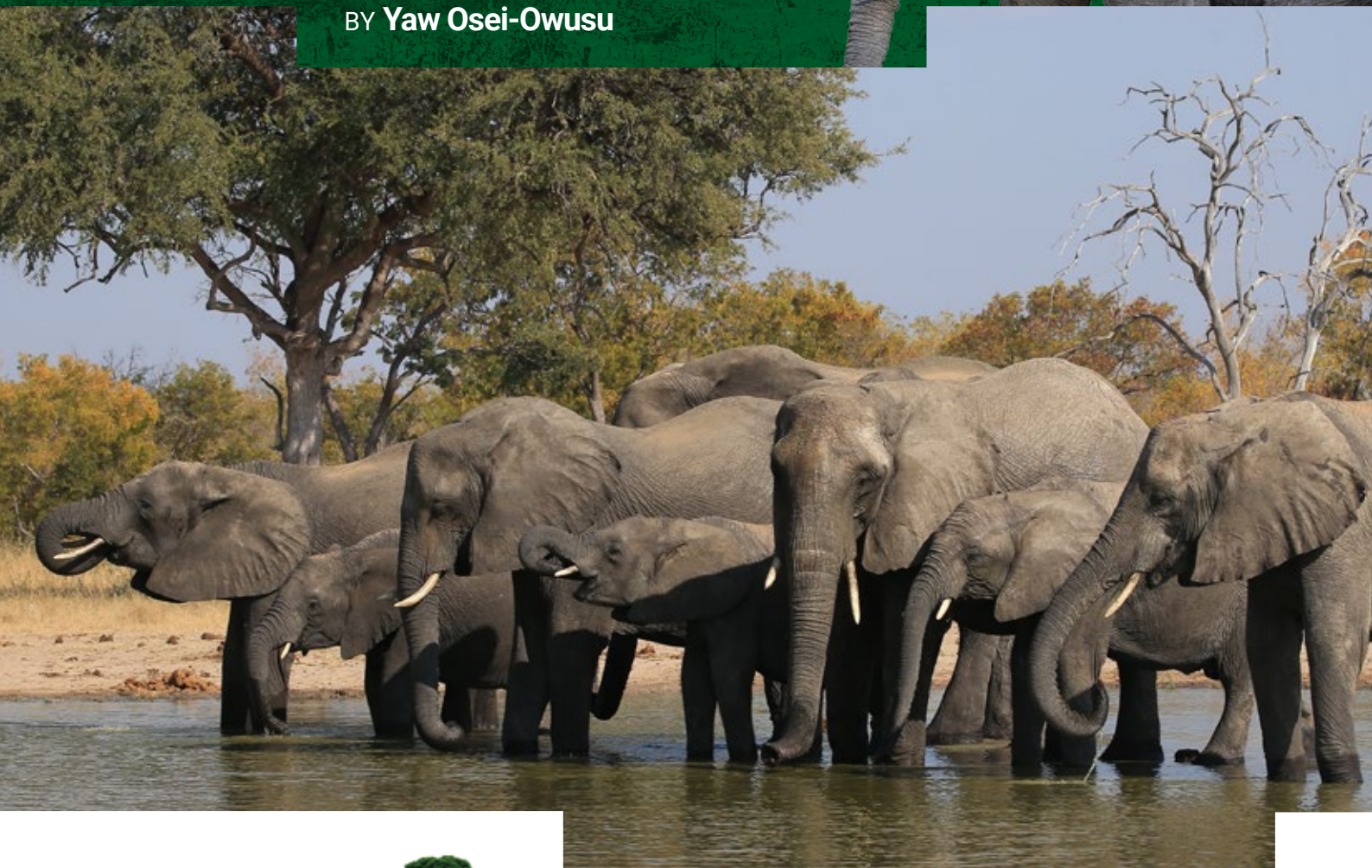
TECHNICAL MANUAL



HUMAN-WILDLIFE CONFLICT

Elephants

BY Yaw Osei-Owusu



CONSERVATION ALLIANCE
INTERNATIONAL 2018



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[This Technical manual is adapted from the training manual developed by Yaw Osei-Owusu & Lonneke Bakker (2008)]



Preface

These manuals are a follow-up to a series of projects executed in the Kakum and Bia Conservation Areas in Ghana's Central and Western Region respectively. The project – titled "Reducing Human-Elephant Conflict through improved monitoring, stakeholder engagements and law enforcement" – was funded by the African Elephant Fund (AEF) and implemented by Conservation Alliance (CA), in collaboration with the Wildlife Division of the Forestry Commission, and the Chiefs and people of the beneficiary communities. AEF received numerous requests for assistance from member countries to set up similar elephant crop-raiding techniques and provide training in human-elephant conflict management. In response, CA prepared these manuals in English with a view to disseminate, as widely as possible, the project outcomes.

The full training package consists of a 'Technical Manual', and a 'Farmers Manual' on the project in Ghana. The 'Technical Manual' intends to inform policy makers, conservation authorities, extension service etc. about the background to human-elephant conflict and the various techniques which could be used as deterrents to keep out of crop fields. The 'farmers Manual' is mainly intended to explain successful and new techniques to rural populations.

The techniques described in the Technical Manual are based on three strategies: The first is protection against elephants – 'keeping the elephant away from humans'; the second is mitigation (easement) of the problem – 'making sure the problem does not go out of hand'; and the third is prevention from human-elephant conflict through land use planning – 'prevent the conflict from occurring altogether'. Eventually, the best

way to resolve conflicts between humans and elephants is to use a decentralized, farmer-based approach, which uses features of all these three strategies: community-based problem-elephant control.

We would like to express our appreciation to Yaw Osei-Owusu, the Executive Director of Conservation Alliance-executors of the project who, by his enthusiasm and strong personal skills, made the project a success and this training package a reality.

Nana Kofi Adu-Nsiah

Executive Director
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Foreword



perennial problem confronting conservation of Kakum and Bia Conservation Areas is human-elephant conflict. It is estimated that there are around 60-80 farming communities, with around 1200 households, within a 5k radius of these parks. With a successful conservation effort since the development of ecotourism and conservation of lands within the corridor, the backlash has been a continuous raiding of crops by elephants, primates, birds, duikers etc. resulting in severe food insecurity within the communities. This situation has on a number of occasions led to serious poaching, loss of farmers' livelihoods and killing of humans.

Ensuring farmers' livelihoods and food security through reduction of conflict between forest fringe communities and wildlife is an international agreed goal. Achieving this goal is within outreach given sufficient political will, adequate resources and an integrated response from governments and civil society. In rural areas where poor fringe communities live close to nature and are dependent on natural resources, conservation can help find equitable ecological sustainable solutions to conflicts and food security.

A range of crop protection methods have been implemented in the past, but with little overall effort. Resolving the conflict issue has become critical to the conservation of elephant population, the effective management of forests

and improvement of community livelihoods. Over the past five years both conservation and development thinking have advance enormously to design and implement simple deterrents that have worked to mitigate conflicts and enhance farming activities. This manual, which is one of the products of a project implemented by Conservation Alliance in Ghana, fulfils the dreams of many conservationists to develop long-term strategy to promote the co-habitation of humans and elephants including land use planning.

Yaw Osei-Owusu
Executive Director
Conservation Alliance
International



Using this manual

Training materials are teaching aids used during training to facilitate effective communication and learning. A training package was developed under project “Reducing Human-Elephant Conflict through improved monitoring, stakeholder engagements and law enforcement”, organized and funded by the African Elephant Fund (AEF). The project was implemented in Ghana around Kakum and Bia Conservation Areas. The training package, which includes a technical training manual and a farmer’s manual explains the techniques for reducing elephant-crop damage to farmers for adoption. Some of the techniques described were tested during this project. The overall goal of the project was:

‘To mitigate the impact of human-elephant conflict upon rural farmers, first by introducing strategies to protect crops, and second through periodic monitoring and law enforcement to reduce vulnerability of farms at the edge of forest reserves.’

This technical manual has been designed for use in training field staff in principles and procedures of the techniques for protecting crops from damage by elephants and improving crop yields on farms. Exercises have been suggested for practice by trainees.

This manual has been divided into 6 chapters.

Chapter 1 explores the background and history human-wildlife conflict.

It provides examples of human-wildlife conflicts both in the past and present-day and shows that such conflicts have been around for as long as wild animals and people have shared the same landscapes. The chapter also explains that the problem cannot be completely solved; it can only be reduced and that Government, communities and other organizations should work together to reduce the problem.

Chapter 2 explains the techniques for reducing crop losses through elephant’s damages.

The techniques involved are low technology and utilities cheap, readily available materials. Participants shall be encouraged to review current Problem Animal Control (PAC) methods, and assess their effectiveness using a number of criteria.

Chapter 3 focuses on the easement of the human elephant conflict.

It examines the various problem animal control units and makes the case for benefit sharing as one of the options for human elephant conflict mitigation.

Chapter 4 examines land use planning as the best options for reducing human-elephant conflict. The crop protection strategy so far described will reduce the incidence of crop damage in the short term. However, none of the above methods tackle the root of the conflict problem. The underlying land use problem is the farmer are growing food crops close to the forest or conservation area edge. To address the rood problems

it will be necessary to institute a system of land use change in areas affected by crop raiding. This chapter focuses on appropriate land use planning in fringe communities, leading to the avoidance of crop raiding.

Chapter 5 looks at community based problem elephant control methods. It provides guidelines for community involvement and explains procedures for monitoring and evaluation of the various methods to determine their effectiveness.

Chapter 6 provides practical measures and exercises for participants.

It is expected that on completion of the training exercises, the participants will have the necessary skills and knowledge to introduce crop protection strategies to farmers around forests and conservation areas where similar exists. The trainees will also learn about appropriate methods of food crop production to achieve improved yields.

Throughout this manual the term ‘park’ is being used and implies forest reserve, protected area, national park or any other area, which elephants inhabit although the techniques have been tested in Ghana near a forest reserve with a population of forest elephants (*Loxodonta africana*).

We hope that all those who use this manual will find it a valuable tool in transferring information on elephant anti-crop raiding deterrents and crop improvement.

Glossary

- 1** A 'conservation area' or 'protected area' or 'national park' in the text refers to a 'forest reserve'
- 2** A forest fringe community is a community located close to a forest
- 3** For several months each year, male elephants emit a message-laden chemical secretion from glands above their cheeks. It's part of an annual social phase known as musth, a time of pumped-up aggression and sexual activity for males at or beyond their teen years.

List of acronyms

CBPAC	Community Based Problem Animal Control
CBPEC	Community Based Problem Elephant Control
CA	Conservation Alliance
CI	Conservation International
CIG	Common Interest Groups
FAO	Food Agriculture Organization of the United Nations
HEC	Human Elephant Conflict
HWC	Human Wildlife Conflict
PAC	Problem Animal Control
PEC	Problem Elephant Control
WD	Wildlife Division of Ghana Forestry Commission

Summary

A Few animals elicit such drastically different human emotions, as do elephants. Elephants capture the imagination and unswerving affection of people worldwide but inspire animosity and fear among those sharing their land with these huge animals. Field reports from across Africa describe local antipathy to elephants beyond that expressed for any other wildlife.

Communities surrounding forest reserves and conservation areas engage in small-scale subsistence and cash-crop farming. Those farms close to the boundary are vulnerable to elephant crop damage, which is most intense during the food crop-harvesting season, but also occurs to a lesser extent throughout the year. Elephants jeopardize communities' food security and livelihoods and communities' attitudes towards elephants are consequently negative. Resolving the conflict has become critical to the improvement of the livelihood of rural communities co-existing with elephants and the conservation of the elephant population.

The African Elephant Fund (AEF) and Conservation Alliance (CA) initiated a joint project to mitigate the conflict between farmers and elephants, and ultimately improve food security in communities surrounding the Kakum and Bia Conservation Areas. The Kakum and Bia Conservation Areas cover 350 km² and 305 km² respectively. Of moist tropical forest and represents the few remaining areas of West Africa's

Upper Guinean Forest hotspots with most of its plants and animals relatively intact (CI, 2004). The human elephant conflict component of the project had a two-stage approach: first, the implementation of crop protection measures to reduce the amount of crop damage; and, second institute a system of land use planning which discourages the cultivation of target crops close to park boundaries and improves the productivity of farming in communities. It developed a training package made up of a technical manual and a farmer's manual for training farmers on how to reduce elephant crop damage.

The project successfully promoted a number of crop protection methods, particularly low-tech community-based problem animal control methods (traditional methods, chili pepper-grease fencing, chili-dung bricks, bamboo blasters, alarm bells, bee hives and field patrols). These methods have been implemented successfully elsewhere; however, if they are unsuccessful in meeting the demand for conflict mitigation then a set of mid-tech or high-tech interventions should be used. A low-tech approach is strongly recommended initially as the cost and the implementation logistics are undemanding. High-tech methods such as electric fencing are only recommended as a last resort. Techniques that are low-cost and community-oriented stand a better chance of success, as they are affordable, and are wholly owned and administered by the farmers.

