Human-Elephant Conflict Mitigation

A Training Course for Community-Based Approaches in Africa

Participant's Manual

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Foreword

Human-elephant conflict (HEC) is a complex and pervasive problem that occurs throughout the range of the African elephant wherever elephants and people share the same habitat, often competing for the same resources. HEC is recognized by the IUCN Species Survival Commission's African Elephant Specialist Group (AfESG) as a major threat to the long-term survival of the species.

Recent case studies from across sub-Saharan Africa have shown that communal crop-protection efforts, using an integrated package of simple, low cost and locally-adapted deterrence methods can quickly and effectively reduce local levels of elephant damage. While this can help to reduce site-specific conflict to tolerable levels, sustainable management of HEC will also require measures, such as national land-use planning and policy changes to ensure that affected communities receive a greater share of the benefits and fewer costs from living with elephants. Thus, while the community-based conflict mitigation methods that are the focus of this training course constitute an important "first line of defense", long-term HEC mitigation needs to be supported by activities at higher levels.

Making extensive use of real-life examples and case studies, combined with a strong practical element, this training course aims to provide African wildlife managers and local residents with the basic tools needed for effective community-based HEC management. The course material has been developed by some of Africa's leading experts on HEC mitigation and covers all the essential topics in five comprehensive modules: 1. Responsibility for managing HEC; 2. Elephant behaviour & ecology in HEC situations; 3. Recording, reporting and analysis; 4. Overview of main mitigation measures currently in use and 5. Main steps in developing a community based HEC mitigation strategy. Taken together these modules are designed to equip HEC mitigation practitioners with the knowledge and skills needed to effectively manage conflict at the site level.

I am therefore pleased to give this course the official seal of approval as a "certified training product" of the AfESG.

Dr. Holly T. Dublin
Chair
IUCN/SSC African Elephant Specialist Group

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Downloading this Course

The course is certified by the IUCN/SSC African Elephant Specialist Group and will be available for download from the following websites: African Elephant Specialist Group http://iucn.org/afesg/hec, Elephant Pepper Development Trust www.elephantpepper.org and the World Wide Fund for Nature http://www.panda.org/africa/elephants.

Cover photo: Bull elephants crossing a fence, Sengwa, Zimbabwe. F. V. Osborn

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The Purpose of this Manual

This training course is designed primarily to train African wildlife managers in human-elephant conflict (HEC) mitigation. The course provides a detailed introduction to implementing a programme of community-based HEC mitigation through a combination of theory training and practical exercises. This manual is designed to involve the participants actively in the learning process: in addition to trainer presentations there will be group discussions and participant presentations. With participants coming from many different backgrounds, it is anticipated that everyone will benefit from sharing their experiences on HEC.

There is a strong practical element to this training course, requiring participants to engage in a series of activities. These include measuring crop fields and damage areas and constructing mitigation measures such as fencing and chilli dung bricks. This practical experience is considered essential in gearing managers up to establish their own mitigation programmes. In addition, participants will gain experience of conducting practice interviews and will learn how to use a range of PRA techniques. HEC is mainly about people, and interacting with people is a critical component of any HEC mitigation programme.

Training Objectives

The specific objectives of this training programme are to ensure that participants are:

1. Trained as trainers in community-based human-elephant conflict mitigation techniques;
2. Competent with the theory and practice of community-based conflict mitigation methods;
3. Able to assess and compare the effectiveness of current conflict mitigation techniques; and,
4. Familiar with the history of human-elephant conflict.

Following the course it is anticipated that participants will be fully conversant in the following activities:

1. Training farmers in the concept of community-based HEC management and mitigation;
2. Establishing community-based HEC mitigation projects using suitable methods;
3. Monitoring and evaluating all HEC mitigation activities; and,
4. Adapting HEC mitigation methods to local conditions.

Manual Design

The training manual consists of 5 modules, each tackling a different topic of HEC mitigation. Each module follows the same structure, commencing with a brief introductory presentation outlining the purpose of the module and the key objectives. The bulk of each module consists of a combination of trainer presentations using PowerPoint and group discussions. Case studies are widely used and they are displayed in grey boxes within each

module. A list of the key references used in each of the modules is supplied at the end of each section. Two of the modules have associated practical sessions which are detailed at the end of the relevant sections. Each module is summarized below.

1. What is Human Elephant Conflict and Whose Responsibility is it?
In this module we explore the types of human-elephant conflict (HEC) that occur and investigate their impacts upon rural communities. We discuss who has had responsibility for HEC management through history. By means of case studies we then examine current strategies for elephant management across Africa and identify the key problems facing elephant management.

2. Elephant Behaviour and Ecology in Conflict Situations
In this module elephant ecology and behaviour is explored in order to further our understanding of HEC. Elements of elephant habitat selection, distribution, diet and social structure are presented and discussed in the context of elephant conflict, in order to help explain the patterns of crop damage that occur. Understanding the behaviour of crop-raiding elephants will assist in the development of effective mitigation measures.

3. Mitigation Measures used in HEC
In this module we review the HEC mitigation measures currently in use across Africa today. Individual mitigation methods are critiqued and key problems are identified, including logistical failings, and the need for intervention from wildlife authorities or expertise and financial support from NGOs. Community-Based Conflict Mitigation (CBCM) is a new approach which helps to overcome these problems by enabling rural farmers to address their own conflict issues using a range of low-cost and effective methods that farmers administer themselves. The core methods of this approach are presented here. Finally, long-term methods for conflict mitigation are discussed, including land-use planning and generating benefits from wildlife through community-based conservation.

4. The Importance of Recording, Reporting and Analysis of Problem Incidents
In this module we give an overview of recording, reporting and analysis of HEC incidents. We first define qualitative and quantitative data types and identify the advantages and disdavantages of using each system. We then present methods for the monitoring of HEC using both qualitative and quantitative means. Guidance for field work is given and a suggested template for data collection is provided. Data collection methods are rehearsed through practical exercises in crop damage assessment and interviewing techniques. Finally, we explore the analysis of data for annual reports and for more advanced requirements.

5. Developing Community-Based HEC Mitigation
This final module explains how to go about implementing an HEC mitigation project using CBCM methods. There are several stages, commencing with a pilot survey of current HEC methods, which leads into the selection of methods suitable for each area. Following this we describe the criteria for selecting demonstration sites and the procedure for showcasing the CBCM methods to communities, including practical exercises in establishing each mitigation method. Finally, we

discuss the impacts of conflict upon rural livelihoods and look into options for small enterprise development.

Participant Evaluation

The course is evaluated by each participant according to the amount they feel they have learnt during the training. The assessment is conducted using a form that the participants fill in both at the very beginning of the course and at the end. The assessment of knowledge is based on a series of questions about human-elephant conflict and its mitigation. Each form is anonymous, as it is not the intention to assess individuals, but rather to evaluate the course as a whole. The form is displayed at the end of this manual.

The Organisations Involved in this Manual

Elephant Pepper Development Trust

The Elephant Pepper Development Trust works to improve the livelihoods of rural farmers living in elephant range through the deployment of appropriate conflict mitigation methods and the development of agricultural techniques which promote elephant conservation.

Since 1997 Elephant Pepper Development Trust has engaged with rural communities in Zimbabwe to develop practical solutions to conflict with elephants. It has pioneered the use of community-based methods for crop protection, using chilli and a range of locally appropriate techniques that help farmers solve their own problems.

Today Elephant Pepper works in seven African countries and runs training courses in conflict management for African elephant managers. For more details please visit our website at: www.elephantpepper.org

African Elephant Specialist Group (AfESG)

The World Conservation Union (IUCN) Species Survival Commission's AfESG is one of the most active of the +100 taxonomic Specialist Groups of the Species Survival Commission (SSC). The SSC is the largest of the six commissions of the World Conservation Union (IUCN). It is the mission of the AfESG to promote the long-term conservation of Africa's elephants throughout their range.

Recognizing human-elephant conflict (HEC) as a major conservation priority, the AfESG established in 1996 a five person Human Elephant Conflict Task Force (HECTF) to carry out research into and develop "tools" for the management of HEC in Africa. Since that time the HECTF, subsequently renamed the Human Elephant Conflict Working Group, has produced numerous reports, technical briefs and practical guidelines on HEC. These products include a comprehensive Decision Support System for HEC managers, a standardized data collection protocol and accompanying manual for training local enumerators, a review of compensation schemes for elephant damage, review of problem elephant policies and management options, technical briefs on the use of fencing and other barriers, plus numerous case studies from across the continent. Most products are available in French, English and Portuguese as free PDF downloads from the AfESG's website: http://iucn.org/afesg/hec

World Wide Fund for Nature (WWF).

WWF is one of the world's largest and most experienced independent conservation organizations, with almost 5 million supporters and a global network active in more than 100 countries. WWF's mission is to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature by:

- conserving the world's biological diversity
- ensuring that the use of renewable natural resources is sustainable
- promoting the reduction of pollution and wasteful consumption.

In 2000 WWF launched a new African Elephant Programme. Building on 40 years of experience in elephant conservation, WWF's new initiative supports strategic field interventions to help guarantee a future for this threatened species. WWF's elephant projects focus on: improving wildlife policies and legislation; conserving elephant habitat; reducing illegal killing of elephants and the illegal trade in elephant products; reducing human-elephant conflict; improving the livelihoods of people living alongside elephants; and increasing public support for elephant conservation.
http://www.panda.org/africa/elephants

Module 1

What is Human-Elephant Conflict and Whose Responsibility is it?

Photo: Crops damaged by elephants. F.V. Osborn

Module 1

What is Human-Elephant Conflict and Whose Responsibility is it?

1.0 Introduction

In this module we explore the types of human-elephant conflict (HEC) that occur and investigate their impacts upon rural communities. We then discuss who has had responsibility for HEC management through history. By means of case studies we then examine current strategies for elephant management across Africa and identify the key problems facing elephant management.

1.1 Background to Human-Elephant Conflict

A broad definition of human-elephant conflict is "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 in Africa including birds, rodents, primates, antelopes, buffaloes, hippopotamus, bush pigs, and elephants. While it is widely recognised 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.

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. Elephants elicit the greatest fear from rural communities because 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 both Africa and Asia.

HEC occurs throughout the elephant range, and has been reported in most of the 37 elephant range states of the African continent in both savanna and forest situations. 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 increased the potential for conflict between humans and elephants in many regions. Elephants have been compressed into ever-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.

HEC creates anger towards elephants from the communities who live with them because they can ruin people's livelihoods. Such anger undermines support for elephant conservation, and has lead to farmers killing elephants or turning a blind eye to poaching in retaliation for the damage they have caused. Consequently HEC casts an ominous shadow over the future of elephant conservation outside protected areas.

Many factors influence the location and timing of conflict, including the maturity of crops, the area of crops under cultivation, and the distance of a farm from the boundary of a protected area. 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. It has been suggested that patterns of conflict are most strongly influenced by the individual behaviour of elephants. These issues are explored in detail in Module 2.

1.2 Direct and Indirect Conflict

Human-elephant conflict may be categorised as either 'direct' or 'indirect' according to its impact upon people. Direct HEC impacts upon the physical and economic wellbeing of rural communities by causing damage to crops, livestock and property, as well as human injury and death. Indirect HEC causes broad and indirect social impacts upon people, for example through the effort required to protect crops and property, the disturbance of normal activities such as walking at night, and the fear of injury or death. Such indirect costs may form a major component of the conflict perceived by local people.

1.2.1 Direct Conflict

Crop Damage
Crop damage is perhaps 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.

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 neighbouring villages. Human death, although less common than crop damage, is the most severe manifestation of HEC and is universally regarded as intolerable.

Elephant 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.

Elephant 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 kill cattle.

1.2.2 Indirect Conflict

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 fruit *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.

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.

1.3 Overview of Policies for Problem Wildlife Management in Different Countries

HEC has far-reaching implications for communities across the African continent. But who is responsible for HEC, and who should try to solve the problem? In colonial times across Africa it was usual for the State to take control of all natural resources, especially the large game species. The State established rules for the protection and hunting of game species which through high cost generally excluded local people. At the same time the State assumed control for problem animal management and disturbance shooting and killing problem elephants were the methods widely used to combat crop damage and human death caused by elephants. Today the State retains responsibility for elephants, as the legal custodians. However, as community-based conservation approaches are increasingly adopted, the responsibility for elephant management is steadily being devolved to the local level.

1.3.1 History of Policies for Problem Elephant Management

In the following section, elephant management policies for a selection of countries and regions across Africa are discussed. This is not intended to be an exhaustive description of all policies; rather it showcases specific countries in which policy has been developed. In many African countries "problem elephants" are being managed in the absence of any policy at all.

Central African Elephant Conservation Strategy 2005 (Sourced from IUCN, 2005)

The Current Situation

In Central Africa elephants occur in Gabon, Congo, Cameroon, Central African Republic, Chad and the Democratic Republic of Congo. The main elephant management issue in Central Africa is poaching, which is still common. However, HEC is increasing as the human population expands.

In all countries the State has responsibility for elephant management. However, across this region there is little legislation on HEC and there are limited resources to carry out HEC management. In addition there is limited information available on HEC patterns. Problem elephants are often destroyed by wildlife authority personnel, but reaction times are usually slow, because of the remoteness of many locations. At present there are few community-based conservation initiatives.

In Central Africa there are serious institutional failures in elephant conservation and management, including a lack of technical capacity to carry out HEC management activities, an ineffective legal framework and a lack of information about elephant distribution, threats, ecology and HEC patterns

Current Methods of HEC Mitigation

- Traditional methods, e.g. drums and fire, carried out by local farmers.
- Destruction of problem elephants carried out by the wildlife authority

In addition, there are isolated small-scale experiments with community-based crop protection being carried out, for example by WWF at Campo Ma'an National Park in Cameroon.

The Following Needs have been Identified:

- Land-use planning to reduce habitat fragmentation and HEC.
- Research to identify corridors of movement between elephant ranges
- Development of an HEC strategy that enables communities to manage elephant problems
- Investigation into the feasibility of income generation from elephants through tourism and sport hunting.
- Development of substantial benefits for communities in order to increase local tolerance to conflict.
- Research into a) conflict dynamics and b) conflict mitigation
- Research into new local and regional legislation to mitigate HEC
- Capacity building of local wildlife managers to deal with HEC
- Education / awareness building of the value of elephant conservation.

Review of Elephant Management Policy in Southern Africa (R D Taylor, 1999)

Elephant management strategies in Southern Africa are more advanced than in any other region across the continent. All six southern African countries (Namibia, South Africa, Zimbabwe, Zambia, Botswana, Mozambique) have legislation which protects elephants fully. Mozambique developed a national strategy for elephants in 2002, and Bostwana is in the process of developing a strategy. Namibia has published its policy on HEC management, which is detailed in the following case study.

Elephant management is the responsibility of the State, but with an increasing trend in decentralization and devolution. Procedures for dealing with problem elephants focus upon destroying elephants in defence of human life and/or the loss of property outside protected areas. There is also a heavy reliance upon disturbance shooting. Responses are usually made by centralized teams in reaction to elephant conflict incidents. Response times are poor and rarely are the elephants that caused the problem targeted. However, there is a move to devolve responsibility for HEC to community-based conservation programmes. Long-term strategies for HEC mitigation involving benefits and land-use planning are becoming more commonplace.

Current Methods of HEC Mitigation

- Traditional methods, e.g. drums and fire, carried out by local farmers.
- Disturbance shooting, carried out by the wildlife authority
- Destruction of problem elephants, carried out by the wildlife authority
- Electric fencing, usually carried out by NGOs or the wildlife authority
- Compensation, currently only carried out by the Botswana Government, which pays compensation for damage caused by elephants to people's crops, livestock, property and lives.

To date most problem elephant management has been very *ad hoc*. However, there is progress being made in the decentralization of problem elephant management, especially where successful community-based conservation programmes are in operation. In Zimbabwe, responsibility for natural resources has been delegated to the legal land occupant, meaning that private landowners and organized community groups can assume authority over their wildlife.

Such devolution of authority enables the development of longer-term solutions, such as:

- Land zonation, which can reduce overlap between agriculture and elephants
- Generating revenues from elephant-related activities to create incentives for elephant conservation among rural communities.
- Establishment of community-based conflict mitigation measures

What is Needed

- Development of national policies for problem elephants
- Research into alternative HEC management options
- Implementation of CBC programmes which provide incentives for elephant conservation and offset costs
- Devolution of authority for HEC management to communities living with elephants
- Implementation of standard monitoring and data analysis

Ghana's Elephant Conservation Strategy (Ghana Wildlife Division, 2000)

The Current Situation

The Ghanaian government has developed an elephant management strategy which focuses upon illegal ivory trade, habitat management and HEC. Ghana used to have a dedicated problem animal management unit, but this has been disbanded. Currently HEC mitigation is the responsibility of the Wildlife Division, which uses disturbance shooting, but also has the authority to destroy problem elephants. As with other countries, this centralized strategy suffers from poor response times and logistical failings. Recently, there has been an interest in community involvement in conservation, with benefits to be returned to communities. However, the government is committed to a no-hunting policy and all potential income generation would be through non-consumptive activities such as tourism.

