Final Report

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Okavango Delta Management Plan

Component 5: Wildlife Management – Human Elephant Conflict

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ABBREVIATIONS

CBNRM	Community Based Natural Resources Management
CBPAC	Community Based Problem Animal Control
DSS	Decision Support System
DWNP	Department of Wildlife and National Parks
EPDT	Elephant Pepper Development Trust
HEC	Human Elephant Conflict
IDRNC	Integrated Rural Development and Nature Conservation
MOMS	Management Oriented Monitoring System
ODMP	Okavango Delta Management Plan
PAC	Problem Animal Control

CHAPTER ONE

REPORT ON HUMAN – ELEPHANT CONFLICT IN THE ODMP RAMSAR SITE

1 Summary

This is the final report of the Human-elephant conflict consultancy and includes an overview of the activities undertaken over a 10 month period in 2006. The report proposes an implementation plan to reduce conflict in the delta region. Like many situations where there is conflict between elephants and people, solutions are elusive and complex. Conflict is widespread across the region and in some cases fairly severe. Technically the problem is possible to resolve but the political will to address the underlying causes needs to be addressed and strong leadership is needed to resolve issues regarding, for example, settlement patterns, compensation and cultivation before any lasting solution can be implemented.

Part of the solution will require a combination of the designation of elephant corridors, modification or elimination of compensation for crop damage by elephants and the removal of subsidized incentives to cultivate. Larger protected agriculture operations other than the current dispersed unprotected *sub*-subsistence farming currently being practiced, may need to be developed, to be sufficient to provide alternative sources of cereal crops for the human population.

In July 2006 the consultants counselled that mitigation methods could not be recommended until a series of activities are undertaken by the DWNP, local and central Government and the people of the affected communities. We believed then and now that instituting mitigation without addressing the underlying causes of this conflict may exacerbate the problem in many of the communities where this conflict is acute. This said, we have been tasked by the DWNP and ODMP to suggest and pilot a mitigation strategy which is aimed at addressing both the short and medium term issues.

The mitigation of conflict between elephants and people is a process which will take a number of seasons to implement fully. An adaptive management approach toward conflict reduction must be adopted by the implementing authority. To insure that the short term successes in reducing crop loss to elephants is followed by implementing the medium and long term measures which are necessary for the sustained reduction in conflict incidents.

The mitigation methods demonstrated to DWNP staff included the community-based problem animal control methods developed by the Elephant Pepper Development Trust (EPDT) and include a range of simple actions that can be taken by a farmer to reduce crop loss to elephants. These include both passive and active methods (outlined elsewhere in this report) and are based on the principle that an individual farmer must take responsibility for this conflict. These methods are augmented by the inclusion of ground chilli peppers which create a lasting innate aversion response by elephants.

Selection of fields and the development of relationships with farmers is already fairly late for meaningful data to be collected during the 2006/07 season as this should be undertaken in the dry season.[1] If an accurate assessment of the methods is to be achieved this season then money and resources need to be allocated extremely quickly.

[1] See the EPDT manual

2 Introduction

The overall elephant management goal is to "conserve and optimise elephant populations while ensuring the maintenance of habitats and biodiversity, promoting the contribution of elephants to national development and to the communities within their range at the same time as minimising their negative impacts on rural livelihoods."[2]

As part of the first objective to reduce human-elephant conflict to acceptable levels, activities suggested included a national assessment of human-elephant conflict cases and put appropriate counter-measures in place and to promote community participation (training etc) and encourage and assist affected communities to address the problem themselves using multiple countermeasures including disturbance of animals, physical barriers and repellents.

In order to address the final part of the ToR we include a detailed proposal for a pilot mitigation project for the Delta RAMSAR site that in theory could be expanded to the other areas where conflict exists in Botswana. In order to put this proposal into context, an analysis of the current and past conditions concerning conflict with elephants is presented.

3 Situation Description

The Okavango Delta has been described in a number of studies[3] where the main environmental issues influencing conflict between elephants and people have been identified as rainfall patterns and access to water by elephants. The rains usually start in November and end in March and the delta floods peak in June/July. The main subsistence crops are maize, sorghum, millet, beans and pumpkins/watermelons and tend to be intercropped or saturated soil cultivation is widely practiced toward the end of the rainy season and dry season gardens are common. [4]

"The majority of people in Ngamiland maintain a diversified income generation system as a means of reducing risks in an unstable environment. The main economic activities in the district are rainfed and flood recession cultivation *(Molapo)*, livestock management, fishing, hunting, gathering of veld products, small scale commercial enterprises like the production and sale of crafts and local food and beverages, wage labour in the tourism industry, and formal employment in the government and in the private sector.[5] "The importance of the individual economic activities varies from household to household; from community to community; from season to season and from year to year in response to variations in rainfall and flooding, access to resources, labour and capital, and cultural and other factors influencing preferences"[6]

Villages (pop >2000 persons) have schools, clinics, council offices, police station and communication facilities. In terms of the relevant institutions active in these areas the communities of Seronga, (S18 47 58.9/E022 37 14.9) Gunotsoga, Ereetsha, Beetsha and Gudigwa (see Map 1) make up the Okavango Community

[2] National policy and strategy for the conservation and management of elephant in Botswana (2003)

[3] Mosojane, S. (2004)

[4] The people, their agricultural practices and suggestions to resolve these problems are well documented in the ODMP interview report and the paper by Bendson and Meyer. This document outlines both the history and the underlying causes of the conflict with exacting clarity and its recommendations should be implemented as a matter of urgency. As many of the points we wanted to make are better worded in this manuscript, with thanks we quote extensively from it in this draft report.

[5] Bendson and Meyer (2003)

[6] IUCN 1992

Trust (OCT). The Trust has leased NG 22 (a multi-purpose area intended to include sable hunting) and NG 23 (a photographic area) for several years and operated photographic and safari hunting operations with joint venture partners."[7] The DWNP also has representatives in these areas and there is an ecotourism development project at Gudigwa with the Mabukakhwe Cultural Community Trust.

An issue of major concern is the fact that many of the people are cultivating illegally with no formal land tenure. Also people regularly cultivate within 150m of the water which contravenes the Environmental Conservation Act. In fact the main vegetable grower in Seronga village is in this illegal zone. It is also worth noting that there is very little commercial agriculture in and around Maun and most vegetables are imported from South Africa.

3.1 Elephant ecology

It must be stressed that understanding the seasonal ecology of this elephant population is essential for designing a mitigation program. The study of elephant behavior is a well researched field and basic understanding of what is creating this conflict is developed through detailed analysis of specific sites. For example, an intensive study needs to be undertaken in Seronga with regards to designing an elephant corridor.

The elephants in this area are dependant for the water from the delta during the dry season and will tend to drink at least once every two days. In a normal rainfall year, ephemeral water sources tend to begin to dry up in late March and the number of animals recorded crossing through villages to get to water increased significantly.[8]

In a number of documents it was suggested that water points be situated in the 'hinterland' to reduce the need for elephants to pass through settlement en route to a drinking spot and thus keep elephants away from villages. We do not support this idea because artificial water points for wildlife are notoriously difficult to maintain and unless supported by tourism and may just exacerbate the situation.

Elephants are complex creatures which have the ability to exist in a wide range of conditions. Their ecology and their adaptability has been the subject of extensive research, especially since the 1970s. As highly intelligent social animals, elephants exhibit complex behaviour which has also been extensively researched.

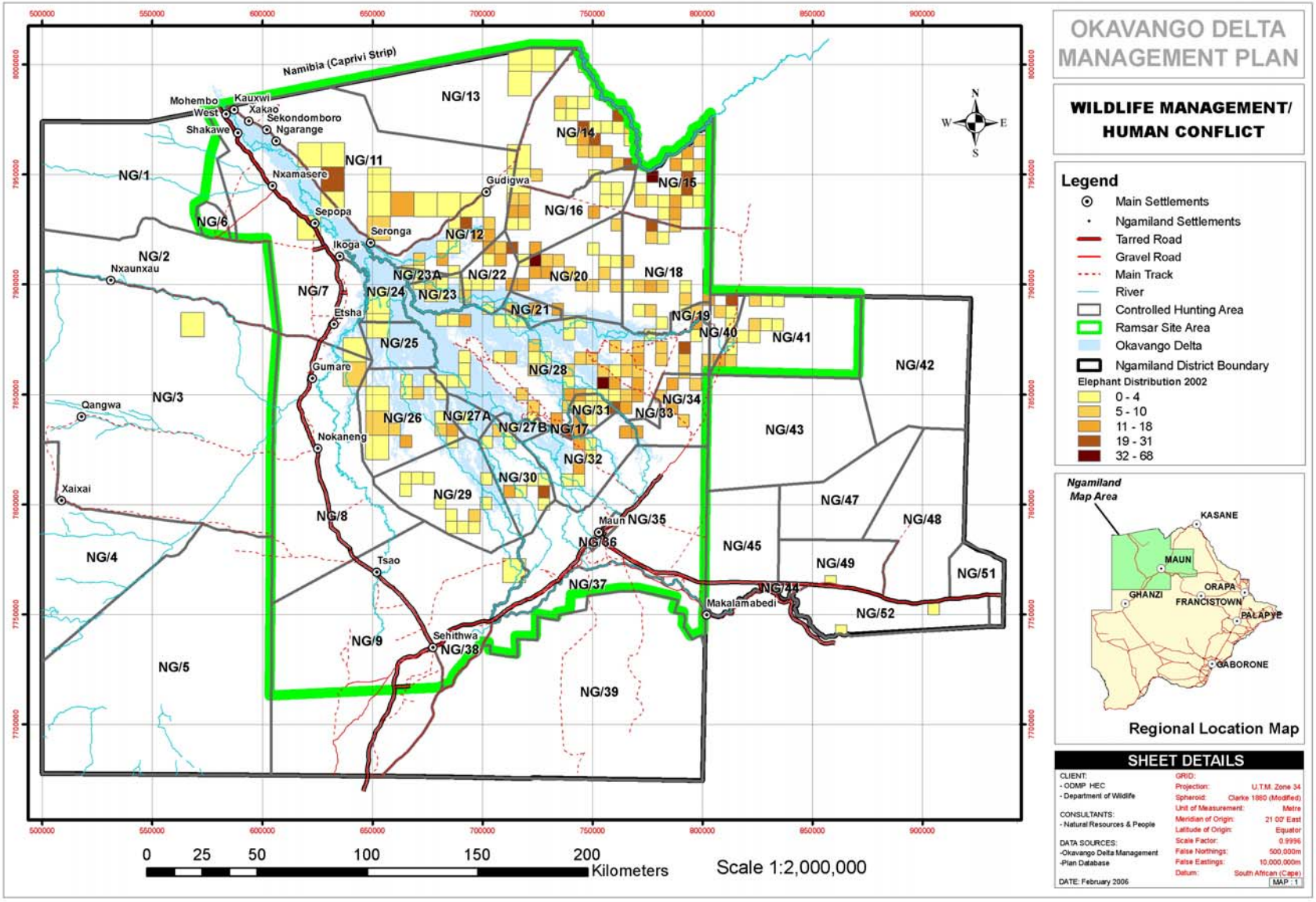
Elements of elephant habitat selection, distribution, diet and social structure are presented and discussed in the context of elephant conflict, in order to help explain the patterns of crop damage that occur. The behaviour of crop-raiding elephants is investigated in order to identify patterns that will assist in the development of effective mitigation measures.

3.1.1 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. For example in Chobe National Park family herds rarely travel more than 3.5km from permanent water during the dry season because of the high water dependence in calves.

[7] Gadd, M. (2002)
[8] Mosojane, S (2004)

Map 1: 2002 Dry Season Elephant Distribution



3.1.2 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. For example, in the Zambezi Valley elephants feed 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 also 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.

3.1.3 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 (Laws et al, 1975). 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 will travel large distances in search of oestrus females, especially during the rains when mating occurs.

3.1.4 Patterns of crop damage

Crop damage is highly variable in space and time, 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.

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 village next door may receive no damage at all. However, despite this variation, several patterns exist.

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 damage also occurs along established elephant pathways. Sources of permanent water are a further interface for conflict to occur, being a resource that both humans and elephants directly compete for. Elephants are highly water-dependent and where water is limited then 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. Elephant crop damage may also be influenced by vegetation type. For example elephant damage to vegetable gardens along rivers during the dry season can coincided with the fruiting of trees elephants like to feed on.

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 exhibits a peak of activity when crops approach 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 in the mid dry season when vegetable gardens are mature.

Mature crops are targeted by crop-raiding elephants because they are most palatable at this stage of growth. Their fruiting bodies and seeds are highly nutritious. Indeed, mature crops will be 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.

3.2 Results

3.2.1 Conflict hot spots in the RAMSAR site

No one source of data gives an accurate assessment of a 'hotspot'. A number of factors have influenced our selection of three distinct areas Seronga, Sepopa and Shorobe. Firstly we examined the PAC event book in Maun for the past three seasons and grouped the reports. We spoke to the PAC unit about where they spend most of their time then travelled to various villages around the delta and asked locals. While every settlement we visited complained of some conflict with wildlife, the highest consistent intensity is in these three areas.

In addition to these three primary hot spots, the small settlements or cattleposts of Moghaga, Ndorotsha, Maqwee, Dungu and Danga are in the midst of elephant traffic and frequently have complaints.[9] "Communities like Ditshiping, Mababe and Sankuyo, located in the Wildlife Management Areas of the delta, are extremely exposed to elephant invasion and have almost given up ploughing."

3.2.2 Compensation

The compensation scheme grew out of a long history and while it was launched as a generous way that the government could reduce the impact of wildlife on people, it has in fact created much of the problem seen today. Compensation schemes almost always breed corruption and are not sustainable. Put simply, the system does not encourage development. These schemes are easily exploited to everyone's benefit but not equitably distributed.

[9] Gadd, M. (2002)

There are a number of reports of complaints that farmers have about the scheme such as the period between incident and the visit by the authorities and pay out of compensation takes too long,[10]farmers view the amounts as too little especially regarding livestock.[11] However we saw some examples of an incident being investigated within a week and a payout for crop loss of over BWP1,000 executed in under three weeks.

Complaints about compensation tend to be from farmers living in remote areas and generally mention the time between the incident and the assessment in addition to the low amount paid out. This system allows for many areas of potential corruption. There is pressure for the assessor and farmer to collude and inflate damage claims, not defend them, and attempt to get as much compensation as possible. A rational farmer would plough and plant in an elephant corridor hoping to receive compensation (e.g. farmers get 6 bags average@BWP25 per bag equals BWP150 versus BWP250 per hectare through compensation). In addition there appears to be a political element to it in the delta as the presidential campaigning has begun. [12]

"The inadequate compensation rates for crop losses by elephants and hippos and for livestock killed by predators was a main concern to local land users, raised in 5.9% of all statements. Farmers felt that the losses they faced were way above the compensation payments and requested government to consider increasing the rates to the full market value of their crops or their livestock. The communities were not pleased to hear from the DWNP staff said that due to shortage of funds government does not intend to raise the damage payments. It was explained that the payments are only meant to alleviate the impacts of damage by wildlife but do not intend to replace what has been lost and that the word "compensation" (which means: replacement of the value) will be replaced by the term "*ex gratia*" (which means: out of kindness)."

"Especially in remote areas, where the wildlife conflict is most pronounced, people faced problems in reporting the damage incidence in time (within a week) as there is frequently no wildlife office in the vicinity and no public transport available. Often, when the officers are not able to assess the damage promptly, farmers have difficulties in proving the evidence as the tracks of the intruding wildlife became faint. To overcome this problem it was advocated to let the Agricultural Demonstrator or the Tribal Police Officer handle the damage assessment. Some affected farmers described that they had waited a year or more to receive the compensation. Others had given up altogether in claiming their losses as the travelling costs involved in the procedures outweighed the expected payments."[13]

The general consensus from both Africa and North America is similar. These schemes are ultimately not effective and prove to be counter productive. "Monetary compensation schemes for elephant damage appear to suffer from a considerable number of deficiencies."

[10] Mosojane, S. (2004)
[11] EPDT interview
[12] EPDT interview
[13] Bendson, H.

3.2.2.1 Compensation as a flawed concept

Compensation is unable to decrease the level of the problem (because the cause of the problem is not being addressed)
Compensation reduces the incentive for self-defense by farmers (and therefore could even exacerbate the scale of the problem)
Compensation cannot address the unquantifiable social 'opportunity costs' borne by people who are affected by the threat of problem elephants.

3.2.2.2 Practical problems in implementing compensation

Compensation is cumbersome, expensive and slow to administer, (because of the need to train assessors, cover large areas, have stringent financial controls etc) and once embarked upon, potentially has no end point.
Compensation is open to considerable abuse or blatant corruption (e.g. through: bogus claims; inflated claims; deliberate cultivation in places where crops are likely to be damaged)
There are usually never sufficient funds to cover all compensation claims.
Payment of compensation to only some victims may cause disputes or social problems.
Where compensation schemes need to be promulgated in law, their ability to keep pace with changing economic circumstances or changes in social policy are hopelessly slowed down."[14]

3.2.2.3 Community self-insurance schemes

The concept is currently in place in Namibia and has been touted to be one of the most realistic alternatives to the present compensation scheme. The system will deal with issues of conflict resolution as well as payments for crop losses but is not centralized. The Conflict Resolution Committees (CRCs), which is the community leadership of traditional authorities, seeks to balance the losses of individual community members against benefits from wildlife/elephants gained by the communities. Farmers will then be paid fixed-rates for losses from elephants or any other wildlife species that have a collective value to communities, with payments only being made to registered members, in the event of such member's field being predated upon. However, such payments will only be made within a specific laid down framework of rules and conditions (some kind of constitution), which need be developed by the community members themselves. Claims that fail to meet specifications in the constitution will be deemed ineligible for payment.

3.2.3 Conflict

There is significant conflict with a range of species which live in the delta. The main non-insect crop pests are various bird species which devastate the cereal crops, especially sorghum and millet. Primates, hippo, buffalo, kudu and bush pigs also contribute to the losses farmers' experience, thus elephants are not the biggest threat to cultivation but when they raid their impact is considerable.

[14] AfESG Compensation review

In addition there is a chronic conflict situation with predators which cannot be seen in isolation from the issues surrounding crop pests. We realize these issues have been addressed in previous phases of the ODMP but a joint approach is needed to facilitate mitigation.

"People felt that the activities planned by the DWNP under the ODMP were not directly addressing their concerns as they will only culminate in studies and management plans. Local land users believed that there was enough evidence that the human-wildlife conflict was increasing rapidly and demanded a more action oriented approach to alleviate the problem. People had the impression that government was not taking their contribution seriously. Farmers suggested "Moving a thousand elephants to the capital and to the major villages in the south to make decision makers more aware of the gravity of the conflict"[15].

3.2.4 DWNP-PAC Units

While the Wildlife Department generally has good relations with communities, only communities have the right to kill raiding animals while Department personnel do not. The DWNP staff commented that they feel they are trying to implement a flawed system. "Compensation and PAC is political", was noted repeatedly. Staff mentioned that they have old vehicles and lack of staff and equipment to do their job properly.

In addition, there appears to be very little relationship between DWNP and the private sector with regards to issues surrounding HEC, short of taking lease fees.