Low-tech community-based PAC methods were conveyed to the community through demonstration sites. These sites were established in each of the target communities and these were the focal points for the dissemination of methods and training. The demonstration sites were selected on the following criteria: high vulnerability to crop damage; level of community cooperation; and accessibility of the site to other communities. The experimental design should be simple and robust, in response to the variable and heterogeneous nature of the area.

It is recognized that the crop protection strategy fulfils a "stopgap" approach to conflict. The immediate benefits will be the reduction of crop damage in communities around the project areas. However, the approach does not tackle the fundamental causes of conflict. These must be broached by land management, which forms the second component of the programme. Land-use planning is essential and it is a fundamental element of conflict mitigation.

Human – wildlife conflict

1.1 Introduction and History

Human –wild life conflict (HWC) is a term that is commonly used by conservationists and wildlife managers to describe problematic situations between wild animals and people. The conflict emerges when wildlife and humans' requirements overlap, with consequential costs to people and wild animals. Wildlife species negatively impact upon the food security and livelihood of affected people. While people become hostile to towards wildlife around their communities. Wildlife species, such as elephants, lions, crocodiles and hippo's invade human settlements and raid crops, cause damage to personal belongings, injure or kill livestock and can even injure or kill people.

In general, the causes for human wildlife conflicts worldwide can be brought back to three principal dependent causes. The first is human population growth; more people and expanded human conglomerations increase the chance that humans negatively interact with wildlife. People have encroached areas

previously occupied with wildlife. A second cause is the demand for natural resources; humans have transformed forests, savannah and other ecosystems into agricultural land and cities, leaving fewer resources for wildlife. Thirdly, due to other human activities, habitats for wildlife have disappeared or have been severely degraded, leading animal to wander into human settlements.

Because of factors such as wildlife population increases inside protected area, large herbivore migrations accompanied by predators, and the need for access to scarce resources, such as water during the dry season or a drought, animal populations often cannot be contained within conservation areas and thus encroach on human settlements. From baboons in Namibia attacking young cattle, to the greater one horned rhino in Nepal destroying crops, orangutans in oil palm plantations or European bears and wolves killing livestock, the problem is universal, affects rich and poor and news for all

concerned. In addition to monetary value of the assets lost, injury or death of a family member has considerable social and emotional implications for communities involved. In many societies farmers traditionally compensate for losses by hunting and consuming the animals that damaged their crops.

In present times many wild animals and their habitats are legally protected, and the outlawing of hunting and resource collection activities creates antagonism between people and conservation areas. While some species have a protected status under CITES (the Convention on International Trade in Endangered Species), culling of problem animals and decreasing population sizes of wildlife species is not straightforward. Nevertheless, illegal retaliation killings and other form of human hostility towards wildlife species and conservation efforts persist and HWC is seen as of human hostility towards wildlife species. Conservation managers today are required order to achieve their

conservation objectives. To tackle the complex conflict issues with communities in order to achieve their conservation objectives.

HWC has been in existence for as long as humans have existed and wild animals and people have shared the same landscapes. Some observers have blamed colonialism for ruining traditionally harmonious relations between wildlife and local people. They believe that tribal African societies were accustomed and adopted to living with wildlife threats and found means and ways to cope with them. Once the colonial powers commenced hunting activities and other, intensive, use of natural resources, the equilibrium between man and nature got disturbed, and conflicts emerged. Others believe HWC, such as crop-raiding by elephants, is as old as agriculture itself in Africa.

Some examples of early HWC include the following:

- The fossil record shows that large animals such as lions and tigers preyed upon Neolithic man.
- In 2000 B.C. hippos in the Nile delta in Egypt fed on cultivated crops and crocodiles ate livestock.
- African pastoralists have been defending their cattle from lions and other predators like hyenas, crocodiles etc. for thousands of years.
- In the early 19th century of homes, reports of elephant's crop raiding, which resulted in food shortages and the displacement of homes, were often reported in Africa.

Nowadays, human-wildlife conflict occurs across all continents, and takes a wide variety of forms. Below are some more examples of conflict between wild animals and people in Africa:

- Chimpanzees destroy crops around Tai National park in Cote d'Ivoire.
- Baboons cause damage to forest plantations in Zimbabwe.
- Honey badgers raid commercial bee hives in South Africa.
- Crocodiles kill up to 2 tourists per year in National Parks within Zimbabwe.
- Elephants destroy crops around Kakum Conservation Area in Ghana.
- Jackals in southern Africa kill small livestock and poultry.

As demonstrated by the examples given above, conflicts are particularly common in or near conservation areas bordering densely populated human settlements. In villages at the boundary of National Parks, communities around Forest Reserves and in settlements within the reserves, wildlife populations are close to humans and conflicts are severe. Where people encroach on wildlife habitats, e.g., farming in an elephant moments corridor, and when wildlife food sources are destroyed and wildlife has to adapt to new conditions, conflicts are also likely to result. There are also cases where wild animals adapt to human conditions, for example leopards hunting at the edge of Nairobi. Other likely situations for the development of conflicts is when wild animals have been injured by poachers, and become aggressive, or 'rough', towards humans, or when wild animals have been disturbed by human activities within the reserve (such as logging) and

are moving out of the reserve.

The immediate causes for HWC to develop are numerous, but include the production of palatable foods by humans, e.g. maize – plants which are more attractive to wild animals than many natural food sources; the return of higher mammals, such as primates and elephants to habitual feeding grounds – if humans have settled in these areas there is a chance that conflict will occur; secondary vegetation growth stemming from certain farming practices – some animals species are drawn to patches with young, succulent vegetation. Moreover, if water is in short supply, wildlife will be attracted to sources that humans use. Some animal species are appealed to human settlements by maturing fruits, e.g. oranges, pineapples are pawpaw.

Encroachment by wildlife upon human settlements has consequences for the livelihood and food security of rural populations. Equipment, crops, food stuffs, structures and other possessions can get damaged or destroyed. For rural families which are practicing subsistence farming, one night could mean the disappearance of a season's work and the destruction of months of food supply. Injury or death of a family member stemming from encounters with wild animals species, have serious implications for the production capacity of families in rural societies. With one family member less, the available labor for the farm is greatly reduced. There can be high cost for countries' economies stemming from prevention and the cure of diseases transmitted between wildlife and livestock. Increasing occurrence of HWC lead to a negative attitude of human populations towards

wildlife and preservation activities proposed by government in the light of the development of eco-tourism. To minimize the social, environmental, economic and political costs, it is necessary to find solutions to this growing problem.

Protective strategies can be implemented to prevent the conflicts from occurring in the first place. Examples are natural and artificial barriers aimed at keeping the wildlife away from crops or human

settlements. Mitigation strategies are designed to reduce the level of impact once the conflict occurred and lessen the problem for humans. For example, compensation system involve financial payments of licenses to exploit natural resources to pay-off affected communities for the damage they experienced. Proper planning of land use, the adoption of best practices for wildlife management and improved public and culture; systems can prevent HWC from developing in long run. The most reasonable approach to managing human-wildlife conflict is to implant

protective strategies to avoid the conflict from occurring in the first place, short term mitigation strategies at places where problem is already occurring and planning and implementation of long-term preventive strategies.

1.2 Background of human-elephant conflict

To many, elephant are a mythical symbol of power and wisdom. They are seen by conservationists as 'flagship' or 'keystone' species, and much international attention is given to the survival of elephants and their habitats. To rural Africans, they can be frightening reality. Over 80% of the elephant range in Africa lies outside protected areas, and farmers and elephants increasingly come into contact. Elephants can destroy a local farm and its crops over one night, and severely reduce the potential for farmers to feed their families and generate income, and moreover, there is a real risk of injury or death. Rural populations thus incur the primary costs of living with elephants, but receive few of the benefits from activities such as eco-tourism and tourism hunting. The attitude of local farmers towards elephants are frequently negative as a result. Farmers have little means of protecting themselves and their farms to these gigantic mammals.

And the shooting of ravaging individuals is prohibited by international and national law. Human-Elephant Conflict (HEC) can be considered a major threat to elephant conservation, as well as to agricultural production across Africa. A broad definition of human- elephant conflict "any human-elephant interaction which results in negative effects on human social, economic or cultural life, on elephant conservation or on the environment". A wide variety of vertebrate pests come into conflict with farming activities Africa including birds, rodents, primates, antelopes hippopotamus, bush pigs, and elephants. While it is widely recognized that in most cases African elephants (*Loxodonta Africana*) do not inflict the greatest damage to subsistence agriculture, they are regularly identified as the biggest threat to African farmers (Parker et al.2007)

HEC occurs wherever people and elephants coincide, and poses a serious challenge to wildlife managers, local communities and elephants alike. Increasing human populations and expanding agriculture have the potential for conflict between humans and elephants in many regions. Elephants have been compressed into every-smaller areas and their traditional migration routes have been cut off. As a result, humans and elephants compete directly for land that is becoming increasingly scarce. Farms positioned directly on the bank of a river, or in a path, or corridor, used by elephants to reach the river, are more likely to be raided. Elephants are generalist feeders, and it can therefore be said that anything which is palatable for humans, is commonly also fit for elephant consumption. Plants which were selectively bred by humans for hundreds of years, contain less deterring chemicals

and high levels of nutrients, and are therefore an interesting food sources for elephants.

The majority of elephant crop-raiding occurs during the hours of darkness. In TransMara, Kenya, all recorded crop raids occurred between 13:00 and 05:00, with a peak of activity at 20:00. This peak of crop-raiding activity in the evening may be explained first, by elephants using the cover of darkness to increase their chances of success. Second, an elephant's feeding activity would naturally increase through the afternoon and evening, peaking around 21:00. Thus, the majority of crop-raiding occurs during the period that elephants would be naturally feeding.

Elephants may not cause the greatest damage overall when taken at the district or national levels. However, the damage they often inflict is devastating for the individual farmer. They have the potential to damage large areas of crops, destroy property, and cause injury and death. Consequently, HEC is a severe concern in elephant conservation in Africa. Conflict does not seem to be a density-dependent phenomenon, meaning that it is not strongly related to the number of elephants within an area. Nevertheless, there has been a marked increase in reports from countries with growing elephant populations with severe consequences.

1.2.1 Direct impact

I Damage to Crops

Crop damages is the most prevalent form of conflict across the African continent. When elephants damage food and cash crops, they affect a rural farmer's livelihoods. Elephants in large groups can destroy large areas of crops in a single night. While elephants target staple food crops such as maize, they also damage cash crops such as cotton and cocoa. Crop damage not only affects a farmer's ability to feed his or her family, it also reduces cash income and has repercussions for health, nutrition, education and ultimately, development.

The occurrence and frequency of crop raiding is dependent upon a multitude of conditions such as the availability, variability and type of food sources in the natural ecosystem, the level of human activity on a farm and the type and maturation time of crops as compared to natural food sources. Climatic and weather conditions can also play a role; there is some anecdotal evidence suggesting that elephant crop raiding around forests is more likely with rainy circumstance. Crop raiding also in general occurs during the night. To limit the risks associated with damaging crops of farmers, elephants shall often remain close to an area with natural vegetation. In order to be able to retreat when exposed to danger.

The table 1 below attempts to estimate the cost of damage by elephants across Africa by a team of experts. Average losses range from 0.2% (Niger) to 61% (Gabon) of planted fields. Estimates of annual costs of elephant raids ranged from \$60 (Uganda) to \$510 (Cameroon) per affected farmer. Elephants were recorded consuming over 20 different crops, with maize ranking first. Nearly all the researchers commented on the irregular, patchy distribution of damage. Certain farms and/or communities were disproportionately damaged due to their proximity to a forest edge, a water source or migration route. Similarly, many researchers commented on variability in the timing of raiding, particularly for forest elephants (*Loxodonta Africana cyclotis*). Despite their recognition of the highly irregular and localized pattern of elephant damage, the cost to the farmer is quite phenomenal.