Current Methods of HEC Mitigation

- Traditional methods, e.g. drums and fire, carried out by local farmers.
- Disturbance shooting, carried out by the wildlife authority
- Destruction of problem elephants, carried out by the wildlife authority

What is Needed

The National Elephant Conservation Strategy has set eight objectives, four of which relate directly to HEC:

1. Wildlife legislation must be improved, adopted and implemented to provide the basis for effective law enforcement and community involvement in wildlife management;
2. The rate of habitat loss and incidence of human-elephant conflict will be reduced in each elephant range;
3. The capacity of stakeholders will be improved; and,
4. Awareness of elephant conservation issues must be improved at all levels.

Namibia's Elephant Management Strategy (Republic of Namibia, 2006)

The Current Situation
Namibia has recently published a national strategy on elephants. The historical range of the elephant has decreased dramatically in Namibia in the past 100 years. However, with poaching under control, Namibia's elephant population is again increasing. Elephants are only found in the north of the country, both within the extensive protected area network, and across the communal lands.

Namibia has embarked on a programme of encouraging the formation community conservancies - with the objective of benefiting communities through the sustainable utilization of natural resources as well as maintaining biodiversity. Today there are over 40 registered and emerging conservancies with 150,000 members managing wildlife over an area of 100,000 square kilometres in the areas where elephant populations are expanding in Namibia. These serve to protect the elephant's seasonal movement routes, their range outside the protected area network and their occasional range.

Human elephant conflict is increasingly a problem which causes great animosity towards elephants. HEC is currently being tackled in a variety of ways:

Current Methods of HEC Mitigation

- Disturbance shooting carried out by the wildlife authority
- Killing problem elephants – also carried out by the wildlife authority
- Electric fencing around gardens carried out by NGOs
- Protection of water installations with barriers carried out by communities and NGOs
- Research into alternative cash crops carried out by NGOs

An important method for reducing HEC is through the elephant's economic value to tourism and the hunting industry. Through the conservancy system, benefits from elephants can be returned to the communities that live alongside them. This strategy recognizes the fact that elephant survival relies upon the willingness of rural communities to tolerate living with, and sharing resources, with elephants. This strategy places significant responsibility for elephant management with community conservancies.

In addition, community conservancies have a mechanism of insurance by which members of a conservancy may receive a payment to offset damage caused by elephants and other wild animals. This scheme is presented in more detail in Module 3.

1.4 Summary of National and Regional Policies for HEC

From the above case studies it is apparent that few countries have clear and unambiguous national policies toward problem animal control. While the level of commitment to HEC mitigation varies among the regions, it is possible to draw parallels in the problems currently being faced:

- There is generally poor and unclear legislation governing elephant management.
- State wildlife authorities are most commonly in control of HEC.
- Reactive responses to conflict occur on an *ad hoc* basis
- Methods commonly used to implement HEC are ineffective, e.g. disturbance shooting and killing problem elephants, and response times are slow
- There is low capacity and there are few resources to implement HEC mitigation

It is also possible to identify similarities in what is needed across the continent in order to address HEC in the future. The key needs are:

- Development of clear, comprehensive legislation for each country
- Decentralised management of elephant problems where suitable community organizations exist
- Development of new HEC mitigation methods through research and collaboration with other countries
- More training and resources for elephant managers
- Development of community-based conservation programmes which enable benefits from elephants to be generated and fed back to communities.
- Development of long-term strategies such as land-use planning
- Increased education and awareness of elephant management issues.

1.5 References

Barnes, R.F.W. (1996): The conflict between humans and elephants in the central African forests. *Mammal Review* 26: 67-80.

Bell, R.H.V. (1984): The man-animal interface: an assessment of crop damage and wildlife control. In: *Conservation and wildlife management in Africa.* Bell, R.H.V. & Mcshane-Caluzi (eds.), US Peace Corps seminar, Malawi.

Hoare, R.E. (1999): Determinants of human-elephant conflict in a land-use mosaic. *J. Appl. Ecol.* 36 (5): 689-700.

IUCN (2005): Central African Elephant Conservation Strategy

Naughton, L. Treves, A. & Rose, R. (1999): *The social dimensions of human-elephant conflict in Africa: a literature review and case studies from Uganda and Cameroon.* IUCN African Elephant Specialist Group, Gland, Switzerland.

Sitati, N.W., Walpole, M.J., Smith, R. J. & Leader-Williams, N. (2003): Predicting spatial aspects of human-elephant conflict. *J. Appl. Ecol.* 40: 667-677.

Taylor, R.D. (1999): A review of problem elephant policy and management in Southern Africa. *AfESG Human-Elephant conflict Task Force report.* IUCN SSC African Elephant Specialist Group, Nairobi, Kenya.

Wildlife Division (2000): Strategy for the Conservation of Elephants in Ghana. Wildlife Division Forestry Commission P. O. Box M239 Accra – Ghana.

Module 2

Elephant Behaviour and Ecology in HEC Situations

Photo: Young bull elephant in Muzarabani District, Zimbabwe. F.V. Osborn

Module 2

Elephant Behaviour and Ecology in HEC Situations

2.0 Introduction

In this module elephant ecology and behaviour is explored in order to further our understanding of HEC. Elements of elephant habitat selection, distribution, diet and social structure are presented and discussed in the context of elephant conflict, in order to help explain the patterns of crop damage that occur. Understanding the behaviour of crop-raiding elephants will assist in the development of effective mitigation measures.

2.1 Elephant Ecology

Elephants are complex creatures that have the ability to exist in a wide range of conditions. Their ecology and their adaptability has been the subject of extensive research.

2.1.1 Elephant Distribution

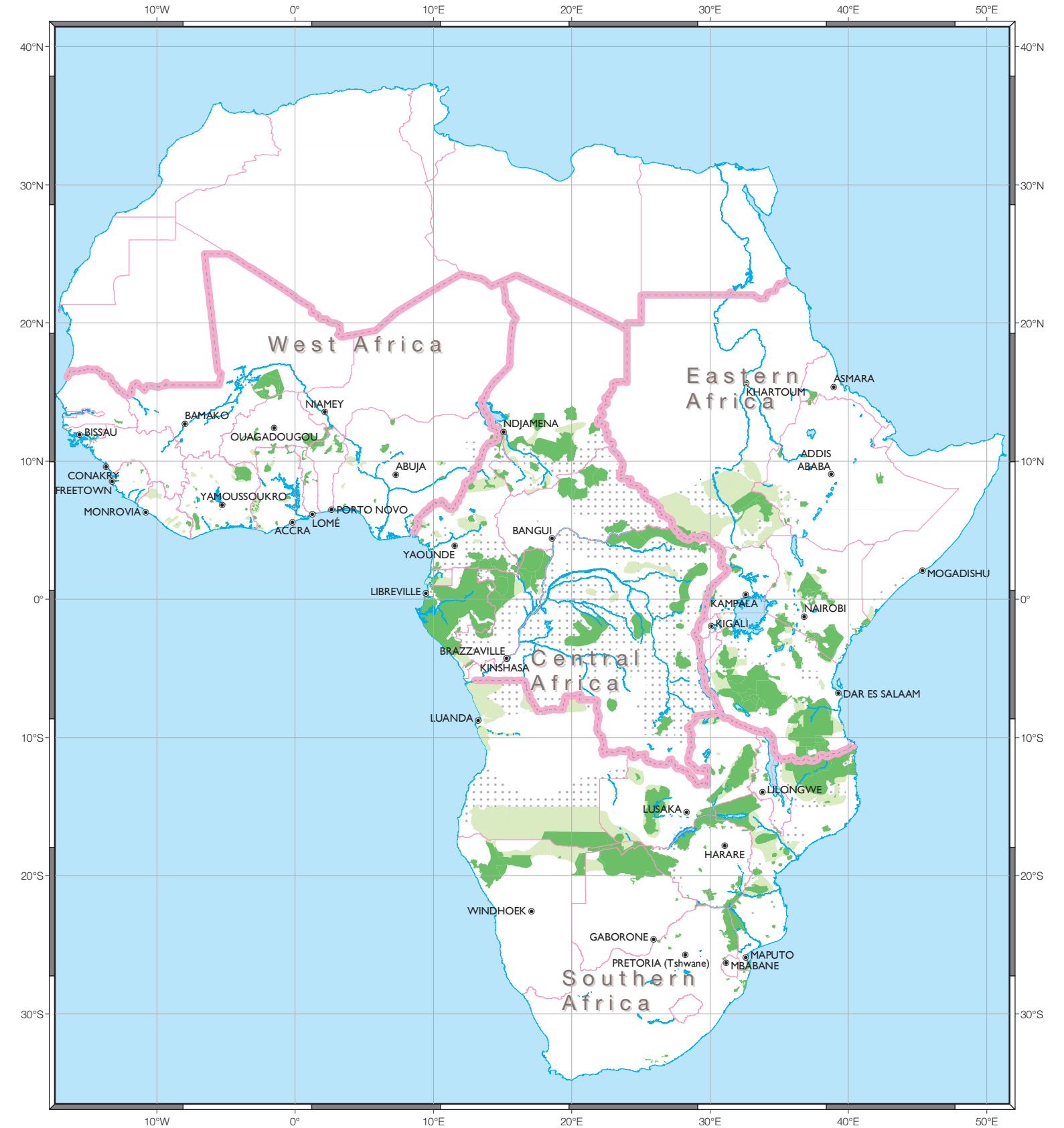
African elephants are generalists and can adapt to a wide range of habitats. Throughout history their ancestors have successfully inhabited the tropical, sub-tropical and temperate zones of the world. Today African elephants can be found from arid and semi-arid conditions in East and Southern Africa, to lush tropical conditions in the forests in West and Central Africa (Figure 1).

Within these geographical zones elephants occupy a diverse range of habitats, from closed-canopy forest to deciduous woodland to grassland. The size of home range varies enormously in relation to the environmental conditions. For example, in the lush conditions of Lake Manyara elephants may occupy 15-52km^2 whereas in the semi-desert of north west Namibia they may occupy more than 18,000km^2

The distribution of elephants in Africa is inextricably linked to that of humans, not least because they share similar habitat requirements. An analysis of rainfall and soil fertility in Kenya and Zimbabwe concluded that elephants and humans both ‘preferred fertile wetter areas’ and that competition for land between the two species was inevitable.

The relationship between people and elephants is complex. It appears that people and elephants can coexist within the same landscape, but only up to a certain threshold of human density. Once this threshold is exceeded, elephants disappear from the landscape. However, it does not appear to be the density of people that affects the elephants so much as the transformation of natural habitat to agricultural land. If land transformation exceeds 40-50%, elephants will be extirpated from the landscape.

Elephant Range in Africa



Regional Boundary

International Boundary

Capital Cities

Elephant Range

Known

Possible

Doubtful

African Elephant Specialist Group

0 700 1,400 2,800 km

Sources:
African Elephant Database
Digital Chart of the World

This map is unprojected.
Scale is indicative only.

2.1.2 Elephants and Water

Elephant ranging patterns are determined by water availability, which in turn is dictated by rainfall. Adult elephants require about 160 litres of water per day. In regions where rainfall is seasonal, elephants are restricted by the location of permanent water. In Chobe N.P., Botswana, family herds rarely travel more than 3.5km from permanent water during the dry season because of the high water dependence of calves.

2.1.3 Elephant Diet

Elephants spend 70-90% of their time foraging, consuming between 100-300kg of vegetation per day. Their diet is varied, consisting of grasses, foliage, bamboo, roots, bark, wood and fruits.

Elephants are generalist feeders and will exploit the vegetation that is available to them. In the Zambezi Valley, Zimbabwe, elephants fed from 140 different species of vegetation. Savanna elephants are both browsers and grazers, feeding on grasses during the wet season and switching to browse during the dry season. When grass is in its early growth cycle elephants tend to graze more and consume less browse. As grasses dry and become more fibrous and less nutritious, they switch back to browse.

In seasonal rainfall areas elephants may move in response to fruiting trees. For example, in the Zambezi Valley, Zimbabwe, elephants move to riverine woodland during the dry season to feed upon the fruits of the *Masawu* tree. Elephant distribution may also be affected by other resources, such as shade during the hot season and sodium from salt licks.

2.1.4 Social Structure

African elephants live in a 'fluid and dynamic social system in which males and females live in separate but overlapping spheres'. Female elephants live in small cohesive groups of close relatives with their immature offspring. Females born into a group remain with the family, while the males are ejected on reaching sexual maturity. Young males leave their natal groups at about the age of 14, and may briefly join up with other family groups or bull groups.

Bull groups are usually smaller than family groups, with a mean size of 2.4 elephants. Bull groups have long been described as loose associations of unrelated animals with weak social bonds, but more recent research suggests that the social structure may be more complex than previously thought. Bull elephants generally travel greater distances than cows, reflecting the different social structure that characterises each sex. Bulls may travel large distances in search of oestrus females, especially during the rains when mating occurs.

Some defining characteristics of elephant ecology have now been presented. In the following section we describe general patterns of HEC and attempt to relate these to elephant behaviour. We focus upon crop damage as the most prevalent cause of conflict and as the subject of most conflict research.

2.2 Patterns of Crop Damage

Crop damage is highly variable in space and time. It is affected by many factors and is little understood. However, through extensive research several key patterns have been discerned, including peaks of seasonal activity and intense conflict at specific locations, as described below.

2.2.1 Spatial Patterns

Elephants damage crops in a way that varies greatly from location to location, and also over time. There are few spatial trends, making it difficult to predict where conflict will take place. For example, one village may be heavily damaged by elephants while the next village may receive no damage at all. However, despite this variation, several spatial patterns have been identified.

Crop damage is more likely to occur along the boundaries of protected areas and usually decreases with increasing distance from the boundary. Elephants from the protected area raid crops closest to the boundary because the risk of detection is lowest there. Elephants have an acute spatial awareness and it is likely they are able to recognise the transition between 'safe' forest and 'dangerous' farm land. Few elephants will risk going deep into the farming area, so the majority of damage occurs on the farms bordering protected areas.

Crop-raiding elephants may also make use of habitat refuges to hide during daylight. These refuges may be small and surrounded by human settlements, sometimes at great distance from protected areas. Once night falls, the elephants are able to leave the refuge and enter the fields.

Crop damage also occurs along established elephant pathways. In the Taita-Taveta region of Kenya, crop damage was positively correlated with migration patterns of elephants, suggesting that elephants raided crops opportunistically as they moved.

Sources of permanent water are a further interface for conflict to occur, being a resource that both humans and elephants directly compete for. Crop damage has been observed around water points in Taita-Taveta and close to water points in Zimbabwe's mid-Zambezi Valley. Elephants are highly water-dependent and where water is limited the potential for conflict is high. Crop damage at water holes may be incidental: elephants coming to water may discover crops there and raid them opportunistically.

In arid range states water itself may become the focus of conflict. In Namibia's Kunene Province elephants regularly damage water installations. In northern Kenya elephants may become aggressive at water sources and have been known to chase and even kill livestock attempting to reach the water.

Elephant crop damage may be influenced by vegetation type: in the mid-Zambezi Valley, Zimbabwe, elephant damage to vegetable gardens along rivers during the dry season coincided with the fruiting of the *Masawu* (*Zisiphus macrunata*) tree, which produces sweet fruits that elephants eat. In the forests of Cameroon, the secondary growth vegetation

around agricultural fields attracted elephants to the crops. It is thought the elephants were initially attracted to the thick climbers and shrubs, which inevitably led to crop raiding in adjoining fields.

2.2.2 Temporal Patterns

Crop damage displays broad inter-year variation, meaning that areas that are heavily affected by crop damage one year may not be affected in the next, and vice versa. But despite this variation, strong seasonal patterns can still be identified.

Crop damage usually exhibits a peak of activity which coincides with crops reaching maturity. In the savanna habitats of Southern Africa this usually occurs towards the end of the rainy season when the crops are mature. In some areas a dual-season peak of activity has been described, with a second peak of activity occurring in the mid dry season, when vegetables in small river-side gardens reach maturity.

Mature crops are targeted by crop-raiding elephants because their fruiting bodies and seeds are highly nutritious. Indeed, mature crops are far more nutritious than natural forage that is available to elephants. It has been suggested that in Southern Africa the decline of quality in natural forage acts as a trigger for crop-raiding: as the grasses dry out at the end of the wet season their nutritive value declines, prompting the elephants to seek out other sources of food.

