Land Use in Mumbwa Game Management Area: Livelihood, Migrations, and Land Cover Change

by
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This dissertation includes [three] unpublished publications. The development and writing of the papers were the principal responsibility of myself and, for each of the cases where this is not the case, a declaration is included in the dissertation indicating the nature and extent of the contributions of co-authors.

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With regard to [chapter three - Human migration and settlement dynamics in Mumbwa Game Management Area pp 49-77 of the dissertation], the nature and scope of my contribution were as follows:

Nature of contribution
- Organised and searched for literature - Collected and analysed data - Conceptualised and wrote paper

The following co-authors have contributed to [chapter three, pages 44-78 in the dissertation]:

Name	**e-mail address**	**Nature of contribution**
Karen Esler		- Provided advice as main supervisor - Editing of the paper
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Donald Chungu		Provided advice as co-supervisor - Editing of the paper

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- Organised and searched for literature - Collected and analysed data - Conceptualised and wrote paper

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Abstract

As category VI IUCN Protected Areas where people can practise the sustainable use of natural resources, game management areas (GMAs) of Zambia employ a mixed land use approach. The Mumbwa GMA, adjacent to Zambia's Kafue National Park, has five land use zones. Although each zone has a distinct land use, over time the GMA has experienced an overlap in land uses by nearby communities and external migrants, particularly in two of the zones meant for conservation (conservation zone) and to cater for human livelihoods (development zone).

This study compared three aspects of land use in the conservation and development zones with the aim to contribute to improved land use in the conservation and development zones of the Mumbwa GMA. Firstly, the study investigated the magnitude and patterns of human migrations in the two zones. The second part assessed the extent to which the households settled in these zones earn their livelihoods and rely on the GMA for their livelihoods and wellbeing. Lastly, the study quantified and accounted for the long-term spatial land-cover changes for the period 1990 to 2017. A mixed-method approach was employed for this study, using a structured questionnaire, focus group discussions, key informant interviews, and remote sensing imagery.

Results indicated that a higher (76%) proportion of people living in the conservation zone are external migrants compared to those living in the development zone (50%). Households from both zones did not intend to leave the GMA, even though they acknowledged the need to conserve wildlife. The more land a household occupied, the less they planned to migrate. The households from both zones practised similar livelihood activities and relied more on farming and less on GMA-related livelihoods such as hunting and concession fees. More conservation zone households (72%) compared to those from the development zone (38%) said their wellbeing had improved, and they attributed this improved wellbeing to improved crop yield. For the period 1990 to 2017, the area under forest in the conservation zone reduced from 54 to 32%, and was replaced mostly by other wooded areas and croplands. During the same period, the development zone experienced an increase in the share of cropland from 3.7 to 44%. The respondents attributed the observed land use and cover changes to agricultural expansion, wood extraction, and population growth.

This research shows the magnitude of human migrations and land-cover changes in the Mumbwa GMA. It suggests an overlap in land use in the Mumbwa GMA's conservation and development zones, which negates the purpose of having distinct land uses for the two zones. The collapse in the land use plan is attributed to, *inter alia*, poor law enforcement and uncoordinated and inappropriate local conservation policies, specifically those governing land use and livelihoods in the GMA. It is important, therefore, to strengthen law enforcement and realign the conservation/ land use policies in the GMA.

Keywords: Conservation zone, development zone, land use, land-cover change, livelihoods, migrations.

Opsomming

As kategorie-VI IUCN beskermde gebiede, waar mese toegelaat word om natuurlike hulbronne volhoubaar te gebruik, pas wildbestuurareas (GMA's) 'n gemengde benadering tot die gebruik van grond toe. Mumbwa GMA, wat aan Zambië se Kafue Nasionale Park grens, het vyf grondgebruiksones. Hoewel elke sone duidelik uitgestippelde grondgebruik het, het die GMA met verloop van tyd 'n oorvleueling daarvan deur nabygeleë gemeenskappe en immigrante ervaar, veral in twee van die sones wat bedoel was om te bewaar (bewaringsgbied) en om voorsiening vir menslike lewensbestaan (ontwikkelingsone) te maak.

In hierdie studie word drie aspekte van grondgebruik in die bewaring- en ontwikkelingsones vergelyk. Eerstens word met dié studie die omvang en patrone van menslike migrasies in die twee sones ondersoek. Die tweede deel het ten doel om te bepaal in watter mate die huishoudings in hierdie sones hulle lewensbestaan maak en op die GMA daarvoor en vir hul welstand staatmaak. Laastens kwantifiseer en doen die studie verslag oor die langtermyn ruimtelike en tydverwante grondbedekkingsveranderings vir die tydperk 1990 tot 2017. 'n Gemengde-metodebenadering is in hierdie studie gebruik.

Daar is oor die afgelope 16 jaar bevind dat 'n hoër (76%) proporsie mense wat in die bewaringsgebied woon immigrante is, vergeleke met dié in die ontwikkelingsone (50%). Huishoudings van albei gebiede het geen planne gehad om die GMA te verlaat nie, hoewel hulle die nodigheid erken het dat dit noodsaaklik is om wild te bewaar. Hoe meer grond 'n huishouding beset het, hoe minder was die plan om pad te gee. Die huishoudings in albei sones het soortgelyke bestaansbedrywighede beoefen en het meer op boerdery en minder op 'n GMAverwante lewensbestaan soos jag- en konsessiegeld staat gemaak. Meer huishoudings in die bewaringsone (72%) het gesê hulle welstand het verbeter in vergelyking met dié in die ontwikkelingsone (38%). Die verbeterde welstand word aan die verbeterde oesopbrengs toegeskryf. In die tydperk 1990 tot 2017 het die bewaringsone 40% van sy bosgebied aan houtplantasies en gewaslande afgestaan. Indieselfde tydperk het die ontwikkelingsone 'n toename van 1 116,3% in gewasgebiede ondervind. Die respondente het die waargenome veranderinge aan landbou-uitbreiding, houtontginning en bevolkingsgroei toegeskryf.

Hierdie studie demonstreer die omvang van menslike migrasie en verandering ten opsigte van gronddekking in Mumbwa GMA. Die studie dui op ’n oorvleueling in grondgebruik in Mumbwa GMA se bewarings- en ontwikkelingsones wat die doel om duidelike grondgebruike vir albei sones te hê negatief raak. Die mislukking van die plan vir grondgebruik word onder meer toegeskryf aan swak wetstoepassing en ongekoördineerde en swak beleide rakende grondgebruik en lewensbestaan in die GMA. Dit is derhalwe belangrik om wetstoepassing te versterk en die beleid rakende grondgebruik in die GMA te herbelyn.

Sleutelwoorde: Bewaringsone, ontwikkelingsone, grondgebruik, grondbedekkingsverandering, lewensbestaan, migrasies.

Dedication

To Liwanga Mukuni and Keyana Naleli.

The world is at your feet to conquer. In my small way, may I inspire you to greater things.

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List of Acronyms

CRB	Community Resource Board
DNPW	Department of National Parks and Wildlife
EIA	Environmental Impact Assessment
EPB	Environmental Project Brief
FGD	Focus Group Discussion
GMA	Game Management Area
IUCN	International Union for Conservation of Nature
LU/CC	Land Use and Cover Change
NGOs	Non-Governmental Organisations
PAs	Protected Areas
PC	Principal Component
PCA	Principal Component Analysis
SPSS	Statistical Package for Social Sciences
WCPA	World Commission on Protected Areas
ZAWA	Zambia Wildlife Authority

Chapter 1 Introduction

1.1. General introduction

Protected areas (PAs) have been set up worldwide as a tool to conserve biodiversity and critical ecosystem services (Bennett & Dearden, 2014; Chape et al., 2008; Gurney et al., 2014; Pouzols et al., 2014; Watson et al., 2014; World Commission on Protected Areas (WCPA), 2015). Over time, many PAs have also come to include improving the livelihoods of the local communities as a key objective (Clements et al., 2014; Ferraro & Hanauer, 2011). In Africa 17% of the land is classified as some form of PA, with 37.87% (286 161 km^2) of Zambia being protected (International Union for Conservation of Nature (IUCN), 2019a).

The International Union for Conservation of Nature (IUCN) defines a protected area as "a clearly defined geographical space, recognised, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values" (Dudley, 2008: 8).

Despite the good intentions, balancing PA goals has proved challenging (Crist et al., 2017; DeFries et al., 2010). Balancing the goals proves difficult because the competing interests of stakeholders (Mena et al., 2006), lead to conflict (Xie et al., 2014). Matenga (2002) even suggests that many international conservation agencies and other stakeholders regard human wellbeing as a secondary priority to conservation. Among the common problems associated with PAs are human encroachment (Hartter et al., 2015; Watson et al., 2015), uncontrolled natural resource extraction (Curran et al., 2004; Nagendra, 2008) and land use conflict (Cortina-Villar et al., 2012; Watson et al., 2014). The ultimate consequence is a dysfunctional ecosystem (Borrini-Feyerabend et al., 2013; Rockström et al., 2009).

Many PAs are established on land formerly occupied by indigenous people (West et al., 2006). This has forced them to abandon their way of life and their homes (Muboko & Bradshaw, 2018; Oldekop et al., 2016; Scholte et al., 2016), which means that disgruntled communities end up living

near the PAs (Bodmer & Puertas, 2007; Kepe, 2008). The displacement creates conflict, which affects the way the local people view and relate to the PAs (Andrade & Rhodes, 2012; Brockington & Igoe, 2006; West et al., 2006) and may encourage the illegal use of resources (Tumusiime et al., 2011). In Zambia, for example, the Kafue National Park was established in 1924 in an area previously used for subsistence cropping or cattle grazing, which led to the eviction of five chiefs and their subjects (Mwima, 2001). To this day, local people still threaten to return to their land.

In response to conservation conflicts, global and national policymakers integrated local communities into conservation programmes, which encouraged multiple land use by granting local communities some level of access to the PAs (Nelson & Chomitz, 2011). Through the 2003 World Congress on Protected Areas' Durban Accord, policymakers agreed that PAs should not just be world heritage sites, but should also help to reduce poverty in associated local communities (International Union for Conservation of Nature (IUCN) - The World Conservation Union, 2005). The Congress Accord acknowledged that native communities need to benefit from their resources through sustainable natural resource use (WCPA, 2015), giving rise to new conservation policies (Muhumuza & Balkwill, 2013). The idea was that this would gain local support by providing some access to PAs for the benefit of the local people (Smith, 2003; Wright et al., 2016). Local support could be achieved by either compensating the locals for reduced resource access in PAs or by offering them an alternative and sustainable means of livelihood.

Integrating local communities into PAs carries its challenges (Bennett & Dearden, 2014; Holmes, 2013). To this day scholars still debate whether a good balance between conservation and improved livelihoods has been achieved (Clements et al., 2014; De Santo et al., 2011; Nagendra, 2008; Pfaff et al., 2014). Studies show the varied impacts of PAs on local poverty levels (Andam et al., 2010; Clements et al., 2014; Ferraro et al., 2011) and conservation (Carneiro, 2011; Hansen & DeFries, 2007; Sandker et al., 2009). Studies further provide insights into the factors responsible for the success or failure of communities living near PAs (Andrade & Rhodes, 2012; Bennett & Dearden, 2014; Lambin & Meyfroidt, 2011). According to Brockington and Wilkie (2015), the success or failure stems from unclear objectives of PAs, which give rise to divergent expectations among the various stakeholders who are involved.

It is postulated that PAs generate adverse effects on neighbouring communities through the loss of livelihoods (Gelsdorf et al., 2012) and restricted access, while bearing the cost of human-wildlife conflict (Tumusiime & Vedeld, 2015). Watson et al. (2014) attribute the failure to improve livelihoods in these communities to the constant reviewing of PA objectives. However, determining the socio-economic impacts of PAs proves difficult, not only because researchers do not select appropriate comparison groups (Andam et al., 2010), but also because determining rural livelihoods is complicated (Angelsen et al., 2011), making causal inferences challenging. Although creating PAs may impact local people adversely, they too in turn may affect the PAs. It is suggested that poverty and environmental degradation form a vicious cycle (Scales, 2011), a common feature of biodiversity hotspots that also experience extreme poverty (Zhang et al., 2013). Nevertheless, Babigumira et al. (2014), among other scholars, argue that the poverty-environmental degradation debate is context-specific and can therefore not be generalised.

Despite the conservation efforts, people continue to settle in PAs and convert more land into other land uses (Curran et al., 2004; Muhumuza & Balkwill, 2013), with surrounding communities expanding their activities into the PAs (Hansen & DeFries, 2007). In areas supporting tree biomass, the result worldwide is forest loss (Mwavu & Witkowski, 2008), but even more so in the tropics (Sunderlin et al., 2005). From 1990 to 2015 the global area under forests diminished by 3%, while that of the tropics diminished by 5% (Keenan et al., 2015), with an average loss of 0.25% reported for Zambia (Integrated Land Use Assessment Phase II (ILUA- Phase II), 2016).

Zambian policymakers created game management areas (GMAs) in an attempt to reduce the impact of people on PAs in Zambia. The GMAs are a type of PA surrounding national parks that allow for multiple land uses (Fernández, 2010; Robinson et al., 2013; Simasiku et al., 2008). The IUCN classifies GMAs as Category VI, a PA in which people can practise the sustainable use of natural resources (International Union for Conservation of Nature (IUCN), 2019b). In line with the IUCN definition, the surrounding local communities are permitted to use the resources in GMAs, but sustainably.

Although Zambia has one of the largest areas under protection (about 40% of the country) in southern Africa (Matenga, 2002), there is a high level of encroachment by people in most GMAs

(Pfeifer et al., 2012). Such encroachment has resulted in a progressive decline in the area being conserved (Simasiku et al., 2008). Forty percent of most GMA land has been modified at an annual habitat conversion rate of 0.69% (Lindsey et al., 2013). The modification is more pronounced in GMAs surrounded by densely populated rural communities involved in shifting agriculture and with high poverty levels than in other GMAs (Lindsey et al., 2014). The result is severe loss of natural resources and biodiversity (Lopoukhine et al., 2012).

Studies to understand the link between continued biodiversity loss in PAs and the poverty of surrounding households have yielded little concrete information. The studies may not be considering the underlying dynamics of the local people and their role in decisions on land use, making it challenging to identify and secure the appropriate corrective measures. Research in Zambia's GMAs often focuses either on livelihoods or on conservation separately from each other. In cases where research is conducted, the researchers do not publish most of their findings, which can thus not inform policy and strategy to benefit the target households. This study reports on both livelihood activities and on the land cover changes in the Mumbwa GMA.

1.2. Problem statement

The global and regional need to manage natural resources sustainably cannot be over-emphasised. In line with the 2003 World Congress on Protected Areas' Durban Accord, Zambia adopted the multiple land use approach in GMAs to simultaneously conserve wildlife, generate income, and cater for human wellbeing. Zambia introduced a wildlife conservation system that follows a zoning approach that demarcates the GMA into five land use zones: buffer, conservation, development, special use, and tourism zones. This approach follows the biosphere reserve concept that was idealised within the UNESCO's Man and the biosphere (MAB) program where countries set aside conservation areas with multiple uses (Bridgewater, 2016). The concept was further adjusted in which a core conservation area is surrounded by other less intensive land uses/ zones from which local communities can practice sustainable livelihoods (DeFries et al., 2010).

Game management areas play an important role in the livelihoods of the many resource-poor rural Zambians, who lack access to other sources of subsistence income and employment, because they

have little cash and few other resources (Bandyopadhyay & Tembo, 2009). Livelihood factors such as the need for farming land, food, income, and employment continue to lead to the degradation of conservation habitats in most of Zambia's PAs (Lewis et al., 2011; Metcalfe, 2006; Nshimbi & Vinya, 2014; Richardson et al., 2015). Many authors have demonstrated that globally and especially regionally PAs are under threat from illegal land use and natural resource extraction (Bailey et al., 2016; Bragagnolo et al., 2017; Cortina-Villar et al., 2012; Guerra et al., 2019; Johnson, 2019; Kauano et al., 2017; Mackenzie & Hartter, 2013; Rija et al., 2019; Van der Ploeg et al., 2011).

The Mumbwa GMA in the Greater Kafue National Park ecosystem has not been spared the problems of wildlife ecosystem habitat degradation. In the last three decades the Mumbwa GMA has experienced one of the worst levels of human encroachment and deforestation (Chemonics International, 2011). For example, the conservation zone, even though designated for wildlife conservation, has over time come under intense human encroachment. The settlement of people in the conservation zone has reduced the wildlife revenue derived from safari hunting (Chemonics International, 2011). Additionally, the Department of National Parks and Wildlife (DNPW) spends most of its resources on minimizing or sorting out human-wildlife conflicts as a consequence of illegal human settlements.

Unfortunately, evidence on the ground indicates that migrants coming from other Zambian provinces settle in the conservation zone in search of sustainable livelihoods (Zambia Wildlife Authority (ZAWA), 2014). Once people settle in the GMA, they practice livelihood maintenance in ways that may not be sustainable and can degrade the environment. The settlement of people in a critical wildlife conservation zone raises a number of both livelihood and ecological questions:

1. How extensive is the problem of human migrations in the Mumbwa GMA?
2. To what extent do the households rely on the GMA for their livelihoods and wellbeing?
3. What are the long-term spatial patterns that have occurred in the Mumbwa GMA as a result of human-induced disturbances?
4. How do National conservation policies influence human migrations, livelihoods, and land cover changes in the Mumbwa GMA?

1.3. Aim and objectives of the study

This study aimed to contribute to sustainable land use in the conservation and development zones of the Mumbwa GMA. The overall objective of the study was to understand land use in the Mumbwa GMA in the context of human migrations and livelihood maintenance, which in turn change the land cover of the GMA. This overarching objective was addressed by three more specific objectives, as outlined below.

1.3.1. Objective 1 (Chapter 3)

To investigate the magnitude and patterns of human migration in the conservation and development zones in Mumbwa GMA. The following research questions were asked to address the first objective:

1. What are the migration and settlement patterns of the households in the conservation and development zones?
2. Why do migrants prefer the conservation to the development zone?
3. Are there differences between the way that respondents in the two zones view and justify the illegal settlements in the conservation zone?
4. What individual and household characteristics might predispose the respondents to migrate?

1.3.2. Objective 2 (Chapter 4)

To assess the extent to which households from the conservation and development zones rely on the GMA for their livelihoods and wellbeing. The following research questions were asked to address the second objective:

1. Is there a difference in livelihood activities between the households living in the conservation and development zones?
2. How reliant on the GMA are the households for their livelihoods and wellbeing?

1.3.3. Objective 3 (Chapter 5)

To quantify the long-term spatial land cover changes and account for their drivers in Mumbwa Game Management Area for the period from 1990 to 2017. The following research questions were asked to address the third objective:

1. What was the extent and nature of land cover change in Mumbwa GMA's conservation and development zones during the period 1990 to 2017?
2. What are the households' perceived drivers of land cover changes in the conservation and development zones?
3. How have the households from the two zones contributed towards the land cover change in the GMA?

1.4. Significance of the study

Researchers have extensively studied the subject of land use, livelihoods, and migration in PAs. But whereas most studies in Zambian GMAs approach the GMA as a whole, this study contributes a unique comparison of two land use zones within the same buffer (GMA). This study can contribute towards more sustainable land use in the GMA, which protects the original design of having different land uses within the same GMA. The study also contributes to the documentation of the status of land use/cover in the two zones. Although researchers have assessed land use in Zambia, this is done at the national level, and to my knowledge researchers have not published specific data on the changes that have occurred in the Mumbwa GMA. Further, most of the debates about land cover changes in GMAs, including Mumbwa, are often speculative and do not take into account concrete data. The debates also apply to the problem of migrations and subsequent settlements in the GMA. The narrative is often one-sided and from the policymakers' perspective, with little being known from the migrant's point of view. Accurate information on the latter dimension can inform policy on improving conservation packages, which benefit not only the natural resource base but the local people as well.

1.5. Structure and overview of chapters

This dissertation consists of six chapters. The first two chapters (1 and 2) introduce and contextualize the study. The next three chapters (3, 4, and 5) are data chapters that are written in academic paper format and present the findings of the research. The final chapter (6) synthesizes and concludes the information from the research findings, providing management guidance.

In Chapter 1, before introducing the structure of the dissertation, the study introduces PAs as a way of conserving biodiversity while providing for local people's livelihoods. The chapter then provides insight into the challenges of achieving a balance between conservation and improving the people's livelihoods.

Chapter 2 starts with a detailed description of the study area. It then gives the conceptual framework used for the study, explaining and linking the different components. The chapter concludes with the research strategy and design used for the study, indicating the various methods used to collect and analyse the data.

Chapter 3 analyses migration and settlement patterns among different classes of migrants in the two zones. The migrants are grouped into three categories depending on their origin, i.e. non-migrants, local migrants, and external migrants.

Chapter 4 compares the benefits, livelihoods, and wellbeing associated with living in either the conservation or development zones. Data from a household survey, focus group discussions, and in-depth interviews were used to compare the zones.

Chapter 5 quantifies the different land uses and subsequent land cover changes in the Mumbwa GMA from 1990 to 2017. The chapter also uses a household survey to look at the households' land use characteristics that impact on land cover.

Chapter 6 summarises the main findings from the research (Chapters 3, 4, and 5) and concludes the dissertation. The chapter highlights the problems encountered during the study, recommends future research avenues, and offers management guidance.

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Chapter 2 Methods

This chapter has three parts. The first part describes the study area and gives the background to the game management area (GMA) as well as key features. The second part presents the conceptual framework and the elements that guided the research. The chapter concludes with an account of the research design and strategy, with an overview of the methods used to collect and analyse the data.

2.1. Study area

The research was conducted in the Mumbwa GMA, located in Zambia's Mumbwa district. Based on the International Union for Conservation of Nature (IUCN) classification, the Mumbwa GMA is class VI, which indicates that sustainable natural resource use is permissible alongside protection of the ecosystem (World Commission on Protected Areas (WCPA), 2015). The Mumbwa GMA is one of the nine GMAs around the Kafue National Park (Figure 2-1), Zambia's largest National Park. The Mumbwa GMA, located between (-15.330762, 25.912861 to -14.946877, 26.880199), covers approximately 3 370 km^2 of land (Namukonde & Kachali, 2015). The GMA borders a non-protected area on the east and Namwala GMA on the south, while the north and west are bordered by the Kafue National Park (Figure 2-1).

2.1.1. Historical overview and administration

Kafue National Park (formerly Kafue game reserve before 1920) was created to address the issue of declining wildlife populations and establish a purposeful Wildlife Management Policy (Mwima, 2001). The state displaced five local chiefdoms to other designated settlements to accommodate the reserve. These chiefdoms were under chief Kasonso from the north-west, Kabulwebulwe from the west, Kaingu from the north, and Musungwa and Shezongo from the south. A provision was made for a few villages to stay near the park (in an area called a development zone, as described

later in this chapter), primarily to supply park labour. It was only in 1972 that the Mumbwa GMA was established as one of the current nine Kafue National Park buffers.

Mumbwa GMA households fall under three chiefs: Chibuluma and Mulendema of the Ila people, and Kabulwebulwe of the Nkoya people. The three chiefs constitute the GMA's Wildlife Management Authority (Siachoono, 1995; Zambia Wildlife Authority (ZAWA), 2014). Those living in designated settlements have formed 15 village action groups (VAGS), which self-organise into the community resource boards (CRBs) that administer the GMA's affairs (Namukonde & Kachali, 2015). Although chiefs, acting through the village headmen, allocate land to families or clans, the land remains under the chief and cannot be titled.

2.1.2. Key physical features

The Mumbwa GMA lies on a plateau with an elevation between 1 150 m and 1 200 m above sea level. The GMA falls in Agro-Ecological Region IIa,[1] which has an annual rainfall of 800 to 1 000 mm falling in an average of 80 days (Chomba et al., 2013). Temperatures range from 18 to 40° C during the year. The soils are well drained with different soil types, the predominant ones being leptosols and oxisols (Chomba et al., 2013). The Kafue River, the main river in the GMA, borders the Mumbwa GMA with the Park. Other rivers in the GMA are the Lutale, Nkolola, Chungu, Nansenga, Itapira, and Lukomezhi.

2.1.3. Key biological features

The Mumbwa GMA has approximately 450 to 500 plant species. The area is predominantly dry, miombo woodland (Chidumayo, 2019), characterised by *Brachystegia, Julbernardia,* and *Isoberlinia* tree species, and *Themeda triandra, Hypharrhenia,* and *Heteropogon contortus* grass species. The miombo woodland, which generally grows slowly, has small trees and shrubs below a 10- to 20-m high canopy (Chomba et al., 2013) which represents a transition between Africa's rainforests and semi-arid savannahs (Vinya, 2010). *Acacia polyacantha, A. erioloba, A. sieberiana,* and *A. tortilis* also occur in patches within the GMA. Other parts of the GMA have

[1] Zambia is divided into three Agro-Ecological regions (zones) based on climate and soil. Region I receives average annual rainfall below 800 mm, while Region III receives average annual rainfall of over 1 000 mm

Termitaria woodland characterised by *Acacia nigrescens, Tetradenia riparia, Garcinia livingstonei,* and *Syzygium guineense*. The riparian woodland occurs along the Kafue and Nansenga Rivers with trees like *Diospyros mespiliformis, Homalium* spp*,* and shrubs like *Warneckea* spp and *Canthium glaucum*. Other vegetation types are *Baikiaea* forest (given special status because of their rare occurrence), wetlands, and grassland.

The Mumbwa GMA has a diversity of wildlife, with common animals being the elephant (*Loxodonta africana*), sable antelope (*Hippotragus niger*), buffalo (*Syncerus caffer*), waterbuck (*Kobus defassa*), puku (*Kobus vardonii*), impala (*Aepyceros melampus*), warthog *(Phacochoerus africanus)*, lion (*Panthera leo*), leopard (*Panthera pardus)*, wild dog (*Lycaon pictus)*, hyena (*Crocuta crocuta*), banded mongoose (*Mungos mungo*), baboons (*Papio ursinus*) and vervet monkeys (*Chlorocebus pygerythrus*). Although the animal species found in the GMA are known, their specific numbers are not well documented (Frederick, 2011).

2.1.4. Land use and zoning schemes in Mumbwa GMA

The Mumbwa GMA consists of five zones based on land use: buffer, wildlife conservation, development, special use, and tourism zones (Figure 2-1). This study focuses on wildlife conservation and the development zones. Below is a summary of the zones and their land uses, based on the Department of National Parks and Wildlife (DNPW) Mumbwa GMA management plan (ZAWA, 2014).

The wildlife conservation zone, commonly called the conservation zone, occupies 1 905.5 km^2 of land, or 57% of the Mumbwa GMA (ZAWA, 2014). The conservation zone provides for hunting and non-consumptive tourism and contains prime wildlife habitats. The only structures allowed in this zone are hunting camps, lodges, and infrastructure used to protect the park's resources. Furthermore, developers in this zone are required to conduct environmental project briefs (EPBs) to evaluate if the infrastructure is suitable for the GMA. Although photographic tourism, resident and safari hunting, and collection of forestry products are permitted in this zone, human settlements and mines are not. The conservation zone is the most heavily affected by illegal land use.

The buffer zone occupies 628.58 km^2 of land, or 19% of the Mumbwa GMA (ZAWA, 2014). The buffer zone is the transition between the conservation zone and the development zone, thereby acting as a corridor for wildlife movement (Figure 2-1). This means that wildlife can freely move between the park and the GMA. Although photographic tourism and research are permitted in this zone, people cannot settle, hunt, farm, or mine there. Roads and infrastructure used to protect resources can be built after passing an environmental impact assessment (EIA) and EPB.

The development zone occupies 528.7 km^2 of land, or 16% of the Mumbwa GMA (ZAWA, 2014). The primary purpose of the zone is to provide for human settlement and socio-economic activities. People can build houses and other structures that facilitate development in this zone, provided that the buildings meet the EIA's standards and approval of traditional leaders, especially for large projects. Furthermore, farming, fishing, and tourism are permitted, provided that they do not violate environmental laws. For example, agricultural practices that degrade the soil and illegal waste disposal are not allowed.

The tourism zone occupies 169.91 km^2 of land, or 5% of the Mumbwa GMA (ZAWA, 2014). This zone promotes both consumptive and non-consumptive tourism and permits the building of lodges, hunting camps, roads, and signage, as well as hunting, photographic safaris, angling, and boating. However, people are not permitted to settle, farm, mine, harvest trees or have pastures for their animals in this zone.

The special use zone occupies 137.52 km^2 of land or 4% of the Mumbwa GMA (ZAWA, 2014). Special use zones protect particular landscapes or features unique to the GMA. In the Mumbwa GMA the special use zone protects *Baikiea plurijuga* vegetation found in the Tepula area. The state permits the building of cultural tourism facilities, lodges, resource protection infrastructure, and roads in this zone. However, people are not allowed to hunt, harvest trees/ thicket, settle, or mine in this zone. If any development is carried out, it must meet EIA and EPB standards.