Table 1 Estimates of crop damage by elephants in Africa

Location	Estimate source	Measurement unit	Results for all crops	maize	cassava	millet	sorghum	banana	Ground-nuts
Congo	R	Average % loss in field (n=29) and total monetary value of loss	23.7% worth US\$574	36%	42%				
Cameroon	?	Annual monetary value of damaged crops (uncertain methods)	0 to 22,000 per village, \$89-\$104 per farmer						
Cameroon	F	Total monetary value of damaged and losses per field (n=97 farmers)	US\$99,000 in two years	5%		37%	53%		
Cameroon	R	Range of % damage to fields in path of elephant or on park boundary	105%-96% (85% of field loss <15%)				65%		12%
Cameroon	F	Average per capita annual losses, amount and % annual production	0.88% ha per capita, 23-27% annual production						
Cameroon	R	Average % loss (n=455 fields in 44 villages)	40%						
Gabon	R	Average and range % loss for fields raided by elephants (n=125 fields)	61% (1.5-90%)		52%			66%	
Ghana	R	Average % loss in fields damaged by elephants in previous 30 days (n=140 fields)	48%	68%				43%	
Ghana	F	Average % loss in proceeding month for fields near reserve boundary	50%						
Kenya	R	Total area damaged in 34,400ha study area and monetary value	772.8ha worth US\$64,975						
Kenya	?	Total cost to farms and average % losses by field (n=105 farms)	US\$33,000						
Malawi	R	% crops loss by ALL species, elephant and bush pig responsible for 80%		4.80%					1.50%
Niger	R	Average and range % loss to fields	0.2% (0-100%)						
Uganda	R	Mean area damaged per field per raid on farms on forest boundary		38.4%				21.4%	28.6%
Uganda	R	Mean area damaged per field per raid on farms < 300m from forest boundary	5.7% (0-21%)						
Zimbabwe	F	Range of friction total dry weight destroyed per field		0-7%		0-4%	0-7%		

Estimate Source: R=Researcher; F= Farmer. Source: Haughton L et al., 1999

II Damage to food stores

In the savanna areas of Africa, farmers commonly store their harvested crops in special stores made of mud, wood or bricks. Elephants may damage food stores during the dryer months following the main crop harvest. The loss of this stored food is considered far more disruptive to farmers than the raiding of crops while they were still in the fields, because a lot of damage can be done to such a concentrated food source in a short space of time. In addition, damage to field crops can be negated by planting replacements if the damage occurs early in the season, but food stores cannot be replaced until the following growing season.

III Human death and injury

Elephants kill and injure people across the African continent. Most of those killed are men, and many of these incidents occur during the night. In one study in Kenya, alcohol was found to be a key factor in one third of the deaths; victims were drunk and returning home from the bar. Others died protecting their crops, herding cattle and walking at night between neighboring villages. Human death, although less common than crop damage is the most severe manifestation of HEC and is universally regarded as intolerable.

IV Damage to other property

Elephants may also cause extensive damage to other property such as fencing and water installations. In Chobe National Park, Botswana, a tourist camp was abandoned after elephants repeatedly dug up the water pipes to access the water in the dry season. Single bull elephant repeatedly destroyed fencing around a game capture boma during 1999 on a wildlife ranch in the Lowveld of Zimbabwe. Occasionally elephants will kill livestock: in Zimbabwe's Zambezi Valley cattle were killed close to water sources during the night. Similarly in Kenya, elephants have been reported to chase and killed cattle.

1.2.2 Indirect impact

While indirect conflicts do not directly impact livelihoods, they still have a negative effect upon people's lives. For example, the fear of running into elephants may restrict people's movements between villages, especially where attacks have recently occurred. Such fear among children may reduce school attendance, or interfere with the collection of fuel wood and thatch grass, or the collection of wild fruits or other resources (e.g. water). In the Luangwa Valley, Zambia, elephants destroyed stores of the fruits Masawu, which had

been collected to supplement the diets of local farmers. In Zimbabwe's Zambezi Valley, elephants feeding upon Masawu fruits caused fear and consternation among communities living nearby (Parker et al. 2007).

In the crop raiding season farmers and their families will be required to guard their crops and property, leading to loss of sleep and energy, poor employment opportunities, increased exposure to malaria and psychological stress. Such indirect costs do not translate well to economic value and so are difficult to compare conventionally. However, while less-easily quantified than direct conflict, these indirect forms of conflict still significantly impact upon people's lives.

Elephants therefore impact negatively on local communities in many ways e.g. by raiding crops, killing livestock, destroying water supplies, demolishing grain stores and houses, injuring and even killing people. The costs of such conflict can be significant. In most African nations today, the real and perceived costs of human-elephant conflict (HEC) greatly outweigh the potential benefits and subsequently, elephants are increasingly being excluded from many parts of their former range.

CASE STUDY 2

Zimbabwe.

Twenty farmers from Gonono Village in the Zimbabwe were asked to list and rank consequences of HEC according to frequency and severity.

Table 3: Frequency and severity of HEC experienced by Zimbabwean farmers

Conflict issue	Rank
Crop damage	1
People killed by elephant	2
Necessity of guarding field	3
Destruction if tress	4
Destruction of property	5
Consumption of beer by elephants	6

1 = Most common form of conflict 6= Least for of conflict

Discussion and conclusion

The issues in Zimbabwe and Ghana are very similar: in both places crop damage was considered the greatest problem; and resource competition, property destruction and human death were all mentioned. Food crops were ranked first, because they were considered form of conflict by far.

From table 2

(in Box 1) cash crops were considered second most important as they provided money for extra food, and therefore provided food security. Competition for natural resources, such as raffia palm for roofing, is serious when

it occurs, but it happens rarely. There may occasionally be competition for water during the dry season in drought years. Loss of life was considered by all to be the most severe type of conflict, but its extreme rarity led it to be ranked last. In addition the participants stated that the only people who were perceived to bear the responsibility for their deaths.

Human's death is ranked higher in the Zimbabwean case study, reflecting the fact that it is a common occurrence there. This comparison goes to show that conflicting has similar issues in very different areas, and common themes can be found. However, the issues also very form place so it is important to understand the local conflicts issues before attempting to engage the conflict problem.

Many wildlife management authorities have been involved in attempts to find a resolution to the pressing and increasing problem of Human-Elephant Conflicts. Equally so, (international) non-governmental organizations and development organizations have attempted to resolve the problem by influencing wildlife management, often with limited or short-duration effects. One of the critical aspects is that conventional methods used often rely upon a well-equipped and widespread coverage of wildlife management authorities to assist communities with HEC incidents. Moreover, the methods used provide only temporary relief and do not provide a lasting, or geographically encompassing solution. The monetary aspect that is the lack of sustained financial resources needed to implement and maintain HEC management strategies, is often also a large setback for long-lasting impact of assistance.

1.3 Overview of current methods for HEC management

Across Africa farmers employ a wide range of traditional methods to chase elephants away. Farmers guard their field, and once elephants approach, any means is used to prevent the elephants from entering the farm and raid the farmers' produce. Means include shouting, beating drums or making other loud noises and burning fires. The dilemma is the elephants are highly adaptable, and rapidly habituate (i.e. get used to) to 'empty threat' deterrent methods – those which scare, but cause no physical harm. The effectiveness of any traditional methods is therefore reduced once elephants are exposed to them multiple times.

Another widespread method has been the deployment of a unit of wildlife employees who fire shots over crop raiding animals' heads. Disturbance shooting, as this method is known, is still in common use throughout the continent. But strategies that rely upon centralized units always suffer from logistical failings such as transport and poor response times, as villages experiencing conflict tend to be distant and inaccessible. Killing of crop raiding elephants by wildlife authorities faces the same constraint with regard to response time; it is rarely possible to shoot an elephant 'caught in the act'. Besides, the administrative requirements in some countries in order to kill an elephant can be lengthy and tedious. Moreover, a program of institutionalized killing of problem elephants run the risk to be abused by those seeking commercial gains through poaching elephants for their ivory.

The relocation of people out of elephant's or other wildlife habitats away from human settlements has been carried out in numerous locations across the continent, but experience many problems. It is often difficult to find a new location for a human settlement with no exposure to wildlife, and the social, economical and cultural issues associated with resettlement of humans to allow for elephant or wildlife habitat to be (re-) established are numerous. Finding new habitat for problem causing elephant groups can be equally socially tedious. Relocation requires technical capacity and financial resources that are commonly lacking. In addition, relocation effects are not always effective, with elephants walking back to their original habitat, or dying en route.

Electric fencing, a high-tech solution which is implemented in many southern African countries, tends to produce good results initially. The initial capital can be provided for by international agencies, but the maintenance and upkeep of fences often constitutes a major challenge. The long-term commitment required from international agencies or other institutions to fund the program makes this option unfeasible in many cases.

At present no single strategy effectively eradicates crop damage. The eradication of crop damage through a complete separation of elephants and humans appears to be an unobtainable goal. Wildlife managers agree that the objective now is to advocate co-habitation, and in order to do so, the

conflict should be reduced to tolerable levels. To this end, crop protection strategies are being implemented by farmers to allow for some prevention of crop raiding. It forms only one component of conflict mitigation, and efforts must also be directed to wider and more long-term strategies, such as transferring benefits from conservation activities to communities that bear the cost of living with wildlife, and land use planning, which tackles the underlying causes of conflict. Nevertheless, crop protection forms a tangible and valuable approach and if well planned and executed with the full participation of community members, will reduce the levels of conflict between elephants and farmers and thus promote co-habitation. The attitudes of rural communities and their relationship with elephants are critical to the success of elephant conservation schemes.

A community-based approach to conservation is being widely recommended for projects across the world. In recent history, many governments assumed total control of wildlife and natural resources and communities were sidelined by centralized control. Today this trend is being reversed, with resource right being reverted to the community level through community-based management and conservation schemes. Besides the practical considerations regarding control by government authorities on the use of resources, the motivation behind this strategy is that if communities understand the value of natural resources, (illegal) use and over-

exploitation shall diminish. To increase the resilience of communities and compensate for the foregone benefits of collecting and using natural resources, and the associated costs of HEC, local communities should be involved in the management and should benefit from natural resources. When natural resource conservation provides benefits

to communities, people will be more tolerant towards intended conservation activities and the possible conflicts arising from it.

Protection: Crop protection methods

Crop protection methods share a similar purpose—they are designed to reduce crop damage by deterring elephants from entering cropping areas. However, there are many approaches, some experimental and some tested, from elephant rangeland across Africa and Asia. The fact that elephants are able to get used to any single deterrent has implications upon the selection and implementation of methods.

It is recommended that a combination of techniques be employed in order to minimize the risk of elephants becoming used to any single method. New methods described in this manual are

not meant to replace ones already in use in communities.

Some methods will be based upon traditional methods already used for centuries, whereas others are modern methods. There is a variance in the level of technology which is used, as well as the basis upon which the methods work, e.g. acoustic, olfactory or tactilely. For the purpose of this manual, techniques were divided into protective measures, effective before the elephants reach the field, mitigative measures, used once crop raiding has occurred and long-term preventive measures, to avoid the problems between human and elephants from occurring in the first place. Below a distinction is made on the basis of whether a technique is a protective or a mitigative measure, while later in the report preventive measures shall be

discussed (see chapter 4).

Protective measures are aimed at deterring elephants from coming to the fields of farmers. The techniques are based upon influencing elephant's behavior or ecology. Some techniques can be set up with locally available material, which others require high level of technological insight and materials and substantial funds and external assistance would be needed in order to implement the techniques.

2.1 Traditional techniques

Traditional techniques imply techniques which have been used throughout history by local communities, and of which knowledge is passed on from generation to generation. They are most often based upon scaring elephants away from fields, in the hope that the elephants will return to more natural habitat. They generally utilize low-tech materials that are widely available. Most traditional methods are of limited use as a deterrent, usually only temporarily easing the problem, or shifting it to a neighboring area.

Usually a community will rely upon just a few methods, and these will be used repeatedly with little variation.

- **Noise:** The most common way that farmers attempt to chase elephants out of fields is by making loud noises. Farmers use a range of noisemakers, such as beating drums, tins and trees, 'cracking' whips in addition to yelling and whistling to chase elephants.
- **Missiles:** Farmers throw rocks, burning sticks and, occasionally, spears at crop-raiding elephants. This usually involves getting close to the animals, and therefore the danger level is high.
- **Bamboo Blasters:** Farmers create a hole in a piece of bamboo stick measuring about 45cm long. A powdered chemical substance called calcium carbide is then poured into the hole. About a spoonful of water is sprinkled on the chemical substance and the hole covered for a few minutes. A white stream of vapor comes out of the hole when the covering is removed, and when lighted it makes a great noise.
- **Pipe bombs:** In Zimbabwe farmers manufacture pipe bombs using a metal pipe sealed at one end and half-filled with water. The pipe is bunged and placed on the fire, and when it heats up the bung explodes from pipe with a noise similar to a .458 rifle shot. In Zambia some farmers are able to make homemade gunpowder that they use to make small explosions.
- **Fires:** Fires are lit on the boundaries of fields or are carried as burning sticks by the farmers. Approaching elephants will get deterred by the smoke, or anxious of the flames. This method becomes ineffective when it rains since the fires are usually put off.
- **Visual deterrents:** Brightly colored cloths and plastic are hung from a simple fence at the edge of the fields. Such visual deterrents may have an initial 'scaring' value, but it is unlikely this method would provide any reliable protection.
- **Guarding the field:** Farmers get organized into communal groups to guard crops on rotational basis from a series of watchtowers that are constructed. They can be equipped with strong torches and tin drums to scare off elephants when they are encountered. They can also light fires and keep them maintained late into the night along the front line of farms.

Traditional methods are typically hard to evaluate objectively –often =being used in combination with each other and sometimes with other methods. Nonetheless, as a counter-measure they show some degree of success when compared to areas where no crop defense is practiced, and most particularly where elephants, for whatever reason, do not continually challenge the deterrence system. These methods shall still be used as much as possible if farmers consider that they work.