3.2.5 Farming systems in Botswana

One of the issues observed was the lack of intensity toward agriculture that exist around the delta. The reason for this is complex and related to both a strong livestock heritage where cultivation has never been seen as high priority. This combined with government subsides make farmers less than committed to high yield production.

The result of various government programs is one of the major obstacles to creating an atmosphere where mitigation will be successful. It is therefore important to review the history. In general fields are very small and food is given to those that are considered destitute.

3.2.6 Policy related incentives and subsidies

"From 1996 to 1998 government assisted farmers in the CBPP affected area of Ngamiland with free seeds (32 kg of seed for 5 ha and 2 kg cow peas), payments for draft power (5 ha at P150/ha), row planting (5 ha at P60/ha.), and destumping. The relief program did not result in a production increase, as the rainfall was too low and sporadic (Regional Agricultural Office Ngamiland, 1998)."[16]

The main issue that needs to be addressed is the culture of dependency that has developed with people living in these areas. The various disasters have created a sense that people in Ngamiland deserve hand outs from the Government. They are provided with seed and farm implements at subsidized prices. In some areas people appear to plant knowing they will get compensated if it does not grow.

[15] Observations, Concerns and Recommendations Related to Component 5: Wildlife Management: Institution responsible: Department of Wildlife and National Parks Results and Analysis of the Feedback Community Consultation Process on the ODMP. H. Bendsen

[16] Bendsen and Meyer (2003)

"Survey results in Ngamiland West Communal Second Development Area (CFDA) indicate, "the youth has lost interest in agriculture" (Kirkels, 1992). Parents are not sending their children to school to become better farmers but with the aspiration to increase their chances to find formal employment (Rashem, 1988)."[17] In addition, "Although women carry out most of the activities in crop farming, ploughing is considered to be a male domain. The fact that a growing number of households in the district are female headed (in 1980 27%; in 1996 38%, and in 1998 47%) (Agricultural Statistics Unit, 1980, 2000 and 2001) with limited access to male labour and to draft power for ploughing, contributes substantially to the stagnation of the arable sector."[18]

Also, men are traditionally responsible for protection of crops from large and dangerous pests. Less men available means that farms are not guarded and are easy targets for raiding animals. This in turn makes an already vulnerable household less able to maintain adequate nutrition levels through the dry season.

"Most farmers cultivate small areas for subsistence purposes. At present only 10% of the farmers reach full subsistence level and live mainly from their own production (Ndozi, Nthibe & Bandeke, 1999: 36). According to the Agricultural Statistics (Agricultural Statistics Unit, 2002), not more than 10,668 ha were cultivated in Ngamiland in 1997. Looking at the long-term average 2.1 ha are ploughed annually per household (Agricultural Statistics Unit, 1968-2002)."

"On average only 40% of the total area cultivated can be harvested at the end of the cropping season (Agricultural Statistics Unit, 1968 – 2002). In some years, the ratio between area harvested and planted is even less favourable. These figures clearly illustrate the uncertainties crop-farming bears. The high failure rate can be attributed to drought or erratic rainfall patterns, flooding (in flood-recession farmland) and crop losses or crop damage by livestock, wildlife, birds (particularly quelea), rodents, and pests. Even though millet is more likely to be damaged by birds, it is far more drought resistant. When comparing the likelihood of crop failure between different crops, it becomes apparent that maize and sorghum are more vulnerable to total crop losses than millet (analysis of Agricultural Statistics, 1968-2002)."

"The younger generation feel that with elephants around it is not worth farming- Villagers seem a bit confused about which activities to engage in."

3.2.7 Corridors

One of the underlying issues creating this conflict is the places where elephants and people congregate and this is often associated with the need for both to drink and for people to cultivate. People have settled along the panhandle and elephants need to drink so in some areas hundreds of elephants are passing through villages to get to water during the dry season.

A number of people around Seronga village are living in a very clearly defined movement path of elephants. There are daily movements from the panhandle eastwards into the dry bushveld which might indicate these animals are displaced due to people and the elephants are being forced to live in sub-optimal habitats during the day then move to drink and feed at night along the delta.

Many of the farmers living in these areas do not have any land title but still are eligible for compensation. Some of these people will need to be moved, through

[17] Bendsen and Meyer (2003)
[18] Bendsen and Meyer (2003)

incentives, to areas that can be defended. These areas are politically sensitive and conflict with a range of species is a national issue.

The ODMP Land Use Plan is presently held in draft until other ODMP component inputs are made available including recommendations from this component for the designation of elephant movement corridors. Map 2 indicates the location of corridors in the northern part of the Ramsar site. The corridors have been identified or verified by the following means:

- Corridors were identified through community and private sector input to the tourism development plan using participatory planning techniques. These corridors were transferred to paper maps using GIS;
- Corridors were located using GPS through field visits during the socio-economic survey and mitigation strategy field trips;
- Corridors were verified using PAC staff local knowledge during the training of trainers field activities in the Panhandle area;
- Corridors were collaborated with existing data on elephant road crossings for the area from Seronga to Ereethsa.

It should be noted that not all corridors on the map relate to areas with human conflict. Some areas in the eastern part of the Ramsar site have been identified for potential tourism development to facilitate tourist site developments to maximize elephant viewing.

3.2.8 Mitigation

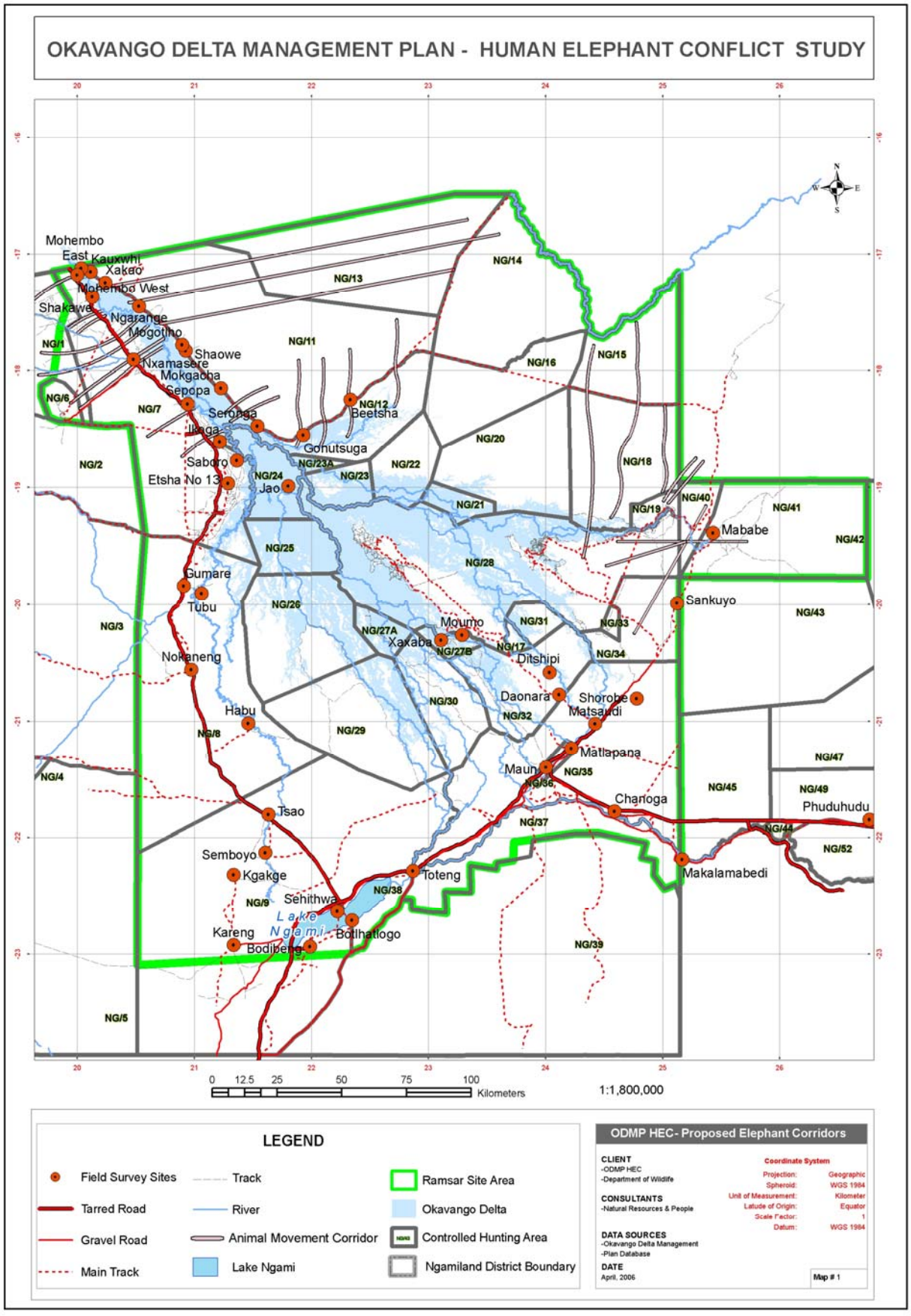
Fields tend to be between 1-5 km from homesteads which appears partly due to people wanting to live by a main road but cultivate near water. No evidence was observed of farmers actively defending their crops at night from elephants unless the fields are within sight of a homestead. Farmers seemed unwilling to sleep in temporary shelters in their fields to guard against raids like what is done in other parts of the region. Small areas of cultivation are encircled with 1-2 meter high wire mesh fences mainly to keep out domestic stock. In comparison to other areas in Africa, farmers engage in little conflict mitigation for either crop pests or predators.

The main point which needs to be addressed by the ODMP is the fact that if cultivation is being undertaken in areas deemed ‘illegal’ then mitigation will create more of a problem for all stakeholders. Existing laws need to be enforced.

3.2.9 Land Use Issues

At the core of this problem is land use planning (LUP). A much more detailed survey of this issue needs to be undertaken as a priority. There is a need for enforcement of laws regarding land use around the delta and the laws are in place but need to be enforced. There is a need to educate land holders of the value of having land certificates and the allocation of new fields or elephant corridors must be a participatory process. This issue will be addressed more fully in the pilot proposal.

Map 2: Location of Elephant Corridors



3.2.10 Elephant population growth and over abundance

While it is difficult to draw a clear correlation between the growing elephant population in Botswana and the increase in conflict between elephants and people, aerial surveys confirm that the number of elephants has increased in the Delta over the past decade. This fact is due to the ever expanding population in the region and the fact that they are increasing the pressure on both the Delta ecosystem and thus the farmers who now encircle the Delta.

It is also not clear if the recommended elephant population reductions suggested in the Elephant Management Plan would significantly reduce the current levels of conflict. However, strategic reduction of herds in areas where they are increasingly coming into contact with farmers would make the elephants far more susceptible to being repelled by traditional methods, at least in the short term. There is no question that Botswana has to manage its elephant population for the benefit of the country's human population and at times this means sustainable hunting and culling.

3.3 Socio-Economic Survey

As part of gathering the necessary baseline information, the consultants commissioned a socio-economic survey in the hotspots identified through discussions with a range of stakeholders. The goal of the socio-economic and resource economic assessments was to provide quantitative and subjective information concerning the current and past status of human elephant conflict in Ngamiland and the RAMSAR site. As numerous socio-economic field surveys have been previously completed, concerted efforts was made to extract baseline socio-economic data from existing reports in order to allow the actual interaction with the community members to focus on human elephant conflict.

The main objectives of the socio-economic survey was to quantify variation on the type of conflict being experienced across the RAMSAR site and elicit community concerns regarding current and any proposed changes to approach to address HEC issues.

In order to analyze policy impact and implementation of an approach to ameliorate the impact of elephants, the economic component sought to assess the current approaches and assess the possibilities for alternative ones. These results suggest that the people living in the RAMSAR site are impacted negatively by the presence of elephants and are in need of some livelihood options to mitigate the economic burden of living with wildlife.[19]

3.4 Cost-Benefit Analysis

In the attached survey undertaken on behalf of the consultants, results indicate that without elephant-induced crop losses, the contribution of crop production to households' livelihoods and to the national income could be between one and a half and three times higher. Thus, for example, without current levels of elephant damage, the value of crop production in the Okavango Delta area to the national economy could increase from some P2.8 million to some P7.5 million per annum.

Second, cost-benefit analysis shows that the costs to communities in terms of elephant-induced crops losses, are outweighed by the benefits that communities can and do derive from wildlife through CBNRM investments. Thus the policy (as adopted by the Namibian government) that HEC can be approached through

[19] Socio-economic survey of communities around the Okavango Delta (Attached document)

CBNRM development is economically sound for Botswana, at least in the context of the Okavango delta.

One important implication of these findings is that research and development on farm- and community-level mitigation of HEC impacts should continue and HEC should be as far as possible be internalized within the CBNRM process. Policies that allow for mitigation and compensation at household level, but within the context of CBNRM will likely be the most economically efficient, and preferable to any compensation schemes involving central government.

4 Recommendations

These recommendations reflect the interrelated nature of conflict and natural resources management under the Okavango Delta Management Plan. At least two components of the ODMP may require consideration in an integrated manner if conflict is to be addressed.

Implementation of existing land use schemes and enforcing the ban on stream bank cultivation and cultivation in recognized elephant corridors. The issue of illegal farming/settlement must be addressed and enforced, especially in the panhandle areas.

Compensation for elephant damage should be discontinued through a phased program that encourages farmers to take responsibility for protecting their crops as this money can be better allocated elsewhere should be a stated goal for the coming season.

- **Proposed a gradual** removal of the scheme i.e. reducing the amount paid out on an annual basis for any crops lost. This contrasts fully the current situation whereby the amount paid out in the past 5 years has been increasing and communities still feel that the compensation is even lower than they expect.
- **Conditional payment** of compensation: implies that those following to the latter laid down procedures such as those in CBPAC will have a percentage of their lost property being compensated for. For example, if one is not kraaling his cattle he will not be paid anything, the same applies to those not protecting their crops or living near their crops shall not be compensated for any loss they incur. Those settling illegally in elephant corridors should have the same fate as well.

Self assurance scheme (as mentioned earlier)

Discussion between government departments and NGO's with regards to the reason people are cultivating in such marginal agricultural areas and the need to remove subsidized incentives to cultivate. Realistic alternatives for food security need to be identified.

Detailed scrutiny of existing elephant movement pathways in order to address the issues of mandatory removal of people from designated elephant corridors.

Amend the current monitoring scheme and publish data regarding the patterns of crop damage in each area- map and present these to the communities.

Experiment with the mitigation program introduced to officers in Maun in November 2006 and if accepted by both DWNP and the communities, look to expand in the 2007/8 season.

The ODMP has requested 'high level' strategic objectives relating to recommendations to address human elephant conflict in the Ramsar site that should be incorporated into the Final ODMP Management Plan. The following three interrelated objectives are proposed:

To increase the direct economic value from *non-consumptive* use of elephants in order for elephants to complement current livelihood strategies in Ngamiland

To ensure economic benefits are maximized through integrated land use planning inputs from the Land Board, Department of Tourism, Department of

Crops and Animal Production, Veterinary Department, Department of Wildlife and National Parks and the Department of Environmental Affairs (ODMP)

To ensure economic benefits reach the household level in all areas where communities live with elephants through measures including adaptation of the compensation scheme, CBNRM benefits distribution, or others that may be identified through consultation with interested and affected communities

If as the CBA states, that HEC can effectively eliminate the viability of crop production (and therefore, usually, food security), then a range of measures will be needed to deal effectively with HEC; no single response will be appropriate in all cases. Perhaps, no single response will be able to deal with HEC by itself.

Maximization of the economic potential of the resident elephant population would appear to present a favourable alternative and complementary livelihood strategy to rural populations characterized by high levels of unemployment and poverty in Ngamiland.

In the absence of allocation of resource rights to communities Government may still be able to promote a system where the benefits from wildlife may be sufficient at the household level to internalize the negative costs of living with elephants.

To achieve this, an integrated multi-faceted response is proposed:

The Draft Land Use Plan for the Tawana Land Board to include identified corridors;

Proposed panhandle tourism development area to utilize designated corridors;

Citizen empowerment element of tourism component to ensure economic opportunities available to communities (proposed scorecard)

CBNRM action plan ensures ‘mechanism’ for distribution of benefits to communities

Benefits at household level used to support community based compensation program

Field level traditional and non-traditional mitigation used to protect villages, property and agriculture fields outside of corridors;

Decision support to include: MOMS, streamlined PAC, Tourism scorecard, policy impact matrix

If not achieved, present a request to relevant Departments to support problem animal control and compensation

1. **Land Use Planning Component** – The proposed designation of NG 13 as a wildlife management corridor in the Draft Land Use Management Plan most likely needs to be reconsidered to include parts of NG 11, as there is clear evidence of elephant movement corridors to access water from the Delta. Clear statements about physical developments, agriculture and compensation are required in the Land Use Plan for proposals in the elephant movement corridors. Clarification of “molapo” and “stream bank” cultivation is required as there is a distinction between the two in the panhandle area and in the areas to the east of Maun.
2. **Sustainable Tourism Component** – Alternative and supplementary livelihood strategies for those communities currently practicing subsistence agriculture in elephant movement corridors can be proposed that may include eco-tourism or community based conservation as part of the tourism development plan for communities in the panhandle area. Revenue from eco-tourism or hunting concessions may be considered as part of a “self-insurance” plans to be administered in lieu of the current government based compensation programme.

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CHAPTER 2

PILOT STUDY DESIGN OF MITIGATION MEASURES

1 Proposal for one year implementation of Information and Mitigation Study

The consultants were tasked by the director of DWNP to propose a strategy for implementing mitigation trials at various sites across the Delta, but other hotspots across Botswana. While those sites are not addressed, we feel that the same process outlined below could be implemented as is at any other conflict hotspot in Botswana.

2 Project design

The three main aspects of this study will be: 1) implementing a range of mitigation efforts and 2) data collection and monthly analysis of conflict incidents in three areas of the Delta earlier identified as hotspots and 3) assistance in integrating elephant mitigation strategies as part of alternative livelihood strategies through integrated landuse planning. The general research and management questions to be addressed are:

1. What mitigation methods would be effective in these villages?
2. How can data be collected effectively?
3. How can conflict situations be managed by local committees?
4. How can compensation be reduced?
5. Will CBPAC methods be successful in Botswana?
6. At the end of the project will people have an improved perception of the Delta and its management?
7. Has the political pressure on wildlife managers been reduced?
8. Has the livelihood security of Ngamiland improved?

3 Project design for the 2006/7 wet season in the Okavango RAMSAR site

The goal of the implementation of a pilot mitigation program is to assess the usefulness of the proposed system for wildlife managers and farmers in the RAMSAR site. To this end it is important that the Community-Based Problem Animal Control (CBPAC) program is adopted in its entirety and then the impacts are closely monitored for at least one season.

The first role of the Primary Investigator (PI) will be to discuss the proposed strategy with all stakeholders before the raiding period begins. Consensus will need to be reached and farmers willing to try the methods will need to be further identified. The PI will then need to build up trust with the participating farmers by regular visits to the selected fields. Farmers will be expected to record all visits to their fields by elephants so it is important to insure that these records are accurate.

An essential role of this individual will be to bring together all of the various stakeholders needed to resolve the middle term issues such as the land boards, local traditional leaders and the farmers themselves.

