

The Hidden Costs of Human-wildlife Conflict in Mukungule Game Management
Area, Mpika District, Zambia

By

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requirement of the degree of Master of Science in Environmental and Natural
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CERTIFICATE OF APPROVAL

This dissertation of Philip James Muyoma has been approved as fulfilling the requirements or partial fulfillment of the requirements for the award of Master of Science in Environmental and Natural Resources Management by the University of Zambia.

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Abstract

Human-wildlife conflict (HWC) has presented serious challenges to people living in Mukungule Game Management Area (GMA). Located next to the North Luangwa National Park (NLNP), the people living in the GMA have over the years experienced HWC. Many of their livelihood activities usually come in contact with wildlife. The major livelihood activities for the local people are farming and charcoal production. Both these activities involve the clearing of land leading to massive encroachments of areas which are predominantly habitats for wildlife. Furthermore, the perceived increased in wildlife populations due to reduced poaching has led to a lot of wildlife leaving the Park into the GMA, where human activities are allowed.

The aim of the study was to examine the nature of human-wildlife conflict and their subsequent hidden costs in Mukungule GMA, northern Zambia. Four objectives were set for the study, these were; determine the main type of HWC that occur within the study area, investigate factors leading to conflict, identify the hidden costs associated with HWC within the study area and to explore the distribution of hidden costs among community members.

By using questionnaire surveys, focus group discussions, in-depth interviews and field observations, the study examined the nature of Human-wildlife Conflict and their subsequent hidden costs on the affected communities living in the GMA. The study area was divided into three clusters where a sample of 124 households was conveniently sampled for the household survey. Three FGDs were conducted, one in each cluster, and three key informant interviews were conducted in each cluster. Furthermore, key informant interviews and focus group discussions were conducted in each cluster.

The study shows that expansion of agricultural activities has led to an increase in humans encountering wildlife, leading to HWC. Elephants, bush pigs and monkeys are the most problematic animals. Crop raiding was found to be the most common form of conflict, largely because farming is widely practiced and is the major economic activity in the area. The hidden costs of conflict identified were; increased exposure to mosquitoes, reduced incomes, food insecurity, school dropouts and opportunity costs.

The study recommended that in order to address HWC there is need to, introduce alternative livelihood sources such as bee keeping alongside there farming activities, growing crops that are unpalatable to wildlife in areas that are prone to crop raiding, while growing crops for consumption near their homesteads and strengthen the enforcement of land use plans of the GMA to ensure that they are followed strictly by all members of the community. This will help to safe guard crops as agriculture will be concentrated away from known HWC hot spots.

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List of acronyms

CBNRM	Community Based Natural Resources Management
COMACO	Community Markets for Conservation
CREATE	Conservation Research on East African Threatened Eco-systems
CRBs	Community Resource Boards
CSO	Central Statistics office
FAO	Food and Agricultural Organisation
FGD	Focus Group Discussion
FZS	Frankfurt Zoological Society
GMA	Game Management Area
GRZ	Government Republic of Zambia
HCT	Human Capital Theory
HC	Human-wildlife Conflict
IFAD	International Fund for Agriculture Development
IUCN	International Union for Conservation of Nature
KI	Key Informants
MHDT	Mpika Health District Team
NGO	Non-governmental Organisation
NLNP	North Luangwa National Park
SPSS	Statistical Package for Social Sciences
SARPO	Southern African Regional Programme Office
UBS	Universal Book Stall
UNICEF	United Nations International Children Educational Fund
WWF	World Wide Fund for nature
ZAWA	Zambia Wildlife Authority
ZDHS	Zambia Demographic Health Survey
ZMW	Zambian Kwacha

CHAPTER ONE: INTRODUCTION

1.1 Background to the study

Present-day wildlife conservation faces serious challenges in trying to formulate a balance between human needs and survival of endangered wild animal species. Wildlife conservation is increasingly taking place in heavily human-affected ecosystems, which are simultaneously the locations of rural poverty and biodiversity (Johansson, 2008; Richardson *et al.*, 2012). Competition for resources between humans and animals in such areas frequently results in human-wildlife conflict (HWC). The occurrence of human-wildlife conflict is common all over the world. In Zambia, human-wildlife conflict is very common in Game Management Areas (GMAs) where human settlements and wildlife co-exist. This has presented challenges in meeting the needs of local people as well as those of wild animals. Challenges are compounded by limited livelihood alternatives and infrastructure, lack of sufficient agricultural inputs, and poor or restricted access to credit (Richardson *et al.*, 2012).

GMAs are designated areas around National Parks that are intended to act as buffer zones between human settlements and areas for wildlife protection. Only activities that are compatible with wildlife protection are allowed within these areas, including managed Safari Hunting and Photographic Safaris. GMAs were primarily intended to achieve the dual objectives of addressing sustainable natural resources management and socio-economic development of local communities (GRZ, 1998; Richardson *et al.*, 2012). However, continuing increased human habitation within GMAs has led to proliferation of livelihood activities that are affected by the presence of wildlife. These activities include subsistence agriculture, charcoal production and fishing (Simasiku *et al.*, 2008, Richardson *et al.*, 2012). Human-wildlife conflict has therefore been a major problem in many GMAs in Zambia, particularly where farmers routinely experience crop destruction by wildlife despite help provided by the Zambia Wildlife Authority (ZAWA) and NGOs operating in GMAs.

Conflict situations can arise anywhere, but are frequently concentrated at the edges of wildlife reserves where land and soil are often fertile and very productive for agriculture (Nelson *et al.*, 2003). Mukungule GMA adjoining the North Luangwa National Park in northern Zambia is no exception; the area experiences considerable human-wildlife conflict, mainly manifested as crop raiding, competition for available resources (mostly forest products), injuries or deaths of local people, and in some cases killing of the animals involved (Monney *et al.*, 2010). Conflicts arise from a range of direct and indirect negative interactions between humans and wildlife (Hill *et al.*,

2002). These interactions can culminate in harm to all involved, lead to negative human attitudes towards wildlife and conservation, decrease human appreciation and tolerance of wildlife, and potentially undermine conservation efforts (Nyhus *et al.*, 2000; Korbee, 2007; Dickman, 2010).

Crop-raiding incursions by elephants, for example, can inflict extensive crop and property devastation locally, and have a significant impact on community perceptions of conservation areas (Osborn and Parker, 2003; Graham and Ochieng, 2008). An indicator of the potential severity of conflict can often be seen in responses by affected communities, many of which make desperate and dangerous attempts to kill elephants to protect their crops, lives, and livelihoods (Choudhury, 2004; Mackenzie and Ahabyona, 2012). These events show that community tolerance of elephants often deteriorates quickly, threatening to undermine conservation initiatives (Kangwana, 1995; Madden, 2008; Zimmerman, 2009).

Like in many rural areas of Zambia, HWC has persisted over many years in Mukungule GMA. This is despite various attempted mitigation measures introduced for communities and households to safeguard their crops and property from wildlife damage (Frankfurt Zoological Society, pers. comm.). Persistence of conflict and difficulties in mitigating its impacts are common globally. Reports of conflicts generally increase with increased human habitation around protected areas (Messmer, 2009) often resulting in long-term food insecurity that perpetuates already extensive poverty (Simasiku *et al.*, 2008). Ogra (2008) indicates that, on average, seasonal losses due to crop-raiding may range from 20 to 50 per cent of anticipated yield, and underscore the hardship that HWC presents to poor farming communities. Given the importance of HWC and its impacts on human welfare and conservation efforts, considerable scholarly attention is now focusing on understanding the drivers of HWC and how conflict and losses can be mitigated.

However, many approaches to framing and studying human-wildlife conflict only emphasize its visible direct costs. Hidden impacts remain poorly addressed, and include costs that (a) are indirect or uncompensated, (b) may involve foregone opportunities, (c) are usually temporary delayed, and/or (d) are often psychosocial in nature. There remains, in this regard, the need to understand these hidden costs. This study, therefore, examines the nature of human-wildlife conflicts in Mukungule GMA and the hidden and opportunity costs associated with conflicts for local people.

1.2 Statement of the Problem

Human-wildlife conflict has ravaged many parts of rural Africa over the years. A range of studies have shown the implications of these human-wildlife conflicts on rural livelihoods and conservation efforts, noting particularly negative impacts on household food security and livelihoods through crop damage and livestock depredation by wildlife (Messmer, 2009, Simasiku *et al.*, 2008). Mukungule GMA is no exception to this trend. The GMA has been identified as a hot spot for HWC and that the problem has persisted since the 1930s (Nyirenda *et al.*, 2011; Sennett, 2013). There is an increase of reports of people encountering wildlife and bearing the associated costs. In most studies conflict is predominantly framed and measured in terms of its visible impacts (Treves *et al.*, 2006). These are impacts that are easy to notice and can be readily evaluated. Hidden impacts on the other hand are often overlooked and poorly addressed in the relevant literature. This frequently results in only a partial evaluation of the impacts of conflict on people's wellbeing (Ogra, 2008). This major gap in the literature regarding hidden costs presents a challenge to HWC management and conservation efforts. Local people are key to effective HWC management and conservation efforts. If the costs of HWC are borne entirely by local people and are not adequately identified or dealt with, this may increasingly hinder various conservation and HWC management efforts over time. In this regard, this study seeks to examine the various impacts of HWC for communities in Mukungule GMA, particularly focusing on identifying and understanding the hidden costs.

1.3 Aim of Study

The aim of the study was to examine the nature of human-wildlife conflicts in Mukungule GMA, northern Zambia and their subsequent hidden costs.

1.4 Objectives

The following were the objective of the study:

1. Determine the main types of HWC that occur within the study area.
2. Investigate the factors that lead to HWC.
3. Identify the hidden costs associated with HWC within the study area.
4. Examine the distribution of hidden costs among community members.

1.5 Research questions

The research questions of the study were as follows;

1. What form do HWCs in Mukungule GMA often take?
2. What are the main factors lead to these human-wildlife conflicts?
3. How do these conflicts impact livelihoods of people in the GMA?
4. What are the hidden costs associated with HWC in the study area?
5. How are these costs distributed among affected people in the study area?

1.6 Rationale

This study aims to examine the nature of HWC in Mukungule GMA and investigate its costs, with particular emphasis on the hidden cost of human–wildlife conflict. It presents an account of identified and potential hidden impacts, investigating their effects for rural communities. The study has provided recommendations that could be used to review current wildlife conservation policies, enhance their effectiveness, and formulate changes to help mitigate conflict for local communities. The findings are also more broadly important for policy decision-makers by providing greater insight about problems frequently associated with wildlife conservation in GMAs. Community developers working in GMAs can use the findings as tools to increase awareness of HWC issues and management options in local communities. Additionally, the study contributes to the pool of wildlife conservation knowledge and therefore is useful for the academic fraternity and those interested in wildlife conservation.

1.7 Organisation of the dissertation

This dissertation comprises six chapters. Chapter One provides the background and introduction to the study. Chapter Two is the literature review, focusing on human-wildlife conflict in general as well as direct and hidden costs of conflict and aspects of HWC management more specifically. Chapter Three describes the social, economic and ecological characteristics of the study area. Chapter Four details the methods used in the study. It highlights the selection of study sites and collection of data, as well as data processing and analysis. Chapter Five presents the results as well as discussion of the research findings. Chapter Six comprises conclusions and recommendations.

CHAPTER TWO: LITERATURE REVIEW

This chapter provides a review of literature relevant to this study. It discusses key issues of HWC, including the nature, effects, and costs, as well as management options that have been suggested. It also shows measures that have been undertaken in other regions of the world to address HWC.

2.1 Description of human-wildlife conflict

Human-wildlife conflict (HWC) can be described as conflict that arises from negative (i.e. adverse or unfavourable) interactions between humans and wildlife. According to Madden (2004), HWC occurs when the needs and behaviour of wildlife impact negatively on the goals of humans, or when the goals of humans impact negatively on the needs of wildlife. Interactions can have both positive and negative ramifications, and Morzillo (2014) proposes that from a human perspective, interaction outcomes range across a continuum from entirely positive to completely negative. Human-wildlife conflict particularly affects both humans and animals at the fringes of human settlements that intersect with wildlife refuges, where the actions of both lead to conflict. Outcomes for humans are often destruction of crops and/or property, injuries, or loss of human life, while wildlife may suffer injuries and retaliatory killings (WWF, 2008). Conflicts have been taking place from time immemorial, but in many regions, their frequency has been increasing markedly over recent decades (Browne-Nunez and Jonker, 2008; Dickman, 2010). In many cases, rapid growth in human populations near areas protected for wildlife has led to encroachment into protected areas, thereby disturbing wildlife habitat (Lamarque, 2009).

2.2 Nature and increase of human-wildlife conflict

Crop damage is the most prevalent form of human-wildlife conflict affecting people whose livelihoods are dependent on agriculture (Graham *et al.*, 2009). Livestock depredation, property damage, and injury or killings of people are other common forms of conflict with wildlife in areas affected by HWC (Gadd, 2005; Barua *et al.*, 2013). Where conflicts are attributed to elephants, property damage frequently includes houses and grain stores (Walpole *et al.*, 2004; Fernando *et al.*, 2005).

Increasing human populations and expanding agriculture have increased the potential for conflict between humans and wildlife in many regions. As a result, humans and wildlife compete directly for farming land that is becoming increasingly scarce (Parker *et al.*, 2007). With growth in human populations and reduction of wildlife habitat the conflict intensifies in severity, leading to

increased threats to human lives and livelihoods as well as conservation of wildlife species. Woodroffe and others (2005), note that increases in the amount of land transformed and used by humans has led to a drastic reduction in natural habitats for wildlife, resulting in increased competition for land and resources between humans and wildlife. Human-wildlife conflict is largely universal; from tigers killing cattle in Malaysia and elephants trampling fields in Africa, to sun bears destroying corn crops in Colombia and wolves attacking sheep in Italy (Lamarque *et al*, 2009; WWF, 2008). It happens around the world, affects affluent and poor, and is adverse for all concerned (WWF, 2008). Madden (2008:189) emphasizes that;

Causes of HWC increase include the expansion of human populations into or near to areas inhabited by wildlife, intensification and modification of human uses of those areas, and fragmentation and loss of habitat in those areas. Additional root causes of HWC include the designation of protected areas, where human activity is forbidden or strictly limited, that are insufficient in size for wildlife needs.

The affected community's livelihoods are disturbed. People in the rural areas depend highly on crops from their farm activities for sustenance; some crops are consumed while others are sold. An individual's ability to deal with crop loss may be influenced by numerous factors, which could be ecological or social. Individuals with relatively large landholdings are usually best able to manage losses, while poorer individuals usually do not fare well and have compounding vulnerability because they live in risky areas and have few resources to cope with losses (Naughton *et al.*, 2000).

Wild animals have proved to be pests in many regions by damaging crops, leading to compromised household food security. For example, the amount of crop damage that can be caused by a herd of elephants in one night has high potential to render a household without food until the next farming season. This is particularly the case in rural areas of Africa where food security and livelihoods are tenuous in poor communities on the periphery of protected areas (Monney *et al.*, 2010). There is a strong need for effective measures to be taken to find and implement mitigation actions against HWC in areas of high conflict (HWC hot spots), particularly in areas where conflicts are impacting very negatively on the livelihoods of communities (Hanks, 2000).

Studies of HWC conducted over the years have revealed that a wide variety of wildlife species act in ways that cause harm to human livelihoods (Conover 2002). Two perspectives have been used in these studies; either from the wildlife conservation perspective or analysis from the perspective of people affected by conflicts (Musyoki, 2007). Wildlife biologists are usually most interested in

the consequences of crop raiding for wildlife and focus on conservation. Social science studies, on the other hand, are more likely to adopt farmers' perspectives in their investigations about crop raiding. These studies examine needs and aspirations of local communities to bring socio-economic insights to HWC problems. According to Musyoki (2007), many studies provide estimates of the extent of losses experienced by farmers but very few explore the meaning of these losses to farmers.

Managing HWC is complex because it requires the involvement of many stakeholders. Efforts of government through various agencies, development organizations, conservation organisations, and local communities are required to find appropriate lasting solutions. The complexities arise because of the different interests of each stakeholder group. Of the parties involved, local community participation has frequently not played a large role due to the perception that wildlife management is the responsibility of central governments (Lesley, 2000; Songorwa *et al*, 2000). But with communities living near wildlife being the major victims, there have been increased calls for their participation and a leading role in managing HWC. Zimmermann (2009) highlights that, best practice in human-wildlife conflict mitigation promotes the need to empower local communities and encourage them to take responsibility for preventative actions. However, government agencies need to provide the necessary framework within which local people can operate. In many areas, including the GMAs around the North Luangwa National Park, there is need for tailor-made management structures that not only encourage but also motivate communities to participate actively in safeguarding their lives and livelihoods. Furthermore, participatory HWC management is not an end in itself offers a platform to provide long-term strategies that are widely accepted by all stakeholders (Osborn and Parker, 2002; Webber and Hill, 2014). In the absence of such strategies, wild animals continue to use human-occupied areas outside protected areas to survive, thereby generating conflict. Additional contributing factors to the HWC challenges faced by people living near protected areas include a lack of co-management and co-ownership opportunities for local people, and costs that are out of proportion to the benefits for local people of living with wildlife (Hill *et al.*, 2002; Berkes, 2004).

2.3 Costs of human-wildlife conflict

The often-protracted nature of human-wildlife conflict over extended years can exert numerous costs on households and communities, including loss of crops and livestock, destruction of property, injuries and deaths in some cases, and loss of opportunities (Dickman, 2010). Based on

the different perceptions that can be adopted, a range of costs of HWC for local people have been identified, involving economic, social, ecological, and cultural factors.

2.3.1 Visible costs

The costs associated with HWC are usually identified by noticeable effects and therefore are referred to as visible or direct costs (Barua, 2013). These are most commonly crop and/or property damage but also include physical injuries or death. Food security has been compromised in many areas that are vulnerable to crop losses, particularly to elephants in the Zambian case; costs are often uncompensated and impacts are increased by limited infrastructure, shortages of agricultural inputs, and lack of access to affordable credit (Richardson *et al.*, 2012).

2.3.2 Hidden costs

On the other hand, hidden costs also exist. These are costs that are not readily noticeable but still experienced and borne by affected communities. Hidden costs are poorly addressed in the HWC literature and most research attention has focused on visible or direct costs. Hidden costs may include loss of sleep hours, increased workload, family breakups, foregone opportunities, reduced school attendance by children, fear, and in some cases mental health problems (Hill *et al.*, 2002; Barua *et al.*, 2013). These costs are frequently additional to visible or direct costs, particularly crop damage by wildlife. Ogra (2008) describes hidden costs as those characterized as uncompensated, temporally delayed, and psychological or social in nature. Hidden costs manifest as decreased returns from livelihoods, reduced food security, poor health, increased opportunity costs, and diminished wellbeing (Barua *et al.*, 2013). Madden (2008) describes costs emanating from human conflicts with gorillas in Bwindi Impenetrable National Park, Uganda, as having great impact on the livelihoods of affected households.

Community participation in management of conflict becomes, especially important because affected communities are major stakeholders. As a result, co-management of HWC as an approach to finding the solution is vital.

2.4 Conflict mitigation measures

As discussed in the preceding section, HWC can be very costly for affected households and communities, and hence various mitigation measures have been used with varying success. Common mitigation measures include non-electric barriers, chilli fences, burning chilli bricks, physical guarding, use of fire crackers, and producing loud noises using metal plates or pots

(Osborn, 2002; Sitati and Walpole, 2006; Hill and Wallace, 2012). These initiatives frequently do not provide lasting solutions to the issues of HWC. Several studies (see Dunham *et al.*, 2010; Hoare, 2012; Harich *et al.*, 2013) suggest reduced competition for land and other resources between humans and wildlife could be a solution to HWC, which could be achieved through better land-use planning.

2.5 Managing human-wildlife conflict

Treves and colleagues (2006) promote the concept of co-managing human-wildlife conflicts, calling for collaboration between local communities and wildlife managers. It is from such collaborations that effective management without destruction of biodiversity may result. Treves and colleagues (2006) also identify the role of non-governmental organizations (NGOs) as crucial because they often provide technical skills and materials to local stakeholders. NGOs can also help to diffuse potential mistrust that may exist between government-agency wildlife managers and local communities affected by HWC.

Usually (by mandate) the main focus of government agencies is conservation of wildlife, while local communities are primarily interested in maintaining their sources of subsistence and livelihood; conservation is rarely a major goal for communities, especially if they have already suffered from HWC and have built animosity towards wildlife. However, the value of wildlife cannot be ignored (Chardonnet *et al.*, 2002). As a result, government agencies should incorporate local communities in wildlife management efforts, including managing HWC. Participatory HWC management should be seen as part of community-based natural resources management (CBNRM) schemes, which aims to provide opportunities for communities to benefit from revenues and employment arising from tourism and recreational hunting on their communal lands (Scholes and Mannell, 2001). In Zambia, CBNRM schemes often have operational weaknesses such as problems of equitable benefit-sharing among households in affected areas and protected area managers. Elite capture and a lack of transparency or accountability in management of funds remain major challenges (Richardson *et al.*, 2012). Furthermore, in Zimbabwe, CBNRM systems have been criticized for failing to empower local communities and failing to control poaching (Richardson *et al.*, 2012).

The lack of sufficient and clear policies to address HWC often results in spontaneous ineffective crisis management, which focuses on the result instead of the underlying causes of the problem (Kangwana, 1995). The negative political impacts of HWC are usually also disproportionate to the actual impacts on people and their livelihoods (Magome, 2007). Clear policies on dealing with

problem animals are thus vital for government credibility, especially given the sensitive nature of HWC. Policies should state clearly who holds responsibility for problem animals and define appropriate responses. Also, greater attention should be given to involving and empowering local communities in HWC mitigation, which could include developing mechanisms for communities to gain more economic benefits from wildlife. As recognized by Richardson and colleagues (2012), when policies are clear both wildlife protection and communities living in GMAs will benefit, and the goals of conservation are likely to be reached when wildlife are protected and conflict is minimized. Increased involvement and access to benefits would contribute to developing positive attitudes by local people towards wildlife and conservation (Gandiwa *et al.*, 2013). Another strategy employed by conservation agencies has been implementing conservation projects that aim to achieve conservation goals while also advancing the welfare of local communities. Clearly, no single strategy will be adequate and policies will therefore need to integrate different approaches to addressing HWC efficiently (Walpole *et al.*, 2006).

CHAPTER THREE: DESCRIPTION OF THE STUDY AREA

This chapter provides key details of the study area, namely; location, climate, water sources, vegetation, and main socio-economic activities practiced in the area. It further shows the specific sites in the area where data was collected

3.1 Location and size

Mukungule GMA is located in Mpika district of Muchinga Province, northern Zambia, and is situated on the western border of North Luangwa National Park (NLNP) (See Figure 3.1). With an approximate area of 1,900 km², the GMA lies between latitudes 11°10' to 13° 00' south and longitudes 31° 36' to 32°14' east (See Fig. 3.1) (Adapted from ZAWA, 2004).

3.2 Climate

Mukungule GMA is located within a high rainfall ecological zone (Region III) and receives an average of 900mm of precipitation annually, with characteristic tropical climatic conditions. Maximum annual rainfall is approximately 1,200mm. The area has three distinct seasons; hot-wet (November to April), cool-dry (May to August), and hot-dry (September to November) (ZAWA, 2004).

3.3 Relief and Drainage

Mukungule GMA generally lies about 1200m above sea level, although the north most part of the GMA has hill elevating to 1500m above sea level at the foot of the Muchinga escarpment. The south west boundary of the GMA follows the Kalenga range while the south east boundary with the NLNP follows the Ibangwe hills (ZAWA, 2004).

The GMA is drained by a number of perennial rivers and streams, including the Kampamba, Mwaleshi, Lufila, and Mufushi rivers. The main streams in the GMA are Muneshi and Mwanswa, these are usually characterized by dambos. These rivers and streams form an important part of the drainage system for the North Luangwa ecosystem. They are a major source of water for wildlife in the ecosystem, and hence can be a major platform for conflict between humans and wildlife in the area.

3.4 Vegetation

The following vegetation types occur in the study area; Closed forest which comprises of climatic (Dry evergreen forest) and edaphic (Riparian forest), open forest comprising of Miombo

woodland, Mopane woodland, Munga woodland and Munga shrub. The other type of vegetation predominantly found in the area is the grasslands. The vegetation of grasslands occur as, Dambo grasslands, Bog grasslands and Riverine grasslands (Fanshawe, 1970; Fanshawe 1971). The vegetation provides the habitat for wildlife, as the GMA provides a buffer between Park and organised human settlements.

3.5 Socio-economic activities

The people of Mukungule GMA are primarily Bisa, although many are Bemba speakers. The Bisa have lived in the area for over two centuries (Garoon, 2009). Livelihood activities of people in Mukungule GMA are predominantly (a) crop-based agriculture; (b) livestock production of cattle, goats and sheep; (c) gardening along banks of water courses, and (d) employment associated with North Luangwa National Park, (ZAWA, 2004). Selling of crops, livestock, or other commodity items is also a major income earner in the GMA. Groundnuts often return the most profitable income, followed by beer brewing, (ZAWA, 2004). Natural resources utilization has provided some alternative livelihood activities, including hunting, fishing, weaving, and carving (ZAWA 2004). Farming is a major economic activity and because it is done deep in the bush, crops are then vulnerable to the presence of wildlife, which often leads to crop damage and subsequent income loss.

3.6 Study Sites

Six villages in Mukungule Game Management Area (GMA) adjacent to North Luangwa National Park were selected for the study. The villages selected were, Mukungule, Chishala, White, Kabuta, Nkhomba and Kakoko (Figure 3.1). These villages were selected due to their close proximity to the North Luangwa National Park, extensive border with the park, and vulnerability to HWC, which is one of the major challenges faced by households living in GMAs (Richardson et al., 2012). Villages were grouped into three clusters based on their size and proximity to each other: (1) Mukungule cluster (Mukungule village), (2) Chishala cluster (Chishala, White, and Kabuta villages) and (3) Nkhomba cluster (Nkhomba and Kakoko villages) (see figure 3.1). Mukungule village is central within the GMA and, compared to other villages, has the greatest number of people with non-agricultural livelihood activities, although incidents of HWC are still prevalent. It was also important to collect data from Mukungule residents because Mukungule is the administrative centre for the GMA and all HWC incidents are reported to the traditional ruler (Chief Mukungule) based there. Chishala comprises villages closest to NLNP and therefore likely

to be most vulnerable to HWC. These villages provided particularly good insights about everyday experiences of living with protected animals. In contrast, Nkomba is furthest from NLNP and enabled examination of the spatial distribution of conflict. Nkomba also facilitated comparison of experiences of HWC between those living closest to the Park and those located relatively far from the Park. Therefore, each cluster had its own dynamics that collectively provided a comprehensive understanding of HWC issues within Mukungule GMA.

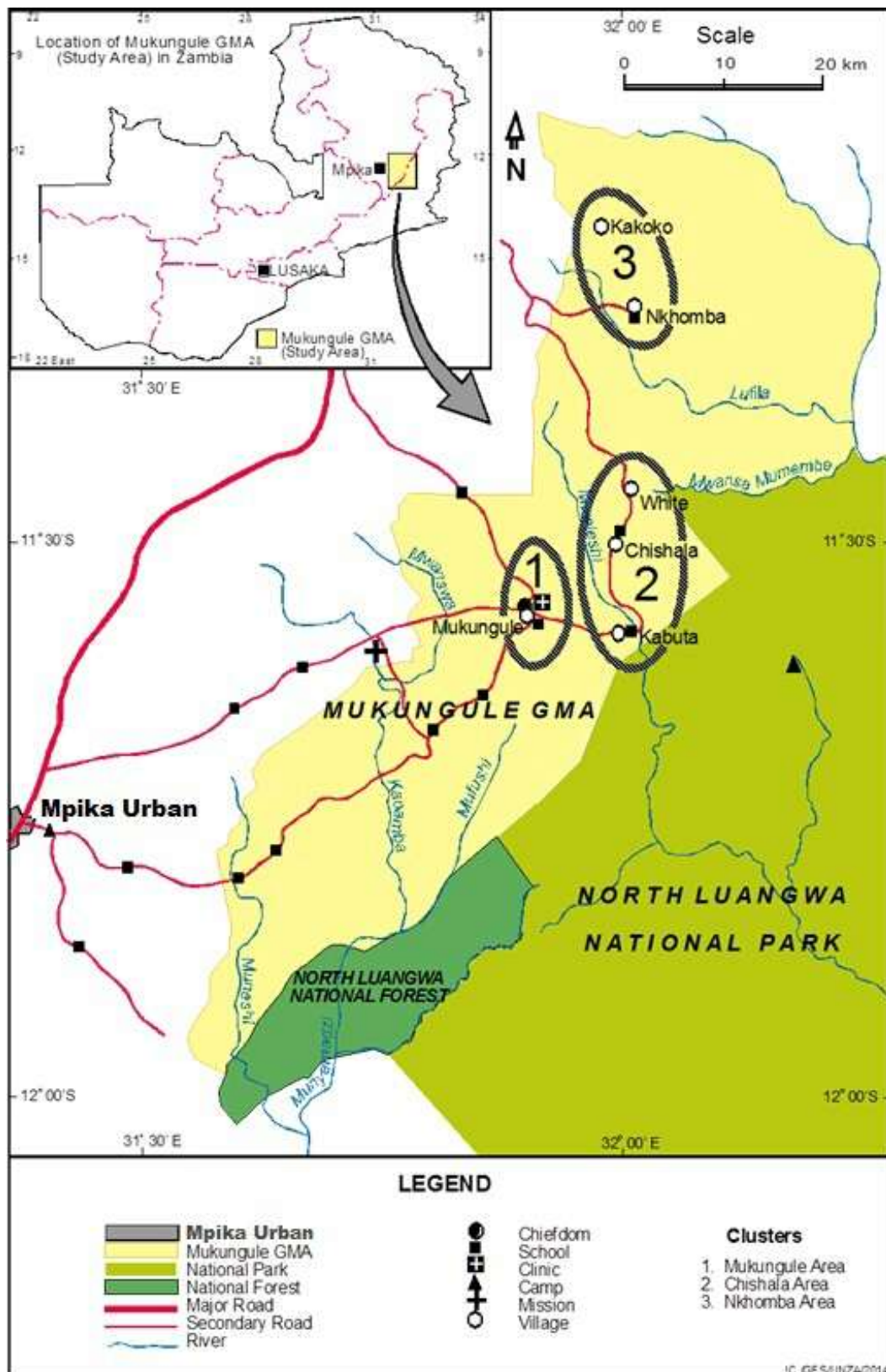


Figure 3.1 Location of the study area

Source: Adapted from ZAWA (2004).

CHAPTER FOUR: METHODOLOGY

This chapter describes the methods used for data collection, sources of data, and how data were analysed, including both primary and secondary data. Given the complexity of human wildlife conflict (HWC) issues, a mixed methods approach was used and both quantitative and qualitative data were collected. This approach enabled triangulation of results through integration of various findings (Bernard, 2006; Hussein, 2009).

4.1 Data Collection

Primary data in this study were collected through a household survey, interviews, and focus group discussions. Data collected using these tools included local perceptions of the nature of HWC in Mukungule GMA, the costs and distribution of conflict, and mitigation measures. Data from the Mpika Health District Team (MHDT) were integral regarding the malaria burden in the study area. In addition, the study used secondary data to complement primary data.