2.2 Acoustic Deterrents

Acoustic deterrents are noises which are used to deter elephants, either by the shock value of an unexpected loud noise, or by specific noises that are known to scare elephants.

↳ **Disturbance shooting:**

Disturbance shooting is the firing of gunshots over the heads of crop-raiding elephants. Used across the continents, disturbance shooting has been a long-standing deterrent. However, it is at best considered a temporary respite from elephants, as there is a large body of anecdotal evidence to suggest that elephants habituate to gunshots if exposed to them for a prolonged period of time. This method relies upon centralized units responding to the problem, and is therefore constrained by transport and logistical problems.

↳ **Cattle recordings:** Played-back recordings of Masai cattle noise to elephants in Amboseli NP, Kenya scared off elephants. These elephants are periodically hunted or injured by the local Masai tribesman. The outcome was that elephants retreated from the recordings because of an association made between the danger posed by the Masai, and the sounds of their cattle. This method may only be effective in areas where a similar relationship

between people and elephants exists. In addition, it requires expensive recording and playback equipment.

↳ **Elephant's communication:**

A number of studies of elephant communication have demonstrated possibilities for manipulating elephants' behavior with playbacks of vocalizations. Some research has been done into using elephant communication as a deterrent; researchers in Namibia recorded elephant warning calls, and played these back to elephants in order to scare them away. In another study, bull elephants were attracted by playbacks of recorded 'post-copulatory rumbles'. There are a number of other calls that could be used to attract or repel elephants that are less well understood, but perhaps could be used in the future.

↳ **Alarm system:** Alarm systems are acoustic devices that are usually established at the boundary of the farms and set off by a tripwire. The loud noise from the alarm when the elephant touches the trip wire is primarily meant to alert farmers

to the presence of elephants, but it also has some deterrent effect.

↳ **Bells:** In Zimbabwe cowbells were strung along a simple string fence at the edge of vulnerable fields. As the elephants attempted to enter the fields they started the bells ringing and this alerted the farmers to the elephant's presence.

↳ **Electric sirens:** In Namibia, researchers tested a system using sirens that were triggered when elephants made contact with the trip wire. They reported some success. In Sri Lanka researchers have found similar success with such methods. The limitations are that in high rainfall conditions it is difficult to maintain electrical systems, and they are also vulnerable to theft.

2.3 Physical Barrier Systems

Barriers work on the principle of physically excluding elephants from the crop fields. The method involves putting up physical barriers in the pathways of elephants to ward them off from crop fields. A wide range of potential methods exists.

- **Trenches:** In Asia, digging trenches along a Park boundary or around water points has been pursued with varying degrees of success. The concept is to dig a trench that is wide and deep enough so that an elephant cannot step over it (elephants are not able to jump). In some places, trenches are filled with pointed sticks to further deter elephants from crossing. Trenches, in conjunction with electric fences, have worked well if both are well maintained. The major drawback with trenches is that, if dug on a slope, they encourage soil erosion. Elephants have also been known to fill them in by kicking soil from the edges into the trench, thereby filling it and enabling them to cross. Trenches required a large initial investment of labor and intensive maintenance.
- **Covered trenches:** Experiments with shallow trenches overlain with branches and leaves have been successful in India. When an elephant treads upon the leaves it feels the substrate give and fears it will plunge into a pit, so it withdraws. The trench need only be 30cm deep but it must be wide enough to prevent an adult bull from stepping right over it. The covering must be well maintained, because once an animal realizes that this is a hoax, this tactic will be ineffective. This method requires a great deal of labor and in high rainfall areas soil erosion may be a problem.
- **Bamboo spikes:** Short lengths of bamboo are sharpened and dug into the ground so that the spike protrudes vertically from the soil. Spikes must be positioned close together and in a wide band so that the elephant can neither step between the spikes, nor step over the entire barrier. Elephants will not tread on the spikes, as they require large surface area to distribute their weight. In areas where bamboo is readily available this method would be cost-effective, but the limitations would be the labor and time involved in the construction. This was tried in Asia and had limited success.
- **Sharp Stones:** A barrier of sharp stones is laid out in a broad band and the elephants will avoid crossing them (as above). The method is time-consuming and labor intensive, but ultimately cheap and low maintenance. It would require access to a large number of suitable stones.
- **Brick walls around water structures:** A barrier of bricks is constructed around water structures to prevent elephants from crossing them. Walls need to be at least two large rocks in width, and 1.8m high and a sufficient distance from water tanks and pumps to prevent elephants reaching the installations from outside the wall.
- **Barriers with natural material:** One of the most common barrier materials is thorn branches. Logs and sticks are also piled up around the edges of fields. In some areas, farmers simply run bark ropes from tree to tree and hang pieces of white cloth from the line. None of these barriers can stop a determined elephant but any boundary to cultivated area creates a psychological barrier that can have some impact.

The most important aspect is the availability of the materials to build the barriers. The limitation of barriers is that they are generally expensive to construct, require a lot of labor and require high levels of maintenance. Much anecdotal evidence suggests that elephants will overcome even the most sophisticated barriers over time. In addition, permanent barriers may not be popular with farmers as they are seen as a restriction on agricultural expansion.

2.4 Vegetative barriers

Vegetative barriers are put up by planting certain plant species which have features to deter elephants. Besides providing a barrier to approaching elephants, they could also serve to demarcate farms.

↳ **Barrier of unpalatable crops:**

One can reduce the attractiveness of cultivated areas by planting unpalatable crops in vulnerable areas, e.g. on farms at the edges of protected areas. Crops may include sisal, chili, tea, ginger or oilseed. These unpalatable crops may not necessarily deter the elephants. However, these crops will not be raided and therefore the farmers' livelihood is ensured. However, these crops will not be raided and therefore the farmers' livelihood is ensured. More information on land use planning is given in chapter 4.

↳ **Barrier vegetation:**

Mauritius thorn (*Caesalpinia decapetala*), has been planted in a number of locations in Africa to act as a 'natural barrier' against crop-raiding animals such as primates. However, there is very little data to suggest that this barrier is effective against elephants. The plant is known to be very invasive and its distribution by animals (through eating and depositing the seeds) into a protected area should be closely monitored. Cactus and Sisal have also been tried but little systematic research exists on the effectiveness of these plants to halt elephant movement.

↳ **Buffer zones:**

The purpose of a buffer is to create a zone of reduced attractiveness between the conservation area and surrounding crops. This involves clearing secondary forest on the boundary and creating some physical distance between boundary and cultivation. An optimal buffer zone should contain unpalatable crops (such as sisal) grown adjacent to sub-optimal elephant habitat. There is, however, no evidence that such boundaries make a difference to elephant movements as the elephants can just pass through them to the cultivation.

2.5 Fencing

Fences are made out of strong (artificial) material and erected to create a physical blockade between elephant habitat and human settlements. In southern Africa, trial and error has led to the design of most effective and efficient fences.

- ↘ **Non-electric fencing:** Strong, non-electrified fences have been used successfully to restrict elephant movements in many parts of Africa and Asia. These fences are usually built with wooden or steel poles driven vertically into the ground. Heavy gauge wire or cable is strung between the poles and drawn tight. While these fences do meet with some success, they can be expensive to erect and maintain.
- ↘ **Electric fencing:** electric fences come in a variety of designs, and have been used to protect small farms, enclose entire wildlife reserves, or deflect animals away from specific areas. Elephant fences are usually high-voltage and incorporate a number of design features, including extra pole wires, to protect them from elephant attacks. Elephants are notorious at seeking out the weak points of fences. The materials, installation and maintenance costs make electric fencing impractical for applications in poorer developing countries unless funded by international aid agencies. In addition, equipment such as solar panels, energizers, batteries and wire are all desirable materials, and there is a high risk of theft.
- ↘ **Single-strand fencing Electric fencing:** These kind of fences can be adapted to rural conditions, and by cutting down on building costs, can become more affordable. For example, it is possible to construct a fence with just a single live strand and hang it from bush poles instead of metal stanchions. This cuts costs considerably, but there is still a need for insulators, solar panels and batteries. In South Luangwa, Zambia, small community plot fencing failed because despite community ownership, there were problems maintaining the fence in a working state.
- ↘ **Bee hive fencing:** This is relatively a new method being promoted in the project area based on evidence of its efficiency as expressed by park management of Bia and Kakum Conservation Areas (a novelty of the project). The bee hive fence consists of lining the boundaries of a farm close to the park with bee hives at an interval of 4 meters. When the hives colonize, the bees become a natural deterrent each time an elephant gets to the bee hive fence. The bees cause irritation to the elephants and thereby drive them back into the park. This method also serves other purposes including enhancing pollination on the farm as well as providing honey for income and/or food for local households.

A key factor determining the success of a fence is ownership. When a fence is constructed and maintained by a government agency, such as the Wildlife Division, then it is viewed as a government fence, and the maintenance is left to the government. Rarely does a government agency have the resources to maintain a fence year after year, and inevitably the fence deteriorates. If the community builds a fence (with the cost of materials subsidized by a donor agency), and the community is responsible for its upkeep, then success is more likely.

Hoare (1995) concluded that fences around parks or reserves tend to give poor results. His point is bolstered by the case of the Shimba Hills Nature Reserve in Kenya that was fenced in the mid-1990s. In January 2003, there were complaints from nearby communities because elephants had broken through the fence. Similar problems have been reported in the Zambezi Valley of Zimbabwe, where a community fencing project failed because of repeated damage from elephants.

2.6 Chemical deterrents

Chemical compound(s) with potential deterrent capabilities may prove an effective way to deter elephants, either as an unpleasant or painful smell, or as a targeted compound such as a hormone, which creates fear.

↘ **Capsicum deterrent:** Repellents based on resin from *Capsicum* spp. (Chili peppers) have been used to alter animal behavior for a variety of species, including bears, ungulates, dogs, and humans (Bullard 1985). The resin contains capsaicin, a chemical found in fruits of *Capsicum* spp., which is the agent that makes them taste hot. The irritating quality of this stimulation produces a burning sensation that mammals find extremely unpleasant. A Capsicum aerosol has been tested extensively as an elephant deterrent in Zimbabwe (Osborn, 2002) and has been found to effectively repel crop-raiding elephants. The limitations to this method are that the system is relatively expensive and the delivery of the pepper spray to the elephant is entirely reliant upon wind direction.

Another capsicum deterrent under development in Zimbabwe (M. La Grange, pers. Com.) is chili 'bombs' which can be shot at elephants. Upon impact, they would burst open and deliver the capsicum to the skin of the elephant. This deterrent was once tried in the Kakum forest in Ghana with little success because the wind direction kept changing and the 'bombs' were intercepted by the trees. This technique is however continuously under development and improved upon and many provide positive results in the future.

↘ **Chili bricks:** Chili bricks are a low-tech technique that evolved from the pepper spray. Working on the same principles that elephants are repelled by Capsicum, the chili bricks only utilize simple, locally available materials. Dry chili is mixed with elephant or cattle dung, and compressed into bricks. The bricks are then sun-dried and burnt at the edge of the fields. The bricks burn slowly and produce a strong smelling cloud of chili smoke. Research in Zimbabwe has shown this technique to be both effective and easy to manufacture.

exhibited by female elephants to atomized secretions collected from the temporal glands of musth bulls may be potentially usefully as a repellent for non-musth bulls and females. Recent tests with chemicals present in musth secretions, one ketone in particular, seems to prevent elephants from consuming food items encircled by rings of dilute concentrations of this naturally occurring ketone (Rasmussen et. Al 1993). This method may have great potential, but at present there is no practical application for the approach.

'heat' on your tongue). A very hot pepper measures approximately 30,000SU. The capsaicin is mixed with soybean oil and inserted into an aerosol can with a modified spray nozzle (similar to hairspray). The mixture is then pressurized and when the trigger is depressed, an atomized spray cloud is produced. Atomizing the capsaicin into a gas cloud makes it an extremely effective irritant. The effects of pepper spray on elephants are far more severe, including temporary blindness which last from 15-30 minutes and a burning sensation of the skin which last from 45 to 60 minutes.

↘ **Musth secretions:** As African elephant temporal gland secretion was tested as an elephant repellent with somewhat ambiguous results. The avoidance reactions

↘ **Pepper Spray:** To extract the capsaicin, peppers are soaked in solvents. The amount of 'heat' in a pepper is measured in Scovil Units (1 SU=just enough capsaicin to feel

Mitigation: Easement of HEC

C Mitigation measures are designed to reduce the level of impact upon elephants and people, and lessen the perceived problem by humans. The common denominator in most of these methods is that people are receiving some kind of benefit from living with wildlife, so that the tolerance towards and acceptance of HWC increases. The methods below are all being implemented and tested with some mixed results, and more research is needed to assess their effectiveness for the long-term management of co-habitation between human and elephants and the resulting conflicts.