2.2.3 Crops Targeted by Elephants

Elephants have a natural preference for derivatives of plants from the *Gramineae* family, which includes maize. Such food crops are attractive to wild animals because the selective breeding of wild plants over centuries has reduced naturally-occurring defence chemicals, spines and thorns, and fibrous tissues, making them more palatable. Maize ripens uniformly and presents a super-rich patch of food and is consequently highly vulnerable to predation.

Of twenty crops destroyed by elephants across Africa in sixteen different sites, maize was ranked the number one target crop in every case. However, despite their preference for maize, elephants will also damage a wide range of food and cash crops, including cotton, sunflowers, ground nuts, water melons, millet, onions, beans, mangoes, cassava, sugar cane, pumpkins, potatoes, plantain, okra, tomatoes and cocoyam, among others. This ability to target many crops reflects the fact that elephants have evolved as catholic feeders with a highly varied diet.

2.2.4 The Impact of Wet and Dry Season Crop Damage

As already mentioned, in seasonal range elephants may raid crops both in the wet season and the dry season. These two periods of crop damage differ greatly in terms of the crops affected and the impact upon rural peoples' lives. In Zimbabwe's Zambezi Valley farmers grow crops such as maize, cotton and sorghum extensively through the wet season in fields of 2-10 acres in size. These rain-fed crops represent the main food and cash harvest for the year. Such fields are sporadically raided by elephants, but rarely are entire fields destroyed. Farmers treat damage to their main crops as severe because they rely on these crops to feed them through the dry season.

By contrast dry season crops are grown in small fenced plots along the fringes of major rivers and are bucket-irrigated from wells dug in the river beds. These crops provide supplementary food through the long dry period. Elephants will commonly destroy the plots completely, such that the farmers are forced to abandon them. But while farmers in the Zambezi Valley are irritated by such damage, it is considered a far lesser issue than damage to wet season crops.

2.2.5 Behaviour of Crop-Raiding Elephants

Group Size

Crop raiding is usually carried out by small groups of elephants. In Zimbabwe 89% of crop-raiding incidents were due to small groups of elephants of between 1-10 animals. In the mid-Zambezi Valley 40% of all wet season incidents were caused by elephants in groups of 1-5. In Kenya a similar pattern occurred: 80% of crop raiding incidents were perpetrated by groups of 1-10 elephants.

There may be several explanations for the small group size of crop-raiding elephants. First, bull elephants are believed to be responsible for the majority of crop-raiding incidents, and they naturally form smaller groups than cows. Second, elephants may avoid forming large groups when crop raiding because smaller groups are more stealthy and hence are less likely to be detected by farmers.

Timing of Crop Raiding

The majority of elephant crop-raiding occurs during the hours of darkness. In TransMara, Kenya, all recorded crop raids occurred between 19:00 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.

Differences in Behaviour Between Bulls and Cows

In many crop damage studies it has been bull elephants that have been identified as causing the majority of problems. Across Asia the effects of crop-raiding bull elephants were found to be more than five times that of cows. Radio collared bull elephants have been found consistently closer to human settlement than cows, suggesting a greater male tolerance to disturbance. Similarly, in Kenya bull elephants were found closer to towns than cows.

It has been hypothesised that bull elephants are more likely to take risks than cows, in order to increase their nutritive intake and thus maximize their reproductive success. A similar pattern found in Asian elephants suggests the same strategy operates there too. In addition, female elephants with calves may be less willing to expose their offspring to the higher levels of risk associated with crop-raiding and being in close proximity to settlement. However, increasingly elephant research is documenting mixed herds of elephants, i.e. cows and bulls together, as being responsible for crop damage.

2.3 Habitual Crop-Raiding by Elephants

The hypothesis that problem elephant activity might be due to only certain individual animals in any population has been considered by researchers working on both African and Asian elephants. However, there is little evidence to support this hypothesis. In part this may be due to difficulties in obtaining accurate data.

The problems encountered include:

- Difficulty in identifying individual elephants, especially at night in the fields;
- The high likelihood of problem individuals being destroyed; and,
- Promotion of this idea by local communities.

An alternative theory suggests that a 'segment' of an elephant population will be involved in conflict incidents, but that at any one time conflict is caused by a variable number of individuals within that segment. It appears that new individuals are recruited to this segment, as evidenced by the fact that consistent killing of problem elephants does not eliminate conflict. If this is the case then the killing of problem individuals, or their translocation, will not be sufficient to solve the problem.

2.4 Conclusions

In this module we have reviewed elephant ecology and behaviour in terms of distribution, diet and social interactions. We have identified key patterns of crop-raiding, and have related these to behavioural traits. Elephants raid crops close to the boundary of protected areas as a means of minimizing risk. Crop-raiding usually peaks when crops are mature because of a lessening in the nutritive quality of grasses. The elephant's catholic diet extends to crops - a wide variety of crops are damaged but maize is usually favoured over all others. Crop-raiding occurs in different seasons and exerts different impacts upon rural communities. Elephants tend to raid crops in small groups, and while there may be habitual raiding, it is extremely difficult to collect data on this. In the following module we explore the variety of conflict mitigation measures that are currently in practice across the African continent.

2.5 References

Barnes, RFW (1982): Mate-searching behaviour of elephant bulls in a semi-arid environment. *Animal Behaviour* 30: 1217-1223.

Bell, RHV (1984): The man-animal interface: an assessment of crop damage and wildlife control. In: *Conservation and wildlife management in Africa.* Bell, R.H.V. & Mcshane-Caluzi (eds.), US Peace Corps seminar, Malawi

Hoare, RE & du Toit, JT (1999): Coexistence between people and elephants in African savannas. *Conservation Biology* 13, No. 3: 633-639.

Hoare, RE (2001): Assessing the evidence for the existence of habitual problem elephants. http://www.iucn.org/themes/ssc/sgs/afesg/hec/pdfs/hecprobele.pdf

Parker, G.E. & Osborn, F.V. (2001): Dual season crop damage by elephants in northern Zimbabwe. *Pachyderm* 30: 49-56.

Parker GE (2006): The Costs and Benefits of Elephants: Communities and the CAMPFIRE Programme in Zimbabwe. *PhD Thesis*, University of Kent, UK.

Poole, J.H. (1996): The African elephant. In: *Studying Elephants.* Kangwana, K. (ed), 1-8. AWF technical handbook 7, Nairobi, Kenya.

Module 3

Mitigation Measures Used in HEC

Photo: Thunderflash used to scare elephants in Bwazi Village, Zimbabwe. F.V. Osborn

Module 3

Mitigation Measures Used in HEC

3.0 Introduction to HEC Mitigation Measures

In this module we review the HEC mitigation measures in use across Africa today. We review a wide range crop protection techniques, classifying them either as traditional methods, conventional approaches or experimental methods. Rural farmers have used traditional methods, including burning fires and beating drums, for hundreds of years. Wildlife managers across Africa rely upon a series of conventional methods, including disturbance shooting, killing problem elephants and fencing as a means of mitigating HEC. In addition, there are a number of experimental methods to reduce crop damage utilizing acoustic, olfactory and barrier techniques, which have emerged relatively recently. The problems associated with these techniques are discussed, including the logistical challenges of centralized responses to conflict, and the issues of habituation, expense and reliability with complex interventions.

We then introduce the concept of Community-Based Conflict Mitigation (CBCM), which is a short-term approach that enables rural farmers to tackle their own conflict issues. CBCM is designed to overcome the logistical problems that occur with current HEC methods and consists of practical methods for crop protection that are both inexpensive and locally available. They are designed to be implemented by communities with limited resources, without the need for outside assistance.

While not the focus of this module, a number of long-term community-based conflict mitigation measures are also discussed. Most of the methods mentioned so far may be considered ‘short term’; that is, they address the immediate problem of crop damage. By contrast, ‘long term’ methods are more substantial and usually address an underlying issue of conflict. These include land-use planning, benefit sharing and crop insurance. These measures are mentioned briefly in the text and explained in detail in a supporting document.

3.1 Crop Protection Techniques

Crop protection methods share a similar purpose: they are designed to reduce crop damage by deterring elephants from entering cropping areas. There follows a review of crop protection techniques from across Africa with some references to work in Asia. These are loosely grouped into categories of similar methodology, namely traditional deterrents, conventional deterrents and experimental deterrents.

3.1.1 Traditional Deterrents

'Traditional' deterrents are those that have been devised by rural communities living alongside elephants. Such deterrents are usually composed of low-tech materials that are widely available in rural locations. Rural farmers may use a range of noisemakers, such as beating drums and tins, 'cracking' whips and yelling and whistling to chase elephants away. Farmers may also use catapults, or throw rocks, burning sticks and occasionally spears at crop-raiding elephants. This usually involves getting close to the animals, and therefore the level of danger is high. Fires may be lit on the boundaries of fields or burning sticks may be carried by the farmers. Plastic and rubber may also be burnt to create a noxious smoke, and fires may be left burning all night even if the farmers are not present in the fields.

Across Africa and Asia, farmers attempt to construct barriers around their fields and homesteads to deter elephants. One of the most common barrier materials is thorn branches. Logs and sticks may also be piled up around the edges of fields. In some areas farmers may 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 they do create a psychological barrier that may have some deterrent effect. The constraining factor is usually the availability of the materials to build the barriers.

The problem with all traditional deterrents is that they tend to become ineffective over time. Usually a community will rely upon just a few methods, and these will be used repeatedly with little variation. The methods mentioned above may be considered 'empty threats'; that is, the elephant may be scared by them, but they cause no actual harm. Because of this, elephants may habituate to them, and may eventually ignore them altogether.

3.1.2 Conventional Deterrents

There are a wide range of conventional approaches to HEC mitigation which have been common practice for wildlife managers across Africa.

Disturbance Shooting

Disturbance shooting is the firing of gun shots over the heads of crop-raiding elephants. Used across the continent since colonial times, disturbance shooting has been a long-standing deterrent. However, it is at best considered a temporary respite from elephants. 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 is usually carried out by wildlife authority game scouts responding to the problem from a central location, and is therefore constrained by transport and logistical problems. Slow response times are considered the greatest problem, with scouts arriving at the scene of crop damage long after the elephants have moved on.

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 may incorporate a number of design features, such as extra pole wires, to protect them from elephant attacks. Elephants are notorious at seeking

out the weak points of fences. Elephants can overcome most modifications in time, meaning that a fence's effectiveness cannot be ensured by design, construction and voltage alone.

The materials, installation and maintenance costs usually make electric fencing impractical for applications in poorer developing countries unless funded by international aid agencies. In addition equipment such as solar panels, energisers, batteries and wire are all desirable materials, and there is a high risk of theft.

A key factor determining the success of a fence is ownership. A fence that is constructed and maintained by a government agency will always be viewed as a government fence. The maintenance will be left to the government and the community will take little or no responsibility. Rarely does a government agency have the resources to maintain a fence year after year, and inevitably the fence deteriorates. However, if the community builds a fence (with the cost of materials subsidised by a donor agency), and the community is responsible for its upkeep, then success may be more likely, because local people have a stake in its success. Nevertheless, many community fences have failed through local maladministration and the emphasis is now upon fences that are individually owned.

Electric fencing can be adapted to rural conditions by cutting down on building costs and materials. 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, all of which are high value items at risk from being stolen.

The limitation of barriers is that they are generally expensive to construct, require a lot of labour and high levels of maintenance. In addition, much anecdotal evidence suggests that elephants will overcome even the most sophisticated barriers over time. Furthermore, permanent barriers may not be popular with farmers as they are seen as a restriction on agricultural expansion. Finally, there is a risk that wire fencing will be used as snares to kill wildlife, especially if there are maintenance problems with the fence, or if the community has not assumed ownership of the project.

Removal Techniques

The removal of problem elephants from a high conflict area is another approach to crop protection. It is effected by either translocating or killing elephants within the problem area. This management intervention may target and remove specific problem elephants, or generally reduce the local population of elephants by removing some individuals.

Translocation

The removal of a problem animal through translocation has been used in Kenya and South Africa, among other places. Usually elephants are tranquilised and transported to a new location on specially adapted vehicles, where they are released. Translocation is a humane management alternative to killing problem elephants.

However, the cost of translocation 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. A criticism of this method is that it relocates problem animals to a new area, and therefore the initial problem is not solved, merely displaced to another site.

Shooting Problem Elephants

Wildlife managers consider the killing of problem elephants a last resort. Nevertheless, the practice has been in common use across Africa for the past 100 years and is still widespread. Shooting an elephant while it is crop raiding has been considered the best way to 'teach' the other elephants to stay away from crops. The meat is usually given to the people to appease their anger and to provide some form of compensation for crop losses.

However, while this method is still practiced in much of the elephant's range, most wildlife managers feel that it is generally of little long-term effect and is also a waste of a valuable resource. Response times are slow and wildlife personnel may arrive days after the problem occurred. Often the elephant responsible for the damage cannot be identified, and a token animal is killed instead. The reaction of the other elephants can be to change areas of raiding rather than to stop crop-raiding altogether. Anecdotal evidence even suggests that crop-raiding elephants in Sengwa, Zimbabwe returned to raid crops in a field where an elephant had been killed the previous night.

3.1.3 Experimental Methods

Experimental methods are innovative ideas which are currently being field tested, so at present there is limited evidence of their effectiveness.

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.

Playbacks of Recordings

Researchers have tried playing back a range of noises to influence the behaviour of elephants including playing recordings of cattle noises to elephants that had been periodically hunted or injured by pastoralists. The elephants appear to associate the cattle noises with the danger presented by their herders. A number of studies of elephant communication have demonstrated possibilities for manipulating elephants' behaviour with playbacks of their own vocalizations. Bull elephants have been successfully attracted by playbacks of recorded 'post-copulatory rumbles'. There are a number of other calls that could be used to attract or repel elephants, such as low frequency distress calls emitted during culling.

The problems with using elephant vocalisations as a repellent are: 1) most are of very low frequency and thus require expensive equipment to record and playback; 2) a large repertoire of recordings would probably have to be used to avoid habituation; and 3) the potential exists for disrupting normal communication and social systems. At present this field is experimental and the effectiveness of such deterrents is largely speculative.

Barrier Systems

Barriers work on the principle of physically excluding elephants from the crop fields. A wide range of potential methods exists.

Trenches

In Asia, trenches have been dug along protected area boundaries or around water points with varying degrees of success. A trench has to be wide and deep enough to ensure an elephant cannot step over it (elephants are not able to jump). In some places, trenches have been filled with pointed sticks to further deter elephants from crossing. Trenches in conjunction with electric fences have worked well where both have been well maintained.

The major drawback with trenches is that they encourage soil erosion. Elephants have also been known to fill them in by kicking soil from the edges into the trench, thereby enabling them to cross. Trenches require a large investment of labour, or mechanized digging equipment, and intensive maintenance. Wildlife officials in China are currently using barriers to control elephants in Yunnan province, where elephants have killed up to 23 people since 1998.

Community Trenches in Uganda (M Keigwin)

Communities on the southern boundary of Queen Elizabeth National Park, Uganda, have suffered serious crop losses to elephants and have been killed and injured trying to protect their crops. The Uganda Conservation Foundation (UCF) has been working with these communities to establish an elephant-proof boundary trench. In the first stage of the project an MOU was signed between the community and Uganda Wildlife Authority (UWA). This agreement was an important starting point as it identified the key partners and outlined responsibilities for the construction and maintenance of the trench.

The trench itself has been dug with 100% local labour, with accounts being managed by UWA, and UCF acting as technical advisors. The trench is 2m wide and 2m deep, with the spoil earth banked up half a metre from the trench's edge. Currently the trench forms a 15km barrier and there are plans to extend it to 45km in the near future. The trench does not run through valleys or marshy areas as it would fill with water. In these areas UCF is experimenting with a range of other barriers. So far the trench has been 100% effective at keeping elephants out of the fields. www.ugandacf.org

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 30 cm 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 realises that it is a hoax this tactic will become useless. This method requires a great deal of labour and in high rainfall areas soil erosion may be a problem.

Bamboo Spikes

Short lengths of bamboo can be 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 constraining factors include the labour and time involved in the construction and maintenance.

Sharp Stones

A barrier of sharp stones can be laid out in a broad band in the same manner as the bamboo spikes (above). The method is time-consuming and labour intensive, but ultimately cheap and low maintenance. It would require access to a large number of suitable stones. This methods is used primarily to protect water pumps and storage facilities.

Barrier Vegetation

Mauritius thorn (*Caesalpinia decapetala*) has been planted in a number of locations in Africa to act as a 'natural barrier'. However, there is very little data to suggest that this barrier is effective against elephants. In addition, this plant is known to be very invasive and its distribution by animals (through their eating and depositing of the seeds in dung) 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 as natural barriers. The available evidence suggests that spiny plants grow too slowly, are too patchy to form a cohesive barrier and their thorns alone are not sufficient to deter elephants.

Non-Electric Fencing

Strong, non-electrified fences have been used 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 have met with some success, they can be expensive to erect and maintain, there is a large labour investment required and expert advice is needed.

Olfactory Deterrents

Olfactory deterrents are chemical compounds that animals taste or smell. They may take the form of an unpleasant or painful smell, or as a targeted compound such as a hormone, which can create fear.

Capsicum Deterrent

Repellents based on resin from *Capsicum* spp. peppers have been used to alter animal behavior for a range of wildlife, including bears, ungulates, dogs, and humans. The resin contains capsaicin, a chemical found in fruits of *Capsicum* spp., which is the agent that makes them taste hot. This chemical produces a burning sensation that mammals find extremely unpleasant.

A capsaicin aerosol has been tested extensively as an elephant deterrent in Zimbabwe and has been found to effectively repel crop-raiding elephants. However, the limitations to this method are that the system is relatively expensive and the delivery of the pepper spray to the elephant is reliant upon wind direction.

Musth Secretions

Researchers have tested the repellent qualities of African elephant temporal gland secretions with somewhat ambiguous results. However, the avoidance reactions exhibited by female elephants to atomised secretions collected from the temporal glands of *musth* bulls indicate that such chemicals may be potentially useful as a repellent for non-*musth* bulls and females. Chemicals present in *musth* secretions appeared to prevent elephants from consuming food items encircled by rings of dilute concentrations of this naturally occurring ketone. This method has great potential, but much research must be undertaken before this can be considered a practical deterrent.

3.2 Summary of Problems with Current HEC Mitigation Techniques

In the previous section we have discussed a wide range of HEC mitigation techniques. While the approaches are diverse, we can identify common problems that consistently occur:

- The materials for HEC mitigation can be expensive or hard to source, e.g. ammunition, solar panels for electric fencing, vehicles for translocation.
- Conflict mitigation that is carried out by wildlife authority personnel suffers from slow response times, e.g. disturbance shooting, killing problem elephants
- There is a dependence upon outside organisations for money, resources and expertise, e.g. electric fencing, translocations, recording elephant communications.
- Elephants habituate to mitigation methods that are ‘empty threats’ and they become ineffective, e.g. traditional methods, disturbance shooting.
- Some mitigation methods are very labour-intensive, e.g. trenches, fencing.

In the past conflict mitigation methods have been the responsibility of wildlife authorities. But the management of elephant problems is being increasingly decentralized as community-based conservation programmes are established. In line with this, community-based conflict mitigation (CBCM) is rapidly gaining support. The rationale for CBCM is described below, and emerging tools and techniques are presented.

3.3 The Rationale for Community-Based Conflict Mitigation

Community-Based Conflict Mitigation (CBCM) is a relatively recent approach to HEC which empowers communities to address their own conflict problems. The concept of CBCM came about from the realisation that rural communities could not rely upon outside agencies to solve their conflict problems, however traditional methods of conflict mitigation were weak and vulnerable to habituation. Thus CBCM is a series of effective, low cost HEC mitigation techniques that rural farmers can administer as and when they

require. They have been tested extensively in Zimbabwe and Kenya and have been successfully implemented by Elephant Pepper in a large number of countries, including Ghana, Mozambique, Zambia, Botswana and Namibia.

3.3.1 Key Attributes of CBCM

CBCM was developed to overcome many of the problems experienced by current mitigation methods. CBCM is designed to be:

1) **Inexpensive,** and affordable to rural farmers. This is critical if the methods are going to be sustainable;

2) **Effective** at reducing conflict, as farmers will soon give up on ideas that don't work;

3) **Decentralised,** so communities take responsibility for their own conflict issues and no longer rely entirely on outside help. Farmers must take responsibility for guarding their own crop;

4) **Locally available,** so that farmers can source the materials from within their area;

5) **Adaptable** to local conditions; and,

6) **Variable,** using multiple methods to overcome the problems of elephant habituation. Elephants will not be able to get used to a single method because methods will be rotated and changed.

3.3.2 The Importance of 'Low Tech'

Bearing in mind the remote and relatively poor circumstances of most communities suffering from HEC, low-tech deterrents are considered most suitable for CBCM as they are generally robust, cheap and easy to maintain. They also require little or no outside support. In addition, getting the community to take responsibility for the interventions is core to the success of the CBCM approach. Low-tech methods usually require a greater level of community involvement than higher technology methods, and are therefore an appropriate starting point.

3.4 The CBCM Toolbox

In the following section, we present new tools that are suitable for the CBCM approach. This range of innovative, low-tech deterrents described in the following section has been developed and field-tested by the Elephant Pepper Development Trust, and adopted by a number of organizations that sometimes modify these methods. Many of the methods involve chilli, which is a natural irritant that can cause intense short-term pain to mammals. The rationale for using chilli is that elephants have a highly sensitive olfactory system and chillies will therefore cause them pain. Therefore, such a deterrent should be more resistant to habituation than an 'empty threat' which causes no harm. However, chilli is just one of an array of potential methods and it does not need to be the focus of the approach.

It should be stated that individual methods cannot be expected to be effective alone. The effectiveness of the CBCM approach stems from the use of mitigation methods *in combination*, which reduces the risk of habituation. The individual mitigation methods are categorised below according to their purpose. Thus, vigilance methods increase a farmer's ability to detect crop-raiding elephants; barrier methods impede an elephant's access to the crop fields; and active deterrents chase elephants away from the fields. A good mitigation strategy would contain elements from each category, as described in detail in Module 5.

3.4.1 Increased Vigilance

Improving vigilance is the key to effective crop protection – if farmers can detect the elephants early then they can reduce the amount of damage that is done.

Guarding Fields

Farmers who actively guard fields have a greater chance of reducing crop damage. In TransMara, Kenya, farmers have established guard towers at the edge of fields which enables them to observe approaching elephants in safety. They use powerful torches to locate the elephants before they enter the farms. Such an approach has been highly effective, as demonstrated by reduced incidence of crop-raiding. The key to this success is that farmers are willing to actively guard their fields, and respond to incursions by elephants as they occur. This strategy is especially successful where farmers work together to guard their fields.

Photo: Watch tower in Chadope, Zimbabwe. G.E. Parker

Alarm Systems

Alarm systems are acoustic devices that are usually established at the boundary of the farms and set off by a tripwire. Their primary goal is to alert farmers to the presence of elephants, but they also have some deterrent effect.

Researchers have tested a system using sirens that were triggered when elephants made contact with a trip wire set up around the fields and they reported some success. However, the limitations are that in high rainfall conditions it is difficult to maintain electrical systems and they are also vulnerable to theft.

Alarms can play a critical role in crop protection as they offer security to the farmers. Farmers in Zimbabwe found them to be critical to field guarding as: a) they always knew when the elephants were approaching; and, b) the bells sometimes drove the elephants away. Many farmers complained that it was exhausting guarding the fields all night and it was impossible to maintain constant vigilance. For this reason alarm systems were highly regarded because they allowed farmers to sleep whilst maintaining a level of vigilance.

3.4.2 Barrier Deterrents

Barriers are designed to keep elephants out of the crop fields, as described in previous sections. However, the barriers described below are ideal for the CBCM approach.

Simple Fencing
Simple fencing, made from bush poles and string (ideally fibre ropes) can be constructed at the edge of the fields. The fencing will not be strong enough to stop elephants from entering the fields, but chilli grease can be added to the fence to make it less attractive to elephants. In addition, cowbells and other alarm systems can be added to the string. In order to increase the visual impact of the fence, a 5m wide clearing should be made between the fence and the edge of the woodland. This cleared area will also assist farmers in spotting an approaching elephant.

Chilli Grease
Dry chilli pepper should be ground to a fine powder and mixed with old engine grease. If no grease is available then palm oil residue, or used car oil will work just as well. Chilli grease can be smeared on bits of cloth and hung on the fence, and also smeared upon the string itself. The chilli will deter the elephants from touching the fence.

3.4.3 Active Deterrents

Active deterrents are used to chase elephants from the fields once they present a direct threat to the crops or property.

Noise Makers
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 the pipe with a noise similar to a .458 rifle shot. In Zambia some farmers make homemade gunpowder from minerals and plant extracts, which they use to make small explosions. In Ghana, a similar effect is achieved with bamboo filled with calcium carbide and a little water. The gas produced is explosive and makes an impressive noise. Such methods works well initially; however, with consistent use it is likely that elephants will eventually habituate to them. In addition, the danger associated with these methods is great, and they are not suitable for areas with sensitive security issues.

Chilli Bricks
Chilli bricks are a low-tech technique that were developed by the Elephant Pepper Development Trust. They work on the principle that elephants are repelled by capsicum, the compound that makes chillies hot. The chilli bricks only utilise simple, locally available materials. Dry chilli is mixed with elephant or cattle dung, and compressed into bricks using a brick mould. The bricks are then sun-dried and burnt at the edge of the fields at night. The bricks burn slowly and produce a strong smelling cloud of chilli smoke. Research in Zimbabwe's mid-Zambezi Valley has revealed this technique to be effective at deterring elephants and easy to manufacture.

3.4.4 CBCM – a Summary of Important Points

- CBCM enables rural farmers to tackle their own conflict problems without having to rely upon outside help.
- Farmers will need to actively guard their crops – it is not enough to build fences and expect them to be effective on their own.
- A good CBCM strategy will incorporate vigilance, barrier and active deterrents.
- CBCM methods should be used in combination for the greatest effect.
- CBCM is NOT a silver bullet that will solve conflict completely. However, it will help to reduce the impact of elephant crop damage upon rural communities.
- CBCM is NOT designed to replace current mitigation techniques. Rather, it should be used to reinforce existing approaches.
- Diversification and development of new tools is to be encouraged at all CBCM sites.

3.5 Long Term Community-Based Mitigation Measures

The approaches to HEC mitigation mentioned so far aim to reduce the incidence of crop raiding, either through crop protection or through reducing the number of problem elephants. Such short-term approaches alleviate, rather than eradicate, the problem. In contrast, interventions such as land-use planning may provide solutions that deal with the root causes of conflict, namely that agriculture overlaps with elephant range. In addition, the use of benefits as a means of offsetting the costs of conflict has become a popular approach to HEC mitigation. The costs of conflict can either be directly met through compensation and insurance schemes, or indirectly through community benefits, such as is common practice in community-based conservation programmes.

While not the focus of this training manual, the following mitigation methods are considered to have a critical role in reducing conflict and wildlife managers should be aware of them. These approaches are summarised below, and presented in greater detail in the resource document “Long Term Community-Based HEC Mitigation Strategies” accompanying this Module.

3.5.1 Land-Use Planning

Land-use planning approaches to HEC attempt to separate agricultural activities and elephants. This can be achieved through the identification and zonation of separate areas for farming and wildlife, or through the development of buffer zones at the edge of protected areas, or through the restriction of agricultural development in wildlife corridors. Land-use planning is considered a long-term approach to conflict mitigation because it tackles an underlying cause of conflict – namely that food crops are grown within elephant range. Separating agriculture and elephants within a landscape should reduce the potential HEC in the long term.

3.5.2 Offsetting the Costs of Conflict

Over the past twenty years, conservationists and wildlife managers have developed a different approach to conflict mitigation – rather than attempting to reduce the amount of conflict, they have concentrated upon providing benefits that offset the costs of conflict to rural communities. This strategy attempts to alleviate the impact of conflict by providing benefits that aim to increase people’s tolerance to problem animals.

Compensation Schemes
In most compensation schemes the Government directly offsets a portion of the cost of a conflict incident through a cash or 'in kind' payment direct to the farmers. The extent of damage in each incident is measured through an exhaustive assessment process. Such schemes have been largely viewed as a failure because they are easily corrupted and they can encourage farmers to take no action to protect their own crops.

Community Insurance Schemes
While it is widely recognised that compensation schemes have failed, local insurance schemes are showing great promise in Namibia. Community insurance uses revenues generated from wildlife to balance the losses of individuals within a conservancy. Payments are only made to registered conservancy members according to the conditions agreed by all conservancy members. This system has much tighter controls than a conventional compensation scheme and there is less opportunity for corruption. Most importantly, all conservancy members pay into the system and therefore have a stake in it.

Benefits from Wildlife
In Community-Based Conservation programmes the benefits generated from wildlife-based activities such as tourism and hunting may be used to offset the costs of conflict. This process does not actually reduce the amount of crop damage or conflict caused. Rather, it attempts to offset the damages by providing positive benefits to communities that suffer conflict. Benefits can take the form of community projects such as schools and clinics, cash payments to households, or capacity building and training.

Ultimately the best results for conflict mitigation may come from a combination of long-term measures, such as land-use planning, which accommodates the needs of humans and elephants within a landscape, and community-based conservation, which returns benefits to rural communities. However, such complex interventions require political will and a large timeframe in which to be implemented. In the meantime, it is recommended that community-based conflict mitigation measures are used in combination with other short-term measures to reduce the impact of human-elephant conflict upon rural communities.

3.6 Determining What Works Best in a Given HEC Situation

HEC varies between sites and over time. It is difficult to know whether a particular combination of mitigation methods that have been successful elsewhere will be suitable for your area. Guidelines for selecting and implementing mitigation measures in your area are given in Module 5. In addition, the AfESG have produced a Decision Support System which is designed to help wildlife managers to decide on the appropriate course of action, and it is recommended that participants read it.

3.6.1 The Decision Support System
The Decision Support System (DSS) proposes a series of logical steps to follow which will help the wildlife manager to make management decisions relating to HEC. The DSS recognizes that HEC management requires a multidisciplinary approach, blending applied research and 'conventional wisdom' in order to address HEC in the field.

The DSS begins by exploring the information that is needed before HEC mitigation measures can be implemented. This includes the frequency, distribution and severity of HEC incidents, the types of incident that occur, determining who is affected locally, and the elephants responsible for HEC.

The options for conflict mitigation are then listed, beginning with traditional methods and leading on to disturbance methods, killing methods, barrier methods, experimental methods, translocation, compensation, wildlife benefits from utilization, and land-use planning, such as have been described in detail at the beginning of this module.

The DSS then explores common principles of HEC, describing commonalities of elephant behaviour, crop preferences and patterns in the tolerance of different communities to HEC. The concept of multiple interventions and 'synergy' between different methods is presented. HEC monitoring is then discussed in detail, with examples of data collection techniques. The distinction between data collection and research is drawn.

Methods of HEC mitigation are thoroughly assessed according to their short-and long term efficacy, based upon known field trials. While many methods are considered to be effective in the short-term, only removal of the entire elephant population and land-use planning options provide any long-term effectiveness. Advantages and disadvantages of each group of methods are presented.

Finally, the DSS provides guidance on the development of a management plan. This begins with the identification of goals and objectives, incorporating decision-making at all levels from politicians to community level. The actions to be taken (data collection; mitigation methods) are then considered in terms of time scale, resources and feasibility. The importance of monitoring and evaluating progress towards goals is highlighted.

French, English and Portuguese versions of the DSS can be downloaded free of charge from the AfESG website: http://www.iucn.org/themes/ssc/sgs/afesg/hec/hectools.html

3.7 Conclusions

This module has presented a comprehensive review of the HEC mitigation methods currently in use and has identified the key weaknesses that exist, including poor response times and reliance upon outside organisations. CBCM overcomes many logistical problems by enabling rural communities to tackle their own conflict problems. CBCM uses mitigation methods that are inexpensive, locally available and effective against elephants. There are three elements to a successful CBCM strategy: increasing vigilance; constructing barriers and using active deterrents. CBCM is designed to be used in conjunction with other HEC mitigation approaches to reduce conflict. Finally, long-term community-based mitigation approaches are briefly discussed. In the following module we discuss how to record and report HEC incidents using quantitative and qualitative means.

3.8 References

Hoare RE (1995): Options for the control of elephants in conflict with people. *Pachyderm* (19): 54-63.

Hoare, RE (2001): Management implications of new research on problem elephants. *Pachyderm* 30: 44-48.

Hoare, RE (2001): *A Decision-Support System for Managing Human-Elephant Conflict Situations in Africa.* IUCN/SSC AfESG, Nairobi, Kenya.

IUCN/SSC AfESG Guidelines for the *in-situ* Translocation of the African Elephant for Conservation Purposes: http://www.iucn.org/themes/ssc/sgs/afesg/tools/trnsgden.htm

O'Connell-Rodwell, CE Rodwell, T Rice, M & Hart, LA (2000): Living with the modern conservation paradigm: Can agricultural communities co-exist with elephants? A five-year case study in east Caprivi, Namibia. *Biological Conservation* 93 (3), 381-391.

Osborn, FV & Parker GE (2002): Community-based methods to reduce crop loss to elephants: experiments in the communal lands of Zimbabwe. *Pachyderm* (33), July-December 2002 pg 32-38

Osborn, F.V. & Parker G.E. (2003): Towards an integrated approach for reducing the conflict between elephants and people: a review of current research. *Oryx* Vol. 37 (1): 80-84.

Sitati, N.W. & Walpole, M.J. (2006): Assessing farm-based measures for mitigating human-elephant conflict in Transmara District, Kenya. *Oryx* 40 (3): 279-286.

Thouless, CR (1994): Conflict between humans and elephants on private land in northern Kenya. *Oryx*, 28:119-127.

Module 4

Recording, Reporting and Analysis of Problem Incidents

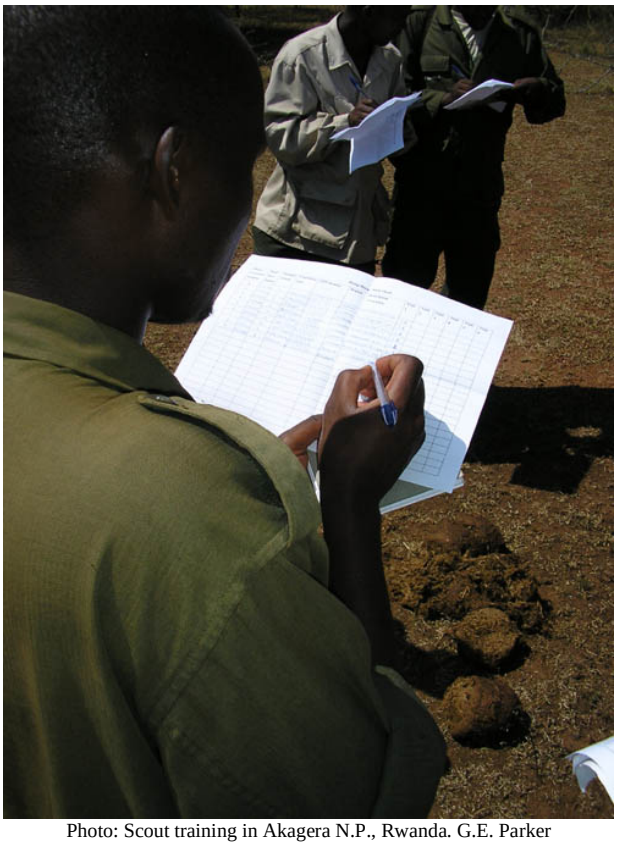


Photo: Scout training in Akagera N.P., Rwanda. G.E. Parker

Module 4

Recording, Reporting and Analysis of Problem Incidents

4.0 Introduction to Monitoring

In this module we give an overview of recording, reporting and analysis of HEC incidents. We first define qualitative and quantitative data types and identify the advantages and disadvantages of using each system. We then present methods for the monitoring of HEC using both qualitative and quantitative means. Guidance for field work is given and a suggested template for data collection is provided. Finally, we describe the analysis of data for annual reports and for more advanced requirements.

4.1 The Importance of Monitoring

In recent years researchers and wildlife managers have started investigating the subject of HEC in earnest. A variety of studies on HEC have been conducted in a range of African countries and with improving communication systems, and increasing democratization, HEC has been more widely recognized and reported. Nevertheless, much conflict still goes unreported. Because of the size of the species range and the relative newness of this topic, there has as yet been very little coordination between the many HEC research programmes.

Studies of HEC are usually designed in isolation, and use a variety of methods that provide different results. A standardized system of monitoring is now required in order to enable valid comparisons to be made about levels of HEC both within and between different geographical regions of Africa. Adopting a standardized data collection protocol, such as that presented by the AfESG, will ensure that the quality and detail of data on HEC will also be standardized.

Furthermore, current HEC monitoring focuses upon quantitative research; whereas here we also recognize the value of qualitative research and present advice for qualitative data collection and analysis. Below we discuss the relative merits of qualitative and quantitative data collection, and then go on to present the specific methodology for data collection. In the final section we summarise the data in annual report format, then introduce some advanced analysis techniques.

4.2 Quantitative and Qualitative Data

There are two types of data which can collected: quantitative and qualitative. ***Quantitative*** refers to the collection of numbers, such as measurements and counts. An example would be measuring a field using paces to assess the total cropping area. By contrast, ***qualitative*** data collection involves the views and perceptions of people, and may take the form of an interview or a group discussion, e.g. asking a farmer about the crops he grows. Each of these approaches has its advantages and disadvantages.

4.2.1 Quantitative Data

Quantitative data is useful because it provides hard numbers which are objective and unbiased by human emotion. This is important when studying conflict, which is an inherently emotive topic for those it affects. Quantitative data is easy to analyse because it is already in number form, and data from different areas can be directly compared.

Some examples of quantitative data collection are described below:

1. Spatial measurements, such as measuring the area of fields or the length and direction of an elephant path.

2. Transects: counting elephant dung along randomly placed transect lines to assess the population size.

3. Mapping conflict incidents in GIS in order to understand the influence of geography, e.g. the effects of rivers upon conflict incidents. Also to make predictions about the location of future conflict.

However, quantitative data collection does have some drawbacks. Usually a team of enumerators is required to collect the data, and they require specialized training and careful supervision which is expensive and necessitates a large time investment. Data forms are essential in quantitative data collection, as the information *must* be comparable to data collected in other areas. Quantitative data captures direct conflict well, but is not suitable for indirect conflict issues such as fear and inconvenience, which are difficult to value numerically.

4.2.2 Qualitative Data

Qualitative data collection helps us to explore both the direct and the indirect issues of conflict. It is possible to investigate a broad range of issues, including physical damage, perceptions of risk, and strong emotions such as anger and fear, which are common responses to conflict. In addition, conflict can be explored over a time scale that is beyond the scope of quantitative research, because perceptions draw upon experiences and memories that span many years. Qualitative information enables the manager to understand HEC from the farmer's viewpoint. Identifying the most important elements of conflict is essential for its effective management of HEC.

Some of the techniques for collecting qualitative data are described below:

1. Meetings, which can be either formal or informal. Formal meetings will be arranged in advance, and will follow an agenda of issues and will be minuted. Informal meetings may be spur-of-the-moment and could be as simple as a discussion in the street.

2. Interviews are a good means of finding out people's feelings and views on an issue. In addition they are a good way of exploring the history of an issue, and collecting background information. Like meetings, interviews can be formal and pre-arranged, or informal 'chats'.

3. Questionnaires can be useful for certain types of research, and ensure that standard data is collected.

4. Observations. Some information may be based purely on your own observations. For example, observing that a particular village appears to be consistently menaced by elephants throughout the year may lead to further investigation to determine why this may be the case. It is therefore important to write field notes that include your own remarks.

Like quantitative data, qualitative data has its drawbacks. It should be actively collected by trained enumerators, and therefore requires a large investment in training and supervision. Training is especially important as enumerators must appreciate the purpose of this approach, as well as being familiar with the various techniques. In addition, interview-based research carries the risk of inaccuracy, with farmers regularly exaggerating the amount of crops they loose to wildlife. However, such inaccuracies can be balanced out through parallel quantitative studies, which may serve to verify the qualitative findings.

4.2.3 Summary of Quantitative and Qualitative Data Collection

For a balanced overview of conflict within your area it is recommended that both quantitative and qualitative approaches be used. Quantitative data will provide an objective view of the direct damage caused, how much and where; whereas qualitative data will provide an understanding of the broader indirect issues and enable you to see conflict from the farmer's viewpoint. Both approaches require a substantial investment in training and supervision. Each enumerator will be responsible for actively collecting reports on all incidents of elephant conflict within their area.

4.3 Quantitative Data Collection

For active data collection it is necessary to employ and train field enumerators who will actively collect the details of HEC incidents. Such enumerators must be able to travel to the location of each incident, assess the area of crops damaged, the quality and age of the crops, and the severity of the damage caused. This information will enable an accurate assessment of each incident and will ensure that data is comparable between areas.

Information about the crop-raiding elephants can also be collected. The group size and sex of elephants involved in HEC is useful for conflict management. In addition, if individuals or groups can be reliably recognized, it will be possible to assess whether habitual crop-raiding occurs.

Crop Damage Assessment Form

Crop damage assessment requires the use of a standardized data form (Figure 2). The crop damage assessment sheet uses measurements of area to assess crop damage. Data forms are essential as they ensure the same kind of data is collected each time an incident is reported.

Report Details

The first section of the form lists the date, location and name of farmer. These details are essential, and MUST be filled in accurately, as they allow the report to be followed up in future. Recording the *complainant's name* sounds obvious, but sometimes farmers will have several different names, so all names given must be listed.

Figure 2: Standard AfESG Crop Damage Report Form

WILDLIFE DAMAGE REPORT FORM **FORM No. _____/_____**

DISTRICT_____ WARD_____ VILLAGE _____

Date of Damage _____ Date of Report _____

Exact Location Reference (MAP) _____

or (GPS) _____

Complainant(s)_____

Enumerator Name _____

CROP DAMAGE ASSESSMENT : USE PACES – MEASURE LENGTH X WIDTH

			APPROXIMATE LENGTH X WIDTH (PACES)				
CROP TYPE	**Quality* G/M/P**	**Stage** S/I/M**	**Area Grown**	**Damage Area 1**	**Damage Area 2**	**Damage Area 3**	**Damage Area 4**
			X	**X**	**X**	**X**	**X**
			X	**X**	**X**	**X**	**X**
			X	**X**	**X**	**X**	**X**
			X	**X**	**X**	**X**	**X**
			X	**X**	**X**	**X**	**X**
			X	**X**	**X**	**X**	**X**

*** Good /Medium /Poor ** Seedling / Intermediate / Mature**

OTHER TYPES OF DAMAGE (tick and give brief detail)

Food store_____

Water supply_____

Direct threat to human life_____

Human injury/ death _____

Livestock injured / killed_____

Other (specify)_____

PROBLEM ANIMAL SPECIES (1) _____(2) _____(3) _____

	Number	**Tracks seen**	**or**	**Animals seen (tick one)**
Estimated Group Size Total	_____	_____		_____
Males (if known)	_____	_____		_____
Females & young (if known)	_____	_____		_____

YOUR COMMENTS

_____ (continue on back)

WAS THIS REPORT FORWARDED FOR ACTION? YES / NO

To Whom?

_____

Where? _____When? _____ How ? _____

The *Date of incident* is the date that the crop damage occurred, which may be different from the date that you report the incident. The map grid reference or GPS reading will enable you to relocate the site and will allow you to enter the incident into GIS for analysis.

Crop Information
Enter the *Type of crop* that has been damaged. If two separate crop fields have been damaged, then use a different line for each. If one field with several crops growing together has been damaged then enter all the crops together.

Estimate the *Crop quality* before it was damaged using simple categories:

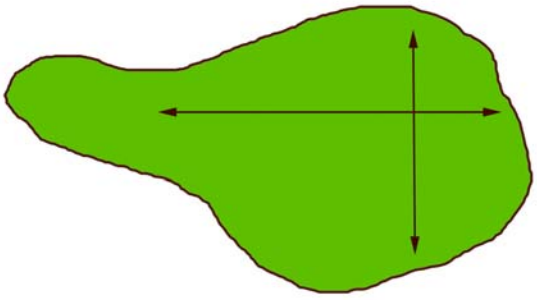
1. **Poor** - if the crop is of low quality and a poor harvest is expected
2. **Medium** - if the crop is in fair condition
3. **Good** - if the crop is in excellent condition and a good harvest is expected

Estimate the *Crop age* using simple categories:

1. **Seedling** - when the crop is at early stage of growth
2. **Intermediate** - when the crop is growing but does not yet have fruits
3. **Mature** - when the crop is producing fruits or seeds.

Estimating Total Field Size
Use paces to estimate the length and width of the area that contains crop damage. The farm may not be a neat square, so the average width and lengths should be given. Notice that the width measurements do not extend to the furthest extremes of the field; rather they fall somewhere between the longest and shortest width. The same applies to length measurements (Figure 3).

Figure 3: Estimating the average length and width of the field.



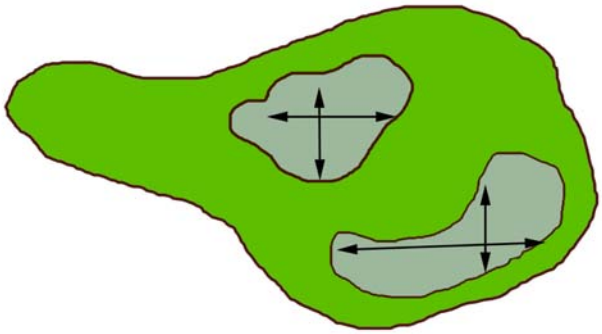
The length and width of the area grown is recorded: 42m x 25m

Estimating the damaged area
Figure 4 shows two portions of crop damage (light grey) within the field. The width and length of each should be measured as above, by taking the average dimensions. The area of each damaged portion should be calculated separately:

Damage portion 1: 10 x 8m
Damage portion 2: 12 x 5m

There is no need to calculate the area - this will be undertaken by the field supervisor as part of the monthly data summary.

Figure 4: Estimating the area of damage.



Other Types of Damage
This section allows you to fill in the details of other types of HEC, for e.g. damage to property or injury caused to a person.

Elephant Assessment
It is important to estimate the *group size of elephants* involved in the crop-raiding from the footprints. Ask the farmer if he witnessed the event, as he may have actually seen the elephants. Farmers can check the paths elephants normally travel each day and record either the presence or absence of elephants.

It may be possible to work out the sex of elephants, but this is only possible in certain circumstances. It is notoriously hard to tell the sex of adult elephants from the size of their footprints. This is because there is an overlap in size between bulls and cows: while in general cows have smaller feet than bulls, some cows may have very large footprints and some bulls may have small footprints. It is only possible to sex elephants from footprints if you observe very small footprints, which indicates there were calves in the group. This means that there were cow elephants too, and it can be assumed that the group was a mixed herd. Only enter details on the sex of elephants if you are sure of the facts.

4.4 A Strategy for Quantitative Data Collection

Before establishing a quantitative crop damage assessment scheme, it is worth spending some time on planning. The following key points are designed to help you with this process:

1. It is important to define the area in which you will collect crop damage information. If the area you intend to cover is very big, you may have trouble employing and supervising enumerators and the quality of the monitoring may suffer. Equally, if the area is very small, the data collected may be too limited to be of use.

2. You must consider the coverage of HEC reporting within your area. You may wish to collect data in every community within your area, which will provide a complete picture of the conflict situation. However, if your area is extensive then you may wish to select a sample of representative sites and collect conflict data in these sites only. Take care to select the sites randomly – if you only select communities in which high levels of conflict occur, then your information will be heavily biased towards the worst conflict.

3. You need to make sure you have a team of reliable and hard-working enumerators. The easiest way to select enumerators is to ask each community to put forward several candidates for the post. All candidates should then go through a selection day involving practical exercises and an exam, and the candidate from each village with the best performance should then be given the job.

4. Each individual enumerator should cover a specific area whose boundaries are defined and agreed before the data collection begins. An enumerator may cover his or her own village or several local villages. Alternatively, if farms are scattered, he or she may cover a large area defined by geographical boundaries. If enumerators are covering larger areas they may need bicycles or other forms of transport.

As mentioned before, enumerators will need to consistently record accurate measurements for each of the elements of the crop damage reporting form (Figure 2). Good, comprehensive training is the key to establishing an effective conflict assessment scheme. A 2-day training course format is provided by the AfESG on their website: http://www.iucn.org/themes/ssc/sgs/afesg/hec/hectools.html. Enumerators should be trained by the supervisor, who will also be responsible for the field supervision. Usually a supervisor lives at a central location and will visit the enumerators in the field to check on data collection. Checks should take the form of arranged visits and random spot-checks every month. It is important that all enumerators meet regularly with their supervisors to discuss data collection, air any problems and receive further training.

4.5 Qualitative Data Collection

Qualitative data collection requires staff who understand the principles of Participatory Rapid Appraisal (PRA) and who are familiar with the associated field techniques. It is essential that staff are suitably trained before field data collection commences, as they will

not only benefit from a wide variety of interview techniques and exercises; they will also be able to reduce bias and cross-check their results.

4.5.1 Interviews

Qualitative conflict assessment usually takes the form of interviews or group discussions with farmers. By nature such activities are flexible and designed to explore the issues in question. As such, there is not usually a rigid check list, as in a questionnaire, but rather a set of key topics which are used to guide discussions. Having a list of topics also ensures that the same key points are discussed in each interview.

An example of key topics is given below:

- Note the name of the farmer and the location and date of the interview
- Ask interviewee/s if they suffer any problems from wildlife crop damage
- Ask interviewee/s what type of damage each wild animal causes
- Ask interviewee/s whether they have any problems with elephants
- Ask interviewee/s the types of problem elephants cause
- Ask interviewee/s to rank the elephant problems

The above list will ensure that certain key information will be covered, while at the same time allowing any interesting topics that arise to be explored in full. Conflict can be an extremely emotive subject for those affected by it. When discussing conflict with rural communities it is common to receive emotive and inflammatory responses to questions. In order to elicit the most objective responses it is often best to approach difficult topics, such as elephants killing people, in an indirect manner. This means the interviewee is introduced to the topic in incremental stages and will be less prone to excitable responses. For example, instead of asking how many people are killed by elephants, it would be better to first ask what types of problem wildlife causes, then whether wild animals have ever injured people, then if they know of any cases of wild animals killing people, before coming round to the topic of elephants killing people.

4.5.2 Ranking

Ranking is a simple means of prioritizing subjects in the order of importance. Ranking makes it possible for people to compare and value issues, such as problem animals, and produce a list of animals in order of the magnitude of the problems they cause. Three types of ranking are presented below with data from the Mid-Zambezi Valley.

Direct Ranking

In direct ranking, the subjects, e.g. problem animals, are listed and assigned a rank directly. There is no buildup to the results; they are based on initial feelings. This method produces instinctive responses which may be subject to emotion. In the example below participants were asked to directly rank crop-raiding problem animals.

1. Elephants
2. Bush pigs
3. Baboons
4. Monkeys
5. Porcupines

Pairwise Ranking

In this form of ranking the subjects, e.g. problem animals, are compared to each other in pairs. For each pair the greater problem animal is given 1 mark, and the lesser is given 0. The total score for each animal at the end of the exercise reveals the rank order of the animals. The advantage to this method is that each animal has been compared to every other, so there is an element of objectivity. In the table below the results are entered for each animal in rows: for elephants in the first row a score of 1 in column two signifies the elephant is considered a greater problem than bush pigs. The animal with the highest total score is ranked number 1.

Table 1: Pairwise ranking of problem animals

	Elephant	**Bush pig**	**Baboon**	**Monkey**	**Porcupine**	**Total**	**Rank**
Elephant	X	1	1	1	1	4	1
Bush pig	0	X	0	1	1	2	3
Baboon	0	1	X	1	1	3	2
Monkey	0	0	0	X	1	1	4
Porcupine	0	0	0	0	X	0	5

Matrix Ranking

In matrix ranking the subjects, e.g. problem animals, are ranked according to a set of criteria. These criteria describe the problem in greater detail. For the following exercise we chose four criteria: the amount of crop damage each animal causes in a year; the average group size; the threat to human life; and the number of months in the year that the animals are a problem. Each problem animal is ranked according to each of the criteria in turn, with 1 being the greatest problem and 5 being the least. In the example below elephants are considered to cause the greatest amount of crop damage per year, and porcupines the least. For each animal the rank for each criteria is tallied and a total rank is assigned. In this form of ranking the animal with the lowest total receives a rank of 1.

Table 2: Matrix ranking of problem animals

Problem animal	**Crop damage per year**	**Group size**	**Threat to human life**	**Time span of problem**	**Total**	**Total rank**
Elephant	1	3	1	1	6	1
Bush pig	2	4	3	4	13	4
Baboon	3	2	2	1	8	2
Monkey	4	1	4	1	10	3
Porcupine	5	5	5	5	20	5

This method of ranking encourages respondents to think about the nature of the HEC problem, and is therefore the most objective of the three ranking methods presented here. The detail provided helps us to understanding the underlying issues better: in direct ranking we can see that a certain animal is the biggest problem; but using matrix ranking we can understand *why* this animal is considered the greatest problem.

4.6 Advice for Community Training

When interacting with people in rural communities it 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 will help to maximize your success:

- Prepare well in advance. If you are meeting with the community, plan the content, objectives, timing, materials and background you need to carry the meeting out.
- Notify the community of your intentions well in advance and make sure you notify and meet with community leaders if necessary.
- 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.
- Triangulate your methods. Use several different methods to ask the same question. This will enable you to cross-check your results and reduce potential bias. Triangulation is considered good PRA practice.
- Feedback. When you have conducted meetings and interviews it is good practice to feed the information you have collected back to the community. You may hold a brief meeting and present your results. This not only gives the community an understanding of why you are collecting the data, it also allows you to cross-check the information. If the community argues that some of the data is incorrect, you may be able to make corrections.
- Do not engage in long speeches about conservation and how important it is. This may lead farmers to assume you feel the elephants are more important than the people.
- Work with, and encourage people who are enthusiastic. Others who are less enthusiastic may be persuaded by example.

4.7 Analysing Conflict Data

It is essential that some form of data analysis takes place; otherwise the efforts to collect the HEC data are wasted. A simple analysis will reveal patterns and trends within your data and will enable you to summarise events. You will also be able to compare at a glance the difference between different areas of conflict and between years. The outputs of your analysis – graphs and tables – will help you to explain the situation of conflict to communities, wildlife managers, politicians, NGOs and other interested groups. Both quantitative and qualitative data require analysis and presentation.

4.7.1 Annual Summary of Conflict Data

Data from the HEC recording scheme should be collected and stored in a central place by the field supervisor. The data should be summarized in a simple annual report which displays the basic patterns of HEC, including the frequency, area and severity of conflict. This annual report will provide comparable information on the patterns of crop damage that is sufficient for local-level management decisions, including the deployment of wildlife personnel, the siting of conflict mitigation projects and the disbursement of wildlife-related benefits.

Example of an Area Annual Report on Human - Elephant Conflict (Muzarabani District, Zimbabwe, 1998)

Conflict between elephants and humans has become an important issue within some communal lands in Zimbabwe as elephants frequently cause damage to crops and property. The Muzarabani Rural District Council (RDC) has an obligation, under its Appropriate Authority status accorded by the natural resource management programme CAMPFIRE, to address this problem.

Human - Elephant Conflict: ***What We Need to Know***

- Which areas of the district are affected?
- What time of year is the problem worst?
- Which crops are being damaged?
- How bad is the damage to crops and property?
- Which elephants are causing these problems?
- Where do problem elephants have a refuge?

Human - Elephant Conflict: ***What Activities were undertaken***

A problem elephant reporting scheme was established by the Mid-Zambezi Elephant Project (MZEP) to provide detailed information about problem elephants within the district. As ten *resource monitors* were already employed in each of the ten wards of the district, the RDC suggested they be trained to carry out the additional reporting duties (i.e. to report every incident of elephant damage within their respective wards). The scheme started with the training of resource monitors before the crop planting season. Two day-long workshops covered the following topics:

- rationale for the work
- interview technique
- map reading to accuracy of a six figure grid reference (UTM grid system)
- identification of elephants by age and sex (if possible)
- elephant spoor counting
- crop damage assessment
- forwarding of reports

Each reporter was provided with a 1:50 000 scale map of their ward, a notebook and reporting forms. On hearing of crop damage via community members, the resource monitor went to the scene of the incident and filled in a standardized report form which contained the following information:

1. Date of incident;
2. Location of incident (a six figure grid reference and the name of the village);
3. Crop type and age;
4. Size of field;
5. Size of damaged area;
6. Number and sex of elephants involved.

Monthly meetings were held by MZEP at the RDC offices to collect results and discuss any problems. In addition regular field visits were made to each reporter to overcome specific problems and assist the data collection. Each reporter received a monthly allowance for doing this extra work, paid by MZEP.

Human - Elephant Conflict: *What Happened in 1998*

There were 155 problem elephant incidents recorded during 1998. Eleven (7%) involved property while 144 (93%) involved crops. The results of the reporting scheme are separated into sections based on the following questions:

a) Which areas are worst affected?
b) What time of year is the problem worst?
c) Which crops are affected?
d) How bad is the crop damage?
e) Which elephants are damaging crops?

(a) Which Areas are Worst Affected?

The map (Figure 5) shows the location of each report of a problem elephant incident. At this scale one dot can be used to represent multiple incidents. Crop damage appeared to be more common in the western wards of the district where there is more farming and the incidents occurred in clusters around areas of settlement. During the wet season crop damage occurred mainly around villages bordering the protected area. Dry season damage normally occurred along the major rivers, and was focused along the Musengezi between Muzarabani Business Centre and Dambakurima Business Centre.

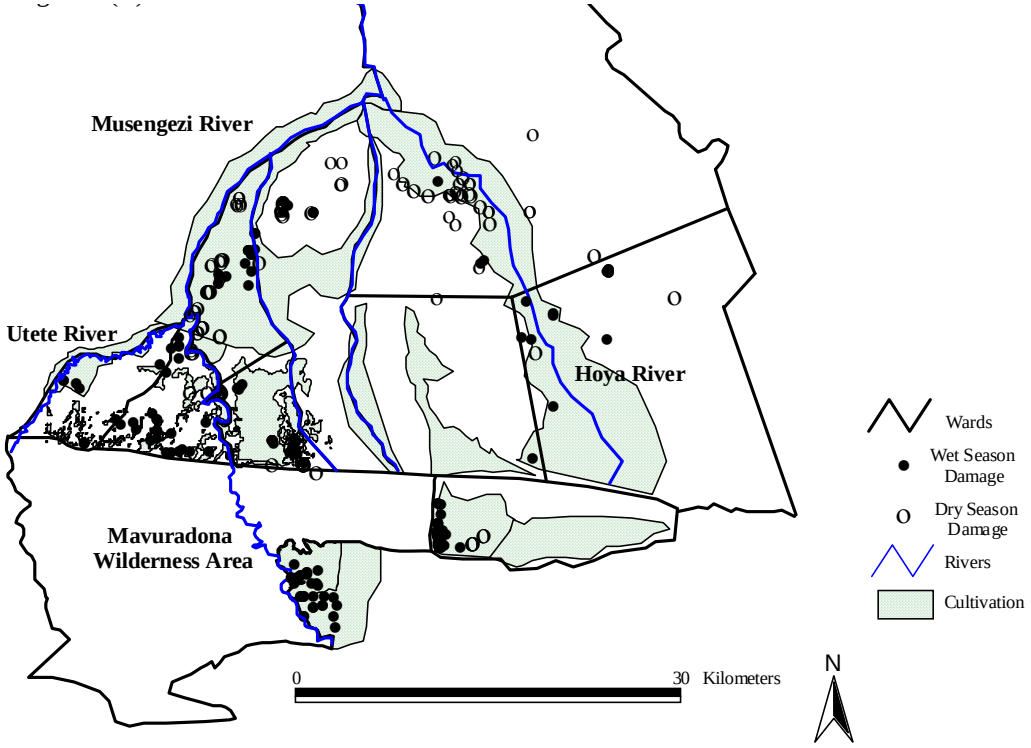
In the wet season elephants damage maize and cotton crops which are grown in fields surrounding the villages. Elephants can roam widely at this time of year because water is easily available and there is a lot of thick vegetation for cover. During the dry season elephants are attracted to the major rivers where they can still find water, and to the fruiting Masau trees (*Ziziphus mauritiana*) which grow along river banks. Many thickets also occur along the river banks, particularly in the Musengezi, and these make ideal hiding places during the day. When they come to water at night the elephants damage gardens growing vegetables and maize.

(b) What time of year is the problem worst?

The number of crop damage reports per month for the whole of 1998 (Figure 6), shows there were two distinct peaks of crop raiding cases: the first occurred in the wet season (January-March) and the second in the dry season (July-September).

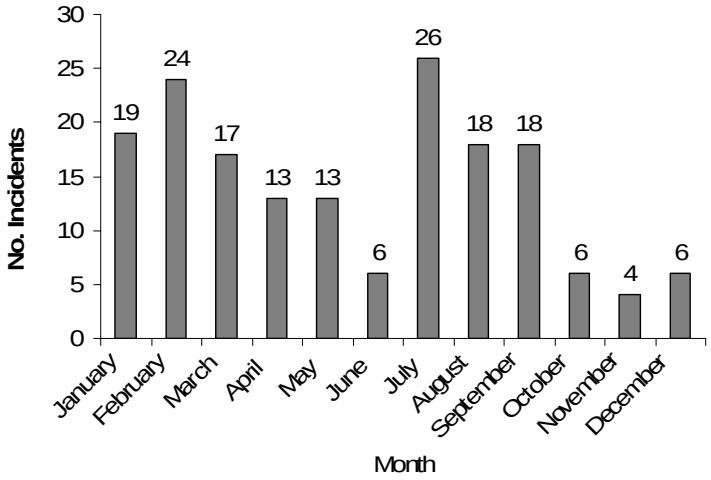
During the wet season most of the reports were from elephants damaging maize and cotton crops. In the dry season period most of the damage was to vegetables. In the period from October to December very little crop damage occurred. These patterns of crop damage reflect the farming practices. During the rains farmers grew maize and cotton crops in fields surrounding their villages. These crops matured in the period February - March and this is why a great deal of crop damage occurred at this time.

Figure 5: Locations of Incidents in Muzarabani District, Zimbabwe



At the end of the rains farmers abandoned their larger fields and cultivated small gardens along the beds of major rivers. Here the water table is high enough for bucket irrigation and vegetables and green maize were grown. By October most gardens had finished producing and this is why little elephant damage occurred after this time.

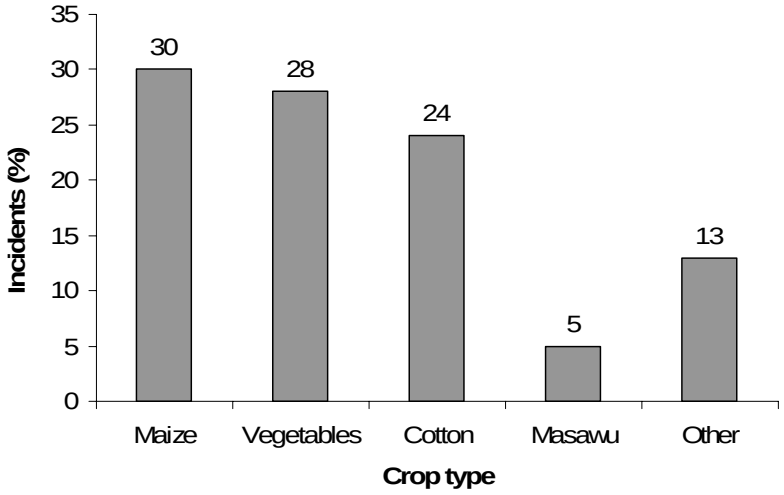
Figure 6: Elephant Damage Incidents Per Month in Muzarabani District 1998



(c) Which Crops are Affected?

The percentage of incidents for each crop type damaged (Figure 7) shows which crops are affected in Muzarabani District. Maize is the crop worst affected, followed by vegetables and then cotton. 'Other' crops include millet, groundnuts and sugar cane, which are affected to a lesser extent.

Figure 7: Selection of Crops by Elephants in Muzarabani District 1998

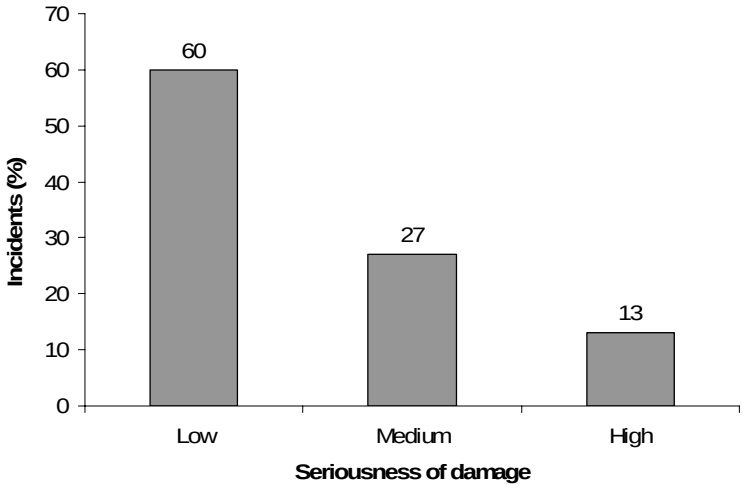


The majority of the damage (76%) is done to food crops and only 24% of the damage is to the cash crop cotton. This is because food crops are more nutritious than cotton, which does not produce edible fruits. In most of the reports of damage to cotton, elephants caused minor damage to the crop as they walked through the field. Damage to food crops tended to be more severe as elephants ate the crop as well as trampling it.

(d) How Serious is the Crop Damage?

Crop damage by elephants was asessed in three categories: low, medium and high. The seriousness of each damage incident was assessed by the researcher who scored the age and quality of the crop and the amount of damage reported by the enumerator on each incident form. Higher scores mean more damage. Over the whole district in 1998, most incidents (60%) were not serious, about one third were in the medium category (27%) and in a small percentage of cases (13%), farmers suffered heavy losses (Figure 8). This shows that while elephants are a nuisance in many places in the district, the actual economic damage they cause is serious only in a minority of cases. These results illustrate the value of a scheme where there is independent assessment of damage by trained people. If this reporting scheme was not in place the RDC would be besieged with complaints and would have no way of knowing whose complaints were serious and whose were not.

Figure 8: Levels of Elephant Damage to Crops in Muzararbani District 1998



(e) Which Elephants are Damaging Crops?

Most of the crop damage was caused by small groups of elephants. On average the group size of crop raiders was six. 80% of all the crop damage incidents were caused by groups of 8 or fewer elephants. Occasionally bigger groups were involved and sometimes these groups could be as large as 30 elephants. Most of these groups were mixed herds of elephants: bulls and cows together. In other areas of Zimbabwe bulls commonly cause crop damage, so this result is unusual, but probably reflects the structure of the Muzarabani elephant population as a whole.

Summary of Problem Elephant Reporting, Muzarabani District 1998

- Crop damage is concentrated in the western wards of the district.
- Maize, vegetables and cotton are the three crops worst affected by elephants.
- Crop damage in the wet season affects maize and cotton and is widespread in the district.
- Crop damage in the dry season centres on the larger rivers, mainly affecting vegetables and green maize.
- Damage to food crops is greater than damage to cash crops.
- Only a small number of crop damage cases cause serious losses.
- Crop raiding is mainly caused by small, mixed-sex groups of elephants.
- No human injuries or deaths from elephants were recorded in 1998.

4.8 Advanced Data Analysis

While annual summaries are invaluable to the wildlife manager, and provide a baseline of information, it is useful to conduct an advanced analysis of the HEC data. Such an analysis provides more complex information for elephant management, and yields more sophisticated detail for presentation to national bodies, NGOs and donors. Advanced information is useful to the manager – it can increase his or her

understanding of the HEC problem, and provide an insight into specific issues. The methods presented here are not complicated, and require only a working knowledge of programmes such as Microsoft Excel.

4.8.1 Background to the Data

Elephant crop damage has become a critical issue for wildlife managers in Zimbabwe's mid-Zambezi Valley. The Rural District Councils have a mandate to manage wildlife through the community-based conservation programme CAMPFIRE, which makes them responsible for HEC management. Between 1997 and 2003 the Elephant Pepper Development Trust (EPDT) supported Guruve RDC's elephant management programme by establishing elephant conflict monitoring in ten villages across three Wards in Lower Guruve.

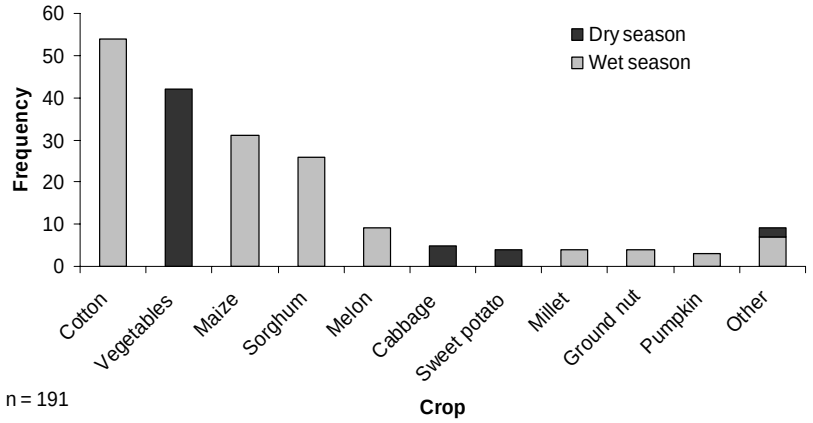
Ten enumerators were selected and trained by EPDT to record incidents of HEC within their own villages. G. Parker acted as trainer and supervisor to the field staff. The information enumerators collected was cross-checked through regular site visits and monthly meetings in which results were collected and problems were discussed. The information for 2003 was analysed and published in G. Parker's PhD thesis, sections of which are displayed below to demonstrate more advanced analysis of HEC data.

4.8.2 Comparing Frequency and Area

When people analyse crop damage reports, they will usually use the frequency of incidents as their main metric of conflict. Frequency gives a good overview of the distribution and timing of crop damage incidents. However, the limitation with frequency is that it gives no idea of the extent of the damage that has been caused. For example, an incident in which a small area of damage has been caused is given the same level of importance as an incident in which a large area of crops has been destroyed.

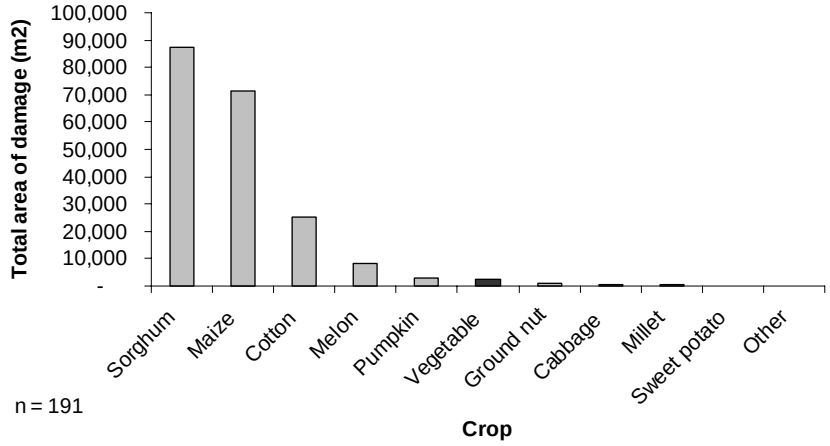
In Figure 9 crop damage is displayed as frequency for each type of crop for 2003. Cotton is the most frequently affected crop, followed by dry season vegetables. Maize and sorghum, the main food crops of the area, are placed 3rd and 4th.

Figure 9: Frequency of Elephant Crop-Raiding Incidents per Crop Across Ten Study Villages in 2003.



If we take the same data series and plot the area of crops damaged rather than the frequency, an entirely different pattern emerges (Figure 10). It is instantly obvious that the food crops sorghum and maize suffer far more damage than any other crop. The area of cotton damaged is roughly one third of that of maize. Interestingly, vegetable crop damage is rendered insignificant by this area analysis, despite having been the second most frequent form of crop damage.

Figure 10: Total Area of Elephant Crop Damage to Each Crop Type Across Ten Study Villages in 2003.

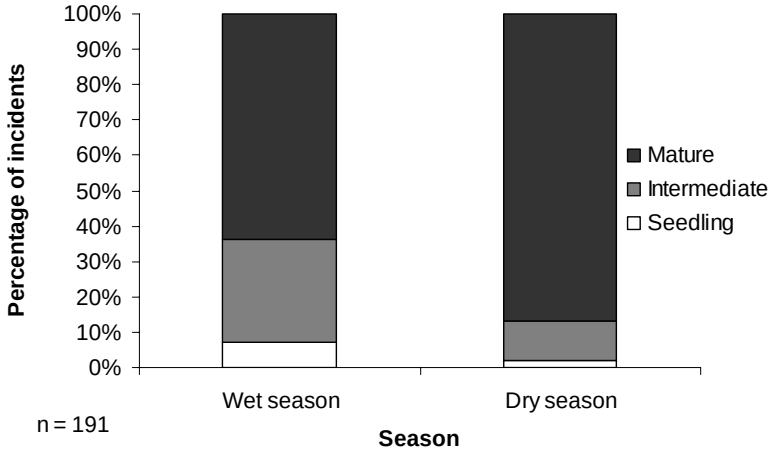


Using area instead of frequency provides entirely different results, and gives a more accurate picture of the impact of the crop damage upon the farmer. Now we can see the actual extent of the damage, and can focus our management efforts accordingly. This exercise demonstrates that using different crop damage metrics can substantially alter the result.

4.8.3 Age Class of Crops

We described how to classify crops according to age at the beginning of this Module. In Figure 11 below we separate crop damage incidents according to the age of the crops affected. The percentage of incidents affecting different ages of crops is compared between wet and dry season crops. While percentages differ slightly, it is clear that mature crops are at the greatest risk from elephants. This result mirrors results of other research across the continent: elephants appear to target mature crops because they are highly nutritious at this stage.

Figure 11: Frequency of Crop Damage for Each Age Class of Wet and Dry Season Crops Damaged by Elephants in 2003.

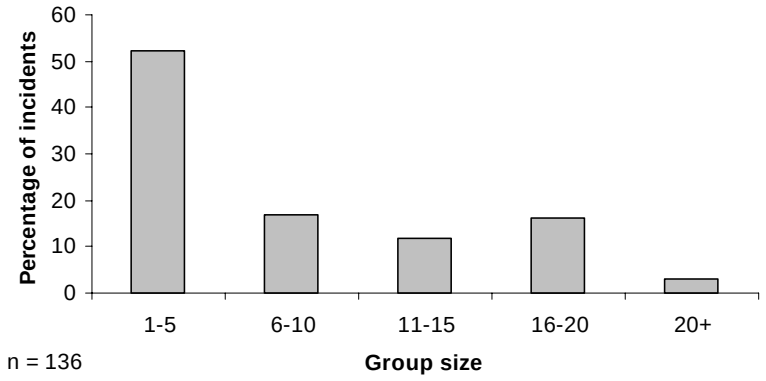


4.8.4 Which Elephants are Causing the Problem?

Crop damage reports should contain information about the elephants who caused the crop damage. This information is useful to the manager because it defines which demographic group of elephants is causing the problem, and which group sizes are responsible for the greatest damage.

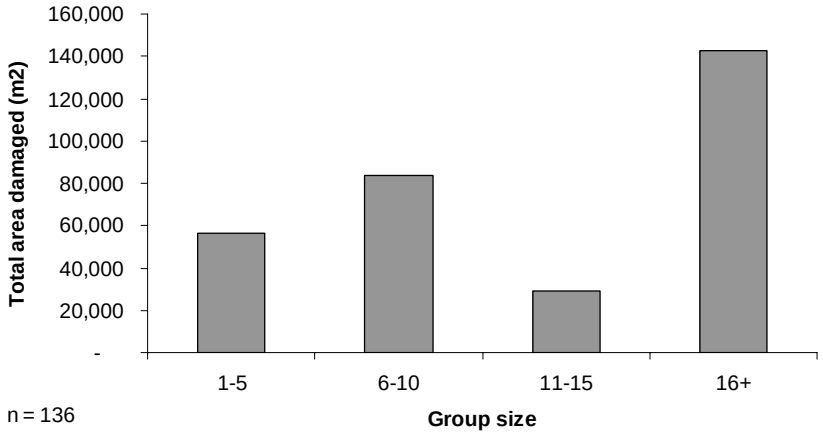
Figure 12 displays the percentage of crop raiding incidents caused by different group size categories of elephants. Over one half of all incidents are caused by elephants in groups of between 1 and 5 animals. Less than 20% of incidents are caused by the larger group size categories. This demonstrates that small groups of elephants are the most common, and larger groups are relatively rare.

Figure 12: Frequency of crop-raiding elephants per group size category for wet season crop damage in 2003.



We have already discussed that area of damage is a more advanced metric of crop damage than frequency. For this reason we plot the total area of crop damage caused by different group size categories of elephants in Figure 13.

Figure 13: Total Area of Crop Damage per Elephant Group Size Category, for Wet Season Crops Damaged in 2003.



Here we see that elephants of groups of 16 or more cause nearly one half of all the damage. This is extraordinary, considering that this category of elephants accounted for les than 20% of the frequency incidents. At the same time elephants in groups of 1-5 are responsible for roughly one quarter of the total damage by area.

This analysis tells us that while small groups of elephants are frequent raiders, they cause relatively little damage. It is the big groups of elephants that raid infrequently who cause the greatest area of damage in total. Research from Uganda shows the large impact incidents, in which an entire field of crops may be destroyed in one go, are what rural farmers fear the most. It is this potential to cause catastrophic damage to crops which sets the elephant apart from other problem animals in the eye of the

farmer. In terms of conflict management it is important to focus upon the rare incidents caused by large groups of elephants. Extra resources should be sent to areas where elephants raid crops in large groups.

4.8.5 GIS Analysis

Geographical Information Systems (GIS) are a means of digitally mapping and spatially analysing HEC data. GIS enables us to identify key conflict zones at a glance. In addition, it allows us to determine the influence of geographical features such as rivers, human variables such as roads, and climatic variables such as rainfall, upon the location of conflict incidents. However, GIS analysis requires the use of specialist software which in turn requires considerable training. For this reason, GIS analysis is not covered in this manual. Nevertheless, if your project has the capacity for GIS analysis, we strongly recommend you carry this out.

4.9.Conclusions

A systematic approach to HEC monitoring enables the wildlife manager to track patterns of HEC over time and to make comparisons between different geographical areas. Both quantitative data and qualitative data should be collected. Quantitative data provides objective information which is easily analysed and compared. By contrast, qualitative data provides an insight into a farmer's perceptions of HEC. Both are equally valuable and should be used in combination. Staff should be comprehensively trained in both techniques and intensively supervised by a competent field supervisor. Data should be analysed to produce an annual summary of results which will identify key patterns of conflict. Advanced analysis can also be used to explore specific patterns in greater detail.

4.10 References

Hoare, RE (2001): *Data collection and analysis protocol for human-elephant conflict situations in Africa*. IUCN/SSC AfESG, Nairobi, http://www.iucn.org/themes/ssc/sgs/afesg/hec/hectools.html

Hoare, RE (2002): *A training package for enumerators of elephant damage.* IUCN/SSC AfESG, Nairobi, Kenya. http://www.iucn.org/themes/ssc/sgs/afesg/hec/hectools.html

Naughton-Treves, L. (1998) Predicting patterns of crop damage by wildlife around Kibale National Park, Uganda. *Conservation Biology*, 12(1):156-168.

Parker, G.E. & Osborn, F.V. (2001): Dual season crop damage by elephants in northern Zimbabwe. *Pachyderm* 30: 49-56.

Parker GE (2006): The Costs and Benefits of Elephants: Communities and the CAMPFIRE Programme in Zimbabwe. *PhD Thesis*, University of Kent, UK.

4.11 Practical Exercises

Two practical exercises will be conducted in conjunction with this module.

Exercise 1: Crop Damage Reporting.
This practical exercise will be held in fields in which actual crop damage has recently occurred. If no crop damage has recently occurred, a simulation can be set up. The exercise will involve questioning the farmer about the incident, gaining background knowledge on the location and time of incident. It will also involve measuring the field and quantifying the extent of the damage. Time required: 3 hours (approx.).

Exercise 2: PRA Interview Techniques.
PRA interview techniques will be practiced in groups at the site of the training. Participants will practice all qualitative crop damage reporting techniques, including asking questions about crop damage, using different ranking methods to prioritise problem animals and conflict issues, and triangulating the methods used. Time required: 2 hours (approx.).

Module 5

Developing Community-Based HEC Mitigation

Photo: Children in Livingstone, Zambia. F.V. Osborn

Module 5

Developing Community-Based HEC Mitigation

5.0 Introduction

This final module explains how to go about implementing an HEC mitigation project. There are several stages, commencing with a pilot survey of current HEC methods, which leads into the selection of methods suitable for your area. Following this we describe the criteria for selecting demonstration sites and the procedure for demonstrating the new HEC methods. Finally, we discuss the impacts of conflict upon rural livelihoods and look into small enterprise development.

5.1 How to Start an HEC Mitigation Project

There are several key activities that must be undertaken early on in the establishment an HEC mitigation project. The first is a brief survey of farmers within your area to find out what conflict mitigation methods are currently being used. This will help you to select the methods of mitigation that will be appropriate for your area, which is the second stage. The third stage involves selecting one or several sites at which to demonstrate the new mitigation techniques, as described in detail below.

5.1.1 A Rapid Survey of Current Mitigation Methods

It is recommended that you conduct a series of short interviews with farmers from across your study area. The interviews will enable you to find out about the nature of conflict issues locally and will reveal which methods are currently being used, and to what effect. Interviews should be carried out by someone with training in PRA techniques and who speaks local languages fluently. It is important to state your objectives to each interviewee at the outset and make it clear the reasons for asking questions and the purpose of your project. At this stage it is important not to make promises about what the project will deliver, as this may raise expectations.

Some suggested questions for rapid interviews are given below:

- Do you have any problems with wild animals?
- If so, what sort of problems do you encounter?
- How often do these problems occur?
- Do you take any measures to reduce conflict?
- If so, what do you do?
- What methods do you use against which animals?
- How effective are these methods? Discuss each one in turn. Use the ranking techniques from Module 4 to prioritise the methods.
- Are you interested in trying new methods?

This information will help you to build up a picture about the local problems and what is being done to address them. In addition, it will give you an idea as to who is

receptive to new ideas and would be willing to work with you in the future. Don't forget to record the name of every interviewee plus the date and the location.

5.2 Selection of Mitigation Methods

As discussed in previous modules, there is a vast array of crop protection methods to choose from. Deciding upon the correct methods is a very difficult process. Methods may first be selected on the basis of whether they had been field tested or not, with preference being given to those that have been successfully implemented in other areas. The methods will also need to meet cost and technology limitations, and be suitable for the physical conditions of the site itself.

5.2.1 Cost and Technology

Every HEC mitigation method can be categorized in terms of its cost, the level of technology involved and the need for outside assistance. A simple fence with cowbells can be considered a cheap and low-tech method because it uses entirely local materials and can be easily repaired. By comparison, an electric fence can be considered a high-tech intervention because it is expensive, the materials are specialized, and construction and maintenance require assistance from outside. High tech methods transfer responsibility to the organizations that fund and maintain them, so perpetuating a community's dependence on outside organizations. By contrast, low tech methods are ideal for CBCM projects because they ensure that responsibility for conflict mitigation is taken by the community, who establish and maintain the methods themselves.

Obviously for community-based crop protection we are looking to use low tech methods which are also low cost, and which require little or no assistance from organizations outside the community. Always aim to start with the lowest technology methods, but keep higher technology options in reserve as they may be required in the future. Very high tech interventions, such as electric fencing, should be considered a last resort once all other options have been tried.

5.2.2 Site-Specific Considerations

Every location is physically different. Site-specific considerations such as climate, agricultural practices and spatial patterns of conflict must be assessed in order to select suitable mitigation methods.

Climate

Mitigation methods must be suitable for the climatic conditions to ensure they remain effective. In areas that experience long rainy seasons with high atmospheric humidity, any crop-protection method utilising electricity will have to be specially designed to cope with the climate. In areas of heavy rainfall trenches may cause erosion. For example, in Uganda, communities have dug trenches on level ground, but have used other barriers such as fencing and walls in valley bottoms and along steep inclines. This has been done to avoid erosion and infilling of the trench by water in the valley bottoms (M. Keigwin, *pers comm*).

Spatial Arrangement of Fields
In some communities fields may occur in a single location which has a collective boundary. In other areas crops may be grown in small isolated plots scattered across a wide area. Each system of agriculture requires a different approach to mitigation: for collective fields it may be possible to establish a collaborative approach to crop protection; whereas in scattered fields it may be more appropriate for each farmer to manage his or her own crop protection.

Community Cooperation
In certain regions farmers may engage in communal tasks, such as road building. This social mechanism may be useful as a model for communal crop protection – people who are used to working together on community projects may be more amenable to the concept of communal crop guarding. Where such activities occur, there is potential to develop a formal community patrol in which farmers patrol all fields in teams on a rotational basis. However, where no formal social co-operations exist, it may be more difficult to establish such a system.

Previous Crop Protection Trials
It is possible that crop protection schemes have been tried in the past in communities around your site. If any of these have been perceived to fail then there is little point in reinventing the wheel. It may be best to avoid such methods as communities will be resistant to trying them again. You will be able to explore this issue during the rapid assessment of current mitigation methods.

5.2.3 Summary of Selection Criteria
In light of the selection considerations, your project should aim to:

1) Introduce cheap and low-tech methods initially.
2) Encourage traditional community deterrent methods and incorporate them into deterrent strategy.
3) Build upon current community guarding and patrolling activities, and encourage further community cooperation.
4) Approach previously failed deterrents with caution as they may be shunned by communities.

5.3 Selecting Which Methods to Use

5.3.1 Selecting a Combination of Methods
Now you should have narrowed your choice of mitigation methods down to those that are most suitable for your area. The next stage is to select methods that will work well together. Below we present the combination of methods that is recommended by the Elephant Pepper Development Trust as a good introductory package. As mentioned in Module 3, there are three elements to an effective mitigation strategy:

1. A barrier, such as a simple fence or trench, which will impede an elephant's entrance to the fields;
2. An alarm, such as a trip wire or bells attached to the fence, which will alert a farmer to the elephant's presence; and,

3. A deterrent, such as chilli bricks and chilli grease, or bamboo bangers to scare the elephant away.

An example of suitable methods is displayed in Table 3. Please note that there are many other methods that could also be used.

Table 3. Example of Mitigation Methods to be Implemented (Parker, 2003).

Method	Type	Description	Cost	Technology level	Availability	Community responsibility
1. String fence	Barrier	String and bush poles surrounding plot	Low	Low	Local	High
2. Alarm system	Alarm	Cowbells tied to simple fence	Low	Low	Local	High
3. Chilli grease	Deterrent	Grease and chilli applied to fence	Med	Low	Local	High
4. Chilli dung	Deterrent	Chilli dung bricks burnt at edge of plot	Low	Low	Local	High

5.3.2 Responsibility for Mitigation Methods

Before implementing HEC mitigation methods, it is important to establish who is responsible for mitigation. Traditionally, when elephants destroy crops or damage property farmers feel that the wildlife authority is responsible and expect some form of compensation. This stems from a long history of colonial and post-colonial governments who have assumed ownership of wildlife. However, most government wildlife authorities are unable to meet the demand for crop protection, as it is expensive and logistically difficult.

With the advent of CBC, authority over wildlife is increasingly being awarded to local communities. This usually means communities taking responsibility for HEC as well. Research indicates that communities who take responsibility for crop protection may be more likely to succeed than those who wait for assistance from external organisations. It is therefore critical that farmers assume some of the responsibility for crop protection.

It is important to lay out responsibilities and clarify roles before the conflict mitigation project is established. In Uganda, a written MOU was drafted between community members and the Uganda Wildlife Authority before an elephant-proof trench was constructed along the border of Queen Elizabeth National Park. The MOU detailed responsibilities for building and maintenance, so reducing the potential for misunderstandings later on in the project. While a written contract may not always be necessary, a meeting with the community should be organized in which responsibilities for the mitigation project are clearly stated.

5.4 Where to Start

5.4.1 Location of Demonstration Sites

We recommend that new crop protection methods are introduced to the community via demonstration sites. A demonstration site fulfills two purposes: first, it displays the crop protection methods to surrounding communities; and second, it demonstrates the effectiveness of the methods of crop protection. Farmers will thus be encouraged to establish their own CBCM systems at their fields. The location of a demonstration site is critical to its performance. In selecting the position of a demonstration site you should consider the following factors:

1. Probability of crop damage (risk)
2. Level of community participation
3. Accessibility of site.

A high risk of crop damage is deemed important as one of the objectives of the demonstration sites is to test the effectiveness of elephant deterrents. Therefore all demonstration sites should be in vulnerable locations. Farms at the boundary of a protected area are at greater risk from crop-raiding than those further away. Food crops are more vulnerable to crop damage than cash crops, with maize being the highest risk of all. In addition, farms with large varieties of crop types are at greater risk than farms with just a few types.

Community participation is a measure of how receptive each community is to new elephant deterrent methods. A real interest in crop protection is considered a pre-requisite for the siting of a demonstration plot. Finally, the plots are designed to introduce the new methods to the surrounding communities, and so need to be accessible to as many farmers as possible.

5.4.2 Establishment of Demonstration Sites

Farmers will be trained in the crop protection methods by means of a practical demonstration held at each site. A suggested framework for establishing a demonstration, which has been successfully implemented by Elephant Pepper in Ghana, Zimbabwe and Zambia, is displayed below:

1. Conduct a short meeting with farmers within your selected community to explain the goals of the programme. State that the project is coming to introduce crop protection methods that will help reduce the levels of HEC within the community. The following points MUST be made clear:

    - The experimental methods should reduce the levels of crop damage, but will not completely solve the problem.
    - No single method will be effective alone. The best results will come where combinations of methods are used.
    - The methods presented are a small sample of many possible methods, and will be added to and adapted over time.
    - Farmers will need to be present in the fields at night - the methods cannot be expected to work without the farmer’s presence.

- The project may financially support the establishment of the demonstration sites. However, there will be no long-term funding for deterrents for individual farmers.

2. Introduce the proposed methods and describe the purpose behind each method:

    - A fence will be constructed from string and bush poles and will encircle the field. The fence will not be not strong enough to physically stop an elephant - rather it is a structure onto which other things can be added.
    - Bells or sirens will be attached to the fence to act as an 'alarm system' to warn farmers that elephants are close to the fields. This will help farmers to react to crop-raiding incidents, but requires that farmers stay close to the fields during the peak crop-raiding season.
    - Chilli is effective against elephants because they have an extremely sensitive sense of smell, and when they smell chilli it causes them intense pain. The trick is to deliver the chilli to the elephants to maximum effect. Two chilli-based deterrent methods will be used:

        a. The first method is to mix chilli and grease and smear it on cloths, which are hung from the fence. When the elephants come to the fence they smell the chilli and are deterred from breaking the fence.
        b. The second method is to mix chilli with elephant dung and make compressed bricks using a brick mould. When dry the bricks will burn for 4-6 hours and produce a strong chilli smoke. The bricks can be burned at the edge of the fields overnight as a deterrent.

Photo: Farmers attach chilli cloths to a fence, Ghana. G.E. Parker

The discussions should be followed by an active demonstration, where a suitable field (preferably with food crops near maturity) is selected and the above methods are implemented with participation from the farmers. It is important that the farmers are actively involved in the process of establishing the methods.

5.4.3 Important Points

- Variation is the key to establishing an effective deterrent system. We recommend you use the methods displayed above as a starting point, but over time you should introduce new methods.

- Encourage adaptation among farmers. If they have new ideas for mitigation they should be encouraged to develop them.
- Support farmers in establishing mitigation methods. However, do not create the expectation that you will provide materials for ever. Farmers should understand the methods are designed to be implemented without outside help.

5.5 Improving Rural Incomes and Developing Alternative Livelihoods

5.5.1 Crop Damage and Rural Incomes

Human-elephant conflict seriously affects the livelihoods of rural farming communities. This is especially the case for crop damage, which reduces the ability of a farmer to feed his or her family. In northern Zimbabwe rural farmers rely almost entirely upon their crops to subsist, and apart from cash crops such as cotton, there is little alternative economic activity. This is the case for many rural communities across the continent. Even where other forms of income occur, farming still contributes a large proportion of livelihood. Therefore, to mitigate the impact of crop damage upon rural livelihoods, we need to reduce crop damage, but we also need to diversify rural incomes.

5.5.2 Small Enterprise Development

Encouraging small enterprise development can help to reduce the impact of human-wildlife conflict upon rural farmers' livelihoods, by improving and diversifying people's incomes. If farmers are less reliant upon their crops then conflict will have a lesser impact upon them. There is a further benefit to encouraging a shift away from agriculture-based livelihoods: if farmers engage in alternative livelihoods, such as tourism or craft work, the area of land under cultivation will be reduced and the potential for conflict will be lessened.

But how is it possible to develop alternative livelihoods? We present three case studies in which alternative sources of income have been explored. In the first two, alternative cash crops are introduced or encouraged in a new area. In the third case study, an entirely new industry has been established.

Growing Ginger in Ghana (GE Parker)

Little research exists on elephant 'preferences' for particular crops, but there are a few crops that elephants appear not to eat. Ginger and chilli are two such crops and they have been encouraged in communities around Kakum Conservation Area, Ghana, where HEC is commonplace.

It is possible to harvest 30 or so baskets of ginger from an acre of land. Each basket is worth a minimum of C 60,000 (US$6.80), which makes a total of C 1,800,000 (US$205.00) for every acre planted. These prices can double towards the end of the season as demand rises. This price compares favourably to other annual cash crops, with the added benefit that ginger does not appear to be attractive to wild animals. In addition, ginger is easy to store and transport. Farmers sell ginger at the local market in Fosso, the nearest town. However, there is potential to start selling in Cape Coast or even Accra, where larger markets exist.

Growing Chilli in Zimbabwe (FV Osborn)

Chilli pepper has been introduced as a cash crop by the Elephant Pepper Development Trust to northern Zimbabwe to help rural farmers combat elephant crop damage. Chilli is considered ideal for high conflict areas because: 1) it is a highly adaptable plant which can grow in semi-arid conditions; 2) the complex chemicals that make peppers hot make them unpalatable to mammal pests; 3) chillies are a high value crop; and 4) the low grade chillies can be used to make deterrents such as chilli dung bricks and chilli grease.

Capsaicin is the part of a chilli that makes it 'hot' and is derived from the dried fruits from the family *Solanaceae*. Chillies are grown either as an annual or perennial and in tropical areas the plant can produce fruits for up to 3 years. In addition, these hot peppers can be used by farmers to protect their crops from mammal pests.

Elephant Pepper has been encouraging the growth of chilli in communities in the Zambezi Valley of Zimbabwe since 1998. By partnering with a commercial entity, the Chilli Pepper Company, Elephant Pepper has been able to provide agricultural training and support to farmers. The farmers sell their chillies direct to the Chilli Pepper Company in a Fair Trade-style arrangement which has maximized their returns. This not only improves rural incomes; it also reduces a farmer's vulnerability to crop damage.

Making Elephant Dung Paper in Kenya (M Graham)

The Symbiosis Trust was established in 2005 to provide training and support to communities living in an area of human-elephant conflict in north Kenya. The Trust supports a women's group to produce and sell handmade elephant dung paper. The paper is simple and cheap to make using waste paper, elephant dung, water, paper glue and several wooden frames-much like the production of any other handmade paper. Currently the women are making letter writing sets and art paper of a variety of different sizes for which they receive between US $80 to $300 of direct revenue per month.

The concept of the project is to both offset the costs associated with living with elephants and engender a sense of ownership and responsibility for elephants through the provision of benefits to *individuals*. The challenge for the trust is to generate sufficient demand to create a much larger pool of dung paper producers and 'elephant beneficiaries'. To this end the trust is launching a range of new handmade dung paper products in 2007, including: diaries, scrap books, jewelery boxes, picture frames and gift bags. With careful marketing and further development, it is possible that these products could be part of a HEC alleviation tool kit for smallholders in north Kenya and beyond.

5.6 Conclusions

This final module has detailed the stages of implementing an HEC mitigation strategy in a rural community. Suitable HEC methods are selected through a process of rapid interviews, a critique of the costs and technology of HEC methods, and considerations of site conditions. It is suggested three elements are incorporated into the strategy: vigilance, barriers and active deterrents. The CBCM approach should be introduced

by means of a demonstration site established in a suitable location. The process of engaging with the farmers involves outlining the purpose of CBCM, introducing each method and describing its effect. Finally, the impact of conflict upon rural livelihoods is discussed and small enterprise developments are introduced through presentation of 3 case studies from across Africa.

5.7 References

Osborn F V & Parker G E (2002): A community-based system to reduce crop damage by elephants in the communal lands of Zimbabwe. *Pachyderm* 33 (July-December 2002): 32-38.

Parker GE (2003): *Ensuring Farmer's Livelihoods and Food Security Around Kakum Conservation Area, Ghana: Management of Human-Elephant Conflict.* International Consultant's Final Report. UN/FAO, Accra, Ghana.

Parker GE (2006): The Costs and Benefits of Elephants: Communities and the CAMPFIRE Programme in Zimbabwe. *PhD Thesis,* University of Kent, UK.

5.8 Practical Exercises

Two practical exercises will be conducted in conjunction with this module:

Exercise 3: Practicing Rapid Survey Techniques.
Participants should form pairs at the training centre and practice the raid survey questions displayed in section 5.1.1 of the participant's manual. Time required:1 hour.

Exercise 4: Establishing a Demonstration Plot using CBCM Methods
In this exercise the participants should go through the process of selecting a demonstration site. They should then establish a fully functioning demonstration plot for CBCM methods, including a simple fence with alarms, chilli grease and chilli dung bricks. Time required: 3 hours.

Pre- and Post-Training Course 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

Questions

1. How familiar are you with the term “human-elephant conflict” (HEC)?

1 2 3 4 5

2. Do you know the difference between direct and indirect conflict?

1 2 3 4 5

3. Are you familiar with current HEC policies in place across Africa?

1 2 3 4 5

4. How much do you know about elephant behaviour and ecology?

1 2 3 4 5

5. What do you know about the spatial and temporal patterns of HEC that occur?

1 2 3 4 5

6. Are you familiar with methods of HEC mitigation?

1 2 3 4 5

7. How much do you know about the strengths and weaknesses of current HEC mitigation techniques?

1 2 3 4 5

8. Are you familiar with Community-Based Conflict Mitigation (CBCM)?

1 2 3 4 5

9. Do you understand the strengths and weaknesses of CBCM?

1 2 3 4 5

10. Do you know how to set up and maintain a CBCM system?

1 2 3 4 5

11. Are you familiar with quantitative and qualitative data collection?

1 2 3 4 5

12. Do you have knowledge of using PRA techniques to interview rural farmers?

1 2 3 4 5

13. Can you set up a CBCM demonstration site?

1 2 3 4 5

14. Are you familiar with small enterprise development and alternative livelihood approaches?

1 2 3 4 5

15. How well do you feel you would be able to train others in CBCM techniques?

1 2 3 4 5

Overall Course Evaluation

Please give a score that reflects how you feel about the course for each of the following:

- Course organisation
- Course facilitation
- Course content
- Food & accommodation
- Whole package

1=poor and 5=excellent