4.2.1 Household Survey

Questionnaires with both open and closed ended questions were administered to households by the researcher through one on one interaction. The questionnaire contained questions organised around areas or themes to be covered (Newing *et al*, 2011). The survey provided data regarding respondents' experiences with wildlife in relation to the research questions. The questionnaire (Appendix 1) was adopted for the household survey administered to one hundred and twenty four households.

4.2.2 Focus Group Discussions (FGDs)

Three focus group discussions were conducted, one in each of the three clusters; guiding questions are provided in Appendix 2. Each focus group discussion had ten participants. Discussions were moderated by a research assistant conversant with local customs and fluent with the local Bemba language. Participants were recruited by the researcher with help from a local village-based guide, and comprised long-term residents of the study villages and those who had experienced human-wildlife conflict recently as well as historically. This profile of participants permitted discussions based on broad experience with HWC, maximising data validity and reliability. Issues explored included the nature of HWC experienced locally, costs incurred, mitigation measures taken, and desired potential actions to alleviate problems associated with human-wildlife conflict.

4.2.3 Key-Informant Interviews

Unstructured interviews were used to collect data from key informants (KI) who, usually by virtue of their role or background, have specialist knowledge or extensive experience. This type of interview provides greatest flexibility in questioning because it does not follow a prescribed set of predetermined questions (Bernard, 2006). This method was used because it provided an opportunity to gain information from decision makers who address conflict situations as well as those who assist victims of conflict, incorporating a range of perspectives and expertise. Among issues discussed during key-informant interviews were the policy implications of human-wildlife conflict, the roles of the Chief and Community Resource Boards (CRBs) in managing conflict, the potential health implications of HWC, and the typical conflict experiences of local long-term residents.

Key informants interviewed were

- The Headman of Mukungule Village (the Chief's advisor).
- A Mukungule Community Resource Board (CRB) officer.
- A Mpika Health District official
- The ZAWA Senior Warden for the Northern Region, Zambia
- Three long-term residents of the study area, one in each village cluster.

4.2.4 Field observations

With assistance from a local guide, the researcher carried out on-sight observations of farming fields that had been recently affected by wildlife. These observations provided an understanding of the extent of damage caused by wildlife and, in conjunction with discussions with farmers, insights about the efforts of people affected by crop raiding to protect their farms. Images showing damage to crops by wildlife as well as measures taken locally to protect fields are provided in Appendix 3.

4.3 Sampling and sample size

The sample was selected on the basis of convenient sampling due to the non-availability of village registers and the fact that most residents were not available in their homes. In this regard, the study depended on the availability of a number of households. For each cluster, the study targeted a sample of at least 20 per cent of households of each cluster. Where opportunity existed to collect more data (i.e. where residents were available and easy to reach) the study went beyond

20 per cent. As a result, the sample for the household survey was 124, distributed as follows; Mukungule 30, Chishala 51 and Nkomba 43.

4.3 Data processing and analysis

Data legibility and completeness of questionnaires were checked on a daily basis after returning from the field. Following data collection, the answered questionnaires were sorted according to the village cluster that each individual household belonged to. Data from the questionnaires were entered into Statistical Package for Social Sciences (SPSS) version 16 to facilitate statistical analysis. Variables, values, and data labels were defined in SPSS. Descriptive statistics were used to analyse responses, particularly in terms of frequencies and proportions. Data were presented using tables and charts.

4.4 Limitations of the research

Because villages in Mukungule GMA did not maintain registers of resident households it was not possible to conduct (theoretical) random sampling, even if this had been logistically feasible. Convenient sampling was used and efforts were made to be aware of and minimise potential selection biases; however, it is possible that the sample was skewed to some extent in favour of respondents at home within each village at the time of sampling. To fully understand patterns of human-wildlife conflict in Mukungule GMA, it would also be beneficial to conduct the research over sequential years, particularly to develop effective, locally-appropriate interventions to deter crop raiding, reduce costs for resident households, and mitigate conflict.

CHAPTER FIVE: PRESENTATION OF RESULTS AND DISCUSSION

This chapter presents and discusses the results of the study. In particular it focuses on the livelihoods of the people in the study area, the nature of HWC, hidden costs of HWC and their distribution among members of the community.

5.1 Livelihoods of people in the study area

The livelihood or occupation of respondents can have an important bearing on their economic productivity and wellbeing. The results show that, across all three village clusters, agriculture is the major economic activity for the majority of respondents (76.9%) (Table 5.3). Other important but less common occupations are charcoal production (14.0%), trading agricultural produce and similar products (7.8%), and formal employment (1.3%). The fact that very few respondents are engaged in other activities indicates a lack of livelihood diversity locally and that respondents are predominantly reliant on crops and farming production for livelihood. It is these agricultural activities that cause local people to come into contact with wildlife and generate conflict situations.

Table 5.1 Main livelihood activities within each village cluster.

Livelihood	Village cluster			
	Nkomba (n=43)	Mukungule (n=30)	Chishala (n=51)	All clusters (n = 124)
	%	%	%	%
Farming	82.4	71.4	76.9	76.9
Charcoal production	13.7	14.3	13.8	14.0
Trading agricultural produce	3.9	11.9	7.7	7.8
Formal employment	0	2.4	1.5	1.3
Total	100	100	100	100

Source: Field data

Trading produce from agricultural activities or similar products (such as charcoal) is an important livelihood activity that compliments growing of crops. Maize, millet and beans are the items traded most within the study area (Figure 5.1). Of respondents who produced crops for livelihood,

53.3 per cent were female and 46.7 Per cent were male, which is consistent with gender distribution for the sample of the household survey and confirms that farming is widespread.

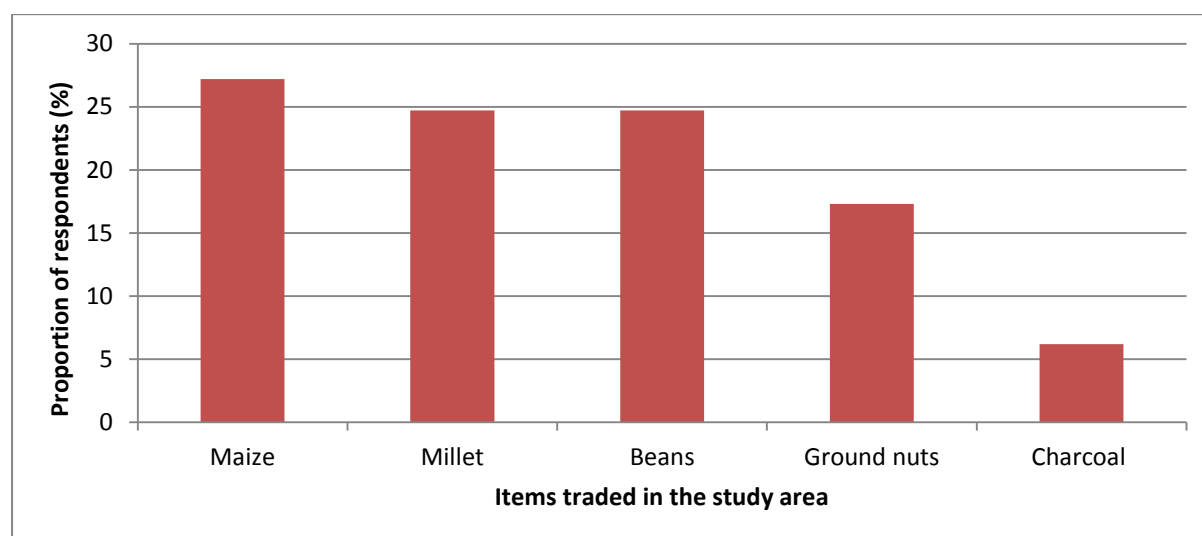


Figure 5.1 Items traded most frequently in the study area.

Source: Field data

As is the case in many other rural regions of Zambia, the people of Mukungule, Nkombwa, and Chishala are facing a wide range of challenges in their livelihoods. However, the findings of this study suggest that the major livelihood problems faced in these areas are wildlife-related. Of the factors impacting livelihoods mentioned by respondents, crop destructions by wild animals was considered the greatest challenge constraining livelihoods in the study area (Figure5.2). Other notable problems included lack of agricultural inputs, limited access to markets, and low selling prices for crops.

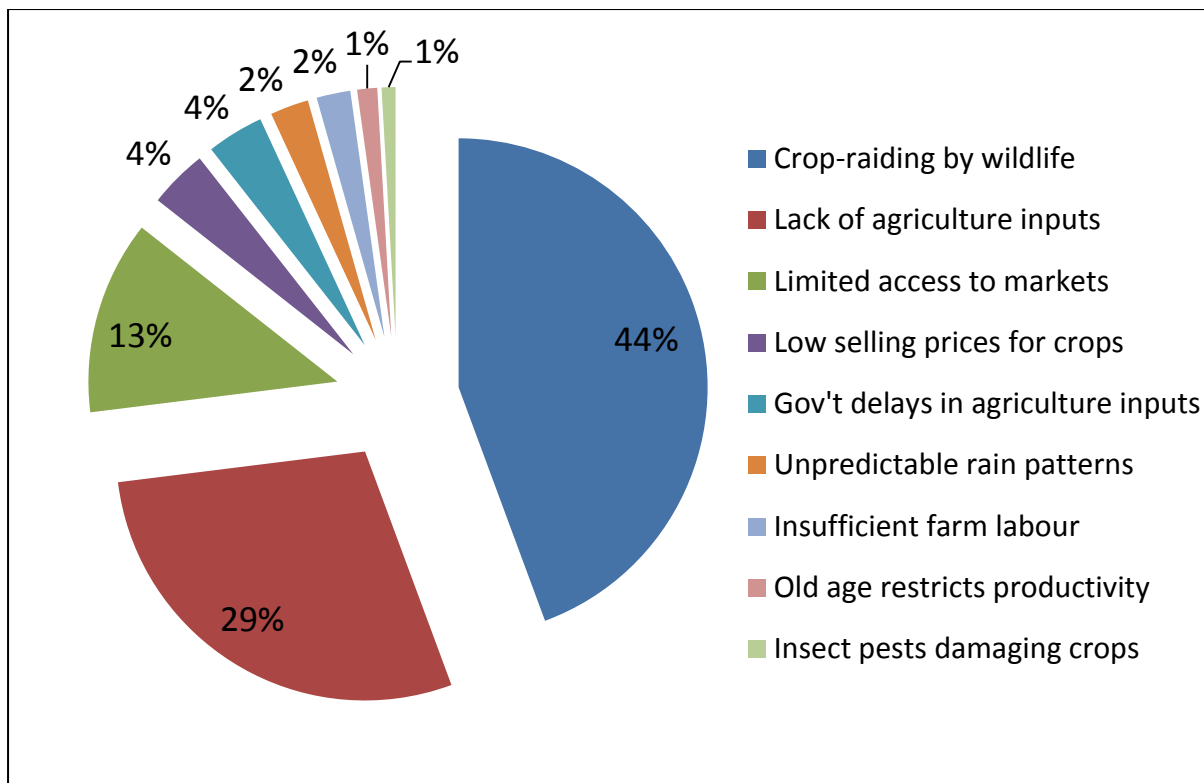


Figure 5.2 Factors affecting agricultural activities

Source: Field data

The large proportion of respondents citing crop raiding by wildlife as the most important challenge constraining their livelihoods indicates that HWC is prevalent across the study area. Crop raiding emerges as the most important problem primarily because the majority of households depend on farming. In this regard, crop raiding directly and adversely impacts the welfare of people in the study area.

5.2 Types of human-wildlife conflict in the study area

Across all three village clusters, more than 90 per cent of respondents stated that their experiences with wildlife lead to livelihood problems, hence the existence of conflicts. In Mukungule and Chishala, all respondents (30 and 51 respectively) stated that their interactions with wildlife generated livelihood challenges. While this was also the case for 85 per cent (n=38) of respondents in Nkomba, 15 per cent (n=5) stated they do not have any problems due to wildlife.

Human-wildlife conflict in the area primarily takes the form of crop raiding (88 per cent), probably largely because farming is the mostly widely practiced livelihood activity. Considerably

fewer respondent households reported being affected by wildlife through depredation of livestock (12 per cent).

Reported interactions with wildlife were not entirely negative. In some cases, wildlife has contributed positively to the welfare of local people through generation of income through the Community Resource Board (CRB). Money raised via tourism through the CRBs has been used to support facilities such as clinics and schools in the area. However, this form of income is restricted in the study area due to limited viable tourist activities. Also, wildlife is often a source of food within local communities. The people of Mukungule are proud to have wildlife in their area, as mentioned by respondents during focus group discussions. The presence of wildlife enables families to teach their children about the different wildlife species found in the area, and therefore it is likely that children growing up in Mukungule GMA know more about wildlife than those living in towns and who have to pay money to see wildlife. The range of impacts of living with wildlife is substantiated by Morzillo *et al.* (2014), who states that human-wildlife interaction ranges over a continuum from positive to negative outcomes, leading to a need for assessment across various perspectives.

The study showed that five types of HWC can be identified based on the nature of interactions between wildlife and humans (including their livelihood systems). Table 5.4 summarises the type of human-wildlife conflicts that were identified.

5.2.1 Problem animals

Respondents reported the elephants (*Loxodonta Africana*) as the main problem animal in Mukungule GMA. The majority of respondents (88 per cent) were of the view that elephants cause most crop damage. However, bush pigs (*Potamochoerus larvatus*) and vervet monkeys (*Cercopithecus aethiops*) were also reported to cause significant crop damage. Only 12 per cent of respondents reported livestock depredation as another form of conflict experienced in the area, even though only 1.5 per cent (n=1) reported experiencing it. Chickens and goats were reported to be killed by leopards (*Panthera pardus*) and this was only reported in Chishala area, which is closest to Park. Figure 5.3 shows the proportion of respondents in each village cluster reporting particular species of wildlife as problem animals.

Table 5.2 Typology of human-wildlife conflict in the study area.

	Conflict type	Nature of conflict
1.	Crop damage by wildlife (Interactions between wildlife and crops)	Crops are eaten and tramped on by wildlife. Crops that are most vulnerable are maize, cassava, millet, sweet potatoes and ground nuts. Wildlife species that are involved are elephants, bush pigs, and monkeys.
2.	Predation of livestock (Interactions between wildlife and livestock)	Small domestic animals are eaten by wild animals. Livestock that are mainly affected are goats and chickens. Leopards are most often responsible.
3.	Threats to human life (Direct interactions between humans and wildlife)	People's lives are threatened when they encounter wildlife, especially elephants while guarding fields.
4.	Reduction of wildlife habitat due to increased human activities (Interactions between humans and wildlife habitats)	Expansion of livelihood activities has resulted in a reduction of wildlife habitats leading to increased interactions with wildlife.
5	Threats to animal life	Humans kill some problem animals such as monkeys found eating their crops.

Source: Field data

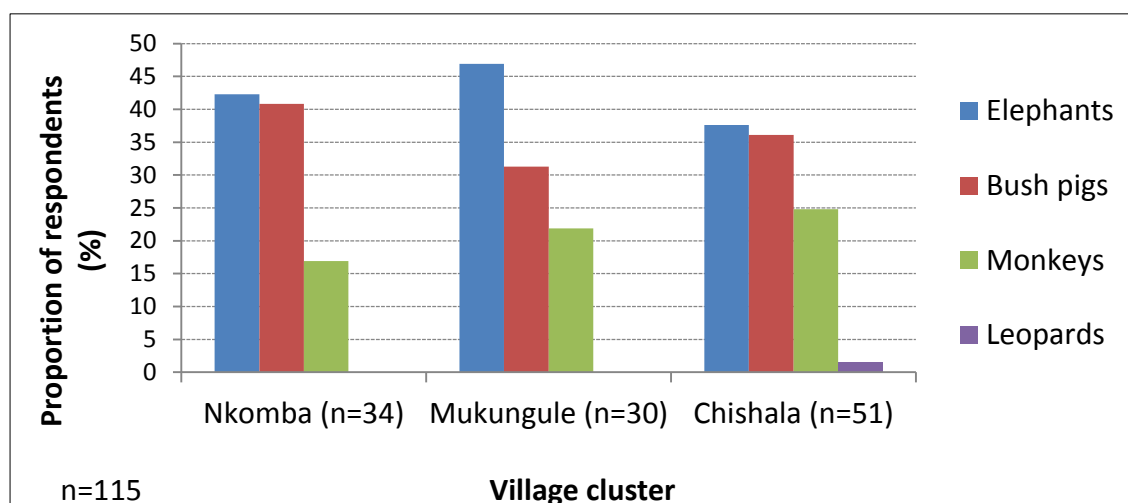


Figure 5.3 Proportion of problem animals in the respective clusters.

Source: Field data

Official reports of conflict incidents involving monkeys are relatively rare because monkeys are usually killed by local people without reporting. Therefore, reports of damage by wildlife are most biased towards incidents involving damage by elephants. According to ZAWA officers, this skew is due to government policies on control of problem animals, where the controlled animal is intended to be given to people incurring losses as a form of compensation. As a result, most crop damage by smaller species such as monkeys goes unreported.

5.2.3 Frequency and duration of human-wildlife conflict

Human wildlife conflict in the study area generally occurs all year round and the majority of respondents reported experiencing interactions with wildlife each month (Figure 5.6). Other experiences of conflict were reported as being either seasonal, weekly or daily. Respondents in each village cluster stated different relative frequencies of conflict, although Mukungule and Chishala had similar patterns with high monthly occurrence. In Nkomba, seasonal incidents were most frequent (44.7%).

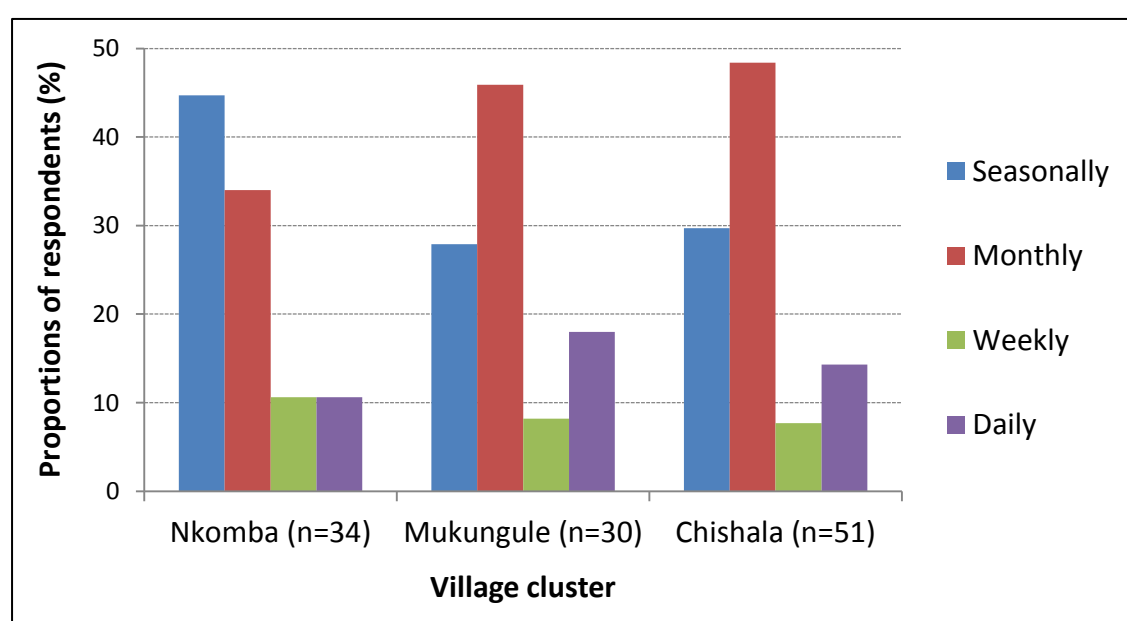


Figure 5.4 Frequency of HWC reported by respondents in each village cluster.

Source: Field data

Of respondents stating that conflicts occur seasonally, 51.9 per cent reported that conflicts are most common during the wet season (i.e. November to April). However, 48.1 per cent of respondents stated that conflicts are not restricted as seasonal, but occur throughout the year. This

means residents of Mukungule and Chishala village clusters are likely to spend a large proportion of their time attending to HWC issues arising from close proximity to NLNP

5.3 Factors that have led to human-wildlife conflict in the study area

Respondents generally reported that there is an increase in the occurrence of conflict between humans and wildlife. This perceived increase is in part a result of more extensive human activities locally, as well as a perceived increase in wildlife populations due to a possible reduction in poaching activity. With an estimated 3000 households and over 16000 inhabitants (ZAWA, 2004; CSO, 2010), people mainly engage in land and forest-based economic activities, which lead to more interactions with wildlife, potentially generating conflict. Over 90 per cent of respondents practice economic activities that come into conflict with wildlife, these are farming and charcoal production. Both of these activities often involve clearing forests, which in turn, increases exposure of human activities to wildlife by decreasing the extent of wildlife habitat. Furthermore, due to higher demand for land, most of these activities are occurring in areas that have been zoned as wildlife areas within the GMA. This increased demand for land for agricultural purposes and the simultaneous disregard for land use regulations, has contributed to an increase in HWC in the GMA.

These conflicts are more frequent during the wet season because of greater availability of water points for wildlife in the area, allowing animals to venture further from the Park. Based on field observations, this is much less the case during the dry season and therefore conflict situations are significantly lower in number because many animals remain deep in the Park near the fewer permanent water sources. Also, the wet season is characterised by the presence of a wide variety of crops in farmers' fields, which attracts wildlife due to the typically higher nutritional value of these crops. Preference for cultivated crops with high nutritional value is likely to be an optimal foraging strategy for wildlife living close to agricultural areas, especially elephants that can range over large distances (Sukumar, 1991). Therefore, social, economic, and ecological factors may operate complementarily leading to the impacts of human-wildlife conflicts.

5.4 Hidden costs of Human-wildlife conflict

The costs of human-wildlife conflict are numerous and can be divided into two categories: visible and hidden costs. In literature, these visible costs are well known and perhaps clearly understood. On the other hand, the hidden costs are costs are not directly noticeable and are more difficult to

quantify, but are equally borne by the affected communities. It is these hidden costs that were of particular interest to this study.

The hidden costs of HWC in this study were identified from the day to day socio-economic effects of conflicts on affected people. The aspects of livelihoods and social activity assessed were loss of possible income, insufficient food, loss of time due to guarding of fields, and restricted movements within villages. The proportion of respondents reporting these impacts of HWC varied across village clusters (Figure 5.7). Insufficient food potentially leading to malnourishment and/or poor health was reported most frequently in each village cluster, and was greatest in Nkomba. On the other hand, restricted movement was reported least frequently in Nkomba and most frequently in Chishala, probably because Nkomba is further away from the park boundary and experiences less wildlife presence.

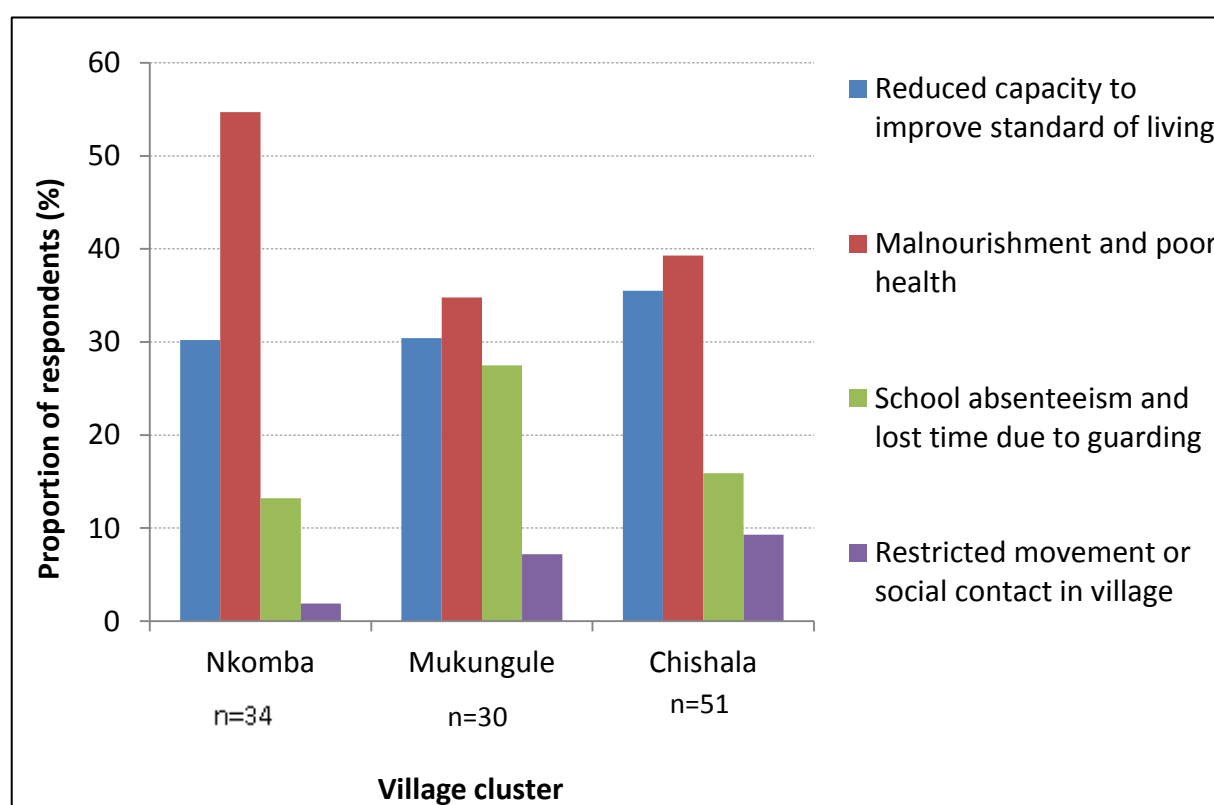


Figure 5.5 Proportion of respondents reporting types of hidden cost associated with HWC.

Source: Field data

5.4.1 Reduced capacity to improve standards of living

Like in many rural areas of Zambia, agriculture is a major source of livelihood and income-generating venture for many households in Mukungule GMA. However, losses from crop raiding by wildlife can increase and entrench the poverty experienced by these households to the extent that they are unable to meet their basic needs. The findings show that an average maize field in the study area loses approximately 15×50 kilograms of maize each crop-growing season. In monetary terms, based on the 2013 and 2014 maize price set by the government (ZMW 65.00 per 50 kilograms), this amount of loss costs farmers ZMW 975.00. The amount of income loss is based on maize as the major marketable and staple crop grown in the area, without even accounting for the costs of losing other crops to wildlife. The average income loss to crop raiding per household in each cluster was ZMW 388.60 in Nkomba, ZMW 920.80 in Mukungule, and ZMW 900.80 in Chishala. For people whose livelihoods are dependent on their crop outputs, these amounts of income loss are major and very significant (MacDonald, 2007). This direct income loss has resulted in a range of hidden costs in the study area, such as reduced capacity to improve standards of living and households failing to send their children to school. The majority of the children in Mukungule GMA who attend school only attend primary level, largely because it is government policy to provide free education at this level. Many children eligible to attend secondary school do not attend, or cease attending, due lack of sufficient household income. A high rate of early marriages locally also contributes the cycle of poverty in affected households, and these may be related to lack of income.

5.4.2 Malnourishment and poor health

Household food insecurity is also a major problem in Mukungule GMA and crop raiding by wildlife often leads to large reductions in harvests. Harvests are divided into two portions; one for consumption over the year until the following harvest, and the remainder to be sold to generate cash income. Reduced harvests resulting from crop damage by wildlife sometimes mean there are insufficient crops harvested to sell, and possibly also insufficient for the household's food requirements. There may therefore be severe shortages of food in affected households during the dry season, persisting into the wet season when planting and cultivation is taking place. Most of the respondents (84%) reported food shortages, and during the wet season, people mostly rely on wild vegetables which are low in nutrition to supplement their diet. This household food insecurity may also prompt early harvesting of maize before it dries fully so it can be ground into mealie meal. Food shortages may have resulted in hidden costs such as malnutrition and poor

health, especially among smaller children who may then have stunted growth. This assertion is supported by 43 per cent of respondents, reported as such.

Correlates of malnutrition include inadequate food and nutritional intake, food insecurity (i.e. uncertain access to food), and a high burden of infectious or non-infectious diseases (UNICEF, 2009). On-going crop destruction by wildlife in Mukungule GMA has played a large role in reducing farmers' harvests over time, leading to increased food shortages, persistent food insecurity, and the hidden costs of malnutrition and poor health that flow from it.

Maxwell and Smith (1992) describe the different shocks that may cause food shortages leading to food insecurity in rural households. The two shocks that lead to food shortages in Mukungule GMA are work shocks and output shocks. Work shocks occur when availability of labour changes abruptly, often due to illnesses or sudden unexpected events. In Mukungule, work shocks are mainly due to malaria illnesses that debilitate farmers and undermine food security in affected households. Output shocks can compound the problems of work shocks and food insecurity. These occur when crop yields are reduced due to crop damage or destruction, either by weather events, disease, insects, or wildlife. In Mukungule GMA, destruction of crops by wildlife and failure to implement effective mitigation measures has resulted in reduced yields and continuing food shortages that compromise nutrition and food reserves for many households (see *Nyirenda et al.*, 2012).

5.4.3 Exposure to mosquitoes

Like many other communities coexisting with wildlife, residents of Mukungule GMA guard their crops in an effort to protect them from wildlife. Most farmers have built temporary shelters for use during guarding hours, which are typically at night. In some cases a household will shift completely from their village to live in their field shelter for a large part of the crop-growing period until harvest is completed. These practices increase the exposure of many people to mosquitoes that carry malaria (figure 5.6) (Osborn and Hill, 2005), not only increasing the risk of contracting malaria but also increasing the number of cases of malaria locally. Mukungule is a mosquito prone area and therefore crop guarding is a high risk activity in terms of exposure to mosquitoes. Records at Lufila Rural Health Centre showed that the highest numbers of malaria cases are reported among farmers during the crop-growing season, particularly from February to May when guarding peaks. Partial data from clinic records for 2014 indicated 317 malaria cases for February, 225 malaria cases for March (up to 16th March), and 123 malaria cases for April (up to 7th April). Medical personnel at Lufila Rural Health Centre attribute this high incidence of cases

to exposure to mosquitoes during crop guarding. This is consistent with responses from 92.7 per cent of respondents (n=115).