These methods are not merely valid for the control of HEC, but for HWE management as a whole. Local ecological circumstances, as well as peoples' cultures and socio-economic conditions will determine the suitability of the described techniques and their potential to address HEC. Moreover, the policy and legislative framework of a country or location are important pre-conditions to allow for some of the methods below to be implemented.

3.1 Benefit sharing

In line with current trend in conservation to place more emphasis on community involvement in the management of natural resources, benefits sharing can be a method to harness more support from communities for conservation efforts. The concept is that part of the revenues stemming from revenue-generating conservation activities, such as eco-tourism and hunting, are made available to a community fund, which can then be used to undertake development priorities in a community.

In this way, communities would benefit from the existence of a conservation area with elephants, and it is thought that the level of tolerance from crop-raiding elephants would be increased.

In practice, benefit sharing between protected areas or forest reserves and communities experiences a multitude of problems. Quite often, there are insufficient revenues to finance the needed conservation activities, let alone to share these revenues with riveraine communities. Another impediment

are administrative arrangements; e.g. formal acknowledgement of existence, the setting up of a bank account and the actual claiming of the funds with responsible authorities.

Although the belief is that communities are more willing to live with HEC once they receive benefits from conservation, farmers will most likely still be deprived of their means of subsistence once HEC occurs, and will still feel jeopardized by the presence of elephants.

3.2 Problem Animal Control (Pac) Units

In a number of African countries, experimentation is ongoing with the deployment of a special Problem Animal Control (PAC) unit. The units are based at strategic places and have all the needed clearance and necessary material available in order to solve HWC. In this way, the PAC unit is able to respond rapidly to reports on the occurrence of HWC. The usual procedure is that at first instance, PAC units attempt to drive elephants back to the conservation area by making noise and shooting in the air. In case that is unsuccessful, they may revert to shooting the problem elephant. PAC units can also be tasked with training community members or even local police or military based in an area on how to deal with HWC and the establishment of protective techniques. Sometimes they are also tasked with controlling illegal activities such as poaching.

3.3 Shoot and sell Live game sales

Another method to create more goodwill with communities is that when problem animals are shot (e.g. by PAC units), their meat, skin, ivory etc. is sold. This method is most commonly used in Namibia and has been labeled 'shoot and sell'. The revenues can be (partly) transferred to communities. Shooting an elephant while it is crop raiding has in the past been considered the best way to 'teach' the other elephants to stay away from crops. However, in many situations, the elephant responsible for the majority of the damage cannot be identified, and a token animal is killed. Often the reaction of the elephants is merely to change areas of raiding rather than to stop crop-raiding altogether.

The sale of live animals to private reserves, protected areas, zoos, private collectors etc. can compromise an important

source of income for a conservation area. It could involve removing a specific problem animal and transferring it elsewhere. Proceeds from live sale can also be shared with community. For both these methods, it is important that the system is well-regulated, to avoid deceiving designations of a problem animal situation, in order to obtain the animal for live sale or for its trophy. Knowledge of the population size of the concerned species would also be needed in order to determine the desirability of off take of individuals. On the other hand, the method does ensure that the problem animal is removed and future problems with that individual are avoided and that the community or farmer gets some kind of monetary compensation for the damage caused by the animal.

3.4 Tourism hunting

Tourism or trophy hunting, the hunting of wild game by (foreign) tourist, compromises the most important source of income from conservation activities in many African countries. Depending on the population size of a given species in a country, CITES assigns a quota to a country for the number of animals that can be shot.

In practice, it is often difficult to designate specific problem causing animal to be shot by a sports hunter, while the logistics involved for the sports hunter to get to the exact location can be lengthy. However, proceeds from sports hunting can be shared with the community, and the community receives other benefits such as employment opportunities to assist with sports hunt.

3.5 Compensation and Insurance Schemes

Compensation schemes involve the transfer of funds from wildlife authorities or government to those farmers or communities affected by HWC. The HWC insurance scheme is a rather innovative approach which involves the establishment of a system where community members each contribute a certain percentage to a fund, and an individual receives compensation from this fund in case he or she is affected by HWC.

Both methods require an accurate assessment of the cause of crop damage, or injury or death of a person. In many countries the validation of HWC reports and assessment of damage are seen as an impediment to implementing these kinds of

schemes; it is difficult to get to the site timely and it is tedious to determine the exact cause of damage/injury/death. It is therefore believed that these kinds of schemes are very prone to dishonesty on the part of affected people. Moreover, it is believed that these kind of schemes do not encourage people to protect their crops and assets, and many even stimulate them to provoke HWC insurance scheme operates on a more local scale, and therefore reports can be more easily verified. It is however necessary to train designated local people to verify the causes of damage. While the insurance scheme can impose certain practices which need to be undertaken by the participating farmers to avoid HWC, the method seems promising.

3.6 Translocation

The removal of a problem animal through translocation to another area has been used in limited situations. The cost is extremely high and the operation involves specialist equipment and skills. In several cases the operations have ended in failure, either with an animal dying en route, or with the animal returning to the source area a short time after its release. An objection to this method is that it relocates problem animals to a new area, and therefore the initial problem may just be displaced to a new site.

3.7 local land use planning

Small-scale planning of land use activities in a community could provide some easement of the occurrence of HWC. In the case of elephants, for example, people could be encouraged to farm away from conservation area boundaries, water points and land used by elephants as a passage (corridors). Besides that, stimulating the production of non-palatable crops ensures that crops are raided by elephants and food security for the farmer is ensured.

It is often challenging to convince farmers to change practices which have been used over generations, or farm in a different area, since local knowledge of production systems and 'the land' is an important prerequisite for successful farming. On the other side, if food security is jeopardized continuously, local land use planning may be the only resort to avoid the attractiveness of farms to elephants. Chapter 4 describes in more detail the possibilities of various forms of land use planning in order to prevent human-elephant conflicts from arising.

Prevention: Land use planning

C

The crop protection strategy so far described will reduce the incidence of crop damage in the short term. However, none of the above methods tackle the root of the conflict problem.

The underlying land use problem is that farmers are growing food crops close to the conservation area. To address the root problems it will be necessary to institute a system of land use change around the conservation areas. Land use planning is a fundamental human-elephant conflict management strategy and offers possible the best chance of overall success.

Sheer land space is required to yield food, structural timber, fuel, wood, cash crops, and water, and further land space is needed for location of houses, recreation areas, reserved and amenity areas. In this saturation the state of balance between man and environment can maintained only by a similar increase in the skill with which to manage the land's productive capacity. In most developing countries, this necessary increase in skill is not apparent. In the process, land is destroyed resulting in reduced habitat for wildlife. The absence of and appropriate land use plan for most communities especially those close to the boundary of conservation areas accounts for the persistent conflict between humans and wildlife.

4.1 Land use planning

Land use planning affects almost every aspect of life in rural communities. It helps decide where in our communities farms and homes should be made; where parks and schools should be located; and where markets and other essential services should be provided. It means managing our land and resources. It helps each community to set goals about how it will grow and develop and to work out ways of reaching those goals while keeping important social, economic and environmental concerns in mind. It

balances the interests of individual property owners with the wider interest and objectives of the whole community. Good planning leads to orderly growth and the efficient provision of services. Land use planning is an ecosystem – based tool that can link the environment, the community, and the economy in ways that help ensure the sustainability of resources. It is the process, communities use to identify appropriate and compatible uses for land within their jurisdictions. It is therefore a large scale and a long-term method aimed at aimed

at creating space for people and wildlife to live together. It is a key element of community-based method for mitigating human-wildlife conflict and fundamental for good management of wildlife, but land use planning and any changes in land use that are agreed can take several years to negotiate and implement. Most farms tend to be conservative in outlook and the greatest challenge of our time is to persuade them of the need to improve their land use so that they can live in harmony with both their land and their neighbors (wildlife) by the

adoption of improved land use practices which also encourage higher yields from smaller areas. The advantage to any farmer of planned land use is that once the plan been devised he would have a complete inventory of productive natural resources available to him, upon which an agreed plan to action will be based. This indicated where he may best make

use of his money and directs his efforts for the benefit both of himself, the land he works and wildlife.

Because of the diversity of sites where human-elephants conflict occurs there are few guidelines for addressing this process. But it has long-term benefits for alleviating human-elephant conflict,

improving conservation for other species and habitats and establishing a positive relationship with local communities. Additionally, it offers opportunities for forest fringe communities to cultivate crop without any fear of elephant damage and thereby help to improve the livelihoods of the people.

4.2 PEC management through land use planning

The following land use changes have been proposed for their potential to address human-elephant conflict:

- Reducing the conflict interface
 - o Reduce human settlement encroachment into elephant range;
 - o Relocate agricultural activity out elephant range;
 - o Consolidate human settlement patterns near elephant range.
- Facilitating defense against problem elephants
 - o Change the location of crop fields (e.g. to close proximity with dwellings);
 - o Change the cropping regime (e.g. to crops not affected by elephants, diversify into more types of crops possibly reducing overall exposure, use intercropping layout, change timing of harvest).
- Increasing efficiency I agricultural and economics production
 - o The last two points above are relevant here, plus;
 - o Reducing the dependency of the local economy on agriculture.
- Modifying problem elephant movement
 - o Create or secure elephant movement routes/ corridors;
 - o Secure elephant and human access to different water points (e.g. by manipulating the water supply to change elephant distribution, or by using salt licks to facilitate elephant redistribution);
 - o Reposition protected area boundary;
 - o Expand protected area(s);
 - o Designate new protected area(s).

Involvement in land-use planning is typically a long term process that requires government support, often legislative and/or policy changes, and can be extremely expensive to implement. Modifying the spatial distributing of humans and /or their crops, changing the cropping regime (e.g. temporally, spatially and /or by introducing different crops), and possible even developing the economy from agriculturally dependent to wherever might be locally viable, thus all fall into the realm of conflict management. For farming communities, the most practical land use planning techniques of mitigating human-wildlife conflicts are:

- 1 Relocate agricultural activity out of elephant range;
- 2 Zoning or change the location of crop fields (e.g. to close proximity with dwellings);
- 3 Reduce human settlement encroachment into elephant range.
- 4 Cultivating non-target crops such as chili-pepper, ginger etc.;
- 5 Intensification of agriculture.

Relocation of Agricultural Activity:

One of the goals of land-use planning is to affect a shift of food crops away from the forest edge or conservation area. To avoid repeated crop damage from elephants, farmers would have to move their food crops away from edge if the forest on their own accord. While this will reduce the risk of crop damage, it will also improve food security in the communities.

Zonation of farming land: barns et al (2003) suggested a zonation system whereby farmers with land within 1 km of park boundary would be discouraged from growing food crops over time, and would be encouraged to cultivate crops that are unpalatable to elephants. They would also seek alternative sources of income. This would reduce the attractiveness of the land immediately adjacent to Park boundary to elephants. In the second zone, more than 2km from the park boundary, farmers could cultivate subsistence food crops.

Reduction of human settlement encroachment into elephant range:

Due to population growth and poor planning in most rural communities, settlements are being established close to park boundaries. One of the surest ways of mitigating human-elephant conflict is to reduce human settlements encroachment into elephant range.

Cultivation of non-target crops: little research exists on elephant ‘preferences’ for particular crops, but there are a few crops that elephants appear not to eat. Many of the crops currently grown by small scale farmers are vulnerable to wildlife. But ginger and chili peppers are ash crops that are resistant to damage

by elephants. By growing crops such as ginger and chilies, rural farmers are able to harvest a crop that is commercially viable, resistant to elephants, and useful in the defense of their fields.

Intensification of agriculture: An improved grain yield is the result of improved planting material (seeds), cultural management and climate, and the interactions among these factors. If farmers were to grow food crops in shared intensive plots away from the forest, they would not reduce the area of land under cultivation, they would also move their crops away from only reduce the area of land under cultivation, they would also move their crops away from the forest edge. By intensify agriculture, increasing inputs and boosting yields, farmers would maximize their returns from smaller plots of land. Intensification would be facilitated through the introduction of improved practices such as fertilizers application, use of improved planting materials and enhanced cultural management. These activities must be preceded by demonstration followed by supervised practice.

Below is a list of potential types of demonstrations for land use change:

- Method demonstration- this is the process of demonstrating how a particular activity is done, e.g. using knapsack sprayer; a shoulder plastic/metal bag for keeping pesticides for spraying, etc. Farmers present are given the opportunity to try their hands at the activity. This results in the acquisition of practical skills by farmers.
- Results demonstration – This is the

process of showing the results of a particular activity. The process also includes explaining the various activities that produced the result. It enables the farmers to see the benefits of a particular activity or sequence of activities but does not result in any skills acquisition by the farmers.

- Whole (complete) demonstration this includes all steps of exposing farmers to technology. The process includes both method and method and result demonstrations. The process.
- Results in acquisition of skills, seeing results and evaluation of the technology in terms of constraint and benefit. It is recommended that this type of demonstration is followed in introducing the non-target crops to communities.

Please see Annex A for a description of issues to be considered for implementing land use demonstration.

Community-based problem-elephant control

Centralized control over resources has made way to a more decentralized approach, where communities are involved to a greater or lesser extent in the management and conservation of resources. It is widely believed that to protect natural resources effectively, especially outside protected areas, local communities must be involved in the ownership, management and benefits sharing from wildlife conservation. Most government wildlife departments are unable to meet the demand for crop protection, and is therefore important to shift some of the responsibility for crop protection to the farmer. Farmers who lose crops to elephants often feel powerless to combat the problem. If farmers are to be engaged in conflict mitigation, when they must be empowered with appropriate tools and training to tackle the problem. Communities who engage in crop protection, and have proprietorship over the methods of crop protection they use, are more likely to

succeed than those who do not engage the problem.

The specific goals of any particular intervention PEC scheme are likely to vary depending on the details of the situation concerned, but possible goals for conflict resolution schemes may include:

- Reducing the amount of crop losses to elephants
- Improving local people's attitude towards, and perceptions of, a protected area and its wildlife
- Helping affected farmers to improve agricultural production practices
- Increasing the amount of crops being harvested locally, through improved local yields (via improved cultivation and plant husbandry techniques, use of different crop types, improved harvesting and/or storage techniques for example).
- Reducing levels of poaching

The CBPEC approach incorporates a number of PEC methods. All components need to be used to make the system effective. The methods of CBPEC are diverse and largely new to elephant management, which reduces the probability of elephants habituating to them. In addition, using techniques based upon chili peppers inflict pain upon mammals, and so represents a 'real' threat as opposed to an 'empty' threat like disturbance shooting. The system is not panacea; it is not 100% effective at preventing crop damage. Rather is designed to reduce the impact of conflict upon a farmer's livelihood. CBPEC is not designed to replace existing methods. It is complementary to all current methods and should be employed in addition to present PAC efforts. The system is flexible and can be adapted to new situations. The crop protection methods considered suitable for a certain community should be selected from both traditional and 'new' methods after using assessing the problem in the community.

5.1 Background

Human-wildlife conflict involves both humans and wildlife; therefore one needs to have a comprehensive understanding of the issues at stake. In order to obtain the necessary information to fully assess a situation, it is appropriate to consider the conflict circumstance from a number of different perspectives. It may not necessarily be adequate, or appropriate, to concentrate just on devising techniques for deterring elephants from raiding crops. Any such intervention must be acceptable to the farmers themselves as well as effective and affordable, thus it may be advantageous for trainers/researchers investigating crop protection methods to have some understanding of local social systems, labor divisions and constraints, gender roles, and land and crop tenure systems, when designing deterrence strategies. For example, farmers in Zimbabwe have been reluctant to adopt electric fencing patterns whereby individual household crops are fenced, yet this was shown to be the most effective pattern against crop raiding elephants. Instead it was more acceptable to local farmers that farms be community fenced rather than individually fenced separately to reduce cost of fencing and ensure community unity (WWF, 1997, Hoare 2000).

As well as having detailed information about the nature of the conflict, it is useful to have knowledge of local perceptions of the severity of damage, how and whether people use particular strategies to try to minimize the levels of crop damage occurring and who actually makes formal complaints about crop

raiding by elephants. Such information will help identify which methods will be suitable to communities, whether crop damage per se is the important issue or whether it is a proxy for another issue. In addition, this information will help to identify target groups for consultation in any intervention program.

A non-lethal elephant management system, Community-Based Problem Elephant Control (CBPEC) has therefore been developed that is suitable for community based crop protection. The concept was developed in Zimbabwe by the Mid-Zambezi Elephant Project. It stemmed from the understanding that current PEC technique did not effectively assist communities living alongside elephants (Osborn and Parker 2003). There was a need for a system of PEC that the farmers could administer as and when necessary. EBPEC fits well with the concept of community-based conservation, in that it provides farmers with the tools to manage conflict problems, and therefore enables them to deal with their own wildlife problems. CBPEC was developed to overcome many of the problems experienced by current PEC methods. The system enables rural communities to take control of the elephant conflict in their areas by providing farmers with the necessary skills, resources and confidence to defend their crops. These methods provide respite for farmers when used in combination with other methods but not necessarily offer a 100% foolproof solution to the problem of elephant crop damage in fields.

CBPEC is designed to be:

- ↳ Inexpensive and therefore affordable to rural farmers. This is a critical aspect for the methods to be used on a long-term basis.
- ↳ Effective at chasing the elephants, as farmers will soon give up on ideas that don't work. For the methods to be considered effective the problem of crop damage must be reduced.
- ↳ Decentralized, so communities take responsibility for their own conflict issues and no longer rely on outside help. Farmers must take the responsibility for guarding their crop. The crops are theirs, and only they will receive benefit from them.
- ↳ Locally available, so that farmers can source the materials from within their arena.
- ↳ Adaptable, and suited to local conditions, if a particular material is not locally available substitutes should be effective as well.
- ↳ Multiple methods. By using multiple methods the system aims to overcome the problems of elephant habitation. Elephants will not easily get used to a single PEC method because the methods used will rotate and be added to.

A multi-stage approach, involving the use of methods which are gradually

more technology-based, and costly, is advocated here. Firstly, introduce community based low-tech methods that the farmers can take responsibility for themselves. Secondly, implement mid-tech options that require some input from outside. Thirdly, high-tech options, requiring intensive outside management, should be considered where further action is required. The

multi-stage approach will be important while low-tech options are ultimately more suitable for communal use as they require little or no outside support. Besides that, getting the community motivated, and having them take responsibility for the interventions, is core to the success of conflict mitigation. In general low-methods require a greater level of community involvement, and

therefore are an appropriate starting point. In one would start with high-tech options it is impossible to regress to low-tech as the farmer's expectations will already be very high. Moreover, to start with them. High-tech options should however not be disregarded, and may play an important role if the low-tech options fail.

5.2 Introducing CBPEC methods in a community

In order to introduce the crop protection methods to the farmers, demonstration sites are a crucial means of bringing information across. The sites should be maintained for up to 6 months to allow sufficient time for the farmers in surrounding communities to visit them, and to maximize the chance of elephant encounters. When establishing a demonstration site it is essential to consider the following:

- ↘ Level of risk. A higher risk of crop damage is deemed important as one purpose of the demonstration plots is to test the effectiveness of elephant deterrents. Therefore all potential sites will be within 500m of the forest boundary, and will contain food crops near maturity. This presents a high potential for being raided by elephants.
- ↘ Vulnerable crops. Select a site that has food crops such as cereals (e.g. maize) or tubers (e.g. cassava), as these crops will act as an attractant to the elephants and are therefore at greater risk.
- ↘ Season. The demonstration plot must be established during the cropping season, when food crops are maturing.
- ↘ Accessibility. The primary function of the demonstration plots is to introduce the new methods to surrounding communities. The site must therefore be accessible to a large number of people so that the methods can be displayed to as many communities as possible.
- ↘ Communities of the farmer. The farmer must have an interest in the project, so that he not only maintains the demonstration site and actively defends his field, but also passes on the information to other farmers in the area.
- ↘ Level of Community Participation: Community participation is a measure of how receptive each community is to new elephant deterrent methods, and how much they currently engage in crop protection activities. High interest in crop protection could speed up wide-scale adoption of the techniques.

Traditional methods which communities are already using should be maintained in the CBPEC approach. Examples are the making of noise by banging on trees or metal items like car tyre rims or empty drums and use of bamboo blasters and pipe bombs; guarding of the farms at night, possible based upon a pre-determined schedule of duty for each specific farmer; the use of fire in areas where elephants are regular visitors and shooting in the air by wildlife authority staff. Traditional methods are cheap to apply, they can be easily applied by the farmer, have some limited effects and are commonly not fatal to elephants.

Methods producing some kind of barrier between the farm and the elephant habitat are also suitable to be used in the community-based approach to problem elephant conflict resolution.

The following barriers are deemed highly suitable:

- A fence made out of poles and string, which would not be strong enough to stop elephants from entering a farm, but will show an approaching elephant that there is something in its way and to hold other materials in place. Bells could be attached to the fence in order to alert the farmer of approaching elephants and give the impression to the elephants that there are people nearby. The bells should be hung on the fence every ten or so paces. A more technology-dependent technique would be connect the fence to a battery-operated alarm. The noise made by the electronic alarm when an elephant touches the fence is also intended to warn the farmer who is guarding the farm the elephants have come. The farmer can then make other noises using bamboo blasters, or other methods like fire to scare the elephant away.
- A buffer zone can be created by clearing secondary forest or other vegetation on the boundary of the conservation area, so some physical distance is present between the boundary and cultivation. The cleared strip of land can then also be easily used for patrolling the fields at night by selected individuals.
- Trenches (3m wide by 3m deep) have been found to be effective, and avoided by elephants. Such trenches are dug round fields with maturing crops and slightly covered with tree branches and palm fronds.
- Sharpened stones, stakes are sometimes placed on elephant path approaching fields or round crop fields. The pain experienced when the elephants step on the spikes keep them away from the fields.

The large advantage of barriers is that they provide a more permanent solution. On the other side, one should keep in mind that barriers need an initial investment of labor in order to be build, and need to be maintained. Items such as bells and a battery operated alarms are vulnerable to theft.

Deterrents could be used to make the methods described above even more effective. Chemical deterrents based on chili pepper, as described in section 2.1.6 and in the box below, have proved effective against elephants if set up and maintained correctly. The advantage of using chili based techniques is that they are relatively cheap as compared to other deterrents, have no long term harmful physical effect on elephants and can produced locally. Box 2 below give more detailed information on producing chili fences and chili dung bricks.

BOX 2

Techniques based on chili

How to make chili fences?

Some parts of the elephant's body are very sensitive and it has a good sense of smell. Because of this they find pepper very irritating and painful when they come in contact with it or when they smell it. Elephants also do not like the smell of grease, used or dirty oil from cars.

- 1** The chili pepper must be ground to a powder and mixed with grease or used oil in a container. If you can smell the pepper as you mix it with grease or oil as you breathe while working, then the elephant can smell it over one hundred times more. You may also wear a pair of gloves helps the chili powder to stick on the pieces of cloth.
- 2** Smear mixture of pepper and grease on pieces of old cloth.
- 3** Tie these pieces of cloth on the fence with the side of the cloth with the pepper-grease or used oil mixture facing the farm.
- 4** Make sure that there are enough of these pieces of cloth around the whole farm for maximum effect. Place one cloth every four paces from the last one.

How to make chili dung bricks?

Ground hot chili pepper is mixed thoroughly with dung of elephant and molded into bricks. In the absence of elephant dung, any material that will help the ground chili pepper to stick together could be used. The dung of goats and sheep could be good substituted. These bricks are burned in fires along the field boundaries to create a noxious smoke that lasts for 3-4 hours.

- 1** Collect some fresh elephants dung and break into small loose parts. Mix well with chili pepper. Add water little by little to help with the mixing. Find an empty container, which is open on both ends to use as a mould.
- 2** Place the container on a hard surface and fill the container or mould with the pepper dung mixture. Press and pound the mixture until it is hard.
- 3** Carefully, push the hard but wet pepper – dung brick out of the mould and place in the sun to dry. The brick is ready to use when it is dry enough to burn well.

5.3 Community involvement

Farmers should be trained in the crop protection methods by means of demonstration within the selected sites. Due to the practical nature of crop protection systems, it will be necessary to conduct a physical demonstration at each site.

Conduct a short meeting with the selected farmers to explain the goals of the program. State that the program is coming to introduce ideas that will help reduce the levels of conflict within the community. The following points MUST be made clear:

- ↘ The methods are not expected to be 100% effective.
- ↘ No single method will be effective, and combinations of methods are essential.
- ↘ The methods are some of many possible methods, and will later be added to and adapted.
- ↘ Farmers will need to guard the fields in addition to these methods.
- ↘ Explain the methods to be introduced in detail, and purpose behind.

Box 3 below provides some important guidance for using the methods.

BOX 3

Important notes for using the methods

- ↘ Elephants are very clever animals and it is not possible to know when they will attack a farm.
- ↘ Elephants easily learn new things. So, one day they will learn that the fence and the bells do not hurt them. To be able to use the methods for a long time to prevent elephants from damaging crops, use the methods at the elephants are likely to visit a farm, for example when the crops are ripe and ready to be harvested.
- ↘ Elephants avoid farms where they think that people are present.
- ↘ Elephants have much stronger senses especially of smell and touch. That is why they do not like chili.
- ↘ Elephants easily learn new things. So, one day they will learn that the fence and the bells do not hurt them new things. To be able to use the methods for a long time to prevent elephants from damaging crops, use the methods at the time that elephants are likely to visit a farm, for example when the crops are ripe and ready to be harvested.
- ↘ When these methods are used in combination with other methods, the elephants cannot easily get used to them because if they come to well protect farm and see a fence, hear bells and smell the chili that irritates them, then there are too many different things that they do not like.