4 Methods

Conflict studies always require a range of data sets over multiple seasons to fully assess each case. Three general areas in the north east side of the pan handle the south west and the south eastern corner of the Delta. In these sites a minimum of three sub-sites will be selected in different situations (e.g. fields near the delta or fields in the hinterland). In these sub-sites a minimum of five areas of agriculture not larger than two hectares will be selected for mitigation trials. This selection process has to be fluid as farmers may abandon fields, harvest early or be the site where an elephant is killed. All of these invalidate a field as a data point.

Under the oversight of the PI, enumerators in each trial area will map out the current agricultural layout and traditional elephant movement patterns. Farmers' selected for mitigation trials will be trained in CBPAC methods at training sessions before the onset of the crop-raiding season. Fields for intensive monitoring will be selected after consultation with all the stakeholders, particularly the farmers.

In order to insure that monitoring and mitigation work is undertaken correctly, two sets of trainings are needed. First is a 'train the trainers' for the senior level of those involved in the success of this program which was undertaken in November 2006 at DWNP offices in Maun[20]. These will be followed with a series of site specific trainings for farmers in the three pilot locations.

In the attached training document all the data sheets needed by the PI are available and weekly records of elephant activity in the areas near the selected field sites monitored. Mitigation methods will need to be monitored at least weekly in the months leading up to the raiding season then daily once the first raids occur.

The three hotspots identified by this consultancy were the villages of Seronga, Sepopa and Sherobe. These sites also provide a contrast of situations which will aid in the final assessment of the introduced mitigation methods. At least 5 fields in each village will be monitored by both the farmers on a daily bases and the PI on a weekly bases. It will also be important to select a village, not the three listed above, by random to monitor as a control.

5 Field monitoring and analysis

Accurate information about when and where the conflict is occurring is important for making decisions. Simple crop damage monitoring schemes are very important for gathering information that can be used in drawing up a strategy to combat the problem.

In general two types of data will be collected. The first is technical, such as raiding incidents, field visits, success or failure of various methods. These are easily scored on data forms and can be analyzed statistically on a monthly basis. The second types of data are more subjective and have to do with perceptions of farmers, measuring changes in political pressure and addressing livelihood security. These data are better assessed through on-site observation and interpretation and semi-structured interviews.

The field selection process began with the oversight of DWNP officials and should be completed before the end of the year. The PI will begin the process of training the farmers in the simple monitoring forms that will be introduced over the coming months. When the first visits start to occur in late January, early February, more intensive monitoring of the patterns of visitation to the pilot sites by crop raiding elephants.

The basic data set on which much of the other analysis will be based is the crop damage incidents (see attached data sheet). These data will be collected on a daily basis and both positive data (actual incidents) and negative data (days of no activity) will be recorded. This will tell the PI two important things- when exactly did the crop raiding occur and how much damage do they inflict on individuals and villages. These data can also be compared statistically between villages and with the control.

The next data set will be the 'Active PAC' records that both farmers and the investigators will record. These data forms (see attached) give structure to what happens during a raiding incident and importantly what, if any, mitigation was exercised and will help to access the effectiveness of the active PAC. Finally a record will be kept of the effectiveness of the various 'Passive PAC' methods introduced. These include clearing of buffer zones, string fences and pepper grease (see attached manual).

The last set of data to be collected are those regarding the perceptual changes of the participants. These, in some ways, are the most difficult to measure and involve the development of a series of a questionnaire that will be administered before and after the raiding season. While the most difficult to interpret these results will be the most important for assessing the effectiveness of the mitigation methods.

6 Monitoring and evaluation

Using the existing event books and the proposed MOMS data capture and record keeping, monthly summaries will be graphed and mapped. A person will be needed to create and present these two the PAC enumerators to insure data accuracy and to keep staff involved in the process. Quarterly progress reports will be distributed to those involved for feedback so approaches taken can be reviewed during the season. Monitoring data will need to be incorporated into a GIS database to assist in analysis and display of the results to facilitate an understanding of their relevance to other areas in Botswana experiencing human elephant conflict. The GIS will assist landuse planning through the identification and confirmation of movement corridors for consideration by the Land Board. The land use planner will seek to identify community based tourism products focusing on positive benefits from elephants for promotion by the Department of Tourism.

7 Time Line for Pilot Scheme

The consultants suggest that the PI be selected and in place in Maun as soon as possible. The allocation of funds has already been delayed and a considerable amount of 'catch-up' work will already ensue. The first task of the PI will be to finish the field selection process recently undertaken by participants of the EPDT training course. Then farmer training must begin in the three target areas immediately.

Once elephants return to the area their daily movements will be monitored by the local enumerators and once the first visits to the fields occurs then the project switches from a teaching mode to an implementation mode. Assessments will be made of the primary mitigation methods such as the fencing and burning of chilli dung on a week by week basis.

8 Budgeting

1. Allocation of human resources

A project of this nature will need a 'champion' in both the ODMP and the DWNP who will oversee and monitor data collection from a range of sites. The first aspect of this project will be to allocate the people and the salary needed to sustain them over twelve months. In addition a number of researchers will need to be responsible for field monitoring on a weekly basis during the peak season. Ideally these people will be based in the conflict areas for the key periods of data collection to insure that both the information gathering and mitigation trials are implemented correctly. Lastly each researcher will need at least two local enumerators at each project site.

2. Allocation of material resources

The main cost in a study like this one is transport and it is essential that an appropriate vehicle is allocated for the duration of the project. Another budget line will include fuel and maintenance. This vehicle will be turned back to Government of Botswana at the conclusion of the project. Other items such as PAC materials will either be procured in Maun, Gaborone or Harare. An office and accommodation for the Primary Investigator (PI) and support staff in Maun would also need to be organized.

FINANCIAL EXPENDITURE			SCENARIO 1		SCENARIO 2	
ITEM	**Unit**	**Amount (BWP)**	**Number**	**Total**	**Number**	**TOTAL BWP**
Human resources						
Subsistence						
Primary Investigator (PI) @ BWP 6,220 per day x 350 days	Days	622	350	217,700	350	217,700
Project coordinators @ BWP 311 per day x 300 x 3 people	People	311	900	279,900	-	-
Land Use Planner	Days	2,177	24	52,248	15	32,655
GIS Mapping	Days	1,244	15	18,660	15	18,660
3 assistants @ BWP62 per day x 300 days (6 assistants in scenario 2)	Assistants	62	900	55,980	1,800	111,960
Lodging BWP 45 per day for 300 days-PI and 3 co-investigators	Day	45	900	40,500	900	40,500
Food BWP 50 per day for 300 days-PI 3 co-investigators	Food	50	900	45,000	900	45,000
Loding and Food Land Use Planner	Night	400	14	5,600	14	5,600
Accountants/Secretary	Fixed rate	93,300	1	93,300		-
Driver	Fixed rate	55,980	1	55,980		-
Travel						-
Vehicle (New purchase to be returned to Bots Gov)	Unit	124,400	1	124,400	1	124,400
Cost of vehicle(s) BWP2.2/km x 2000 km	Kilometres	12	4,200	52,248	6,600	82,104
Land Use Planner Travel	RT Flight	1,000	6	6,000	6	6,000
Regional traveling @ 1,866 per trip x 5 trips	RT Flight	1,866	5	9,330	5	9,330
			Sub-total	**1,056,846**	**Sub-total**	**693,909**
Equipment						-
Bangers x 100		622	1	622	1	622
Chilli dung bricks						
Cow bells x 100		622	1	622	1	622
Bailing twine x 100m		1,866	1	1,866	1	1,866
Mutton cloth x 100m		1,866	1	1,866	1	1,866
Grease/used oil x 50l		1,555	1	1,555	1	1,555
Log beehives @ BWP 311 x 20		311	20	6,220	20	6,220
Honey harvesting suits @ BWP 622 x 2		622	2	1,244	1	622
Slashers, shovels, gloves, torches,		6,220	1	6,220	1	6,220
Consumables						
Office Rent @ BWP 1,866 per month x 12 months		1,866	12	22,392		-
Monthly bills @ 100 per month x 12 months		622	12	7,464		-
Office/ field Consumables		6,220	1	6,220	1	6,220
Printing course material @ BWP 155.50 each x 8 x 3		1,244	1	1,244	1	1,244
Other				-		
Subsistence for the 8 participants during 5 day course @ 150 per day x 5 days x 3 courses				18,000		0
			Sub-total	**75,535**	**Sub-total**	**27,057**
			TOTAL	**BWP 1,132,381**	**TOTAL**	**BWP 720,966**

CHAPTER 3

RESULTS OF THE SOCIO - ECONOMIC IMPACT STUDY

1 Summary

As part of the NRP consultancy a socio-economic survey was carried out in 'hotspots' identified through discussions with a range of stakeholders. The goal of the socio-economic and resource economic assessments was to provide quantitative and subjective information concerning the current and past status of human elephant conflict in Ngamiland and the RAMSAR site. As numerous socio-economic field surveys have been previously completed, concerted efforts was made to extract baseline socio-economic data from existing reports in order to allow the actual interaction with the community members to focus on human elephant conflict.

The main objectives of the socio-economic survey was to quantify variation on the type of conflict being experienced across the RAMSAR site and elicit community concerns regarding current and any proposed changes to approach to address HEC issues.

In order to analyze policy impact and implementation of an approach to ameliorate the impact of elephants, the economic component sought to assess the current approaches and assess the possibilities for alternative ones.

These results suggest that the people living in the RAMSAR site are impacted negatively by the presence of elephants and are in need of some livelihood options to mitigate the economic burden of living with wildlife.

2 Methodology

Data were collected using household surveys and focus group discussions. For the focus group discussions, village leaders were requested to identify between six and eight key informants that could provide information regarding human–elephant conflict in and around the village. Key informants were invited to a meeting to gather general information concerning livelihood activities and strategies in the village as well as past and current trends regarding human–elephant conflict. As part of the focus group discussions, community mapping was conducted with the key informants to attempt to describe where elephant incidents have occurred in and around the village, in order to better understand the spatial nature of the conflict.

Due to the absence of specific geo-referencing of actual impact at the household level from the Problem Animal Control records of the Department of Wildlife and National Parks, the key informants were asked to select up to five households in each village to be surveyed after the focus group survey. Quantitative and qualitative information regarding the impact of human–elephant conflict at the household level was collected using this survey instrument.

As agreed with the client, the sample size was chosen to provide the greatest amount of information to be collected efficiently and effectively, without placing additional burden on community members who may already have been part of previous household surveys and kgotla meetings regarding other aspects of the Okavango Delta Management Plan being undertaken at the same time. Households were purposively sampled – that is, they were selected on the basis that they had suffered from crop damage caused by elephants in the 2004/2005 cropping season. This purposive sample means that the results are not statistically representative of all farming households around the Okavango Delta, though they may be representative of farming households that have suffered from crop damage caused by elephants around the Okavango Delta.

Ten villages were sampled, which aimed to reflect a uniform spatial distribution in the three 'hot spot' areas noted by the Steering Committee – to the north-east of Maun, the eastern Panhandle and the western Panhandle (see). The field work was conducted between the 19th of May and the 1st of June, 2006.

Table 1 outlines the villages actually surveyed, the dates that fieldwork was conducted and details of the number of household surveys and focus group discussions completed in each village. Eleven focus group discussions and 44 household surveys were completed during the field work phase. (In one village, Matsaudi, key informants were split into two groups, and two focus group discussions were conducted. One group was representative of youth in the village, and the other of elders). Of the households surveyed, 43 households (98 percent) had suffered from human–elephant conflict during the 2004/2005 cropping season. The timing of the survey meant that it was not possible to ask about human–elephant conflict during the 2005/2006 cropping season, as the season was not complete at the time of the fieldwork.

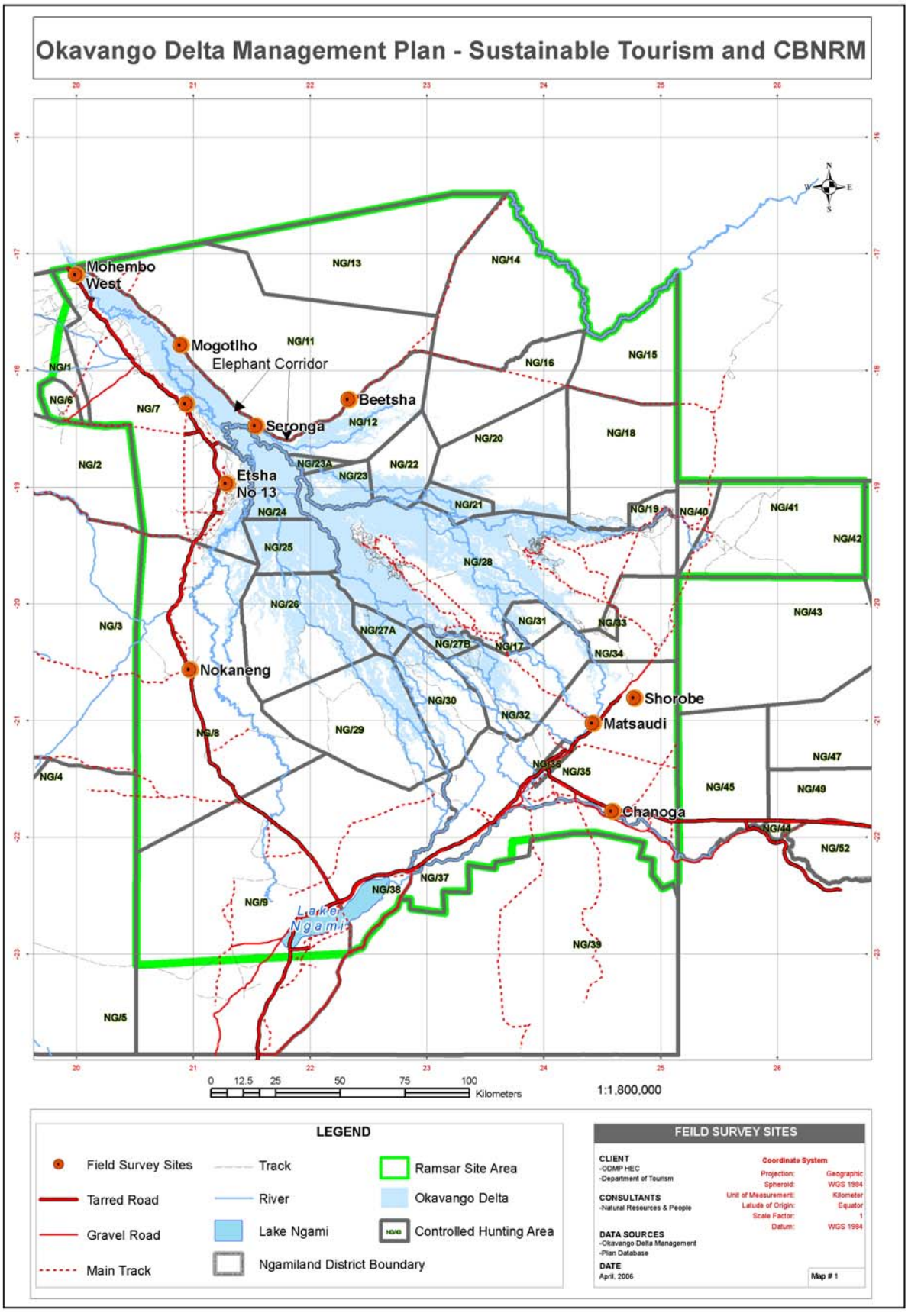
Table 1 Sample locations and logistical information

Hot Spot Area	Village	Date	Number of surveys completed	Focus Group Discussion completed
Northeast Maun				
Western Panhandle	Mohembo West	22nd May	5	1
	Etsha	23rd May	4	1
	Nokaneng	24th May	4	1
	Sepopa	24th May	6	1
Eastern Panhandle	Seronga	30th May	4	1
	Beetsha	31st May	5	1
	Mokgotlho	29th May	1	1
Maun	Chanonga	1st June	3	1
	Matsaudi	19th May	6	2 (Elders & Youth)
	Shorobe	18th May	6	1
Total			44	11

It has been noted that households may sometimes exaggerate the impact of damage caused by wildlife at the household level. Roche notes that 'people may deliberately or accidentally not tell the truth or omit information' is a concern when using participatory tools for impact assessment (1999:147). It is thought that in this case, if exaggeration has taken place it may have been because the survey provided an opportunity for people to express anger and frustration about the regular occurrence of damage caused by wildlife and the limitations of the measures to deal with it. However, as is noted below, while some exaggeration may have occurred in responses to this survey, the general impacts and trends in human–elephant conflict are broadly the same as those experienced in other areas of southern Africa, and the data collected is thus be assumed to be reliable.

All figures reported below are results from the household survey and/or the focus group discussions, except where attributed to other authors.

Map 3: Location of Sampled Villages



3 RESULTS

3.1 Demographics

44 percent of household members were 17 years or younger, and 56 percent were 18 years and above.

Of the 0–17 age group, 78 percent lived at the homestead, while 22 percent lived 'away'. Of those who were 18 years or older, 60 percent lived at the homestead, and 40 percent lived 'away'.

The demographic trends for all households are presented below in Table 2. 68 percent (30) of households were headed by a male, with the remaining 32 percent (14) households being headed by a female. In female headed households, the mean household size was slightly lower (9.1) than the average for all households, as was the median household size (7).

Table 2 Household members living 'here' and 'away'

Age	Total	Average	Median	Minimum	Maximum	Living here	Living away
0-17	186	4.2	3.5	0	12	146	40
18+	240	5.5	5	1	16	144	96
Total	**426**	**9.7**	**9**	**1**	**21**	**290**	**136**

The surveyed households appear to be larger than the average for rural Botswana, where households reportedly have an average of 4.39 people per household (CSO, 2003). Even if only those 'living here' are considered, this survey shows an average of 6.6 people per household which is still considerably larger than the average for rural Botswana. However, when these 'rural' figures are disaggregated by district, Ngamiland has an average household size of 9.5 and a median of nine (Mendelsohn and el Obeid, 2004). According to the Ngamiland agricultural statistics, 64 percent of farming households are headed by a male, not significantly different from the results from this survey (Department of Agriculture, various dates).

3.2 Wealth

Respondents were asked about household ownership of assets as a proxy of wealth in the surveyed communities. On average, households owned three different types of assets (median=4; mode=3; range=0–11). As can be seen in Table 3, the most frequently owned (except for radios) are productive assets associated with agricultural activities and stock keeping (i.e. ploughs, carts and fencing). Few households own non-productive (i.e. consumption) goods, with the exception of radios.

Table 3 Asset ownership

Asset type	No. of households that own asset	% of ownership
Plough	39	89
Radio	28	64
Cart	26	59
Other*	24	55
Fencing	23	52
Car/truck	9	20
Large water storage container	9	20
Mokoro	9	20
Generator	8	18
Fruit trees	7	16
Fishing equipment	6	14
Sledge	6	14
Television	5	11
Solar panel	3	7

Asset type	No. of households that own asset	% of ownership
Bicycle	1	2
Tractor	1	2
Other includes – axe, brick oven, gun, mortar & pestle, phone, rake, scaffolding, spade, tuck shop, water pipe.		

Of those asset types owned by more than 20 percent of the surveyed households, ownership of most assets was not significantly different between female and male headed households. It was observed that a higher proportion of male headed households owned mokoro's (27 percent versus seven percent for female headed households) and fencing (57 percent compared to 43 percent of female headed households). A greater proportion of female headed households owned carts (71 percent versus 53 percent of male headed households) and wheelbarrows (57 percent compared to 30 percent of male headed households).