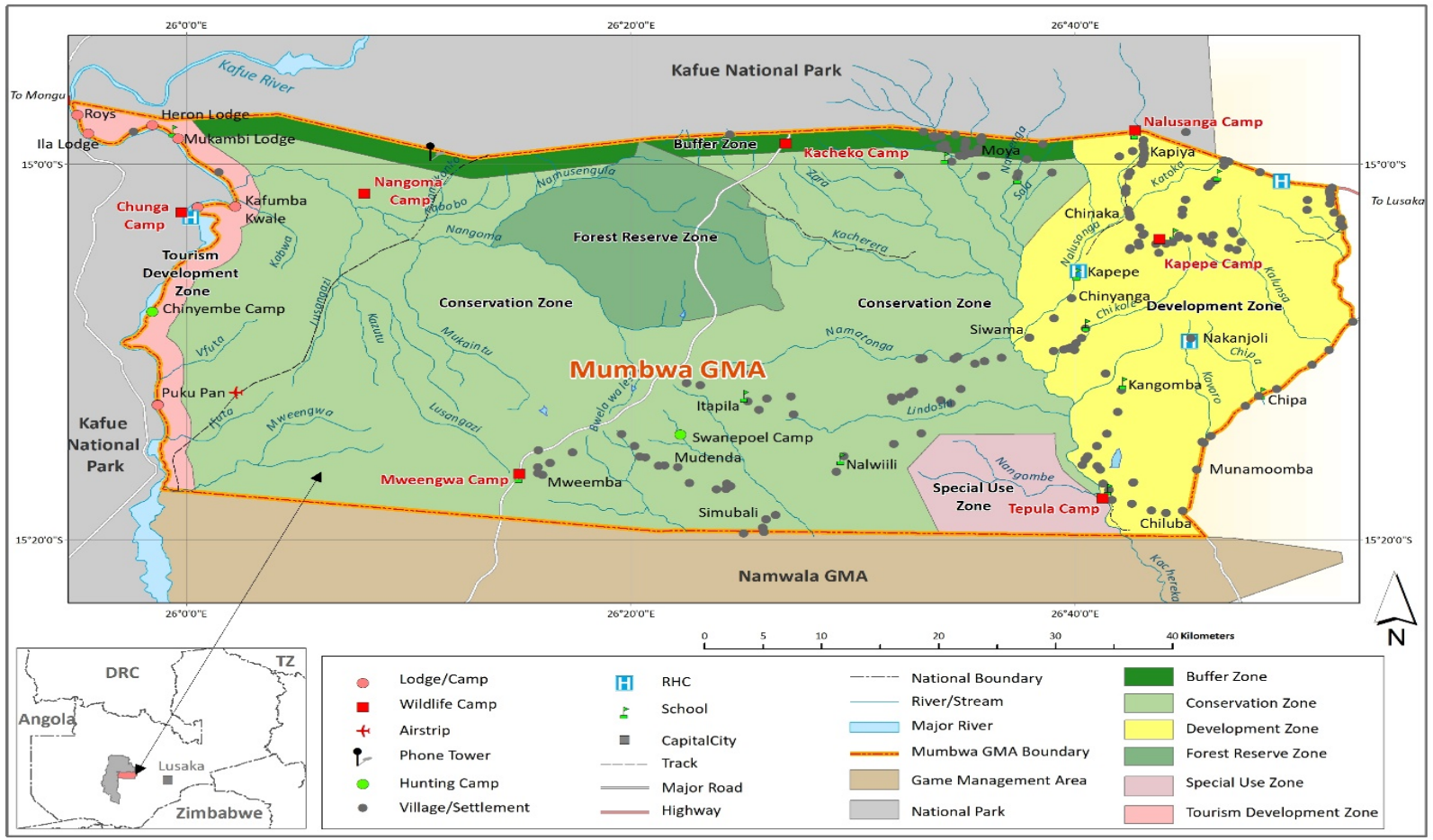

Figure 2-1 Land use management zones of the Mumbwa Game Management Area, used with permission from Zambia Department of National Parks and Wildlife (2019)

2.1.5. Land use and relevant National policies in the game management area

The main policy governing land use in game management areas is the National Parks and Wildlife Policy. The policy provides guidelines on the aspects of promoting Community-based Natural Resources Management (CBNRM). The policy focuses on protecting wildlife and income generation from tourism, aimed at national economic growth (Zambia. Ministry of Lands, Natural Resources, and Environmental Protection, 2018). Being a mixed land use protected area, the GMA has various aspects which require various policies that correspond. Five other sectoral policies (see Table 2-1) have aspects related to land use in the GMA (Zambia. Ministry of Agriculture and Ministry of Fisheries and Livestock, 2016a; Zambia. Ministry of Lands, Natural Resources, and Environmental Protection, 2014; Zambia. Ministry of National development and planning, 2016b; Zambia. Ministry of Mines, Energy, and Water Development, 2015). However, having fragmented policies that are applicable to the GMA proves ineffective as the different policies have different, and sometimes conflicting objectives. For example, the Wildlife act which gave rise to the National Parks and Wildlife Policy manages forests in protected areas as wildlife habitats (Zambia, 2015), while the National Forestry Policy only manages protected forests, and not those in national parks and GMAs (Zambia, 2014). Prior to the current policies (Table 2-1), the government drafted the National Policy on Environment to harmonise management of the different sectors of the environment (Zambia. Ministry of Tourism, Environment, and Natural Resources, 2009). The environment and natural resources management and mainstreaming programme (ENRMMP) has also attempted to coordinate the various stakeholders in the various environmental sectors.

Table 2-1 A summary of the National policies that are relevant to land-use in Mumbwa Game Management Area

Policy	**Relevant policy objectives**	**Policy measures**	**Relevance of policy to GMA land use.**
Energy Policy in Zambia (2008)	- Ensure better management of woodlands and forests as sustainable sources of fuel wood - Improve the technology of charcoal production and utilization - Promote appropriate alternatives to fuelwood and reduce its consumption	- Encourage the establishment of forest plantations/wood lots in wood deficit areas - Encourage the adoption of efficient and cost effective production techniques - Encourage the use of alternative renewable sources of energy	- With 84% of Zambian households relying on fuelwood for energy, this policy is key to reducing pressure on forests
National Policy on Environment (2009)	- To have an encompassing national environmental policy that will support the Government's priority to eradicate poverty and improve the livelihoods of people	- Ensure that ministries/ departments implement their sectoral policies consistently with and support the guiding principles and specific provisions of the *National Policy on Environment*	- Having multiple land uses, the GMA requires input from several sectoral policies
National Forestry Policy (2014)	- To manage and maximise the productivity of Zambia's forest resources - To empower local communities and traditional leaders in the management and protection of forests - To improve the role of forests in addressing climate change through mitigation and adaptation - To promote sustainable harvesting of wood and	- Establish criteria and indicators for sustainable forest management - Establish incentives and benefit sharing mechanisms for communities that manage and protect indigenous and plantation forests - Create public awareness on the importance of forests in mitigating effects of climate change - Provide guidelines for charcoal production on farmlands and other productive areas	- Forests are the primary habitat of wildlife, a key in mitigating climate change, and an important source of livelihoods to local communities in the GMA

Policy	Relevant policy objectives	Policy measures	Relevance of policy to GMA land use.
	production of Charcoal to reduce deforestation		
Second National Agricultural Policy (2016)	- To increase agricultural production and productivity - To promote the sustainable management and use of natural resources - To mainstream environment and Climate Change in the agriculture sector	- Promote the use of improved crop varieties and certified seed - Promote sustainable land management technologies like conservation agriculture - Promote and strengthen agricultural production methods that are resilient to Climate Change	- Agriculture is the main livelihood activity among GMA households and is often in conflict with conservation
National Policy on Climate Change (2016)	- To promote and strengthen the implementation of adaptation and disaster risk reduction measures to reduce vulnerability to climate variability and change	- Promote sustainable land use planning to protect key ecosystems and related services. - Promote landscape based livelihood diversification - Reduce forest degradation and loss of forest ecosystems	- Because of their vast forests, GMAs are key in mitigating the effects and progression of climate change.
Draft National Land Policy (2017)	- Prepare and update internal boundaries to promote national good governance frameworks - To strengthen customary land administration in order to guarantee security of tenure - To protect and conserve commons lands, which are essential for the livelihood support, economic growth and for the overall well-being of a community	- Delineate jurisdictions of natural conservation areas, forests, national parks, GMAs and other protected areas - Develop and disseminate guidelines for the issuance of customary land certificates and the ensuing rights and obligations under such certificates - Promote involvement of community institutions at village and Chiefdom levels to strengthen	- The land in the GMA is allocated by the chief to his subjects. However, this land cannot be put on title, but each family is registered with the chief.

Policy	Relevant policy objectives	Policy measures	Relevance of policy to GMA land use.
		decentralized governance of natural resources	
National Parks and Wildlife Policy (2018)	- To create enabling conditions for effective conservation of wildlife and sustainable growth of the sector - To devolve wildlife user rights; costs and benefits to community and private land owners - To unlock the economic potential of wildlife and performance of the sector	- Sustainably manage the existing protected areas and, where necessary, create additional categories of protected areas - Decentralize the management of protected areas (except national parks) to appropriate local communities - Develop clear guidelines on the devolution of wildlife management, user rights, and costs/ benefits to land owners	- The GMA directly falls under this policy, which stipulates how GMA land should be used to conserve wildlife and improve the local people's livelihoods.

2.1.6. Human settlement and population demographics

The state and the three chiefs with subjects in the GMA set aside land in Chungu to conserve wildlife in 1972 in what is currently called the conservation zone. They further established settled households near water sources such as Lutale and Nansenga rivers, or main roads like the Lusaka-Mongu road (M 9) (Chomba et al., 2013), in what is currently called the development zone. However, chief Mulendema's death resulted in succession wrangles within his chiefdom in the 1990s, forcing approximately 100 households, under headman Kapeshi, to migrate towards Chungu stream in the conservation zone (ZAWA, 2013). Over time, Kapeshi's settlement co-opted other settlers, leading to considerable population growth to about 1 000 households by 2013. This community is very mobile and has spread to Mumbwa East, and is advancing towards the GMA's prime hunting block in Mumbwa West within the conservation zone.

Because of the high inward (mostly illegal) and out-migration, determining the specific population and its density is difficult. Furthermore, census data depend on voting wards, which have different boundaries than the GMA. In 1995, chiefs Chibuluma and Mulendema estimated their chiefdom's total population at 8 000 and 3 500, respectively (Siachoono, 1995). Chief Kabulwebulwe could not give estimates but declared 200 villages. Chomba et al. (2013) reported that the total GMA population was 6 000 in 2000 and more than 10 000 by 2011. The Central Statistics Office (CSO, 2010) reported in 2010 that the Mumbwa GMA population had a 0.4% annual growth rate, with the population increasing from 24 628 in 2000 to 33 176 in 2014 (ZAWA, 2014). This increase was attributed to an influx of settlers to the GMA, with 7 584 new external migrants by 2010. The Ministry of Health (2010) estimated the population at 25 712 in 2010, distributed as 56% and 44% males and females, respectively. This study used the ZAWA estimates of 33 176 as it includes the external migrants to the GMA.

2.1.7. Livelihoods and social amenities

Subsistence agriculture is the main livelihood activity for Mumbwa GMA households, with maize being the main crop (Figure 2-2; Figure 2-3). Other income-generating livelihood activities include bee-keeping, poultry farming, employment in the consumptive, and non-consumptive tourism industry, harvesting non-timber products, traditional or artisan fishing, and weaving (ZAWA,

2014). The GMA also generates income from trophy hunting (Table 2-2; Chemonics International, 2011). The GMA ranks fifth of the 36 Zambian GMAs in generated revenue from hunting; high numbers of buffalo, lions, and leopards are hunted (Namukonde & Kachali, 2015). Most of the income is from trophy hunting and is shared among the state, chiefs, CRB administration staff, village scouts, and community projects, with the chief administering the community's share of 15% (Lindsey et al., 2014). Illegal trophy and game hunting also contribute as income sources in the GMA, with 39% of the Kafue National Park's arrested poachers belonging to the Mumbwa GMA in the years 2000 to 2009 (Namukonde & Kachali, 2015). The GMA hosts two lodges/campsites (Mukambi & Puku pan), which are involved in photographic concessions, while two other camps are engaged in hunting concessions (Chemonics Iinternational, 2011).

The Mumbwa GMA has several community primary schools, three middle schools, six upper basic schools, and one high school. The Mumbwa GMA residents depend on water from rivers and boreholes/wells funded by donors.

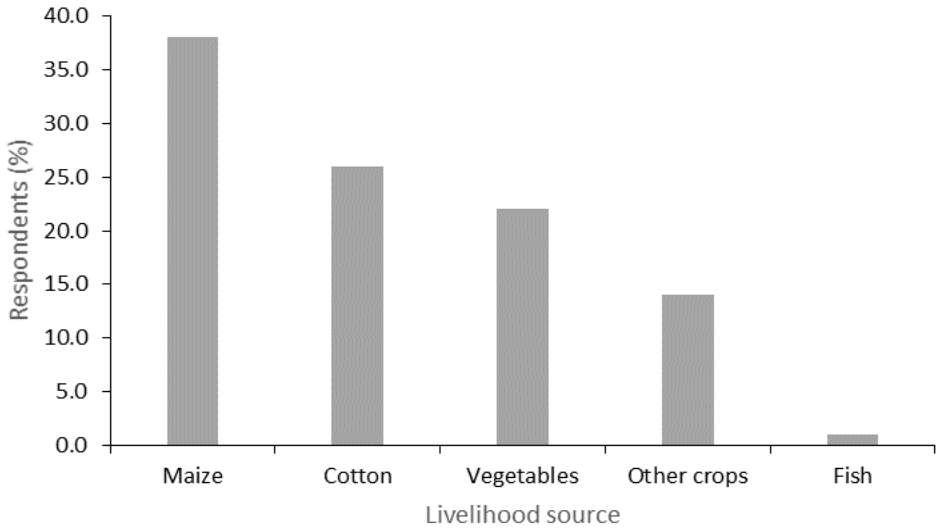

Figure 2-2 Chart depicting the importance of livelihood sources in a sample village (Kahosha) in Mumbwa Game Management Area. Adapted and modified with permission from Chemonics International (2011)

Figure 2-3 Mumbwa development zone farmers in their fields. Source: Fieldwork, 2017; photograph taken by Justin Muyoma (data-collection assistant)

Table 2-2 Mumbwa Game Management Area hunting license revenues and bagged animals for safari and resident hunting from 2005 to 2010

Year	2005	2006	2007	2008	2009	2010	Change (2005-10)
Generated income (USD)	142,760	66,000	134,600	201,160	156,280	157,240	10.2%
Number of animals bagged	195	113	213	233	221	235	20.5%

Source: extracted with permission from Chemonics International (2011)

2.2. Conceptual Framework

Conceptual frameworks provide a guide that connects underlying sets of ideas that serve to make sense of related concepts (Pickett et al., 2010), in turn giving the direction to the research (Ostrom, 2009). The conceptual framework used for this study is a hybrid of the sustainable rural livelihoods "framework for analysis" (Scoones, 1998) and Babulo's (2008) adaptation of the "sustainable livelihoods conceptual framework" (Figure 2-4). A livelihood is comprised of assets (natural, physical, human, financial, social) and activities (farm, non-farm, others) needed to sustain a living (Babulo et al., 2008). The framework has interlinked components, all centred on how households use resources at their disposal to achieve sustainable livelihoods, with other intended or unintended consequences. This study uses the framework to understand and connect the various ways in which households use the land as a natural resource to sustain their livelihoods. The framework illustrates how human agents use the land to secure their livelihoods and how the agents, in turn, interact with the environment and social conditions. The interaction results in a cycle connected by several interrelated loops (Ostrom, 2009) and may be influenced by both gradual and rapid change (Folke, 2006). This study investigates specific components of the framework through three data chapters, each focusing on a particular element. Land use and cover changes are better understood by incorporating a range of disciplines because of their complex nature (Porter-Bolland et al., 2007). For example, this study borrows knowledge from the social sciences (human behaviour and social patterns) as well as the physical sciences (land-cover change mapping).

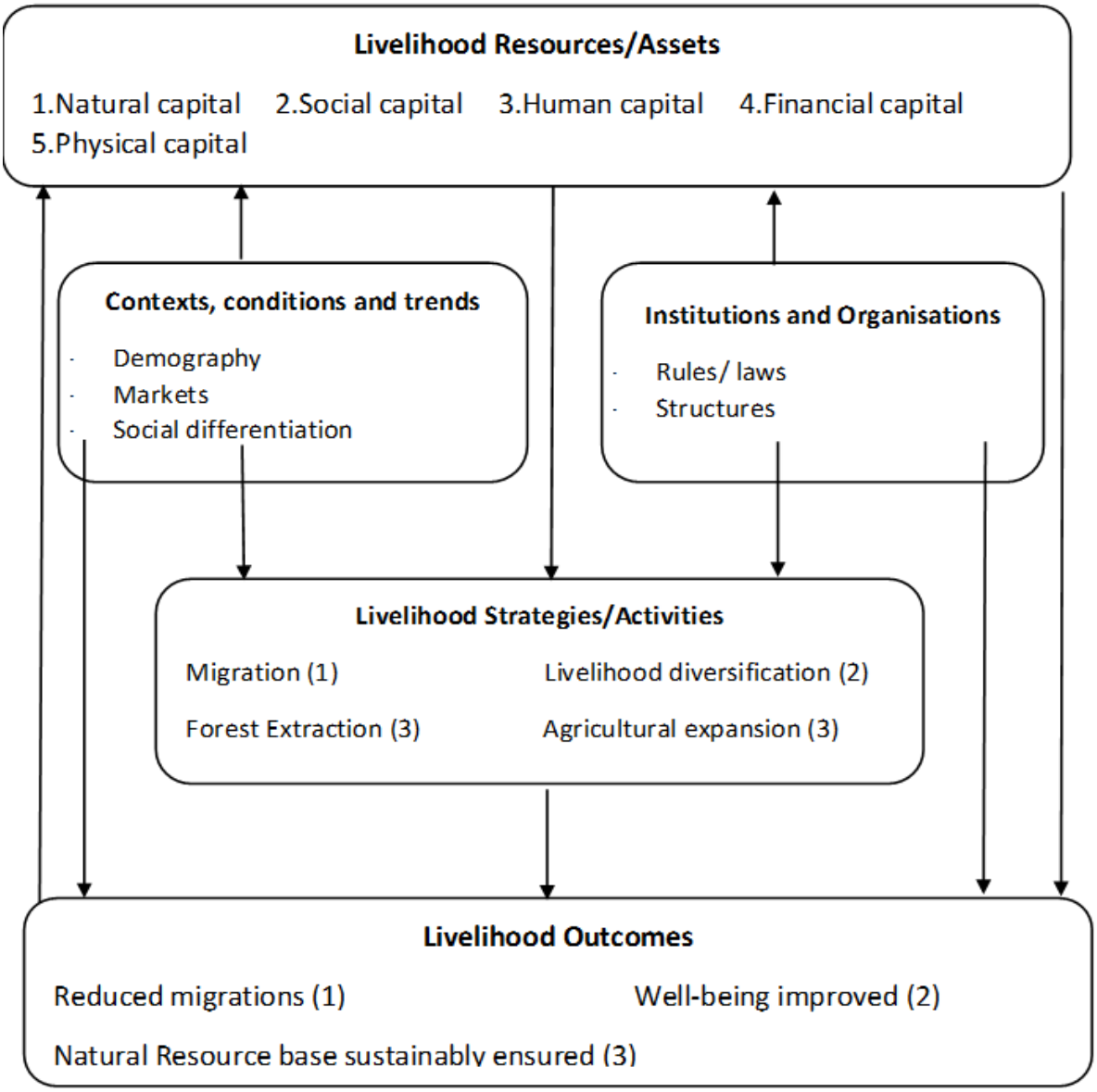

Figure 2-4 A conceptual framework for livelihoods. Source: adapted from Scoones (1998) and Babulo et al. (2008). Note: the numbers in parentheses refer to objective numbers.

2.2.1. Elements of the framework

Livelihood resources/assets are the building blocks people use to pursue their livelihoods (Scoones, 1998) and for the production of basic needs (Ellis, 2000). Various resources/assets, also known as capital, have been identified, with the list not being exhaustive. Among the common ones are natural, physical, economic/financial, human, and social capital. This study focuses on natural and social capital, and to some degree the other forms of capital as well. Natural capital in this study includes the land and forests from which the households derive their livelihoods (Scoones, 1998). Natural assets should be distinguished from physical assets, which are a product of economic production processes (Ellis, 2000), for example, crops and livestock. Natural capital forms the basis upon which the other forms of capital build. Social capital includes the networks and relationships formed among households to sustain their wellbeing through various livelihood strategies (Scoones, 1998). Social capital is important in this study because it forms the basis of most migrations (Ellis, 2003). Economic capital consists of the financial capital base, while human capital includes the skills needed to support livelihoods (Scoones, 1998). Most of these assets are used either simultaneously or in sequence, or even as substitutes to produce goods and services (Scoones, 1998).

Once the households have livelihood assets to choose from, they come up with strategies or activities which involve specific asset combinations aimed at achieving their desired outcomes (Babulo et al., 2008; Department for International Development (DfID), 1999; Ellis, 2003). In this study the terms ‘strategies’ and ‘activities’ refer to what households engage in to sustain their livelihoods (Ellis, 2003). Scoones (1998) identifies three livelihood strategies that households may engage in, which this study adopts (Figure 2-4). Migrations are a common strategy in low-income countries that households resort to in search of better livelihoods (Ellis, 2003). The migrations, however, tend to put pressure on limited resources associated with protected areas (PAs), creating tension between the local people and migrants (Vorlaufer & Vollan, 2020). Another strategy is either to intensify or extend agriculture by improving farming methods or by cultivating more land. This strategy is particularly critical for households that rely on farming, as is the case in the Mumbwa GMA. The households may also diversify into non-farm livelihood sources to create a broader base from which to choose. This strategy is one of the designs in GMA conservation

packages in which households should benefit from livelihoods centred on conservation programmes. Livelihood strategies among the rural poor often rely on the natural resource base (Scoones, 1998; Shackleton et al., 2007) and the availability of other assets such as human capital. Furthermore, individuals are driven and motivated by other factors that help them decide which strategy to adopt. Individuals within households choose the strategies which affect and relate to other strategies within the system (Kamwi et al., 2015; Parker et al., 2003). For this reason, this research recognises that individuals within households do not operate in isolation, as they belong to communities which are part of complex ecosystems and contribute to land use change (Berkes et al., 2000; Cumming et al., 2015). This puts households at the centre of biodiversity conservation (Contreras-Hermosilla, 2000; Uggla, 2010). Whatever strategy the households engage in, the anticipated livelihood outcomes impact on their wellbeing as well as on the natural resource base (Serrat, 2017).

Although there are many assets, not all households can access them. The access and choice of these assets may be determined by institutions, policies, and politics, among other factors (Scoones, 1998). Institutions involve rules and rights that govern both the households and other stakeholders in the GMA (Ellis, 2003) and may be formal or informal (Scoones, 1998). Other outside factors can influence the livelihood activities of the household and the natural resource base (Babulo et al., 2008). For example, a ban on the sale of ivory may reduce the legal hunting of elephants, but this in turn reduces the revenue that goes to the local communities.

This study was designed in such a way that each successive chapter builds on the previous one and the overall concept of land use in PAs. The first data chapter (Chapter 3) sets the scene by analysing migrations as the main cause of encroachment which increases human activity in the GMA, especially the conservation zone. Chapter 4 then looks at the livelihood activities that the households from both zones engage in as they aim to improve their livelihoods and wellbeing. The chapter focuses on how reliant the households from the two zones are on the GMA for their livelihoods. Chapter 5 analyses the effects of land use by households on the natural resource base stability. As an outcome (objective 3), this study looks at the trends in land cover change, with an emphasis on forests as a natural resource base.

2.3. Research design and strategy

This study employs a case study approach (Figure 2-5). Until recently, case studies were perceived by some researchers to lack scientific merit because they lack generalizability (Babbie & Mouton, 2012). However, case studies are now acknowledged as able to provide a broader view of a phenomenon because they employ multiple methods (Cook & Campbell, 1979; Creswell & Creswell, 2017) and improve the validity and reliability of the collected data (Mikkelsen, 2005). For these reasons, a case study presents an opportunity for this study to view land use from the perspective of different actors, but within a specific context (Zainal, 2007).

Research strategies guide researchers to select appropriate methods to address the objectives. This study employs both qualitative and quantitative data-collection methods to give a clearer picture than using a single method would (Creswell & Creswell, 2017). Quantitative data show relationships among variables, while qualitative data attempt to explain the relationships. A mixed-method approach further puts to rest the debate about which approach provides better results. The use of single methods, however, has its purpose in research (Morgan, 2007).

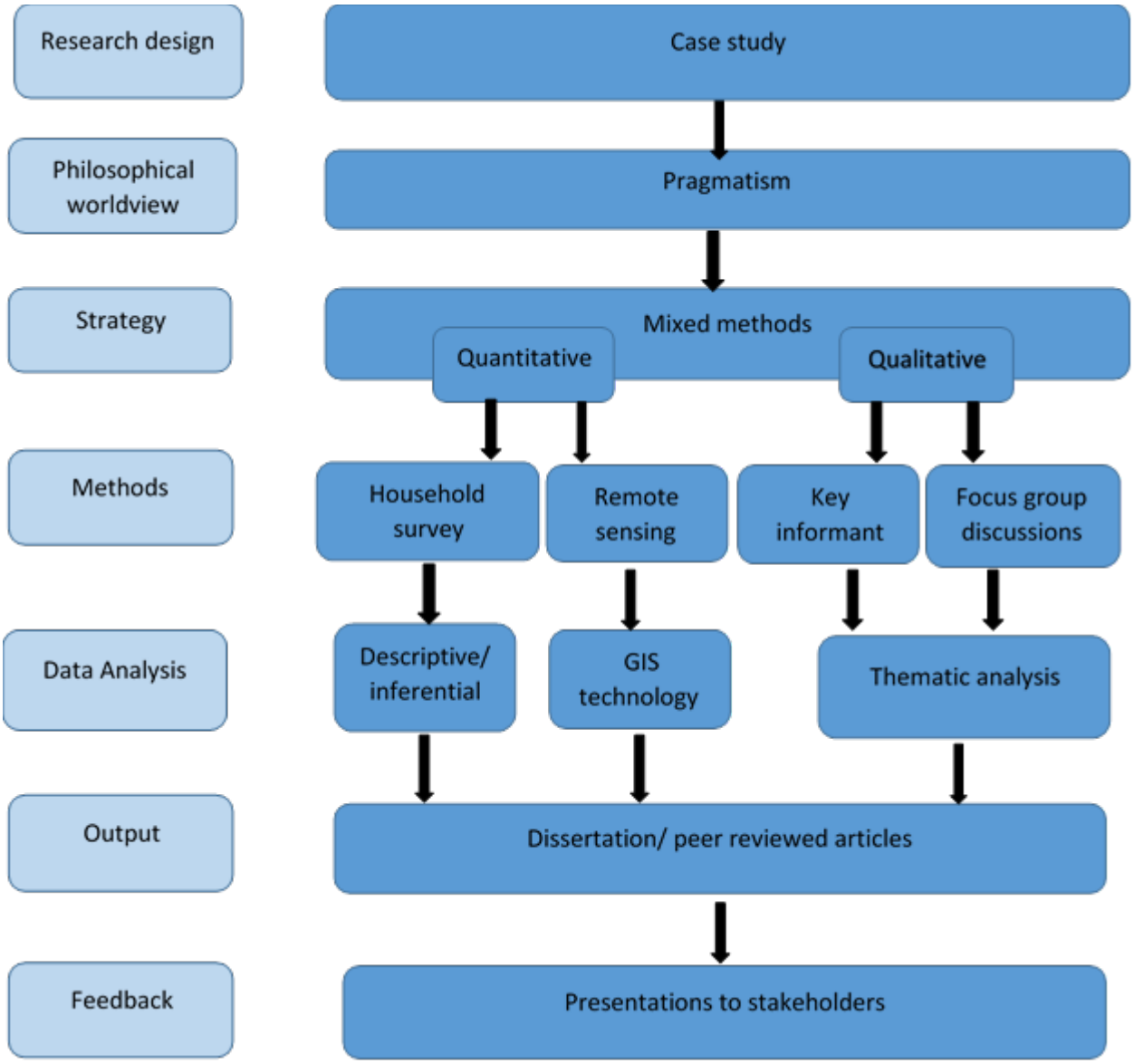

Figure 2-5 An overview of the research design and strategy used to conduct the study, adapted from Sitas (2004)

2.3.1. Philosophical world view

Philosophical worldviews or research paradigms provide insight into researchers' perspectives on the world and reality (Morgan, 2007) and will therefore, direct the researcher (Håkansson, 2013). Diverse philosophical worldviews have been identified, with the post-positivists being one

extreme and constructivists the other. Creswell and Creswell (2017) describe the post-positivist approach as one seeking to determine the truth or validate theories by establishing a cause and effect relationship through empirical evidence. On the other hand, the constructivist seeks to understand and give meaning to social and historical events, thereby coming up with theories. Traditionally, researchers had to align themselves to either the post-positivist or constructivist worldviews, which influenced the methods chosen and analysis done (Yvonne Feilzer, 2010). Since none of the above paradigms fitted well for this research, the study adopted the pragmatic philosophical worldview, which seeks to solve problems and understand the consequences of actions (Creswell & Creswell, 2017). Issues are best understood when analysed from different angles using multiple methods and drawing on different worldviews, which should not conflict with but complement each other (Morgan, 2007; Yvonne Feilzer, 2010). Reality has layers, some of which are stable and others not, making it impossible to predict anything with absolute certainty. Having multiple layers of reality means there is no one truth and this in turn calls on the researcher to employ various means to address world problems. This worldview acknowledges that single paradigms can not only limit the researchers' curiosity, but also miss what may be vital but not so apparent (Glogowska, 2015).

The pragmatic philosophical worldview embraces the ‘abduction/abductive’ approach (Table 2-3), which borrows elements from the inductive and deductive approaches (Graneheim et al., 2017; Håkansson, 2013; Morgan, 2007). The abduction/abductive approach is an iterative process that turns observations into theories, which are then tested. On the one hand, quantitative researchers view the truth as something which can be objectively determined, while qualitative researchers see it as subjective (Yvonne Feilzer, 2010). This approach acknowledges that the researcher can never infact be objective, and in their subjectivity they are guided by some principles (Morgan, 2007). This means that people can interpret the same thing differently.

Furthermore, the concept of transferability refutes the notion that a phenomenon can be so specific and unique as not to apply to other phenomenon. Neither is something so general to apply to all. Therefore, the land use problems in the Mumbwa GMA, though unique, can be used to gain insight into how to solve land use problems in other PAs.

Table 2-3 A pragmatic alternative approach to the critical issues in social science research methodology

	Qualitative Approach	**Quantitative Approach**	**Pragmatic Approach**
Connection of theory and data	Induction	Deduction	Abduction
Relationship to the research process	Subjectivity	Objectivity	Inter-subjectivity
Inference from data	Context	Generality	Transferability

Source: with permission from Morgan (2007)

Addison et al. (2008) describe three timeframe approaches to collecting data. One-off indicators, for example, socio-economic surveys, can be used in livelihood studies. Such indicators, however, do not eliminate or account for other factors that influence the phenomenon of interest. The second option is panel data, collected at several points in time to monitor aspects of interest. Although the panel data approach was desirable for this research, because it enables the monitoring of change as it happens, it takes time and could not be undertaken within the time allowed for the study. Thirdly, data can be collected in retrospect, relying on the respondents' ability to recall events or reasons that happened at a particular time in the past. This study combined the first and third options. Remembering things in retrospect, however, presented a risk because some respondents could not remember exact dates. To reduce the scope for error, the respondents were asked for periods in which events occurred rather than specific dates. Another risk was social desirability bias, where respondents give answers which they feel are socially acceptable, not what they believe is true (Grimm, 2010). The bias may especially come from those in the conservation zone because of their illegal status. The bias was neutralized as much as possible by using simple neutral words when asking the questions, assuring the participants of anonymity, and creating an atmosphere where there was no incentive for providing socially biased answers.

2.3.2. Data collection

A detailed description of the methods is given in Chapters 3, 4, and 5. Field data were collected from July 2016 to June 2017. Four methods were used: a structured questionnaire, key informant interviews, focus group discussions (FGDs), and remote sensing. Ethical clearance was granted for use of the data-collection tools (details given towards the end of this chapter). The questionnaire was the primary instrument, while the FGDs, interviews and remote sensing validated some of the findings from the questionnaire (Harrell & Bradley, 2009). Individual households and social actions formed the primary units of analysis, as described by Babbie and Mouton (2012). Secondary data were reviewed through various sources such as maps and documents from the Department of National Parks and Wildlife (DNPW).

2.3.2.1. Focus group discussion

Focus group discussions (FGDs) are recommended for obtaining knowledge from groups of people with similar problems or interests (Drake, 2013; Krueger & Casey, 2014). It was important for this research to highlight shared experiences and stories which may otherwise not be revealed during individual interviews (Kamberelis & Dimitriadis, 2013; Wilkinson et al., 2004). Freitas et al. (1998) have identified three circumstances in which FGDs can be used along with other methods;

1. To precede a quantitative research method, thereby enabling the researcher to acquire more knowledge of the field and gain insight into potential problems;
2. Used simultaneously with a quantitative research method to triangulate or validate the results obtained;
3. It is used as a follow-up in a quantitative research method to shed more light on an area of interest that may have emerged during the course of the research.

For this research, the FGDs were used for the first two reasons. The FGDs preceded the completion of the questionnaire. The FGD responses, alongside literature and the study's objectives informed the questions and anticipated answers in the questionnaire. Furthermore, the FGD data were used to validate the findings from the other methods.

The target population was individuals living within the conservation or development zones of the Mumbwa GMA. The focus group discussion participants were invited through the CRB liaison officer. The group's shared experiences were the primary unit of analysis. Two main subgroups were identified; households that were living in the conservation zone and those living in the development zone. Two further subgroups were formed; the male and female participants were separated to encourage participation among women (Stewart & Shamdasani, 2014). Initially, the males and females formed one group, after which they were separated and then brought back together to discuss and draw conclusion. The males and females were separated to make the female participants more comfortable about expressing their views amongst themselves before discussing with the men. Each subgroup on average comprised of 15 participants. Krueger and Casey (2014) suggest an average of 15 participants per group; 15 is small enough for every member to participate and big enough to get a range of divergent views about the research topic.

Moderators were trained to assist with the FGD. Each group had a moderator and a co-moderator. The role of the moderator was to lead and guide the discussion by asking questions and probing, while the co-moderator took notes. The FGDs were held at the CRB offices where communities hold their meetings to facilitate dialogue, which is key to obtaining valid information (Freitas et al., 1998). The participants sat in a semi-circle so that their contributions could easily be picked up by other members; this indicated that there was equality, with everyone being on the same level (FGD interview schedule is attached as Appendix 2).

2.3.2.2. Questionnaire

A household survey was conducted to collect data on respondents' demographics, land use characteristics, benefits of living in the GMA zones, migration patterns, livelihood activities, and wellbeing. The questionnaire (Appendix 3) consisted of both open and closed questions. Some of the open-ended questions were coded and used in statistical analysis, while others helped gain further insight into respondents' views.

The study population was household heads living within the Mumbwa GMA. Proportionate random sampling was used to select respondents from the two test sites within the GMA (i.e. those living in the conservation and the development zones). Proportionate sampling is used when the subgroups (zones) have vastly different numbers in terms of population (Salkind, 2010). A sampling intensity of 10% was used to determine the number of respondents from each zone, as suggested by Neuman and Robson (2014). Random sampling was then done to select individual households from each zone. The development zone households were sampled from all three chiefdoms, depending on their population, while the two areas where most people are settled in the conservation zone were selected.

The questionnaire was pre-tested on 20 respondents to ensure that the questions were appropriate and clear for the targeted population and enumerators. After the questionnaire was adjusted, it was administered at the respondents' home at their convenience. A total of 437 (136 and 301 from the conservation and development zones, respectively) household heads or their proxy were interviewed, with each interview lasting for about 30 minutes to one hour.

2.3.2.3. Key informant interviews

Key informant interviews were used to collect data on the state of land use and its history in the Mumbwa GMA. Data from the interviews provided insight into land use and the challenges experienced in the GMA. These interviews helped look at specific challenges in land use while still leaving room to obtain more data, as suggested by Rabionet (2011). Furthermore, the interviews provided more detailed information that could not be collected through the household survey (Creswell & Creswell, 2017).

The target population was individuals who had specific leadership roles within the Mumbwa GMA, or who had at some point worked for the government departments responsible for the GMA. The selected key informants were the Director of the Department of National Parks and Wildlife (DNPW), two other DNPW officers, a senior agricultural officer (SAO), a veterinary officer, and a former Tourism and Natural Resources Minister. The interviews were 'face to face' at a place of the interviewee's choice. Voice recorders were the first choice for note-taking, as recommended

(Rabionet, 2011). However, paper and pen were also used for those who were uncomfortable with the voice recorder. The questions used for the interviews are attached (Appendix 4). The order of questions was followed, as indicated in the list. Follow-up questions were asked when clarification was required.

2.3.2.4. Ground truthing and Satellite imaging

Global Positioning Systems (GPS) and satellite images were used to quantify and monitor land cover changes (with assistance from Chenje Mtonga from Remote sensing center in Zambia and Christiaan Theron from the Centre for Geographical Analysis, Stellenbosch). Ground truthing was done in May 2015 to complement remote sensing data (Glenn et al., 2008) and classify the imagery. Among the collected GPS points were landmarks and human-made features. Satellite images of the Mumbwa GMA were then acquired from the Earth Resources Observation and Science (EROS) (athttp://glovis.usgs.gov) for the years 1990 (TM: Thematic Mapper), 2000 (TM), 2008 (TM), and 2017 (OLI_TIRS: Operational Land Imager_ Thermal Infrared Sensor). The year 1990 served as a baseline, while 2017 was the most recent year. Data from several time points allows the creation of land-cover maps over greater spatial extents and more frequent time steps (Nagendra, 2008). Images were obtained for the dry season to avoid cloud cover, as suggested by Tilumanywa (2013).

It should be noted that although such analyses can identify areas of land-cover change, they are less capable of locating areas of degradation within a particular land-cover type, which also is an indicator of human impact. The term land degradation is yet to have a universal definition, but broadly speaking does not lead to changes in land cover class in the short term (Margono et al., 2014). With continuous degradation, a forest can change to other wooded lands, which are predominated by grasslands and shrubs. Nevertheless, satellites enable evaluations of rates of land-cover change at a landscape scale in a relatively unbiased manner compared to expensive and detailed assessments based on field interpretation. Visual interpretation of the maps was then done, alongside the calculated changes in the area, to note changes in the land-cover classes. Net changes were reported between periods of interest using the cross-tabulation matrix method of Pontius Jr et al. (2004). Five land use/cover classes were used (forest, other wooded areas, cropland, bare land, and water bodies).

2.3.3. Data analysis

Data analysis was done using different methods, as described in detail in the relevant data chapters (3, 4, and 5). The use of various analysis methods is in line with the different methods used, which are anchored in the pragmatic philosophical world view used (Morgan, 2007).

For quantitative data, both descriptive and inferential analysis were conducted using SPSS version 22. Cross-tabulation and the chi-square (χ^2) tests of independence were conducted to establish statistically significant variables ($P<0.05$). Principal component analysis (PCA) was applied to the perceived benefits of living in the two zones to reduce the number of identified benefits and establish which variables contributed more towards the observed variances, but at the same time not distorting the variables (Jolliffe & Cadima, 2016). Independent samples t-test were also conducted to separate the means of various parameters used for the two zones.

Qualitative data from the questionnaire were coded so they could be analysed statistically. The qualitative data were from answers whose questions did not have predetermined answers. Deductive coding was done for those answers that fitted within the prescribed themes. For those that did not fit, inductive coding was done where similar responses were given specific codes (names) and grouped. Qualitative data from the interviews and FGD were analysed using thematic analysis in ATLAS.ti. The relevant codes were identified with reference to the study's objectives and guided by the conceptual framework. Since the study's objectives guide thematic analysis (Braun et al., 2019), some of the given information was not used if it was not of interest. Each transcript was looked at to see what parts of it fell into which categories of interest, for example, indirect and direct drivers of land-cover change.

2.4. Ethical clearance

Ethical clearance is mandatory when working with human subjects. For this research, ethical clearance was granted by Stellenbosch University's Ethics Committee for Human Research in the Humanities before collecting data (Ref: SU-HSD-002306). The research proposal, consent form,

tools used to collect data, and supporting permits were submitted together with the online application to the committee. There was no need to use the assent form (required by Stellenbosch University's Ethics Committee for Human Research in the Humanities when minors are interviewed) because no minors were interviewed in this study. The application clearly stated the research objectives and how the data would be collected. The committee was assured that all information obtained was confidential, and the names of the participants would not be published. Furthermore, the consent form would be given to the participants and their permission requested before the interview. Also included in the consent form were the potential risks and benefits to the stakeholders. Permission to research in the Mumbwa GMA was granted by DNPW (then ZAWA).

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Chapter 3 Human migration and settlement dynamics in Mumbwa Game Management Area

Abstract

Human migrations and settlements in protected areas are a concern. Mumbwa Game Management Area (GMA), one of the buffers to Kafue National Park in Zambia, hosts many external migrants from other parts of the country. This is especially so in the zone reserved for conservation (conservation zone) compared to the one where people are allowed to settle (development zone). This chapter investigated the magnitude and patterns of human migrations in these two zones. The study employed a mixed-method approach. Results showed that the conservation zone received proportionately more external migrants than the development zone (76% compared to 50%) over the last 16 years. Many of these external migrants had no plans to leave the GMA, especially those who acquired access to more land. Although households from both zones valued conservation, the need to grow more crops for conservation zone households and to accommodate the increased human population for the development zone households was more urgent. These results suggest that the conservation zone is more prone to human migrations, especially from people outside the GMA. Weak law enforcement, unclear GMA boundaries, and increased population have exasperated the migrations.

Keywords: Conservation zone, development zone, human migration, settlements, game management areas.

3.1. Introduction

Human migrations to buffer zones in protected areas (PAs) pose a threat to biodiversity conservation (Hartter et al., 2015; Meyerson et al., 2007; Tritsch & Le Tourneau, 2016), with negative outcomes reported worldwide (Bilsborrow, 2002; Jones et al., 2018). The migrants add to the natural human population growth and increase the number of settlements (Hartter et al., 2015; Wittemyer et al., 2008). The migrants may, for example, become illicit natural resource harvesters (Hettig et al., 2016) and agents of land-use change through the conversion of natural habitats to agricultural land (Caldas et al., 2015; Kamwi et al., 2015). Cases of encroaching onto PAs are reported worldwide (Broadbent et al., 2012; Watson et al., 2015), with the tropics being more prone to this (Laurance, 2012) because of internal migrations (Carr, 2008; Hecht et al., 2015). Human migration and the ensuing population growth, especially in sub-Saharan Africa, remain understudied despite their role in advancing biodiversity loss (Hartter et al., 2015).

A variety of theories and methods are employed to explain human migration and biodiversity loss (De Jong, 2000; Hartter et al., 2015; Hunter et al., 2015). Many focus on factors that predispose people to migrate, for example, personal attributes and the stage in the household's life cycle (Barbieri et al., 2009). Individuals from large households with little land, for example, are more likely to migrate as the children grow up (Barbieri et al., 2009). It follows that having social amenities such as schools and clinics reduces the chances of people moving away. The very existence of these social amenities could attract migrants (Barbieri et al., 2009; Wittemyer et al., 2008).

Scholte and De Groot (2010) propose three models to explain why people migrate to PAs: frontier engulfment, attraction, and incidental mechanisms. The *frontier engulfment model* refers to people moving to suitable farmland which happens to be next to a PA. Thus the decision to migrate is not influenced by the PA's existence. Salerno et al. (2014) show that Africa and Latin America present such a scenario where people migrate to the proximity of PAs because of available farming land, among other things, and not because of the PA *per se*.

In the *attraction model*, as posited by Wittemyer et al. (2008), people migrate to PAs because of their abundant resources and PA benefits. In this case, the PAs offer economic prospects, food,

and other necessities of life (Bilsborrow, 2002). Those who recognise the opportunities provided and are willing and have the resources to embrace it, migrate and the PA is a key attraction to this migration.

While the first two models point to pull factors (either outside or inside the PAs), the *incidental mechanism model* points to push factors. People may flee from conflicts or disasters and seek refuge in PAs (Hecht et al., 2015). Societies have been known to migrate as a strategy to adapt to global environmental changes, although this may come with vulnerabilities and risks (Adger et al., 2015). For example, people may be forced to migrate as a consequence of increased changes in climate, which affects their livelihoods. In Zambia, this is significant for households that rely on farming, which are forced to migrate because of reduced rainfall and pasture for their livestock, only to face human-wildlife conflict.

Whichever model applies to migrations, the result is a growing human population and more intensive activities within or adjacent to PAs (Amacher et al., 1998; Becker et al., 2013; De Sherbinin & Freudenberger, 1998; Hartter et al., 2015; Vorlaufer & Vollan, 2020; Williams, 2011). Based on their study of 306 PA buffers in Africa and Latin America, Wittemyer et al. (2008) postulate that PAs have a higher than average annual population growth rate relative to their counterpart rural areas. However, others have questioned this finding by Wittemyer et al. (2008), mostly because the analysis focuses only on satellite images and census data, without considering the social dynamics applicable (Hoffman et al., 2011) and the population density before the PAs were established (Shoo, 2008).

Most often external migrants, unlike indigenous people, are regarded as caring less for PAs (because they have a less vested interest in it), and will therefore invest little in the PA (Charnley, 1997) and may even degrade it (Specht et al., 2015; Tritsch & Le Tourneau, 2016). Policymakers in particular view external migrants as a nuisance who fail to conform to the stipulated rules of a system (Hecht et al., 2015). Indigenous people are inclined to support policymakers and are themselves viewed as caring more about conservation (Abbot et al., 2001; Broadbent et al., 2012). Moreover, although indigenous people may themselves be internal migrants, they are not viewed as presenting the same danger as those coming from other areas (Vorlaufer & Vollan, 2020). These

views create social tensions, which can lead to conflict (Adger et al., 2015; Reuveny, 2007; Vorlaufer & Vollan, 2020).

Zambian policymakers attempted to accommodate people displaced when PAs were created by moving them to buffers around national parks, called game management areas (GMAs). Game management areas consist of five zones based on land use, i.e. buffer, conservation, development, special-use, and tourism zones. People are only permitted to settle in the development zone, while the conservation zone is reserved to conserve wildlife (Zambia Wildlife Authority (ZAWA), 2014). Having these land use zones has not, however, deterred people from migrating into the conservation zone, with Zambia's PAs being among the most encroached upon in Africa (Pfeifer et al., 2012). Humans have modified about 40% of Zambian GMA habitats compared to only 2.9% in parks (Lindsey et al., 2013). Although the rates indicate that the GMAs do act as buffers for the parks, the annual habitat loss in the GMA is 0.69%, which is not far off from the rest of the country at 0.51% (Lindsey et al., 2013). National census data show that districts housing GMAs are being urbanised and record higher population growth rates than non-GMA ones (Lindsey et al., 2014).

Although people continue to encroach upon Zambian PAs, few studies have been conducted to understand the reasons and extent of encroachment (Watson et al., 2015). Thus far, most migration research on PAs has focused on population growth, with little emphasis on the behaviour of the migrants. Human migrations and subsequent settlements, as a conservation zone land use, are in direct conflict with conservation.

This chapter investigates the magnitude and patterns of human migrations in the conservation and development zones. This objective is explored in terms of four questions. Firstly, What are the migration and settlement patterns of the households in the conservation and development zones? Second, why do migrants prefer the conservation to the development zone? Third, are there differences between how the respondents in the two zones view and justify the illegal settlements in the conservation zone? Fourth, what individual or household characteristics might predispose the respondents to migrate? According to literature, the conservation zone has more external migrants than the development zone (Chemonics International, 2011; ZAWA, 2013).

Hypothetically, this should not be the case since land use in the conservation zone should be more restricted than in the development zone, given policy directives.

This study categorises migrants into three classes based on their place of origin (non-migrants, local migrants, and external migrants). Since a mixed-method approach was used to collect the data, it follows that the analysis required several methods to address the research objective. The first three research questions address the background and current status of the migrants. Considering the migrants are already in the GMA, the study saw it appropriate to include the fourth question addressing factors which might predispose the respondents to migrate in the future. This approach serves two purposes: firstly, to analyse in retrospect what could have brought the external migrants to the GMA, and secondly, to postulate what can be done for them to encourage them to leave the GMA. Moving forward, it is important to know the migrants' plans.

3.2. Methods

3.2.1. Description of the study region and historical overview

The Mumbwa Game Management Area (GMA) is located in central Zambia (-15.330762, 25.912861 to -14.946877, 26.880199). The 3 370 km^2 GMA was established in 1972 as a buffer on the upper east side of the Kafue National Park. The Mumbwa GMA is comprised of five zones with distinct land uses: buffer, conservation, development, special-use, and tourism zones (Figure 2-1). People are only permitted to settle in the development zone, while the conservation zone is reserved for wildlife conservation. The land in the GMA was set aside by three chiefs: Chibuluma and Mulendema of the Ila people, and Kabulwebulwe of the Nkoya people (Siachoono, 1995), who relocated to the development zone and continue to be the GMA's custodians. One settlement in the conservation zone originated from chief Mulendema after a succession dispute. The other people living in the conservation zone do not fall under any particular chief.

The GMA hosts high numbers of external migrants (ZAWA, 2013), mostly originating from the province lying south of the park (Chemonics International, 2011). The Mumbwa GMA has an

approximate population of 33 500 (ZAWA, 2014) and an annual population growth rate of 0.4% (ZAWA, 2014). Around 7 854 (632 households) of this population are external migrants, illegally settled in the GMA's conservation zone (ZAWA, 2014). People were initially settled on the eastern side of the GMA in the development zone near water sources (Chomba et al., 2013) but are slowly spreading towards the west into the conservation zone (ZAWA, 2014) (see Figure 5-3). The Mumbwa GMA houses the main entrance to the Kafue National park, which attracts settlements (Chemonics International, 2011). In 1972 only 3.2% of the GMA's land was occupied by people compared to 46.8% in 2011 (Lindsey et al., 2013). Because of the high level of uncontrolled migrations into the Mumbwa GMA, it is crucial to understand these migrations and subsequent settlements.

3.2.2. Data collection

Data were collected between July 2016 and June 2017, using both qualitative and quantitative approaches. Qualitative methods included focus group discussions (FGDs) and key informant interviews. Quantitative data collection involved a household survey, using a structured questionnaire.

The GMA was stratified into the conservation and development zones. The respondents in the two zones were further divided into three, based on the respondents' place of origin. Respondents living in the village of their birth were classified as non-migrants. Those who had migrated from another village within the GMA were classified as local migrants, while those from outside the GMA were classified as external migrants. These classes enabled the analysis of migration patterns among the different classes. Ethical clearance to work with human subjects was granted by Stellenbosch University's Ethics Committee for Human Research in the Humanities (Ref: SU-HSD-002306). The Department of National Parks and Wildlife (DNPW) in Zambia granted permission to collect data from the GMA.

Three focus group discussions (FGDs) were held, one each under the chiefs Chibuluma and Kabulwebulwe, and another in the conservation zone before implementing the other survey instruments. The FGDs were held first for two reasons: to assess group dynamics of unplanned

settlements, and to inform the possible household survey questions and answers (Freitas et al., 1998). At some point during the discussion the group was divided into two based on gender. An average of 15 participants per sub-group was engaged in the FGDs, as recommended by Krueger and Casey (2014). Three local enumerators were trained to assist with conducting the discussions and taking notes. Questions asked included enquiries about GMA land use, its associated problems, and the people's views on settling in the conservation zone (Appendix 2).

Similar questions were asked to key informants who were identified and interviewed based on their knowledge of land-use history and settlements in the GMA (interview schedule attached as Appendix 4). The selected key informants were the Director of the Department of National Parks and Wildlife (DNPW), two other DNPW officers, a senior agricultural officer (SAO), veterinary officer, and a former Tourism and Natural Resources Minister.

The household survey was administered in all three chiefdoms in the GMA and across the two zones. A structured questionnaire was designed using data from the FGDs, the relevant literature, and observations. The questionnaire was then pre-tested on 20 households in the GMA to ascertain if it was suitable for collecting the needed data. A proportionate random sampling at a 10% sampling intensity (Neuman & Robson, 2014) was used to determine the sample size based on each zone's population. A total of 136 and 301 respondents were selected from the conservation and development zones, respectively. Households were selected randomly to ensure the sample was representative of each zone. Three local enumerators who spoke the local languages and had experience in data collection were trained to assist with data collection. Although the questionnaires were written in English, the interviews were conducted in the local languages. The data collected included information on: 1) the respondent's place of origin, 2) respondent's plans to migrate, 3) whether respondents had relatives who influenced their settlement, 4) whether respondents influenced others on where to settle, and 5) the respondent's views on settling in the conservation zone (Appendix 3).

3.2.3. Data analysis

Various methods of analysis, all aimed at addressing the four research questions, were employed. The first step was to categorise respondents into one of the three categories described above (non-

migrants, local migrants, and external migrants) based on their area of origin. Frequencies, cross-tabulations, and the chi-square ($\chi 2$) tests of independence and their statistical significance ($P<0.05$) were determined. These analyses were done to compare the responses (variables) from the questionnaire within and across the two zones. The strength of the association between the zones and variables was determined using Cramer's V test with a score between 0 (no association) and 1 (complete association). Migration and settlement patterns for the two zones were analysed using the independent samples t-Test.

Plans to migrate were taken as a proxy of migration behaviour, as suggested by De Jong (2000). This analysis is important for policymakers as they plan future action to relocate the migrants. Multinomial logistic regression was used to assess the likelihood of households migrating. The variables were tested for the six assumptions needed to carry out multinomial logistic regression (Hausman & McFadden, 1984). Three models were developed, i.e. for the total sample, the conservation zone, and the development zone. Determining the likelihood of migrating was based on the respondents' plans to migrate, which had three responses of Yes, Not Sure, and No. The 'No intentions to migrate' category was used as a default, which meant the migrants wanted to stay in their current location. Four classes of predictor variables were used, i.e. personal attributes, land attributes, household lifecycle, and migrant status/network.

The interviews from the FGDs and key informants were transcribed and then uploaded into Atlas.ti. A hybrid of deductive/inductive thematic analysis was used (Fereday & Muir-Cochrane, 2006). Theoretical thematic analysis, which is more deductive and is driven by the researcher's analytic interests (Braun & Clarke, 2006), was the primary step used to come up with themes and codes. The themes and codes focused on those aspects related to the research questions (Braun et al., 2019), for example, whether people should or should not be allowed to settle in the conservation zone was used as a theme, while sub-themes were the reasons why people should or should not settle in the conservation zone. Some elements of inductive thematic analysis were incorporated in the sense that new themes which had not been preconceived were noted and included in the coding, making the process iterative.

3.3. Results

3.3.1. Migrant characteristics

A total of 437 households were interviewed. Both zones recorded low numbers of non-migrants, relative to local migrants and external migrants (Table 3-1). The conservation zone recorded a higher proportion of external migrants (76.4%) compared to the other classes combined (23.6%) within the zone, especially in the Tepula area. The non-migrants and local migrants in the conservation zone were slightly younger relative to the external migrants, within and across the zones. The conservation zone external migrants had the highest (77.9%) proportion of males across all classes and zones (Table 3-1). Many (69.3%) of the conservation zone external migrants were from the Southern Province of Zambia (Table 3-1). These results align with the information provided by policymakers who, when interviewed, singled out the Southern Province as the original home for most external migrants.

In contrast, the development zone external migrants were from diverse provinces with diverse ethnicities (Table 3-1). The Tongas, who are not native to the GMA, dominated the conservation zone among all three classes of migrants (Table 3-1). For the development zone, the Ilas, who are native to the area, recorded the highest proportion among the non-migrants (54.1%) and local migrants (31.5%). A key finding was that external migrants in the conservation zone on average occupied more land (13.8 ha) than people in the other classes within the zone (4.8 ha), and compared to the development zone respondents (8.2 ha). The land size in the development zone were similar across the classes.

Table 3-1 Characteristics of the interviewed households from the conservation and development zones based on their migration status

Characteristics	Conservation Zone						Development Zone					
	Non-migrants (n=16)	SD	Local migrants (n=16)	SD	External migrants (n=104)	SD	Non-migrants (n=61)	SD	Local migrants (n=89)	SD	External migrants (n=151)	SD
Households Interviewed within each zone (%)	11.8		11.8		76.4		20.3		29.6		50.1	
Male respondents (%)	56.3		56.3		77.9		68.9		51.7		64.2	
Respondent age[a]	36.0	7.7	35.0	12.9	42.0	14.2	45.0	17.4	41.0	14.3	44.0	14.7
Household size[a]	6.6	2.1	8.7	5.0	8.6	4.7	6.9	3.9	7.1	3.7	7.4	3.5
Adults[a]	2.6	1.0	3.4	2.1	3.6	1.9	3.1	1.8	2.9	1.5	3.1	1.5
Children[a]	4.0	1.7	5.3	3.2	5.0	3.3	3.8	2.6	4.2	3.0	4.3	2.6
Ethnic group (%)												
Nkoya	12.5		0.0		1.0		8.2		4.5		6.0	
Kaonde	12.5		6.3		1.0		8.2		16.9		9.9	
Ila	12.5		12.5		1.0		54.1		31.5		17.2	
Tonga	43.7		68.7		83.6		11.5		20.2		20.5	
Lozi	0.0		12.5		4.8		4.9		7.9		21.9	
Luvale	12.5		0.0		3.8		3.3		0.0		7.9	
Others	6.3		0.0		4.8		9.8		19.0		16.6	
Place of origin												
Conservation zone	100.0		25.0		n.a.		n.a.		16.9		0.0	
Within same GMA	n.a.		75.0		n.a.		100.0		83.1		n.a.	
Other GMA	n.a.		n.a.		4.8		n.a.		n.a.		14.6	
Southern province	n.a.		n.a.		69.3		n.a.		n.a.		23.2	
Central province	n.a.		n.a.		14.4		n.a.		n.a.		17.9	
Western province	n.a.		n.a.		4.8		n.a.		n.a.		18.5	
Lusaka	n.a.		n.a.		6.7		n.a.		n.a.		11.9	
Other provinces	n.a.		n.a.		0.0		n.a.		n.a.		13.9	
Land holding size (hectares)[a]	3.9	2.2	5.7	3.8	13.8	9.7	8.8	5.4	8.6	5.0	7.3	4.8

Note. [a] mean value of characteristic while SD indicates the standard deviation for the mean.

n.a. does not apply to the corresponding category. n is the number of respondents interviewed

3.3.2. Human migration and settlement patterns in the game management area

Although the development zone households had been settled longer in the GMA (15.7 years) compared to those in the conservation zone (6.4 years), the average number of places the respondents had lived in within the GMA was similar for the two zones (Table 3-2). External migrants in both zones reported having found others already settled there (41.7% and 39.5% for the conservation and development zones, respectively). The director of Department of National Parks and Wildlife (DNPW) pointed out how unplanned settlements were spreading from east to west, i.e. from the development zone towards the hunting block in the conservation zone, thereby putting pressure on the wildlife.

Table 3-2 The number of years the respondents have lived in their zone and the number of locations they have settled within the game management area

	n	Mean	SD	Median	Mode	t-values
Years lived in the zone						
Conservation zone	120	6.4	6.2	5.0	2.0	-8.049***
Development zone	239	15.7	11.9	14.0	5.0	
Number of places lived at within the GMA						
Conservation zone	120	2.0	1.5	2.0	2.0	-0.219NS
Development zone	240	2.1	0.6	2.0	2.0	

*** = significant (P<0.001- two-tailed);
NS = Not significant (P>0.05)
Note: SD= standard deviation, n is the number of respondents interviewed

Respondents from both zones had relatives within their villages (Table 3-3). There was a significant difference between zones in terms of having relatives beyond the respondents' villages but within the GMA ($\chi^2_{1,437} = 50.865$, p = 0.000, Table 3-3). Those living in the development zone reported having more relatives outside their villages within the same GMA. Significantly ($\chi^2_{2,437} = 8.10$, p = 0.017) more conservation zone respondents intended to migrate compared to their counterparts (16% and 12.6% from the conservation and development zones, respectively) (

Table 3-3). The conservation zone households who intended to migrate listed a shortage of agricultural land (43%) and population increase (26%), among others, as the reasons for migrating.

Those from the development zone had no specific reason for planning to migrate (26%) but, to a lesser extent, cited a shortage of agricultural land (18%) and increased population (5%) as possible reasons. Considering the high levels of human-wildlife conflict and evictions by authorities in the conservation zone, none of the respondents thought they would migrate to have peace of mind. The interviewed policymakers were of the view that a larger population drove people to search for new land to farm. Respondents from both zones mostly intended to migrate to another place within the GMA, with very few planning to go back to their original homes (Figure 3-1).

When asked where the external migrants had heard of the GMA's existence, conservation zone households mostly cited family, while for those in the development zone it was through the family and to a lesser extent via friends and the government. There was a significant difference between the zones for those who heard about the GMA from family ($\chi^2_{1,346} = 8.980$, $p = 0.003$), friends ($\chi^2_{1,346} = 60.584$, $p = 0.000$), and government ($\chi^2_{1,346} = 10.129$, $p = 0.001$).

Table 3-3 The proportion of respondents who said "Yes" to questions used to distinguish migration networks between respondents from the conservation and development zones

	Zone		Statistics
Question	Conservation Yes (%)	Development Yes (%)	(χ^2)
Were you invited to your village?	26.7	22.4	0.932NS
Have you invited others to your village?	10.3	8.7	0.297NS
Have you invited others to the GMA?	5.1	6.0	0.137NS
Did you find other settlers when you arrived?	41.7	39.5	0.156NS
Do you intend to migrate?	16.9	12.6	8.100*
Do you have relatives in your village?	69.9	64.0	1.425NS
Do you have relatives in other parts of the GMA?	30.1	66.8	50.865***

* P< 0.05; ***P<0.001 (two-tailed)
NS = Not significant (P>0.05)

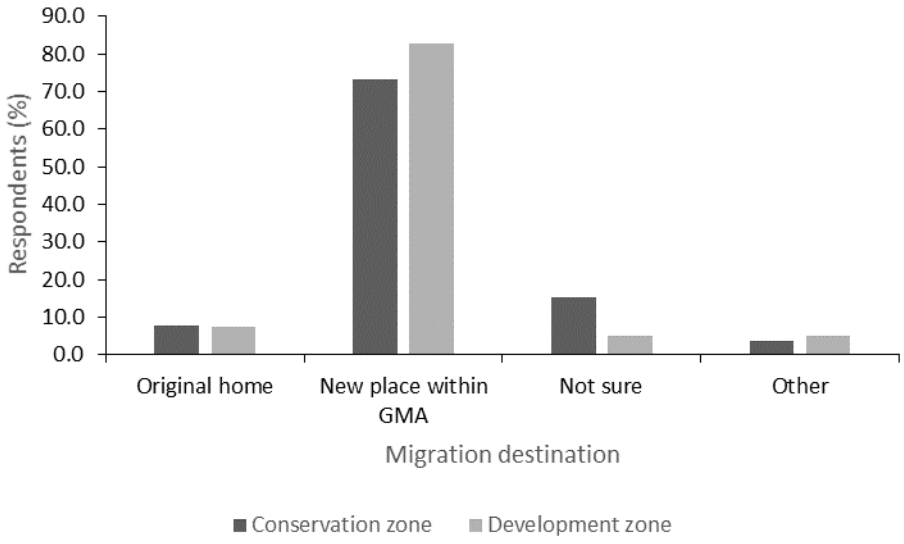

Figure 3-1 The locations that the respondents intend to migrate to

3.3.3. Respondents' perceptions of illegal settlements in the conservation zone

Generally, those living in the conservation zone felt they should be allowed to live there, while those living in the development zone and policymakers disagreed. Although living in the conservation zone is illegal, most (88.2%) of the conservation zone households felt they should be allowed to settle in the conservation zone compared to 27.6% of those living in the development zone. The responses from the two zones were statistically different at the 95% confidence level (($\chi^2_{1,437} = 138.576$, p = 0.000; Cramer's V = 0.563). Similar sentiments about being allowed to settle in the conservation zone were expressed during the FGDs. The respondents from both zones shared similar views on why people should or should not be allowed to settle in the conservation zone (Table 3-4). However, more respondents from the development zone felt they should be allowed to settle in the conservation zone because their population had increased (Table 3-4). Despite having access to land, those in the conservation zone thought the land was not enough. Sentiments such as "*animals are considered more important than people*" were frequently echoed by the conservation zone respondents. From the FGDs held in the conservation zone, the respondents collectively felt that the state prioritised wildlife over them. Those living in the development zone, on the other hand, felt the conservation zone was essential for conserving and preserving wildlife for future generations.

Policymakers and the development zone households viewed those living in the conservation zone as people bent on breaking the law. One of the policymakers questioned why anyone would choose a dangerous area occupied by wildlife to practise farming. Two policymakers further suggested that people living in the conservation zone went to the extent of using crops as bait to trap animals. From the survey, the development zone households highly valued the conservation zone for wildlife conservation, but did not view it as a source of revenue (Table 3-4). Those living in the conservation zone, although living there, felt it was not theirs but belonged to the State and the Community Resource Boards (CRBs). The interviewed policymakers expressed concern over the high number of unplanned settlements in the conservation zone, which had consequences such as poaching and human-wildlife conflict. In terms of whether people knew who influenced where people settled in their village, many households (93% and 89% in the conservation and development zones, respectively) were unfamiliar with whom to talk to about land allocation problems in the GMA.

Table 3-4 Respondents' views on why people should or should not be allowed to live in the conservation zone

	Respondents' zone		Statistics	
Reasons for allowing settlement	Conservation zone n=136	Development zone n=301	χ^2	Cramer's V
To grow more crops	38.5	26.0	3.186NS	0.128
Population pressure	18.0	44.6	16.098***	0.287
Land is scarce	31.1	16.2	5.404*	0.166
Animals and people should co-exist	4.9	5.4	0.023NS	0.011
People are more important than animals	8.2	4.1	1.276 NS	0.081
Others	4.1	9.5	2.303 NS	0.108
Reasons for not allowing settlement				
Conservation	64.3	94.0	16.171**	0.265
Revenue source	7.1	2.8	0.858 NS	0.061
Wildlife is dangerous	0.0	0.0	0.000 NS	0.000
Belongs to government/ CRB	21.4	1.4	20.889**	0.301
Others	7.1	2.3	1.517 NS	0.081

Note: n represents the number of respondents interviewed in each zone while figures under zones indicate % of respondents who said yes to the corresponding reason for allowing or not allowing people to settle in the conservation zone.
* P< 0.05; ** P< 0.01; ***P<0.001 (two-tailed); NS = Not significant (P>0.05)

3.3.4. Predisposing factors for human migrations from the game management area

Anticipating migrations can help put in place preventative measures, hence the need to determine if there were household characteristics that predispose households to migrate. Three models for predicting the respondents' intentions to migrate were generated using multinomial logistic regression (Table 3-5). Results for the total sample showed that respondents from mostly non-native ethnic groups were more likely to migrate than those from the native Ila. Furthermore, if respondents were to increase their area of land, they are expected to prefer staying on in the GMA, relative to migrating, which was also the case within each zone. Respondents with a history of migrating within the GMA (local migrants) were also more likely to migrate in the future. Generally, the households in the development zone exhibited a higher number of variables that could predict people's intentions to migrate relative to the conservation zone households (Table 3-5). For example, the males, some ethnic groups, and the local migrants from the development zone were more likely to migrate compared to the same category of people in the conservation zone. None of the predictor variables for the household life cycle could be used to predict people's plans to migrate across the zones (Table 3-5).

Table 3-5 Determinants of the likelihood to migrate from Mumbwa Game Management Area

Predictors	Total sample		Conservation zone		Development zone	
	Logistic coefficient	Std error	Logistic coefficient	Std error	Logistic coefficient	Std error
Personal attributes						
Gender (ref=female)	0.532NS	0.483	-.460NS	0.943	1.422*	0.706
Age (years)	-0.005NS	0.014	-0.024NS	0.032	-0.005NS	0.018
Ethnic background						
Nkoya	2.090 *	0.845	-19.237NS	0.000	2.821**	0.953
Kaonde	0.816 NS	0.882	-0.038NS	2.184	0.824NS	1.076
Tonga	2.622 ***	0.681	0.761NS	1.706	3.228***	0.847
Lozi	1.724 *	0.779	1.564 NS	1.952	1.665NS	0.960
Luvale	2.217*	0.886	0.947NS	1.895	2.412*	1.141
Others	0.641NS	0.882	-18.075NS	9856.884	0.884NS	0.986
Ila [a]						
Land attributes						
Total land occupied (hectares)	-0.081***	0.016	-0.130***	0.037	-0.049*	0.021
Land use restriction	0.506NS	(0.389)	1.393NS	1.737	0.068NS	0.479
No land-use restrictions [a]						
Household life cycles						
Household head	-0.358NS	0.526	0.387NS	1.011	-1.023NS	0.770
Total household size	0.004NS	0.120	-0.176NS	0.296	0.149NS	0.142
Children in households	0.109NS	0.157	0.395NS	0.411	-0.057NS	0.177
Migrant status/ networks						
Non-migrants	0.934NS	0.483	0.769NS	0.876	0.781 NS	0.668
Local migrants	1.563***	3.98	1.194NS	0.867	1.409**	0.506
External migrants [a]						
Relatives in village	-0.178NS	0.359	0.596NS	0.786	-0.489NS	0.473
No relatives in the village [a]						
Intercept	-3.075	0.950	-1.106	2.522	-3.914	1.208
Number of cases	434		136		299	
-2 Log-Likelihood	497.907		77.936		351.978	
Model X^2	129.153 NS		92.105***		95.844***	
Nagelkerke	0.337		0.690		0.354	

* P< 0.05; ** P< 0.01; ***P<0.001 (two-tailed); NS = Not significant (P>0.05)
Reference category for intentions to migrate is no intentions to migrate (stay)
[a] reference category
Std error= standard error

3.4. Discussion

Mumbwa Game Management Area (GMA), especially the conservation zone, hosts many external and local migrants. This is common in other buffers to protected areas (PAs) (Bamford et al., 2014; Wittemyer et al., 2008). Zommers and MacDonald (2012) reported similar patterns in Uganda's Budongo Forest Reserve, where only 24% of the respondents were living in the villages of their birth. This study also indicates that many of the external migrants are involved in frontier engulfment migration in search of farming land**.**

3.4.1. Why do migrants prefer the conservation to the development zone?

It could be expected that the development zone would record more external migrants than the conservation zone because of differences in land use. This was not the case. There are several reasons for the observed trend.

Firstly, migrants were attracted by the vast amount of land available for farming in the conservation zone, regardless of the policies to protect this land. Migrations driven by farming are common to other African PAs (Bamford et al., 2014; Estes et al., 2012; Jones et al., 2018; Scholte, 2003; Zommers & MacDonald, 2012). The Mumbwa GMA supports farming because of its fertile land and climate (Chemonics International, 2011), particularly in the conservation zone, as confirmed by the Senior Agricultural Officer (SAO) (Moonga, 2017). The Tongas, who are the majority of the external migrants, are renowned farmers in the country. Some authors, however, broadly argue that most land in Zambian GMAs may not favour farming, questioning the idea that people migrate to the GMA in search of farming land (Bandyopadhyay & Tembo, 2009; Child & Wojcik, 2014). Secondly, the GMA boundaries, alongside its zones and park, remain unmarked, making it difficult for non-indigenous people who come to the conservation zone to know the boundaries. Besides, PA boundaries often shift (Naughton-Treves et al., 2005). In another study of the Mumbwa GMA, 70% of the respondents did not know the boundary that separates the GMA from the park (Namukonde & Kachali, 2015).

Thirdly, although the indigenous tribes may be aware of the GMA's history and boundaries, they are unable to exclude others from the GMA because of weak land ownership rights (Child & Wojcik, 2014; Schlager & Ostrom, 1992). The current National Forestry Policy supports the co-management of forests by the state and the locals (Zambia. Ministry of Lands, Natural Resources, and Environmental Protection, 2014). If this support extends to forests in PAs, indigenous people will be empowered to prevent outsiders from entering the conservation zone, as suggested by Jones et al. (2018). People have also been known to stay longer in PAs with weak rules about migrants (Hecht et al., 2015). Unlike the development zone, the conservation zone lacks social and administrative structures, making it challenging to monitor settlers. The conservation zone falls under three chiefs, who govern collectively. Governing such a complex Social-Ecological System with migrants often fails because there are too many different aspects to govern (Meyerson, 2007; Turner et al., 2016). In 2013 two of the three chiefs, upon learning that the third chief had allowed 31 families to settle in the conservation area, threatened to settle their subjects there as well, resulting in uncontrolled migrations (Mwale, 2013, December 7).

Fourthly, not everyone who lives or works in the GMA understands the concept of zoning, as observed in the FGDs and some key informant interviews. The general view was that people and wildlife should co-exist throughout the GMA. With such views, people are bound to settle anywhere in the GMA. Finally, because of limited resources, the state cannot afford to monitor the conservation zone, in part because it is located in the less accessible interior compared to the development zone. Areas situated in far off places tend to have weak institutions and weak law enforcement (Hecht et al., 2015; Lambin et al., 2003). In South America, for example, people grow coca in remote forests away from law enforcers (Hecht et al., 2015).

3.4.2. Respondents' perceptions of the illegal settlements in the conservation zone

Respondents expressed mixed views about settling in the conservation zone, suggesting that personal needs and interests guide stakeholders' perspectives. Those living in the conservation zone, for example, did not understand why wildlife was 'given both the park and GMA land,' which they perceived as the state prioritising wildlife over them. Such views may explain why

people see PAs negatively (Matseketsa et al., 2018; Nastran, 2015; Sylvester et al., 2016; West et al., 2006). Nevertheless, local people generally support conservation, as maintained in the literature (Martin et al., 2018; Karanth & Nepal, 2012; Nsonsi et al., 2017; Walpole & Goodwin, 2001), giving policymakers allies in the GMA. Lack of knowledge on zoning schemes, coupled with weak law enforcement, may also contribute to people's views on settling in the conservation zone, with many respondents assuming that the entire GMA was reserved for wildlife and people to live in harmony. Such misunderstandings make it challenging to keep people away from the conservation zone. In Estonia and rural cultural landscapes, local people comply with restricted access to the PAs without being sure about the aims of the PAs or where their boundaries lie (Kliimask et al., 2015). Although the people's views may not always be accurate, they carry some element of truth and can influence people's attitudes towards conservation (Bennett, 2016; MacKenzie, 2018). Furthermore, the way people view their environment shapes their expectations and how they will use the land (Tudor et al., 2014; Vodouhê et al., 2010).

3.4.3. Predisposing factors for human migrations in the game management area

The non-ethnic groups in the development zone are more likely to migrate. This is expected considering it is not the migrant's home of origin and there is usually social tension between external migrants and local people. This was not the case for the conservation zone households, who are mostly external migrants. As it turns out, those living in the conservation zone had access to more land, which reduces their likelihood of migrating, as supported by their responses. According to Estes et al. (2012), lack of access to land or not having enough land often drives people to abandon their land. Reluctance to migrate when one has access to land is not unique to the GMA. In rural Ethiopia youths who expect to inherit land are less likely to migrate (Kosec et.al., 2016).

Overall this study acknowledges that the predisposing factors to migration are not definite indicators, but they set a scenario which makes people likely to migrate. People will mostly migrate to avoid risk (Hunter et al., 2015), and from this study it is evident that there are no serious risks, considering external migrants have access to large pieces of land to provide for their livelihood.

The data further suggest that predicting the migrations for people living in the development zone is easier than for those living in the conservation zone. Determining the predisposing factors is probably easier for those living in the developing zone because they are not just random households but form a more cohesive community that has similar values and goals. Household life cycles, which are common predictors of migrations (Massey & Espinosa, 1997), did not yield significant results for this study. The migration networks may not have been a useful way to predict migration because although people reported having relatives around them, they did not influence each other's migration. Furthermore, this study focused on blood relatives and not others who may be in networks such as friends or religious associates.

3.5. Conclusion and recommendations

This chapter investigated the magnitude and patterns of human migrations in the conservation and development zones. What is evident is that the GMA as a whole attracts migrants, especially to the conservation zone. These two zones, however, have different migration problems. The conservation zone receives external migrants, while the development zone records more local migrants, who in their own right are capable of causing the same if not more damage than the external migrants. The issue of migrants to the conservation zone, if not addressed, will send a message to outsiders and the indigenous tribes that people can settle in the conservation zone. At face value, people migrate to the GMA in search of farming land, but further analysis showed that there are other reasons which fuel the migrations, including population growth, weak law enforcement, lack of knowledge on zoning schemes, and unclear boundaries. These aspects require more than just GMA management, but a concerted effort from the various stakeholders with interests in the GMA, especially law enforcers and local people. Unfortunately, the various stakeholders view migrants and their subsequent settlements differently. The migrants claim they are just farmers in search of land, while the local people and law enforcers view them as illegal natural resource extractors. This, among other reasons, undermines attempts made by individuals to address the problem of migrants to the GMA.

Regardless of the zone, respondents saw the need to conserve wildlife. This could be the starting point for solving the problem of migrants to the conservation zone, since most stakeholders express goodwill towards conservation efforts. Attempts to relocate the new settlers have failed, because the people were consulted and not engaged in the process. Moving forward, policymakers should engage the settlers, which should not just focus on providing alternative farming land but also consider the factors discussed above.

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Chapter 4 A comparative livelihood study of the conservation and development zones in Mumbwa Game Management Area

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Abstract

Protected areas may provide a source of livelihood to local people through controlled land use. This can be achieved in game management areas (GMAs), an IUCN category VI protected area that buffers national parks. However, a high share of households in GMAs remain poor. This chapter assessed the extent to which households from the Mumbwa GMA in Zambia rely on the GMA for their livelihoods and wellbeing. Households from two zones within the GMA were contrasted: one reserved for conservation but encroached upon by people (conservation zone) and the other meant for human settlements (development zone). A household survey alongside focus group discussions was used to collect data. The findings suggest that households from both zones practice similar livelihood activities, which mostly revolve around farming. Households from either zone do not receive significant benefits from conservation programmes. The major advantage of living in the conservation zone is access to farming land, while those in the development zone have access to schools and clinics. The conservation zone households reported more cases of improved wellbeing compared to the development zone households. These results suggest that households from both zones rely more on farming and less on the GMA-specific livelihood activities, which de-emphasises the GMA's role in providing for the local people and the different land uses in the two zones.

Keywords: Conservation zone, development zone, game management area, livelihoods.

4.1. Introduction

Many rural people in Africa rely on natural resources for their livelihoods and wellbeing (Babulo et al., 2008; Chilongo, 2014). At the same time most protected areas (PAs) in Africa are situated in rural areas among indegenous people (Muboko & Bradshaw, 2018; West et al., 2006). People are thus potentially excluded from the sources of their livelihood (Brockington & Igoe, 2006), since PAs may interfere with local peoples' established livelihoods (Andrade & Rhodes, 2012; Curran et al., 2009; Pullin et al., 2013; Snyman, 2012; Williams, 2011). In such cases conserving biodiversity while sustaining human wellbeing becomes a challenge (Adams et al., 2014; Cortina-Villar et al., 2012; Hares, 2009; Karanth & Nepal, 2012; Karki, 2013; McShane et al., 2011; Zhang et al., 2013). Policymakers have incorporated human wellbeing as a PA objective to balance human wellbeing and conservation (Adams et al., 2014), with many African countries adopting community-based conservation programmes to achieve this balance (Matenga, 2002). This intervention may persuade local people to conserve biodiversity, but excessively high hopes can be generated (McShane et al., 2011; Walpole & Thouless, 2005). Failure to meet their expectations drives the local people to seek alternative livelihood sources, some of which may go against conservation policies (McShane et al., 2011).

Although scholars accept that PAs can improve livelihoods, they express mixed views as to whether this does happen (Dewi et al., 2005; McShane et al., 2011; Oldekop et al., 2016; Salerno et al., 2016; Sims, 2010). Attempts have been made to demonstrate a causal relationship between biodiversity conservation and livelihoods in or near PAs, acknowledging how difficult it is to control for other underlying causes like differences in geography (Andam et al., 2010). Nevertheless, compelling evidence shows that most people living near PAs and forests are not spared having to deal with socio-economic problems (MacKenzie et al., 2017; Sawathvong, 2004; Sunderlin et al., 2005). The costs of living near PAs may outweigh the perceived benefits (Davis, 2011). Most poor people live on marginal lands worldwide (Mundial, 2002), which are also lands on which most PAs are established and are less suitable for agricultural production (Child & Wojcik, 2014; Millennium Ecosystem Assessment (MEA), 2005). Poor people living adjacent to PAs in Africa are thus driven to depend on natural resources such as agricultural land and forests (Cortina-Villar et al., 2012). Barbier's (2010) study of 76 developing countries, including Zambia,

revealed that the highest poverty levels occur in countries whose populations are concentrated in environments not suited for agriculture. Such cases of high poverty levels around Africa's PAs leave little hope for improved livelihoods among the rural poor (Foerster et al., 2011).

Allowing controlled land use and resource access in PAs can safeguard biodiversity and motivate local people (Andrade & Rhodes, 2012; Barbier, 2010; Harihar et al., 2014; Kangalawe & Noe, 2012; Wittemyer et al., 2008). One way to do so is through creating buffer zones around PAs that accommodate both conservation and human needs (Lima & Ranieri, 2018; Martino, 2001; Robinson et al., 2013; Sayer, 1991). In this way, the human impact remains outside the park, while people use the buffer to harvest natural resources in a controlled and sustainable manner. However, one pertinent question is: What takes priority in the buffer, the people's wellbeing, or conservation? To address this, Integrated Conservation and Development Projects (ICDPs) apply zonation by setting aside a primary conservation area surrounded by a buffer zone for human socio-economic activities alongside conservation efforts (Lima & Ranieri, 2018; Naughton-Treves et al., 2005). DeFries at al., (2010) call these buffers 'zones of interaction' and suggest that rather than have a buffer that has one land use, the buffer should instead be demarcated into different zones with specific purposes. The zones that require conserving are allocated more restricted land uses compared to others. The literature, however, suggests that the effect of mixed-use PA on conservation remains inconclusive (Miranda et al., 2016).

Zambia adopted the concept of 'zones of interaction' with different land uses within the buffer (Schmitz et al., 2012). The buffers around National Parks, called game management areas (GMAs), are designed to reduce human impact on the parks and simultaneously provide a livelihood for the local people (Andrade & Rhodes, 2012; Matenga, 2002). The Department of National Parks and Wildlife (DNPW) has divided game management areas into five zones, i.e. buffer, conservation, development, special use, and tourism zones (Zambia Wildlife Authority (ZAWA), 2014). Only the development zone is supposed to accommodate human settlements and related socio-economic activities. The conservation zone, on the other hand, is designed to conserve biodiversity but allow for certain conservation-related livelihood activities, e.g. controlled trophy hunting and collection of non-timber forest products (NTFP).

Although the conservation zones are reserved to conserve biodiversity, they record cases of illegal human settlements (Chemonics International, 2011; Lindsey et al., 2013; Lindsey et al., 2014; Simasiku et al., 2008). Because of the illegal status of such settlements, the state has excluded the households in the conservation zone from conservation programmes and their associated benefits. The development zone households, on the other hand, can benefit from such programmes in three ways, as described by Abbot et al. (2001). Firstly, the households may benefit through packages that compensate for the loss of resource access, for example, cash payments for environmental services (Ezzine-de-Blas et al., 2019; Handberg & Angelsen, 2019; Moros et al., 2019). Most conservation programmes in developing countries offer incentives aimed at compensating local people through community projects (Infield & Namara, 2001; Spiteri & Nepalz, 2006) such as clinics and schools (Wittemyer et al., 2008). Secondly, households can engage in alternative diverse or specialised livelihood activities depending on available resources or risks involved (Scoones, 1998). The third option aims to increase the value of the natural resources, which encourages people to value and therefore, protect wildlife. The wildlife, in turn, attracts tourists who spend money, part of which goes to the local communities. Zambian GMAs offer community projects, which are yet to be well operationalized (Namukonde and Kachali, 2015; Lindsey et al., 2013; Simasiku et al., 2008). According to the Zambian government in the National Forestry Policy, many Zambians, especially in rural areas, rely on forest products for consumption during the off-farming season (Zambia. Ministry of Lands, Natural Resources, and Environmental Protection, 2014). The extent to which forests can reduce poverty, however, remains inconclusive (Kalinda et al., 2008).

Having established that local people near PAs should benefit and derive livelihoods from PAs, this study assesses the extent to which households from the conservation and development zones rely on the GMA for their livelihoods and wellbeing. A mixed-methods approach (questionnaire and focus group discussion) was used to address this objective. This study acknowledges that although the households can easily say what livelihood activities they are engaged in, determining their level of reliance on the GMA is not as easy (Angelsen et al., 2011). The proportions of households that engage in particular GMA livelihoods is therefore used as a proxy for reliance, assuming the

more a household relies on an activity, the more they will engage in it. This study, therefore, does not quantify but indicates the level of household reliance on the GMA. Because the development zone was designed for human settlement, the study hypothesizes that the development zone inhabitants rely and benefit more from the GMA related livelihood activities/benefits because of their legal status compared to the conservation zone households whose status is illegal. This study expects that the levels of livelihood reliance on the GMA across the two zones should also be different. Previous studies in Zambian GMAs have not distinguished between these zones (Fernández, 2010; Franks & Small, 2016; Lindsey et al., 2014; Simasiku et al., 2008). Since the research incorporates the aspect of zones, its findings have a more nuanced potential to guide policy on how to manage the current zoning schemes and how to ensure that the conflict between conservation and livelihood is reduced.

4.2. Methods

4.2.1. Study Area

This study was conducted in the Mumbwa Game Management Area located in the central part of Zambia (-15.330762, 25.912861 to -14.946877, 26.880199) (Figure 2-1). The GMA was established in 1972 as one of nine buffers around Zambia's Kafue National Park and covers an area of 3 370 km^2. Chiefs Chibuluma, Kabulwebulwe, and Mulendema came together and gave up some of their lands to form the Mumbwa GMA, with all three chiefs being custodians of the GMA. The area receives a mean annual rainfall of 1 000 mm, which is evenly distributed in the rainy season, and temperatures ranging from 18 to 40^o C during the cold and hot seasons. The vegetation in the area is dry miombo, a local name used to describe a woodland, dominated by *Brachystegia, Julbernardia,* and *Isoberlinia* tree species (Chidumayo, 2019). The soils are well drained with different soil types, although the predominant types are leptosols and oxisols (Chomba et al., 2013). A diversity of animals, including large herbivores such as elephants (*Loxodonta africana*) and buffaloes (*Syncerus caffer*), and carnivores like lions (*Panthera leo*) and leopards (*Panthera pardus),* among others, are common in the Mumbwa GMA (ZAWA, 2014).

The Mumbwa GMA is demarcated into five zones: the buffer, conservation, development, special use, and tourism zones (Figure 2-1). People can only settle and carry out livelihood activities in the development zone, while the conservation zone is set aside for biodiversity conservation. The development zone communities practise subsistence agriculture, with maize as the main crop (Chemonics International, 2011; Namukonde & Kachali, 2015). The households on the eastern edge of the GMA practise small-scale semi-commercial farming (Chemonics International, 2011). Other livelihood activities include fishing, employment in the tourism industry, and the use of NTFP from the conservation and development zones. Small-scale copper mines operate on the eastern boundary of the GMA (ZAWA, 2014). The Mumbwa GMA's development zone has 11 basic schools, one high school, two community schools, a trade and youth centre, and several health centres. Over time, people have settled illegally in the conservation zone, which is the largest zone, occupying 56.5% of the GMA. The government does not allow the building of schools or hospitals in the zone, and the zone's inhabitants are excluded from conservation programmes. However, the construction of lodges and hunting camps is allowed in the conservation zone, alongside photographic tourism and safari hunting.

The Mumbwa GMA was selected for the study because of its potential livelihood activities from its abundant wildlife base. Furthermore, the conservation zone has attracted new settlers, who pose a threat to conservation through illegal land use.

4.2.2. Data collection

A mixed-method data collection approach was employed, using focus group discussions (FGDs) and a household survey from July 2016 to June 2017. The first step involved FGDs for two reasons: first, to determine perceived benefits and livelihood activities of groups living in the conservation or the development zones, and secondly, to feed into the designing of the household questionnaire. Three FGDs were conducted: two with communities from the development zone and one with those from the conservation zone. Through the community resource board (CRB) liaison officer, an open invitation was communicated to the community members. On average, 15 participants were engaged per FGD sub-group, with men and women being separated and then brought back together at some point during the discussion. The sub-groups were created to encourage

participation among women, who tend not to be as active as their male counterparts in mixed gender groups (Stewart & Shamdasani, 2014). Flip charts and notes were used to keep a record of proceedings. Participants were asked questions (Appendix 2) concerning land use activities and benefits associated with the two zones. As suggested by Chambers (1994), group consensus was sought for each answer before proceeding to the next question. In cases where ranking was required, the same procedure was followed until the participants reached a consensus answer.

Proportionate random sampling was used to select the respondents for the household survey (Bless et al., 2013), with a sampling intensity of 10%, as suggested by Neuman and Robson (2014). One hundred and thirty-six (136) households were selected from the conservation zone while, 301 households were selected from the development zone. The conservation zone households were selected from the Chungu and Tepula areas, while those from the development zone were selected from all three chiefdoms.

Three local people were trained to assist with the interviews. Before administering the questionnaire, the interviewers explained to the respondents the purpose of the study before obtaining their verbal consent to participate. The questionnaire was pre-tested on 20 respondents, after which it was adjusted to include aspects that were initially not included and exclude aspects that were not relevant to the GMA (Appendix 3). Household heads were interviewed or in their absence another household adult (over 18 years, mostly the spouse) was interviewed. Collected data included household characteristics such as respondent's age, and the number of adults and children. Respondents from each zone were asked to identify benefits derived from their zone, as well as benefits that they felt could be derived from living in the other zone, in the household survey. It was essential to review the respondents' views not only of their zone but for the other zone as well, since perception influences actions and choice of livelihood activities (Mertz et al., 2009). Respondents were further asked to characterise their livelihood activities and wellbeing as a result of living in the GMA (Appendix 3). The questions were asked in the local languages (Tonga and Ila). Ethical clearance was given by Stellenbosch University's Ethics Committee for Human Research in the Humanities (Ref: SU-HSD-002306), while permission to work in the GMA was granted by the Department of National Parks and Wildlife (DNPW).

4.2.3. Data analysis

A variety of analyses were performed using SPSS for Windows (Version 22) to distinguish the two zones in terms of the benefits, livelihoods, and wellbeing of the households. The analysis recognises that apart from the zones (which is the primary distinction made for the households), other factors may be at play. For this reason, some of the tests checked for collinearity between factors, as explained towards the end of this section on data analysis.

Descriptive statistics were used to describe respondents' demographics and their responses to the questionnaire. Cross-tabulation and the chi-square (χ^2) tests of independence were conducted to establish statistically significant variables ($p<0.05$). The variables that showed significant differences were then subjected to the Cramer's V test to determine the strength of the association, with a score between 0 (no association) and 1 (complete association).

Principal component analysis (PCA) was then applied to the perceived benefits of living in either zone. The PCA was done to reduce the number of identified benefits (13 and 12, for the conservation and development zones, respectively) into principal components and establish which variables contributed more towards the observed variances. The suitability of the data for PCA was assessed by generating a correlation matrix for all variables. The matrix was then checked for coefficients with values ≥0.3 (Stewart et al., 2018). Scree plots were inspected to confirm the adequacy of the number of factors retained in the analysis. The Kaiser-Meyer-Olkin (KMO) index was applied to measure sampling adequacy with a cut-off of > 0.6 (Stewart et al., 2018). Bartlett's test of sphericity was applied to ensure that there was no correlation between the variables (> 0.5) (Stewart et al., 2018). The orthogonal rotation method using Varimax was used by maximizing loadings of variables on extracted factors and minimizing loading on other factors. The rotation was done to make the interpretation of the results easier. The variables were transformed and reduced into fewer linear combinations, without losing much information (Lawrence, 2005). A cut-off point of 1 or more was used on the Eigenvalues. Factor scores of the identified principal components were used for further analysis in a t-test to compare the means of the principal components between the zones.

The livelihood activities were grouped into two broad categories, i.e. farm and non-farm livelihood activities (Table 4-6). This classification is borrowed from classes used to distinguish income from activities that involve growing crops and rearing livestock (farm activities) from those that generate income through other means such as employment (non-farm) (Brown et al., 2006). The study then focused on the farm livelihoods to examine crops grown and livestock kept as a livelihood diversification strategy. Dummy variables of 1 were allocated to each type of crop grown and livestock kept. Conversely, a value of zero was given to indicate the absence of the crop or livestock. An aggregate of the dummy variables was done to assess the level of crop and livestock diversification. The aggregated scores were then tested to compare their means using the independent samples t-test.

Also of interest was determining the odds of improving human wellbeing using several predictor variables such as zone and household possessions. The odds are best determined using ordinal regression when ordered categories are used as the dependent variable (e.g. worsened wellbeing, no change in wellbeing, and improved wellbeing as used in this study). This model assumes that the dependent variable is semi-quantitative, and the differences among its categories have the same meaning (Guisan & Harrell, 2000). Although the dependent variable (human wellbeing) used in this study was ordered, it did not meet the assumption of proportional odds, as the differences in the odds were minimal. Because of this, multinomial logistic regression was used in which human wellbeing was considered nominal. Furthermore, the variables that expressed collinearity with the zones, for example, ethnic background, were removed from the model as they would undermine the significance or contribution of the independent variables (Vatcheva et al., 2016). Independent variables included the respondent's zone, place of origin, the total area occupied, changes in household possessions, and livestock and crop numbers.

4.3. Results

4.3.1. Household characteristics

Most (78.7%) of the respondents were household heads, with slightly more males interviewed from the conservation zone relative to the development zone (Table 4-1). The majority of the respondents were in the age range of 23 and 56 years. Conservation zone households reported a

higher average number of household members but a lower adult to child ratio relative to those in the development zone. For ethnic group distribution, many of the conservation zone households were Tonga, with Tepula alone recording 94% Tongas (Table 4-1). The development zone households presented greater ethnic diversity (Table 4-1). No clear pattern was observed in landholding size, although Tepula (conservation zone) recorded the largest average area of land occupied per household.

Table 4-1 Respondent demographic characteristics for the households interviewed in two and three areas of the Mumbwa Game Management Area's conservation and development zones, respectively

	Conservation zone				Development zone					
Characteristics	Chungu		Tepula		Chibuluma		Kabulwebulwe		Mulendema	
		SD		SD		SD		SD		SD
Households Interviewed(n)	71		67		147		74		78	
Household head (%)	70.4		83.6		77.6		81.1		80.8	
Male respondents(%)	66.2		79.1		57.8		62.2		67.9	
Respondent age [a]	40.0	13.5	40.0	14.1	43.0	15.2	43.0	14.3	42.0	15.2
Household size [a]	8.0	4.5	9.0	4.6	8.0	4.2	7.0	3.2	6.0	2.5
Adults [a]	3.0	1.6	4.0	2.0	3.0	1.8	3.0	1.3	3.0	1.3
Children [a]	5.0	3.1	5.0	3.2	5.0	3.2	4.0	2.3	3.0	1.7
Adult: child	0.6		0.8		0.6		0.8		1.0	
Ethnic group (%)										
Nkoya	4.2		0.0		0.0		23.0		1.3	
Kaonde	5.6		0.0		5.4		12.0		23.1	
Ila	5.6		1.5		36.7		6.8		35.9	
Tonga	60.6		94.0		26.0		9.5		12.8	
Lozi	11.3		0.0		12.2		20.3		11.5	
Luvale	8.5		0.0		2.7		9.5		3.8	
Others	4.2		4.5		17.0		18.9		11.5	
Landholding size (hectares) [a]	5.0	4.0	18.3	6.6	9.1	5.0	7.0	4.8	7.4	4.9

Note. [a] represents the mean values for each characteristic while the value in brackets indicates the standard deviation for the mean;

n is the number of respondents interviewed

4.3.2. Benefits associated with the game management area

Households can benefit from GMAs in two ways. Firstly, the GMA has conservation packages that its inhabitants should benefit from. Secondly, living in either zone comes with its particular benefits, as seen below.

4.3.2.1. Conservation package benefits

No respondent from the conservation zone reported receiving personal or community benefits in the past year. On the other hand, 2.9% and 4.4% of the conservation zone households reported having received personal and community benefits ten years ago, respectively. Only 1.3% compared to 4.3% of the development zone respondents reported receiving personal benefits in the past year and ten years ago, respectively. Similarly, only 3.7% compared to 29.7% of the development zone respondents reported receiving community benefits in the past year and ten years ago, respectively. Boreholes, which are a source of clean water (Figure 4-1), have been set up in the development zone while those living in the conservation zone rely on wells, some of which animals also drink from.

Figure 4-1 Respondent in Kabulwebulwe (development zone) demonstrating the use of a hand-pumped borehole set up in her community. Source: Fieldwork, 2017; photograph taken by Dina P. Mambwe

4.3.2.2. Benefits of living in either the conservation or development zones

From the survey, most (94.1%) conservation zone households said the land in the conservation zone was fertile and available for them to grow crops (Table 4-2). Though at lower percentages, the responses from the development zone households followed a similar trend. Respondents from

the development zone cited game meat (57.8%) as a conservation zone benefit, while those from the conservation zone scored it a low 7.4%. Generally, respondents from the development zone scored the benefits from living in the conservation zone lower than their counterparts, except for the use of forest products and fish (Table 4-2). Through the FGDs, groups from both zones ranked agricultural land as the most important benefit from the conservation zone (Table 4-3).

Respondents from both zones were then asked what they perceived as the benefits of living in the development zone. The respondents from the two zones noted similar benefits (Table 4-2). However, more people in the development zone rated their benefits more highly than their counterparts in the conservation zone. For example, 97.3% of development zone households selected clinics relative to 87.5% of the conservation zone households (Table 4-2). Also, 42% of the respondents from the development zone viewed communication networks as a benefit relative to 20.6% from the conservation zone. From the FGDs, respondents from both zones ranked clinics as the essential development zone benefit (Table 4-3).

Table 4-2 Respondents' perceived benefits of living in the Mumbwa Game Management Area's conservation and development zones

	Respondents' zone		Statistics	
Conservation zone benefits	Conservation zone n=136	Development zone n=301	χ^2	Cramer's V
Bushmeat	7.4	57.8	97.824***	0.473
Settlement land	92.6	51.5	69.110***	0.398
Pasture	88.2	45.8	69.599***	0.399
Available cropland	94.1	63.1	45.414***	0.322
Abundant rainfall	54.4	27.2	30.124***	0.268
Fish	5.1	23.6	21.725***	0.223
Water dams	44.1	24.9	16.176***	0.192
Fertile land	94.1	87.0	4.884*	0.106
Charcoal	9.6	18.3	5.413*	0.111
Honey	11.0	18.6	3.950*	0.095
Wood	20.6	16.3	1.198 NS	0.052
Caterpillars	7.4	11.0	1.376 NS	0.056
Other	0.0	0.7	0.908 NS	0.046
Development zone benefits				
Schools	74.3	91.3	22.656***	0.228
Communication networks	20.6	42.0	18.779***	0.208
Clinics	87.5	97.3	16.740***	0.196
Job opportunities	7.4	18.0	8.470**	0.139
NGO help	6.6	15.7	6.845**	0.120
No tsetse flies	6.6	17.0	8.500**	0.140
Others	2.9	0.3	5.614**	0.113
Markets	32.4	43.7	4.985**	0.107
Concession money	5.1	12.0	4.944**	0.106
Boreholes	61.8	70.3	3.140 NS	0.085
Agricultural inputs	21.3	27.7	1.972 NS	0.067
Peace of mind	35.3	41.7	1.588 NS	0.060

Note: n represents the number of respondents in each zone while figures under respondent's zone indicate % of respondents who said yes to the corresponding benefits. * P< 0.05; ** P< 0.01; ***P<0.001 (two-tailed); NS = Not significant (P>0.05)

Table 4-3 Respondents' ranking of perceived benefits of living in either the Mumbwa Game Management Area's conservation or development zones from the household survey and focus group discussions

	Benefits from zones			
	Household survey		**Focus group discussion**	
Respondents	Conservation benefits	Development benefits	Conservation benefits	Development benefits
Conservation households	1. Agricultural land 2. Settlement land 3. Pastureland	1. Clinics 2. Peace of mind 3. Schools	1. Agricultural land 2. Settlement land 3. Pastureland	1. Clinics 2. Peace of mind 3. Boreholes
Development households	1. Agricultural land 2. Bushmeat 3. Settlement land	1. Clinics 2. Boreholes 3. Peace of mind	1. Agricultural land 2. Bushmeat 3. Settlement land	1. Clinics 2. Peace of mind 3. Schools

Note. Figures indicate the ranks allocated to each corresponding benefit

A PCA of the perceived benefits in the two zones yielded four principal components for the conservation zone and three principal components for the development zone, accounting for 66.5% and 67.5% of the variances (Table 4-4). The initial list of perceived benefits (Table 4-2) was thus reduced and renamed to represent the common characteristics among the variables within each component. The principal components were thus designated as Forest/GMA products (PC1, composed of bushmeat, caterpillars, charcoal, fish, honey, and wood), Available land/water (PC2, composed of dams, more rain, cropland, pastureland, and settlement land), Others (PC3, composed of 'other' benefits not named by the respondents), and Soil fertility (PC4, composed of fertile land) for the conservation zone benefits. The principal components from the development zone benefits were named as Access to finances and inputs (PC1, composed of concession money, NGO assistance, job opportunities, and agricultural inputs), Other social amenities (PC2, composed of peace of mind, boreholes, and communication networks), and Clinics and schools (PC3, composed of clinics and schools). The means of the PCA generated scores showed that the households in the two zones had similar views only on soil fertility as a conservation zone benefit (Table 4-5). Furthermore, only 'other social amenities' were viewed similarly as a development zone benefit by respondents from both zones. The means for 'access to finances' and 'clinics and schools' were statistically different ($t_{1,136} = 3.021$, $p < 0.05$) and $t_{1,301} = 4.354$, $p = 0.000$), respectively (Table 4-5).

Table 4-4 Principal component analysis of the respondents' perceived benefits from the conservation and development zones

	Conservation Zone benefits			**Development Zone benefits**		
Components	Eigenvalues	Proportion of variation (%)	Cumulative variation (%)	Eigenvalues	Proportion of variation (%)	Cumulative variation (%)
Comp1	3.99	30.67	30.67	4.69	39.07	39.07
Comp2	2.32	17.88	48.55	1.45	12.06	51.13
Comp3	1.28	9.83	58.38	1.02	8.47	59.60
Comp4	1.06	8.12	66.50	0.95	7.87	67.47
Comp5	0.87	6.71	73.21	0.82	6.87	74.34
Comp6	0.63	4.86	78.07	0.61	5.08	79.42
Comp7	0.58	4.43	82.49	0.55	4.59	84.00
Comp8	0.56	4.27	86.76	0.53	4.40	88.40
Comp9	0.46	3.55	90.31	0.45	3.78	92.18
Comp10	0.39	2.97	93.28	0.39	3.26	95.44
Comp11	0.34	2.57	95.85	0.31	2.57	98.01
Comp12	0.31	2.36	98.22	0.24	1.99	100.00
Comp13	0.23	1.78	100.00			

Conservation zone benefits; Comp1= Forest/ GMA products, Comp2= Available land/ water, Comp3= Others, Comp4= Soil fertility.
Development zone benefits; Comp1= Access to finances, Comp2= Other social amenities, Comp3= Clinics, and schools

Table 4-5 Summary statistics of the principal components of the benefits of living in either Mumbwa's conservation zone or its development zone

Benefits	Conservation zone		Development zone		
	Mean	SD	Mean	SD	t-values
Conservation zone benefits					
Comp1 (Forest/GMA products)	0.04	0.75	-0.18	1.05	6.628***
Comp2 (Available land/water)	-0.73	0.71	0.33	0.93	-13.100***
Comp3 (Other)	-0.24	0.83	0.11	1.05	-3.435**
Comp4 (Soil fertility)	-0.11	0.68	-0.05	1.11	1.888 NS
Development zone benefits					
Comp1(Access to finances and inputs)	0.19	0.77	-0.09	1.08	3.021**
Comp2 (Other social amenities)	0.10	1.10	-0.05	0.95	1.389 NS
Comp3 (Clinics and schools)	0.38	1.42	-0.17	0.67	4.354***

** P< 0.01; ***P<0.001 (two-tailed); NS = Not significant (P>0.05)
Note. Comp= Principal Component and SD= Standard deviation

4.3.3. Livelihood activities and household reliance on the game management area

Overall, households relied on on-farm activities across the GMA (Table 4-6). Households in both zones emphasised growing crops as their livelihood activity both now and ten years ago. The conservation zone households, however, were more involved in livestock rearing than those in the development zone, and more so in the past year (57.0% compared to 15.6%, Cramer's V = 0.425) relative to ten years ago. The conservation zone households were less involved in wage employment compared to their development zone counterparts, and this difference is more substantial now than ten years ago. Charcoal burning was another difference between the zones, with slightly more households from the development zone (8.3%) involved in charcoal burning compared to those in the conservation zone (0.7%).

Although not significantly different, the conservation zone respondents are currently more involved in livestock raring and businesses compared to ten years ago (Table 4-6). Equally, they rely less on salaried employment (0.7%). Those in the development zone rely more on growing crops, salaried employment, charcoal burning, and businesses, while their involvement in salaried employment has reduced. Hunting, gathering, and fishing activities were low across all households. The majority of households, i.e. 93.4% of the conservation zone and 80.1% of the development zone households, said they collected/used forest products. Respondents from both zones cited firewood as the most essential forest product harvested.

Table 4-6 The proportion of the population involved in farm and non-farm livelihood activities (at the time of the study and ten years before the study)

	Livelihood activities at time of study (% proportion)		Livelihood activities ten years before study (% proportion)	
Livelihood activities	Conservation zone (n=136)	Development zone (n=301)	Conservation zone (n=136)	Development zone (n=301)
Farm activities				
Growing crops	91.9 NS	91.7 NS	90.4 NS	85.0 NS
Keeping animals	57.0 ***	15.6	47.8 ***	15.0
Non-farm activities				
Salaried employment	0.7 NS	2.7 NS	3.7 NS	4.3 NS
Wage employment	0.0	6.0**	0.0 NS	1.0 NS
Business	17.8 NS	20.3 NS	10.3 NS	11.0 NS
Charcoal burning	0.7	8.3**	0.7 NS	4.3 NS
Hunting	0.0 NS	1.0 NS	0.0 NS	0.7 NS
Fishing	0.7 NS	1.0 NS	0.7 NS	2.3 NS
Gathering	0.0 NS	0.3 NS	0.0 NS	0.0 NS
Dependent	5.2 NS	1.7 NS	3.7 NS	6.3 NS
Others	0.0 NS	0.7 NS	0.0 NS	0.3 NS

Note. n represents the number of respondents in each zone, while figures in each column indicate % of respondents who said yes to corresponding livelihood activities.

** P< 0.01; ***P<0.001 (two-sided); NS = Not significant (P>0.05)

4.3.4. Diversification strategy for farm livelihood activities

The proportion of households growing particular crops remained stable over the past ten years for both zones, with maize as the main crop. The number of households growing legumes and sunflower increased over time, especially in the conservation zone. An independent samples t-test to determine differences between the zones in the types of crops grown in the last ten years showed that the conservation zone households diversified more in crops grown relative to those in the development zone (Table 4-7). The proportion of households growing groundnuts, soybeans, cotton, sweet potato, sunflower, and vegetables was higher among the conservation zone households. Also, 68.0% of the conservation zone households recorded an increase in crop yield in the last ten years relative to those in the development zone, where 29.1% reported an increase in crop yield (Figure 4-2) which was statistically different ($\chi^2_{3,432} = 63.639$, $p = 0.000$). The most cited reasons by conservation zone respondents for this increase were improved soil fertility (76.9%) and improved farming methods (34.1%). Those in the development zone attributed the increase to access to capital (36.4%) and improved soil fertility (26.1%). Conservation zone households whose crop yield declined cited drought (63.6%) as the main reason, while those in the development zone attributed the reduction to reduced soil fertility (48.5%) and drought (45%).

Table 4-7 Summary statistics of the types of crops grown by Mumbwa Game Management Area's conservation and development zone households

Independent variables	Conservation zone			Development zone			
	n	Mean	SD	n	Mean	SD	t-values
Types of crops currently grown	132	4.03	1.65	296	2.89	1.40	6.89***
Types of crops grown ten years ago	127	3.63	1.55	286	2.69	1.30	5.95***
Types of livestock currently kept	115	2.91	0.91	229	2.15	0.99	7.12***
Types of livestock kept ten years ago	113	2.81	0.85	236	2.05	0.92	7.38***

***P< 0.001 (2- tailed), Note. n= sampled number and SD= standard deviation

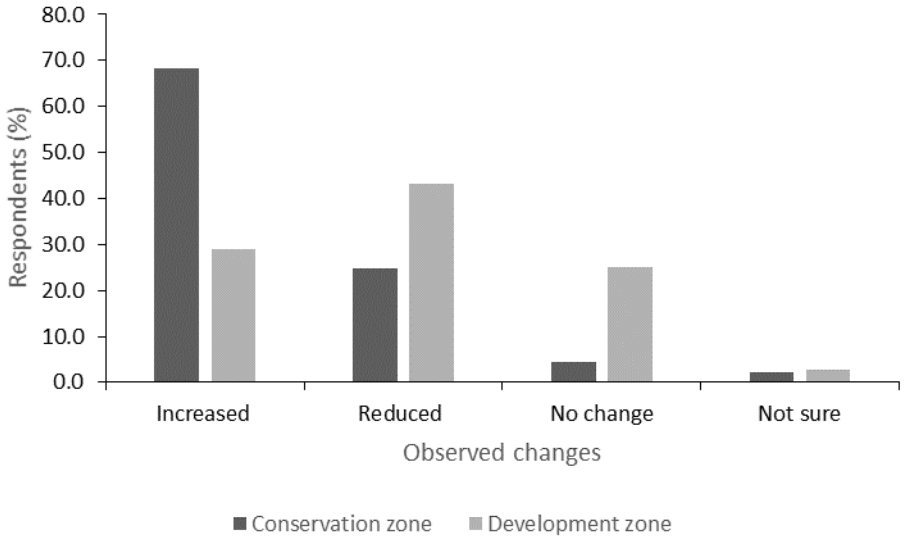

Figure 4-2 Respondents' observed changes in crop yield over the last ten years leading up to the study in the conservation and development zones

The reported livestock kept by the households in declining order of abundance were chickens, goats, cattle, and pigs (Figure 4-3). Just like the crops grown, the types of livestock kept by households in the GMA have not changed much over the last ten years. However, the conservation zone households owned and still own more goats and cattle than their counterparts in the development zone. Furthermore, the conservation zone households diversify more than those in the development zone (Table 4-7). Although both zones consider cattle as the most important livestock, goats and chickens were considered as the second most important in the conservation and development zones, respectively. Fifty-six percent of the conservation zone households recorded an increase in livestock numbers relative to those in the development zone (27.8%) over the last ten years. The most frequently selected reasons by conservation zone respondents for this increase were improved pasture (81.7%) and reduced animal diseases (56.3%). Those in the development zone attributed the increase in livestock abundance to a decline in animal diseases (77.5%).

Figure 4-3 Livestock kept by households in Mulendema chiefdom (development zone), Mumbwa Game Management Area. Source: Fieldwork, 2017; photograph taken by Dina P. Mambwe

4.3.5. Human wellbeing in Mumbwa Game Management Area

Seventy-two percent of the conservation zone households reported improved wellbeing compared to 37.6% from the development zone (Figure 4-4). Those in the conservation zone attributed the improvement to good crop harvests (96.9%), new businesses, and better commodity prices. Those from the development zone attributed the improvement to good harvests (84.2%), new businesses, and joining a cooperative group.

Conversely, there were more cases of perceived worsened livelihoods in the development zone relative to the conservation zone (Figure 4-4), which were statistically significant ($\chi^2_{2,437} = 45.693$, $p = 0.000$). Those in the conservation zone attributed the worsening livelihood to eviction-related

conflicts, livestock loss, and crop failure. Those from the development zone attributed the worsening livelihood to crop failure (78.8%), a weak economy, and livestock loss. Conservation zone households coped by engaging in business and wage labour, while those in the development zone coped through wage labour, business, and charcoal burning. In terms of predicting human wellbeing, adding the predictors to the multinomial logistic model relative to having the intercept alone significantly improved the fit between the model and data, $\chi^2_{52,396} = 464.091$, $p = 0.000$. The Nagelkerke value (R^2) was 0.78. Predictor variables whose results were significant are presented in Table 4-8. Results show that people are more likely to improve their wellbeing compared to being worse off or not experiencing any change if household possessions or crop yield increased. Furthermore, having more land increases the chances of improving wellbeing.

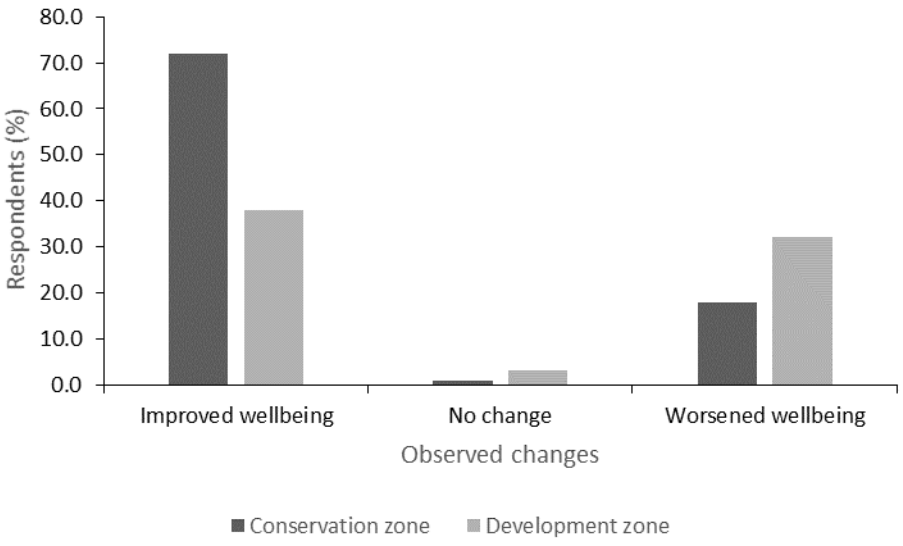

Figure 4-4 Respondents' views of the changes on their wellbeing over the ten years before the study

Table 4-8 Summary of multinomial logistic regression for predicting improved human wellbeing among Mumbwa Game Management Area households

Predictor	Worsened livelihoods		No change in livelihood	
	B	e^B	B	e^B
Total area	0.073***	1.076	0.014 NS	1.014
Tribe (ref= Ila)				
Nkoya	1.617 NS	5.400	1.365 NS	3.915
Kaonde	-2.316*	0.990	-0.696 NS	0.499
Tonga	0.328 NS	1.388	0.453 NS	1.573
Lozi	-0.100 NS	0.990	0.360 NS	1.036
Luvale	-1.655 NS	0.191	-1.262 NS	0.283
Others	-0.418 NS	0.659	0.696 NS	2.005
Changes in possession (ref= increased)				
Reduced	4.337***	76.463	2.882***	17.841
No change	3.957***	52.321	4.226***	68.409
Changes in crop yield (ref= increased)				
Reduced	3.588***	36.161	2.210***	9.117
No change	2.546**	12.753	1.978**	7.229
Not sure	2.918**	18.499	3.315*	27.515
Changes in animal numbers (ref= increased)				
Reduced	0.954 NS	2.597	0.254 NS	1.289
No change	0.446 NS	1.562	1.054 NS	2.869
Not sure	1.552 NS	4.722	2.400*	11.328
Respondents place of origin (ref= not local)				
Local	0.939 NS	2.559	1.408*	4.087
Constant	-7.492		-4.928	

*p < .05. **p < .01. ***p < .001; NS = Not significant (P>0.05)
Note: Improved human wellbeing is the reference for changes in human wellbeing
B= multinomial logistic regression coefficients for the models while e^B= odds ratios for the predictors

4.4. Discussion

The approach taken by this study to contrast the conservation and development zones is unique to this study. Other studies on game management areas (GMAs) have focused on the development zone as representative of GMA households (Franks & Small, 2016; Namukonde & Kachali, 2015). The results of this study show that the conservation zone benefits its households through access to farming land, while the development zone offers social benefits such as schools and clinics to its inhabitants. Although people living in the development zone should benefit from the conservation programmes, the households have received few or no benefits at both personal and communal level. These findings reject the hypothesis that the respondents from the development zone benefit significantly from living in the development zone compared to their conservation zone counterparts. Also, both zones rely on farming and less on non-farm activities tied to the GMA, with improved wellbeing attributed to farming and possessions, and not necessarily the GMA.

4.4.1. Respondents' perception of benefits of living in either the conservation or development zone

Households in the development zone were reluctant to admit receiving benefits from the conservation programmes. This is common among people living near protected areas (PAs) (Davis, 2011). The few who acknowledged the benefits said those benefits had drastically reduced over the last ten years. People could have been reluctant to admit receipt of benefits because they did not receive the benefits or wanted to portray themselves as victims to gain sympathy from the researcher. Also, most respondents did not fully understand the nature of the benefits. For example, many households did not view a community school built by a tourist as a GMA benefit. From personal observations and the interviews, the few benefits disbursed were communal. Most conservation benefits remain communal (Naidoo et al., 2016; Namukonde & Kachali, 2015) and do not translate into personal benefits, making the benefits less appreciated by households. Households can benefit from tourism-related employment, for example, whose proceeds go to individual households (Karanth & Nepal, 2012) or those benefits reserved for student bursaries (Bruyere et al., 2009). In Bwindi, Uganda, many households were not happy with public benefits, which went towards projects such as building council halls (Tumusime & Vedeld, 2012). Other

researchers suggest that people will not admit to having received benefits when there is no evidence (Scholte & De Groot, 2010), or when the benefits are unexpected (Baird, 2014), especially with tourism sharing schemes (Tumusime & Vedeld, 2012). For benefits to be appreciated, the conservation programmes should explicitly state the potential benefits to the recipients to avoid misunderstandings (McShane et al., 2011; Snyman, 2012; Spenceley et al., 2019). People also view non-monetary benefits as free and value them less (Bennett, 2016). This view is strengthened because although natural forests such as those in the GMA are a benefit, their monetary value is difficult to quantify (Zambia. Ministry of Lands, Natural Resources, and Environmental Protection, 2014).

The general view is that the conservation zone benefits its occupants more, since the zone's benefits promote farming, which is the main livelihood activity. The proceeds from farming are more tangible in the short term compared to those from the communal projects. What may be overlooked in the comparison is that the conservation zone households (Tonga ethnic group) are traditionally farmers and own more livestock, which may give them a head start, making it seem that they are benefiting more from farming in the GMA. Although the indigenous tribes like Ila and Nkoya also grow crops, they are traditionally known to be hunters. Also, the conservation zone currently has more virgin land and fewer people than the development zone.

4.4.2. Livelihood reliance of households on the game management area

The farm-related livelihood activities were more prominent than the non-farm activities for both zones, which refutes the hypothesis that the two zones have different livelihood activities. The reliance on farming livelihood activities by respondents from both zones suggests there is a failure in either conservation/livelihood policy or its implementation. One cannot over-emphasise the role of policy on livelihoods, as policy determines households' access to resources (Mogende & Kolawole, 2016; Scoones, 2009). The National Parks and Wildlife Policy, which is the main policy that governs the GMA, emphasises on the restricted access to and the protection of wildlife, with little mention of the livelihoods of the local people. Firstly, having zones with different land uses within the GMA has not yielded the desired results, as households farm in a zone meant to conserve wildlife. The institutions meant to enforce the law and give rights to the local people have proved

to be inadequate, forcing the development zone households to depend less on the GMA-based livelihoods. Despite restricted access to the conservation zone, households settle there and gain access to the resources. Strangely though, these households focus more on farming than the other GMA resources, probably because of their farming background. Secondly, the results show that the development zone households depend on farming for their livelihoods, which means the objective of creating the GMA to improve the people's livelihoods has also not been achieved. The development zone households, having legal, controlled use of the GMA resources, are allowed to engage in GMA-related livelihood activities such as gathering of non-timber forest products, alongside agriculture. Having legal access to natural resources does not mean people should not practise agriculture, but that they should rely more on the GMA's unique sources of livelihoods, for example, hunting and tourism. Agriculture cannot be eliminated as a livelihood activity because the GMA was established on land previously used for cropping or grazing by local inhabitants, making farming a key activity (Matenga, 2002). Zambia's Fifth National Development Plan (FNDP) acknowledges that agriculture is vital to reduce poverty (Kalinda et al., 2008).

The results from this study further suggest that the non-farm activities could not be linked to the GMA, suggesting that the households across the GMA do not rely on the GMA's existence for their wellbeing. Most households in other Zambian GMAs also rely on non-conservation livelihood activities such as farming (Chemonics International, 2011). The reliance on non-conservation livelihood activities is typical of people living near PAs (or those under conservation programmes). For example, in the PAs of Sierra Madre de Chiapas, Mexico, people depend on farming, which has led to forest clearing (Cortina-Villar et al., 2012). In Tanzania, people live near PAs because of available farming land and pasture (Salerno et al., 2014). Communities living near Mikumi National park, in particular, depend on farm income (Vedeld et al., 2012).

Like other rural households in developing countries, the GMA households practise other livelihood activities (Babulo et al., 2008), which cushion them in case the primary livelihood source fails (Sunderlin et al., 2005). The people living in the development zone diversified more by engaging in businesses and wage labour, with more opportunities now compared to ten years ago. There could be several reasons for this trend. Firstly, the reported low crop yields from the development

zone may drive the zone's inhabitants to seek alternative livelihood sources. Secondly, the conservation zone is isolated, reducing the prospect for its households to engage in income-generating ventures such as businesses or seeking employment. Thirdly, the illegal status of the conservation zone households may limit what livelihood activities households can practise. When faced with limited livelihood choices, people turn to illegal resource use (Fernández, 2010).

4.4.3. Differences in Human wellbeing between the zones

It is established that restricting the use of natural resources in PAs can have a multitude of social and economic impacts on local people who have traditionally relied on these resources for their livelihoods (Foerster et al., 2011). This study showed that living in the conservation zone offers access to more resources, thereby improving wellbeing. As alluded to earlier, those living in the conservation zone own more livestock and grow more crops compared to the development zone households, which could explain why their wellbeing improved over time. The observed strong link between wellbeing and what households own supports this study's claim. This study's findings are consistent with those of Franks and Small (2016), who observed that the local people in Mumbwa GMA did not attribute improved wellbeing to the GMA but to farming. Wittemyer et al. (2008) corroborate that the effects of the PA environment on household improvements could be because of high farming output and not necessarily the PA itself. In Peru, living near PAs does not guarantee improved wellbeing (Miranda et al., 2016), especially for PAs with minimal economic activities. The findings of Miranda et al. (2016) apply to the Mumbwa GMA as well because of its limited economic activities.

4.5. Conclusion and recommendations

The results discussed in this chapter show that living in the conservation zone is more rewarding in terms of livelihoods and general wellbeing compared to living in a legally designated development zone. Proximity to resources benefits those living in the conservation zone as most of the GMA inhabitants are farmers. Generally, the benefits from the two zones complement each other. What stands out is that the current zoning scheme is disadvantaging the local people living

in the development zone, which raises the question of whether the zoning scheme is serving its purpose. Since the conservation programme is perceived not to benefit the local households, such views present a problem because people often reject conservation programmes that do not guarantee their wellbeing.

Based on these findings, there is a clear need to offer tangible benefits to those living in the development zone if the GMA is to remain intact. Since the development zone households rely on farming, policymakers should improve the farmers' crop yield by increasing agricultural input support and technical services. The conservation programme should not depend on trophy hunting, but include other income-generating activities such as photographic tourism. The implementers of the benefit-sharing scheme should be clear on how the benefits will be shared to reduce unrealistic expectations from the inhabitants.

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Chapter 5 Quantifying recent land-cover changes in the Mumbwa Game Management Area

Abstract

The way households choose to use land in protected areas (PAs) has an impact on land cover in their surroundings. This study analyses recent land use/cover changes (LU/CCs) and their drivers in Zambia's Mumbwa Game Management Area (GMA), a category VI IUCN PA. Two zones (conservation and development) within the GMA were investigated. Remote sensing data and geographical information systems (GIS) data were used to quantify the LU/CCs from 1990 to 2017. Five land use/cover classes (forest, other wooded areas, cropland, bare land, and water bodies) were identified. A structured questionnaire was used to determine the local households' perceptions of the drivers of LU/CC. The LU/CCs exhibited a degradation-deforestation transition. Forests covered 54.0% of the conservation zone in 1990 but this decreased to 32% by 2017. By 2017 the share under other wooded areas increased from the initial 35% to 57%, while that of cropland increased from 0.5 to 6%. In the development zone, other wooded areas dominated the zone at 56.8% in 1990. Up to 2017 the share fell to 40%, while that of cropland increased from 4 to 44%. The share under forest declined from 16 to 10%. Across both zones, the leading direct drivers of LU/CC were agricultural expansion and wood extraction, while natural population growth and urbanisation (of Mumbwa town) were cited as the main underlying drivers. In addition, migrations were also cited as a driver in the conservation zone. The findings provide evidence of land cover change and the role that uncontrolled migrations along with uncontrolled land use plays in the change. Furthermore, the observed changes in both zones suggest that in time, if no preventative measures are put in place, the conservation zone will transition into the current status of the development zone, with little forest cover left.

Keywords: Conservation zone, development zone, land use, land cover change, game management area.

5.1. Introduction

Land use and its associated land cover changes can lead to biodiversity loss through the conversion of natural ecosystems, such as forests, to other land uses. Reports of forest loss persist (Ahrends et al., 2010; Asner et al., 2009; Drummond & Loveland, 2010), particularly in tropical rainforests (DeFries et al., 2010), where over 80% of new agricultural land replaced forests between 1980 and 2000 (Gibbs et al., 2010). Protected area (PA) forests and their buffers are not exempt from this loss (Curran et al., 2004; Margono et al., 2014). Research on PA land use/cover changes (LU/CCs) often emphasise the magnitude and patterns of the change, rather than their causes (Kumar et al., 2013; Tsegaye et al., 2010), hence the approach adopted for this study to include an investigation of the causes. Moreover, simple cause-effect relationships cannot easily explain the causes of forest decline.

Malthusian theory, based on classical economics, attributes the increased pressure on land and its use to the increased human population (Lambin et al., 2000; Meyer & Turner, 1992; Tilumanywa, 2013). Since land is finite and as a basic means of production produces arithmetically, while the human population increases exponentially, the land will at some point not be able to sustain the number of people that live (Hardin, 2009). Natural scientists hold similar views and attribute the earth's degradation to humans' negative impacts (Jolly, 1994). With reports of increased human population in African PAs, PA land is under pressure. Contrary to Malthusian population-driven change, Boserup (2017), an agricultural economist, viewed population growth as a positive drive that motivates people to intensify land use through improved technologies. Although the land is finite, population pressure makes people intensify land use and exploit the intensive – rather than the extensive – frontier. As to whether this is attainable in African PAs, has yet to be determined.

Most of these theories do not operate in isolation (Lambin et al., 2001), since land cover, even though a product of increased population, is a complex phenomenon and affected by many factors (Angelsen & Kaimowitz, 1999; Kleemaan et al., 2017). Accordingly, this study does not focus on any one theory, but draws from a range of theories to understand the observed changes. On one hand, PAs receive external migrants, which entails increased population and pressure on land and resource extraction. However, with effective conservation and land use policies as well as law enforcement in place, households can intensify their production rather than expand. The process

of intensified land use, however, may lead to degradation (Child & Wojcik, 2014; Jolly, 1994). Although increased population can degrade the land, other factors such as inappropriate policies that do not favour the environment and climate change also affect the process (Jolly, 1994; Kindu et al., 2015; Lanckriet et al., 2015; Way, 2016). For example, the distribution of fertilizer and seed to households in areas meant for conservation encourages households to intensify their crop production (personal observations, April, 2017).

The drivers of LU/CC are classified as either proximate/immediate or underpinning/underlying (Angelsen & Kaimowitz, 1999; Lambin et al., 2003; Meyer & Turner 1992). The proximate drivers are manifested by human actions, which are influenced by underlying forces which drive the decisions made (Angelsen & Kaimowitz, 1999; Betru et al., 2019). Since human actions are observable they tend to stand out when it comes to investigating land cover change in PAs (Alemayehu et al., 2009; Bozkaya et al., 2015; Estes et al., 2012; Huston, 2005; Munteanu et al., 2014; Quintero-Gallego et al., 2018; Rosa et al., 2015). This study classifies the drivers into direct and underlying. However, because of the conspicuous nature of human action, the emphasis is placed on households and their role in the observed changes. Human population growth, an underlying driver of LU/CC, often drives agriculture, a proximate driver. These two drivers often interact to cause land cover change and disturb ecological integrity (Strassburg et al., 2014). Increased population does call for increased agricultural production, but this is sustainable only to a certain level. Most drivers of the LU/CC do not work in isolation (Duraisamy, 2018), with most (70%) LU/CC studies showing that the drivers interact (Lambin et al., 2003).

Protected areas should reduce the effects of these drivers' on biodiversity loss, with forest conservation being critical in some regions of the world. Global concerted efforts have seen a 500% increase in PAs in the last 50 years (UN, 2003 as cited in Wittemyer et al., 2008), with 150,000 protected sites created (United Nations Environment Programme (UNEP), 2009). These efforts have not, however, completely controlled forest loss in PAs (DeFries et al., 2005; Gaveau et al., 2007; Geldmann et al., 2013; Naughton-Treves & Brandon, 2005). Furthermore, the tropics, compared to other parts of the world, continue to lose forests in both protected and non-protected areas (Hartter et al., 2011; Sloan & Sayer, 2015; Wright and Samaniego, 2008), with 60% of forest loss recorded in the tropics (Cernea & Schmidt-Soltau, 2006). The attempts to preserve forests

prove less effective where there is insensitivity to regional social needs (Mwavu & Witkowski, 2008), making it difficult to implement local conservation policies. This is worsened because there are many causes of land cover changes, which may interact at different levels and with different combinations (Angelsen & Kaimowitz, 1999; Lambin et al., 2001). For example, Africa's growing food demand (Guida-Johnson & Zuleta, 2013), high fuelwood use (Broadhead et al., 2001) and continued population growth (Dinka, 2012) often interact to drive the land changes by exerting pressure on land use and thereby escalating forest loss. Tilman et al. (2001) postulate that, at this rate of forest loss, a further 10 million km^2 of the world's forest will be converted to other land uses by 2050.

Like most African countries, Zambia continues to experience high levels of forest loss (Hansen et al., 2013), especially because about 84% of Zambian households rely on fuelwood for energy (ILUA- Phase II, 2016). Zambia's forests continue to decline, in part because of inadequate land-use policies and structures to monitor and enforce the law in forested areas (Zambia. Ministry of Lands, Natural Resources, and Environmental Protection, 2014). Less than one third of Zambia's forests are on state land and thus formally managed (Kalinda et al., 2013). Land in GMAs, though located on customary land, is managed by the state. To reduce forest loss and conserve biodiversity, Zambian policymakers have established game management areas (GMAs), a IUCN category VI PA, which permit the controlled use of natural resources. In 2014 the Zambian government published the National Forestry Policy (Zambia. The Ministry of Lands, Natural Resources, and Environmental Protection), which includes PA forests. However, forest intactness, which indicates the level of forest disturbance, is statistically not different between areas under state protection and those under customary land (Kalinda et al., 2013).

Since parks remain ecologically linked to – and are therefore influenced by – their surroundings (DeFries et al., 2010; Gross et al., 2013; Laurance, 2012; Lima & Ranieri, 2018), GMAs must reduce the human influence on the park while providing sustainable livelihoods for the local population. People have continued converting the GMA forests to other land uses such as shifting agriculture and human settlements (Simasiku et al., 2008; Watson et al., 2015). Human activities have modified land in Zambian GMAs, with most GMAs having about 40% of their land modified

from forest to cropland/settlements at an annual habitat loss of 0.69% (Lindsey et al., 2014). The conversion in GMAs is high compared to the rate of 0.05% in national parks. Although the parks remain relatively intact, this may not last for long if land-use conversion in GMAs is not stopped. Mumbwa GMA, in particular, has been highly disturbed. In 1972 humans used only 3.2% of Mumbwa GMA for settlements and farming compared to 46.8% in 2011 (Lindsey et al., 2013).

This study employed both spatial land cover analysis and the local peoples' perspectives to quantify the long-term spatial land cover changes and account for their drivers in Mumbwa GMA's conservation and development zones. This approach was used because spatial changes detected from remote sensing data alone do not fully explain the impact of land-use activities on natural vegetation (Cortina-Villar et al., 2012; Hartter et al., 2011). To this effect the study attempted to contrast the two zones in terms of (1) the extent and nature of land cover change during the period 1990 to 2017, (2) the drivers that have contributed towards land cover change, and (3) the role households have played in the land cover change. The study hypothesized that there is more land cover change, especially forest loss, in the development than in the conservation zone, where land use is more restricted through existing conservation policies.

5.2. Methods

5.2.1. Description of the study site

The study was conducted in the Mumbwa Game Management Area in central Zambia, on the eastern border of the Kafue National Park (-15.330762, 25.912861 to -14.946877, 26.880199). The state established Mumbwa GMA in 1972, in consultation with three local chiefs (Chibuluma, Mulendema, and Kabulwebulwe), who agreed to set aside 3 370 km^2 of land as part of a buffer to Zambia's Kafue National Park. The GMA lies at an altitude of 1 289 m and receives annual precipitation of 1 000 mm. The GMA has a subtropical climate with three distinct seasons – the wet rainy season, the cold dry season, and the hot dry season. Temperatures range between 18^0 C and 40^0 C depending on the season. Mumbwa GMA's vegetation is classified as dry miombo woodland, dominated by *Brachystegia, Julbernardia,* and *Isoberlinia* tree species (Chidumayo, 2019a). The miombo woodland has small trees and shrubs below a 10 to 20-m high canopy

(Chomba et al., 2013), which is a transition from Africa's rainforests to semi-arid savannahs (Vinya, 2010). *Acacia polyacantha, A. erioloba, A. sieberaa,* and *A. tortilis* occur in patches within the GMA. A special use zone was explicitly created for an area that has *Baikiaea spp* forest, which needs conserving. Mumbwa GMA has a diversity of wildlife including 19 large herbivore species (elephants, buffalo, antelope, etc.), 13 carnivore species (lion, leopard, wild dog, cheetah, etc.), four primate species (Kinda baboons, Vervet monkeys, etc.), and seven omnivore and rodent species. The soils are well drained with different soil types, although leptosols and oxisols are predominant (Chomba et al., 2013). The GMA consists of five general land-use zones, i.e. buffer, conservation, development, special use, and tourism zones (Figure 2-1). Human settlements were initially near water sources in the development zone (Figure 2-1), but have spread out to other zones with increasing human population. Although people are only permitted to settle in the development zone, they can use the resources in the conservation zone sustainably.

Mumbwa GMA stands out as a case study because of the concerns expressed by stakeholders that migrants are adding to the already high number of wood harvesters and those converting the land in the conservation zone to other uses. This implies that the land use in the conservation zone is now similar to that in the development zone, which should not be the case. The GMA, which is classified as prime, hosts the highest diversity of grazing wildlife in southern Africa (Franks & Small, 2016). However, indiscriminate forest clearing threatens the GMA's function as an ecological buffer, as emphasised by the Department of National Parks and Wildlife (DNPW) (ZAWA, 2014). A disturbed GMA, in turn, deprives the country and local communities of the much-needed ecosystem services and income.

5.2.2. Data collection

This study was designed using a "nested level" approach, as described by Broadbent et al. (2012). Four levels were used: the landscape level through remote sensing data; at National policy level through key informant interviews; at the community level through focus group discussions (FGDs); and at household level through structured questionnaires with household heads.

5.2.2.1. Satellite imagery and GIS data

Both the conservation zone (1 980.13 km^2) and the development zone (654.07 km^2) were subjected to landscape analyses. A set of four multi-temporal Landsat satellite images at a spatial resolution of 30 meters were downloaded from https://earthexplorer.usgs.gov/ for path and row 173070 and 173071. The images were from 16 September 1990 (TM: Thematic Mapper), 26 August 2000 (TM), 3 October 2008 (TM) and 28 September 2017 (OLI_TIRS: Operational Land Imager_ Thermal Infrared Sensor). All images were collected during the dry season to avoid cloud cover, which can compromise the quality and accuracy of the collected images (Liu et al., 2015). The year 1990 was selected as a starting point for two reasons; it was the earliest clear Landsat image that could be obtained at no cost, and secondly, most of the people interviewed had not lived in the GMA before then (see Table 3-2). It was essential to know the respondents' views of land cover change within a similar time frame as the images. In May/June of 2015 forty training samples were generated in arc GIS and mapped from both the conservation and development zones. Sixty randomly selected points were also identified using high-resolution images from Google Earth. These points were collected to train the spectral signature of the various land use/cover classes. Landmarks like the river, roads, and schools were used to measure coordinates for purposes of ground-truthing.

5.2.2.2. Key informant interviews and Focus Group Discussions (FGD)

To obtain the views of policymakers on land-use change in the GMA, key informant interviews were conducted with the Director-General of the DNPW, a DNPW principal natural resources management officer, a senior agricultural officer (SAO), a DNPW principal community-based natural resources management expert, a veterinary officer, and a former Tourism and Natural Resources Minister. These key informants were selected because of their knowledge and experience with land use in Mumbwa GMA. Open-ended questions focused on land-use history, associated land-use problems, and potential solutions to land-use conflicts in the GMA were asked of the interviewees (Appendix 4). Three FGDs were held in Chibuluma, Kabulwebulwe, and the conservation zone. An open invitation was sent out to community members willing to participate. Each area had two subgroups based on gender to encourage participation from members. On average, each subgroup had 15 participants as recommended (Krueger & Casey, 2014). Moderators who understood the local language were employed for purposes of interpretation and

taking of notes. Flip charts were used to guide the discussions and notes were taken. The men and women were separated at some point during the discussion to encourage free participation, especially among the women (Stewart & Shamdasani, 2014). Questions asked were about land use and associated problems (Appendix 2). Consensus answers were formulated for each question before moving to the next question.

5.2.2.3. Household survey

A household survey using a structured questionnaire was conducted in 2016/17 in Mumbwa GMA's conservation and development zones. The questionnaire was pre-tested on 20 households within the GMA before being administered to the respondents. The first part focused on demographic data, including the respondent's age, gender, ethnic background, and the household size (Appendix 3). The second part sought to identify how the households contribute to land cover change through their land use. Questions asked were focused on frequency and reasons for forest clearing. The third part dealt with the perceived drivers of land cover change. For the drivers of LU/CC, the study used Geist and Lambin's (2002) classification of proximate and underlying drivers. The individuals within households were also asked if they had observed changes in the GMA forested area (used as a proxy for a land cover change) and what they thought were the causes of the change. The respondents were not provided with possible drivers to avoid leading them on. Instead, the person administering the questions ticked whichever response was given on the list. The interviewer went on to ask if there were specific tree species that had increased or reduced in numbers in the study area.

Household heads were selected through proportionate random sampling at a 10% sampling intensity (Neuman and Robson, 2014), giving a total of 136 and 301 respondents from the conservation and development zones, respectively. Three local enumerators were trained to assist with administering the questionnaires and translation into local languages. Before the interviews, the purpose of the survey was explained to the respondents to obtain their verbal consent. Ethical clearance (Ref: SU-HSD-002306) was granted by Stellenbosch University's Ethics Committee for Human Research in the Humanities, while DNPW granted permission to research in the GMA.

5.2.3. Data analysis

Data analysis was conducted at various levels and according to various types, because of the mixed methods used to collect the data and the research questions asked. Below are the detailed analyses done on the four levels of collected data.

5.2.3.1. Image pre-processing

All remote sensing work was conducted using the ENVI software and spatial analyses were performed using ArcGIS (V. 10.3). Pre-processing was carried out using ENVI radiometric correction tools. A seamless mosaic for each year was created and clipped using the GMA boundary. Five land use/cover classes were identified based on high-resolution imagery (Google Earth,Table 5-1). It is vital to select an appropriate land classification system (Mohan et al., 2011). It should be noted that 'deforestation' in this study refers to the conversion of forests to other land uses (Margono et al., 2014). Forest degradation, an elusive term yet to receive a universal definition, is sometimes considered not to affect overall land cover classes (Margono et al., 2014). However, with continuous degradation, forests may be converted to other land uses. Based on this explanation and description of land cover classes (Table 5-1), other wooded areas can be said to be in a process of degradation which turns into deforestation over time and qualifies as a land use/cover class. In an ideal situation, the settlements should have stood out on their own as a class. However, because most of the huts in the GMA are small and surrounded by bare land, they exhibited a similar spectral signature as bare land does. Supervised classification and mapping of the land use/cover classes were done using the Maximum Likelihood algorithm. The land cover area for each class was then used to determine the changes in the land cover classes and the transitions among the different classes. Accuracy was assessed using a random sampling method. Overall classification accuracy was 88.6% with a Kappa coefficient of 0.85 for the 1990 classification, 93.4% with a Kappa coefficient of 0.91 for the 2000 classification, 96.6% with a Kappa coefficient of 0.96 for the 2008 classification, and 99.3 % with a Kappa coefficient of 0.99 for the 2017 classification (Table 5-2).

Table 5-1 Description of land use/cover classes identified in the Mumbwa Game Management Area

Land use/cover class	Description
Forest	Natural forest, predominantly native tree species
Other wooded areas	Predominantly shrubs and grasslands
Cropland	Areas grown with crops
Water bodies	Dams, lakes, rivers, and wetlands
Bare land	Non-vegetated land (rock outcrops, sand) includes area cleared for settlements

Table 5-2 Classification accuracy for the 1990, 2000, 2008, and 2017 images used

Land use/cover class	Accuracy %							
	1990		2000		2008		2017	
	PA	UA	PA	UA	PA	UA	PA	UA
Forest	100.00	88.52	100.00	99.62	100.00	99.8	99.05	100.00
Other wooded areas	75.94	98.38	76.92	94.65	84.38	100.00	100.00	97.33
Cropland	95.65	86.27	89.22	96.81	99.48	77.73	100.00	99.64
Bare land	56.92	89.16	97.96	98.63	100.00	99.30	99.83	100.00
Water bodies	98.99	84.15	99.20	87.99	100.00	100.00	97.28	100.00
Overall accuracy	88.61		93.37		96.62		99.28	
Kappa coefficient	0.85		0.91		0.96		0.99	

Note: Kappa coefficient is dimensionless, PA is the Producer's Accuracy, and UA is User's Accuracy.

5.2.3.2. Drivers of land cover change

The data collected from the questionnaire were analysed using Statistical Package for Social Sciences (SPSS) software, version 22. The data were subjected to descriptive statistics to get an overview of the data's frequency distribution (Burns & Grove, 2009). Cross-tabulations (including

Chi-square test) were done to determine the relationship between the zone and selected variables. The variables included: (1) how easy/difficult it is to obtain land in the GMA, (2) whether respondents are restricted on how they use their land, (3) whether respondents had plans to acquire more land, (4) whether there were observed changes in the area under forest, and (5) the most important forest product used by the respondents. An independent sample's t-test was used to separate the means of the area under each land use and zone. One-way analysis of variance (ANOVA) was used to ascertain whether the area used/occupied by the households was determined by how easy or difficult it was to obtain land in the two zones.

The qualitative data from the key informant interviews and FGDs were transcribed and then analysed using thematic analysis (Braun et al., 2019) in Atlas.ti. The thematic analysis aims to identify, analyse, and report patterns (Braun & Clarke, 2006). Thematic analysis is a hybrid of the deductive and inductive processes, which involves reading and re-reading individual scripts to identify themes, which are later analysed (Fereday & Muir-Cochrane, 2006). The emerging themes and subsequent analysis are reported as a narrative in the results.

5.3. Results

Results from the household survey and remote sensing are reported as figures or tables, while those from the key informant interviews and FGDs are reported as a narrative.

5.3.1. Land use in Mumbwa Game Management Area

On average, the conservation zone households occupied more land than those from the development zone (Table 5-3). The conservation zone households occupied more land under forest, cropland, and pasture compared to the development zone households. On the other hand, the area under wetland and fallow land occupied by households was slightly more in the development zone. A higher proportion of the conservation zone households (40.4%) compared to those from the development zone (9.3%) felt it was easy to obtain land in their respective areas (Figure 5-1) which was statistically different ($\chi^2_{4,301} = 105.377$, $p = 0.000$). Accordingly more development zone households (60.5%) felt it was difficult to obtain land compared to those living

in the conservation zone (19.9%) (Figure 5-1). The extent to which respondents regarded how easy or difficult it was to obtain land in the GMA significantly affected the actual amount of land occupied by conservation zone households ($F_{4,135} = 40.5$, $p = 0.000$). The conservation zone households who said it was very easy to obtain land occupied more land than those who said it was very difficult (Table 5-4). The households who felt it was very easy to obtain land also felt they should be allowed to settle in the conservation zone ($\chi^2_{4,136} = 11.636$, $p = 0.020$). This was not the case for the development zone, where there was no significant difference among the households in terms of land occupied and their view on how easy or difficult it is to obtain land (Table 5-4). Regardless of how easy or difficult it was to obtain land for the development zone households, the households felt they should not be allowed to settle in the conservation zone, resulting in no statistical difference ($\chi^2_{4,301} = 8.878$, $p = 0.064$).

Table 5-3 A comparison of area (ha) that the conservation and development zone households allocated to different land uses

Land use (estimated ha.)	Conservation Zone (n=119)		Development Zone (n=284)		
	Mean	SD	Mean	SD	t-values
Forest	3.22	3.37	1.14	1.33	6.90***
Residential area	0.34	0.30	0.26	0.28	2.91**
Cropland	3.32	2.13	2.13	1.43	5.87***
Pasture	3.77	3.74	2.38	2.63	3.82***
Grassland	1.19	1.95	1.36	1.89	-0.81NS
Wetland	0.14	0.46	0.49	0.71	-6.12***
Fallow	0.06	0.40	0.34	0.70	-5.27***
Total occupied land	11.66	8.63	7.99	5.09	4.61***

** P< 0.01; ***P<0.001 (two-tailed); NS = Not significant (P>0.05)
Note. n= sampled number and SD= standard deviation

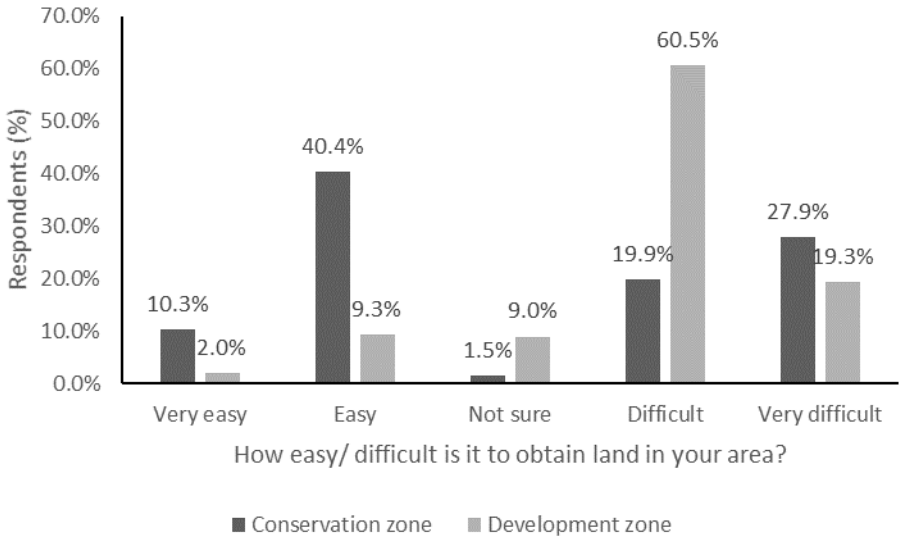

Figure 5-1 Responses to the question "How easy or difficult is it to obtain land in your area?"

Table 5-4 Average area (ha) occupied by respondents classified based on their perception of how easy or difficult it is to obtain land in their respective zones

	Conservation zone			Development zone		
Response	n	Mean	SD	n	Mean	SD
Very easy	14	20.02	6.60	6	4.11	2.36
Easy	55	17.37	7.26	28	9.01	5.62
Not sure	2	3.95	0.72	27	7.10	4.68
Difficult	27	4.01	4.01	182	8.07	5.15
Very difficult	38	5.94	4.29	58	8.10	4.93
	136	11.67	8.64	301	8.00	5.09

Note: SD= standard deviation, n is the number of respondents interviewed

According to the respondents, land used by each household was mostly allocated by the traditional village heads (headmen), with 64.7% in the conservation zone and 63.1% in the development zone. Besides, 20.6% of the conservation zone households said their friends had given them the land, while 15.3% of those living in the development zone said they had inherited their land. More (26.2%) respondents from the development zone felt their land use was restricted compared to 16.2% from the conservation zone ($\chi^2_{2,437} = 6.587$, $p = 0.037$). In terms of who limits land use, the conservation zone households regularly cited the Department of National Parks and Wildlife (DNPW), while those in the development zone cited their headmen (Figure 5-2). Although the conservation zone households felt that the Ministry of Tourism was restricting their land use, none of the development zone respondents held this view ($\chi^2_{1,100} = 15.657$, $p = 0.000$). Similarly, those from the development zone felt the Forestry Department restricted their land use, while the conservation zone households did not feel this ($\chi^2_{1,100} = 8.384$, $p = 0.004$). More neighbours and friends in the development zone restricted each other's land use relative to those in the conservation zone (Figure 5-2).

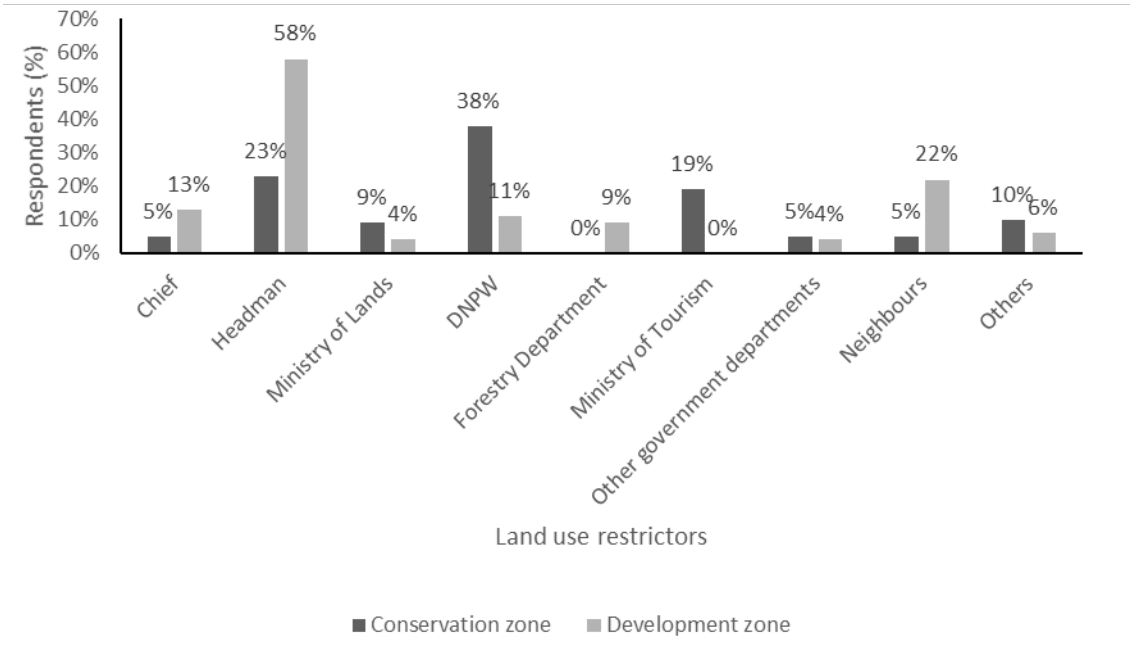

Figure 5-2 Respondents' response to the question "Who restricts land use in your area?"

The survey, key informant interviews, and FGDs all showed that households from both zones mostly used their land for growing crops at different levels, ranging from subsistence to semi-commercial. From the FGDs it emerged that households had increased their field sizes compared to ten years before the study, especially in the conservation zone. More area was being cultivated to accommodate the growing population. Reduced soil fertility also meant the households cultivated larger areas and practised shifting cultivation. The expansion of fields was facilitated by the introduction of small-scale machinery and the use of draft power. Timber logging, which is now licensed, was becoming common. Commercial charcoal production was also on the rise. Most households collected firewood from 'their forests' in their backyards, while some collected from the conservation zone. Alongside the conservation zone households that collected fuelwood from their zone, 20% of those living in the development zone also admitted to collecting fuelwood and other products from the conservation zone.

5.3.2. Land use/cover changes in the Mumbwa Game Management Area between 1990 and 2017

Overall, there was a continuous decrease in area under forest, while there was a continuous increase in other wooded areas and cropland (Figure 5-3). In 1990 forests constituted a substantial proportion of land cover at 54.0%, followed by other wooded areas (35.4%), while the cropland was at 0.5% in the conservation zone (Table 5-5). For the development zone, other wooded areas constituted a substantial portion of land cover at 68.4%, followed by forest (16.4%), while the cropland was at 3.7% (Table 5-6). A pattern is observed in which the crop fields originate from the development zone in 1990 and then spread westwards over time into the conservation zone and towards the park itself (Figure 5-3). By 2017 the conservation zone's land use/cover under forest had reduced by 40.2% (constituted 32.3% of the zone), while that under other wooded areas and cropland had increased and constituted 56.8% and 5.7% of the GMA, respectively. For the development zone, the area under forest and other wooded land reduced and constituted 10.0% and 39.7% of the GMA, respectively, while that under cropland increased by 1 116.30% (constituted 44.5% of the GMA). Compared to the other land use/cover classes, the area under

water bodies remained relatively stable from 1990 to 2017 (Table 5-5; Table 5-6). The area under bare land exhibited both increases and reductions at different points over the time of interest.

For the conservation zone, in terms of percentages, the area under cropland recorded the greatest change over the 27-year period of study (987.7% – from 10.3 to 112.4 ha), especially during the period 2000 to 2017 (Table 5-5). The cropland was mostly converted from other wooded areas and forests (Table 5-7). In terms of absolute area, forests showed the greatest reduction, mostly to other wooded areas (Table 5-7). The share of area under bare land reduced from 6.8 to 1.3%, mostly replaced with other wooded area. The area under forest has progressively reduced by 40% (Table 5-5).

For the development zone, there was a slight increase in area under forest from 1990 to 2000, which then reduced, and later increased again between 2008 and 2017 (Table 5-6). The gain in the forested land was a conversion from other wooded areas (Table 5-8). The area under cropland was mostly converted from other wooded areas. In 2000 there was a rapid increase in bare land, which was then converted to cropland by 2008.

Generally a trend is seen in which croplands are dense and originate from the development zone and then spread and become sparse towards the conservation zone over time (Figure 5-3).

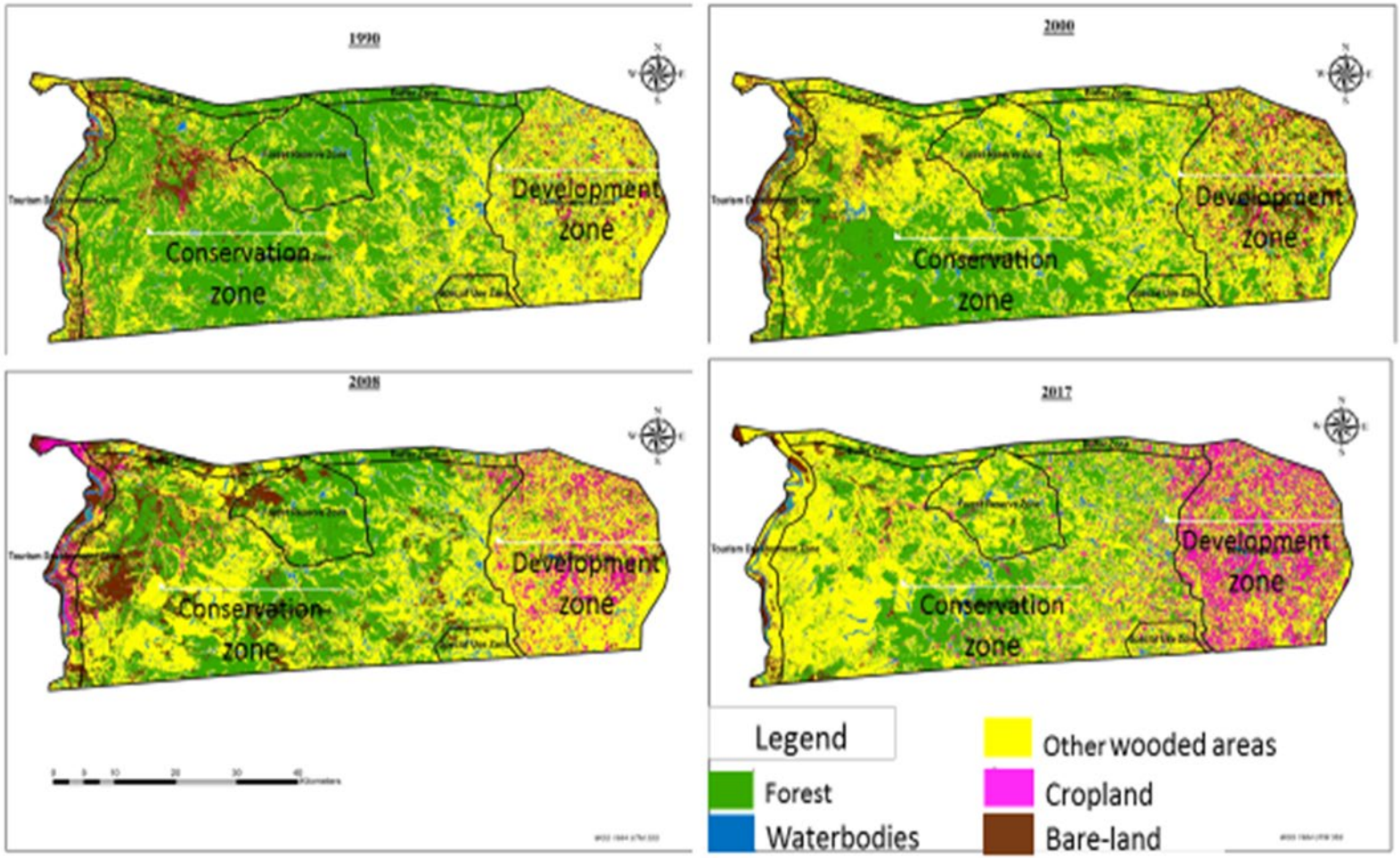

Figure 5-3 A visual representation of the land use/cover change patterns of the Mumbwa Game Management Area from 1990 to 2017 (generated with assistance from Chenje Mtonga)

Table 5-5 Land use/cover changes from 1990 to 2017 in Mumbwa Game Management Area's conservation zone

Land cover class	Absolute area cover (km^2)				Relative proportion of land cover classes (%)				Cover change between periods (%)*			
	1990	2000	2008	2017	1990	2000	2008	2017	1990-2000	2000-2008	2008-2017	1990-2017
Forest	1 069.06	940.69	720.17	639.96	54.00	47.51	36.37	32.32	-12.01	-23.44	-11.27	-40.23
Cropland	10.33	12.32	36.34	112.36	0.52	0.62	1.84	5.67	19.26	194.97	209.80	987.71
Bare land	135.08	96.29	242.96	25.43	6.82	4.86	12.27	1.28	-28.72	152.32	-89.37	-81.17
Water bodies	65.00	54.91	67.90	77.52	3.28	2.77	3.42	3.91	-15.52	23.66	14.76	19.26
Other wooded areas	700.66	875.92	912.77	1 124.90	35.38	44.24	46.10	56.82	25.01	4.21	23.23	60.54
Total	1 980.13	1 980.13	1 980.13	1 980.17								

*Cover change between periods was calculated as 100× (final year area − initial year area)/initial year area

Table 5-6 Land use/cover changes from 1990 to 2017 in Mumbwa Game Management Area's development zone

Land cover class	Absolute area cover (km^2)				Relative proportion of land cover classes (%)				Cover change between periods (%)*			
	1990	2000	2008	2017	1990	2000	2008	2017	1990-2000	2000-2008	2008-2017	1990-2017
Forest	107.16	146.62	38.02	65.37	16.38	22.42	5.81	9.99	36.82	-74.07	71.93	-39.00
Cropland	23.92	64.47	148.4	290.94	3.66	9.86	22.69	44.48	169.52	130.185	96.0	1116.30
Bare land	46.37	90.14	36.94	21.06	7.09	13.78	5.64	3.22	94.39	-59.02	-42.99	-54.58
Water bodies	29.05	17.95	17.91	16.88	4.44	2.74	2.75	2.59	-38.21	-0.22	-5.75	-41.89
Other wooded areas	447.57	334.89	412.80	259.82	68.43	51.20	63.11	39.72	-25.18	23.26	-37.06	-41.95
Total	654.07	654.07	654.07	654.07								

*Cover change between periods was calculated as 100× (final year area −initial year area)/initial year area

Table 5-7 Land use/cover transition matrix showing changes between classes for Mumbwa Game Management Area's conservation zone from 1990 to 2017

	Land cover class in 2000					
Land use/cover class in 1990	Forest	Other wooded areas	Cropland	Bare land	Water bodies	**Total 1990**
Forest	**664.23**	362.12	1.65	34.43	6.63	1 069.06
Other wooded areas	241.84	**394.83**	4.21	32.99	26.79	700.66
Cropland	1.01	5.29	**1.73**	2.91	0.11	10.33
Bare land	20.90	84.19	4.72	**22.52**	2.75	135.08
Water bodies	12.71	29.49	0.03	4.15	**18.63**	65.01
Total 2000	940.69	875.92	12.34	96.28	54.91	
	Land use/cover class in 2008					
Land use/cover class in 2000	Forest	Other wooded areas	Cropland	Bare land	Water bodies	**Total 2000**
Forest	**369.34**	430.09	7.70	112.63	20.93	940.69
Other wooded areas	306.82	**413.89**	20.90	100.17	34.14	875.92
Cropland	2.26	5.71	**1.61**	2.41	0.33	12.32
Bare land	29.07	35.82	5.53	**22.99**	2.88	96.29
Water bodies	12.69	27.26	0.58	4.7	**9.61**	54.91
Total 2008	720.18	912.77	36.32	242.97	67.89	
	Land use/cover class in 2017					
Land use/cover class in 2008	Forest	Other wooded areas	Cropland	Bare land	Water bodies	**Total 2008**
Forest	**307.04**	365.72	27.51	4.06	15.84	720.17
Other wooded areas	248.95	**551.83**	59.12	11.23	41.65	912.78
Cropland	3.67	21.22	**9.00**	2.00	0.46	36.35
Bare land	67.84	151.79	10.59	**7.18**	5.57	242.97
Water bodies	12.46	34.34	6.14	0.96	**14.00**	67.90
Total 2017	639.96	1 124.90	112.36	25.43	77.52	
	Land use/cover class in 2017					
Land use/cover class in 1990	Forest	Other wooded areas	Cropland	Bare land	Water bodies	**Total 1990**
Forest	**474.39**	534.85	43.71	6.98	9.14	1 069.07
Other wooded areas	142.76	**461.19**	49.01	8.92	38.78	700.66
Cropland	0.27	6.30	**2.84**	0.81	0.09	10.31
Bare land	15.92	97.59	10.70	**7.83**	3.03	135.07
Water bodies	6.62	24.95	6.09	0.88	**26.47**	65.01
Total 2017	639.96	1 124.88	112.35	25.42	77.51	

Note: The figures represent the area (km^2) of the vertical land-use/cover that was converted to the corresponding horizontal land use/cover class. The figures in bold represent the area under each land use/cover class that did not change (persisted) during each particular period

Table 5-8 Land use/cover transition matrix showing changes between classes for Mumbwa Game Management Area's development zone from 1990 to 2017

	Land cover class in 2000					
Land use/cover class in 1990	Forest	Other wooded areas	Cropland	Bare land	Water bodies	**Total 1990**
Forest	**36.76**	52.43	7.14	9.64	1.19	107.16
Other wooded areas	100.01	**247.26**	35.61	53.13	11.56	447.57
Cropland	0.24	4.78	**9.27**	9.54	0.07	23.90
Bare land	2.63	16.44	11.56	**15.35**	0.39	46.37
Water bodies	6.97	13.97	0.89	2.49	**4.73**	29.05
Total 2000	146.61	334.88	64.47	90.15	17.94	
	Land use/cover class in 2008					
Land use/cover class in 2000	Forest	Other wooded areas	Cropland	Bare land	Water bodies	**Total 2000**
Forest	**14.74**	101.07	17.75	8.19	4.87	146.62
Other wooded areas	20.78	**234.51**	54.67	16.71	8.22	334.89
Cropland	0.60	26.33	**33.42**	3.64	0.48	64.47
Bare land	1.43	38.26	40.57	**8.13**	1.75	90.14
Water bodies	0.45	12.62	1.99	0.29	**2.59**	17.94
Total 2008	38.0	412.79	148.4	36.96	17.91	
	Land use/cover class in 2017					
Land use/cover class in 2008	Forest	Other wooded areas	Cropland	Bare land	Water bodies	**Total 2008**
Forest	**8.81**	19.12	8.41	1.04	0.64	38.02
Other wooded areas	45.82	**192.90**	151.47	11.32	11.29	412.80
Cropland	5.44	26.09	**110.95**	4.73	1.19	148.40
Bare land	3.01	14.50	15.51	**3.64**	0.28	36.94
Water bodies	2.29	7.21	4.60	0.33	**3.48**	17.91
Total 2017	65.37	259.82	290.94	21.06	16.88	
	Land use/cover class in 2017					
Land use/cover class in 1990	Forest	Other wooded areas	Cropland	Bare land	Water bodies	**Total 1990**
Forest	**13.43**	37.06	21.84	3.52	1.32	107.17
Other wooded areas	45.25	**194.23**	185.38	13.26	9.44	447.56
Cropland	0.34	3.50	**18.76**	1.16	0.14	23.9
Bare land	1.86	12.88	28.43	**2.72**	0.47	46.36
Water bodies	4.48	12.14	6.53	0.40	**5.50**	29.05
Total 2017	65.36	259.81	290.94	21.06	16.87	

Note: The figures represent the area (km^2) of the vertical land-use/cover that was converted to the corresponding horizontal land use/ cover class. The figures in bold represent the area under each land use/cover class that did not change (persisted) during each particular period

5.3.3. Drivers of land use/cover changes in Mumbwa Game Management Area

Respondents were asked the reason for cutting trees the last time that they did so. The conservation zone households cut trees to set up permanent cropping fields (82.1%), for firewood collection (77.6%) and for home poles (60.4%, Table 5-9). Figure 5-4 shows a storage structure made from poles. The development zone households cut trees for firewood (84.3%), home poles (47.6%) and permanent cultivation (28.2%, Table 5-9). On average, households from both zones reported that they cleared a portion of their forest about once a year, giving no statistical difference between the zones. Although the frequency of clearing forests for various reasons (Table 5-9) was similar between the zones, there was a significant difference in the hectares of land last cleared for the conservation zone households (M = 1.7, SD = 1.9) and the development zone households (M = 0.6, SD = 0.8); $t_{156} = 6.275$, $p = 0.000$.

Table 5-9 Respondents' reasons for felling trees the last time that they did so

Reason for cutting trees	Zone		Statistics
	Conservation	Development	χ^2
Permanent cultivation	82.1	28.2	101.295***
Shifting cultivation	3.0	4.8	0.745 NS
Charcoal production	2.2	12.1	10.712**
Commercial poles	1.5	2.4	0.364 NS
Home poles	60.4	47.6	5.771*
Firewood	77.6	84.3	2.609NS
Building houses	55.2	17.7	57.250***
Others	0.7	0.0	1.856NS

* P< 0.05; ** P< 0.01; ***P<0.001 (two-tailed); NS = Not significant (P>0.05)

Note: n represents the number of respondents in each zone, while figures under the respondent's zone indicate % of respondents who said yes to the corresponding reason for cutting trees

Figure 5-4 A storage structure in the Tepula area made from poles. Source: Fieldwork, 2017; photograph taken by Justin Muyoma (data-collection assistant)

A higher proportion (78.7%) of the conservation zone households relative to those in the development zone (51.2%) said the forested area in their zone had reduced, giving a statistically significant result ($\chi^2_{2,402} = 35.733$, $p = 0.000$). This observation corresponds to the recorded absolute values of forest area lost under the remote sensing images (Table 5-5). Among the proximate drivers, agricultural expansion and wood extraction were recorded most frequently across the zones (Table 5-10). Respondents from both zones cited permanent cultivation as the primary driver of LU/CC, although more respondents from the conservation zone reported it (Table 5-10). From the key informant interviews, the policymakers also thought the forest was being lost to agriculture, alongside settlements. The policymakers, however, did not distinguish

the types of agriculture responsible for the loss of forests. Though mentioned at low percentages, demographic and economic drivers stood out among the underlying drivers of land cover change for both zones in the survey (Table 5-10). None of the respondents felt that public beliefs on the use of forests or government policy were contributing to forest loss.

When respondents were asked if they had observed any changes in the abundance of specific tree species over time, 48.5% of the conservation zone households said that they had noted changes, compared to 41.5% of those from the development zone ($\chi^2_{2,405} = 19.384$, $p = 0.000$). In the conservation zone, 38.8% of the respondents said *Brachystegia* spp. were reducing in numbers, alongside 19.4% for *Julbernardia paniculata*, and 14.4% for *Pericorpsis angolensis*. A similar trend was observed for the development zone, with 31.3% of the respondents citing *Brachystegia* spp., 17.4% citing *Julbernardia paniculata*, and 13.0% citing *Pericorpsis angolensis* as declining in abundance. Respondents mentioned *Julbernardia* spp. (42.9% and 21.7% of the respondents from the conservation and development zones, respectively) as the tree species that had increased in number. When probed about how the numbers of the same tree species were reducing and increasing at the same time, the respondents said the increase was in the form of regrowth from felled trees.

The FGD participants agreed that more trees were being cut now compared to the past. According to the participants, felling of trees in the past was done for purposes of clearing of land for cultivation. Currently, the land is also being cleared for charcoal production, which eases their increasing financial responsibilities. Charcoal production was more prevalent among the development zone households compared to those from the conservation zone.

Table 5-10 Respondents' perceived drivers of land cover change in Mumbwa Game Management Area

		Respondents' zone		Statistics
		Conservation zone n=136	Development zone n=301	χ^2
Proximate causes				
Infrastructure extension	Roads	1.9	0.0	2.882NS
	Near markets	0.9	0.0	1.435 NS
	Settlements	20.6	26.1	1.081 NS
Agricultural expansion	Permanent cultivation	78.5	46.4	26.984***
	Shifting cultivation	4.7	11.1	3.37 NS
Wood extraction	Charcoal	24.3	35.3	3.573*
	Commercial poles	2.8	9.8	4.788*
	Home poles	69.2	41.2	19.778***
	Firewood	70.1	29.9	0.641 NS
	Forest fires	18.7	7.2	7.932**
Underlying Causes				
Demographic	Population increment	13.1	13.7	0.022 NS
	Migration	10.3	5.2	2.372 NS
Economic	Urbanization	12.1	9.2	0.609 NS
	Projects	0.9	0.7	0.065 NS
	Market growth	9.3	9.8	0.015 NS
Technological	Agro machinery	0.9	1.3	0.077 NS
	Agricultural inputs	0	1.3	
Policy and institutions	Government policy (property rights)	0	0	-
Cultural	Public attitudes, beliefs, values	0	0	-
Others	Climate change	8.4	5.9	0.625 NS
	In search of water	0.0	0.7	0.072 NS
	Lack of knowledge	0.0	0.0	-

Note: n represents the number of respondents in each zone while figures under respondent's zone indicate % of respondents who said yes to the corresponding benefits. * P< 0.05; ** P< 0.01; ***P<0.001 (two-tailed); NS = Not significant (P>0.05)

5.4. Discussion

This study aimed to quantify the long-term spatial land cover changes and account for their drivers in Mumbwa GMA's conservation and development zones. Overall, the two zones underwent a series of land use/cover changes (LU/CCs) between 1990 and 2017, with both zones experiencing loss of forests. The conservation zone, which is bigger in size compared to the development zone, lost a bigger area under forest compared to the development zone. Moreover, the conservation zone's wooded area increased, while it decreased in the development zone. The observed increase in other wooded areas in the conservation zone supports the view of McNicol et al. (2018) that sparsely wooded areas dominated by a grass understory are replacing Southern African forests. Similarly, the conversion of forests to cropland in both zones confirms Zambia's Integrated Land Use Assessment (ILUA) report that agriculture drives most of Zambia's forest loss (ILUA- Phase II, 2016).

5.4.1 The extent and nature of land cover change in Mumbwa Game Management Area's conservation and development zones during the period from 1990 to 2017

In 1990, 18 years after the GMA was established, the GMA exhibited the ideal land-use plan; people lived and cultivated their crops in the development zone, while the conservation zone had an extensive forest. By 2000, traces of forest loss were evident in the conservation zone. Since few households occupied the conservation zone by then (see Table 3-2, Chapter 3), the development zone households may have caused the observed forest loss. The increased cropland in the conservation zone by 2008 coincides with the arrival of 100 migrant households to the conservation zone following a succession dispute in Mulendema chiefdom (ZAWA, 2013). The increased population called for clearing of new lands, which eventually put pressure on the conservation zone, as explained by the Malthusian theory (Meyer & Turner, 1992).

The households converted forests to other wooded areas and then cropland. The observed changes alongside the households' reasons for clearing forests suggest a forest degradation-deforestation trajectory in which households first convert forests to other wooded areas and then to cropland. Other studies show similar results in which forests are not directly converted to croplands, but first

degrade as people collect fuelwood (Broadbent et al., 2012; Cortina-Villar et al., 2012; Dimobe et al., 2017; Guida-Johnson & Zuleta, 2013; Hosonuma et al., 2012). This way, households meet their immediate basic needs (Dimobe et al., 2017), in this case for fuelwood and then food.

Since households do not directly convert forests to croplands, cut trees can regenerate as time passes, thereby recovering the forests. Slowing down the opening of new croplands could encourage trees to regenerate. Although this study did not look at forest regeneration, the FGDs and the survey indicate areas with tree regrowth, signifying forest regeneration. The high conversion of bare land to other wooded areas in the conservation zone also signifies forest regeneration. Experiments have shown that clear cut miombo (*Julbernardia paniculata* and *Brachystegia spp*) regenerate, although at a slow rate, especially for older trees (Chidumayo, 2019a) and dry miombos (Chidumayo, 2019b) like those in Mumbwa GMA. Charcoal producers, on the other hand, usually fell trees at knee-high level, which can enable trees to regenerate. Because of this, Chidumayo and Gumbo (2013) suggest that on a broader landscape scale, charcoal burning causes forest degradation rather than deforestation. Msuya et al. (2011) suggest that charcoal production is a threat to forest loss in Tanzania. People in Mumbwa GMA mostly cut miombos, which offer a good source of charcoal (Chemonics International, 2011). Lambin et al. (2003) claim that the dry tropical miombos of southern Africa have undergone land cover changes. According to the Integrated Land Use Assessment (ILUA) report for Zambia, however, semi-evergreen vegetation, where miombo belong, are the least threatened woodlands in Zambia (Zambia, 2008).

The similarity in forest loss and household land use regardless of zone suggests that having different levels of land-use restrictions in the two zones does not deter the households from practising similar land uses. Andrade and Rhodes (2012) and Tumusiime et al. (2011) agree that the level of resource use does not always reflect how restrictive the use of resources is. Andrade and Rhodes (2012) based their opinion on a study of 55 protected areas (PAs) from developing countries under different IUCN categories. In South Asia, PA habitats are converted at rates comparable to areas not protected (Clark et al., 2013). China's Wolong Nature Reserve demonstrated that the reserve was losing its habitat faster than before the reserve was created (Liu

et al., 2001). Failure to conserve in such cases is attributed to policies that focus only on conservation and do not factor in the local people's socio-economic needs (Kalinda et al., 2008; Pressey et al., 2015; Simasiku et al., 2008; Usman & Adefalu, 2010; Watson et al., 2014). In Western Ethiopia, the problem is not a lack of appropriate policies, but their ineffective implementation (Betru et al., 2019). In the case of Mumbwa GMA, having several state departments with divergent interests/policies operating from the GMA has not helped control land use. Most of these agencies are focused on conservation and not on the people's livelihoods.

5.4.2 The perceived drivers of land cover changes in the conservation and development zone

Based on the results from the structured questionnaire and focus group discussion, the households from both zones perceived agricultural expansion and wood extraction as the proximate drivers of LU/CC. The households considered population and urbanization as the underlying drivers of the change. These views correspond with what was observed from the remote sensing images. The images show expanding croplands as more of a driver in the development zone, while the drivers in the conservation zone were extraction, followed by croplands. Other African countries also list agricultural expansion and wood extraction alongside growing human populations as drivers of land cover change (Betru et al., 2019; Hosonuma et al., 2012; Kamwi et al., 2015).

The high use of fuel wood among households contributes to clearing of forests. This is expected, considering most rural households in Sub-Saharan Africa depend on firewood for energy (Mohammed et al., 2015; Sola et al., 2016), with about 84% of Zambian households relying on fuelwood for energy (ILUA – Phase II, 2016). The high demand of fuelwood in form of charcoal amidst increased electricity load shedding among households in Zambia's urban areas further puts pressure on the local forests. This is in spite of the National Energy policy which seeks to promote appropriate alternatives to fuelwood and reduce its consumption. From the focus group discussion, commercial charcoal production was on the rise among development zone households. Charcoal production using *Julbernardia paniculata* and *Brachystegia* tree species is an important livelihood activity for both men and women in the GMA (Chemonics International, 2011), probably because of the good quality of charcoal produced from these species (Vinya et al., 2011). It should be noted,

though, that the respondents reported that they only cut down trees for firewood if there was no dead wood available, as corroborated by Chemonics International (2011) and Kalinda et al. (2008). This again supports the view that there is forest degradation occurring in the GMA. In addition to the day-to-day use of fuelwood, many households, especially those from the conservation zone, practise permanent cultivation and so their fields tend to be larger than those for shifting cultivation. Because of this, there is a higher chance of forest loss at any one forest clearing, as seen from the size of the fields owned by the conservation zone households, than in the development zone.

Although the households indicated that they are not involved in commercial logging of timber, logs awaiting transportation were seen in some parts of the forests. To avoid illegal harvesting of timber, community forests can be set up. Success stories of community forests set up and maintained by the community are reported in Mexico (Köhlin & Amacher, 2005) and Cameroun (De Blas et al., 2009).

5.4.3 The households' contribution towards the land cover change in the game management area

Apart from having similar usage of firewood, the conservation zone households occupy and clear more land than their counterparts in the development zone, suggesting that the conservation zone households contribute more towards the observed forest loss in their zone. This assumption may not always hold, because although the two zones remain separated by geography, the use of resources in the conservation zone is not exclusive to its inhabitants. For example, regardless of the zone, many households collect firewood from the conservation zone. Also, the observed pattern in which croplands are dense in the development zone and then spread with time towards the west into the conservation zone indicates that the croplands in the conservation zone are spatially connected to the development zone and its associated population density. This may mean external migrants settle closer to the development zone or that those in the development zone are extending their fields or yet still that people simply have easier access close to the development zone (see Figure 5-3). Such findings support ZAWA's report that settlements are extending from east to west, and this extension can be attributed to external migrants (ZAWA, 2014). In their case study

of households in eastern Madagascar, Jones et al. (2018) observed that migrants and local people cleared the land at a similar rate, dispelling the view that external migrants alone contribute more towards forest loss. In Indonesia the external migrants clear forested areas as they settle, because they are not easily integrated into already established agricultural areas (Darmawan et al., 2016).

5.5. Conclusion and recommendations

This chapter demonstrates that Mumbwa Game Management Area (GMA) has undergone major land use/cover changes (LU/CCs), with high forest loss experienced in the conservation zone. The results show a trajectory in which forests are converted to other wooded areas before being converted to cropland. This suggests that households clear land to extract wood, then later grow crops on it. Thus, if the loss of forest in the conservation zone is not controlled, the zone will eventually turn into what the development zone is today. This should not be the case, considering that the two zones have distinct land uses and levels of restrictions on resource use and extraction. Households attributed the observed changes to clearing land for agriculture and fuelwood, and as an underlying driver, increased human population. The development zone in particular is under pressure from increased human populations, while the new settlers in the conservation zone are opening and setting up permanent cultivation fields.

Although the role of households as agents of LU/CC cannot be overemphasised, poor law enforcement and policies that do not take into account the livelihoods of the local people make it easy for the households to effect the observed changes. The current conservation policies focus on wildlife, and merely regards the forests as a habitat for the wildlife. Policy should encourage the concept of multifunctional landscapes on which GMAs are developed. Other aspects of the GMA, for example, intensifying agricultural production within designated places to deter households from expanding their fields sould be promoted. Moreover, considering that households depend on fuelwood for energy, offering alternative sources through establishing plantations could also reduce pressure on forests.

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Chapter 6 Synthesis and Conclusions

6.1. Introduction

This chapter presents the key findings and conclusions of the study. It highlights the contribution to the researcher's understanding of land use in the Mumbwa Game Management Area (GMA) through a synthesis of the results from the three data chapters (Chapters 3, 4 and 5). Although the study was specific to Mumbwa GMA, problems around land use in protected areas (PAs) are global, with several developing countries facing a crisis of high in-migration (Wittemyer et al., 2008) and natural resource extraction in their PAs (Bailey et al., 2016; Johnson, 2019; Rija et al., 2019). Although it is known that land use in Mumbwa GMA is under threat, there is still much uncertainty around the extent of the threat, especially on the actual land use/cover changes (LU/CCs) that have occurred and what has driven the change. This means policymakers may formulate policy based on unsubstantiated information.

As people settle in critical wildlife conservation areas such as Mumbwa GMA, a number of questions about livelihoods and ecological issues arise: 1) How extensive is the problem of human migration in Mumbwa GMA? 2) To what extent do the households rely on the GMA for their livelihoods and wellbeing? 3) What are the long-term spatial patterns that have occurred in the Mumbwa GMA because of human-induced disturbances? 4) How do national conservation policies influence human migrations, livelihoods, and land cover changes in Mumbwa GMA? This study aimed to provide evidence and make recommendations based on the results obtained and the insights gained during the study.

A mixed-method approach was employed, providing a holistic view of the problem of land use in the GMA (Creswell & Creswell, 2017; Sattar et al., 2017). The mixed-methods approach is in line with the pragmatic philosophical worldview, which embodies both inductive and deductive approaches as a way of addressing real-life problems. Utilising that approach, the study analyses

the views of the households and other stakeholders such as the policymakers, alongside quantified LU/CCs.

6.2. Objectives, research questions, and key findings of the study

The overall objective of the study was to understand land use in Mumbwa GMA in the context of human migrations and livelihoods, which in turn change the nature of the land cover in Mumbwa GMA. The study adopted and modified the sustainable livelihoods framework to compare the conservation and development zones (see Conceptual Framework; Figure 2-4). The first part of the study (Chapter 3) investigated the problem of human migration in the two zones. Next (Chapter 4) the research assessed the level of the households' reliance on the GMA for their livelihoods and wellbeing. The final data chapter (5) looked at one of the outcomes of the livelihood activities by quantifying and accounting for LU/CCs across the two zones from 1990 to 2017. All the data chapters ascertained the role of National policies formulated to govern conservation and land use in the GMA. Based on the three objectives set out below, the study attempted to answer nine specific research questions. Each research question is followed by a brief account of the findings of the study.

6.2.1. Objective 1 (Chapter 3)

To investigate the magnitude and patterns of human migration in the conservation and development zones.

Research Question 1: *What are the migration and settlement patterns of the households in the conservation and development zones?*

Findings: This study identified three classes of migrants, i.e., non-migrants, local migrants, and external migrants (see detailed descriptions in Chapter 3). The conservation zone recorded a higher proportion of external migrants compared to the development zone, and these were mostly Tonga by tribe, from the province south-east of the Kafue National Park. The nearest Southern province

town (Itezi tezi) to the GMA is approximately 150 km. The development zone households settled in the GMA before those in the conservation zone. Although the development zone also recorded many external migrants, many of the households were also involved in local migration, while those in the conservation zone were external migrants. Most external migrants found other households already settled when they first moved to the GMA and had relatives within their villages. In an ideal situation, households require permission from the chief to settle in the GMA. However, few people were invited, nor did they invite others to settle in the GMA.

Research Question 2: *Why do migrants prefer the conservation to the development zone?*

Findings: The observed higher numbers of external migrants to the conservation zone relative to the development could be explained with reference to several factors, including the availability of farming land, unclear and fluid zone boundaries and weak rights for local people, which incapacitate them from excluding outsiders from the conservation zone (Child & Wojcik, 2014). These factors are aggravated by the inability of law enforcement officers to keep external migrants away from the conservation zone, reflecting its remoteness and the officers' lack of resources. Giving more exclusion rights to local people can empower local communities to keep external migrants away; at the same time, tightening law enforcement could deter would-be external migrants.

Research Question 3: *Are there differences between the way that respondents in the two zones view and justify the illegal settlements in the conservation zone?*

Findings: The households from both zones acknowledged the significance of the conservation zone as a way of conserving wildlife. The development zone households, being predominantly native inhabitants or having lived longer in the GMA, expressed more interest in preserving the conservation zone compared to the external migrants who were living in the conservation zone. However, natural population growth among the development zone households was reducing the land available for growing crops, which made the households view the conservation zone as a settlement option. The general feeling among the respondents was that policymakers and law enforcers, and the DNPW in particular, valued wildlife over human wellbeing. Households echoed

views such as "*the animals have been given the park and most of the GMA*," especially among those living in the conservation zone. The development zone occupies 16%, while the conservation zone along with other restricted zones occupies 84% of the GMA, suggesting that conservation comes first in terms of land allocation.

Research Question 4: *What individual or household characteristics might predispose the respondents to migrate?*

Findings: Respondents from most non-native ethnic groups, especially those living in the development zone, were more likely to migrate than those from the native Ila group. Most non-native tribes live in the conservation zone. Respondents with a history of migrating within the GMA (local migrants) were also more likely to migrate in the future, especially among the development zone households. However, the households that had plans to migrate intended to move to other areas within the GMA. Furthermore, the more land that respondents from both zones had access to, the less likely they were to migrate.

6.2.2. Objective 2 (Chapter 4)

To assess the extent to which households from the conservation and development zones rely on the GMA for their livelihoods and wellbeing.

Research Question 1: *Is there a difference in livelihood activities between the households living in the conservation and development zones?*

Findings: Households from both zones practise similar livelihood activities, with the growing of crops being the main livelihood activity during the past ten years. Households in the conservation zone opt to extend their fields as a livelihood strategy alongside crop and livestock diversification, while those living in the development zone diversify their activities by engaging in wage employment, businesses, and producing charcoal. Those living in the conservation zone can easily

extend their fields for two reasons; firstly, the size of the conservation zone is larger than the development zone, and secondly, the human population in the conservation zone is still small. The illegal status of those living in the conservation zone may, however, limit the diversity of livelihood activities that they can engage in, for example, salaried employment in the tourism sector.

Research Question 2: *How reliant on the GMA are the households for their livelihoods and wellbeing?*

Findings: This study shows that GMA households, regardless of zone, rely more on farming than conservation-related sources of livelihood. These findings reject the hypothesis that the development zone inhabitants rely and benefit more from the GMA-related livelihood activities/benefits because of their legal status compared to the conservation zone households, whose status is illegal. Although the development zone households should enjoy conservation benefits such as proceeds from hunting and concession fees to supplement their livelihoods, this was not the case. Though illegally settled in the GMA, conservation zone households have greater access to fertile land compared to their development zone counterparts. Since most GMA households rely on farming, having access to farmland ultimately improves the wellbeing of those living in the conservation zone. Conversely, restricted access of development zone households to more fertile land in the conservation zone without alternative livelihoods worsens their welfare.

6.2.3. Objective 3 (Chapter 5)

To quantify the long-term spatial land cover changes and account for their drivers in Mumbwa Game Management Area for the period 1990 to 2017.

Research Question 1: *What was the extent and nature of land cover change in Mumbwa GMA's conservation and development zones during the period 1990 to 2017?*

Findings: From the LU/CC maps, both zones lost similar proportions (about 40%) of forest relative to other classes in their respective zones. It should be noted that the conservation zone is larger than the development zone in terms of area, meaning the conservation zone lost more forested area overall. In terms of relative share to the other classes in their respective zone, the area under forest in the conservation zone reduced from 54 to 32.3%, while it reduced from 16.4 to 10% in the development zone. There was a transition of land cover from forest to other wooded areas and eventually cropland. From 1990 to 2017 the conservation zone continued to lose its forest to other wooded areas, which were in turn replaced by cropland. For the development zone, the cultivated area increased, almost replacing other land-use/cover classes. These results reject the hypothesis that there is more land cover change in the development than conservation zone because of the different levels of land use restriction in the two zones.

Research Question 2: *What are the households' perceived drivers of land cover change in the conservation and development zones?*

Findings: Overall, the respondents attributed the observed land cover changes to the proximate rather than the underlying drivers of land cover change; this is not surprising since these changes are more observable by the respondents. Respondents listed agricultural expansion and wood extraction as the main proximate drivers, while population increase, migration, and urbanisation (of Mumbwa town) were cited at lower proportions as underlying drivers. The clearing of forests for permanent cultivation was significantly higher for the conservation zone households relative to those from the development zone.

Research Question 3: *How have the households from the two zones contributed towards the land cover change in the GMA?*

Findings: Households, through agricultural expansion, and to some extent wood extraction, have contributed towards the observed land cover change. The external migrants to the conservation zone continue to open up new fields and cut down trees to set up their homes – hence, the higher

recorded reduction in the forest compared to the development zone. The loss of forest in the conservation zone, however, cannot be blamed entirely on those living in the conservation zone, as those who live in the development zone also have access to the same forests, from which they potentially extract wood. Twenty percent (20%) of those living in the development zone reported collecting fuelwood and other non-timber forest products from the conservation zone.

6.3. Synthesis of findings and insights of the study

The observed high number of external migrants in the conservation zone, insufficient benefits to local people in the development zone, and rapid LU/CC in the two zones are linked (see Conceptual Framework, Figure 2-4) and suggest uncontrolled land use in Mumbwa GMA. The current livelihoods of the households in both the conservation and development zones are unsustainable, as the resource base is being degraded continuously. These results are not unique to Mumbwa GMA, with problems of human migrations (Jones et al., 2018), insufficient benefits to local communities (Davis, 2011), and LU/CC (DeFries et al., 2010) experienced in PAs across the globe. On paper, the Zambian government has created zones to control land use in Mumbwa GMA, with specific conservation policies (Zambia. The Department of National Parks and Wildlife. 2015; ZAWA, 2014). This study shows that in practice there is an overlap in land use between the conservation and development zones. Over time, many external migrants have moved to the conservation zone and have been practising land uses that undermine conservation efforts. This has resulted in forest loss and increased cropped area.

The results of this study suggest that external migrants can easily settle in the GMA because of inadequate law enforcement (caused by understaffed and underfunded DNPW). Furthermore, the local people do not have any power to exclude others from the GMA because of weak land ownership rights (Child & Wojcik, 2014) with the motive behind conservation programmes not clear to them. In most cases, as in other PAs, local people feel policymakers incorporate them in conservation programmes to gain their support and dissuade them from illegal resource use only, not because they care about their wellbeing (MacKenzie, 2018; Martino, 2001; Thondhlana & Cundill, 2017).

It is known that the external migrants to the conservation zone clear land as they settle, and their contribution to land cover change is therefore obvious. However, those living in the development zone can also contribute to the observed changes. This is because the concept of sustainable use of resources in the conservation zone by local people permits them some restricted access to the conservation zone (ZAWA, 2014), which they may over-exploit. The problem with the concept of 'sustainable use' in Mumbwa GMA is that there are no protocols designed on how the people should extract natural resources. For example, one of the core objectives under the National Forestry Policy is to promote sustainable harvesting of wood and production of Charcoal to reduce deforestation (Zambia. Ministry of Lands, Natural Resources, and Environmental Protection, 2014), which is yet to be achieved in the GMA.

Although individual households occupy the land and therefore cause the observed land cover change, the role of National policies that influence conservation and land-use in the GMA cannot be downplayed (see Table 2-1). The policies determine households' access to and incentives to use resources (Mogende & Kolawole, 2016) and therefore determine the level to which people extract resources and use land. Policies should ensure that the local people (development zone households) benefit from living in the GMA. In Costa Rica, the state wins the good will of the local communities who they offer conservation benefits (Andam et al., 2010). Since most households rely on farming, which is most often in conflict with conservation efforts, there is a need to offer alternative livelihood sources, rather than give the households more access to the resources. Offering alternative livelihood strategies is a matter of urgency, since this study shows declining conservation benefits, probably from over-dependence on trophy hunting, an imbalanced benefit-sharing scheme, and lack of engagement from the relevant authorities. The current conservation benefits are shared at the communal level, which does not inspire individual interest to conserve (Tumusime & Vedeld, 2012). The argument here is not to say that the GMA should focus on personal benefits, but to advocate for the benefits to spill over to the individual households, which is not happening in the current conservation programmes. For example, in Kenya's Samburu region, a national reserve, part of the proceeds from park entry fees sponsor student bursaries (Bruyere et al., 2009).

Inconsistent policies on how to manage natural resources, characterized by various institutions having specific mandates, are also contributing to land-use problems in Mumbwa GMA (Kalinda et al., 2008; Zambia, 2014). The high loss of forests and increased cropped land raises questions about the effectiveness of policies governing conservation and land use, especially on forests. From the results, the problem of land use lies not only in policy formulation but in weak implementation as well. There is a gap between those who formulate the policy, those who implement it, and the households it is intended to benefit (see Chapter 4 (4.4.2) and Chapter 5 (5.4.1)).

Protected area buffers, such as Zambian GMAs, are designed as low-impact areas that should buffer people's direct impacts on parks, but they are especially vulnerable because they permit wildlife and people to interact (Cortina-Villar et al., 2012). Having multiple land uses within the same GMA requires different levels of land use restrictions making it more difficult to control land use (Nelson et al., 2011). Since the GMA households depend on natural resources, especially land for their farming and fuelwood to meet their energy needs, policymakers cannot eliminate people's interactions with PAs. What policymakers can do is create an atmosphere where this interaction does not only benefit conservationists but local people as well, which may call for tradeoffs (Ferraro & Hanauer, 2011). Andam et al. (2010) report that PAs have in fact reduced poverty in Costa Rica and Thailand, making human wellbeing compatible with conservation. Andam et al. (2010) suggest that these effects may be because of successful eco-tourism and heavy investment in the two countries' PA systems, among other reasons. Zambian GMAs continue to struggle with funding for management operations.

Overall, the local people of Mumbwa GMA receive little or no conservation-related benefits, which can make them lose interest in conservation. On the other hand, external migrants settle in the conservation zone, which gives them more access to natural resources than indigenous households have. The households from both zones end up prioritising their interests, with little concern about the consequences. These observations present a classic case of 'the tragedy of the commons', where common property management fails because individuals want to derive benefits

but not bear the costs, thereby degrading the resource (Hardin, 1968). This presents a dilemma where conservation and people's livelihoods conflict, and both lose.

6.4. Challenges and limitations to this study

Like any other study, this one also faced challenges and limitations.

Firstly, the pragmatic approach employed in this study adopted several perspectives to understand the phenomenon, which may give a broader realistic view that is appropriate for the particular context. Although this approach may prove useful in problem-solving, it provides a 'bird's-eye view', which may miss specific details. Although this may be limiting, no problem is so unique that its solutions cannot provide some insights that can be used elsewhere.

Secondly, migrations to PAs result in increased human population pressure. Collecting population data for the GMA, though desirable, proved challenging. As suggested by Hartter et al. (2015), migration and population studies in Africa are challenging because data are scarce, and people move back and forth between changing administrative boundaries. Just as an example, the Mumbwa district council estimated the population to be 24 628 in 2005. In 2010 the national census estimated the population of the GMA at 20 737 (ZAWA, 2014), while ZAWA estimated it at 33 500 in the same year. The researcher could only speculate that the figures from the council and the national census did not include those living in the conservation zone. For this reason, this study did not look at changes in human population size resulting from migrations.

Thirdly, the study would have been enriched with data on the livelihoods of households before the GMA was established. However, since most of the respondents were young or not born yet, this could not be done. Instead, the study investigated the ten years preceding the time of the study, considering how difficult it is to recall details over a period longer than that. Furthermore, measuring the effect of PAs on peoples' livelihoods, although it may be inferred, proves difficult (Naughton-Treves et al., 2005). Determining a realistic alternate scenario of GMA households

before the GMA was established may reveal some different circumstances which would have an effect on the livelihoods (Andam et al., 2010).

Fourthly, although the conservation and development zones' LU/CCs are bound by geography, the use of resources in these zones, as alluded to earlier, is not exclusive to their occupants. In general, one can assume that the households in each zone cause the LU/CCs in their zones. However, since the development zone households can 'sustainably' use resources in the conservation zone, eliminating the effects in the conservation zone caused by those from the development zone becomes challenging. The GMA accommodates seasonal charcoal burners, which may profoundly impact forest loss.

6.5. Recommendations

Based on this study's findings, insights from literature, and the researcher's interactions with the stakeholders in Mumbwa GMA, the following recommendations are offered. These recommendations are made considering that PAs the world over are established in different contexts, making it impractical to have a 'one-size-fits-all' strategy to achieve all PAs' objectives (DeFries et al., 2010; Tacconi et al., 2019). The researcher borrows what has worked elsewhere and contextualizes it to fit Mumbwa GMA, considering the GMA's design and other cultural and socioeconomic factors.

Addressing the issue of land use, the phenomenon of external migrants in particular requires that policymakers and law enforcers collaborate with other stakeholders. This starts with acknowledging that the issue of external migrants is not just a problem for the DNPW, but the GMA as a whole. Unlike what is happening in the GMA, the various GMA stakeholders should collaborate at many levels. Since the state underfunds the main law enforcers of land use in the GMA (i.e. the DNPW), pooling of resources with the other state departments operating from the GMA, for example, the Forestry and Agriculture departments, can make enforcing the law easier and more effective. As it is, each department narrows its authority in specific areas, which may

also conflict. For example, the department of Agriculture distributes fertilisers and seeds to households in the GMA, and in some instances people from the conservation zone are also beneficiaries to these inputs. This in some way, encourages the conservation zone farmers to cultivate crops in their zone, which does not fit in with the DNPW's policy of no 'farming in the conservation zone'. As a follow-up, having an all-inclusive conservation policy that encompasses all aspects of natural resources in PAs could reduce duplicating work and conflict among policies. In Bahia, a PA in Brazil, non-governmental agencies that advocate for conservation alongside state agencies pool resources to manage the PA (De Oliveira, 2002). Another way is to decentralize and devolve decision-making and law enforcement to local government structures (Lima & Ranieri, 2018), unlike the current state, where the DNPW has no place within the local government structures. Protected areas in Mesoamerican countries have done this by including local planning committees to decentralize decision-making (Wallace, 2005). Local people should be empowered within the legal framework to enforce the law (Tallis et al., 2008). Law enforcement is currently happening in Mumbwa GMA through village scouts. However, inadequate funding remains a challenge.

Concerning benefits and livelihoods, rather than depending on benefits from hunting revenue, the GMA should also generate income from non-consumptive tourism, for example, photographic tourism as envisaged in the Mumbwa GMA management plan (ZAWA, 2014). Furthermore, although revenue sharing occurs at the communal level, the benefits must be tangible at the household level. For example, the community can offer scholarships to deserving members to further their studies. Since agriculture remains the main source of livelihood, the benefits should extend towards mechanizing farming, which will have two effects: less pressure on using the other natural resources (forests) and a reduced need to expand farming land.

The observed high extraction of fuelwood in the conservation zone has the potential, if uncontrolled, to reduce forest cover in the GMA. With about 84% of Zambian households relying on fuelwood for energy (ILUA – Phase II, 2016), it would be unrealistic to stop people from cutting trees without offering an alternative. Instead, communities can be assigned forests to harvest their fuelwood and produce charcoal. This calls for the communities to manage and restore the forests

as they harvest. This has worked in Mexico where the government offers minimal support to the communities who manage forests and own logging businesses (Köhlin & Amacher, 2005) and in Cameroun were communities can operate on their own or engage external industrial operators (De Blas et al., 2009). In Nepal, communities have formed forest user groups that manage and raise income from buffer zones to national parks (Bhushal, 2012).

Since not all stakeholders (including households) understand the concept or rationale behind having multiple land uses within the GMA, policymakers should raise awareness among stakeholders. Raising awareness on the sustainable use of natural resources among stakeholders is a common objective among policies operating in the GMA. Also, the concept of sustainable use of resources is too vague (DeFries et al., 2010). According to the Mumbwa game management plan, people may use resources in the conservation zone sustainably. The idea of 'sustainable use' is vague and a source of misunderstanding among local people. The whole notion of 'sustainable use' should be clearly explained, giving indications of how much can be harvested based on the current state of the natural resource base. This calls for developing natural resource extraction protocols. This is what is done for wildlife where only a specific number of animals can be hunted based on the overall population (ZAWA, 2014).

6.6. Future direction

Although this study has addressed the research questions, like most other studies, it has revealed other interesting gaps which can be looked into to add value to land use in GMAs, and PAs in general. Below are some of the areas other researchers could build on.

1. Migration and population studies often go together. Since the population data in the GMA are somewhat unreliable until 2010, it would be interesting to use 2010 data as a baseline and use data for the next census in 2020 to build on the baseline. Conducting a longitudinal study would enable researchers to track the migrant settlements and population over time. Barbieri et al. (2009) conducted a longitudinal study to monitor rural-rural and rural-urban migration in which the same households were interviewed after 9 years. This could be

linked to policy interventions made at particular times to assess the effectiveness of the interventions.

2. A follow-up study to the first suggestion would be a focus on the various policies governing conservation and land use in the GMA and how they have evolved. From the conceptual framework used in this study (Figure 2-4), institutions and organisations which formulate and implement policy are key in land use, as demonstrated by this study. This knowledge would enhance the understanding of how conservation-related policies have influenced land use in the GMA over time, with lessons learnt being used to improve future GMA management. