



**WILDLIFE CROP RAIDING AND ITS IMPLICATIONS ON LIVELIHOODS OF
ARABLE FARMERS IN KHUMAGA, BOTETI SUB-DISTRICT, BOTSWANA**

By

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1 **DECLARATION**

2 I declare that the dissertation titled ‘*WILDLIFE CROP RAIDING AND ITS IMPLICATIONS*
3 *ON LIVELIHOODS OF ARABLE FARMERS IN KHUMAGA, BOTETI SUB-DISTRICT,*
4 *BOTSWANA*’ hereby submitted at University of Botswana for Masters of Philosophy, has not
5 been submitted by me for a degree to any other University, that the work in this dissertation is
6 my work and all materials used in this dissertation have been fully acknowledged.

7 Signed

8 Student: _____

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Date:

10

11 **APPROVAL**

12 This work has been conducted under the supervision of Professor J.E Mbaiwa and Doctor O. T.
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17 Signed..... Date.....

18 Dr. O. T. Thakadu

19 Supervisor

20

21 **DEDICATION**

22 This work is dedicated to my dearly beloved mother, Mrs. Ponatshego Gontse, and my late dad
23 Mr. Dikhutsafalo Gontse (*rest in peace Papa, old soldiers never die, they just vanish and*
24 *relocate elsewhere for a better rest after a long fatigued day*).

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198 **ABBREVIATIONS AND ACRONYMS**

199 **CBNRM** Community Based Natural Resource Management

200 **CSO** Central Statistics Office

201 **DEA** Department of Environmental Affairs

202 **DWNP** Department of Wildlife and National Parks

203 **HWC** Human Wildlife Conflict

204 **ISPAAD** Integrated Support for Arable Agriculture Development

205 **MPNP** Makgadikgadi/Nxai Pans National Park

206 **PA** Protected areas

207 **PAC** Problem Animal Control

208 **VDC** Village Development Committee

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DEFINITION OF TERMS

Agro ecosystem

Agro ecosystem refers to a site or integrated region of agricultural production (Gliessman, 2007). In this study, agro ecosystem is a site at Khumaga that is used by farmers for crop production. These sites consist of ploughing fields of different arable farmers.

Arable farming

Arable farming refers to cultivation of mainly field crops for sale or for consumption by farmers (Schans & Bleeker, 2006). In this study, arable farming refers to the cultivation of crops by farmers, either for sale or for consumption. It includes the process of preparing land for cultivation, sowing of seeds, weeding, guarding crops (*against pest, domestic animals and wildlife*) and harvesting crops.

Coexistence

Coexistence is the living together of two species (or organisms) in the same habitat such that neither tends to be eliminated by the other (Woodroffe, Thirgood, & Rabinowitz, 2005). In this study, coexistence refers to peacefully living together between human and wildlife.

Compensation

Compensation refers to payment of money for damages to property caused by wildlife (Wagner, Schmidt, & Conover, 1997). This research defines compensation as the process or the amount of money received by arable farmers from the Department of Wildlife and National Park for crop loss due to wildlife.

Crop raiding

Crop raiding can be simply defined as wild animals moving from their natural habitat into agricultural land to feed on the crops that humans grow for their own consumption and trade (Sillero-Zubiri & Switzer, 2001). In this study, crop raiding refers to a situation whereby wildlife move into farmer's ploughing fields to feed and damage crops that farmers grow for their own consumption or for sale.

Human wildlife conflict

Human-wildlife conflict occurs when the needs and behavior of wildlife impact negatively on the goals of humans or when the goals of humans negatively impact the needs of wildlife (Madden, 2004). In this study HWC occurs when wildlife damage crops of farmers, injure or kill domestic animals, threaten or kill people, or when a farmer retaliates against wildlife and its habitat.

Livelihood

A livelihood in this study is defined as the activities, the assets, and the access that jointly determine the living gained by an individual or household (Frank, 1999).

Local communities

Local community is a group of people with diverse characteristics who are linked by social ties, share common perspectives, and engage in joint action in geographical locations or settings (MacQueen et al., 2001). In this study, local community is a group of people living together at Khumaga village that share common perspective and the same environment.

253 **Wildlife Conservation**

254 Wildlife conservation is an effort to maintain and use natural resources wisely in an attempt to
255 ensure that those resources will be available for future generations (Yarrow, 2009). This study
256 describes wildlife conservation as an activity in which farmers of Khumaga make conscious
257 efforts of protecting wild animal and their habitats for tourism purpose.

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259

STRUCTURE OF THE THESIS

This thesis has five chapters. Chapter One introduces the thesis. It provides the background of the study, the statement of the problem, the objectives of the study, the research questions, and significance of the study and the limitations of the study. Chapter 2 provides a description of the review of the literature. The literature review covers the local, regional and global perspectives in human wildlife conflict. The chapter also covers the theoretical framework that informs the study, which is the Social Exchange Theory.

Chapter 3 covers the research design and methodology. Different methods that have been used in the study are discussed in this chapter. Their choice of methods is also justified in this chapter. Chapter 4 presents findings of the study and discusses the results. The last chapter, Chapter 5 covers the conclusion, summary and the recommendations of the study.

ABSTRACT

Human wildlife conflict in agro-ecosystems is a challenge to wildlife management and conservation and a threat to livelihoods of local communities throughout the world. Thus it calls for urgent and efficient mitigation strategies for biodiversity conservation and rural development to be achieved. This study examines the extent and nature of wildlife crop raiding and its implications on the livelihoods of arable farmers in Khumaga in north-central Botswana. The study was informed by the Social Exchange Theory which postulates that individuals support those alternatives from which they expect the most benefits than the costs. Using primary and secondary data sources, findings indicate that arable farming is the main livelihood option in the study area and it mostly affected by wildlife crop raiding than by other factors. The sustainability of this livelihood option is gradually being threatened by increased persistence of crop-raiding by elephants. Elephant destroy many of the farmers' agricultural produce, with some farmers losing entire field and annual harvest. The losses are frequent and widespread over the study area, creating food insecurity and hatred among arable farmers towards elephants. Results of this study was in line with the SET since the farmers hate elephants and do not want elephants in their area because they do not benefit from them hence they suggest translocation. In light of the above, this study recommends the introduction of collaborative management between farmers and wildlife managers, strengthening of mitigation measures such as undertaking patrols by wildlife officers and re-activation of the electric fence, and lastly undertaking of long term research and monitoring. Both conservationists and farmers should work together in developing strategies that will mitigate the losses, sustain elephant conservation and at the same time offer viable economic alternatives to farmers.

298 **Keywords:** human wildlife conflict, crop raiding, wildlife, livelihoods, conservation, Botswana

299

CHAPTER ONE

OVERVIEW OF THE STUDY

1.1 Introduction

Throughout the world, human-wildlife conflict (HWC) is of great concern as it impacts negatively on conservation efforts and livelihoods of the people, particularly rural communities that live in close proximity to wildlife protected areas (Barua, Bhagwat, & Jadhav, 2013; Gadd, 2005; Gupta, 2013; Hemson, MacLennan, Mills, Johnson, & Macdonald, 2009; Hill, 2004; Mc Guinness & Taylor, 2014; Metcalfe & Kepe, 2008; Ogra, 2009). Negative consequences of HWC include, inter alia, the destruction of food and cash crops, predation on livestock and subsequently loss of income, livelihoods and sense of wellbeing (Hill, 2004; Hoare, 2000; Karanth, Naughton-Treves, DeFries, & Gopalaswamy, 2013a; Linkie, Dinata, Nofrianto, & Leader-Williams, 2007; Mc Guinness & Taylor, 2014).

The conflict can have greater impact on people such as loss of human lives as in human-elephant conflict (Gupta, 2013; Jadhav & Barua, 2012; Osborn & Parker, 2003; Treves, 2007). This creates negative attitudes and perceptions on rural communities towards wildlife conservation, thus compromising conservation efforts as people start to regard wildlife as a cost than a benefit (Sifuna, 2010).

According to Ogra (2009), protected areas were set aside to protect and sustain wildlife populations, but more than a half of wildlife populations are found in lands outside protected areas in agro- pastoral lands. This results in wildlife raiding agricultural lands and destroying crops and farm implements. Ogra (2009) claims that arable farmers encounter a variety of both

direct and indirect costs. These costs include among others restrictions on movements of arable farmers, loss of sleep by farmers, reduced school attendance and increased exposure to diseases like malaria due to guarding field day and night from wild animals (Jadhav & Barua, 2012; Madden, 2004). The combination of both direct and indirect costs make HWC a complex socio-economic and ecological issue that needs concerted effort and mutual understanding between farmers and governments. Efforts have been made to increase human-wildlife coexistence and also to improve realization among communities of potential benefits from wildlife conservation (Conover, 2010; Messmer, 2009).

In Botswana, tourism is one of the main generators of revenue for the country and is sustained by the unique wildlife and wilderness that the country is endowed with. Botswana's tourism is the second largest economic sector in the country contributing BWP14,172.1M in 2013 (8.4% of GDP) to Botswana Gross Domestic Product (GDP) (WTTC, 2014), after mining, which accounted for 22.4 percent of Botswana's GDP (CSO, 2015) and agriculture which accounts for about three percent of Botswana's GDP (Esterhuizen, 2015). Even though Botswana's tourism is a key generator of revenue, local communities bear the brunt of conserving wildlife resources since a majority of them live in and around areas with wildlife, and are at the first to deal with the negative effects of wildlife (Gupta, 2013).

Many of wildlife species that attract tourists to Botswana such as cheetah, hyena, lions, leopards, jackals, python and wild dogs are the ones that frequently kill farmers livestock (Darkoh & Mbaiwa, 2005; DEA, 2010; Graham, 2004; Mbaiwa & Rantsudu, 2003). Between 2000 and 2004 in the Okavango Delta of Botswana, lions were reported to have killed 3,704 livestock, 1151 by leopard and 100 were killed by hyenas (Darkoh & Mbaiwa, 2005). Graham (2004) at Makgadikgadi recorded 276 kill incidences in which, surplus/multiple killing events

were most frequent for livestock species with 1.3 times as many animals killed per kill incident. Darkoh and Mbaiwa (2005) indicated that there were problems experienced by subsistence livestock farmers in the process of obtaining their compensation from the Department of Wildlife and National Parks (DWNP) and their satisfaction levels about the compensation were found to be low. In a related study Mbaiwa and Rantsudu (2003) found livestock predation at Gudigwa Village to be a problem, compensation by DWNP was also noted by 73.7% of the farmers to be poor. Persistent HWC has potential to increase intolerance of wildlife by the farmers in human wildlife conflict hotspots of Botswana (Graham, 2004; Gupta, 2013). Songhurst and Chase (2008) contend that in Botswana, large wild animals are perceived to contribute significantly to the conflict as they raid arable farms with high rates.

According to Darkoh and Mbaiwa (2002), during the post-colonial period, livestock rearing was the backbone of the national economy in Botswana. Now due to Foot and Mouth Disease (FMD), government incentives to arable farming, and increased predation on livestock by carnivores, some local people in northern Botswana have resorted to arable farming as rearing cattle is not economically viable, but still farmers are not benefiting from arable farming as wildlife continues to raid their crops at an alarming rate.

1.2 Research Problem

Human wildlife conflict in agro-ecosystems is a challenge to wildlife management and conservation throughout the world (Barua et al., 2013; Gupta, 2013; Hill & Wallace, 2012; McGuinness & Taylor, 2014; Ogra, 2009). The issue of human wildlife conflict in Botswana, particularly in Ngamiland, Okavango, Chobe enclave and Boteti area is of critical concern to conservation and development (DEA, 2010; Gupta, 2013; Mosojane, 2004; Sifuna, 2010). One

form of the conflict in these areas is that of crop raiding (DEA, 2010; Gupta, 2013; Mosojane, 2004; Sifuna, 2010).

There have been several complaints from the people of Khumaga on issues of problem animals attacking people and destroying crops and property (DEA, 2010). The people of Khumaga are small scale farmers who entirely depend on subsistence agriculture for their livelihoods but the crops they grow are destroyed by wildlife leading to food insecurity (ISPAAD, 2013). According to DEA (2010) economic losses of the local people due to crop damage is one of the major issues that trigger HWC and cause problems in achieving long term conservation in the area. This is likely to cause the affected community to develop negative attitude towards wildlife conservation as they are vulnerable to the effects of wildlife crop raiding (Nyirenda, Myburgh, & Reilly, 2013).

To respond to these problems, the Department of Wildlife and National Parks (DWNP) was set up with one of its key mandate being to achieve biodiversity conservation and to improve the relationships between local people and wildlife (DEA, 2010). DWNP has a division of Problem Animal Control Unit (PAC) whose responsibility is to; 1) assist in the protection of human life and property against damage by wildlife; 2) give advice on mitigation strategies, and 3) ensure that compensation is awarded to those who suffered such loss from species that attract compensation. Despite DWNP's efforts to guard against damage by wildlife, Khumaga residents still experience escalating crop raiding incidences by wildlife (DEA, 2010). It is against this background that the current research study was designed to examine the extent and nature of wildlife crop raiding and its implications on the livelihoods of arable farmers at Khumaga village in Boteti, north-central District, Botswana

A few studies have however been conducted to fully understand the social patterns and underlying processes of human and wildlife interactions in agro-ecosystems in northern Botswana (e.g. Gupta, 2013; Mosojane, 2004; Sifuna, 2010; Songhurst & Chase, 2012) . Though these studies have increased understanding on the factors associated with human elephant conflict in Chobe and Okavango Delta areas, their validity may not be applicable to Khumaga areas which have low populations of elephants, and were separated from the village by the physical barriers such as electric fences and deep and flowing Boteti River. The human wildlife conflict in agricultural landscape of Khumaga within Boteti sub-district has not been adequately studied. However, Graham (2004) studied human lion conflict and did not pay attention to crop raiding in the area, and Monametsi (2008) studied effects of electric fence in reducing HWC, but that was before the Boteti River flowed and again at that time the fence was still intact.

There was therefore a need for up-to-date research and more detailed studies to fully understand the conflict patterns triggered by crop raiding and its implications to communities' livelihoods, perception of local communities towards wildlife conservation, and nature of wildlife crop raiding in Khumaga areas.

1.3 General Research Question

What is the extent and nature of wildlife crop raiding and its implications on the livelihoods of arable farmers in Khumaga? Specific research questions are:

1. What are the effects of wildlife crop raiding on the livelihoods of Khumaga arable farmers?
2. What are the trends in incidents and nature of wildlife crop raiding in Khumaga area

410 over the last 10 years?

411 3. What are the perceptions of Khumaga arable farmers towards wildlife conservation?

412 **1.4 General objective of the study**

413 The general objective of this study was to examine the extent and nature of wildlife crop raiding
414 and its implications on the livelihoods of arable farmers at Khumaga village in Boteti, North-
415 Central District, Botswana. Specific objectives of this study are;

416 1. To assess the effects of wildlife crop raiding on the livelihoods of Khumaga arable
417 farmers.

418 2. To examine the trends in incidents and nature of wildlife crop raiding in Khumaga area
419 over the last 10 years.

420 3. To assess the perceptions of the Khumaga arable farmers towards wildlife
421 conservation.

422 **1.5 Significance of the study**

423 This study is considered significant because of the following reasons:

424 1. This study will provide data for planning purposes.

425 2. The study may also promote peaceful coexistence of wildlife and local communities,
426 and further provide information that could be used in the formation of viable mitigation
427 strategies.

428 3. Findings from this study add to an understanding of interactions between local people
429 and wildlife and further help to improve livelihoods and conservation efforts.

430 4. The study may provide a baseline data for future studies since Khumaga has been grossly
431 understudied, especially on the socio-economic effects of wildlife on the livelihoods of the local
432 communities.

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CHAPTER THREE

LITERATURE REVIEW

2.1 Human wildlife conflict at global scale

Literature on human wildlife conflict points out that living alongside wildlife can impose a variety of significant costs upon local people (Agarwala, Kumar, Treves, & Naughton-Treves, 2010; Gubbi, 2012; Houston, Bruskotter, & Fan, 2010; Jadhav & Barua, 2012; Karanth et al., 2013a; Ogra, 2009; Rakotoarison & Point, 2010; Thapa, 2010; Walker, 2012). According to Dickman (2010) living alongside wildlife species can sometimes impose cost where people forgo economic or lifestyle choices due to impositions placed upon them by the presence of wild animals or conservation areas.

Many wildlife species are reported to frequently raid fields: e.g., deer and raccoon in North America; wild boar in Europe; primates and elephant in Asia; kangaroo in Australia as well as rodent and bird species throughout the world (Lamarque et al., 2009). Choden and Namgay (1996) reported crop raiding to be a major problem that triggers HWC at Bhutan in the subcontinent of India. In North America gray wolves (*Canis lupus*) are arguably the most charismatic and controversial wildlife species, as some people support their conservation and restoration in farmer habitats, while some people advocate for their extermination because they perceive costs from them (Houston et al., 2010).

Sjöberg (2000) indicates that greater risk is associated with more negative attitudes toward an object. Sjöberg (2000)'s view is shared by Dar, Minhas, Zaman, and Linkie (2009), who argued that conflict can reduce local tolerance towards wildlife conservation and also conservation of

other non-conflict species. This remains as a hiatus in Botswana which needs to be closed. HWC can have negative impacts in both wildlife and people. In India for example, between 1980 and 2003 more than 1,150 humans and 370 elephants died in human elephant conflicts (Choudhury, 2004). Still in India, more than one person is killed every day by elephants, in turn more than 100 elephants are fatally injured every year through retributive action by people (Jadhav & Barua, 2012).

Jadhav and Barua (2012) claim that some of the factors that lead to elephant crop raiding in India are crops that are planted such as cereals, millets and rice paddy as they are analogues of what elephants eat in their natural habitat. This is however not known in Boteti district, Botswana. Crop raiding by wildlife generally takes place at night, so to respond to this, farmers resort to nocturnal guarding, thereby exposing themselves to diseases, loss of sleep, poor school attendance, and vulnerability to attacks from wildlife. Some of the farmers end up being addicted to drugs and alcohol as this helps them to stay awake at night (Hoare, 2000; Jadhav & Barua, 2012). Therefore it is important to study human wildlife conflict and its implication to livelihoods and recommend accordingly as the success of wildlife conservation is based on the cooperation of the people (Gubbi, 2012).

2.2 Human wildlife conflict at regional

Human–wildlife conflicts are common across Africa (Adams & Hutton, 2007; Barua et al., 2013; Dickman, 2010; Mfunda & Røskft, 2011; Okello, 2005; Osborn & Parker, 2002; Treves, 2007). The larger large mammalian herbivores and carnivores are traditionally reported as the animals responsible for the majority of human-wildlife conflicts (Lamarque et al., 2009).

477 In agro-ecosystem of Africa where agriculture plays an important role in sustaining rural
478 livelihoods, crop-raiding by wildlife is a common concern (Hockings & Humle, 2009; Mfunda
479 & Røskaft, 2011). In their studies in Tanzania, Holmern, Nyahongo, and Røskaft (2007) and
480 Mfunda and Røskaft (2011) indicate that many rural communities living near protected areas
481 depend on crop production for food security and livelihoods. As a result, crop raiding by wildlife
482 has emerged as a major livelihood concern to people around Serengeti National Park. Crop-
483 raiding is reported to threaten local agricultural practices and rural food supply and undermines
484 conservation efforts (Hartter, 2009; Osborn & Parker, 2002).

485 In Kenya, human–wildlife conflicts are a challenge to conservation, especially in the Tsavo–
486 Amboseli area where wildlife range outside parks and confront local communities, of these
487 animals the elephant was mentioned most frequently e.g. damaging crops, killing and injuring
488 humans and livestock (Okello, 2005). Primate crop raiding is reported to be a major cause of
489 human-wildlife conflict around the forests of western Uganda (Webber, Hill, & Reynolds,
490 2007b). Elephants and baboons were the main problem wildlife species at North Cameroon
491 (Weladji & Tchamba, 2003).

492 Around Nasser Lake, Egypt the fishermen camps and Bedouin communities are reported to be
493 at conflict with crocodiles, as crocodile continue killing community members that also use the
494 lake (Lamarque et al., 2009; Salem, 2013). Dunham, Ghiurghi, Cumbi, and Urbano (2010)
495 reported crocodiles to be responsible for the death of people in Mozambique, more specially in
496 districts bordering Lake Cabora Bassa and the Zambezi River more than other wildlife species.
497 On average 118 people per year were killed by wildlife in Mozambique and two-thirds of these
498 people were killed by crocodiles (Dunham et al., 2010).

In this regard local people rarely tolerate the loss without retaliations (Kansky, Kidd, & Knight, 2014; Mfunda & Røskaft, 2011). This is however not known in Botswana, specifically in Khumaga village. To respond to wildlife crop raiding, there is a compensation scheme to reduce the economic impact of livestock lost to predators or crops raided by wildlife (Barua et al., 2013; Bulte & Rondeau, 2007; Hoare, 2000). Compensation is a widely recommended and often used technique to reduce the economic impact of losses to wildlife and also to protect wildlife from being persecuted by farmers.

Barua et al. (2013) contend that when local communities seek compensation for the loss or damage to crops and/ or property, there is bureaucratic inadequacies which are one of the hidden costs of wildlife crop raiding influencing HWC. This has not been adequately investigated in Botswana. Timely payment can help victims to get over their anger and may reduce their incentives to retaliate against the animals that caused the damage (Nyhus, Osofsky, Ferraro, Madden, & Fischer, 2005). Barua et al. (2013) reported that there are some hidden impacts of human–wildlife conflict in low income countries, including disruption of livelihoods and food insecurity. Considerable opportunity costs are incurred through crop and livestock guarding. Crop raiding by wildlife can have serious consequences for food security, sometimes farmers fail to feed their children due to wildlife crop raiding (Mackenzie & Ahabyona, 2012)

Kansky et al. (2014) for example, claim that sometimes the loss caused by wildlife may seem insignificant at a national level but it is a considerable cost for the affected individuals and families, many of whom are amongst the least privileged people in the world. Some scholars (Irigia, 1990; Thouless & Tchamba, 1992) estimated crop damage by elephants in monetary terms at Northern Cameroon and in western Laikipia, Kenya. Studies by (Adams & Hutton, 2007; Treves, 2007) found out that the resultant losses often arouse negative passions against

wildlife, such that people are unlikely to support conservation, which is likely to undermine conservation. These losses sometimes lead to retaliatory attacks on animals, some of which are protected by international instruments.

Dickman (2010) argues that social factors are ignored in human wildlife conflict studies but they can be more important in resolving conflict as they can strongly influence perceptions of human–wildlife conflict than wildlife damage itself. This remains as a gap in Botswana which needs to be closed. Conservation biologists often make important assumptions about human attitudes and behavior when deciding how to tackle conflict, but often the mismatch between assumed and actual behavior is startling (Dickman, 2010). This was verified by Marker (2002) in Namibia where a number of cheetahs was reduced by conservationists to mitigate the conflict but later researchers found that farmers were still killing cheetahs from their lands even though they were no longer troublesome like before, just that local community have negative perception towards them.

Scholars suggest that reducing wildlife damage alone will fail to produce long term conflict resolution (Dickman, 2010; Mulder, 2006). It is therefore advisable to carry out a survey to determine how communities want human wildlife conflict situation to be addressed (Weladji & Tchamba, 2003).

2.3 Human wildlife conflict at local level

Evidence from literature (Gupta, 2013; Hemson et al., 2009; Mosojane, 2004; Sifuna, 2010) show that the presence of wildlife in Botswana brings a huge cost on peoples' lives. According to Sifuna (2010), wildlife is a valuable natural resource with several beneficial values to the people of Botswana. Though this is the case, wildlife usually cause damage to society in terms

of attacks on people and livestock, damage to crops and other property such as infrastructure and disruption of peaceful existence in local communities living in close proximity to wildlife areas. Gupta (2013) in his study based at Chobe found out that elephants roam the village and raid arable fields, leaving a wake of destruction as they move freely, protected under conservation law, through an extensive mosaic of designated park land, forest reserves and wildlife management areas that enclosed human settlements.

For some farmers, crop raiding by problem animals such as elephants is one of the reasons that they have stopped farming their larger arable landholdings, intended for both commercial and subsistence purposes (Gupta, 2013). This is however against Sifuna (2010)'s argument on wildlife benefits, Sifuna (2010) stated that in developing countries, especially in the rural African context such as Kenya and Botswana, wildlife conservation should be understood in terms of alleviating poverty and helping the people to meet their basic needs not to bring costs on their livelihoods .

There is a need for a broad understanding of both wildlife ecology and human livelihood decision-making in order to resolve the conflict between agricultural livelihoods and wildlife conservation (Gupta, 2013). Even though there are some benefits derived from wildlife conservation through tourism, literature reviewed revealed that although the benefits of utilizing wildlife may be directed to communities through community-based natural resource management (CBNRM) programs, wildlife threats to human life and property damage impair these benefits and engender negative attitudes towards wildlife(Gupta, 2013; Hemson et al., 2009; Sifuna, 2010). Study carried by Hemson et al. (2009) showed that only 17% of households had associations with tourism, but 65% had lost livestock to lions in Makgadikgadi.

However, Sifuna (2010)'s comparative study on attitudes towards wildlife indicated that public attitudes in Kenya are generally negative, and in the Okavango Delta of Botswana they are remarkably positive towards wildlife conservation even though they incur the costs on livelihoods. There are however relatively no studies done in Boteti district on the social factors especially on attitudes towards HWC and wildlife conservation. The two areas represent distinct socio-economic patterns and ecological environments, which may demonstrate differences in tolerance and attitudes.

2.6 Summary of the Literature Review

In summary, the following issues emerged from the review of literature:

a) Literature from other African countries indicates that wildlife management in and around protected areas can be accomplished together with the participation of local communities. Such approach has not been adequately explored in Boteti area, which also has abundant wildlife and large protected areas. The sustainable use of the protected areas and other wildlife refuges requires the participation of all the stakeholders in policy formulation, implementation and monitoring (Mbaiwa & Darkoh, 2005a). Primary stakeholders include the traditional groups which live with the resources, and can easily be motivated to monitor and conserve their own resources.

b) A few studies have been conducted in Botswana to fully understand the social patterns and underlying processes of human and wildlife interactions in agro-ecosystems in northern Botswana (e.g. Graham, 2004; Gupta, 2013; Mosojane, 2004; Sifuna, 2010; Songhurst & Chase, 2012). There is still a paucity of data on socio-economic effects and dynamics of the

human-wildlife conflict in Boteti areas in north-central Botswana. Furthermore, losses to farmers have not been translated into monetary terms.

c) There is little literature relating to crop raiding and livelihoods in Khumaga. Studies done by Graham (2004) focused on human lion conflict and did not pay attention to crop raiding in the area and Monametsi (2008) studied effects of electric fence in reducing HWC, but that was before other interventions occurred such as the flowing of Boteti river that rendered electric fence ineffective. This has created a missing link in human wildlife interaction in agricultural landscape of Khumaga.

2.4 Social Exchange Theory

Social Exchange Theory (SET) emerged in the early work of Malinowski (1922) and Mauss (1925). Even though Social Exchange Theory has emerged that early, it has been one of the major theories used in the field of social psychology since the early writings of Homans (1958) (Collett, 2010). Homans first proposed an exchange perspective in 1958 and later expanded the concept in 1961 (Homans, 1961). Homans (1961) defined social exchange as the exchange of activity, tangible or intangible, and more or less rewarding or costly, between at least two persons. Cost was viewed primarily in terms of alternative activities or opportunities foregone by the actors involved, according to Homans behavior that is rewarded it generally continues (Cook, Cheshire, Rice, & Nakagawa, 2013).

According to Cook et al. (2013) people will become angry and aggressive when they do not receive what they anticipated. Homans (1958) argues that every relationship between and among people comes with costs and rewards. In SET people essentially take the benefits and subtract the costs in order to determine how much a relationship is worth (Blau, 1964; Homans,

1958). Positive relationships are those in which the benefits outweigh the costs, while negative relationships occur when the costs are greater than the benefits (Homans, 1958).

Costs involve things that are seen as negatives to the individual such as having to put money, time and effort into a relationship. The benefits are things that the individual gets out of the relationship such as fun, friendship, companionship and social support (Cook et al., 2013). Rewards and costs come in both material and nonmaterial forms. Some examples of non-material costs are time and pain (Blau, 1964).

The theory was further used in 1959 (Rusbult & Buunk, 1993). Thibaut and Kelley (1959) focused on dyadic relations and thought about the role of rewards and costs in exchange. In their book Thibaut and Kelley (1959) argued that individuals initiate relationships that are valuable to them and maintain those relationships as long as they continue to benefit from the interactions. Thibaut & Kelley (1959) continue to say that when an individual considers whether he or she is satisfied with a particular relationship, the individual weighs the costs and benefits of the relationship and compares that balance with a standard that might be expected given his or her position in the relationship and what they could likely get in an alternative relation. Blau (1964) writing at about the same time, framed his micro-exchange theory in terms of rewards and costs as well, but took a decidedly more economic and utilitarian view of behavior rather than building upon reinforcement principles derived from experimental behavioral analysis. According to Blau (1964) social exchange involves the principle that one person does another a favor, and while there is a general expectation of some return in future, its exact nature is definitely not stipulated in advance.

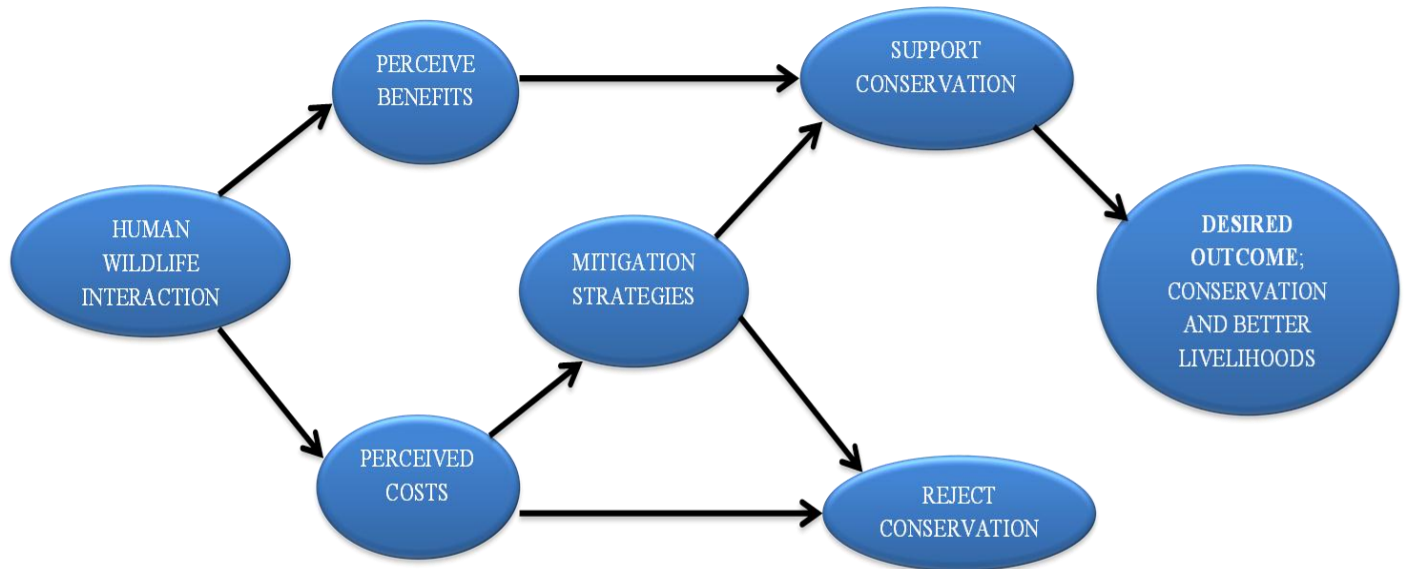
Today, SET exists in many forms, but all of them are driven by the same central concept of actors exchanging resources via a social exchange. Zafirovski (2005) has identified the some weaknesses of the SET. One of the weaknesses of the SET is that the theory neglects culture context and disparities of cultures. The social exchange theory is based off a reward concept, but all cultures are different and in some cultures they may not seek a reward for a relationship. Furthermore the theory involves the relationship between economic and social exchange, the theory is based on the reason for relationships are for individual gain which is more of an economic approach than social approach, and therefore SET should be reduced to economic exchange because the theory is based on costs and rewards (Zafirovski, 2005).

