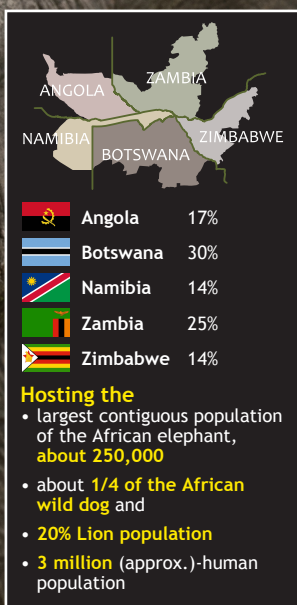
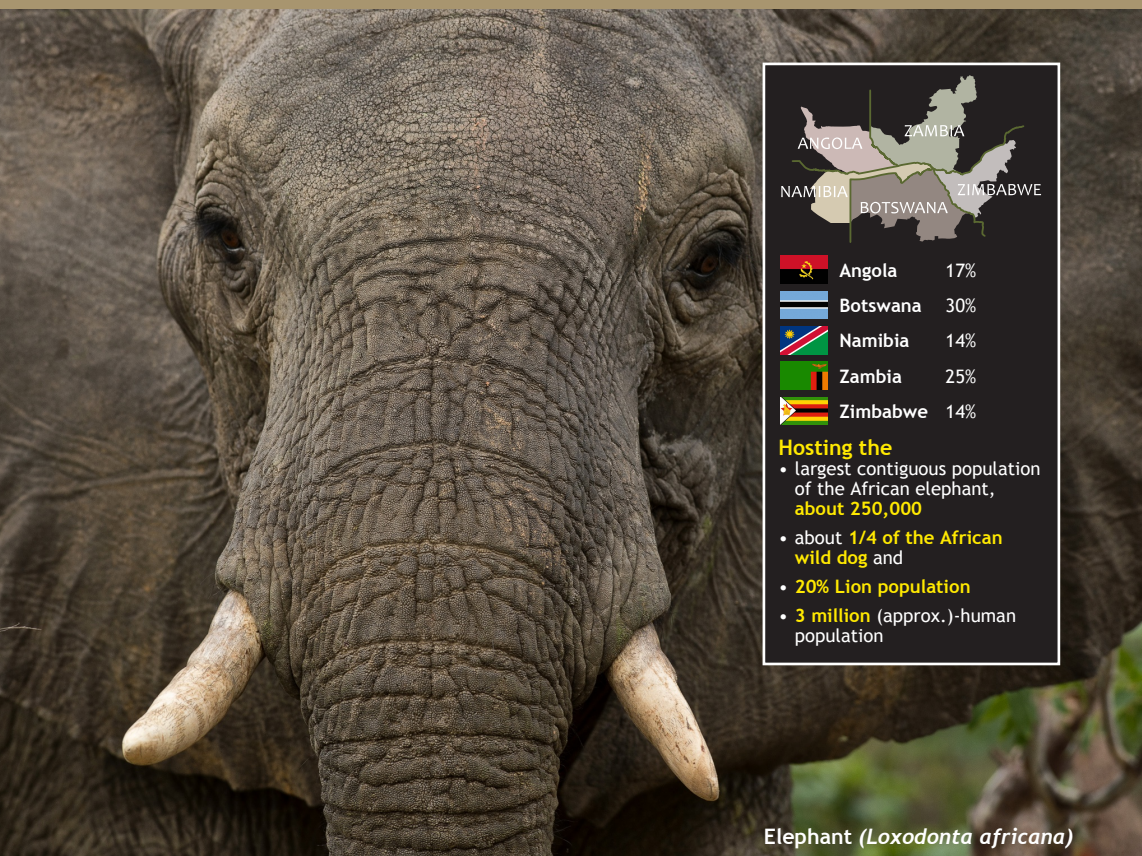




KAVANGO ZAMBEZI

TRANSFRONTIER CONSERVATION AREA (KAZA TFCA)

A MANUAL for REDUCING and MITIGATING HUMAN-ELEPHANT CONFLICT (HEC)