It is important that farms are activity involved in the process of establishing the methods, therefore, the discussions should be followed by an active demonstration, where a suitable field (preferable with food crops near maturity) is selected and the above methods are implemented with the

farms. Effective use of demonstrations for technology transfer is very important extension tool. The success of promoting a technology is very much dependent on how well the demonstrations are carried out. As an extension too, demonstrations are aimed at exposing farmers to the potentials of a new technology. It

also provides the opportunity for the farmers to see and learn how to use the technology and make decisions on whether to adopt the technology or not and where possible adapt part of the technology to suit their conditions. Demonstrations are aimed at achieving three main purposes:

- Awareness Creation
- Skills Training
- Technology adoption to farms' situation

Please see Annex B for a description on how to initiate work with a community.

A 'community scouts' programme mobilizes communities around an issue that affects them seriously. It encourages

the communities and supports them to participate in finding solutions to problems affecting their livelihoods within the context of community based problem animal control. Community scouts can assist with patrolling the fields at night, setting up of the techniques in the community and teaching the techniques to community members and even to other communities. The situation should be monitored closely not only

for its impact terms of responsibility and accountability to the larger community. Materials which are needed, such as boots, torches and note books, should be arranged by the community through, for example, a community funds which is established through voluntary contribution.

Please see Annex C for guidelines for the training of Community Scouts.

5.4 Monitoring and Evaluation

The chosen method and techniques must always be in good condition. That is, it should be kept fully functional and operational. This makes them effective so that they are able to work whenever an elephant visits. Although it is known that elephants usually attack crops where there are no people, when it rains or on dark nights when there is no moon, it is not exactly known when an elephant will attack a specific farm. Another reason why the chosen/selected methods should be looked after is that if they are in good condition, then all the different methods are working at the same time. The farmer should go around the farm every morning to check whether elephants came to the farm and if they came what they did. It is important to gather information on what the elephant did when they came to the fence, while it will provide proof on whether the selected methods are function.

Community Crop Production Scouts and the farmers need to report to Wildlife Division for farms damaged by elephant as soon as possible. The following information should be recorded about the farms which are raided, using the methods explained in this book when elephants raid the farm. A community scout/teacher/village committee chairman should write up the following information after discussing with the owner of the farm that has been visited by elephants

- Name of the farmer
- Name of the community
- Size of the farm
- Crops being grown on the farm
- What methods were used to protect crops before the new methods?
- Which of the old methods do you prefer?
- Which new methods are being used?
- Was the farmer guarding his farm when the elephants came?
- Did the elephants enter the farm?
- What crops did they destroy?
- What is the size of the area that the elephants destroyed?
- If the elephants did not enter the farm what did they do?

There are complications with employing rigorous quantitative monitoring and evaluation systems. By nature crop damage is highly irregular activity and subject to extreme variations in time and space. Therefore it is difficult to make any conclusive comparisons of crop damage between years without long-term data available. A system of monitoring should be implemented which compares data protected farms which data collected in 'control' non-protected farms. The data should be collected in a comparable format, and efforts should be made to ensure that the beneficiary communities or farmers and control communities or farmers share similar physical characteristics. It is important that standardized protocol for monitoring and

evaluation is established at the program. Please see Annex D for an example of a CBPAC self-assessment form.

Three approaches to monitoring are recommended. The first is a quantitative scheme designed to document every incident in which an elephant makes contact with a deterrent, collected exclusively within beneficiary communities of farms. The second is a comparison of the intensity of crop damage incidents within and outside the beneficiary farms. The third will be a series of semi-structured interview conducted with a sample of farms to assess their views of all deterrent methods. The specifics of each approach are below:

- **Deterrent monitoring:** Enumerators will evaluate each event in which elephants contact a crop protection method. Enumerators will describe the elephant reaction to the method, and evaluate the success of the method, using a standardized reporting format.
- **Crop damage:** Crop damage intensity will be measured for each crop damage incident in all selected communities, both within and outside the project area. Crop damage will be recorded to a set format, using a data sheet similar to that displayed in Annex E. The exact proportion of the field damaged will be calculated for each incident, and will be compared between the project and the control communities. If the crop protection strategy is effective, it is expected that the intensity of crop damage will be lower in project communities than in those 'outside'.

- **Farmer evaluation:** Enumerators will assess farmer's attitudes towards the crop protection methods by means of short, structured interviews. The farmer's views and opinions are important factors, as in this community-based approach farmers will need to be brought into the selected process if they are to be successfully implemented. Interviews should be conducted with farmers before and after the main cropping season. The farmers will assess the deterrent methods that are familiar with using a set of criteria. The criteria for assessment reflect the overall investment required from the farmers, and effectiveness as an elephant deterrent.

To analyze results it will be best to combine the ranks of individual farmers to create a 'league table' of most favored methods across the study area. Summary should be conducted at an individual and community level of gauge variations in opinion. This assessment will be conducted both at the beginning of the program (before new methods have been introduced) and at the end. Comparing the two data sets, it will be possible to measure the farmer's opinions of the new methods in comparison to the traditional methods they originally used.

Someone should be assigned to take charge of all data. This person collect the data sheets and enter the data into a data base. Data should be summarized monthly to see what patterns of crops raiding are occurring and which CBPEC methods are working well.

5.5 Concluding remarks

Two themes have emerged from the development and field testing of techniques for mitigating human-elephants conflict: firstly, that no single method works in isolation, but rather that combinations provide the best chance of success; and secondly, that is of fundamental importance to include those who are most affected by the problem in the solution. This is best achieved by transferring ownership of the management strategies to the local communities that are affected, especially where they are 'high-tech' and prone to maintenance needs and skill acquisition. When dealing with issues as emotive as elephant conservation and conflict alleviation, it is to be expected that the way forward will be complex.

It follows that the future will bring new technologies, advances and understanding, and that any management strategy must be adaptive in nature.

Conflict alleviation is a two-sided equation. Both elephants and people are in conflict, and the goal is to enable coexistence and sharing of resources on some scale. This is best achieved by addressing both sides of the equation. Increasing tolerance for elephants and adapting the human landscape will always be the most difficult. But approaches based on sharing the benefits and management of elephants with those most affected by them and a willingness to get involved in long-term

processes like land-use planning and economic development are fundamental. It is very likely that land-use planning to reduce the human-elephant interface offers the best solution.

Human-elephant conflict is likely to be an eternal problem, but its very existence is cause for optimism. As long as there are elephants to conserve there are opportunities for income generation and local management of the costs and benefits, including management. It is unlikely that there will be a widespread remedy, but rather each area and problem will need to be tackled independently, locally and on an appropriate scale. The key concept is adaptive management.

Practical Exercises

Chapter 1.0

- What do you understand by the term human-life conflict?
 - Why and where does conflict occur?
 - What factors account for human-wildlife conflict?
- Enumerate problems caused animals and suggest the effect on people
- Identify the types of human-elephant conflicts in your area. Rank the conflict issues in order of severity, with 1 representing the most severe and 6 the least.
- Mention 5 traditional methods of reducing crop damage by elephants in your area.
 - Mention 3 advantages and 3 disadvantages of traditional methods mention.
- Mention 5 'new' methods animal controls.
 - Enumerate 5 factors that should be considered in designing community based problem animal control method.

Chapter 2.0

- Describe the methods you use on your farm
 - Rank its effectiveness from 1-6 (1 –most effective and 6- least effective).
 - Determine the financial costs and 'other costs' (e.g. fear of scaring the elephant away in the field) of the methods you use on your farm.
- make an assessment of which 'new' methods would work in your area, and describe what you would need to do in order to implement the techniques (e.g. liaise with an NGO to build fence, contract researchers/wildlife division to test sprays, organize community to dig trenches etc.).
 - Make a list of things you could try, and what would be feasible to try (based upon the criteria described; i.e. cost, effectiveness, level of decentralization etc.).
- What is meant the term 'tourism hunting' as a means of controlling problem animals?
- Discuss the various compensation and insurance schemes
- Mention 2 disadvantages of the removal of problem animals through translocation to other areas.

Chapter 3.0

1. Mention some of the benefits communities and farmers will obtain from a well-planned land use
 2. (a) Sketch the plan of your community and identify the major landmarks such as rivers, roads, schools, markets, field with attractive crops for elephants etc., in relation to the conservation area boundary.
(b) Identify the weaknesses of the current land-use plan and develop a more appropriate plan.
 3. Identify non-target crops and show the production of these crops
-

Chapter 4.0

1. (a) Describe and demonstrate the process of mixing chili with grease, putting on cloth and hanging of rope.
(b) How bad does the chili hurt when you rub it on your skin or smell it etc.?
(c) Describe and demonstrate how to make the dung bricks.
2. Divide the group into 2. Ask one group to go back to the village/farm, let the others ring the bell and see if the first group hears it and vice versa.
3. (a) Identify what a 'good community scout is all about' e.g. good eyes, strong physique etc.
(b) Describe what kind of materials a scout would need to do his/her job well.

Annex A

Issues to be considered for implementing land use demonstration

Important issues to be considered for implementing and effective demonstration process are:

1 Acquisition and study of detailed protocol: A demonstration protocol is a document that spells out the procedure to be followed in conducting a particular demonstration. It is important that protocols are studied and well understood before one embarks on implementing a demonstration.

A good demonstration protocol should contain, at least, the following information

- Objective of the demonstration
- Field layout
- Time for various activities
- Type of data collect and when to collect each data
- Time for conducting field and things to discuss during each field day

2 Selection of collaborating farmers: A demonstration is aimed at comparing potential of new technology as against what is being practiced within a locality. It is therefore important that demonstrations are carried out under farmers' field conditions. This therefore calls for the identification and use of a collaborating farmer typical of the area. The use of a farmer-to-farmer extension.

Under the participatory extension approach with groups e.g. Common Interest Groups (CIGs) as units of contract, the following procedure is suitable for identifying and selecting good collaborating farmers:

- Arrange a meeting with the target group for which the demonstration is meant
- Discuss the current technology being used and present the new technology to the group laying emphasis on its requirement and expected benefit
- Allow the group to discuss among themselves the need for the technology and decides whether to have a demonstration or not

- If the group decides on having a demonstration, let the group, with your facilitation, select two or more possible collaborating farmers who are typical of the selection.

N.B.: The above process is important since the collaborating farmer(s) should be socially accepted within the community and must also be a representative of potential users of the technology.

3 Site selection: The following must be considered in site selection for a demonstration:

- Appropriateness of the site for the technology to be demonstrated e.g. demonstrating an erosion control technology on a visible sloping land
- Accessibility and visibility (easy to reach location, located amongst lots of farms)
- Land area (demonstration, require at least a land size of 20 x 20 meters to be visible to passersby).

4 Establishment of demonstration: Before undertaking the establishment of a demonstration, the trainer should read the demonstration protocol carefully and make sure he/she understands the steps to be followed. This could be done in a group to make sure that all participants and if possible collaborating farmers understand what must be done. Some important issues to be taken note of and agreed on by all people involved in the demonstration are as follows:

- Plot size
- Specifications of the technology (plant Spacing, etc.)
- Timing of various activities (e.g. planting, fertilization, etc.)
- Data to be collected during the demonstration

- Need to record unexpected variable such as drought, floods etc. that might affect results of a demonstrations
- Time to arrange field days

During the establishment of the demonstration, as many farmers as possible should be invited to participate in the activities. It is important for farmers to participate practically in the establishment of a demonstration plot, as it will also serve training session for them. The trainer should as a matter of course, explain every activity to the understanding of the participating farmers and provide the opportunity for them to try their hands at doing things themselves. It is important that, during establishment of demonstrations, the trainer is always there to supervise all activities. He/she should not leave the farmers to do things on their own since this could negatively impact on the results of the demonstration. A demonstration plot must always be established alongside a farmers' practice (control) so that the new technology can be directly compared to that which is currently being used.

5 Management of demonstration: the management of demonstration is as important as its establishment. In general, management of demonstration is a collective responsibility between the collaborating farmer(s) and the trainer. The trainer will provide all necessary technical support. Where members' of a group select the collaborating farmer, the whole group should be encouraged to participate in the management of the demonstration plot. Good management of a demonstration plot is a requisite for achieving good results. It is important to note that, 'a bad demonstration is worse than no demonstration'.

6 Field days: during days farmers are invited to see and discuss important issues about the demonstrations. Issues to be discussed could relate to some visible results of the demonstration or an activity that is to be undertaken on that day.