Even though Homans' theory was criticized by other authors for some reasons, today Social Exchange Theory is used by different authors in different fields, e.g Andereck, Valentine, Knopf, and Vogt (2005) in residents' perceptions of community tourism; Brines (1994) in Sociology, Economic dependency, gender, and the division of labor at home; Choi and Murray (2010) resident attitudes toward sustainable community tourism; Hall (2003) in Borrowed theory: applying exchange theories in information science research; Kern and Willcocks (2000) used it in information technology; Pfouts (1978) used it in Violent families: Coping responses of abused wives; Son, Narasimhan, and Riggins (2003) used it in effects of relational factors and channel climate on EDI usage in the customer-supplier relationship. (Andereck et al., 2005; Choi & Murray, 2010; Gursoy, Jurowski, & Uysal, 2002) produced rich literature on residents' perceptions of community tourism impacts using SET.

From a tourism and wildlife conservation perspective, SET proposes that individual's attitude towards wildlife is influenced by their evaluations of the outcomes for themselves and their communities (Andereck et al., 2005). In this study at Khumaga village, the use of SET was

found to be appropriate as it will provide insight into whether farmers are willing to promote conservation of wildlife resources irrespective of crop damage or if they are not willing to support it. This theoretical framework will help us in finding out if people will coexist with wildlife species even though they sometimes bring challenges to their livelihoods.

The theory will further explain the benefits that farmers are having or willing to derive from living with wildlife and potential benefits that wild animals are getting from arable farmers of Khumaga. The advantage of using SET in this study is that it can accommodate explanation of both positive and negative perception towards wildlife conservation, and it can examine relationships at the individual or collective level. SET can help to understand the cost and rewards of relationships and also helps people to predict how to keep and sustain relationships. SET can help us to understand that if there is need for a development then it should benefit the local people to maintain the relationship.



671 **Figure 1. The conceptual framework and application of SET in relation to human wildlife**
 672 **interaction, perceptions, attitudes and efforts towards wildlife conservation (Adopted**
 673 **from Gursoy and Kendall 2006: 607).**

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter provides details of how the study was conducted in order to achieve the set objectives and outcome. Furthermore, the chapter details how data were collected, managed, and analyzed. It also provides justification for the choice of methods that were adopted in this study. The chapter also provides a research design and description of the study area.

1.2 Research Design

A descriptive cross-sectional design was used to examine the extent and nature of wildlife crop raiding and its implications on the livelihoods of arable farmers at Khumaga village in Boteti. Cross-sectional studies can be thought of as a "snapshot" of the frequency and characteristics of a condition in a population at a particular point in time (Ary, Jacobs, Sorensen, & Walker, 2013). Cross-sectional studies are carried out at one time or over a short period. As a result, the studies are usually conducted to estimate the prevalence of the outcome of interest for given population (Ary et al., 2013). A cross-sectional survey suits this study since it can be repeated to measure changes over time in the characteristics that were studied. The descriptive approach was helpful in revealing implications of wildlife crop raiding that might go unnoticed at Khumaga. The descriptive research design approach obtained information concerning the current status of wildlife crop raiding.

3.3 Description of Study Area

3.3.1 Boteti Sub- District

This study was carried out in Boteti Sub-District in North-Central of Botswana, using Khumaga village as a case study (**Figure 3.2**).

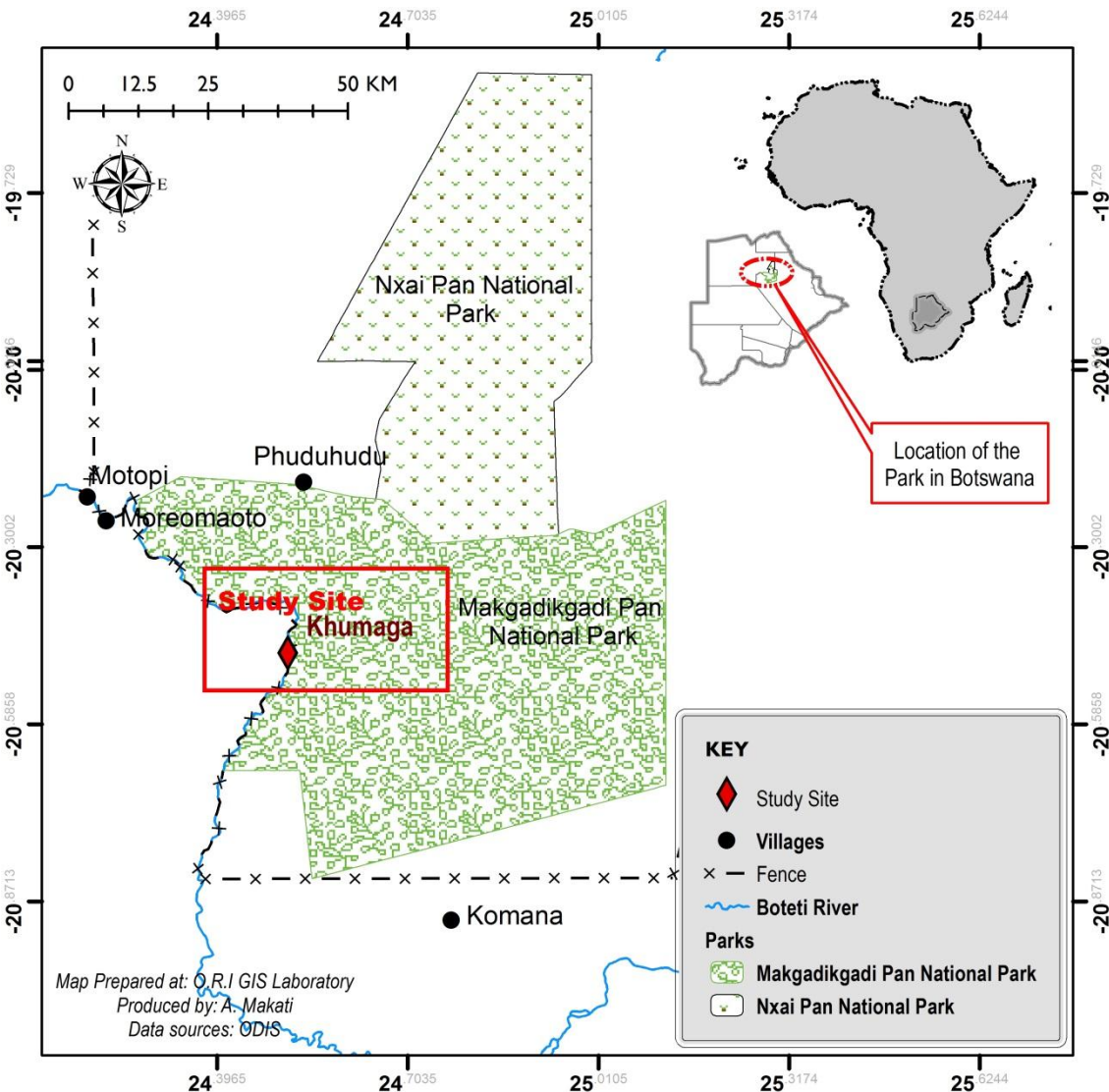


Figure 3. 2 Map of the Study area

The Boteti area is situated in north-central Botswana. The area has a population of approximately 57,376 people (CSO, 2011) and a mean annual rainfall of approximately 350mm

(Ringrose, Chanda, Nkambwe, & Sefe, 1996). The dominant form of land tenure is communal, although private leasehold livestock ranching is emerging, and state land in the form of game reserves also exists (Ringrose et al., 1996). Subsistence agro pastoralism is the dominant livelihood source, but the portfolio of cash sources includes formal and informal employment, and livestock sales (DEA, 2010; Ringrose et al., 1996).

The only permanent sources of water available to wildlife are pools in the Boteti river bed concentrated north of Khumaga (Graham, 2004). Family death and wildlife damages caused by HWC are the major shocks experienced by households in the area (DEA, 2010). Drought and illiteracy are of secondary importance, while wildlife damage to crops and predation on livestock are primary shocks experienced by the people of Khumaga (DEA, 2010).

3.3.2 Khumaga Village

Khumaga is a village in Boteti, in the Central District of Botswana. The population of this village is 758 (CSO, 2011). The village is on the western side of Makgadikgadi Pan National Park near the Boteti River. Khumaga village is a classical case study because human wildlife conflict is higher in this area, possibly due to its close proximity to Makgadikgadi Pan National Park (Graham, 2004). Makgadikgadi National Park's biological wealth consists of indigenous trees like baobabs and palm trees, large populations of migratory ungulates and predators, and non-migratory animals, birds, and reptiles (Valeix, Hemson, Loveridge, Mills, & Macdonald, 2012). The park was established in 1970s and is surrounded by a series of settlements and increasingly degraded subsistence farming land (DEA, 2010).

There has been a long standing human-wildlife conflict in areas around Makgadikgadi Pan National Park and an electric fence (game proof fence) was built in 2004 to reduce the conflict

(DEA, 2010). The fence is non-lethal electrified game proof fence of 2.4 m high. The electric power on the fence of 6000 to 9000 volts was provided by photovoltaic cells. The fence runs on the park side with a parallel standard cattle fence of 1.4 m high (DEA, 2010). According to DEA (2010) the fence is poorly maintained and wild animals are still moving into community areas.

Large animals found in the area include among others the African elephant (*Loxodonta africana*), gemsbok (*Oryx*), giraffe (*Girraffa camelopardalis*), kudu (*Tragelaphus strepsiceros*), hartebeest (*Alcelaphus buselaphus*), ostrich (*Struthio camelus*) and hippopotamus (*Hippopotamus*) (DWNP, 2014). The carnivores found in the area include lion (*Panthera leo*), leopard (*Panthera pardus*), brown hyena (*Hyaena brunnea*), wild dog (*Lycaon pictus*) and jackal (*Canis mesomelas*) (DWNP, 2014; Graham, 2004)

Khumaga residents share Boteti River with wildlife for water (DEA, 2010). When full with water, the river separates the park from the neighboring village. The river was once dry in the mid-1980s and reflooded in 2009. Several farm and non-farm economic activities are sources of livelihoods for people living in Khumaga. Farm based activities include livestock farming, dry land arable farming, molapo or flood recession cultivation, and small scale gardening. Farming is undertaken mostly for subsistence purpose. Khumaga is selected as a study site because it is one of the villages with a high number of human wildlife conflict incidents, that is, a hotspot area for HWC (DWNP 2014). Therefore, there is an urgent need to gain a greater understanding of HWC caused by wildlife crop raiding in this area and to provide recommendations to resolve the conflict influenced by high wildlife crop raiding.

3.4 Pre-testing the questionnaire

The questionnaire was pre-tested at Moreomaoto village, just about 30 kilometers away from Khumaga prior to data collection. Pre-testing the questionnaire enabled the identification of flaws that would compromise the integrity of the study as well as assessing the feasibility of the study and testing the adequacy of the research instrument (Ary et al., 2013; Collins, 2003). Five questionnaires were administered by the interviewer (Face-face interviews techniques with the respondents) at Moreomaoto. The pre-test revealed that some questions were vague and consequently those questions were refined. Some questions were re-written to reduce the time required to keep questionnaire completion below 40 minutes. After the pre-test, the questionnaire was finalized and administered to arable farmers at Khumaga.

3.5 Population and sampling

A sampling frame consisting of 120 active arable farmers from Khumaga village was sourced from the Department of Crop Production in Khumaga. The sampling unit was an active arable farm. Active farmers in this study refer to arable farmers who have been ploughing for the past five years continuously from the time of data collection. The list of active arable farmers was provided by the agricultural demonstrator of Khumaga. In order to collect data on crop raiding, 119 arable farmers were interviewed from a total of about 120 active arable farmers in Khumaga which was the total sample. The intention was to do a total census but one farmer refused the interview. Each active farmer represented a household. According to Walton-Roberts et al. (2014), census data are equally effective for small area assessments. In census studies, a higher sample size and a high degree of statistical confidence can be achieved. In Khumaga, arable farmers who practice rain fed agriculture are also the ones who also practice flood recession (molapo) farming in the area.

Key informants were also purposively sampled. These informants included: Department of Crop Production (DCP), Department of Wildlife and National Parks (DWNP), community leaders (including village chief and headmen). In total there were six key informants including one senior wildlife warden from DWNP, one agricultural demonstrator from DCP, a village chief and three headman of Khumaga village. Each key informant was interviewed separately. Key informants were able to provide more information and a deeper insight into what is going on around them as a result of their personal skills or position within a society (Marshall, 1996b). Key informants were selected because they have knowledge on what is going on in their community at Khumaga. These are people who can provide insight on HWC and give recommendations for solutions of HWC in the agro ecosystem of Khumaga. In-depth interviews with these key informants took advantage of their experience on arable farming at Khumaga and their long-term knowledge on human wildlife conflict caused by wildlife crop raiding and its implications on livelihoods and wildlife conservation. These are the people who can reconcile or approve information. General observations of damage caused by wildlife were also made during the visits of farmers

3.6 Data Collection

Since the study aimed at understanding a phenomenon that is not yet fully understood, both qualitative and quantitative data collection methods were used to give a holistic view on wildlife crop raiding and its implications on livelihoods of Khumaga people. According to Johnson and Turner (2003) qualitative and quantitative methods should be combined in order to compensate for their mutual and overlapping weaknesses. A qualitative method was used to gain an understanding of HWC in Khumaga through the use of face-face interviews and key informants interview. Qualitative methods were used to collect data from respondents, such as causes of

wildlife crop raiding, perception of local people towards wildlife conservation, feelings about particular wildlife species e.t.c. Quantitative methods quantify the problem by way of generating numerical data. Quantitative methods were used to collect data such as, age of farmers, numbers of hectares ploughed and destroyed, numbers of reported cases, incidents of crop raiding, etc.

In this study data were sourced from both primary and secondary sources. Primary sources provided original data that was collected specifically for topic under investigation and its advantage is that it is from the original source (Abowitz & Toole, 2009). Secondary sources provided data that was gathered and recorded by someone else prior to and for a purpose other than the current project. Secondary sources can sometimes provide data that an individual cannot collect on its own, that is either not directly available or will be too expensive to collect (Wagner, Kawulich, & Garner, 2012). Secondary sources included DWNP reports, journal articles on wildlife crop raiding, Makgadikgadi Framework Management Plan, theses and dissertations on HWC. The records of problem animals reported to the DWNP at Rakops from 2000 to 2014 were reviewed by the researcher.

A semi-structured questionnaire with open and closed-ended questions was used for data collection. The questionnaire took 30–40 minutes to complete. In the open-ended questions respondents were allowed to use their own words, these types of questions are typically used to collect qualitative data. For example, respondents were allowed to provide their own views regarding wildlife crop raiding and its implications on their livelihoods. Advantages of using open ended question is that there is great deal of flexibility from the respondent and more details can be provided (Wagner et al., 2012). Open ended questions are excellent in exploring topics in-depth (Newman, 1998; Wagner et al., 2012).

While close-ended questions contained pre-determined responses from which respondents chose the answer that best expressed their viewpoints, they have to choose among the designed alternatives. Close-ended questions will require a *yes/no* answer, other questions required respondents to rank their views on a scale with alternative answers such as: *strongly agree to strongly disagree; strongly satisfied to strongly dissatisfied*. Closed questions are typically used to obtain quantitative data. The results obtained from close questions are more consistent and thus easier to analyse statistically (Wagner et al., 2012).

The questionnaire had four sections. Section A consisted of nine questions on demographic data. This captured the demographic characteristics of the respondents. Section B consisted of eleven questions on the effects of wildlife crop raiding on livelihoods of Khumaga community. Indicators used to measure the effects of wildlife crop raiding on livelihoods include but are not limited to: livelihood activities of respondents, types of crops planted, hectares ploughed, hectares destroyed by wildlife, accumulated hectares, expected yield and actual yield per crop per year, loss per crop in monetary terms per year using Botswana Agriculture Marketing Board (BAMB) rates. Interview data from respondents and key informants were summarized to identify patterns on the effects of wildlife crop raiding on livelihoods in the study village.