Elephant (*Loxodonta africana*)

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Abbreviations

HEC	Human Elephant Conflict
HWC	Human Wildlife Conflict
KAZA TFCA	Kavango-Zambezi Transfrontier Conservation Area
PA	Protected Areas

KAZA Mission



“To sustainably manage the Kavango Zambezi ecosystem, its heritage and cultural resources based on best conservation and tourism models for the socio-economic wellbeing of the communities and other stakeholders in and around the eco-region through harmonisation of policies, strategies and practices”

1. Introduction

Kavango-Zambezi Transfrontier Conservation Area (KAZA TFCA), is a transboundary collaborative initiative of the five Partner States, Angola, Botswana, Namibia, Zambia and Zimbabwe, in the conservation of shared natural resources and the development of the communities in and around the landscape. The TFCA is a mosaic of multiple land uses composed of:

- Protected areas (PAs) in the form of: national parks; game reserves;
- Wildlife/game management areas; forest reserves; and conservancies/ community concessions areas; and
- Communal areas (settlement, pastoral, and arable farming).

There are about 3 million people settled across the KAZA landscape. The human population is mainly rural communities that are largely dependent on subsistence pastoral and arable agriculture. The multiple land use status of the KAZA landscape present many development challenges and opportunities for the affected communities.

Human elephant conflict (HEC) is one of the most challenging conservation issues in the Kavango-Zambezi (KAZA) Transfrontier Conservation Area (TFCA). HEC is defined as any human elephant interaction which results in negative effects on wellbeing of humans and the conservation of elephants and their environment. It is rapidly developing into critical threats to rural communities where HEC occur in various forms including the destruction of crops and property, fear of travelling at night and competition between people and elephants for natural resources. Rural communities in the KAZA TFCA co-exist with elephants at high densities making conflicts inevitable. Human elephant relationships are complex, ranging from relatively peaceful coexistence to extreme levels of hostility.

As human populations continue to grow and people make deeper incursions into natural habitats through agriculture, mining, settlements and infrastructure developments, human elephant interactions and conflicts will become more widespread and prevalent. Effective human elephant conflict mitigation is difficult to implement because it requires a complex set of social and technical measures that need to be combined flexibly at different temporal and spatial scales.

HEC mitigation measures can be implemented directly within the conflict zone or rely heavily on official policy beyond the conflict zone. Methods can also be short term, for example traditional deterrent and disturbance methods. They can also be long term for example fencing, land use planning, education and awareness programmes, translocation, compensation schemes and community conservation.

1.1. Goal of the manual

- The overall goal of this manual is to improve the understanding of conflict between people and elephants and assist the affected communities in applying best management practice to reduce and mitigate the conflicts.

1.2. Objectives of the manual

- To equip users of the manual with knowledge on human-elephant conflict.
- To assist users of the manual to understand and apply best management practices in reducing and mitigating human elephant conflict.

1.3. Targeted users of the manual

- Farmers (subsistence and commercial) experiencing and affected by human elephant conflict.
- Wildlife managers and extension officers.
- People interested in coexistence of people and elephants.



Figure 1: Adult lone bull elephants tend to be involved in most of the reported conflict incidences.

2. Human Elephant Conflict and its management

Human Elephant Conflict (HEC) is not a new phenomenon in the KAZA TFCA. Farmers (commercial and subsistence) and elephants are increasingly coming into conflict as elephant habitat is converted to farmland. HEC takes many forms, including crop damage, human injury and death, damage to property, water tanks and grain stores and livestock death. However, the most prevalent of these in the KAZA TFCA is crop damage and most of this damage is seasonal, exhibiting a peak of activity when the crops approach maturity as they are more palatable and nutritious at this stage. Managing HEC is challenging because elephants are intelligent and adaptable.

Elephant damage to grain stores is a severe problem in KAZA TFCA, particularly during drought conditions. The loss of this stored food is considered far more disruptive to farmers than the raiding of crops while they are in the fields because the elephants can do a lot of damage to such a concentrated food source in a short space of time. 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.