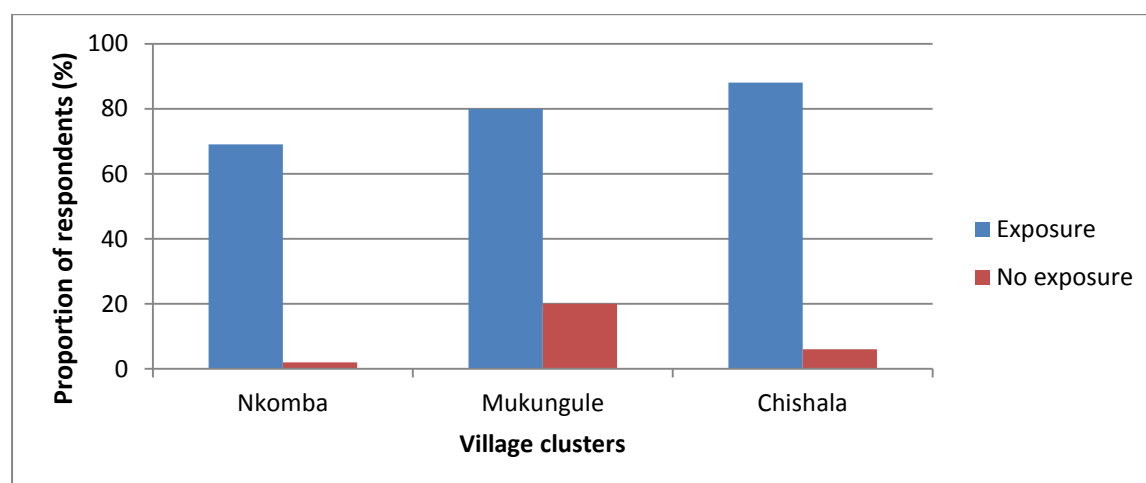


Figure 5.6 Exposure to mosquitoes during crop guarding

Source: Field data

The high prevalence of malaria in the study area may have contributed to the reduced farm productivity, leading to poverty which is experienced by households in Mukungule GMA. Gallup and Sachs (1998) demonstrated that malaria and poverty are intimately connected and, at global scale, countries where people are highly susceptible to malaria have low economic growth. This is the same at household level, where the impacts of malaria can have direct as well as hidden costs. Direct costs are household expenditures related to medical treatment, including medicine, transport, and/or special foods. Hidden costs are mainly in the form of loss of productive labour for those with malaria as well as those looking after them (Russell, 2004).

5.4.4 School absenteeism and loss of time due to guarding of crops

Another hidden cost flowing from guarding crop fields is absenteeism from school because children are required to participate in guarding duties. The worst absenteeism occurs when a family shifts to a temporary home in their crop fields, which increases the distance to schools. Many children stop attending school for the duration of the guarding period, through until harvesting is completed. A total of 77.5 per cent of all the respondents in the household surveyed and all participants in all the three FGD conducted, were of this view. This may resulted in increasing school dropouts and high illiteracy levels in the study area. Teachers Chishala Cluster who were part of the FGD confirmed that school attendance by pupils reduces during the guarding period, which leads to poor performance and the eventual drop out from school.

The high levels of HWC in the study area and resultant loss of income have meant that many households are unable to pay school fees for their children, especially those in secondary school, leading to many pupils stopping education and resorting to early marriages. In this regard, this reduced access to education due to loss of income and a lack of financial resources is a hidden cost of human-wildlife conflict.

According to Oxaal (1997), education creates skills that facilitate higher levels of productivity, provide a greater probability of being employed, and earn more income than those with less or no education (Botha, 2010). It is therefore suggested that there is a causative link between education and poverty. The World Bank (1995) also asserts that education helps to reduce poverty by increasing the productivity of the poor. Opportunities for children to fully participate in education would therefore help communities in Mukungule GMA address persistent hunger and poverty.

5.4.5 Threats to human life

Guarding crops considerably increases threats to the lives of people in Mukungule GMA. Drums, metal plates and pots are often used to make loud noise in combination with fires to scare wildlife away from crop fields. However, these actions frequently provoke the animals especially elephants tend to charge, leading to human injuries and in some instances death (Redpath *et al.*, 2013). All FGDs conducted in the three clusters were of the view that each crop raiding incident presents a large risk to the lives of people guarding crops, hence resulting into threats of injury and in some cases deaths have been recorded. According to the ZAWA official (key informant), in the previous year (2014) a woman had been killed by an elephant while guarding her crops.

5.5 Opportunity costs

Due to problems with wildlife in the study area, some respondents reported that they were prevented from engaging other activities that would help them increase their income or engage in socio-cultural events. These activities included employment for wages, traditional Chitemene farming, growing preferred crops such as cassava, reduced ability to travel, and inability to enlarge their crop fields (Figure 5.8). This is consistent with results reported by Nyirenda *et al.* (2012), who cite opportunity costs as major non-direct costs of HWC, particularly due to time spent guarding fields.

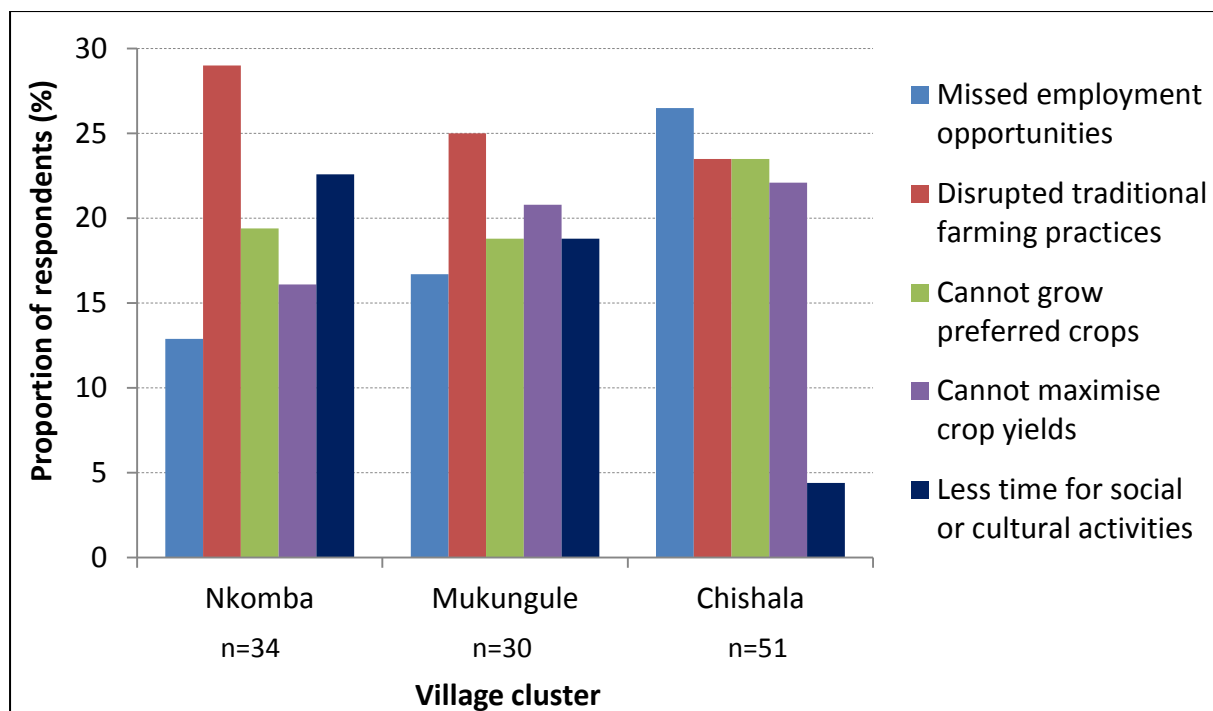


Figure 5.7 Proportion of respondents reporting opportunity cost arising from HWC.

Source: Field data

5.5.1 Missed employment opportunities

In Mukungule GMA crop guarding has been the main intervention used by farmers in efforts to protect their crops against wildlife, in many cases leading households to shift from their village houses to living in their crop fields. Because this requires a large amount of time, they are unable to take up employment opportunities that may arise, for fear of losing their crops to wildlife if their fields are unguarded. Most respondents (52.4%) reported that they are unable to look for or accept employment because they are too busy guarding their crops. This has contributed to increased poverty in the area. This is consistent with the findings of Mackenzie and Ahabyona (2012), who reported that the high labour intensiveness of guarding often restricts rural households from participating in other non-agricultural income-generating activities.

5.5.2 Disrupted traditional farming practices

Use of the traditional *Chitemene* (slash and burn) farming system in Mukungule GMA has reduced significantly because people are unable to divide their labour sufficiently. A total of 52 respondents (41.9%) attributed this reduction to increased time required to manage HWC issues. As a result, use of less familiar and less locally-effective farming methods has reduced crop

production as well as crop diversification. Although less use of Chitemene farming practices is good for forest conservation, it has had negative impacts on local livelihoods.

5.5.3 Growing preferred crops

Cassava has historically been a major crop grown in the study area because it is often used as a substitute for maize meal. Cassava is easy to grow as it doesn't require stringent management like maize and other cereals. However, because cassava is highly susceptible to consumption by wildlife, particularly bush pigs, escalating levels of HWC in Mukungule GMA have reduced planting of cassava considerably, as reported by 37.9 per cent (n=47) of respondents. Cassava takes longer than maize or other common crops to ripen and therefore is exposed to potential destruction by wildlife for a longer period, resulting in high vulnerability. Accordingly, many households have stopped cultivating cassava, and those that have continued only grow it on a small scale for subsistence rather than for sale.

5.5.4 Maximising crop yields

Considering the extensive amount of labour required to protect crops from wildlife and ensure a good harvest, respondents in focus group discussions stated that many households have resorted to reducing (a) the size of their farm and/or (b) the number of fields they have in order to make farming and labour to guard crops more manageable. In Nkomba many households reported that they no longer experience HWC because they have abandoned their fields in the bush (i.e. away from their village) and now only farm near their house where wild animals, particularly elephants, are less likely to venture.

5.6. Distribution of the costs of human-wildlife conflict

Findings from this research show that HWC is a problem burdening all community members whose livelihoods depend on agriculture, this include both those that keep livestock and those who practice arable farming. Also, within households HWC can affect all members. However, the study shows that specific effects vary from household to household. Overall, 30 per cent of respondents stated that adults are most affected (mainly through direct costs), while 25 per cent reported that children are most affected (mainly via hidden costs). Among the adults (i.e. both men and women), the effects are in form of time lost due to crop guarding at night, exposure to mosquitoes leading to malaria illnesses. Furthermore, household heads have to find means to fend for their children and dependants in times of food shortages. Psychological and emotional

disturbances affect these people due to their inability to provide for their families, as remarked by one lady, *“I am troubled when I am unable to provide for my children”*.

As members of these affected households, Children are affected. According to 57.7 per cent of respondents and responses from all the FGDs, children are equally affected when families shift to stay in temporary shelters near their fields for crop guarding purposes, as such children usually stop going to school due to increased distances. This subsequent dropping out of school by children may have resulted in early marriages among the youth. A number of youths may be compelled to get married and start their own homes, as a way of reducing economic pressure on the households. In addition, children are the most affected by malnutrition and food shortages.

In terms of gender, the study showed that there is no significant difference between adult males and females. 21.8 per cent of male respondents reported that they were affected by HWC as compared to 23.3 per cent of female respondents. Generally women and children are the most affected by hidden costs because households that are female-headed are raising children as single parents or guardians. This is consistent with the results reported in Uganda, where female-headed households are particularly vulnerable to crop damage by wild pigs because they are unable to guard their crops efficiently and they generally lack financial resources to hire additional labour (Hill *et al.*, 2002; Hill 2004).

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

This chapter presents the conclusions of the study and provides recommendations that can help address the challenges of HWC in Mukungule GMA.

6.1 Conclusions

The study aimed at examining the nature of human-wildlife conflict and their subsequent hidden costs in Mukungule GMA, northern Zambia. Four objectives were set for the study, these were; determine the main type of HWC that occur within the study area, investigate factors influencing conflict, identify the hidden costs associated with HWC within the study area, examine the distribution of hidden costs among community members.

The study identified crop damage as the major form of human-wildlife conflict taking place in Mukungule GMA. Crops most commonly grown and vulnerable to wildlife are maize, millet, cassava, and groundnuts. The main problem animals in the area are elephant, bush pigs, and monkeys, with elephants identified as most problematic. The study further identified areas that are conflict hot spots, primarily villages located close to North Luangwa National Park. These are Mukungule village and those in the Chishala cluster, especially Chishala and White villages. Human-wildlife conflict is perceived to be increasing in the area and perpetuated by two factors; lack of adherence to GMA land-use plans by local communities as well as perceived increases in wildlife populations due to a possible reduction in poaching activity.

The study findings showed that conflict in Mukungule GMA occurs throughout the year, especially for residents of villages close to the Park such as the Chishala cluster. However, HWC is heightened during the crop-growing season from late November until mid-May when maize harvesting is completed. Crop guarding was identified as the main mitigation method used to protect crops from wildlife. Wire fencing was also identified as a commonly-used deterrent, and although some farmers had received training to use chilli as a deterrent the study did not identify any households using this method.

A wide range of costs were identified by the study. Key direct costs were loss of income, food insecurity, and threats to human life. The main opportunity costs were loss of employment opportunities, disruption of traditional farming practices, inability to grow preferred crops or maximise crop yields, and less time for social or cultural activities. Hidden costs included malnutrition and poor health, reduced capacity to improve standards of living, school absenteeism, high rates of school dropouts, greater risk and incidence of malaria while guarding crop fields,

restricted movement or social contact in villages, and early marriages. These costs have contributed to on-going low agricultural productivity and the subsequent poverty in Mukungule GMA. The distribution of costs cuts across all members of affected households, with men and women, being household heads sharing costs almost equally.

6.2 Recommendations

The following recommendations are made in light of the findings of this study:

6.2.1 Growing alternative crops

The government and NGOs operating in the GMA should consider promoting cash crops that are less palatable or unpalatable to wildlife. These crops could include chilli and possibly cotton; however, it would also be essential to ensure that there is market for such crops. Initiatives such as Community Markets for Conservation (COMACO) may be of value in Mukungule GMA to provide more income for participating households. As such, they could limit growing crops for consumption to areas surrounding their villages, thereby ensuring that their household food security is not compromised.

6.2.2 Alternative livelihood activities

To the extent that feasible options might be available, residents of Mukungule GMA could be encouraged to explore and engage in alternative or supplementary other livelihood activities that are less vulnerable to conflict with wildlife. Bee keeping and honey production may be a viable alternative, and has become a profitable activity in many regions with increased global demand for organic honey. In the North-Western Province of Zambia many people with farming activities disrupted by the opening of mines have been recruited by honey processing companies to produce honey. Bee keeping may be equally viable as a livelihood activity to reduce crop raiding in Mukungule GMA. More so, bee keeping has proved to be a successful deterrent to wildlife in HWC prone areas, which are effected mainly by Elephants (Hoare, 2012; Harich et al., 2013).

6.2.3 Sensitising people about the current land use plan for Mukungule GMA

Given the increasing development of unplanned crop fields in Mukungule GMA that encroach into areas reserved for wildlife habitat, it is recommended that the traditional authorities and CRB sensitise residents about current land use plans and regulations for the GMA. This should then be followed by effective monitoring and enforcement to ensure requirements are being adhered to,

which would contribute significantly to reducing the impacts and costs of HWC across Mukungule GMA.

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APPENDIX 1: HOUSEHOLD QUESTIONNAIRE

THE UNIVERSITY OF ZAMBIA

SCHOOL OF NATURAL SCIENCES

DEPARTMENT GEOGRAPHY AND ENVIRONMENTAL STUDIES

I am a postgraduate student from the University of Zambia. I am conducting interviews for my research. The aim of the research is to understand interactions between people and wildlife within Mukungule GMA and the costs to people of those interactions.

You are kindly invited to voluntarily participate in an interview, which will require approximately 45 minutes of your time.

The information you provide will only be used for this research and will be treated with strict confidentiality.

Your participation is also anonymous – your name is not required and will not be recorded.

You do not need to answer any questions that you would prefer to not answer.

Your help with this research would be greatly appreciated.

Do you agree to participate in the interview?

QUESTIONNAIRE #	
VILLAGE NAME	
DATE	

GENERAL INFORMATION OF THE HOUSEHOLD HEAD

1. Gender Male ☐ Female ☐
2. Age Under 20 ☐ 20 – 29 ☐ 30 – 39 ☐ 40 – 49 ☐ 50 - 59 ☐ Above 60 ☐
3. Including you, how many people live in your household?
4. Number of:
 - i. Adults:
 - ii. Children: Number of children at school:

ECONOMIC ACTIVITIES

5. What Economic Activities do you do?

- (i) Farming [] (ii) Charcoal production []
- (iii) Trading [] (iv) Formal Employment []
- (v) Other (specify) []:

6. If the answer in 5 above is trading, what items do you trade in?

.....

.....

7. In your economic activities mentioned in 5 above, what problems do you face?

[illegible]

NATURE OF HUMAN WILDLIFE CONFLICT (HWC)

8. What kind of experiences do you have with wildlife in your area?

[illegible]

9. Do these experiences lead to any problems?

Yes [] Go to Question 11

No [] Go to Question 10

10. If No to question 9, explain why?

.....
.....
.....
.....

11. If Yes to question 9, which wildlife cause problems or difficulties for your household?

.....
.....
.....

12. What are types of problems and difficulties experienced?

.....
.....
.....
.....
.....

13. How often do you experience these problems and difficulties? (Can choose more than one)

(i) Seasonally [] which seasons? Wet season [] Dry season []

(ii) Monthly [] which months

(iii) Weekly [] (iv) Daily []

14. What economic and/or social activities do you do during the time chosen in question 13 above?

.....
.....
.....
.....

COSTS AND THEIR DISTRIBUTION

15. How do problems and difficulties with wildlife affect your day to day living?

.....
.....
.....
.....
.....
.....
.....
.....
.....
.....

16. Which group(s) of people in your household are affected by problems with wildlife?

(i) Adults [] (ii) Children [] Males [] Females []

17. To your answer in question 16 above, explain how each group is affected.

.....
.....
.....
.....
.....
.....

18. Where there are problems from wildlife, do you receive any help from the government?

(i) Yes [] (ii) No []

19. If your answer is yes to question 18 above, explain the type of help received

.....
.....
.....

20. What activities are you or members of your household prevented from doing due to problems with wildlife?

.....
.....
.....
.....
.....
.....

21. How do you address or solve problems arising from what you are prevented from doing due to problems with wildlife?

.....
.....
.....
.....

22. How much time do you spend addressing the problems mentioned above?

.....
.....
.....

23. Do problems with wildlife affect your household income?

Yes [] How much and how often No []

24. If the answer is yes to question 23 above, explain how problems affect your income?

.....
.....
.....

25. Do problems with wildlife affect you or members of your household in any other way?

.....
.....
.....
.....
.....

MITIGATION MEASURES

26. What do you do to solve problems with wildlife?

.....
.....
.....
.....

27. Whose ideas are these solutions? Local [] NGOs [] Government []

28. What do you suggest should be done to address problems with wildlife in the area?

.....
.....
.....
.....

Thank you very much for your time

APPENDIX 2: FOCUS GROUP GUIDE

THE UNIVERSITY OF ZAMBIA

DEPARTMENT GEOGRAPHY AND ENVIRONMENTAL STUDIES

FOCUS GROUP DISCUSSION

WELCOMING REMARKS

Thank you for agreeing to be part of the focus group. I appreciate your willingness to participate. The aim of this focus group discussion is to us gain more insights about your interactions and experiences with wildlife here in Mukungule area.

The discussion will only take about 1 hour.

INTRODUCTIONS: Moderator and the entire research team

GROUND RULES

1. THERE ARE NO RIGHT OR WRONG ANSWERS

Every person's experiences and opinions are important. Speak up whether you agree or disagree. We want to hear a wide range of opinions.

NATURE/FORM OF HWC AND HIDDEN COSTS

1. What type/form of conflicts exists in the area?
2. Over the years, what has been the trend of these conflicts? – Same, Increase, Decrease.
3. Why do you think it has been so?
4. Do you think population growth has contributed to the conflicts?
5. What are the effects of these conflicts on the community?

- Health

- Children school attendance

- Food security

- Income

- Safety of the people

- Other opportunities

5. What do you think would be the best solutions to these problems?

APPENDIX 3: INTERVIEW GUIDE FOR KEY INFORMANTS

THE UNIVERSITY OF ZAMBIA

DEPARTMENT GEOGRAPHY AND ENVIRONMENTAL STUDIES

Welcoming remarks:

Thanks you for accepting to be part of this study by accepting to be interviewed. The data collected will be used for academic purposes only.

1. How would you describe the HWC situation in Mukungule GMA?
2. What are the major impacts of HWC on the communities living in the GMA?
(Focus and follow up questions on the aspects outlined below)
 - Household income
 - Health
 - Children school attendance
 - Food security
 - Safety of the people
 - Other opportunities
3. What do you think are the possible solutions to these conflicts?

APPENDIX 3: DESTRUCTION OF WILDLIFE AND MITIGATION MEASURES TAKEN



Elephant foot print in a destroyed field



Maize field destroyed by elephants



Metals cans used as alarms on wire fences on edges of fields



Wire used as deterrent against elephants

Appendix 4: Characteristics of respondents

a) Gender of respondents within each village cluster

Gender	Village cluster							
	Nkomba		Mukungule		Chishala		All clusters	
	No	%	No	%	No	%	No	%
Male	23	53.5	10	33.3	26	51.0	59	47.6
Female	20	46.5	20	66.7	25	49.0	65	52.4
Total	43	100	30	100	51	100	124	100

b) Age distribution of respondents within each village cluster

Age category (years)	Village cluster			
	Nkomba (n = 43)	Mukungule (n = 30)	Chishala (n = 51)	All clusters (n = 124)
	%	%	%	%
<20	4.8	3.4	2.0	3.3
20-29	14.3	10.3	23.5	17.2
30-39	31.0	31.0	41.2	35.2
40-49	19.0	20.7	15.7	18.0
50-59	14.3	13.8	9.8	12.3
others	16.7	20.7	7.8	13.9
Total	100	100	100	100