Section C examined trends in incidents and nature of wildlife crop raiding in Khumaga for the past 10 years and it had 20 questions. Indicators that were used to achieve this objective include, but are not limited to the following; wildlife species that raid crops, number of reported cases from DWNP, wildlife species that inflict the greatest damage, ability of PAC officers to attend to reported cases, mitigation strategies used. Section D dealt with the perceptions of the Khumaga people towards wildlife conservation. Indicators that were used to measure this objective include but are not limited to; willingness to conserve wildlife, people's opinion and

views towards wildlife conservation, feelings about wildlife species. Likert type scale was used to assess perceptions of the respondents towards wildlife conservation. Likert scale was composed by series of statements which the respondents were supposed to agree or disagree. Likert scale is a method of ascribing quantitative value to qualitative data, to make it amenable to statistical analysis (Brooke, 1996). Likert scale is normally composed of five point's ratings options such as 'disagree', 'strongly disagree', 'neutral', 'agree' and 'strongly agree'. The subjects are directed to select the response category that best represents their reaction to each statement: strongly agree (SA), agree (A), undecided (U), disagree (D), or strongly disagree (SD)

Face-face interview techniques were used with respondents. According to (Huysamen, 1998; Wagner et al., 2012), a face to face interview is good to use because the researcher is able to clear up misunderstanding of particular questions during the interview process, the interviewee also tends to have higher response rate as people tend to be more willing to being interviewed than to filling in the survey at home during their personal time. Data from arable farmers in this study are supplemented by data from key informants' interviews. Key informants interviews were used to confirm if the information collected from farmers is true. General observations of damage caused by wildlife were also made during the visits of farmers.

3.7 Data Management and Analysis

Data collected in this study were coded and entered into a Statistical Package for Social Sciences (SPSS) database. Thereafter, data were cleaned in preparation for analysis. Borg and Gall (1989) observed that data analysis involves the re-arrangement and manipulation of raw datasets so that they yield the information they hold in as clear a manner as possible. Descriptive analyses were carried out; the information was then used to create a contingency table, which displays

the frequency of each of the variables. The mean, median and standard deviation for the data were calculated. To establish factors influencing certain responses and test whether a variable is dependent on another, a chi – square analysis was employed. Statistical tests were considered significant with p – values equals to or less than 0.05.

3.8 Validity and Reliability, Bias

3.8.1 Validity

To address the validity and reliability of the instrument that was used, the questionnaire was pre-tested at Moreomaoto. To achieve content and face validity, the questionnaire included a variety of questions on wildlife crop raiding and its implication on livelihood of the Khumaga people. The questionnaire was submitted to experts in qualitative research then supervisors approved it. The questionnaire was designed in a way that is actually assessing the intended construct.

3.8.2 Reliability

Reliability is the ability of an instrument to create reproducible results (Ary et al., 2013). A questionnaire is said to be reliable if it produces similar answers repeatedly. Reliability was achieved by pre-testing the questionnaire at Moreomaoto village to ensure that it produces similar answers. During data collection, the researcher made sure that the questionnaire and questions used were consistent among all the respondents.

3.8.3 Bias

Data collector bias was minimized by the researcher being the only one conducting interviews. To avoid moderator bias the researcher remained neutral and he did not give opinions on the answers. Sampling bias was minimized by the researcher by interviewing all active arable farmers at Khumaga. The questions were piloted, adjusted and simplified so that respondents were more likely to participate.

3.9 Ethical considerations

Ethical clearance was obtained from Office of Research Development (ORD). Permission to conduct the study was obtained from the Botswana Research Unit, Ministry of Environment, Wildlife and Tourism, Gaborone. The nature and purpose of study was fully explained to all concerned parties. Approval and permission to conduct the study was also obtained from the Chief of Khumaga Village. The study did not involve human items.

3.9.1. Confidentiality

The respondents were assured that the study maintains a high level of confidentiality through respondent anonymity. Respondents were notified that the study was mainly for academic purposes and that the information would be kept in a safe place to enable access to the researcher only.

3.9.2. Protection from discomfort and harm

This study did not have any risk related to the physical harm of respondents. The questionnaire was designed to be completed between 30-40 minutes to avoid fatigue, headache, and muscle tension. This was based on the fact that a listening span for a human being is between 40-60 minutes. Respondents were also informed that in case they feel some form of discomfort or not

902 comfortable responding to certain questions, they were free to either not answer or stop the
903 interview process.

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CHAPTER 4.

RESULTS AND DISCUSSION

4.1 Introduction

This chapter provides results and discussion for this study. Results presented in this chapter cover: demographic data, effects of wildlife crop raiding on the livelihoods of Khumaga community, trends in incidents and nature of wildlife crop raiding in Khumaga area over the last 10 years and perceptions of the Khumaga people towards wildlife conservation.

4.2 Socio demographic characteristics of respondents

4.2.1 Gender of Respondents

A total of 119 respondents (N=119) were interviewed in this study. The sample was predominantly female accounting for 68% of the total sample, with males accounting for only 32% of the total sample. To insure independence of the data collected in this study, as well as getting representative wider views as possible only an adult family head (man or woman) was interviewed from each household.

4.2.2 Age

Arable farming is one of the key livelihoods of the people in Botswana but generally undertaken by elderly people in society. Results in Table 4.1 show that 82% of arable farmers at Khumaga are over 40 years, illustrating that arable farming is mostly done by elderly people. Proportions of young age group (i.e., below 40 years) were very low (Table 4.1). The mean age of respondents was 55.5 (SD=14.5) years old, and the mode age group was 61 and above. The majority of arable farmers of Khumaga were therefore in their old age.

Table 4.1 Age distribution of Respondents

Age group	n	%
25-30	4	3.4
31-35	4	3.4
36-40	13	10.9
41-50	25	21.0
51-55	12	10.1
56-60	18	15.1
61 and above	43	36.1
Total	119	100.0

The low participation of the young generation in arable farming might be because they are employed or they are still pursuing their education while the elderly people are unemployed and they view agriculture as important to their life, thus they continue the legacy of their culture.

4.2.3 Educational level

Subsistence arable farming in Botswana is carried largely by the elderly who generally having no formal education. Results indicate that 43% (n=51) of farmers did not attend school at all; 34% (n=41) of respondents went to primary school, while 23% (n=27) went to secondary school. Older respondents were significantly less likely to have higher education ($\chi^2(12) = 111.7$, $p < 0.005$), this was also identified by Legendijk and Gusset (2008) in their study.

Results indicate that arable farmers of Khumaga have no formal education and they depend on arable farming for their livelihood. These results indicate that subsistence agriculture remains an important livelihood activity to arable farmers of Khumaga because they are not able to compete in the formal labor market. This was also shown by Warner (2008) that subsistence agriculture remains an important livelihood activity because as it absorbs those individuals who

are not able to compete in the formal labor market. According to DEA (2010), illiteracy is one of the challenges that are faced by farmers of Khumaga..

4.2.4 Marital status

The majority of arable farmers accounting 61% at Khumaga village were found to be married (Table 4.2). Proportions of those that were not married, divorced and widowed were low (Table 4.2).

Table 4.2 Marital status of arable farmers at Khumaga village

Status	n	%
Single	34	28.6
Married	72	60.5
Divorced	3	2.5
Widow	2	1.7
Widower	8	6.7
Total	119	100.0

These results indicate that subsistence arable farming in Botswana with particular interest to Khumaga village is mostly done by married people. The fact that subsistence arable farming is carried out by married couples indicates that this form of livelihood option is still being carried out as it was historically in Botswana. According to Tlou (1985), Batswana men would clear a crop field; use ox-drawn ploughs to cultivate the land, while women would do the weeding and harvesting of crops. This shows that arable farming is joint family activity in Botswana and this culture is still being practiced at Khumaga village. Similarly at Maragoli, Kenya, the husband helps in the preparation of land and ploughing; wives will have the responsibility to ensure that plants are properly planted, do the weeding and harvesting (Verma, 2001). The results concur with the finding of (Nnadi & Akwiwu, 2005; Shortall & Campling, 1999) that married people

are more disposed to farming. This again could be attributed to increased concern for household welfare and food security due to marital responsibilities.

4.2.5 Ethnicity

The majority of respondents were the Bayeyi and Banajwa (**Figure 4.1**). This was supported by the Chief (village administrator) of Khumaga who contended that the majority of Khumaga people used to be Banajwa, but other ethnic groups have since come to settle in the village.

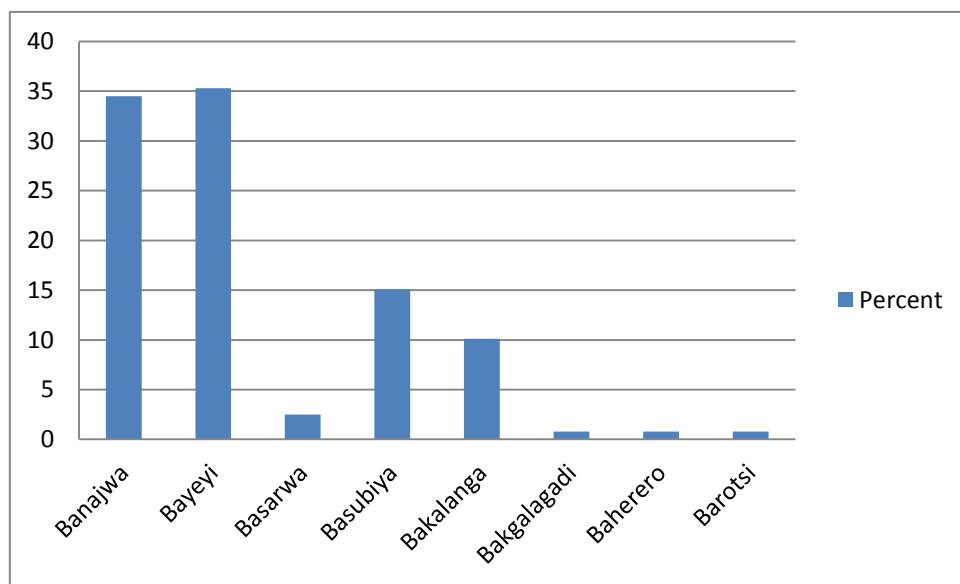


Figure 4.3 Ethnicity of Khumaga farmers

According to the Chief of Khumaga, Banajwa came to Khumaga in the year 1929 and Khumaga was established in 1930. The Chief alluded that Banajwa tribes were group of refugees from Zimbabwe and others were from Ngwato tribes. The Banajwa tribes were reported to have been using the Boteti River for subsistence and wild animals from crownland (*sehuba saga mmamosadinyana*) which is now call Makgadikgadi Pan National Park. The Banajwa also

practiced floodplain crop cultivation locally known as *molapo* farming within flood plains of the river, to utilize the moisture within the deposited alluvial soils.

4.2.6 Livelihoods Options at Khumaga Village

Respondents at Khumaga were asked to list their other livelihood activities that they currently practice apart from arable farming. Results indicate that informal employment with 50% and livestock farming with 41% was the main livelihood activities of the respondents (Table 4.3).

Table 4.3 Livelihood options

Livelihoods option	n	%
Informal employment	60	50.4
Livestock	49	41.2
Small business	7	5.9
Formal employment	3	2.5
Total	119	100

Informal employment included Ipelegeng programme with 48%. Ipelegeng is a government initiative whose main objective is to provide short term employment support and relief whilst at the same time carrying out essential development projects that have been identified and prioritized through the normal development planning process. It targets unskilled and semi-skilled labor for short term assistance due to other economic factors through the use of simple tools and machinery. Respondents informed the researcher that Ipelegeng hires them once in two months; therefore they cannot rely on it. Even though 41% of respondents also mentioned livestock as their other source of livelihoods at Khumaga, some of the large carnivores, like lions (*Panthera leo*) and brown hyenas (*Hyena brunnea*), are reported to prey upon livestock

causing economic loss (Graham, 2004) to farmers. These however, make the lives of the farmers difficult.

The results concur with those of Motsholapheko, Kgathi, and Vanderpost (2011) that households combine subsistence arable farming (molapo or dryland farming) and livestock with other livelihood activities such as informal employment like Ipelegeng. Jones (2002) also reported households at Chobe enclave to have a mixed economy based on three main activities: crop production, livestock production, and wage employment. According to Jones (2002), crop production is undertaken by 86% of the households at Chobe enclave. Mbaiwa and Rantsudu (2003) also stated that even Basarwa communities of Gudigwa, who were traditionally hunter-gatherers, are increasingly taking up arable and livestock production. This is because the Botswana Government has increased the level of support that it gives to small farmers (Gupta, 2013), unlike other African countries where subsidies to small-scale farmers have shrunk (Bryceson, 1999).

4.3 Challenges faced by arable farmers

Crop raiding and environmental conditions make farming difficult and often relatively unproductive at Khumaga village. Interviews with arable farmers at Khumaga indicate that farming is mostly affected by wildlife crop raiding than other factors. These was indicated by 97% of respondents who strongly agreed that wildlife crop raiding is a challenge to arable farming at Khumaga, 84% agreed that low rainfall is also a challenge to crop production at Khumaga and 60% of respondents disagreed that shortage of machinery is a challenge to farming at Khumaga (Table 4.4).

1014 The reason why machinery is not a problem at Khumaga is of Integrated Support Programme
 1015 for Arable Agriculture Development (ISPAAD). ISPAAD was introduced in 2008 by the
 1016 government of Botswana to address challenges facing arable farmers in Botswana. The
 1017 components of ISPAAD include among others, provision of draught power for arable farmers,
 1018 portable water and seeds. Subsistence farmers are assisted with 100% subsidy for hybrid seeds
 1019 to cover a maximum of five hectares and open pollinated seeds to cover a maximum of 16
 1020 hectares.

1021 **Table 4.4 Challenges faced by farmers at Khumaga in percentages**

	Strongly agree	Agree	Neutral	Disagree	Strongly Disagree
Wildlife crop raiding	115 (96.6%)	4 (3.4%)	0	0	0
Low rainfall	12 (10.1%)	100 (84.0%)	6 (5.0%)	0	1 (0.8%)
Shortage of machinery	7 (5.9%)	7 (5.9%)	34 (28.6%)	34 (28.6%)	37 (31.1%)

1022

1023 The agricultural demonstrator at Khumaga reported wildlife crop raiding, unreliable rainfall,
 1024 pests including birds to be a problem on crop production. He further said that elephants are the
 1025 most challenging factor as most of his farmers use thorn bush around their fields to protect
 1026 crops. This concurs with findings of Warner (2008) who observed that despite unpredictable
 1027 environmental conditions that are beyond farmers' control, farmers often point to elephant
 1028 depredation as one of the greatest challenges they face in crop production. Weladji and Tchamba

(2003) also found that crop damage affected 86% of households in six months in the Bénoué Wildlife Conservation Area of North Cameroon.

4.4 Causes of high wildlife crop raiding at Khumaga

Most respondents, 80.7% (n= 96), said high wildlife crop raiding at Khumaga is caused by elephants but government does not take action immediately, while 19.3% (n=23) of respondents said the reason why crop raiding incidents are high is because they are lot of elephants in their area.

An interview with DWNP officer at Rakops corroborates the results that there are many elephants in the study area and they are likely to cause much crop damage. The DWNP officer indicated that the number of elephants in the area has increased due to hunting ban. Botswana has a total of 207,545 elephants (DWNP, 2012). However, Makgadikgadi Pan National Park has about 740 elephants (Chase, 2011). The increased level of conflict is due to expanding national elephant population at Boteti, therefore human-elephant conflict is becoming an increasing issue of concern, with no signs of abating (DEA, 2010). A total of 70% of Botswana's elephants are reported to live in unprotected areas where they may encounter human settlements (DGEC, 2003 cited in Warner, 2008).

In Africa crop raiding has been reported to increase significant as human populations expand and encroach on elephant habitat (Hoare, 2000; Woodroffe et al., 2005) and as elephant populations expand from protected areas into communal land (Sitati, Walpole, & Williams, 2005). High incident of wildlife crop raiding sometimes is caused by the use of inexpensive, low-tech, non-fatal mitigation methods (Davies et al., 2011; Sitati & Walpole, 2006; Webber, Hill, & Reynolds, 2007a).

4.5 Crop raiding in the last five years and animals liable for the damage

In order to understand the effects of crop raiding over a period of time, farmers were asked to state whether they have experienced crop raiding in the last five (5) years. Results from farmers' interviews indicate that a total of about 85% of respondents experienced wildlife crop raiding in the last 5 years (Table 4.5). This implies that wildlife crop raiding at Khumaga was found to be very high.

Table 4.5 Number of years that farmers experienced wildlife crop raiding from 2010-2014

Number of years raided	N	%
1	2	1.7
2	2	1.7
3	4	3.4
4	10	8.4
5	101	84.9
Total	119	100

Respondents were asked to name the crop raiders in their area. African elephant (*Loxodonta Africana*), hippopotamus (*Hippopotamus amphibius*), black backed Jackal (*Canus mesomelas*), cape porcupine (*Hystrix fricaeaustralis*), vervet monkey (*Chlorocebus pygerythrus*), greater kudu (*Tragelaphus strepsiceros*) and common duiker (*Sylvicapra grimmia*) were reported to raid crops at Khumaga. Other studies (e.g. Darkoh & Mbaiwa, 2005) in the region found that elephant (*Loxodonta africana*), antelopes such as greater kudu (*Tragelaphus strepsiceros*) and hippo (*Hippopotamus amphibious*) were responsible for crop damage.

Respondents (100%, n = 119), ranked the elephant as the most frequent crop raider in their area and jackal were ranked second with 72% (n=86) (Table 4.6).

Table 4.6 Ranking of problem animals involved in Crop Raiding

	N	%
African elephant (<i>Loxodonta africana</i>)	119	100.0
Black backed Jackal (<i>Canus mesomelas</i>)	86	72.3
Cape porcupine(<i>Hystrix fricaeaustralis</i>)	62	52.1
Common duiker (<i>Sylvicapra grimmia</i>)	33	27.7
Vervet monkey (<i>Chlorocebus pygerythrus</i>)	16	13.4
Hippopotamus(<i>Hippopotamus amphibius</i>)	6	5.0
Greater kudu(<i>Tragelaphus strepsiceros</i>)	5	4.2
Total	327	274.8

Gillingham and Lee (2003) also reported that over 95% of people living next to the Selous Game Reserve in Tanzania perceived crop damage from wildlife to be a limiting factor of crop yields. It is not surprising that 85% of arable farmers experienced wildlife crop raiding due to elephants. Several studies examining problem elephants and their crop raiding behavior have drawn similar conclusions, that elephants consume cultivated crops because of spatial constraints and because they seek the nutrients provided by those crops (Codron et al., 2006; Osborn, 2004; Rode, Chiyo, Chapman, & McDowell, 2006). Elephants have a high population (10 697) in Boteti compared to other crop raiders in the study area (DWNP, 2012). As a result, it is not surprising that they cause the highest depredation compared to other animals. However, Naughton-Treves (1998) claims that the local communities can sometimes complain most about elephants on the basis that they can destroy an entire field in one night, not that they are the most frequent problem animal. There are other wild animals that can also cause a great deal of crop damage but because they are not as physically imposing as elephants, farmers can easily chase them and they do not cause as much damage in a single raiding incident. Farmers may perceive them as less destructive than

elephants (Naughton-Treves, 1998; Warner, 2008). Campbell-Smith, Simanjorang, Leader-Williams, and Linkie (2010) state that potential dangers posed by conflicts with large-bodied species may also negatively influence the local attitude than of animals with small bodies.

The crops that were commonly grown in Khumaga included millet, maize, sorghum, watermelon, beans, and sweet reeds. Some studies have shown that these crops are prone to crop raids (Chiyo et al., 2005; Gillingham & Lee, 2003). Compared to wild food, cultivated crops tend to attract more elephants (Chiyo, Cochrane, Naughton, & Basuta, 2005). This is however supported by this study as crop raiding by elephants usually happens when preferred plants in the wild are also available. In their study in Uganda, Rode et al. (2006) found that the reason why elephants raid crops even though wild plants are available is because crops have low secondary compounds and contain high sodium levels which are an important nutrient for elephants.

It was noted by arable farmers in Khumaga that: African elephant (*Loxodonta africana*) and hippopotamus (*Hippopotamus amphibius*) raid all crops planted, vervet monkey (*Chlorocebus pygerythrus*) feed on maize, sweet reeds and watermelon, black backed Jackal jackal (*canus mesomelas*) feed on watermelon, cape porcupine (*Hystrix africaeaustralis*) feed on maize and watermelon, greater kudu (*Tragelaphus strepsiceros*) and common duiker (*Sylvicapra grimmia*) feed on beans.

4.6 Amount of crop losses to animals

The measurement of actual crop losses is difficult and controversial (Hill, 2002). In relation to crop production and loss due to wildlife crop raiding, costs incurred by arable farmers at Khumaga were assessed by asking respondents on how much hectares were ploughed and how

much hectares were destroyed each year (Table 4.7). Results indicate that for the year 2014, hectares that were ploughed by respondents was 356.5 in total and 342.5 hectares or 96.1% of hectares were destroyed.

Table 4.7 Hectares ploughed and destroyed

Year	Hectares ploughed	Hectares destroyed	Percentage destroyed
2010	336	333	99.1
2011	330	326	98.8
2012	354	349	98.6
2013	360.5	350.5	97.2
2014	356.5	342.5	96.1

Crop damage by wildlife also affects the number of crop yields by each farmer. Results in Table 4.8 show the number of bags expected by farmers from 2010 to 2014. Farmers expected a total of 2824.5 bags of millet, 2954.5 bags of maize (Table 4.8).

Table 4.8 Expected yield per crop each year

1bag = 50kg for millet, maize, sorghum, beans and groundnuts

1= 1 ton for watermelon, sweet reeds and melon

crops planted	2010	2011	2012	2013	2014	Total
Millet	546.5	544.5	558.5	599.5	575.5	2824.5
Maize	562	568.5	603.5	602.5	618	2954.5
Sorghum	323	319	350	362	362.5	1716.5
Watermelon	277	279	309	313	310	1488
Beans	375	365	412	410	422.5	1984.5
Groundnuts	18.25	17.75	23.75	21.25	20.25	101.25
Sweet reeds	219.5	223.5	249	246	248.5	1186.5
Melon	10.5	11	9	9	8.5	48

1116 As shown in Table 4.9, for the past five years from 2010 to 2014, farmers report to have yielded
 1117 221.5 bags of millet out of 2824.5 expected bags (Table 4.9).

1118 **Table 4.9 Actual yield per crop each year**

1bag = 50kg for millet, maize, sorghum, beans and groundnuts

1= 1 ton for watermelon, sweet reeds and melon

crops planted	2010	2011	2012	2013	2014	Total
Millet	43	39.75	39.5	49.25	50	221.5
Maize	40.75	52	46.5	58	139.75	337
Sorghum	16.25	21	34	14.25	23.5	109
Watermelon	8.5	19.5	30	31.5	40.5	130
Beans	10.15	10	18.5	22.25	30.25	91.15
Groundnuts	1	1	1	0	0	3
Sweet reeds	2	10.5	10	12.5	18	53
Melon	0	0	0	0	0	0

1119

1120 Results in Table 4.10 shows losses suffered by arable farmers due to wildlife crop raiding, from
 1121 2010-2014. The greater loss was incurred by farmers in each crop they ploughed. The loss for
 1122 millet from 2010-2014 was 2603 or 92.2% bags lost due to wildlife crop raiding (Table 4.10)

1123 **Table 4.10 Loss per crop each year**

1bag = 50kg for millet, maize, sorghum, beans and groundnuts (loss)

1= 1 ton for watermelon, sweet reeds and melon

crops	2010	2011	2012	2013	2014	Total loss	Total loss in %
Millet	503.5	504.75	519	550.25	525.5	2603	92.2
Maize	521.25	516.5	557	544.5	478.25	2617.5	88.6
Sorghum	306.75	298	316	347.75	339	1607.5	93.6
Watermelon	268.5	259.5	279	281.5	269.5	1358	91.3
Beans	364.85	355	393.5	387.75	392.25	1893.35	95.4
Groundnuts	17.25	16.75	22.75	21.25	20.25	98.25	97.0

Sweet reeds	217.5	213	239	233.5	230.5	1133.5	95.5
Melon	10.5	11	9	9	8.5	48	100.0

These results in Table 4.8-4.10 show that arable farmers of Khumaga experience persistent wildlife crop raiding that seriously affect their livelihoods. One of the respondents skeptically remarked, “*We are given seeds and machinery for free by government to plant for her elephants*’ when referring to the damage caused by elephants.

In western Laikipia, Kenya, Irigia (1990) recorded damage between 10 to 24% of the total maize crop. At Lake Mburo National Park, Uganda, animals were reported to also destroy 85% of the crops planted (Kagoro-Rugunda, 2004). Thouless (1994) counted crop depredation of maize (45%), followed by beans (13%), wheat (11%), potato (5%) and banana (5%) at Kenya.

The plate below (Plate 4.1) shows the condition of wildlife crop raiding at Khumaga in three consecutive days, a day before crop raiding and a day after crop raiding by elephants. Naughton-Treves (1998) contends that elephant raiding can cause entire farms to be abandoned.



Plate 4.1 A day before and a day after crop raiding by elephants; Picture by K. Gontse (2015)

4.7 Monetary loss due to crop damage by wildlife

The losses by farmers were turned into monetary terms. As a result, findings in this study indicate that from 2010 to 2014, farmers lost bags of millet worth an amount of P542,829.70 or 92.2% of the expected money (Table 4.11). Based on assumptions from Botswana Agriculture Marketing Board (BAMB), the rate of millet per 50kg is P 208.54, maize is P 150.60 per 50kg, sorghum is P 177.30 per 50kg, beans is P 700.00 per 50kg, and groundnuts is P 643.50 per 50kg. These results indicate that farmers at Khumaga lost lots of Pula's worth of crops.

Table 4.11 Loss per crop in monetary terms per year

Crops	Loss per crop in monetary terms (Pula) per year					Totals	% loss
	2010	2011	2012	2013	2014		
Millet	P 104999.9	P 105260.6	P 108,232.30	P 114,749.10	P 109,587.80	P 542,829.70	92.2
Maize	P 78,500.3	P 77,784.9	P 83,884.2	P 82,001.70	P 72,024.50	P 394,195.60	88.6
Sorghum	P 54,386.8	P 52,835.4	P 56,026.80	P 61,656.10	P 60,104.70	P 285,009.80	93.6
Watermelon	-	-	-	-	-	-	-
Beans	P 255,395.00	P 248,500.00	P 275,450.00	P 271,425.00	P 274,575.00	P1,325,345.00	95.4
Groundnuts	P 11,100.40	P 10,778.60	P 14,639.60	P 13,674.40	P 13,030.9	P 63,223.90	97.0
Sweet reeds	-	-	-	-	-	-	-
Melon	-	-	-	-	-	-	-

Human–elephant interaction is exclusively negative and includes financial losses as a result of crop-raiding. Communities near a protected area boundary suffer a disproportionate amount of damage (Naughton et al. 1999; Mosojane 2004). Barua et al. (2013) and Kansky et al. (2014) indicate that sometimes the loss caused by wildlife may seem insignificant at a national level but high costs for the affected individuals and families, many of whom are amongst the least privileged people in the world. Thouless and Tchamba (1992) also estimated crop damage by

elephant in Northern Cameroon to be more than US\$ 200,000, while (Irigia, 1990) assessed the crop damage in Ol Ari Nyiro Ranch in western Laikipia, Kenya to be more than US\$ 33,000.

4.8 Other effects of crop raiding on livelihoods of arable farmers of Khumaga

Crop raiding affects livelihoods at Khumaga. Results indicate that 100% of respondents alleged that their livelihood has been negatively affected by wildlife crop raiding, when they were asked how, 84% (n=100) of respondents alleged that they have abandoned flood-recession farming (molapo farming) because of wildlife crop raiding (Table 4.12).

Table 4.12: Other effects of crop raiding on livelihoods of arable farmers of Khumaga

	n	%
Loss of food leading to poverty	19	16.0
Lack of food due to abandonment of molapo farming	100	84.0
Total	119	100.0

Flood-recession farming is practiced along many rivers of the world (Acreman, 2000). In Botswana, molapo farming is a local term designed to refer to the seasonally flooded plains (Magole & Thapelo, 2005). Molapo cultivation is a traditional farming system which is mostly practiced by farmers living along the fringes of the river. When there are no floods, the molapo fields rely on rainwater for cultivation. Soil in molapo farming is more fertile than of dry land farming, therefore yields in the fertile molapo areas are generally higher than in the dry land (Bendsen & Meyer, 2002). According to Magole and Thapelo (2005), molapo cropping is less risky as the residual flood water in the soil acts as a supply of moisture against seasons of either low or poorly distributed rainfall.

The Chief of Khumaga contended that the majority of the people of Khumaga have traditionally depended on flood recession farming for their livelihoods. According to a DWNP officer, farmers who practice molapo farming are not compensated when their crops are destroyed by wildlife. The agricultural demonstrator at Khumaga also noted that he only allocates free seeds through ISPAAD for those who practice dry land farming not molapo farming because farmers of molapo farming cultivate crops on land that they have no formal land tenure.

Farmers of Khumaga have since shifted to dry land farming as chief and farmers have indicated. Dry land farming is the predominant farming system which is independent of the floods. It is

practiced only during the rainy seasons (Magole & Thapelo, 2005). However, their crops are still destroyed by wildlife leading to food insecurity. Economic losses of the local people due to crop damage is one of the major issue that triggers HWC and causes problem in achieving long term conservation (DEA, 2010).

According to Woodroffe et al. (2005), HWC can bring opportunity costs, where people forgo economic or lifestyle choices due to impositions placed upon them by the presence of wild animals. This was supported by Gupta (2013) who stated that for some farmers, crop raiding by problem animals such as elephants is one of the reasons why they have stopped farming their larger arable landholdings intended for both commercial and subsistence purposes.

4.9 Trends in incidents and nature of wildlife crop raiding

Data collected from the DWNP office at Rakops showed that elephants were generally the ones which cause most of crop damage at Khumaga for the past years. Figure 4.2 shows that from 2001- 2014, a total of 273 elephant crop damage cases were reported at Khumaga. Results indicate that in the last 4 years (2011-2014), unlike previous years, elephant crop damage cases were highly reported (Figure 4.3).

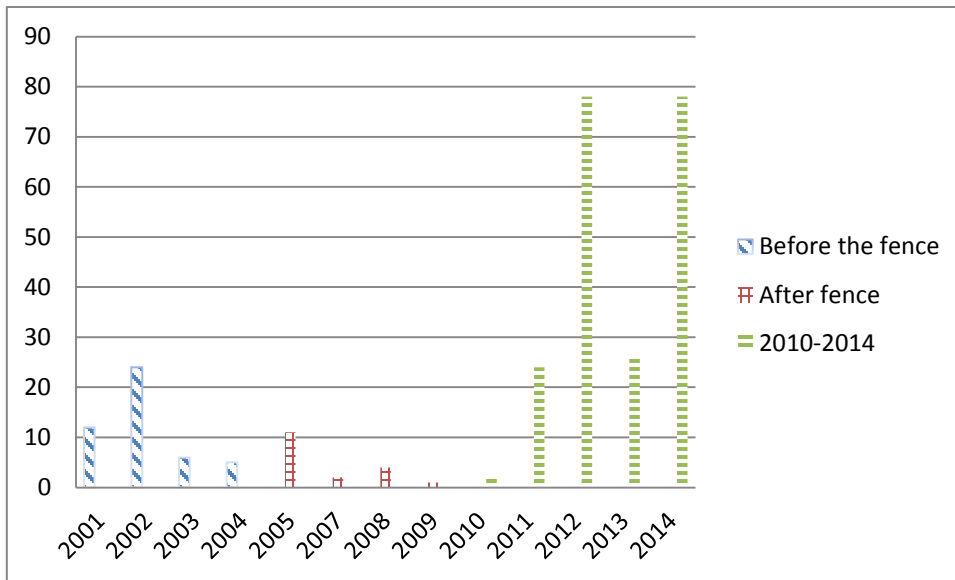


Figure 4.4: Number of crop raids by elephants reported to the DWNP before 2000–2004, after 2005–2009, the erection of Makgadikgadi electric fence and 2010-2014

Crop raiding incidents were high in the last four years possibly due to high numbers of elephants, as respondents have already highlighted, or may be due to ineffective government mitigation measures like electric fence and lack of patrols by DWNP officers. Elephants were reported by chief and headmen of Khumaga to have started showing up on their village in 2009 immediately after the flowing of the river. Animals that were raiding crops by then included hippopotamus (*Hippopotamus amphibius*), black backed Jackal (*Canus mesomelas*), cape porcupine (*Hystrix fricaeaustalis*), vervet monkey (*Chlorocebus pygerythrus*), greater kudu (*Tragelaphus strepsiceros*) and common duiker (*Sylvicapra grimmia*) with only few cases of elephant crop raiding.

According to DWNP officer, there were elephants in the park, by then they were drinking water in the boreholes that are within the park, now because of the reflow of the river elephants are

now going out of the park to drink water in the river and they eventually get attracted by farmers ploughing fields and the vegetation around fields. In Chobe from 2012 to April 2014, 607 crop raiding incidents by elephants were reported at the DWNP (DWNP, 2014). In Seronga, elephants are also reported as the most crop raiders followed by Hippos (DWNP, 2014).

4.10 Electric Fence – Government Preventative Measure

In an attempt to manage crop damage and predation at Khumaga, government of Botswana through DWNP in 2004 erected the non-lethal electrified game proof fence of 2.4 m height that runs along the western boundary of the Makgadikgadi Pan National park (MPNP) with a parallel standard cattle fence of 1.4 m, to reduce human wildlife conflict as Khumaga and Moreomaoto community were complaining of crop loss and predation (DEA, 2010). The purpose of the fence based on key informants and arable farmers was to mitigate HWC. However the respondents indicate that the fence is now not effective. A majority of residents in Khumaga (96%) noted that the fence had been useful in minimizing crop raiding by wildlife.

Data collected from arable farmers show that there was a significant difference in wildlife crop raids before fence (2000–2004) and after fence (2005–2009) $\chi^2(9)=87.3$, $p < 0.005$, and they was no significant difference before fence was erected (2000–2004) and 2010-2014 $\chi^2(3)=.325$, $p =0.955$. A total of 87% of respondents noted that crop raiding by wildlife decreased after construction of the fence around the park (2005-2009), 99% of respondents noted that from 2010-2014, crop raiding incidences were rising and frequent; this was also evidenced by data from DWNP. Monametsi (2008) also find that there was a reduction in elephant crop raids before and after the fence was built.

1237 According to farmers and the DWNP officer, the erection of non-lethal electrified game proof
1238 fence helped much on the issue of wildlife crop raiding at Khumaga. The fence was however
1239 rendered ineffective by the river in the year 2009 because they were points where it crosses the
1240 river providing access to water for both wildlife and community. Solar panels that were
1241 producing electricity were then stolen. The fence is reported by respondents to be poorly
1242 maintained by DWNP, so elephants can trespass anywhere to people's ploughing fields
1243 resulting in increasing number of crop raiding incidents.

1244 The respondents' assertions are corroborated by Thouless and Sakwa (1995) when they
1245 indicated that some fences are not effective enough because they are poorly or not adequately
1246 maintained by relevant authorities. Okello and D'amour (2008) also argue that if the fence is
1247 poorly maintained it can have negative long-term consequences for wildlife conservation as
1248 well as human development. Thouless and Sakwa (1995) further indicated that for electric fence
1249 to be effective against elephants, it is supposed to have high voltage and well maintained.

1250 Fencing is one method used as a mitigation strategy to minimize HWC in Botswana. According
1251 to Mbaiwa and Mbaiwa (2006) Botswana has history of fences in mitigating conflict between
1252 the Ministry of Agriculture and Ministry of Environment, Wildlife & Tourism as the two
1253 ministries are the main contributors to Botswana's Gross Domestic Product (GDP). Mbaiwa
1254 and Mbaiwa (2006) emphasize that the fence can succeed in separating wildlife and livestock,
1255 like the buffalo fence that separate buffalo populations, which are known for transmitting foot
1256 and mouth, within the inner parts of the Okavango Delta from cattle populations. Fences are
1257 however known to disrupt migrations of wildlife (Mbaiwa & Mbaiwa, 2006; Okello &
1258 D'amour, 2008; Perkins & Ringrose, 1996).

Mbaiwa and Mbaiwa (2006) continued by arguing that fence completely cuts the movement of wildlife species and separate wildlife families from each other. Perkins and Ringrose (1996) also argue that fences are liable for the dramatic death of migratory wildlife species. In their study, Okello and D'amour (2008) contend that the use of electric fence is not a solution to the problem of HWC as wildlife will be forced to change migration routes, hence simply shifting human - wildlife conflicts elsewhere rather than solving the problem of HWC. Even though fence have negative effect as highlighted by some authors, arable farmers of Khumaga supported the conclusion made by Thouless and Sakwa (1995) that the electric fence is effective on mitigating wildlife crop raiding provided the fence is well maintained.

4.11 Mitigation measures - Patrols

In addition to the electric fence, there are many other mitigation measures that the government has once introduced at Khumaga village, including frequent ground patrols by DWNP, 98% of farmers noted that DWNP does not carry patrols any more in their area. According to DWNP officer before the construction of Makgadikgadi game proof fence, there was a DWNP unit, Problem Animal Control Unit office (PAC) at Khumaga, whose responsibility was to assist in the protection of human life and property damage caused by wildlife, to make patrols around the area. The unit was also responsible in advising residents on mitigation strategies and ensuring that compensation is awarded to those who suffered such loss in cases of species that attract compensation. Patrols and other responsibilities of PAC officers at Khumaga were then neglected after the construction of electric fence with the belief that the fence would completely mitigate the conflict. The officers were then transferred to other stations immediately after the construction of the fence.

All farmers (n=119) said they report incidences of crop raiding to DWNP officers immediately after they have occurred. About 77% of farmers noted that DWNP officers do not attend to reported cases well on time. Sometimes DWNP officers are not able to verify claims as they attend to the scene after a long time, as much as up to 14 days from the day of occurrence when evidence will no longer be there - sometimes evaded by domestic livestock. A total of 73.0% of the farmers (respondents) noted that reasons that are usually given by DWNP officers for not attending to reported cases on time are unavailability of vehicles (Table 4.13).

Table 4.13 Reasons that DWNP officers give to the farmers for failing to attend to reported cases of wildlife crop raiding on time

	n	%
Shortage of staff	3	2.5
Unavailability of vehicles	87	73.1
Not applicable	29	24.4
Total	119	100.0

The DWNP officer at Rakops supported the findings from respondents by revealing that they lack resources (equipment and personnel), which is why they fail to attend to reported cases on time. The officer revealed that there are about four DWNP officers at Rakops office “*who are supposed to take care of Boteti sub District with only one car*”. Boteti sub district is about 33,806 km² (CSO, 2011) and this is vast area that cannot be effectively covered with only one vehicle. This shows that indeed DWNP office lacks resources to cover the whole Boteti area.

4.12 Flooding of the Boteti River and Crop Damage

The flooding of the Boteti River since 2009 is noted for having escalated incidents crop damage in Khumaga. Respondents feel that the flowing of Boteti River influenced wildlife crop raiding

incidents in their area, as the river attracted elephants to their area. Khumaga residents share Boteti River with wildlife (DEA, 2010). The River that separates the park from the neighboring villages dried up in the mid-1980s and started re-flowing in 2009 (DEA, 2010). Historically, the Boteti River on the western boundary of the MPNP had significant amounts of water augmented by the late floods from the Okavango system. The river also acted as boundary between the cattle posts and Makgadikgadi Pan National Park (Hemson, 2004)

An interview with the DWNP officer revealed that before the reflow of the river, elephant crop raiding incidents were less, then after the river started flowing crop raiding incidents increased. Data from DWNP's Problem Animal Control Unit also showed that elephant crop raiding is now higher than before the river started flowing again. This was also evidenced by farmers when asked about the situation before the river reflowed (2004-2008) and after the river reflowed (2009-2014). About 90% of farmers indicated that before the river reflowed, crop raiding was low and the situation got worse after the river reflowed. This was maybe due to the fact that before the river reflowed (2004 -2008), the electric fence was still intact and still working properly.



Plate 4.2 Flooding of Boteti River and local communities fetching water from the river

4.13 Season when Crop raiding is Common/Occur

Crop raiding generally occurs during the crop season in Botswana which is during the rainy seasons which on average ran from October to May. According to farmers and Agricultural Demonstrator of Khumaga, the fields are normally cultivated in summer (December-February) and harvested in autumn (March-May). Of all the farmers, 99% of them informed the researcher that crop raiding by elephants mostly happens during flowering, 98% of farmers again also said during harvesting time. This was also found by Mosojane (2004) at the Okavango Panhandle that there is a general trend of raiding when the cultivated crops approached maturity at the end of the rainy season. Mosojane (2004) went on to argue that when elephants damaged fields early in the wet season, it was due to trampling as they sought watermelon intercropped with millet (*Pennisetum glaucum*), beans (*Tylosema esculentum*), and maize (*Zea mays*). Nyhus and Sumianto (2000) also found that crop raids usually occur when crops are mature in the wet season. Thouless (1994) reported that in northern Kenya, intense depredations occur close to harvest time in August-September in wet season. In India, the intensity of depredations occur during the major cropping season between October to December in rainy season (Sekhar, 1998).

A total of 61% of respondents said wildlife species, more specially elephants, raid and destroy crops mostly at night. Barnes et al. (2007) argue that elephants prefer to move during dark nights, which is why crop raiding by elephants happens at night. Elephant are also reported to raid crops even during the day hours, 35% of respondents agree that crop raiding by wildlife species sometimes happen in the afternoon. When they were asked how often crop raiders attack their field, 63% of them said weekly and 39% said daily.

4.14 Mitigation strategies used against crop raiding

There are various types of the passive or active mitigation measures that are being used by arable farmers of Khumaga to protect their crops from wildlife. All farmers of Khumaga use thorn bush to protect their crops. Farmers have adopted locally available techniques to mitigate the crop depredation problems. Common techniques used to protect crops against wildlife was making false human structure reported by 91.6% (n=109) respondents, guarding crops reported by 89.1% (n=106) respondents, and 68.9% (n=82) respondents reported to be using chili pepper against elephants (Table 4.14).

Table 4.14 Mitigation strategies used against crop raiders

	n	%
Making false human structure	109	91.6
Guarding crops	106	89.1
Loud sound	94	79.0
Use of chili pepper	82	68.9
Firing with a gun	14	11.8
Traps	2	1.7
Bee hive	1	.8

The said methods have their limitations for short term as they can get habituated if exposed for longer time (Nyhus & Sumianto, 2000; Thouless, 1994). According to Osborn and Parker (2003), night patrolling can help in saving crops with less effort. This is however not practiced at Khumaga as farmers are afraid of elephants at night. Early warning systems, thunder flashes, chilli boms, community scouts and combination of repellents are reported by some authors to be effective in reducing wildlife crop raiding (O'Connell-Rodwell, Rodwell, Rice, & Hart, 2000; Sitati et al., 2005), this is however not practiced at Khumaga

There has been a significant push by the DWNP and independent researchers within Botswana to improve community awareness and implementation of the chili pepper mitigation strategy. Currently the DWNP in Northern Botswana including Khumaga, screened 259 farmers and selected 144 farmers for use of chili pepper, 38 for kraaling, seven guarding dogs, six for early maturing seeds, and six for bee keeping to test the effectiveness of mitigation strategies that can be used to avoid crop loss and predation to farmers. In these projects, farmers are trained on the use of chili pepper and bees as elephant deterrents (DWNP 2014). According to Osborn and Parker (2003), chili grease on field fence as a deterrent can be used and it has been reported to be effective. Osborn & Parker (2003) continue arguing that chili pepper can also be grown around the field as a buffer, since it has also been found to have a high market value. Growing chili as a cash crop can produce material for wildlife deterrent programs where community-based groups exist, since people have lost some economic opportunities (Osborn & Parker, 2003). Even though chili pepper sounds to be effective on mitigating human elephant conflict, its uptake at Khumaga is still limited as some farmers are condemning the strategy saying it is not working for them. This might be because they are not well trained on how to apply the strategy.

4.15 Compensation of farmers by DWNP after crop raiding

DWNP compensates farmers who have experienced crop damage due to wildlife, in cases of species that attract compensation. Therefore, farmers were asked if they had ever sought compensation for elephant damage, 97% of them reported to have received compensation. Respondents noted that they are generally not happy with the compensation of crop loss caused by elephants. Compensation for crop loss by elephants is reported by 89% farmers to be not fair. Data from arable farmers (61%) indicate that DWNP can take up to a year without

1377 compensating them for crop loss by wildlife, and there are practical barriers and costs that one
1378 must follow to make the claims or to receive compensation. One of the respondents alluded that
1379 “*I once received a cheque of P10 from DWNP and for me to cash that cheque I was supposed*
1380 *to travel from Khumaga to Rakops which is about 70 kilometers, which means the cost of travel*
1381 *is higher than the claim*”. However, of recent, government has introduced a new scheme of
1382 100% compensation on damage caused by wild animals like lions and elephants.

1383 The compensation scheme was introduced to reduce economic impact of crops raided by
1384 wildlife or livestock lost to predators, to increase economic incentives for communities to
1385 tolerate adjacent wildlife populations, but its success have been limited at Khumaga.
1386 Compensation is a method for increasing acceptance from local communities for a problem and
1387 not a method of preventing the problem from happening (Treves, 2007). This is a widely
1388 recommended and often used technique to reduce the economic impact of losses to wildlife in
1389 an effort to buy tolerance of problem species (Barua et al., 2013). Barua et al. (2013) claim that
1390 when local communities seek compensation for the loss or damage there is a bureaucratic
1391 inadequacy which is one of the hidden costs of wildlife crop raiding that influence HWC.
1392 Timely payment can help victims to get over their anger and may reduce their incentives to
1393 retaliate against the animals that caused the damage (Nyhus et al., 2005).

1394 The idea of compensating farmers for wildlife damages has gained popularity among
1395 conservation groups and governments. Bulte and Rondeau (2007) indicated that compensation
1396 can be relatively cheap to implement in poverty-struck areas and is readily accepted by local
1397 communities. However, different governments have failed for some of the reasons including
1398 lack of funds, fraudulent claims, bureaucratic inadequacies and the practical barriers that

1399 illiterate farmers from remote areas must overcome to produce a claim (Bulte & Rondeau, 2007;
1400 Sitati & Walpole, 2006).

1401 **4.16 Perceptions of the Khumaga people towards wildlife conservation**

1402 A five-point semantic differential scale was used to measure the perception of farmers towards
1403 conservation of wildlife species. Findings indicate that 42% of respondents were in support
1404 (strongly agree/agree) that conserving wildlife species is important, while 27% of respondents
1405 strongly disagree/ disagree that conserving wild species is important (Table 4.15).

1406 Results indicate that farmers of Khumaga see conservation of wildlife as important. On an
1407 interview with the Chief and headmen of the village, the Chief stated that, “*my son, we are*
1408 *willing to conserve wildlife species provided government is helping us by taking care of*
1409 *elephants to reduce the damage they cause to our livelihoods. Elephants are negatively affecting*
1410 *us*”. During key informant interview with chief and headmen of the village, one of the headmen
1411 expressed that, “*we are urged to live with monsters (elephants) by government but back days*
1412 *some few elephants were said to be seen at Serowe village, soldiers and DWNP officers were*
1413 *sent to Serowe with immediate effect to chase and eliminate them. If it was here at Khumaga,*
1414 *believe me my son no one would have come to help, I don’t know how different we are from*
1415 *other Batswana*”. This indicates that farmers at Khumaga are willing to conserve wildlife
1416 species but they are likely to change because of lack of help from the government in minimize
1417 the damage caused by elephants.