Although loss of human life is less common than crop damage, it is the most severe manifestation of HEC and is regarded as intolerable. The drivers of HEC are many and include human population growth, conversion of wild lands to agriculture, compression of existing elephant populations, and elephants adapting to a new foraging context, and these among others will continue to play a role in the future of HEC and its mitigation. Human elephant conflict situations can escalate when local people or institutions are unable to deal with the conflict effectively. Where possible, people assigned to resolving a conflict situation should already have, or be trained to acquire, the necessary expertise.

Furthermore, simply arriving at a site and taking an interest in conflict can lead to problems in itself, since it immediately raises expectations that a solution will be forthcoming. If the needs of the local people are not addressed, conflict levels may increase both between humans and elephants, and among humans about the value of elephants. It is crucial to understand the local issues related to the conflict, and to assess how people are equipped to address the problem to avoid careless action when implementing any conflict mitigation strategy.

Recognizing and easing underlying social tensions is fundamental to effective conflict mitigation. The issues surrounding human elephant conflict will sometimes be site specific, but a broader understanding of similarities across different sites is beneficial when designing and implementing any conflict mitigation program.

Figure 2: An elephant herd made up of related females and young males.



2.1. Behavioural traits of elephants

Addressing conflict with elephants is a particular challenge. First, it is important to plan and implement as many of the suggestions outlined as possible. The intelligence of elephants requires that a constant rotation of methods will always work better than reliance on a single method.

2.1.1. General elephant behavioural traits

- Elephants are wary of any change that must be exploited;
- They are extremely sensitive to chilli pepper and bees, a fence of chilli and beehives can act as barriers to deter movement of elephants into crop areas;
- Some methods may be effective on newcomers but once strongly habituated are difficult to deter requiring persistence and determination to break the habit, therefore mitigation tools/measures need to be rotated or combined so as to discourage habituation to occur;
- Threats by elephant mainly prevalent in areas adjacent to Protected Areas (PA) and corridors but declines sharply the further away from protected areas and agriculture areas; however in some areas, elephants are beginning to occupy spaces they have never occupied before
- Cow herds largely not risk takers preferring to keep out of cropped lands unless the lands are poorly placed within the proximity of a PA or an elephant corridors/pathways;
- Bulls on the other hand are efficient risk takers going to great lengths to obtain a tasty morsel;

2.1.2. Detection of danger and accessing information.

- Elephants are widely found in most parts of rural KAZA TFCA and in some of the urban areas;
- Elephants have a well-developed sense of smell which they primarily rely upon to locate food and detect danger;
- Their eyesight is not very good but their hearing is excellent and well developed;
- Where they detect even minute changes to routine and obstacles they are not familiar with, they will first avoid it, an observation that must be exploited to provide good repellence; and
- Elephants are observant and quickly recognize weak points in the various preventative measures placed against them.

2.1.3. Social systems

- Elephants have a well-developed and disciplined social structure governing their behaviour. Elephants live in family groupings of a dozen or more individuals, made up of related females and young males;
- The oldest female in the family acts as the matriarch and guides the other adults and offspring in daily life and in times of hardship. The matriarch is usually of about 30 or 40 years of age. She makes decisions on where the elephants eat and wallow. Herds without a matriarch do not function well;

- After males reach puberty, between nine and eighteen years of age, they leave the family herd to roam with bachelor herds of mature bulls. The females remain with the herd through maturity;
- Young adult females rely on older adults to learn mothering skills and they often help to care for the younger calves;
- Males return periodically to the herd beginning around age of 20 to mate;
- Elephant communities collectively raise their young. This frees individual females to forage and helps the herd prosper. Adolescent females usually help the mother raise the calves, increasing their chance of survival;
- Females generally conceive from the age of eight years, though they are receptive (in oestrus) for only a few days over a few years and they can have a life span stretching to 60 years or more under optimal conditions in the wild;
- Musth is a highly aggressive even psychotic state of heightened sexuality and aggression that adult male elephants go through every 3 to 6 months;
- Musth usually lasts only for a few days and is secreted by a gland located about halfway between the animals' eye and ear. This temporal gland swells during musth and produces a strong-smelling, sticky, dark liquid that dribbles and even flows from the elephant's head, staining the lower part of its face; and
- Most of the aggressive behaviour shown by male elephants even during HEC can be associated to this musth period and form part of their reproductive strategy.