Given the importance of stock ownership in Botswana as both a livelihood strategy and an indication of household wealth, households were questioned regarding the types and numbers of stock owned by household members. Ownership of cattle and oxen were distinguished in order to differentiate households that owned draught animals that could be used for ploughing fields in order to plant crops, as approximately 70 percent of rural households use oxen as draught animals, with smaller percentages using donkeys/mules, tractors or a combination of animal traction and tractors (see Department of Agriculture, various dates).

Only one household (2 percent) stated that they did not own any form of domestic livestock. Of the remaining 98 percent of households, they owned on average between three and four different types of domestic stock (median=4), with a minimum of one and a maximum of six. Of the stock owning households, seven households (16 percent) that owned only one type of domestic stock; four owned only donkeys and one household each owned only cattle, goats or poultry.

Table 4 Stock ownership

	No. of households	% of all households	Average (herd/flock)	Median (herd/flock)	Minimum (herd/flock)	Maximum (herd/flock)
Cattle	30	68	24	13	1	150
Oxen	20	45	5	4	1	20
Sheep	2	5	7	7	3	10
Goats	30	68	18	10	2	103
Poultry	30	68	9	6	1	25
Donkeys	28	64	4	4	1	10
Horses	10	23	2	2	1	5

In studies conducted in Ngamiland and elsewhere in Botswana, it has been found that the proportion of households owning cattle is similar to the results from this study, with very similar average herd sizes (see EcoSurv, 1996; Anonymous, n.d.). With respect to other stock types, this survey found slightly higher proportions of households owning each stock type, but with slightly smaller average herds than had been found in other studies (see Department of Agriculture, various dates). It is believed that these differences are not statistically significant.

3.3 Livelihoods

Households had between one and five members of the household contributing cash to the household (average=1; median=1). Only three households (7 percent) reported having no source of cash in the household. On average, each household had almost three people contributing in-kind to the household (median=2), though this ranged between one and eleven household members.

Households undertook between one and ten activities that contributed (either in-kind or income) to the household; in contrast with between zero and six activities that earned cash for the household. On average, each household undertook six activities to provide for its members (median=6), but most commonly undertook seven (i.e. mode=7). On average, only two activities contributed cash to each household (median=2; mode=2).

The top five activities contributing cash and/or in-kind to households were cropping, stock keeping, thatch grass harvesting, reed harvesting and building pole cutting (see Table 5 for further details).

Table 5 Livelihood activities (any rank)

	% of households
Cropping & gardening	98
Livestock production	82
Thatch grass harvesting	75
Reed harvesting	66
Building pole cutting	59
Pensions	48
Employment	41
Craft making	36
Wild fruit harvesting	30
Palm harvesting	20
Fishing	14
Own small business	14
Destitution allowance	11
Other	2
Remittances	-

Cropping and gardening was the most important activity contributing to livelihoods (see Table 6), being ranked as the most important by one third of surveyed households, followed by livestock production, reed and thatch grass harvesting and pensions. Stock keeping was ranked as the second most important activity contributing to the household livelihood by one-third of households, followed closely by cropping and gardening. Livestock production and thatch grass harvesting were ranked as the third most important contributors to household livelihoods (both by 19 percent), followed by formal employment, reed harvesting and pensions. Other activities were important to small numbers of households and/or were ranked as making less important contributions to households (i.e. they were ranked as something other than the top three household activities), with the exception of remittances which were not ranked as important contributors to any surveyed household.

Table 6 Proportion of households ranking activities by importance of livelihood contribution

	1st (%)	2nd (%)	3rd (%)
Cropping & gardening	33	28	5
Livestock production	13	34	19
Reed harvesting	10	4	14
Thatch grass harvesting	10	0	19
Building pole cutting	5	0	3
Fishing	0	4	0
Craft making	4	6	5
Palm harvesting	3	6	0
Wild fruit harvesting	3	6	3
Employment	5	4	16
Own small business	4	2	5
Pensions	8	2	11

	1st (%)	2nd (%)	3rd (%)
Remittances	0	0	0
Destitution allowance	1	2	0
Other	1	0	0

3.3.1 Cropping

According to the Ngamiland agricultural statistics, across the district approximately 66 percent of farming households plant crops (Department of Agriculture, various dates). As noted above, households were purposively sampled for this survey; they were selected because they had suffered from elephant damage to their crops, thus the high proportion of households planting crops.

Households in the region plant both dryland (i.e. rainfed, without irrigation) and recession agriculture/molapo plots. On average households plant five different crops types each season (median=5; mode=4); this ranges between one and nine crop types (dryland and molapo) per household. Of the surveyed households, 81 percent farmed only dryland crops, 16 percent farmed only molapo crops. Only one household farmed both dryland and molapo crops, which farmed dryland and molapo maize and sweet reed. Table 7 below outlines the crops planted by proportion of surveyed households.

Table 7 Household cropping (dryland and molapo) (n=43)

	No. of farmers growing crop	% of all farmers
Maize	42	98
Sorghum	30	70
Millet	22	51
Pumpkins	24	56
Beans	29	67
Ground nuts	13	30
Melons	28	65
Tomatoes	2	5
Green Vegetables	3	7
Fruit	1	2
Other (sweet reed)	18	42

3.3.2 Maize

98 % of farmers ploughed either dryland or molapo maize. Of these, 81 % of fields were dryland and 19 % molapo, and two thirds of these households consumed at least some of their harvest. Those households that consumed part of their harvest consumed on average 46 % of the crop (median=50; mode=50; range=10–100). Only 19 % of households gave away (or bartered) part of their harvest, on average just 27 % of total yield. Just four households, or ten %, reported selling part of their maize harvest during 2004/2005, and on average sold only 23 % of the total harvest (median=20; mode=10; range=10–40).

Table 8 Maize crop damage, all sources

	Elephant damage (n=36)	Domestic animal damage (n=11)	Other wildlife/ pest damage (n=10)
% of total maize farmers	86	26	24
Average damage (% of yield)	59	16	20
Median damage (% of yield)	50	15	20
Mode (% of yield)	100	20	10
Minimum	10	5	10
Maximum	100	30	35
Average dryland damage (% of yield)	57	16	20
Average molapo damage (% of yield)	73	20	-

3.3.3 Sorghum

70 % of farmers planted sorghum in 2004/2005. Of these, 87 % were dryland and 13 % were molapo fields. Two thirds of the households that planted sorghum consumed at least some of the harvest within the households; on average 56 % of the total yield (median=50; mode=80; range=10–100). Only one household gave away or bartered part of their sorghum yield, just six % of their total harvest. Only two households (seven %) sold part of their sorghum harvest, averaging 25 % of total yield.

Table 9 Sorghum crop damage, all sources

	Elephant damage (n=24)	Domestic animal damage (n=10)	Other wildlife/ pest damage (n=7)
% of total sorghum farmers	80	33	23
Average damage (% of yield)	64	15	18
Median damage (% of yield)	65	15	10
Mode (% of yield)	100	20	10
Minimum	10	5	10
Maximum	100	30	35
Average dryland damage (% of yield)	63	15	18
Average molapo damage (% of yield)	73	-	-

3.3.4 Millet

Just over 51 % of households planted millet during the 2004/2005 cropping season. Of these households, 95 % were dryland fields and only 5 % (one household) was a molapo field. 77 % of millet planting households consumed part of their millet crop within the household; on average 62 % of it (median=65; mode=70; range=25–100). One household only gave away/bartered part of their crop (8 % of the total yield). One household sold 10 % of their total millet yield.

Table 10 Millet crop damage, all sources

	Elephant damage (n=20)	Domestic animal damage (n=5)	Other wildlife/ pest damage (n=8)
% of total millet farmers	91	23	36
Average damage (% of yield)	44	18	20
Median damage (% of yield)	33	15	23
Mode (% of yield)	30	15	25
Minimum	10	10	10
Maximum	100	30	35
Average dryland damage (% of yield)	45	18	20
Average molapo damage (% of yield)	30	-	-

3.3.5 Pumpkins

56 % of surveyed farmers planted a pumpkin crop. Of these, 83 % were dryland and 17 % were molapo. 46 % of households consumed some of these pumpkins. On average 64 % of the total yield was consumed within the household (median=70; mode=100; range=10–100). Only two households bartered/gave away some of their pumpkin harvest, on average 20 % of the total yield, and no household sold any of its pumpkin yield.

Table 11 Pumpkin crop damage, all sources

	Elephant damage (n=18)	Domestic animal damage (n=5)	Other wildlife/ pest damage (n=5)
% of total pumpkins farmers	75	21	21
Average damage (% of yield)	81	18	23
Median damage (% of yield)	100	20	25
Mode (% of yield)	100	20	25
Minimum	40	5	10
Maximum	100	30	35
Average dryland damage (% of yield)	80	18	23
Average molapo damage (% of yield)	85	20	-

3.3.6 Beans

67 % of farmers planted a bean crop in 2004/2005. 83 % were dryland and 17 % were molapo fields. 59 % of bean farmers consumed on average 57 % of their bean harvest (median=50; mode=50; range=6-100). No farmers bartered or gave away any of their crop, and only one farmer sold 30 % of his harvest.

Table 12 Bean crop damage, all sources

	Elephant damage (n=23)	Domestic animal damage (n=6)	Other wildlife/ pest damage (n=6)
% of total bean farmers	79	21	21
Average damage (% of yield)	69	17	22
Median damage (% of yield)	70	15	18
Mode (% of yield)	100	30	10
Minimum	10	5	10
Maximum	100	30	40
Average dryland damage (% of yield)	70	19	22
Average molapo damage (% of yield)	60	5	-

3.3.7 Ground nuts

30 % of farmers planted a ground-nut crop. Of these, 92 % were dryland and eight % (one field) was molapo. Of these, 54 % of households consumed some of the ground nut yield (on average 55 % of total yield; median=50; mode=50; range=10–100). No farmers gave away/bartered any ground nuts, nor did any farmers sell any.

Table 13 Ground nut crop damage, all sources

	Elephant damage (n=10)	Domestic animal damage (n=2)	Other wildlife/ pest damage (n=4)
% of total ground nut farmers	77	15	31
Average damage (% of yield)*	71	21	39
Median damage (% of yield)	70	25	23
Mode (% of yield)	100	-	10
Minimum	40	20	10
Maximum	100	30	100
* All crops damaged were dryland crops.			

3.3.8 Melons

65 % of farmers planted a crop of melons in 2004/2005. Of these 89 % were dryland fields and 11 % were molapo fields. Only 25 % of melon farmers consumed part or all of their crop within the household; on average just in excess of half of the yield (median=50; mode= 100; range=10–100). One household bartered/gave away 10 % of their melon harvest, and no household sold any. In addition to damaged caused by wildlife, pests and domestic animals, 4 farmers crops (14 %) were completely destroyed by excessive rain/flooding.

Table 14 Melon crop damage, all sources

	Elephant damage (n=19)	Domestic animal damage (n=6)	Other wildlife/ pest damage (n=6)
% of total melon farmers	68	21	21
Average damage (% of yield)	84	32	22
Median damage (% of yield)	100	20	25
Mode (% of yield)	100	20	25
Minimum	40	5	10
Maximum	100	100	35
Average dryland damage (% of yield)	84	24	32
Average molapo damage (% of yield)	85	20	-

3.3.9 Sweet reeds (Sorghum bicolour)

42 % of farmers grew sweet reeds; 56 % were dryland and 44 % were molapo crops. 56 % of sweet reed growing households consumed some of their own-grown yield – on average 48 % was consumed in the household (median=45; mode=50; range=10–100). No households bartered/gave away any of their yield, and only one household sold any (100 % of their crop).

Table 15 Sweet reed crop damage, all sources

	Elephant damage (n=12)	Domestic animal damage (n=5)	Other wildlife/ pest damage (n=5)
% of total sweet reed farmers	67	28	28
Average damage (% of yield)	71	19	36
Median damage (% of yield)	70	20	25
Mode (% of yield)	100	-	25
Minimum	40	5	10
Maximum	100	30	100
Average dryland damage (% of yield)	67	17	20
Average molapo damage (% of yield)	88	23	100

3.3.10 Tomatoes

Only two farmers reported growing tomatoes and both planted these crops in molapo fields. Both households consumed on average 13 % of their tomato yield. No household bartered/gave away any of their crop. One household sold 45 % of its total harvest. Both farmers suffered elephant damage to their crops; on average destroying 65 % of their total yield (range=50–80). Neither tomato crop suffered damaged from either domestic animals or other wildlife/pests.

3.3.11 Green Vegetables

Only three households reported planting green vegetables, all of which were planted in molapo fields. Of these three, only two households consumed any of their harvest, averaging just 13 % of the total yield (range=5–20). None of the crop was bartered/given away, though one household did sell 45 % of their harvest. All crops were damaged by elephants, averaging 77 % of the total yield (range=50–100). Green vegetable crops were not damaged by either domestic animals or other wildlife/pests.

3.3.12 Fruit trees

Only one farmer expected a harvest from molapo-planted fruit trees in 2004/2005. The total yield was reportedly destroyed by elephants.

3.4 Extent of crop damage

Farmers reported in this survey a total of 173 crops/fields damaged by elephants. As can be seen in Table 16 below, this represents on average four fields/crops damaged by elephants for each farmer. While it is difficult to assess the precise extent of damage to crops by elephants, farmers estimated the %age of lost yield. The minimum yield damage was 10 %, while the maximum was 100 %. In 43 % of cases of elephants damaging crops, less than 50 % of the yield was lost due to the damage; however in more than one third of cases, elephants destroyed the whole crop.

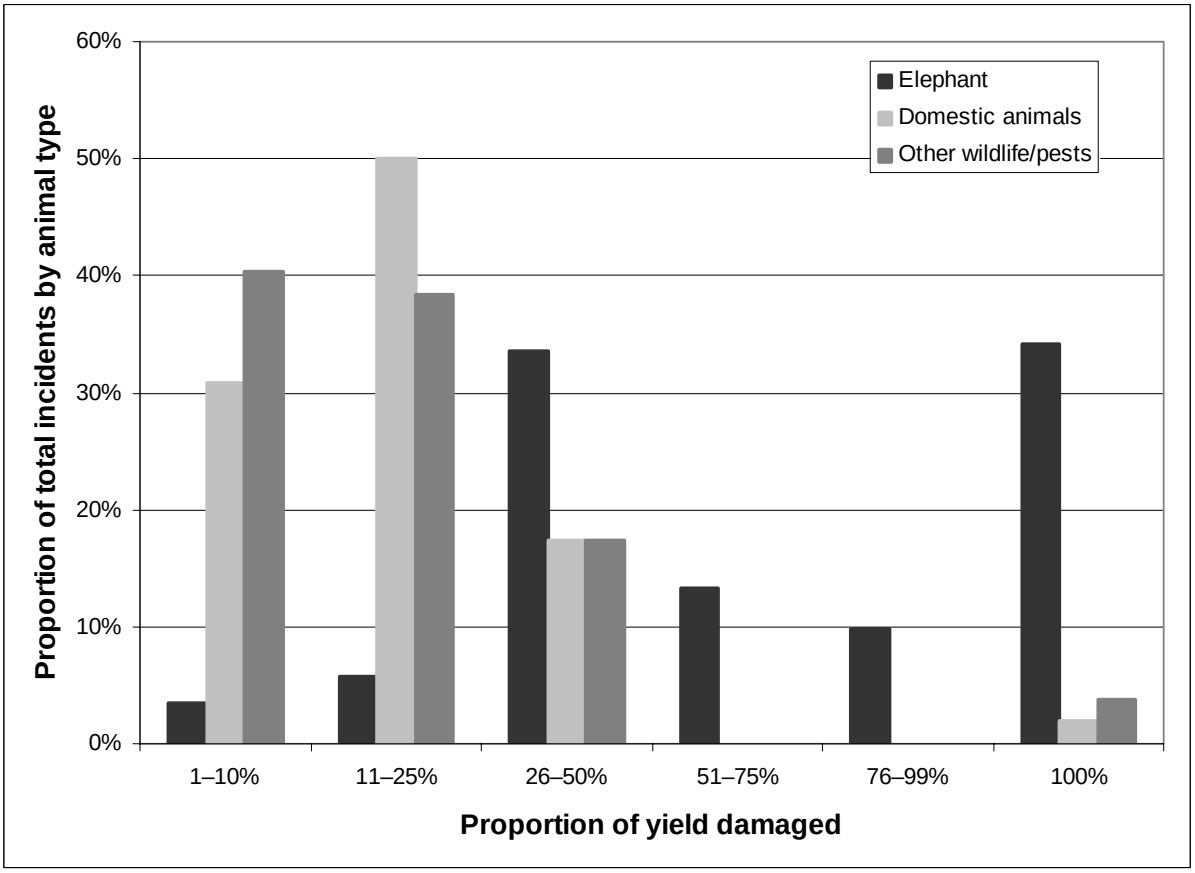
Table 16 Summary of crop damage, all crop types

	Elephant (n=173)	Domestic animals (n=52)	Other wildlife/ pests (n=52)
Average number of crop types damaged per farmer affected	4	2.8	3.5
Average % of yield damaged	67	19	23
Median % of yield damaged	70	20	23
Mode % of yield damaged	100	20	10
Frequency of 100% destruction (No.)	59	1	2
100% destruction as proportion of incidents (%)	34	2	4

Figure 1 Proportion of crop damage by animal type

As can be seen from Table 16 and Figure 1 above, elephants cause both more frequent and greater damage to crops than either domestic stock or other wildlife/pests. Almost half of the damage caused by elephants in this survey destroyed more than three-quarters of the crop entirely; with more than one-third of all cases of elephant damage destroying the crop completely.

In contrast, domestic animals and other wildlife/pests cause considerably less severe damage. In 81 % of cases (for domestic animals) and 79 % of cases (other wildlife/pests), damage caused amounted to one-quarter or less of the total crop yield. Not more than two % of crops had more than 50 % of the yield destroyed by either domestic animals or other wildlife/pests.



Results from the focus group discussions confirm the household survey results, that elephant damage being the most severe of all damage to crops from all sources (excluding weather/climate issues). Problems with predators killing livestock were not discussed as it was outside of the scope of this study). Table 17 outlines the results from the focus group discussions.

Table 17 Ranking of frequency of damage by species

Species	1st (%)	2nd (%)	3rd (%)
Birds	-	36	18
Duiker	-	-	9
Elephant	91	-	-
Hippo	9	9	18
Insects	-	9	9
Monkeys/baboons	-	-	9
Porcupines	-	27	18
Rodents	-	18	18

Following this exercise in the focus group discussions, species were then graded according to the severity of the damage they caused. The species graded as causing hardly any damage (Grade 1) up to 50 % of the time were kudu, other antelope, monkeys/baboons and warthog. Rodents were ranked as causing hardly any damage 45 % of the time. The species graded as causing some damage, but leaving most of the crop intact (Grade 2) up to 50 % of the time were duiker, other antelopes, insects and warthog. Other species were spread across the three grades.

Only birds and elephants were unanimously perceived (100 %) as causing the most severe amount of damage (Grade 3). Porcupines were viewed as causing the most severe amount of damage 80 % of the time.