Table 4.15: Relationship between level of education and Perception of farmers towards conservation of wildlife species

	None	Primary	Secondary	Total	Chi Square test
S/ agree	0	3 (7.3%)	3 (11.1%)	6	= 19.687,df= 8,p = 0.006
Agree	13 (25.5%)	19 (46.3%)	12 (44.4%)	44	
Neutral	24 (47.1%)	10 (24.4%)	3 (11.1%)	37	
Disagree	9 (17.6%)	5 (12.2 %)	3 (11.1%)	17	
S/Disagree	5 (9.8%)	4 (9.8%)	6 (22.2%)	15	
Total	51	41	27	119	

Opinion of arable farmers on conservation of wildlife species was dependent on educational level, respondents with higher had significantly more positive opinions about conservation of wildlife species $\chi^2(8)=19.7.3, p =0.006$, this indicate that education is important in ensuring conservation. This was also evidenced by Mfunda and Røskft (2011) at Tanzania that educational level, number of livestock owned and wealth considerably influence people's perception over crop damage.

The attitude among respondents towards zoning of MPNP was encouraging. When respondents were asked if zoning of MPNP for wildlife based tourism instead of crops and livestock farming was a good thing, 59% of respondents said yes zoning of MPNP was a good thing, while 41% said it was not a good thing.

Elephants are the most destructive wildlife species and farmers of Khumaga have a negative attitude towards elephants. Results in Table 4.16 indicate that a total of 70% (n=83) of farmers reported that they hate elephants and only 16% (n=19) said they like elephants. When farmers were asked how they feel about elephants, A 36 year old woman at Khumaga noted, “*How can I like something that is not created by God. God cannot create something of that kind, elephants*

were made by Satan”, when referring to the body structure of elephants and the damage they caused in their fields.

Table 4.16: Perceptions of farmers towards specific wildlife species

	Love	Like	Neutral	Dislike	Hate
Kudu	-	4 (3%)	-	1 (1%)	-
Elephants	-	19 (16%)	7 (6%)	10 (8%)	83 (70%)
Hippo	-	2 (2%)	3 (3%)	1 (1%)	1 (1%)
Porcupine	-	11 (9%)	19 (16%)	22 (18%)	8 (7%)
Monkey	-	4 (3%)	2 (2%)	8 (7%)	2 (2%)
Duiker	-	18 (15%)	7 (6%)	4 (3%)	-
Jackal	-	12 (10%)	13 (11%)	39 (33%)	22 (18%)

Elephants inspire fear and frustration and are deemed pests to be controlled or extinguished if their behavior infringes on the livelihoods or security of the humans around them. These animals with their body size and strength overpowered humans when they interfered with their survival (Warner, 2008). Campbell-Smith et al. (2010) in their study on human–orangutan conflict suggest that efforts to mitigate may not, per se, change negative perceptions of those who live with the species, because these perceptions are often driven by fear, this might also be the case at Khumaga. A 91 year old man who is also a headman of the village noted that “*since that devil called elephant came to our land no one has ever harvested here in Khumaga and we are dying of hunger because of elephants crop raiding, we have grown without that creature on our land. Since it came, we are always in fear and scared of walking on our own*”. This indicates that farmers at Khumaga are afraid of elephants and they turn to hate it.

Out of N=119 respondents who reported elephant as one of the crop raiders at Khumaga, 70% (n= 83) of respondents said elephants need to be translocated, while 19% (n=23) respondents

said government should kill some elephants in their area and 10% (n=12) want all elephants to be killed in their area (Table 4.17).

Table 4.17: What do farmers want to done about crop raiders in their area?

	Kill all crop raiders	Kill some crop	Let farmers kill	Translocate crop raiders	Leave them
Kudu	-	-	1 (1%)	1 (1%)	3 (3%)
Elephants	12 (10%)	23 (19%)	1 (1%)	83 (70%)	
Hippo	-	2 (2%)	1 (1%)	-	5 (4%)
Porcupine	2 (2%)	25 (21%)	6 (5%)	3 (3%)	24 (20%)
Monkey	1 (1%)	6 (5%)	3 (3%)	1 (1%)	6 (5%)
Duiker	1(1%)	3 (3%)	3 (3%)	2 (2%)	19 (16%)
Jackal	13 (11%)	46 (39%)	9 (8%)	5 (4%)	13 (11%)

Data illustrate that even though elephants affect livelihoods of the Khumaga, farmers seem to know the importance of having them in Botswana, which is why a high number of respondents suggest that elephants should be translocated than to be killed.

This was also evidenced by Sifuna (2010) at Okavango Delta that despite the problem of wildlife damage, people still generally have positive attitudes towards wildlife. At Okavango Delta, people appreciate the economic contribution of wildlife tourism in terms of earnings from tourists and employment opportunities, unlike at Boteti specifically Khumaga. According to Mbaiwa and Stronza (2011), the co-management and economic benefits that local communities derive from wildlife through tourism development has led to the development of positive attitudes of local communities towards conservation of wildlife resources in Community Based Natural Resources Management (CBNRM) areas.

1466 According to Mbaiwa (2002) government of Botswana introduced CBNRM after adopting the
1467 Wildlife Conservation Policy of 1986 and the Tourism Policy of 1990 in order to link
1468 conservation and the development of local people. CBNRM activities are coordinated by a trust
1469 referred to as a Community-Based Organization (CBO). According to Technical Advisory
1470 Committee (T.A.C) reports (2014) there are currently 5 CBO that are operating in Ngamiland
1471 (Khwai Development Trust, Mababe Zokotsama Community Development, Trust Sankoyo
1472 Tshwaragano Management Trust, Xhauxhwatubi Development Trust, and Okavango Jakotsha
1473 Community Trust). Other Trusts are not operational pending signing of sublease; not
1474 operational as they are in the process of converting tourism activities, and others pending
1475 allocation of land. A total of BWP 17, 405, 357 was accrued through the use of natural resources
1476 by 6 CBOs in 2011/12 (DWNP, 2012). DWNP facilitates and supports community based
1477 organisation initiatives with the belief that such initiatives will create jobs, contribute to GDP
1478 and support sustainable utilization and conservation of wildlife.

1479 In Kenya, most of the local people feel strongly that wildlife contributes to their poverty,
1480 therefore they have a strong negative attitude towards wildlife because there is no such
1481 initiatives (Sifuna, 2010). This is likely to happen in Khumaga. According to Okello (2005)
1482 locals' opinions on wildlife and conservation are influenced by benefit systems, wildlife damage
1483 to property, danger to human life, and changes in land use patterns.

1484

CHAPTER FIVE

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

5.1 Summary

The general objective of this study was to examine the extent and nature of wildlife crop raiding, and its implications on the livelihoods at Khumaga village in Boteti, Central District, Botswana. Specific objectives of this study included: a) assessing the effects of wildlife crop raiding on the livelihoods of Khumaga community; b) to examine the trends in incidents and nature of wildlife crop raiding in Khumaga area over the last 10 years; and, c) to assess perceptions of Khumaga people towards wildlife conservation. The study was informed by Social Exchange Theory. This study made use of both primary and secondary data sources. Primary data sources involved face-to-face interviews with N=119 respondents. It also involved unstructured interviews with key informants including Chiefs, Department of Wildlife and National Parks (DWNP) officer, and agricultural demonstrator of Khumaga village.

Secondary data sources were used to obtain information about the effects of wildlife crop raiding on livelihoods of communities living with wildlife, nature of wildlife crop raiding and perception of people towards wildlife conservation. These sources included documents such as DWNP reports of 2013 and 2014, journal articles on wildlife crop raiding, Makgadikgadi Framework Management Plan of 2010, thesis and dissertations on Human Wildlife Conflicts (HWC).

5.2.1 *Effects of wildlife crop raiding on livelihoods*

This study analyzed effects of wildlife crop raiding on livelihoods using indicators which included but are not limited to: livelihood activities of respondents, educational level, types of crops planted, hectares ploughed, hectares destroyed by wildlife, accumulated hectares, expected yield and actual yield per crop per year, loss per crop in monetary terms per year using Botswana Agriculture Marketing Board (BAMB) rates.

Results indicate that a total of about 85% of respondents experienced wildlife crop raiding in the last five (5) consecutive years. This shows that arable farmers of Khumaga experience persistent wildlife crop raiding, mostly caused by elephants. In addition, results indicate that respondents are losing almost every crop and hectare they plough to wildlife, more especially elephants leaving fields bare. The researcher witnessed this raiding during field work. Respondents felt that they are given free seeds and machinery by government to plough for elephants.

For the past 5 years, arable farmers at Khumaga lost almost everything they plough to wildlife. For millet, as an example, farmers lost up to 92% of their crops to wildlife. This loss suggests that Khumaga farmers suffer the consequence of living with wildlife by losing large amounts of revenue that could be obtained from farming. Crop raiding has resulted in some of the farmers abandoning crop farming at Khumaga village. For example, 84% of respondents reported to have abandoned flood recession crop farming known as *molapo* farming due to wildlife crop raiding. Molapo farming is reported to produce more mature crops than dry land farming due to unlimited moisture that makes it more sustainable and profitable (Bendsen & Meyer, 2002; Kashe, Mogobe, Moroke, & Murray-Hudson, 2015). In sorghum production for instance, grain yield

ranges from 1,800 to 2,900 kg ha⁻¹ whereas, under rain fed it can be as low as 121 kg ha⁻¹ (Bendsen & Meyer, 2002; Kashe et al., 2015).

Kashe et al. (2015) claim that maize plant height and grain yield were significantly higher in *molapo* field at Lake Ngami than at dry land field at Shorobe. They reported Grain yield to be (3.40 t ha⁻¹) at Lake Ngami than (2.58 t ha⁻¹) at Shorobe. In this regard, wildlife crop raiding is causing either a decline or abandonment of traditional livelihood options of respondents that they seem to be benefitting from them.

Woodroffe et al. (2005) argue that HWC can bring opportunity costs where people forgo economic or lifestyle choices due to impositions placed upon them by the presence of wild animals. The shift from *molapo* farming to dry land farming is in line with the notions of Gupta (2013) who found that for some farmers, crop raiding is one of the reasons why they have stopped farming their larger arable landholdings, intended for both commercial and subsistence purposes. Relying on dry land farming only is however problematic in times of no rains, as crops of dry land farming rely on rain water than of *molapo* farming which relies on available river water as already indicated. This indicates that wildlife crop raiding negatively affect the livelihoods of the Khumaga as farming is their main source of living.

5.2.2 *Trends and nature of wildlife crop raiding in Khumaga area over the last 10 years*

This objective assessed trends and nature of wildlife crop raiding at Khumaga village, indicators that were used to achieve this objective include, but are not limited to the following: wildlife species that raid crops, number of reported cases from DWNP, wildlife species that inflict the greatest damage, ability of PAC officers to attend to reported case, mitigation strategies used.

Results indicate that African elephant (*Loxodonta africana*), hippopotamus (*Hippopotamus amphibius*), black backed Jackal (*Canus mesomelas*), cape porcupine (*Hystrix fricae australis*), vervet monkey (*Chlorocebus pygerythrus*), greater kudu (*Tragelaphus strepsiceros*) and common duiker (*Sylvicapra grimmia*) are reported by farmers to damage crops. Data collected from the DWNP office at Rakops village showed that elephants were generally the ones which caused most of crop damage at Khumaga for the past years. From 2001- 2014, a total of 273 elephant crop damage cases were reported at Khumaga village. Results indicate that in the last 4 years (2011-2014), unlike previous year's, elephants crop damage cases were highly reported, possibly due to high numbers of elephants and ineffective government mitigation measures such as electric fence and lack of patrols by DWNP officers.

According to the Chief of Khumaga, before the flow of the river in 2009 crops were raided by hippopotamus (*Hippopotamus amphibius*), black backed Jackal (*Canus mesomelas*), cape porcupine (*Hystrix fricae australis*), vervet monkey (*Chlorocebus pygerythrus*), greater kudu (*Tragelaphus strepsiceros*) and common duiker (*Sylvicapra grimmia*). The Chief of Khumaga pointed out that there were very few incidents of elephant's crop raiding (*but since elephants came to our area in year 2009 no one has ever harvested anything because elephants raid the entire field in one night*) as he was explaining the situation of crop raiding. The DWNP officer indicated that the number of elephants has increased in the study area possibly due to hunting ban in 2014. As a result, the increase in population of elephants led to high incidents of wildlife crop raiding.

Results also indicate that african elephants (*Loxodonta africana*) and hippopotamus (*Hippopotamus amphibius*) generally raid everything that is planted. Black backed Jackal (*Canus mesomelas*) reported to be feeding on watermelon, cape porcupine (*Hystrix fricae australis*)

1570 feed on maize and watermelon, vervet monkey (*Chlorocebus pygerythrus*) feed on maize, sweet
1571 reeds and watermelon, while greater kudu(*Tragelaphus strepsiceros*) and common duiker
1572 (*Sylvicapra grimmia*) feed on beans.

1573 Data collected from farmers' interview, DWNP reports and key informants interview affirmed
1574 that crop raiding incidents by wildlife decreased after the construction of electric fence in 2004
1575 around the park. Crop raiding incidences are reported to be rising and frequent because the fence
1576 was destroyed by water and rendered ineffective when the river began flooding in 2009. The
1577 solar panels that were producing electric fence were then reported to be stolen. Therefore
1578 elephants and other wildlife species can now trespass anywhere to farmers ploughing fields.
1579 According to (Okello & D'amour, 2008; Thouless & Sakwa, 1995), for an electric fence to be
1580 effective against elephants, it is supposed to be of high voltage and be well maintained.

1581 According to farmers and Agricultural Demonstrator of Khumaga village, the fields are normally
1582 cultivated in summer (December-February) and harvested in autumn (March-May). Farmers
1583 99% reported that crop raiding by elephants mostly happen during flowering and 98% during
1584 harvesting time. This was also found by different authors (Mosojane, 2004; Nyhus & Sumianto,
1585 2000; Sekhar, 1998; Thouless, 1994) in their studies that crops are generally raided when they
1586 reach maturity. Mosojane (2004) further pointed out that when elephants damaged fields early
1587 in the wet season, it was due to trampling.

1588 This study has shown that most of the crop raids happen during the night. Barnes et al. (2007)
1589 also argue that elephants prefer to move during the dark night, which explains why crop raiding
1590 by elephants happens at night. All respondents alleged that they report to DWNP officers after
1591 crop raiding incidents, and 77% of respondents noted that DWNP officers do not attend to

1592 reported case well on time. Sometimes DWNP officers are not able to verify claims, as they
1593 attend to the scene after a long time, when evidence will no longer be there, sometimes erased
1594 by domestic livestock. The DWNP officer at Rakops supported the findings from respondents
1595 by revealing that they lack resources (equipment and personnel), which is why they are failing
1596 to attend to reported cases on time.

1597 Patrols at Khumaga by the DWNP office were found to be lacking. According to the DWNP
1598 officer, before the construction of Makgadikgadi game proof fence there was a DWNP unit, PAC
1599 unit at Khumaga which was liable for patrols and other responsibilities of PAC at Khumaga.
1600 These responsibilities were then neglected after construction of electric fence with the belief that
1601 the fence will completely mitigate the conflict; the officers were then transferred to other stations
1602 immediately after the construction of the fence. Results indicate that respondents adopted locally
1603 available techniques to mitigate the crop depredation problems: major techniques include
1604 guarding crops and making false structure, respondents also reported to be using chili pepper
1605 against elephants.

1606 Methods such as making false structures, guarding crops and loud sound have their limitations
1607 for short term as they can get habituated if exposed for longer time (Nyhus & Sumianto, 2000;
1608 Thouless, 1994). Currently the DWNP in Northern Botswana including Khumaga, screened 259
1609 farmers and selected 144 farmers for use of chili pepper, 38 for kraaling, seven guarding dogs,
1610 six for early maturing seeds, and six for bee keeping to test the effectiveness of mitigation
1611 strategies that can be used to avoid crop loss and predation to farmers. In these projects, farmers
1612 are trained on the use of chili pepper and bees as elephant deterrent (DWNP 2014).

Generally, arable farmers interviewed were not happy about the compensation of crop loss by elephants; respondents noted that DWNP also takes time to compensate them for the loss. Nyhus et al. (2005) contend that timely payment can help victims to get over their anger, and may reduce their incentives to retaliate against the animals that caused the damage. Of recent, government of Botswana has introduced a new scheme of 100% compensation on damage caused by wild animals like lions and elephants.

The symbiotic relationship or networking between farmers and DWNP is a necessary ideal to be recognized by government for achieving conservation and improved livelihoods. For example regular workshops and training should be conducted by DWNP with farmers on how to coexist with each and every wildlife species. There is also a need to engage farmers when developing policies and strategies to be used by farmers.