Figure 3: Bull elephant in musth, secreting temporin from the temporal glands.

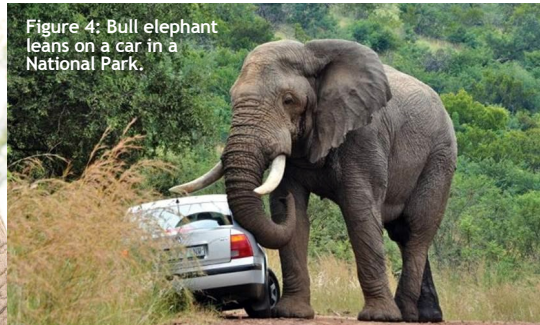


Figure 4: Bull elephant leans on a car in a National Park.



Figure 5: An encounter of people and elephants in the Okavango Delta. This is a common occurrence across the KAZA TFCA.

2.1.4. Communication

- Elephants rely on their sense of smell for many aspects of social and reproductive behaviour;
- Elephants produce a wide variety of calls, with some individuals having a preference for certain sounds;
- Elephants can communicate with different sounds, some a loud enough for the human ear such as trumpeting, and others are inaudible, on frequency sound level, called infrasound that is below the range of human hearing. The advantage of infrasound is that it carries over long distances and passes relatively undisturbed through forests and grasslands; and
- To attract males oestrous females emit low frequency rumbles that can bring in males from long distances around.

2.1.5. Diet and feeding

- Elephants are generalist feeders and can exploit a large variety of food sources. They feed on a variety of plant matter, especially grass, leaves, fruit, roots and bark and can consume up to 5 percent of their body mass in 24 hours;
- Adult elephants can consume 180kgs of feed per day and spend 90% of their time foraging spending very few hours sleeping and doing other activities;
- Adult elephants have a water requirement ranging from about 160 litres per day and this high water requirement and dependency tend to drive conflict with people;
- African elephants are wide-ranging species requiring large areas in which to roam and tend to move in predictable patterns along established pathways while foraging but also establishing their own paths; and
- Availability of food and water govern the seasonal movement and distribution of elephants.

2.2. Common problems caused by elephants

Human Elephant Conflict occur in a variety of settings including farms, protected areas, roads, villages, towns and contexts resource overlap, food provisioning and tourism. Below are some of the common problems that are caused by interactions of humans and elephants in the KAZA TFCA.

Figure 6: Motorists are advised to give way to elephants in and around Protected Areas.



Figure 7: Lone Elephant in Victoria Falls Township



2.2.1. Damage of crops

- Damage of crops that results from invasion of crop fields by elephants can be seasonal but tend to be severe in the dry season when food stores are raided. It is influenced by availability of both crops and wild food resources. Intensity may vary as a function of local crop assemblages, planting patterns, growth stage and ripening periods with certain crops and developmental stages being consumed preferentially;
- Elephants cause great devastation to cereal crops that include maize, sorghum, millet and sometimes wheat and eat all plants edible to people and can consume a subsistence farmer's entire season's crop in one raid;
- Elephants also eat ripe agricultural fruits most often during periods of wild fruit scarcity, but certain seasonal crops such as mango and pineapples are targeted when available, irrespective of wild fruit availability. Hence, crop consumption may be a fallback strategy, but also a preferential means of accessing a high energy food.

Crop damages are more likely to occur:

- In areas close to boundaries of protected areas such as National Parks;
- Near elephant refuges (e.g. forested areas within a farming area) where elephants can hide during the day;
- Near established elephant pathways;
- Near sources of permanent water; and
- Near trees with fruits that elephant like.