Field days are very important in the demonstration process as they provide the opportunity for other farmers, apart from the collaborating farmer, to critically follow the progress of the demonstration. There are no set rules to the holding of field days but the following could serve as a guide to extension

officers:

- At least three (3) field days should be held during the period of the demonstration (during establishment, mid-way and end).
- Field days should also be held when there are important activities to be implemented e.g. spraying of pesticides, fertilizer application etc.
- As many farmers as possible within the community should be invited to participate.
- Farmers should be consulted about a suitable date for a field day (within a suitable range of date). Announcement of the decided field day should be conveyed to the community at least 3-4 days in advance.
- During the field day, the collaborating farmer should be the presenter. The trainer should provide the technical backup.
- A field day should take about 2 hours to complete. If the exercise takes too long time, farmers will find it very difficult to participate next time
- In most cases, there is no need for financial commitments in the organization of a field day for farmers within their own community. However, when farmers are taken out from their community for a field day/tour, trainer needs to provide transport and if necessary snacks/lunch.

7 Evaluation of Demonstrations: This is an important activity in the demonstration process, which is often ignored by trainers. The elevation of demonstrations by farmers is an activity that is aimed at achieving the following:

- Feedback from farmers on their perception of the technology
- Provides the opportunity for farmers for farmers to make suggestions for adapting the technology for their situation
- Help to put the technology and its result in perspective among the farmers

Evaluation of demonstration should be done within the community in which the demonstration was established. As many farmers as possible should be invited to the meeting. As on field days, the collaborating farmer(s) should be the main presenter during the meeting. The role of the trainer during the

elevation meeting will be to facilitate the discussion and help with the explanation of technical issues that are beyond the scope of the collaborating farmer(s).

The elevation meetings should provide information on the following as they relate to the technology being promoted.

- Suitability of the technology to the farming system and constraints that need to be addressed; both social and technical
- Economic viability of the technology in terms of input and output
- Accessibility of the technology as it related to wealth groups, gender, land resources, etc.
- Possible changes in the above, when discussed well are good indicators of a possible adoption rate of the technology within the community.

8 Follow-up visits: The main reason for undertaking a demonstration is to promote the use of a particular

technology. It is therefore important to under-take follow-up visits to the community to find out how the farmers are using the technology. The follow-up visits will help to know whether farmers are using the technology or not. It will also create the opportunity for the trainer to know whether the technology is being used rightly or not. If there are farmers using the technology, the trainer will have the opportunity to know the problems being faced by the farmers using the technology, the trainer will have the opportunity to know the problems being faced by the farmers using the technology and come up with possible ways of addressing the problems. During the follow-up visits the trainer could also organize discussion meetings with sole aim of sensitizing more farmers about the benefit of the technology to promote a rippling effect within the community

9 Records keeping: This is a very important component of the demonstration and decision on the future of the technology is dependent on the data collected.

Annex B

Initiating work with a community

Step 1: Appointment

- Make an appointment with the affected community for a meeting to discuss the problem
- The appointment should be made with the relevant community leaders who are able to call meeting
- As many community members as possible should be encouraged to attend the meeting.
- Make sure women are also invited.
- Agree with the leaders on a date, which is convenient for the community to allow as many members of the community to be at the meeting.

Step 2: Meeting

The main aim of the meeting is to discuss the history of the elephant problem in the area, what they have been doing about it and the opportunity to try some new simple method. During the community meeting, be careful not to give the impression that you will bring magic that will immediately solve the problem.

- Inform the community clearly that you have brought simple methods, which have helped to reduce the problem in other areas so it is up to the community to see if the methods work.
- No food or compensation or any other payment will be given to anybody expect knowledge on how to reduce the problem.
- Find out from the community what methods are being used to protect crops from elephants.
- Ask the community to choose a field where they would like to test the methods and agree on a date inspect the field.
- Make sure that every member of the community, including woman, has the opportunity to express his/her views. No one should be allowed to dominate the discussion.

Step 3: Inspecting the farm to be protected

When the field is chosen, inspect the farm together with the owner of the farm and some leaders or members of the community. The following questions should be asked:

- Is the farm near the park boundary? Has it been attacked by elephants recently? Is it near enough to the community for them to see the methods being tried?
- Does the farm have crops that elephants like to eat especially maize, cassava and plantain?
- Is the owner of the farm willing to use the methods in his or her farm and organize people to help?
- Is the owner of the farm willing to buy the materials that are required to protect the farm?
- Is the farmer prepared to train others to share lessons with other members of the community?

IMPORTANT

Community meeting should arranged at a time when attendance is likely to be good. The community should be asked to select a farm, which has recently been raided. The owner(s) of the farm should be willing to buy the necessary materials. The owner(s) of the farmer should be willing to test the methods being introduced.

Step 4: Farms to protect

- Only farms that have a history of being raided by elephants should be protected, mainly those that are very near the park boundary
- The selected farms should be protected as soon as the crops are about to mature and the crops should not be left in the field long after it is ready for harvesting
- Protected farms should be guarded until the crops is harvested.

Step 5: 'Things to do' for community training

When interacting with people in rural communities is essential to observe local customs, and also to present yourself in a manner that will encourage trust and openness. The following advice for community work was generated from group discussions.

Things to do:

1. Preparation
 - Prepare well in advance. If you are planning a meeting with the community, plan the content, objectives, timing, materials and background you need to carry the meeting out.
 - Know your target group-is it women, men, or a mixture of both?
 - Notify the community of your intentions well in advance and make sure you notify and meet with community leaders if necessary.
 - Select appropriate venue for task, e.g. farm for field demonstration.
2. Meeting
 - Dress appropriately, and observe local customs, e.g. accepting water on arrival when it is offered.
 - Never display superior behavior.
 - Use positive body language. Do not distance yourself from the group: if people are sitting on the floor, then do the same.
 - Use clear and plain language-do not complicate the message you are delivering.
 - Make sure that people have the opportunity to participate. Plan activities so that there are some discussions and debates.
 - Keep any lessons short-do not bore the participants with long speeches.

Things to avoid:

- Don't make any false promises.
- Don't pander to the community. You are there to do a job and make sure to accomplish exactly that.
- Don't request any gifts or accept any favors-they may be conditional.
- Don't provide undue services or favours, as this will be expected of you, and may cloud the message of the project.
- Do not engage in long speeches about conservation and how important it is. This will cause farmers to assume you feel the elephants are more important than the people.
- Do not over-theorise: what is needed is practical solutions to a practical problem.
- Work with and encourage people who are enthusiastic. Other may be persuaded by example.

Involve both men and women in the exercise

Annex C

Guidelines for training communities scout

i Course Content

Community scouts must be trained to patrol fields and park boundaries. To ensure effectiveness and legitimacy of the training programme in terms of conformity with current trends, it is important that the Park Manager makes input in the content of the training programme for the scouts. The course should be delivered in sessions.

Session topics could be:

- National Parks and community relations
- Characteristics and behavior of elephants
- Definition and qualities of a community scout
- Anti-crop raiding deterrents
- Field patrols
- Safety measures and First Aid
- Reporting

ii Training Objectives

For each session, specific objectives and what the participants are expected to learn should be identified. For the overall course, however, the following objectives could be set:

- To orient community members as volunteer scouts in crop raiding prevention and monitoring tactics.
- To impart basic skills in field craft necessary for night time patrols within their community areas.
- To clarify the responsibilities, activities, supervision and reporting requirements for the community scouts.
- To agree on an outline of an operational plan (how many patrols per week; how many people; where does the patrol go; what information does the patrol collect and what do they do with it), for further elaboration later in the individual communities.

Emphasis should be placed on the importance of institution and capacity building on an on-going basis in the form of extension. Non-formal classroom type training for communities is at best a scoping and public relations exercise. The bulk of the training is done in the community visits, informal discussions and the follow up when the communities can see and try things.

iii Guidelines

The significance of the community scouts is in terms of providing continuity and promoting community based problem animal control in an area of high human-elephant conflict. Each community should form a community scout cadre with an average member of scouts per community. Each group should elect a leader and a secretary who will be responsible for the custody and updating of the patrol record book which should be available for inspection by other community members and other stakeholders.

All scout groups should commence activities within a few days of the training. It is expected that there will be a high level of enthusiasm among cadres and community members. Other community members who express interest to join the cadre should be allowed to form another groups while others should be encouraged to support the community scouts with some materials. The operations of the scouts should be monitored closely.

The following issues are pertinent to the continued operations of the community scouts:

- Provision of requisite materials: Efforts should be doubled to ensure that the community scouts programme is supported through provision of the requisite materials and training. Community members could support the scouts by making small contributions from sale of their produce.

- Follow-up visits: It is crucial that the scouts keep good records and making their monthly summaries. More importantly, the scouts need to know that the work they are doing and the data they are collecting is useful for their own communities and for other stakeholders.
- Additional training: This should be provided to the scouts in monitoring and analyzing their own activities. This will ensure that patrol returns are used to plan future patrols. Other areas of training could include present wildlife legislation, crop damage assessment, discipline and report writing.
- Stakeholder participation: Apart from the communities themselves, the pivotal stakeholders, defined as those stakeholders whose response have a major direct or indirect impact on a given activity or issue, including the Wildlife Division should be involved.
- Internal conflict: As the programme has apparently become popular and more people want to join, internal conflict may arise. This should be anticipated and contained before it gets out of hand. The challenge is to discern at which point to intervene so that the intervention does not interfere with the internal process or come too late to resolve it. As such support mechanisms need to be spelt out clearly.
- Elite capture: it is quite common that a programme with good intentions inadvertently creates an elite group of individuals in the community creating the danger of elite capture for motives other than those originally intended. Structures to ensure accountability need particular attention as part of the monitoring strategy.

It is important at this stage to anticipate any possible source of problems to the community scout programme. These might include:

- Institutional failure: Where the assumptions made and structures put in place for the continuation of the community scouts fail to respond to the challenge leaving the scouts unsupervised, unmonitored, unmotivated and unsupported in their work.

Intervention failure: In the event that elephants habituate to the current methods and increase crop damage, the community scouts might feel that they are not making any difference or that their efforts are ineffective. This might lead to a loss of morale among the scouts and loss of confidence in the community. It is important therefore that a mechanism for monitoring the effectiveness of the community scout programme is in place as a fallback position. In the face of such a threat, options for the medium and or high technology methods alongside the traditional ones should be kept open.

Annex D

CBPEC self-assessment Form

This form is designed purely to help us evaluate how effective the training session has been. It is not a test, and there is no need to place your name on the paper. Please answer each question as honestly as possible.

Instructions

Answer each question by placing a ring around the number that most suits your present skills or knowledge in that field.

1 no knowledge	2 a little knowledge	3 some knowledge	4 a lot of knowledge	5 excellent knowledge
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1. How well do you understand the term "human-wildlife conflict"?

1 2 3 4 5

2. Give some examples of human-wildlife conflict:

3. How well do you understand the team Problem Animal Control (PAC)?

1 2 3 4 5

4. Give some examples of PAC methods that you know:

5. Are you familiar with current methods of PAC?

1 2 3 4 5

6. How much do you know about the strengths and weaknesses of current PAC techniques?

1 2 3 4 5

7. What do you know about community-based PAC (CBPAC) techniques?

1 2 3 4 5

8. How well do you understand the strengths and weaknesses of CBPAC?

1 2 3 4 5

9. How well do you understand the terms "passive" and "active" PAC?

1 2 3 4 5

10. How well do you know how to set up CBPAC systems?

1 2 3 4 5

11. How well do you feel you would be able to maintain in CBPAC systems?

12. How well do you feel you would be able to train others in CBPAC techniques?

1 2 3 4 5

Annex E

Crop damage report form

REGION:..... FORM No.

DISTRICT:.....

SUBDIVISION

VILLAGE: REFERENCE FOR EXACT LOCATION:.....

ENUMERATOR NAME:..... DATE OF INCEDENT:.....

COMPLAINANT(S) NAME(S):.....

DATE OF COMPLAINT:.....

CROP	DAMAGE Type	QUANTITY BEFOR DAMAGE (Tick One Category)			AGE OF CROP (Tick One Category)		
		Good	Medium	Poor	seedling	In-term	Mature
Crop 1
Crop 2
Crop 3

DIMENSIONS OF TOTAL FIELD WHERE DAMAGE OCCURRED

LENGTH PACES or METRES or OTHER MEASUREMENT (SPECIFY)

WIDTH..... PACES or METRES or OTHER MEASUREMENT (SPECIFY)

DIMENSIONS OF TOTAL FIELD WHERE DAMAGE OCCURRED

LENGTH PACES or METRES or OTHER MEASUREMENT (SPECIFY)

WIDTH..... PACES or METRES or OTHER MEASUREMENT (SPECIFY)

OTHER DAMAGE	TICK	AND	SPECIFY DETAIL
FOOD STORE
WATER SUPPLY
THREAT TO LIFE
HUMAN INJURY
HUMAN DEATH
OTHER (SPECIFY)

ELEPHANTS INVOLVED	NUMBER	ELEPHANT SIGN (Tick)
GROUP SIZE (TOTAL)	
Adult Male (if known)	TRACKS ONLY
Adult Female (if known)	Animals visual
Immature animals (if known)	Other (Specify)

Your comments:

Was This Report Forwarded?

To Whom?..... Where?.....

When? How?

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