5.2.3 *Perceptions of the Khumaga people towards wildlife conservation*

This objective intended to gain an understanding of what wildlife conservation means to local communities in regard to wildlife species. The assumption was that when arable farmers experience high incidence of wildlife crop raiding by certain wildlife species, they would have negative perception toward those particular species (Conover 1997a), and arable farmers will not support the presence of those species in their area. Indicators that were used to measure this objective include; willingness to conserve wildlife, people's opinion and views towards wildlife conservation, feelings about wildlife species.

Results show that farmers of Khumaga perceive wildlife conservation as important, this was validated by 42% of arable farmers who strongly agree/agree that conserving wildlife species is important, while 27% of arable farmers strongly disagree/ disagree that conserving wild species is important, and 31% were neutral about the statement. The Chief of Khumaga village also

confirmed that they are willing to conserve wildlife provided government helps by protecting them and their fields from elephants as they gravely affect their livelihoods.

Results indicate that farmers at Khumaga in general see conservation of wildlife as important. The attitude among the farmers towards demarcation of Makgadikgadi Pan National Park (MPNP) was encouraging: about 59% of respondents agreed that zoning of MPNP is a good thing. Elephants are the most destructive wildlife species and farmers of Khumaga tend to hate elephants. Arable farmers (70%) reported that they hate elephants, eight percent dislike it and only 16% said they like elephants. About 70% of arable farmers want elephants to be translocated from their area. Farmers want some small animals like jackals and porcupine to be killed by relevant authorities to minimize their numbers as they also cause damage to crops like watermelon and maize.

5.3 Conclusion

The study was set out to examine the extent and nature of wildlife crop raiding, and its implications on arable farmers' livelihoods in Khumaga village in Boteti, North-Central District, Botswana. By assessing the effects of wildlife crop raiding on the livelihoods of Khumaga community, examining the trends in incidents and nature of wildlife crop raiding in Khumaga area over the last 10 years, and assessing perceptions of the Khumaga people towards wildlife conservation.

Though Botswana's tourism is based on wildlife and wilderness which needs to be conserved, arable farmers incur costs from wildlife. Results of this study have shown that wildlife crop raiding is one of the contributing factors of poverty in Khumaga village; farmers lose food and a lot of income that could be attained from arable farming per season to crop raiders. In some

1658 instances, farmers lose a whole field particularly to elephants, which inflict heavy losses.
1659 Nchanji (1998) reported that crop raiding is a serious problem to arable farmers as crop raiding
1660 animals can have a devastating impact on the standard of living of farmers whose entire survival
1661 is dependent on subsistence agriculture. The majority of arable farmers at Khumaga indicated
1662 they have abandoned *molapo* farming due to high incident of wildlife crop raiding.

1663 Elephants are reported to be the most destructive animal at Khumaga. People tend to hate
1664 elephants as they cause more damage than other wildlife species. In this instance, the loss
1665 incurred by arable farmers of Khumaga due to wildlife crop raiding may create negative attitude
1666 towards wildlife and wildlife conservation. Dar et al. (2009) argued that conflict can reduce
1667 local tolerance towards wildlife conservation and also conservation of other non-conflict
1668 species. In India for example, more than 100 elephants are fatally injured every year through
1669 retributive action by people (Jadhav & Barua, 2012). In Kenya, pastoralists are reported to have
1670 poisoned and speared the lions (Frank, Hemson, Kushnir, & Packer, 2006; Frank, Maclellan,
1671 Hazzah, Bonham, & Hill, 2006). The results of other studies (e.g. Dar et al., 2009; Frank,
1672 Hemson, et al., 2006; Jadhav & Barua, 2012) are in line with the argument of SET.

1673 Social exchange theory postulates that if benefits of wildlife conservation outweigh its costs, a
1674 community is more likely to support conservation initiatives, but if costs of conservation
1675 outweigh benefits local communities will not support conservation. An individual that perceives
1676 benefits from an exchange is likely to evaluate it positively; one that perceives costs is likely to
1677 evaluate it negatively. Thus, residents perceiving themselves benefiting from wildlife
1678 conservation through tourism are likely to view it positively (Andereck et al., 2005).

Results of this study support the SET that people will not support something if they do not get benefits out of it. Farmers do not want elephants in their area because they do not benefit from them hence they suggests translocation of elephants as a way of transferring the cost elsewhere since the law of Botswana prohibits killing of problem animals Farmers know that no other way will work except an option that looks like it is conservation related therefore suggesting translocation. They do not want to see elephants within or in vicinity of their arable lands and they even call them satanic creatures. They want the elephants to be removed from their area to elsewhere, because living with elephants is a cost to them, not a benefit. Elephants can raid the entire field in one night and leave the field bare. These animals with their body size and strength, overpowered humans when they interfered with their survival (Warner, 2008). Farmers therefore are unable to guard fields against them. In this regard, persistent wildlife crop raiding at Khumaga has the potential to increase retaliation by farmers towards elephants. This study therefore suggests for collaborative management between farmers and wildlife managers, to increase benefiting from living with elephants and other wildlife and formation of viable mitigation strategies that will reduce the level of impact caused by wildlife in Khumaga and lessen the problems that farmers are facing as a result of wildlife crop raiding. That will result in improvements of local livelihoods and contribute to wildlife conservation motives. Training of farmers in deterrent techniques to prevent crop-raiding is also recommended by this study.

5.5 Recommendations

Based on the results of this research, the following recommendations are proposed:

- A) *Introduce collaborative management between farmers and wildlife managers at Khumaga:* This study recommends collaborative management between farmers and wildlife

1701 managers. Collaborative management refers to a partnership by which various stakeholders
1702 agree on sharing among themselves the management functions, rights and responsibilities of
1703 controlling and taking care of resources under protected status (Borrini-Feyerabend, 1999). This
1704 can reduce hatred and negative perception of farmers if they are allowed to become custodians
1705 of wildlife and make decisions about wildlife use (Metcalf, 1994). This can increase benefits
1706 from living with elephants and other wildlife. Community Based Natural Resource
1707 Management (CBNRM) projects are highly recommended at Khumaga.

1708 In CBNRM, rural communities have rights over the elephants and other wildlife, but these rights
1709 are part of a larger conservation plan that focuses on sustainable use of natural resources. Based
1710 on National parks and Game Reserves Regulations of 2000, the management plan for a national
1711 park or game reserve may designate an area as a community use zone and community use zones
1712 shall be for the use of designated communities living in or immediately adjacent to the national
1713 park or game reserve to conduct commercial tourism activities.

1714 B) ***Strengthen government preventative measure:*** Patrols by DWNP officers are an essential
1715 requirement in Khumaga. PAC offices should be located at Khumaga as it was before the
1716 construction of the fence around the park; this will enable the officers to attend to reported cases
1717 on time and to carry patrols around the village. Well-constructed electric fences will deny the
1718 access of migratory elephants into people's ploughing fields. However, the cooperation and
1719 participation of local people for such an activity through regular monitoring of fence line and
1720 its maintenance are extremely essential. Farmers of Khumaga seek for innovative methods to
1721 keep animals away from their fields, they still have a feeling that electric fence can help in
1722 mitigating HWC in their area

C) ***Need for long term research and monitoring:*** This study found that there is a lack of research at Khumaga on human-wildlife interaction. Further studies should be carried out to design the site specific appropriate strategy to HWC and to improve local livelihoods. Understanding the population ecology of wild animals and their patterns of crop raiding is a prerequisite for implementing effective control measures. In Khumaga, no studies have been done to estimate elephant abundance and their migratory routes.

5.6 Limitations of the study

The limitations of this study include the following:

1. The study was limited to Khumaga, Boteti and the results cannot be generalized to all human wildlife conflict hotspot areas in Botswana. Results can only be generalise only when the socio-economic, ecological and demographics are the same.
2. The researcher didn't manage to use cronbach alpha because of the inadequate number of items. The items were mixed therefore not measuring the same thing. Adequate internal consistency reliability can be obtained with minimum of four or five items per scale (Harvey, Billings, & Nilan, 1985) however current studies should cover this limitation.

5.7 Contribution to knowledge

- a. This study has managed to reveal the extent of crop raiding by wildlife in Khumaga area in social and economic terms, and it brought to the surface the growing negative perceptions of the farmers towards the wildlife, especially elephants that are most destructive and frequent raiders of the crops.
- b. The study also revealed ideas that farmers have about preservation of sustainable livelihoods in Khumaga. This study indicates a need to address the concerns of Khumaga

1745 farmers either through suggesting alternative economic options to them or removing the
1746 problem elephants from their area.

1747 c. New facts have emerged and include total destruction of fields by elephants (up to 99%
1748 of the planted hectare), and that elephants in Khumaga even destroy fields during the day in the
1749 late afternoons. Other facts include the positive attitude that the farmers have towards wildlife
1750 but not the presence of elephants in their farms.

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6.0 REFERENCES

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2070

2071

APPENDICES

2072

APPENDIX 1: Arable farmer Questionnaire

2073



2074

2075

WILDLIFE CROP RAIDING AND ITS IMPLICATIONS ON LIVELIHOODS OF KHUMAGA, BOTETI SUB-DISTRICT, BOTSWANA

2078

STUDENT NAME: KENALEKGOSI GONTSE

2079

ID NO: 201208213

2080

2081

SUPERVISORS: Prof. J. E. Mbaiwa

2082

Dr. O.T. Thakadu

2083

2084

2085

University of Botswana, Okavango Research Institute

Survey Number	Date	Time Start: Time End:
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2086

2087 **Section A: Demographic Data**

2088 A1. Name of interviewee.....

2089 A2. Sex 1) male []..... 2) Female []

2090 A3. Age.....;

2091 A4. Marital status single [] married [] Divorced [] others []

2092 A5. Education level primary [] secondary [] tertiary [] none []

2093 A6. Ethnicity [].....Banajwa [] Bayei [] Basarwa [] Bahambukushu. [] others []
2094]

2095 A7. Religion Christian [] African tradition [] None []

2096 A8. What is your totem?

2097 A9. How many are you in your
2098 homestead?.....

2099 **Section B. To assess the effects of wildlife crop raiding on the livelihoods of Khumaga**
2100 **community**

2101 B1. Have you been growing crops in the past 5 years? Yes [] no []

2102 B2.Do you sell if there is surplus? Yes [] no []

2103 B3. Have you collected seeds from government in the past 10 years? Yes [] no []

2104 B4.What challenges do you face as a farmer in your area?

	Strongly agree	Agree	neutral	disagree	Strongly disagree
--	----------------	-------	---------	----------	-------------------

Wildlife crop raiding					
Low rainfall shortage of machinery					
other (specify)					

2105

2106 B6. Apart from arable farming what are your other livelihoods options?.....

2107 B7. Have you ever experienced crop raiding by wildlife in the last 5 years?

	Yes	No
2014		
2013		
2012		
2011		
2010		

2108

2109 B8. Which wildlife species have raided crops in your area in the last 5 years?

Kudu	
. Elephant	
. Hippo	
. Porcupine	
. Monkey	
. Duiker	
Other	

2110

2111 B9. Of the above mentioned wildlife species, which one raided crops mostly in the last 5 years?

Kudu	
. Elephant	

. Hippo	
. Porcupine	
. Monkey	
. Duiker	
Other	

2112

2113 B10. Which crops are mostly destroyed by the animals mentioned above?

. maize	2114
Sorghum	
.watermelon	
Beans	
Ground nuts	
Other	

2115

2116 B11. How has crop raiding affected your livelihoods?

Year	List of crops ploughed	List of crops destroyed	Hectares ploughed	Hectares destroyed	Expected yield per crop	Actual yield per crop
2014						
2013						
2012						
2011						
2010						

2117

2118 B12. Other than crop raiding how does wildlife species affect your livelihoods?

Fence Damage	
Fear of walking	
Property Destruction	
Others (specify)	

2119

2121 **Section C. To examine the trends in incidents and nature of wildlife crop raiding in**
 2122 **Khumaga area over the last 10 years**

2123 C1. What do you think causes wildlife crop raiding?

2124 C2. For the past 10 years do you think people's livelihood in this community has been affected
 2125 by crop raiding? Yes [] No []

2126 If _____ yes

2127 How?.....

2128 C3 Has the erection of **game proof fence fence** influenced wildlife crop raiding?

2129 Yes [] No [] Don't know []

2130 C4 How was the conditions of wildlife crop raiding **before** the fence and **immediately after** its
 2131 erection then **now**?

		Better					Worse
2000- 2004	Before	1	2	3	4	5	
2005- 2009	After						
2010- 2014	Now						

2132

2133 C5 Did the **flowing of the Boteti river** influence wildlife crop raiding?

2134 Yes [] No [] Don't know []

2135

2136 C6 How was conditions of wildlife crop raiding **before** and **after** the flowing of the river?

		Better Worse				
2004-2008	Before	1	2	3	4	5
2009-2014	After					

2137

2138 C7 Please answer the following question by filling in the most appropriate response according

2139 to your understanding/ knowledge.

Animals liable to damage	Crop damage
Kudu	
Elephant	
Hippo	
Porcupine	
Monkey	
Others	

2140

2141 C8 Which mitigation strategies are you using to protect crops? Tick where appropriate.

Guarding the crops	
Making false human structure	
Loud sound	
Chilli pepper	
bee hives	
Use of traps	

Firing	
Other (specify)	

2142

2143 C9. At what stage in the growing cycle are crops mostly affected?

2144 Germination []

2145 Seedling []

2146 Flowering []

2147 Harvesting []

2148 C10. How often do these wildlife species raid crops?

2149 Daily []

2150 Weekly []

2151 Monthly []

2152 Other []

2153 C11. What time of the day do these wildlife species mostly raid and destroy crops.

2154 Morning []

2155 Afternoon []

2156 Evening []

2157 Night []

2158 C12. What do you do after wildlife crop raiding incidents?

2159 Report to DWNP officers []

2160 Kill them []

2161 Nothing []

2162 Other (specify)

2163 C13. How long does the Department of Wildlife and National Parks attend to reported cases

2164

2165

2166 C14. Do the DWNP officers attend to reported cases on time? Yes [] No []

2167 C15. If no what reasons do Department of Wildlife and National Parks officers usually give for failure to
2168 attend to reported wildlife crop raiding incidents on time?

2169 Shortage of staff []

2170 Unavailability of vehicle []

2171 Other (specify).....

2172 C17. How often do the DWNP officers' conduct patrols in your area?

2173 Weekly []

2174 Monthly []

2175 Yearly []

2176 Other (specify).....

2177 C18. Have you ever received compensation for crop loss by wildlife? Yes [] no []

2178 C19. How long did they take to compensate?.....

2179 C20. Do you think the compensation for crop raiding is fair? Yes [] No []

2180 C21. If NO is it because it doesn't cover;

2181 The cost of growing the crop []

2182 The resale value of the crop []

2183 The cash required to purchase additional food []

2184 Other reason (specify).....

2185

2186 **Section D. To assess perceptions of the Khumaga people towards wildlife conservation**

2187 D1. Conserving wildlife species is important.

2188 Strongly agree []

2189 Agree []

2190 Neutral []

2191 Disagree []

2192 Strongly disagree []

2193 D2. What do you want to done about crop raiders in this area?

	Kill All of them	Kill some	Let farmers Kill some	translocate them	Leave them
Kudu					
Elephant					
Hippo					
Porcupine					
Monkey					
Others					

2194

2195 D3. Please answer the following questions by choosing the most appropriate response according

2196 to your feelings.

	Love	Like	Neutral	Dislike	Hate
Kudu					
Elephant					
Hippo					
Porcupine					
Monkey					
Others					

2197

2198 D4. How do you feel about DWNP?

2199 Like []

2200 Neutral []

2201 Dislike []

2202 Hate []

2203 D5. Is zoning of Makgadikgadi National Park for wildlife based tourism instead of crops and

2204 livestock farming a good thing? Yes [] No []

2205 D6. Makgadikgadi National Park is a waste of land

2206 Strongly agree []

2207 Agree []

2208 Neutral []

2209 Disagree []

2210 Strongly disagree []

2211 D7. Do you like living with wildlife around you? Yes [] no [] not sure []

2212 D9. What do you suggest should be done for human and wildlife species to coexist?

2213