Figure 8: Crop damage is the most prevalent form of conflict by elephants.

2.2.2. Attacks on humans

- Attacks on people by elephants occur mostly when people are protecting their crops and property, when moving in known elephant pathways (mostly at night or early morning) and when people are collecting firewood and other forestry products as well as at water sources such as rivers and in areas of high anthropogenic disturbance, such as on the edge of villages, in towns, and tourist sites;
- Elephants like most animals tend to avoid people and when disturbed they flee from people rather than fight;
- Elephants are considered dangerous and where little resistance is put up whilst crop raiding, they have learned to intimidate people working in lands in the communal areas in order to raid the crop; and
- Reports of aggression toward humans are on the increase in urban areas where they forage in rubbish pits that seldom occurs in natural populations.

2.2.3. Damage to Property

- Quite often, elephants can be a problem destroying property such as grain stores, water tanks and pipes, food stores and pantries in tourism places as well as fences and other barriers costing thousands of dollars in damages, repairing and maintenance costs; and
- Unprotected properties such as wells and food stores where attractants of elephants like food and water are found are easily targeted.

2.2.4. Transmission of zoonotic diseases

- Elephants can spread mycobacterium tuberculosis to people and it is common mainly in captive elephants.
- In the KAZA region, diseases such as anthrax have been known to be transmitted by and to kill elephants.

3. Methods of reducing and mitigating human elephant conflict

Effective human-elephant conflict resolution requires multifaceted approaches, which acknowledge that conflict is a result of not simply economic loss but also deep rooted cultural values and clashes among human groups with different interest and values. The challenge in elephant conflict mitigation is to understand the crop-raiding behaviour and find better ways to manipulate the costs and benefits of raiding, for example, by using up time, increasing risks, or decreasing benefits. Methods of control should also consider the human context, past, present, and future. Changing crop varieties may help.



Figure 9: A graphic of households implementing Community-Based Conflict Mitigation that incorporates several techniques such as beehives, chilli and conventional fences, guard dogs and other measures to deter elephants.



Figure 10: It is important to clear bush around fences to create a buffer that allow farmers to easily spot intruding elephants.



Figure 11: Conservation agriculture and growing of crops that are not palatable to elephants is recommended.

3.1. Use of Repellents

- Use of repellents in reducing and mitigating HEC is a traditional method that aims to deter elephants from having access to vulnerable crop fields. Basic types of visual, sound, and chemical substances that deter elephants from approaching or settling in crop fields;
- Widely used visual repellent such as scarecrows. These are often ineffective at deterring elephants from entering certain areas, as most elephants will readily habituate to them;
- Stock whips, home-made pipe bangers and bells are the traditional sound repellents. Caution is required when considering any visual, sound and chemical repellents as they may displace target elephants to new locations and farms or impact non-target wildlife and humans;
- Vulnerable crops can be sprayed with chemical repellent, such as a bittering agent, that gives an unpleasant experience to elephants. Capsicum solution (hot chilli oil and hot chilli wax) can be used on plants raided by elephants, and this method can reduce the palatability of crops;
- Several chilli based repellents like smouldering chilli bricks and guns can be used as repellents; and
- Colonized beehives have shown to be effective in repelling elephants where conditions are suitable for bee farming. Bees can be integrated into livelihood strategies of communities living in elephant range, with honey being harvested for additional income.

3.2. Guarding crops (Vigilance)

- Many farmers use common traditional practices to reduce and mitigate HEC in KAZA TFCA. Active guarding of the crops throughout the day and night not only on predictable times is important to reduce crop loss. However, guarding and chasing are time and labour intensive and there is increased risk of injury;
- Farmers can use fires, torches and flashing lights to scare away elephants at night;
- Understanding when elephants target certain areas may enable people to direct their resources more effectively. Watch towers are widely used to provide shelter to the guards especially those who deal with chronic incursions;
- The guarding measures preferred by different groups of people vary such as patrolling fields and shouting, banging objects, throwing stones or spears, using catapults, and using guard animals like dogs. Chasing elephants with a pack of dogs or throwing stones also heightens the perception of risk and improves success; and
- The use of dogs and donkeys to accompany livestock has recently been used in Namibia. This has enjoyed a reasonable degree of success in reducing incidences of HEC where cheetah and spotted hyena are concerned. A wide range of dog breeds can be used for this, but under a specific guard dog programme in Namibia, Anatolian sheep dogs were used.

"A unique conservation, tourism and sustainable development partnership."

Figure 12: Bull elephant in a cloud of oleo-resin fired from a chilli dispensing gun.



Figure 13: A man propelling a chilli canister in a field and a labeled chilli gun. These are some of the hi-tech mitigation tools.



Figure 14 & 15: High pitched sound makers used in deterring elephants

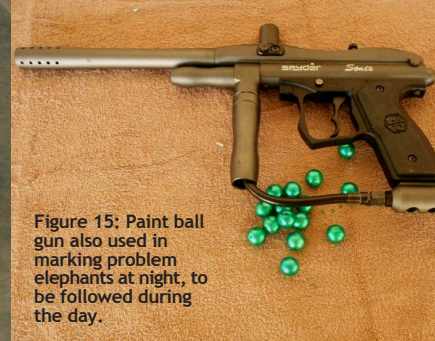


Figure 15: Paint ball gun also used in marking problem elephants at night, to be followed during the day.

Figure 17 & 19: Chilli bricks, made from elephant dung and chilli are burnt around fields.



Figure 20: Fire crackers produce light and deafening sound like gunshots to scare elephants.



Figure 21: Kenyan top-bar beehive under thatched roof mounted around crop fields.



Figure 22: Temporary watch tower where farmers can rest during crop protection.



3.3. Use of barriers

There are several barriers that can be used to inhibit access to human inhabited areas, property and crops. These barriers include:

3.3.1. Fencing

Fencing is a widely used method in KAZA TFCA to keep elephants out of agricultural areas. The effectiveness of the fencing varies and can be related to the prevailing environmental conditions and resource requirements. Below is a list of forms of fencing and their effectiveness.

- Traditional fencing is largely ineffective in mitigating HEC due to elephants ability to pull down fences.
- Live hedges of carefully chosen and locally available species known to be unattractive to elephants could be an effective means of isolating vulnerable crops from the forest edge, particularly when interspersed with unpalatable crops.
- Clearing the vegetation around fences may enhance visibility and discourage more conscious elephants from entering agricultural areas;
- Electric fences can repel elephants but tend to become ineffective due to the elephants ability to learn to overcome the physical barriers;
- The fence must encircle whole field or property as elephants will walk around partial fences;
- Fences may not be repositioned once installed if improper designs are chosen and often fail because of poor design, layout and vandalism or theft. In some cases, fencing wire is used in poaching of wildlife;
- Barriers like deep and wide trenches can deter elephants from crossing into agricultural areas;
- Corrugated zinc sheets placed on fences may act as visual barriers in deterring elephants from entering fenced areas

3.3.2. Buffers zones

- Buffer zones around elephant habitat might discourage elephants from crossing into human settlements and agricultural areas. Buffer zones are blocks of land located between natural forests and cultivated areas that can discourage elephants from crossing between them. The method is a land use practice that is designed to reduce human elephant interactions. Buffer zones are likely to be more feasible in areas where there is a hard edge between elephant habitat and human activities, for example on the edges of some national parks but bull elephants are known to ignore these.



Figure 23-26: A collage of different types of fences used as barriers. Note the use of scare-crows in the last photograph.

Figure 27: Tin cans with small stones inside tied on fences are used as an alarm system as they make noise when disturbed by elephants.



Figure 28: Plastic bottles with shiny aluminum foil inside tied on simple fences to shine in the night and work as a visual barrier to elephants.



Figure 29: Electric fences can be of different types, sizes and design.



Figure 30: Trenches can be dug around crop fields or properties targeted by problem elephants.



Figure 31: Use of traditional fences is common across the region.

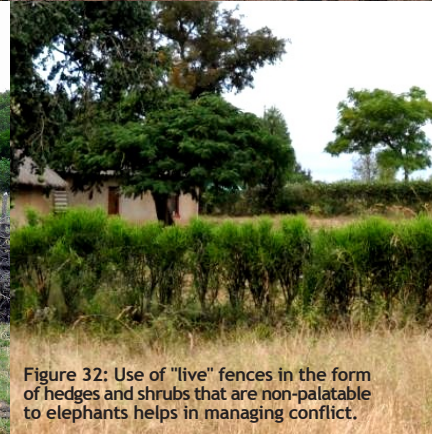


Figure 32: Use of "live" fences in the form of hedges and shrubs that are non-palatable to elephants helps in managing conflict.

3.4. Translocation

- Translocation of either people or elephants as a HEC mitigation measure should be considered only as a last resort as it is expensive and labour intensive. Moving people from areas experiencing aggressive elephants is more likely to yield a long lasting solution to HEC but is the most least likely to be tolerated. The method is more likely to succeed if combined with direct or indirect benefit sharing schemes. However, the translocation of problem elephants is stressful to the animals, can be dangerous and potentially life threatening for the animal.

3.5. Education and awareness raising programs

- As with all HWC situations, education is the basis of changing attitudes towards a conflict situation. This may promote a better understanding of elephant behaviour thus reducing damage across a range of contexts from tourist settings to village encounters. However, the method do not offer a technical solution to resolve human elephant conflicts; and
- Education informs people about how to behave or not to behave when encountering elephants potentially reducing the incidence of aggressive interactions. The method can also equip locals with knowledge on growing of crops that are unpalatable to elephants yet being of high commercial value like chilli peppers.

3.6. Financial incentives

- The provision of financial incentives can be a successful method in reducing and mitigating HEC. When revenue from tourism activities involving elephants is distributed to local communities, negative perceptions towards elephants and the damage they might cause, can be partially addressed; and
- It is important to consider that schemes that achieve successes in the short term may cause serious problems in the long term. For example, tourism can create negative situations with elephants and requires careful management of behavioural problems, (such as stealing food from tourists) to the more serious risks of disease transmission and aggressive behaviour that results in death or injury.

3.7. Monetary compensation

- Monetary compensation for damaged property and / or lost revenues can provide short term mitigation of HEC. However, it addresses only the symptoms and not the causes of the problem and is not encouraged in places where it has not been introduced before.
- Key determinants of success for compensation schemes typically include the accurate and rapid verification of damage, prompt and fair payment embedded in a transparent process, a long term source of funding capable of responding to variations in damage over time, clear rules and guidelines that link payment to sound management practices, an appreciation of the cultural and socioeconomic context and an ability to actively monitor the elephant population of interest.
- Compensation schemes often fail to provide incentives for local people to conserve elephants, especially when they do not identify and target those most affected by elephant damage.

3.8. Land use planning

- In order to have an effective land use plan, a participatory planning system that restricts migration of people into PAs and encourages compatible land uses.
- Integrated land use planning is a long-term effective method for preventing HEC that aims to create space for people and elephants' harmonious coexistence.
- The development and implementation of land use plans is a high priority to mitigate HEC.
- Success of the method to mitigate conflicts is strongly related to uptake of other livelihood options by locals to reduce dependence on livestock as the only source of income.

3.9. Lethal control

- Killing an elephant by shooting or other means is the ultimate escalation of risk. This method of mitigating HEC may only be effective on female herds if the animal is killed in full view of the group caught in the act of raiding. Otherwise, males tend to ignore as they have loose bonds and in most cases, the connection between action and consequence, benefit and cost, is not learned by the rest of the herd. Male elephants, in particular, often emigrate from the group so a male's disappearance is unremarkable.

4. Recommendations for control of habituated elephants

Elephants are resourceful and when they come across crop fields, houses and properties where the food is easily available (in grain/food stores/granaries, lying on tables, displayed in kitchen windows, spread out on camping sites, growing in vegetable gardens, stuffed into dustbins), they will feed on this feast and be back for more. This will become their habit.

In addressing a habituated elephant, identify what is attracting the elephants. This can be food, water or garbage, or a combination. Take action to remove the source, or at least make it a lot harder for the elephant to get to what is attracting them in the first place. Then look at ways of deterring elephants from your property/home.



Figure 33 & 34: Trans-location of problem elephants can be considered in specific situations.

5. Tips on an encounter with a problem elephants

- Remain calm and stand up straight to display a strong and confident yet non-threatening behavior.
- Do not walk through a herd of elephants; instead, wait for an opportunity to walk around them, or wait for them to leave before you proceed.
- If they do not appear threatened by your presence and if they will not move from your path, keep your distance and make a loud noise such as clapping your hands to encourage them to move on.
- Elephants can mock charge you and sometimes back off when only a few metres away.
- Never feed wild elephants.
- Female groups will defend and protect their calves aggressively so if you get too close to them, the matriarch or any other elephant might attack you and the others will join the attack.

6. Training

Training should be a continuous process for all stakeholders. Various programs of training targeting farmers and extension officers should be executed periodically to improve the technical capacity of the various stakeholders that are responsible to respond to HEC. The understanding of animal behavior and wildlife management, as well as the general awareness programs should be part and parcel of the authorities responsible for wildlife management.

7. Conclusion

It is essential to have accurate spatial and temporal geo-referenced information about when and where the conflict is occurring. This understanding, together with implementation of appropriate mitigation measures, should lead to a better focus on target areas and the most relevant species. Wildlife management and conservation authorities need to understand the HEC hotspots in their respective components and design robust programmes for support to the communities against wildlife damages. The support programmes should be accompanied by effective support on implementation of mitigation measures, and Monitoring & Evaluation tools. In order to realize positive result in dealing with HEC all stakeholders are requested to ensure that:

- The above interventions are constantly implemented and supported, and not just as occasional campaigns;
- There is greater active participation in the strategic activities by the various parties responsible HWC mitigation;
- There are opportunities to introduce other innovative mechanisms and approaches on dealing with any type of HWC; and
- Adequate capacity in terms of equipment, skills set, technology, and financial resources are in place to effectively support HWC mitigation.

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KAVANGO ZAMBEZI

TRANSFRONTIER CONSERVATION AREA (KAZA TFCA)



Angola

Ministério da Cultura, Turismo e Ambiente
Rua do MAT - Complexo
Administrativo
Clássico to Talatona
Edifício N° 4, 7°, Andar, Luanda, Angola
Tel: (244) 918458421



Botswana

Department of Wildlife and National Parks
Plot 50380 Moedi House, Fairgrounds
Gaborone, Botswana
Tel: (267) 3971405 • Fax: (267) 3180775



Namibia

Ministry of Environment, Forestry and Tourism
Trotskie Building, 1st Floor
Private Bag 13306, Windhoek
Phillip Troskie Building, Windhoek, Namibia
Tel: (264)-61 2842335 • Fax: (264)-61 229936



Zambia

Department of National Parks and Wildlife
Conservation Division
Private Bag1, Kafue Road, Chilanga, Zambia
Tel: (260) 211 278 129 / 278 482/279 080
Fax: (260) 211 278 524/278 299



Zimbabwe

Zimbabwe Parks and Wildlife Management Authority
The Conservation Division
Conner Sandringham and Borrowdale Roads
Botanical Gardens
P. O. Box CY140 Causeway, Harare, Zimbabwe
Tel: (263) 4 707624-8 • Fax: (263) 04 726 089

Enquiries

KAZA TFCA Secretariat
P. O. Box 821 Kasane, Botswana
Tel: +267 625 1332/1269
Fax: +267 625 1400
Email: info@kavangozambezi.org
www.kavangozambezi.org



Implemented by



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Connected Conservation
and KAZA TFCA Secretariat



info@connectedconservation.com
www.connectedconservation.com