Using the average yields for Ngamiland (1968 to 1998), as collected by the Ministry of Agriculture, the damage caused by elephants, livestock and other wildlife to grain crops is quantified in Table 18 (Ministry of Agriculture, various dates). For maize and sorghum, the average yield lost to elephant damage is virtually equal to the expected yield from a hectare planted to those crops. In the case of millet, the lost yield is approximately the average yield for half a hectare planted to millet.

Table 18 Lost grain yield due to crop damage

		Total (kg)	Average (kg)	Median (kg)	Mode (kg)	Minimum (kg per farmer)	Maximum (kg per farmer)
Maize	**Elephant (n=36)**	9,080	252	154	324	16	1,620
	Livestock (n=10)	348	35	32	32	8	65
	Wildlife (n=10)	486	49	41	16	16	113
Sorghum	**Elephant (n=24)**	4,090	170	121	121	12	774
	Livestock (n=10)	321	32	24	24	6	73
	Wildlife (n=7)	296	42	30	12	12	85
Millet	**Elephant (n=20)**	3,730	186	72	43	14	1,080
	Livestock (n=5)	173	35	29	22	22	58
	Wildlife (n=8)	526	66	47	14	14	180

3.4.1 Non-crop elephant damage

Elephants cause other problems in addition to damaging crops. The destruction of native vegetation was mentioned most frequently as being a problem in/near the villages where the focus group discussions were held; followed by threatening human life and destroying boreholes and water storage. Other problems caused by elephants included killing livestock, digging holes in the road and damaging houses and other property (e.g. fences).

3.5 Mitigation methods and compensation

3.5.1 Mitigation methods

One-quarter of the villages involved stated that no mitigation methods to prevent or reduce crop damage by elephants (or other wildlife) were used in the village. Of those villages where mitigation methods were used, eight different methods were mentioned. These included banging drums/making noise (31 %), burning fires in the fields (25 %) and guarding the fields (13 %). Firing guns into the air to scare elephants, digging trenches and filling them with water, growing chillies, shooting elephants and tying the roots of the *Samanya* tree around the field were also mentioned (six % each). However, villagers stated that the majority of methods do not work – burning fires and shooting elephants were the only two methods that reportedly work. The village where experiments with growing chillies is being undertaken stated that they were too early in the trial to be able to tell whether the method worked.

3.5.2 Compensation for wildlife damage

Of those farmers who suffered elephant damage, 76 % (32) of them reported the damage caused by elephants to the Department of Wildlife and National Parks (DWNP). Of those farmers that reported the damage to DWNP, 81 % received a visit from DWNP staff to assess the damage to their field(s). (Thus, 19 % of farmers were not visited by DWNP staff to assess the elephant damage to their fields.) Only 59 % of households who reported damage had received a compensation payment at the time of the household survey (or 73 % of those whose fields were assessed).

24 % (10 households) did not report the damage to DWNP. Of those who did not report the damage to DWNP, the reasons given included that they did not have enough money to travel to DWNP to report the incident, that the compensation scheme takes too long to make payments, and that the payments are too low in any case (particularly when compared with the value of the damage).

3.5.3 Compensation for livestock damage

The focus group discussions confirmed that all villages suffered from livestock damaging crops, though all said that it was never as frequent as that caused by wildlife; nor did villagers believe that the damage caused was as severe as that caused by wildlife. There are traditional forms of 'compensation' for fields that have been damaged by livestock. Generally, the owner of the field estimates what the cost of ploughing the field (using donkeys, cows or tractor as appropriate) and the owner of the livestock pays the cost of ploughing. If the livestock has damaged fencing around the field, the owner makes the repairs to the fence, or pays for the necessary repairs. More than two thirds of those involved in the focus group discussions were broadly happy with this system, as it is relatively flexible and the amount paid is negotiable. However, just under one third were not happy with this system.

3.6 The impacts of elephant damage

Approximately 68 % (30) of households usually grow enough food to enable the household to sell some of their surplus. According to the survey, 93 % (28) of these households were unable to sell surplus from the 2004/2005 growing season as a result of the elephant damage their crops suffered in that year. Approximately 71 % of female headed households and 60 % of male headed households experienced this difficulty (i.e. that elephant damage meant that the household did not grow enough surplus to sell).

Of those households who normally grow enough surplus to sell each year, 80 % (24 households) were forced to go without during 2005 because they had not earned any income from crop sales. This equates to 55 % of surveyed households having to do without food and basic consumption goods due to a lack of income resulting from human–elephant conflict. 93 % of all female headed households had to forego the purchase of consumption items, compared to 67 % of all male headed households.

88 % of these households had to go without food due to the crop damage experienced by the household. 20 % of households were unable to buy clothes and 10 % were unable to afford school fees and associated education costs as a result of elephant damage to their crops. (These figures add to more than 100, as households often had to go without more than one item because of a lack of cash income that would normally have been earned by selling surplus crop harvest.) Other households were not able afford medical assistance, soap, or repay ploughing costs as a result of their reduced yields and inability to sell surplus grain. Another household mentioned the income lost from not having enough sorghum to brew and sell alcohol, while another had difficulty irrigating their vegetable gardens due to elephant destroying their water tanks.

89 % (39) of households stated that due to the elephant damage suffered by their crops in the 2004/2005 growing season they did not have enough food to feed their household in that year. Of these 39 households, 87 % (34) had to use cash from sources other than crop sales to purchase food for the household; the remaining 13 % (5) did not purchase food using household income. (It is unclear whether these latter households went without food due to a lack of income from other sources.)

Of those households that used income from non-crop sources, 62 % used cash from only one source, 32 % used cash from two sources and the remaining six % used cash from three sources to purchase food. 41 % of households used cash earned from trading of agricultural products (e.g. traditional beer, sour milk, vegetables and fruit) or other goods and services (e.g. craft, bakery sales, fish, traditional healing and sewing). 38 % of households used cash from pensions. 18 % of households were given money by family members. The remaining households used cash from donations by the church, drought relief work or other employment.

32 % (11) of those households that used household cash to purchase food also had to sell or exchange assets to purchase food during 2005. All households that sold or exchanged assets in order to make food purchases sold/exchanged livestock (cattle, goats and chickens).

Of those households that did not use cash to purchase food, only one sold assets during 2005 in order to purchase food. This household sold their car in order to do this. Survey respondents were distressed about the effects of human–elephant conflict (crop damage) and its effects on/meaning to their household.

The majority of households mentioned that the primary effect of the crop damage was that the household did not have enough food during the year; the damage also affected several households livestock holdings as they had to sell some of their stock in order to purchase food and other basic goods. See Box 1 for details of some of the household-level impacts.

Box 1 The effects of crop damage caused by elephants to the household, selected responses

The damage has brought helplessness because there is nothing that can be done. The animal [elephant] is too big.

The elephants do leave us with nothing to survive on. They destroy our fields that we depend on and even leave us homeless. They destroyed my sister's house and it was the only house she had.

It cost us our livestock, we had to sell them to buy food destroyed by elephants

The damage is always excessive. In 2004 the family did not harvest, elephants destroyed everything

The elephants don’t just destroy the fields, they do come close to the houses and once it lean beside the wall of the house, the house fall.

There was just hunger in the family

There was not enough food in the household in order to satisfy their needs.

Elephants destroys the fields and this becomes a problem because they end up harvesting nothing and they are left with nothing to eat.

There was lack of food in order to satisfy my family.

Brings sadness, just pray to God to help them not to suffer that much because elephants leave them with nothing to eat.

Not enough food and money for buying clothes. We went to the extent of not having soap for bathing.

There was no food for the whole year and they [the elephants] destroyed the fence which forced us to put up another one which we had to pay people to put up.

It brings sadness to my family
There was too much poverty which caused my family not to live properly.
We get very sad – now we did not have storage for water.
They do not feel fine and run out of money to hire people to fix the damage, especially fences
There was too much hunger
These elephants bring unhappiness to my family
it really affected our way of living because we did not have sufficient food to support our family.

Several households suffered from non-crop elephant damage, with elephants reportedly destroying houses, fences and water tanks, wells and boreholes, costing money to repair or replace the good, as well as being frightened by the number of elephants near the villages. The damage caused by elephants to fruit trees and native vegetation was also of concern to a number of households.

Observations from the focus group discussions confirm the extent of the impact of wildlife on livelihoods around the Okavango Delta. When asked questions regarding the greatest challenges to improving agricultural productivity in the villages, 61 % of responses related to the (negative) impact that wildlife has – including predators killing stock, elephants and other wildlife damaging fences and crops, and the difficulty of protecting crops from elephants. In fact, 39 % of responses related specifically to damage caused by elephants to crops, and the threats they pose to property and human life as impediments to improving productivity. Other impediments to improved productivity (including lack of agricultural specialists to give advice, water scarcity/lack of rainfall, floods, animal traction constraints and poor animal husbandry) made up 31 % of responses. Damage to crops by livestock were mentioned only seven %.

When asked about challenges to improving livelihoods in the villages, 17 % of responses were related to the problems wildlife cause to improving agricultural productivity. Farmers stated that they could not improve their stock-keeping efficiency and effectiveness due to predation by wildlife, and crop raiding by elephants means that farmers harvests are reduced (or totally destroyed) so there are no surpluses available for sale by the household.

3.7 Change over time

89 % of households interviewed stated that human–elephant conflict had increased over the previous five years. The vast majority (80 %) believed that this was because of increases in population numbers; others stated that elephants had learned which seasons to come to the crops to feed, that fences had been destroyed by elephants which previously kept them away from (some) villages, that the damage per incident had increased, that the prohibition of hunting had allowed populations to grow, that elephants were no longer afraid of people and lived closer to villages, and that the frequency of incidents had increased. Several respondents stated that the DWNP does not control the elephants effectively, and they are not restricted to living in national parks and game reserves, and that the DWNP should reduce their numbers by culling.

Only 4 households believed that the level of conflict between humans and elephants had remained the same over the previous five years, and only one household believed it had decreased.

55 % (24) of households also believed that crop damage caused by wildlife other than elephants had increased over the last five years. Reasons given for the increase in damage was mostly reported as resulting from population increases (75 %), but also the result of wildlife damaging fences and entering cropping areas, because they're protected and cannot be hunted, that the wildlife have discovered it is easier to find food in people's fields, and that the DWNP are not

managing the wildlife populations well (they are not restricted to national parks and game reserves).

27 % of farmers (12) believed that damage from other wildlife had remained the same over the previous five years, and only nine % (4 households) believed that it had decreased over that time (this was partly because individual farmers had improved their fencing, or because the wet season had been better than before and the animals had no need to move into farmers fields).

While only two households stated that they had moved their fields in the previous five years for fear of encountering elephants on the way to their fields or moving them away from known elephant paths, a further seven said that they had not as there was no point in moving because elephants were everywhere, and the damage they caused could therefore not be escaped.

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CHAPTER 4

COST BENEFIT ANALYSIS ECONOMIC ANALYSIS OF HUMAN – ELEPHANT CONFLICT IN THE OKAVANGO DELTA RAMSAR SITE, BOTSWANA

1 Summary

The community-based natural resource management (CBNRM) programme in Botswana (Arntzen et al. 2003) is designed to empower communities with rights over their wildlife. The benefits that communities are able to derive from their resources are expected to provide incentives for them to invest in wildlife conservation. Whether this happens or not, depends on whether the benefits from wildlife outweigh the costs of wildlife. A major cost associated with wildlife in the delta is the damage inflicted on the crops of communities by wildlife, in particular the elephant. The latest elephant management plan places emphasis on the solution to HEC problems (DWNP, 2003).

The economic analysis focuses on the value of HEC crop damage. This emerged as by far the most significant HEC impact in the socio-economic survey. There is also some non-crop elephant damage, and the socio-economic survey recorded that several households suffered from elephants reportedly destroying houses, fences, water tanks, wells and boreholes. Elephants also frighten people near villages, as well as damage fruit trees and native vegetation. Household concerns nearly all focus on crop damage, and the exact extent and cost of the non-crop damage could not be established.

This report seeks to measure the costs of elephant damage on crops in the delta, particularly in terms of household livelihoods, and in terms of national economic growth. Crop damage data are drawn from surveys within the Ramsar Site and applied to crop production and CBNRM enterprise models, to measure livelihood and economic impacts. Results from studies on the economic values of general wildlife damage, to both crops and livestock, from the ecologically and socially similar conditions in the adjacent Caprivi Region of Namibia, provide useful corroborative and comparative information, and are also considered. The implications of the results, for policy on human elephant conflict in Botswana are considered.

The results indicate that the ability of the trust to contribute positively to household income, and the national economy is retained even when HEC costs sustained by households of double the normal average levels are included. The viability of the trust as an investment appears to severely threatened, only when HEC costs of three times current levels are experienced. This suggests that, in the Okavango delta, the losses to crop production sustained by communities are likely to be outweighed by the benefits communities can derive from wildlife through the CBNRM programme. This has implications for the policies surrounding HEC management.

The costs of elephants to crop producer households are thus significant, particularly in the hot spot areas, where the viability of household crop production can be effectively eliminated. It is important therefore to examine, these costs in the context of the benefits that communities can derive from elephants.

2 Impact of human elephant conflict on livelihoods and the economy in the Okavango Delta

In the present project, a study comparable with that described below for the Caprivi region in Namibia has been conducted. Here, the results of the socio-economic impact study (described elsewhere in the second progress report) were used to derive measures of crop losses per household in the parts of the Delta most impacted by HEC, and the Ramsar Site as a whole. These values were than applied in the empirically-based, dryland and molapo, crop production enterprise models, developed during the ODMP economic valuation study of the Okavango Delta Ramsar Site (Turpie et al., 2006). The values were also applied to a model of a community-based natural resource management (CBNRM) trust for the delta developed by Barnes et al. (2001), to determine the impact of HEC at community level.

The crop production enterprise models used for this study have been developed by Turpie et al. (2006) using empirical data from a quantitative survey of 430 households from 12 villages in the Ramsar site, four crop production focus groups in Shakawe, Gumare, Sehitwa, and Maun, as well as various empirical data gleaned from the available data-bases and literature. Important sources in this regard have been Rashem (1988), Murray (2005), Bendsen & Meyer (2002) and Agricultural Statistics Unit (2002).

The models are similar to those described below, and used in the Caprivi study by Barnes & Nhuleipo (2005). They estimate the current annual private and economic (societal) costs and returns to crop production activities, per household production unit, as well as for the aggregate production. Turpie et al. (2006) provided these values for crop production by household, and in aggregate, for five zones within the Ramsar. Figure 2 shows these zones, namely, zone 1 (panhandle), zone 2 (west), zone 3 (south west), zone 4 (south east), and zone 5 (central). Values were also provided separately for dryland crop production (mostly for millet and concentrated in zone 1 (the panhandle), and molapo crop production (mainly for maize and commonly practiced in the west and south east of the delta.

As empirical models, the crop enterprise models already include the broader average costs of wildlife and elephant damage, as they are assumed to be incorporated into the crop yield data provided. The approach used by Barnes and Nhuleipo (2005) in Caprivi, Namibia, was to apply the average damage figures as a cost to the enterprise, effectively doubling the damage costs already accounted for, to measure the impact in terms of loss in private and economic returns. A more accurate primary measure of impact can be obtained by applying average damage value as a benefit, to measure the increase in private and economic returns that would result *without* damage. We have done that here.

The impacts of further damage, e.g., that which might be encountered in most heavily impacted areas were then obtained by adding appropriate additional damage values to the models. The estimates of lost grain yield due to elephant, based on the present socio-economic survey, were used to estimate yield losses due to elephant for households. These yield losses were differentiated according to the various zones delineated in Figure 2.

Table 19 shows the damage values assigned to crop producing households in the various zones. The ‘hot spot’ villages, targeted during the socio-economic survey of the present study, were assumed to contain half the households of zones 1 (panhandle) and zone 4 (south east) as well as all of the households in zone 5 (central). The other half of the households in zones 1 and 4, were assumed to

have half the levels of damage of hotspots, and the households in zones 2 (west) and 3 (south west) were assumed to have one quarter of the level of damage sustained in the hot spots.

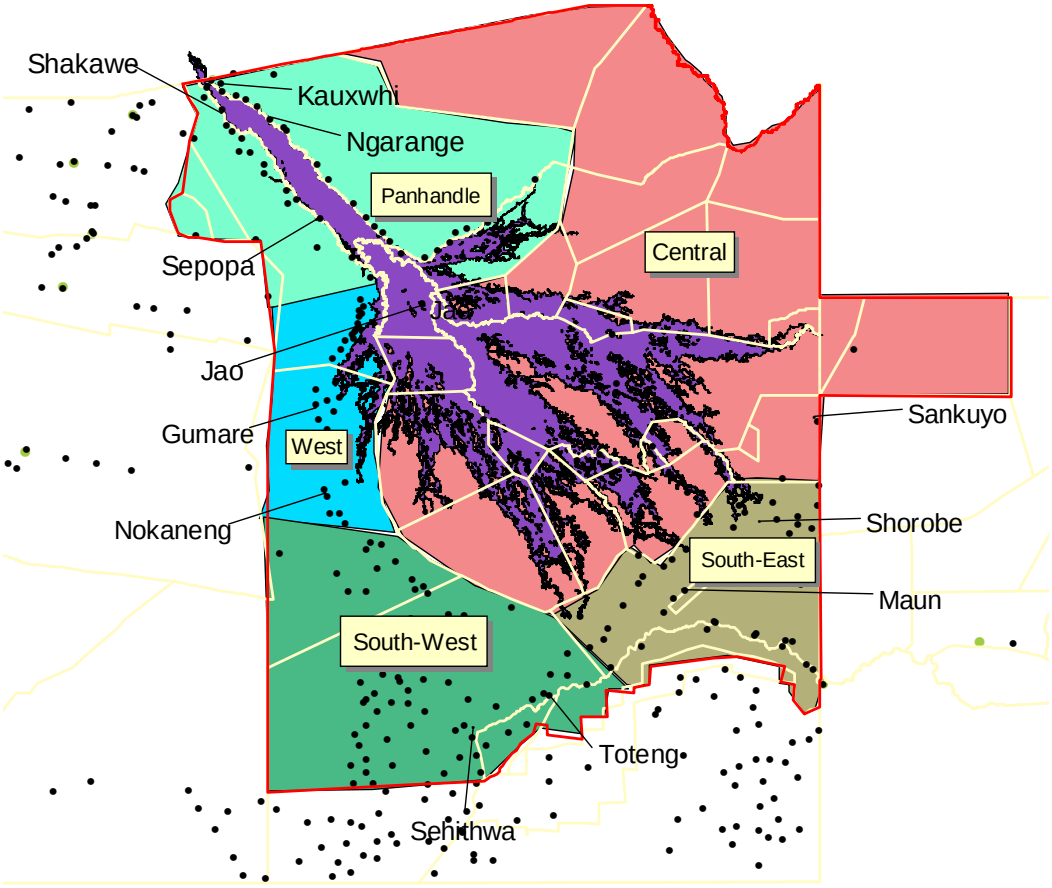

Figure 2: The five zones delineated for the economic valuation of the Okavango Delta Ramsar Site (Turpie et al. 2006), and applied in the present study

Table 19: Levels of damage to crop yields by elephant, assumed for households in the Okavango Delta Ramsar site

	Crop yield kg/household	HEC damage kg/household	HEC damage % of yield
Hot spots (panhandle, south east, central zones)	305	203	0.67
Other panhandle and south east zone villages	305	101	0.33
Rest of Delta villages (west, south west zones)	305	51	0.17
Average for all Ramsar Site villages	305	126	0.41

Table 20 and 3 present the estimated value, or cost, of elephant induced damage to dryland and molapo crop production, in the Okavango Delta Ramsar Site, respectively. The values are presented in terms of the turnover, net profit and contribution to the gross national income of crop-producing households, broken down for the five zones in Figure 2, and averaged for all. As expected the losses are highest for dryland crop producers in the panhandle area (zone 1), and high for both dryland and molapo farms in zones 1, 4 and 5, where the hot spots are

concentrated. The damage values can be compared, after adjustments for currency and inflation, with those estimated for the Caprivi region in Namibia. The estimated cost of elephant damage to crops around the delta appears to be significantly higher, by perhaps three times, than that estimated for Caprivi.

The estimated aggregate value of elephant crop damage in the delta, in terms of the loss in contribution to the gross national income (a comparable measure to the gross domestic product), amounts to P4.69 million in 2006 (P4.15 million for dryland crops and P0.54 million for molapo crops).

Table 20: Cost of human-elephant conflict to dryland crop production in various zones of the Okavango Delta Ramsar Site (P/annum, 2006)

Zones	1 Panhandle	2 West	3 South west	4 South east	5 Central	All zones
Cost per household per annum						**Average**
Turnover	1,096	213	154	745	318	779
Net profit	1,001	142	105	675	273	703
National income*	900	17	20	589	229	607
Aggregate cost per annum						**Total**
Gross output	2,683,700	90,700	86,000	2,698,100	30,500	5,558,600
National income*	2,100,900	6,800	10,700	2,029,200	20,900	4,147,500

* Contribution to gross national income (GNI)

Table 21: Cost of human-elephant conflict on molapo crop production in various zones of the Okavango Delta Ramsar Site (P/annum, 2006)

Zones	1 Panhandle	2 West	3 South west	4 South east	5 Central	All zones
Cost per household per annum						**Average**
Turnover	473	265	92	594	442	187
Net profit	320	183	16	525	409	150
National income*	226	9	0	388	403	79
Aggregate cost per annum						**Total**
Gross output	105,200	318,400	38,200	848,800	28,300	1,339,000
National income*	47,900	9,900	0	528,100	24,500	542,800

* Contribution to gross national income (GNI)

Table 22 and Figure 3 show the impact of HEC elephant crop damage on various measures of crop production enterprise value, and aggregate economic values, for dryland and molapo crop production respectively. The central column of values in both tables reflects the current, status quo, level of damage. The difference between the first column and second one reflects the costs of current average levels of elephant damage. The impacts depicted in the third column are those that might be expected if damage levels were doubled or in the most severely impacted 'hot spot' households.

The results in Table 22 and Figure 3 can be compared with those in Table 25 and Figure 6 below, which show crop damage impacts in Caprivi, Namibia. The estimated impacts appear to be significantly larger in the Okavango Delta. The approaches used in the present study and in the Caprivi studies, were similar, indicating that the finding could have validity. Nevertheless, given the general methodological difficulties of accurately measuring and valuing HEC impacts, this finding must be regarded as tentative.

The costs of elephants to crop producer households are thus significant, particularly in the hot spot areas, where the viability of household crop production can be effectively eliminated. It is important therefore to examine, these costs in the context of the benefits that communities can derive from elephants. We examined HEC costs in the context of a model of a community trust set in zone 1, the panhandle (the high quality community wildlife use model of Barnes et al. (2001), The community trust model represents a typical example of a CBNRM initiative in the Okavango Delta Ramsar Site, where communities are able to derive income from tourism joint ventures through rentals and royalties. While the trust model includes some basic costs of HEC damage mitigation, we have also added the HEC costs borne by trust households, as established in Table 20 and 3, at varying levels to the model, to determine the impact on trust viability. Table 24 and Figure 5 show the results of this cost-benefit analysis.

The results indicate that the ability of the trust to contribute positively to household income, and the national economy is retained even when HEC costs sustained by households of double the normal average levels are included. The viability of the trust as an investment appears to severely threatened, only when HEC costs of three times current levels are experienced. This suggests that, in the Okavango delta, the losses to crop production sustained by communities are likely to be outweighed by the benefits communities can derive from wildlife through the CBNRM programme. This has implications for the policies surrounding HEC management. This finding is corroborated by the finding in the Caprivi study of Barnes & Nhuleipo (2005), where CBNRM benefits were found to outweigh the costs of wildlife damage to both crops and livestock. It is noteworthy that this does not necessarily mean that for *households* CBNRM benefits outweigh the costs of HEC crop damage.

The HEC values estimated here do not include the impact of elephant in the destruction of fences, water tanks, wells and boreholes, and in inducing fear in villagers. Thus the HEC costs could be underestimated. However, the present socio-economic survey, revealed that these values are relatively insignificant compared with those for crops damage. Further, the Okavango Delta economic valuation study (Turpie et al., 2006) found that communities perceptions of the importance of crop production to livelihoods exceeded the actual monetary private and economic value of these activities as measured through quantitative survey and modeling. Communities and households tended to overestimate the pecuniary value of crops and underestimate the value of other livelihood strategies, including livestock. This phenomenon is corroborated in similar findings from elsewhere, in Caprivi, Zambia and Mozambique (Turpie, et al. 2000). It would thus seem unlikely that the costs of crop damage by elephant have been underestimated here. Table 22: The impact of different levels of elephant crop damage on various measures of dryland crop production (P/annum, 2006)

Table 22: The impact of different levels of elephant crop damage on various measures of molapo crop production (P/annum, 2006)

	Elephant crop damage level		
	No damage	1 x damage*	2 x damage
Household-level private and economic measures			
Turnover	1,656	877	81
Net profit	1,317	614	2
Gross national income (GNI)	812	205	Negative
Aggregate economic measures			
Gross output	11,824,000	6,265,500	583,200

Grioss national income (GNI)	5,547,300	1,399,800	Negative

* Values measured by Turpie et al. (2006) under current 'normal' levels of HEC

Table 23: The impact of different levels of elephant crop damage on various measures of molapo crop production (P/annum, 2006)

	Elephant crop damage level		
	No damage	1 x damage*	2 x damage
Household-level private and economic measures			
Turnover	572	385	164
Net profit	470	321	141
Gross national income (GNI)	280	200	99
Aggregate economic measures			
Gross output	4,104,500	2,765,500	1,176,900
Gross national income (GNI)	1,911,600	1,368,800	674,100

* Values measured by Turpie et al. (2006) under current 'normal' levels of HEC

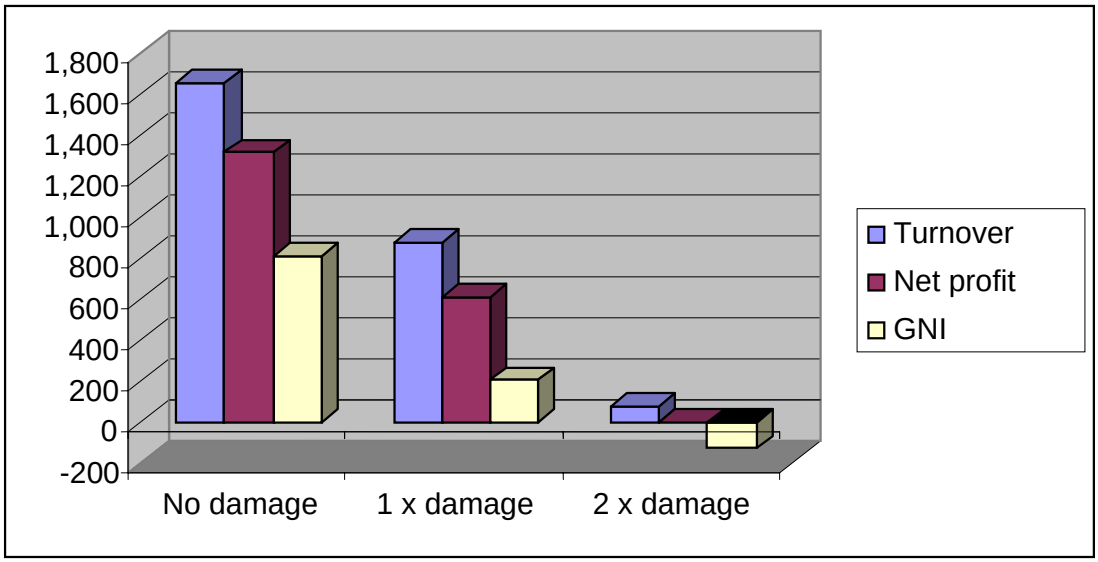

Figure 3: The impact of different levels of elephant crop damage on turnover, net profit and contribution to gross national income of dryland crop producers (P/annum, 2006)

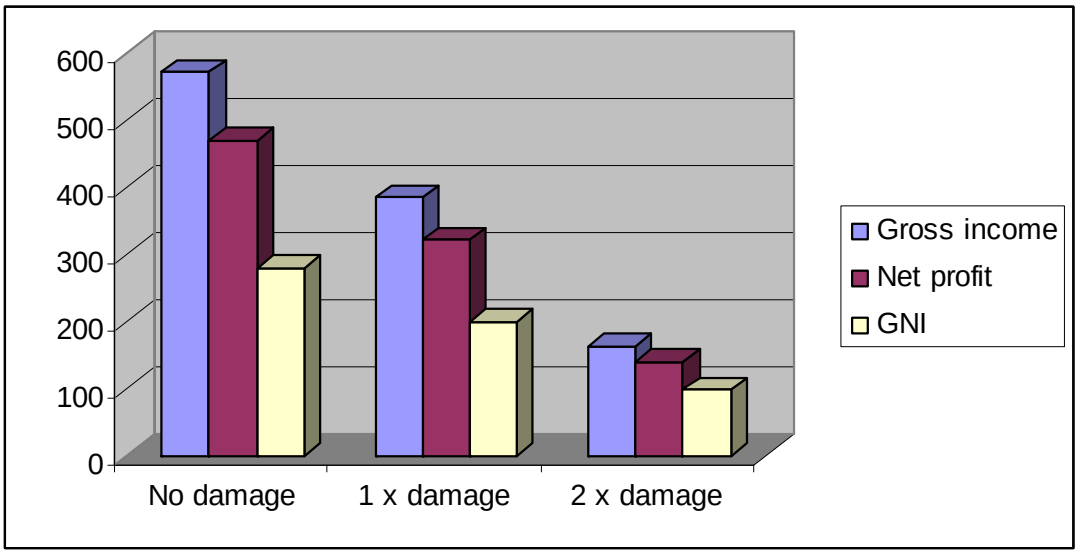

Figure 4: The impact of different levels of elephant crop damage on turnover, net profit and contribution to gross national income of molapo crop producers (P/annum, 2006)

Table 24: Impact of elephant crop damage costs on the measures of private and economic viability for a model CBNRM community trust investment in the Okavango Delta Ramsar Site (P/annum, 2006)

	Elephant crop damage cost level		
	Basic damage cost	2 x damage cost	3 x damage cost
Trust profit	604,200	333,600	-155,900
Community net benefit	1,199,400	928,800	439,300
Gross output	2,578,300	2,578,300	2,578,300
Gross national income (GNI)	2,002,900	1,777,600	1,349,800
Net national income (NNI)	1,894,400	1,669,100	1,241,400

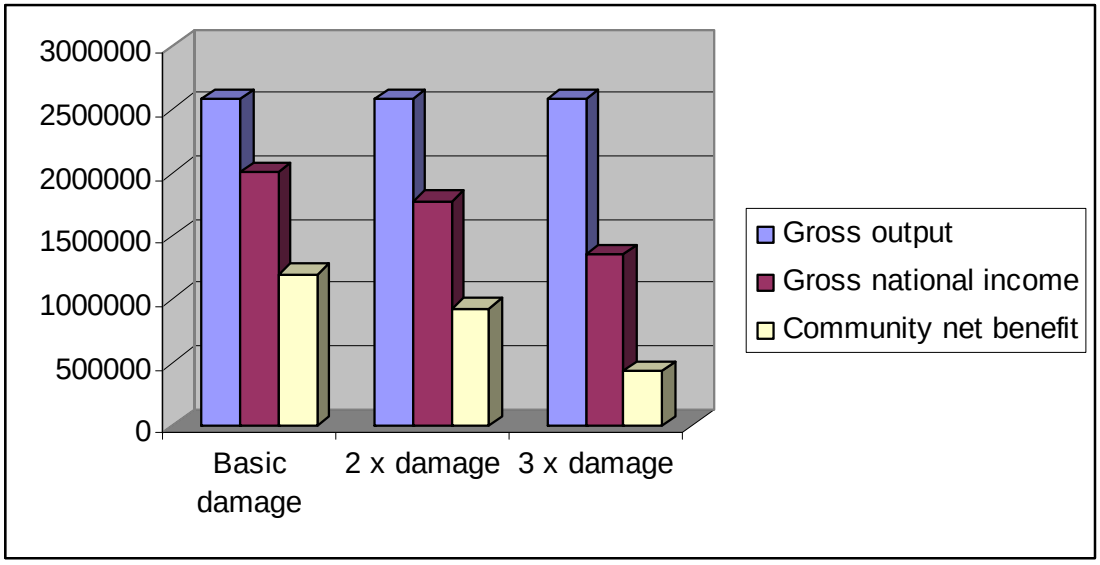

Figure 5: Impact of elephant crop damage costs on the economic gross output, the contribution to the gross national income, and the private community net benefits for a model CBNRM community trust investment in the Okavango Delta Ramsar Site (P/annum, 2006)

3 Policy implications

The findings of the analysis below provide several pointers relevant for policy on management of HEC in the Okavango Delta Ramsar Site, and in Ngamiland as a whole.

First, the evidence suggests that without elephant-induced crop losses, the contribution of crop production to households' livelihoods and to the national income could be between one and a half and three times higher. Thus, for example, without current levels of elephant damage, the value of crop production in the Okavango Delta area to the national economy could increase from some P2.8 million to some P7.5 million per annum.

Second, cost-benefit analysis shows that the costs to communities in terms of elephant-induced crops losses, are outweighed by the benefits that communities can and do derive from wildlife through CBNRM investments. Cost-benefit analysis models for community investments indicate that CBNRM initiatives are able to bear the costs of HEC and still result in positive net present values. Thus the policy (as adopted by the Namibian government) that HEC can be approached through CBNRM development appears to be economically sound for Botswana, at least in the context of the Okavango delta.

One important implication of these findings, is that research and development on farm- and community-level mitigation of HEC impacts should continue. Research into cost-effective means of reducing HEC crop losses though, for example, electric fencing, chilli production, community insurance along the lines of the Namibian HACSIS system (Owen-Smith, 2005), has merit.

Another important implication is that HEC should be as far as possible be internalized within the CBNRM process. Policies that allow for mitigation and compensation at household level, but within the context of CBNRM will likely be the most economically efficient, and preferable to any compensation schemes involving central government. It is however, important to note that successful internalisation of HEC in CBNRM will depend on the degree that the costs of HEC and the benefits of CBNRM can be balanced at the household level. While HEC costs are experienced at household level, CBNRM benefits are commonly realised at community level and do not always filter down to individual participating households. Also the spatial patterns of HEC damage and CBNRM value generation can differ to some extent. This points to the need for mechanisms to such as community-level insurance schemes, to help balance the costs and benefits associated with wildlife.

The analysis above is based on data, all aspects of which need ongoing verification. The role of HOORC in research into the social, economic and natural environments in the Okavango delta is very important. Thus research aimed at better understanding and quantification of HEC as well as its mitigation is important.

4 Experience elsewhere: human wildlife conflict values in Caprivi Region, Namibia

In Namibia, the State does not pay compensation to mitigate damage and losses caused by human wildlife conflict (MET, 2005a, 2005b). The government has considered this in the past and decided that it is too costly, the main costs to government being in person hours, and travel and subsistence for investigating problem animal complaints, and removing identified problem animals.

Compensation systems are also seen as inefficient, and open to abuse. The main thrust of government policy has been to promote a system where wildlife pays for itself, and to enable local communities to internalise the costs and benefits from wildlife. However, the success of such a policy depends on the costs and benefits of wildlife for communities. The following results from a study in Caprivi, Namibia by Barnes & Nhuleipo (2005), and reported in Jones (2006), provide an indication of the scale of these costs and benefits. Values for Caprivi are given in Namibia dollars (N$, 2004) where N$1 was equal to P0.75.

Barnes and Nhuleipo (2005) attempted to synthesise the available data on wildlife damage to crops and livestock in Caprivi to develop average household values for these costs in 2004 prices. The average values were then applied in household crop and livestock production models which have been developed from empirical data for Caprivi and northern Botswana. The aim was to measure the impact that wildlife damage has on the private net benefits associated with household crop production and livestock keeping. The study also applied the damage figures in two enterprise models for community-based natural resource management (CBNRM) conservancies. The aim here was to compare the average costs of wildlife damage in conservancies with the benefits accruing to conservancies from wildlife use. Aggregate estimates of the effect of human-wildlife conflict on household livelihoods in Caprivi, were made, using the statistics on of crop and livestock producing households. The household enterprise models used, also measured the effect of the enterprise in the national income of Namibia, through shadow pricing. Thus, in addition to the impact on livelihoods, the impact of human-wildlife conflict on the national economy, at both household and aggregate level in Caprivi was measured.

Crop losses in Caprivi are, as in the Okavango Delta, largely attributable to elephant. Livestock losses in Caprivi are mainly attributable to hyaena. Average crop and livestock loss values for Caprivi were calculated from several disparate data sources. An important source was a series of estimates of crop and livestock losses along the Kwando River for the years 1991 to 1995, based on Ministry of Environment (MET) data (O'Connell, 1995; O'Connell-Rodwell et al. 2005). Another was a series of estimates of losses in crops and livestock from Caprivi as a whole, between 1996 and 2001, derived from MET data by Mulonga, et al. (2003). More estimates on crop losses were obtained from Suich (2003), who had survey-derived estimates for 2002, from Kwandu and Mayuni Conservancies in the Kwando River area. Evans (2004), reported on crop loss estimates from Kwandu and Mayuni for 2003, based on both survey and government data. These data are highly variable, temporally, spatially, and according to the sources and methods used. They required some manipulation to derive average values with some validity.

An important study was conducted by Sutton et al (2004) who surveyed households across Caprivi gathering a series of data on household characteristics and human wildlife conflict. Sutton's work involved econometric analysis and allowed for estimation of crop loss values and also a shadow, 'farm gate', price for maize. Barnes and Nhuleipo (2005) used this shadow price to adjust the values of crop losses from urban market prices to farm gate prices, for all the other studies. Mulonga et al (2003) and Suich (2003), showed that the MET data on wildlife damage were likely to be incomplete, and suggested adjustment of these values. Thus, after various adjustments, crop damage values, for the period 1991 to 2003, and livestock loss values, for most years in the period 1991 to 2000, were inflated and used to calculate average annual values at 2004 prices. In terms of lost turnover, the average value for crop damage per crop producing household was N$269 in 2004 (P220 in 2006), and the average value for livestock loss per

livestock producing household was N$274 in 2004 (P225 in 2006). Although there are no detailed data on spatial variation in impact, the values in the extremely exposed parts of Caprivi (along parts of the Kwando and Chobe river frontages) appear from our rough calculations to be commonly between 2 and 4 times the regional average.

The average household crop loss value for Caprivi was applied to household crop production models derived from Turpie et al (2000) and LaFranchi (1996) to determine the effect on private net income, private rates of return, and the impact on the enterprise contribution to the economy (gross national income). Similarly, average household livestock loss values for Caprivi, were applied to household livestock production models derived from Barnes et al (2001) and LaFranchi (1996). Once again the impact of this on private net income, private rates of return, and the enterprise contribution to the economy (gross national income) were measured. The crop and livestock enterprise models used are empirically based, and thus implicitly include the impacts of wildlife induced loss. The average losses derived were further applied to effectively determine the effects of double the base damage costs. Sensitivities were conducted to see what the effect of five and nine times the base level of costs would be.

The financial and economic values associated with the community-based natural resource management (CBNRM) programme in Caprivi have been measured using a modelling approach similar to that for the crop and livestock enterprises (Barnes et al., 2002). The average crop and livestock loss figures were applied similarly, to the models for Mayuni and Salambala conservancies to determine the impact of these costs on CBNRM activities as well as the effects of sensitivity analysis. The Namibian CBNRM programme has been shown to have significant positive economic merit (Barnes et al., 2002; NACSO, 2004, 2006), and may hold potential for incorporation of HWC issues.

Table 25 shows the results of this analysis as it applies to dryland crop production in Caprivi. It is clear that if current wildlife damage costs to crops are doubled, then the private net income or profit drops by some 30%. If the wildlife damage costs are multiplied five times, as might well be the case in those areas of Caprivi which suffer extreme damage (see below), then the enterprise becomes entirely non-viable both privately and economically. Figure 6: Impact of wildlife damage on Caprivi household crop production enterprise, in terms of gross income (turnover) net profit and contribution to gross national income (N$, 2004) depicts some of these basic impacts graphically. The average impact of crop damage per household results in a loss of some N$200 in terms of national income. The aggregate impact of crop damage by wildlife in Caprivi is some N$2.1 million.

Table 26 shows the results of the analysis as it applies to livestock production in Caprivi. Here, the impact on household welfare of a doubling of livestock losses caused by wildlife is smaller than it is with the crop enterprises. The private net income drops by some 5% and damage can multiply some 5 times before private returns become marginal. In terms of the enterprise contribution to national income however, the damage is more severe. Average loss of some N$300 per livestock-keeping household per annum, translates to an aggregate figure of some N$3.5 million in Caprivi. Figure 7: Impact of wildlife damage on Caprivi household livestock production enterprise, in terms of gross income (turnover) net profit and contribution to gross national income (N$, 2004) depicts some of these basic impacts graphically. Generally the impact of livestock losses on livelihoods is smaller than that for crop losses.

Table 27 shows the effects of the average impacts of wildlife damage to both crops and livestock as measured per household, on the project, private and

economic returns associated with two community CBNRM conservancies (Mayuni and Salambala). Here the impact of a doubling of wildlife damage costs on project (conservancy) profit, and community income, is quite severe, causing community income to drop by between 35 and 50%. The effect of these costs on the contribution of conservancies to the national income is also quite severe, although economic viability is retained even under conditions of extreme damage.

The analysis of Barnes & Nhuleipo (2005) provides a useful insight into the impact of human wildlife conflict on household livelihoods and the economy in Caprivi. Several noteworthy points emerge. First, the impacts of such conflict on household welfare and livelihood can be severe in the extreme situations where people are most exposed. This points to the need for continued research and development of local mitigation mechanisms, including physical deterrents, as well as insurance. Second, there are real economic costs associated with such conflict. Third, it is generally apparent that the private and economic benefits associated with wildlife in Caprivi (as measured in the returns to CBNRM) tend to outweigh the private and economic costs in terms of crop and livestock losses. Thus the Namibian government policy of promoting a system of CBNRM where wildlife can pay for itself, and communities can internalise both the costs and benefits from wildlife appears to be economically sound.

Table 25: Costs of wildlife damage on household crop production activities in Caprivi, in terms of private returns per household, and in terms of economic value (value added to the gross national income) (N$/annum, 2004)

	Base	Sensitivity analysis		
	Losses x 1	Losses x 2	Losses x 3	Losses x 5
Floodplain crops enterprise				
Turnover	2,200	1,900	1,400	300
Net income (profit)	900	700	100	-900
Net income drop (%)		28.8%	86.4%	201.7%
Profit/investment (%)	23.8%	17.0%	3.2%	Negative
Value added to GNI	500	400	100	-600
Dryland crops enterprise				
Turnover	4,300	3,600	2,200	-500
Net income (profit)	2,200	1,600	900	-500
Net income drop (%)		30.1%	60.2%	120.4%
Profit/investment (%)	42.5%	29.7%	16.9%	Negative
Gross national income loss/household		200		
Aggregate loss in GNI for Caprivi		2,087,200		

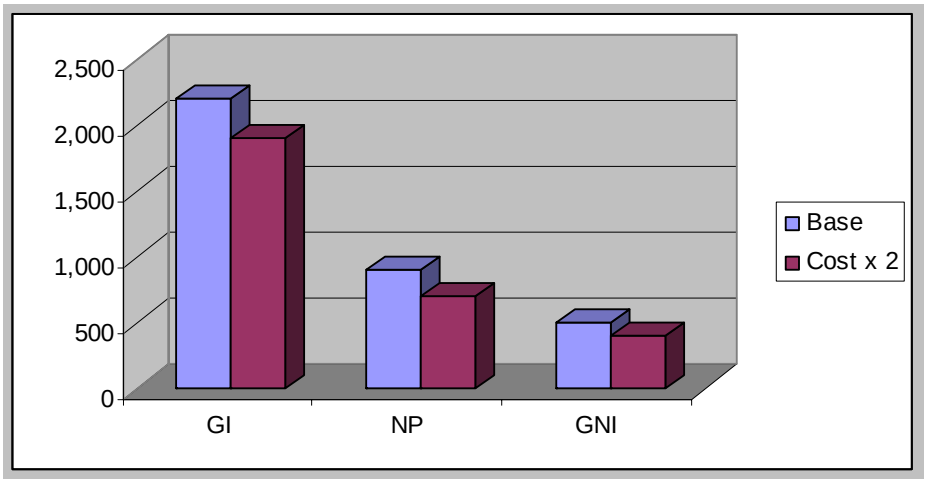

Figure 6: Impact of wildlife damage on Caprivi household crop production enterprise, in terms of gross income (turnover) net profit and contribution to gross national income (N$, 2004)

Table 26: Costs of wildlife damage on household livestock production activities in Caprivi, in terms of private returns per household, and in terms of economic value (value added to the gross national income) (N$/annum, 2004)

	Base	Sensitivity analysis		
	Losses x 1	Losses x 2	Losses x 3	Losses x 5
Ngamiland livestock enterprise				
Turnover	17,300	17,000	15,900	13,700
Net income (profit)	5,200	4,900	4,100	3,000
Net income drop (%)		5%	21%	42%
Community income	11,600	11,300	10,500	9,400
Private IRR (%)	11.5%	10.6%	9.3%	7.1%
Value added to GNI	1,000	700	-100	-1,100
Caprivi livestock enterprise				
Turnover	20,900	20,300	17,800	12,800
Net income (profit)	18,100	17,500	15,600	13,100
Net income drop (%)		3.5%	13.9%	27.8%
Profit/investment (%)	31.0%	29.9%	26.7%	22.4%
Gross national income loss/household		300		
Aggregate loss in GNI for Caprivi		3,523,800		

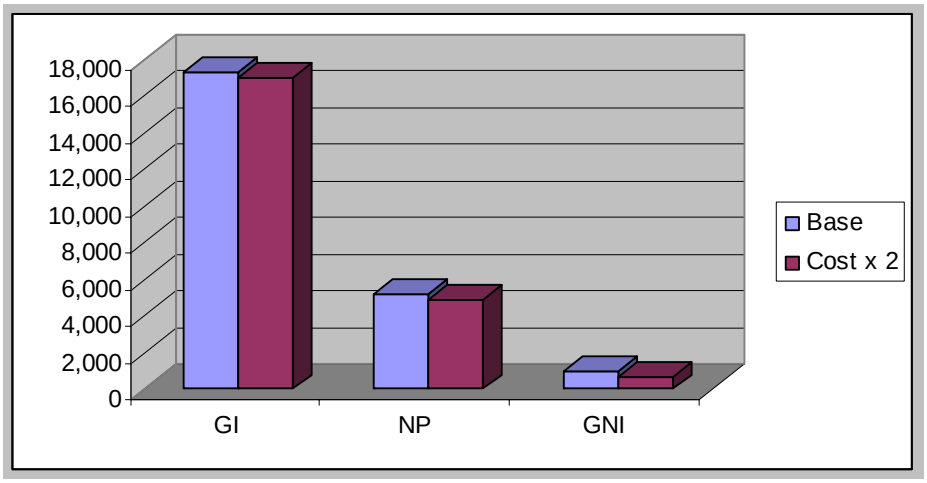

Figure 7: Impact of wildlife damage on Caprivi household livestock production enterprise, in terms of gross income (turnover) net profit and contribution to gross national income (N$, 2004)

Table 27: Costs of wildlife damage to crops and livestock in two community-based conservancies in Caprivi, in terms of project and community returns, and in terms of economic value (value added to the gross national income) (N$/annum, 2004)

	Base	Sensitivity analysis		
	Losses x 1	Losses x 2	Losses x 4	Losses x 8
Mayuni conservancy				
Turnover	1,605,600	1,349,300	676,100	-831,000
Net income (profit)	521,400	265,100	-151,800	-985,600
Community income	1,146,900	730,000	313,100	-520,700
Comm. Income drop	-	36%	73%	145%
Community IRR	220%	123%	38%	Negative
Value added to GNI	1,346,400	975,900	605,300	-135,800
Salambala conservancy				
Turnover	1,197,600	873,400	383,400	
Net income (profit)	209,400	-114,800	-280,500	
Community income	666,900	342,600	18,400	
Comm. Income drop		49%	97%	
Community IRR	40%	0.6%	Negative	
Value added to GNI	823,100	534,900	246,700	

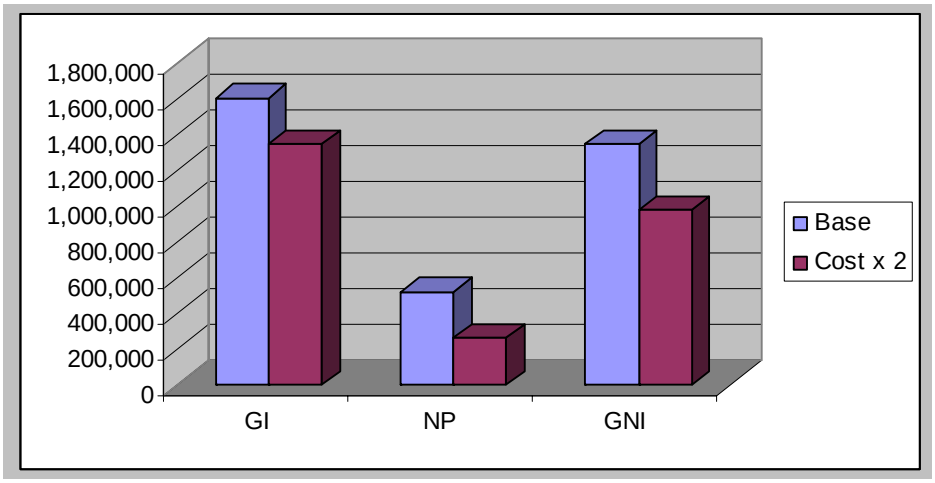

Figure 8: Impact of wildlife damage on community-based conservancy in Caprivi, in terms of gross income (turnover), conservancy net profit, and contribution to gross national income (N$, 2004)

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CHAPTER 5

TRAINING ASSESSMENT

Community Based Human-Elephant Conflict Mitigation Training Workshop

13th-18th November 2006
Maun, Botswana

1 REPORT SUMMARY

The following report is a personal and independent assessment of the situation on the ground in Botswana following the training of trainers exercise carried out as part of the ongoing Okavango Delta Management Plan (ODMP) consultancy in which both the Natural Resources and People (NRP) and the Elephant Pepper Development Trust (EPDT) are actively involved. It should not be taken as reflecting the views of both the EPDT and the NRP. The report will assess among other indicators; training participants, issues discussed, other concerns raised by several stakeholders and general observations by the author. Points raised in this report are not arranged in any order of significance.

2 GENERAL ASSESSMENT

2.1 PARTICIPANTS

It was important having the PAC unit as the core group of trainees as it is going to be the likely implementing or extension agency if there is any implementation to write home about. It was however, also important to have a rather cross sectional or representative group including some research people, some with influence on policy making and implementation or even some from or with a working knowledge of the Land Board or community representatives. This was going to have a marked impact on decision making as participants present for the course were simply implementers without authority to decide on the way forward given the fact that no decision has yet to be taken on whether there would be any implementation or not.

This situation is rather different from other areas in which the EPDT has worked in that apart from having the government taking a lead role and inviting the Trust, in most recent situations it has been some NGO reacting to community calls for intervention where centralized control of PAC by governments have failed. In some cases communities would, through their respective local leadership approach the Trust, for example the Showgrounds community and the Technical Teachers College in Livingstone, Zambia. In situations like this, there are no bureaucratic tendencies in decision making like what is happening in Botswana.

3 HEC MANAGEMENT AS A POLITICAL ISSUE

Generally elephant management and in particular HEC in Botswana has become a highly political and emotional issue at a number of levels. Politicians are said to be under pressure from constituencies to deal with ‘the problem’ where there is a

high incidence of HEC. However, politicians are also concerned by the possibility that the same communities they represent may turn against them if they adopt management measures that may result in the communities “losing out”. From the reports in the consultancy files at the moment, it seems public opinion from affected communities is advocating for culling and or cropping of elephants as their population is said to be increasing exponentially. However, the politicians and other decision makers are afraid of a possible negative impact such a decision might cause on the economy. They fear that not only tourism, but also the diamond industry could be affected if elephants are culled. Most participants suggested that this was one of the major reasons why Botswana had not reduced elephant numbers by culling according to the 1991 management plan.

3.1 COMPENSATION

The scheme still remains the major stumbling block if any CBPAC methods are to be implemented. According to the participants, abuse of this provision by farmers, government officials (including some of the PAC personnel), politicians, damage assessors, etc is rampant and several cases were highlighted and brought to the attention of decision makers. However, there seems to be no commitment to tackle the real issue COMPENSATION ITSELF but more efforts have been put in trying to curb such cases. As such, when officers tasked to carry out damage assessments are colluding with unscrupulous farmers who then will “police the police?” Participants agreed that the whole issue is too political and the government while advocating for the removal of the scheme, it is apparent that it is hesitant to do so. A few recommendations came from the participants regarding compensation and are as follows:

Proposed a gradual removal of the scheme i.e. reducing the amount paid out on an annual basis for any crops lost. This contrasts fully the current situation whereby the amount paid out in the past 5 years has been increasing and communities still feel that the compensation is even lower than they expect.

Conditional Payment of compensation: implies that those following to the latter laid down procedures such as those in CBPAC will have a percentage of their lost property being compensated for. For example, if one is not kraaling his cattle he will not be paid anything, the same applies to those not protecting their crops or leaving near their crops shall not be compensated for any loss they incur. Those settling illegally in elephant corridors should have the same fate as well.

Community self-insurance schemes: The concept is currently in place in Namibia and has been touted to be one of the most realistic alternatives to the present compensation scheme. The system will deal with issues of conflict resolution as well as payments for crop losses but is not centralized. The Conflict Resolution Committees (CRCs), which is the community leadership of traditional authorities, seeks to balance the losses of individual community members against benefits from wildlife/elephants gained by the communities. Farmers will then be paid fixed-rates for losses from elephants or any other wildlife species that have a collective value to communities, with payments only being made to registered members, in the event of such member’s field being predated upon. However, such payments will only be made within a specific laid down framework of rules and conditions (some kind of constitution), which need be developed by the community members themselves. Claims that fail to meet specifications in the constitution will be deemed ineligible for payment.

4 MONITORING PROGRAM

In the Botswana range, human-elephant conflict (HEC) is a problem but is not well quantified. The monitoring system (MOMS) of elephant damage reports by PAC

personnel while well established and “elaborate”, it is rather cumbersome. It is hard to get summarised data on conflict hotspots as well as coming up with a quick trend analysis of events over the crop raiding seasons. The following also need attention:

Lack of sound data on numbers, distribution, conflict, impacts, etc, of elephants remains a major problem,

Landscape level monitoring, analysis and evaluation of human-elephant conflict to develop land use planning and predictive mitigation (early warning) approaches to reduce human-elephant conflict.

Support for monitoring and data collection that can better inform decision-making through: Calculation and quantifying elephant damage as economic data, quantifying farming area ‘at risk’ in each HEC zone, producing HEC maps at different scales suitable as well as comparing pest species damage to have comparative analysis

Support for in-service training of mid-level managers (particularly on issues related to elephant management and HEC in particular)

Support for CBNRM, particularly on institutional and governance issues so that communities can be empowered to conserve wildlife and manage human/elephant conflicts in a manner that achieves a win-win outcome.

Investment in a highly focused and targeted public relations campaign to inform national decision-makers and the general public of the issues concerning elephant management in Botswana and across other range states.

4.1 LINKING COSTS AND BENEFITS OF LIVING WITH ELEPHANTS

Participants were in agreement that for conservation programmes to be successful both in providing benefits to communities and protecting wildlife, not only must the benefit be received and valued by the local people, but the linkage between the benefit and the elephants as a resource must be made clear. Most participants also felt that among agriculturists who suffered a net loss to elephants, people preferred help offsetting or preventing these costs and such measures would include killing of elephants. Consumptive use such as eating elephant meat was considered not to be a viable alternative in most communities who consider their livestock to be better alternatives.

The presentations from Madinare and Kasane showed that there was a bit of gender attributes towards attitudes to elephant damage and ultimate conservation ideals. Women were slightly less tolerant of problem elephants than men. This is also common elsewhere in African elephant range states; women tend to be more negative about elephants possibly because they are more dependent upon agricultural production for sustenance and livelihood or because their daily routines such as collecting firewood and water bring them into contact with elephants more frequently. However, it is apparent that consumptive and non-consumptive use as well as non-use values must be considered and should contribute competitively to rural development if elephants are to be considered as an alternative and viable land use option.

5 MANAGEMENT OPTIONS

It is generally agreed that without a collaborative and holistic approach that is based on vertical and horizontal integration from the lowest levels up to the final decision makers, the management of HEC will continue to be blighted by several problems. The major points observed were:

Need for land use planning

Identification and prioritization of elephant corridors and discouraging settlements and developments that close or fragment these

Habitat manipulation through provision of water points away from human settlements and livestock grazing areas to limit or reduce the interface of humans and elephants

Adoption of CBPAC methods when the conditions for effective implementation have been put in place e.g. addressing the compensation and land plan use issues

Need to adapt the use of chilli-based deterrents not only on protecting fields but also on other conflict areas such as water tanks (Jojos), grain bins as well as fencing off communities.

Use of chilli based repellents such as the “chilli spray gun” below.

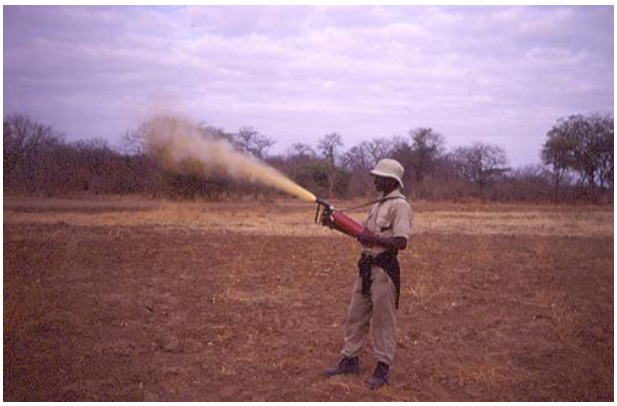

Figure 1. Chilli pepper spray gun during field trials in Zimbabwe.

The gun proved very popular with participants such that they recommended it to be tried in Botswana. They suggested that the guns would be owned and their use controlled solely by the department’s PAC unit and use it in conjunction with disturbance shooting as well as other existing non-fatal methods. This they felt will also encourage farmers to take up the use of other chilli based deterrent methods if they see the effectiveness of the gun. They also felt the government should seriously consider this option if it is willing to have the use of chilli based deterrents adopted without completely and abruptly removing the consumption scheme. Much better information is needed on the values and opinions of those conserving, managing and living with elephants, as well as on the social, economic, land use and policy related dimensions of the HEC problem, to enable informed, equitable and sustainable decisions to be reached.

6 CONCLUSION

In Botswana 60% of its large elephant population lives outside protected areas during the rainy season and this is the period of greatest threat to the fields of subsistence farmers. Attempts to mitigate crop and other damage caused by elephants have had a limited impact. Creating appropriate incentives and ways for rural subsistence farmers to live with elephants is an option that deserves to be more fully and realistically explored. More specifically there is, firstly, the need to devolve decision making about the conservation and management of elephants to those communities that live with elephants, and secondly, the there is need to increase the benefits derived from elephants (both live and dead) to local communities. Elephants have the potential to generate major financial returns to communal farmers, to protected areas, and to other land under wildlife use, and by so doing to contribute to maintaining and extending wild areas in the region. However, it is how the income generated is going to compare with the predominantly and thriving livestock production which is going to determine to a greater extent the level of acceptance by local communities.

It is important to note that the HEC and generally the elephant management issue is not a simple single-species conservation issue – it is embedded in a complex social-ecological system with important cross-scale effects and drivers. The ethical and value systems of major players with an interest in elephant conservation emerge as the overriding driver of resource management decisions and these are operating at an inter-continental scale. For this reason the overriding priority should be to establish what the people of Botswana living with the elephants think about the conservation and consumptive use of elephants. This way, HEC has a chance of being reduced and not eliminated.

CHAPTER 6

TRAINING PROCEEDINGS REPORT

Community Based Human-Elephant Conflict Mitigation Training Workshop

13th-18th November 2006
Maun, Botswana

1 ACKNOWLEDGEMENTS

We would like to thank the participants who took part in this "training of trainers" workshop for making it such a fruitful learning experience. Thanks are also due to all those who made this workshop possible: The staff and management of Okavango Delta Management Plan (ODMP), the Botswana Department of Wildlife and National Parks (DWNP) for hosting of the theoretical sessions of the training at their offices and providing refreshments, as well as the Elephant Pepper Development Trust (EPDT) and the Natural Resources and People (NRP) for providing the course facilitators. Special thanks to Mr. Moghetso of Etsha 6 community for his willingness to have his field used as a demonstration plot for the practical demonstration of the Community Based Human Elephant Conflict Mitigation techniques.

Our apologies in advance to anyone we have unintentionally omitted to acknowledge.

1.1 REPORT SUMMARY

This report details the proceedings of the 5-day training course held in Maun, Botswana. The training and subsequent report are required as deliverables as part of the project outputs in the ongoing consultancy. The course comprised theory and practical sessions. Theoretical sessions were held at the Department of Wildlife and National Parks offices and the practical sections were conducted in Estha 6 where human elephant conflict incidences were reportedly very high in and around crop and vegetable fields. For three days participants explored the current Human-Elephant Conflict (HEC) situations in their local areas and were exposed to a wide range of HEC mitigation strategies that are categorized into active, passive and vigilance methods and primarily those that are chilli based. The participants were then introduced to a suite of Community Based Problem Animal Control (CBPAC) methods developed by the Elephant Pepper Development Trust (EPDT). Practical training took place over two days during which a CBPAC demonstration plot was established. Course participants were generally middle level wildlife managers from several departments of the DWNP of Botswana albeit with marked background in PAC. Several other wildlife concerns were discussed with a focus on human-elephant conflict as well as various forms of community based initiatives with a bearing on community livelihoods, particularly of people living in areas abutting wildlife range across Botswana.

1.2 BACKGROUND

Human-elephant conflict (HEC) in Botswana as in all other elephant range states has been identified to be a major conservation and management issue where humans and elephants coexist. Mitigating such conflict has arguably taken centre stage in biodiversity conservation as well as livelihood concerns across Ngamiland and all other areas graced with elephants. Just like many other southern African countries, Botswana's elephant population has been stable for more than a decade and has been reportedly increasing (Mosojane, 2004). Communities living in settlements that abut traditional and historical elephant range such as Gudigwa, Seronga, Etsha and Madinare, Chobe etc, need sustainable ways of keeping elephants and other crop pests out of their fields. HEC can take many forms, including the destruction of crops and property, the killing of livestock and at times human beings, fear of travelling at night, and competition between people and elephants for natural resources. People who are worst affected by conflict are generally poor subsistence rural farmers living in an area of high wildlife density.

Many Non Governmental Organizations and Government Wildlife Departments have continuously attempted to mitigate this conflict, with most efforts focussed upon crop protection. However, it appears current Problem Animal Control (PAC) techniques designed to reduce the impact of elephant crop damage are inadequate, either being too expensive for rural farmers to afford, or being impractical in remote locations. In Botswana's case other issues such as Land Use Planning (LUP) and the seemingly controversial and highly political compensation scheme complicates the HEC issue. There is thus a real need to develop new PAC techniques in communal farming areas.

1.3 INTRODUCTION

This training of trainers programme was designed to train middle level wildlife managers working for the Department of Wildlife and National Parks of Botswana in techniques for reducing conflict between communities and elephants. The training was organised by the Natural Resources and People with training facilitators coming from the Elephant Pepper Development Trust for the consultancy work currently in progress under the Okavango Delta Management Plan. The goal of this training was to equip the wildlife managers with community based PAC techniques to enable them mitigate the impact of human-elephant conflict upon communities across the elephant range of Botswana.

The training focused upon both crop and other property protection strategies and exposed participants to other several wildlife concerns with a bearing on effective PAC implementation and it sought to have the trainees prepared and well versed in dealing with both the communities and the elephants. The techniques introduced were first, developed in Zimbabwe and have been used to successfully reduce elephant damage on crops and other properties in many other countries in Sub-Saharan Africa. The techniques involved are of low technology and emphasised utilisation of cheap and available materials. It was anticipated that on completion of the training the participants would have acquired the necessary skills and knowledge to introduce these strategies to local communities where they are based.

In fulfilling this requirement, the workshop therefore aimed at empowering wildlife management personnel, particularly those within PAC units with knowledge, attitudes and skills for facilitating the development of these techniques. The success of the course was therefore largely dependent on whether the participants were able to translate the concepts into community owned priorities and targets, and adapt them to the particular local conditions especially HEC

mitigation, as well as Government commitment to have several issues addressed for the effective implementation of these methods at a pilot or national scale.

1.4 TRAINING PROCEEDINGS

The course began by welcome remarks and the purpose of the course which is to come up with HEC mitigation measures that allow for human and elephants coexistence, from the Dr. Masunga, the Head of the Research Unit of the DWNP Maun office and later all the participants introduced their selves. In the opening remarks it was emphasized that the workshop had to be highly interactive as the issue under discussion called for collaboration given that most of the participants are the very people who bear the brunt of frustrated and disgruntled communities suffering from the depredations of elephants and the politicians' "top brass" who want to see the issue resolved without losing their constituencies. The General Manager of the NRP, Mr. Kent Burger who also gave a brief background and the long goal for the ODMP, echoed these sentiments. He also noted the need for harmonization of policies with Land Use Planning especially in such issues as wildlife/elephant movement corridors as well as other tourism initiatives prior to the implementation of the CBPAC techniques. The facilitators then got the day's session underway by giving the overview of and or outline of the course followed by the course objectives, which were to ensure that participants are:

Trained as trainers in community-based Problem Animal Control (PAC) techniques
Competent with the theory and practice of community-based PAC methods
Able to critique current conflict mitigation techniques Following the course it was also anticipated that participants will be fully conversant in the following activities:
Training communities in the concept of community-based PAC
Establishing community-based PAC sites at suitable locations
Monitoring and evaluating all PAC activities
Adapting PAC methods to local conditions

Participants were then given the chance to state their expectations from the course. Below are some of the expectations listed:

To be able to get the approach to implement CBPAC methods
To know how the chilli based deterrents work, and what makes them so effective
To learn other issues of HEC management including policy issues
To know the best approach when dealing with communities

Participants were also encouraged to make the course as participatory as possible by critiquing the methods they were to be introduced as well as by giving as much information they had regarding their local areas. It was agreed that there was need for flexibility from both the participants and facilitators for the training to be more effective and worthwhile.

Participants were then introduced to the background of the Elephant Pepper Development Trust, which was formerly known as the then Mid-Zambezi Elephant Project (MZEP) having been established in 1997. Then its goal was to develop elephant management strategies for Community Areas Management Programme For Indigenous Resources (CAMPFIRE) Districts within Zimbabwe. MZEP researched elephant ecology, developed an elephant movement corridor, and monitored conflict across the Districts of Guruve and Muzarabani. One of the main objectives was to establish community-based crop and property protection strategies. Following the successful development of a community-based PAC

system, MZEP engaged in a regional programme to train wildlife managers in these methods. In 2002 MZEP became the Elephant Pepper Trust and extended its training activities across elephant range states of Africa and Asia.

The day's first module gave an overview of what HEC is, its background/history and who's responsibility it is. A more broader and holistic definition of HEC was adopted for the course, which states that "Any human-elephant interaction that results in negative effects on human social, economic and cultural life, on elephant conservation or on the environment" (IUCN/AfESG, 2001). The causes of HEC were then explored and it was noted that the reasons why conflict continues to be existence is because of both people and elephant related issues. The former include increasing settlement in corridors, increased farming in elephant refuge areas, expanding human population as well as tourism and development in most areas of Ngamiland. Elephant related conflict causes were noted as change in elephant movement (straying in people settled areas), complex elephant behaviour, dry season grazing whereby elephants abandon their usual refuges and move into areas where people and their livestock share resources as well as increasing elephant local population.

Another discussion point focused on where this conflict occurs. As in many other countries, areas of conflict were found to be around shared water forest resources, fruiting trees, forest edges, along fragmented elephant routes and also on Jojo tanks and cropping fields. Participants also discussed on the reasons they thought exacerbated the tendencies of elephant crop and property damage. It was agreed that in most cases farmers crop fields were laid along known elephant corridors, other factors were to do increasing elephant numbers and their compression into smaller areas leading to habitat damage and subsequent seeking of alternative feeds. Due to fertilization in fields, crops in them have relatively higher nutritional status than that surrounding the forest or within the forest hence elephants target these areas.

In Etsha, where elephants reportedly damaged Jojo water tanks, it was noted that elephants were now habituating and adapting to local human conditions such that they could easily associate people and their dependency on water thereby easily targeting the tanks. It was also stated that most communities in Botswana do not live near their fields and if they did most fields are not protected either because they know that they will be compensated if they lose their crops to elephants or they are afraid of the animals which they deem a burden on their livelihoods. Most communities do not value elephants as they are not realizing tangible benefits from them as compared to elephants and in any case they do not have any sense of ownership of these animals thus view them as the responsibility of the DWNP.

This scenario leaves most fields vulnerable to elephant damage, as the crops become "easy and nutritious" prey for the elephants. Participants then chronicled the conflict issues in their local areas. In this section they focused on such issues as the nature or type of conflict, where it occurs, who does the reporting and recording of HEC incidents, why it occurs and how they relate to the local communities. In their presentations, they also gave their opinions and views with regards to the issue of compensation as well as ranking the problematic animals with the animals causing severe damage according to the reports they get from the farmers.

The compensation scheme raised a heated debate as to how best can it be handled, executed and possibly be removed as it was considered to be highly abused by several stakeholders, that is the farmers, wildlife management personnel, damage assessors from other ministries and also politicians. Later in the day the issue of perceptions of conflict were discussed. It was noted that most

communities perceived elephants to be the greatest problem animal but usually the situation on the ground is that other small pests such as the insects, birds, primates, rodents and warthogs cause excessive damage, at times much more than elephants but communities can easily overlook this because of a number of reasons. These were explored and it was agreed that elephants are considered the most problematic pest species because:

Farmers able to control other animals such as birds and rodents
Framers can kill and eat small crop raiders e.g. duikers
Elephants cause extensive damage in one visit than all these animals
Elephants are big and imposing, therefore they intimidate people
Crop raiding by elephants nocturnal and most people are not willing to guard their fields during this time and also fear exposing themselves to other risks such as contracting malaria or even snake bites
Elephants do not fear humans like other animals do and;
People fear elephants hence exaggerations.

A case study of perceptions of conflict was then given and it was recommended that only with research and sustained monitoring of damage incidents can the participants be able to confront communities with credible data to change these perceptions. With changed perceptions communities will be in a better position to protect their properties as they will be in the right mind frame. Participants were then introduced to the several costs of HEC and the major points was that:

The costs of living with elephants can be divided into several categories and these are damage costs, other direct costs, indirect costs, and environmental costs. Damage costs include the destruction of crops, property, and human life by elephants. Direct costs include expenditures on deterrents to elephant damage and expenditures on management services required by the elephant population. Indirect costs include the opportunity cost of base resources required to sustain a healthy elephant population, such as land and water. Other indirect costs are associated with changes to agricultural production systems in order to avoid elephant damage. Further, it is likely that farmers who are victims of frequent elephant attacks suffer from psychological stress as a result. Finally, in some parts of Africa the elephant appears to be locally overpopulated.

This can result in considerable damage to the ecosystem, which also entails costs. It was also noted that the costs of living with elephants could be borne by different sectors of society in Botswana. For example, damage to crops will most directly affect farmers living in areas adjacent to elephant habitat. However, it is also possible, under certain market conditions, for consumers in the elephant damage area to bear part of the costs of elephant damage in the form of higher prices paid for the food that they consume. On the other hand, costs associated with management services are borne by the wildlife management ministry of the host country.

Other indirect costs are associated with changes in agricultural practices forced by living with elephants. For example, in the Okavango Delta this can mean avoiding cultivation along rivers where soils are rich and water is plentiful because elephants also favour these habitats. It can also mean shifting production from a profitable crop that is favoured by elephants to a less profitable crop that elephants are less likely to attack. For example, elephants in this area seem to be particularly partial to melons and vegetable crops. These also tend to be relatively high-value crops in the farmer’s portfolio. Elephants might also affect agricultural practices seasonally. For example, farmers might avoid producing intensive, dry-season gardens because other food is scarce at this time so the gardens would

be particularly attractive to elephants. Like in most elephant range states, it was agreed that in areas where elephant attacks are common, it appears that farmers and their families endure substantial psychological stress from spending long nights in the fields chasing away elephants and worrying about their crops. It was concluded that course participants and all other stakeholders need to acquaint themselves with these costs so that informed decisions are taken on which methods may be effective in PAC.

Day 2 began with a brief recap of the previous day's proceedings. Participants were then introduced to the policies of problem wildlife management across Africa with particular emphasis on problem elephants. Policies in three different time periods were given; that is policies governing problem wildlife management during the pre-colonial, colonial and postcolonial eras of Africa. Currently, it was revealed that no country had a concise and specific policy on HEC management but most Governments retain overall ownership and responsibility for wildlife, especially elephants. There is also now an increasing popularity of CBNRM and devolution of responsibility for problem elephant management to local communities.

There followed a section of the general ecology and behaviour of crop and property damaging elephants. The course content exposed participants to several aspects of elephant ecology from reproduction, physiology and anatomy, feeding patterns, social systems, behaviour as well as the predictability of elephant depredations. The major points coming from the discussions were that elephants exhibited almost similar patterns across all the regions of Botswana. Below is a summary of the discussion points:

Temporal patterns of crop damage: Crop damage displays broad inter-year variation from place to place. It also exhibits a peak of activity when crops approach maturity e.g. towards end of rain season when crops are most palatable and decline in quality in natural forage acts as a trigger for crop raiding

Types of crop damaged: These are in no specific order but maize tended to come up top in the ranking of most susceptible crops to damage, cotton, sunflowers, ground nuts, water melons, millet, onions, beans, mangoes, cassava, sugar cane, pumpkins, potatoes, plantain, okra, tomatoes and coco yam, etc

•**Seasonal differences in crop damage:** Elephants may raid crops both in the wet season and the dry season. However, these two periods of crop damage differ greatly in terms of the crops affected and the impact upon peoples' lives **as** dry season crop damage is more serious than wet season damage because during the dry season farmers do not have alternative food and can easily starve.•**Group size of crop-raiding elephants: Varies but studies in** Zimbabwe and Kenya showed that 89% of crop-raiding incidents were due to groups of elephants of between 1-10 causing 40% of all wet season incidents. **Technical faults**: -This implies the material and design of most barrier systems, which might not be durable or suffer from maintenance problems, for example electric fences.

Lack of commitment: Most communities lack commitment and self-drive to make the methods work effectively.

Centralized control: In most countries problem animal management is centralized in the government departments such that decision making is usually delayed**.**

Lack of resources: This entails both human and capital resources for effective implementation of several methods.

Politics and tenure: Politics could be village level and local, as well as regional and national. With regards to tenure, it was noted that communities in Botswana

have very minimal ownership if any of local natural resources, elephants included. This has a bearing on the effectiveness and success of any mitigation method to be used.

Target species behaviour: Elephants easily habituate to many deterrent methods making most of these techniques to fail.

Day 3 also began by a recap of the previous day's work and two participants did that. Later, the facilitators introduced the concept of CBPAC and explained how it works. Through discussions, the central points and underlying principles of this approach to work were noted as:

It needs to be cheap and self-sustaining
Local community participation vital
Techniques used need to be continuously evolving
Decision making need to be decentralised to the village or household level
Communities need to live near their fields or properties and co-operation among community members is very important
The system has to be flexible
It is not designed to replace existing methods but designed to compliment them, thus it is a combination of mitigation measures whose **synergy-**is aiming to reduce, not eliminating the problem; and that
The system is not a panacea!!
Land-use planning to reduce habitat fragmentation and HEC.
The introduction of more sustainable agro-pastoral systems to reduce human-elephant interface.
Identification of corridors of movement between elephant ranges Development of a HEC strategy that enables communities to manage elephant problemsInvestigation into income generation through elephant tourism.

Capacity building of local wildlife managers to deal with HECEducation / awareness building of the value of elephant conservation. National policy for problem elephants

Communities to receive more substantial benefits. This will mitigate HEC by increasing local thresholds of tolerance to conflict. Awareness of elephant conservation issues must be improved at all levels.

Devolution of authority for HEC management to communities living with elephants

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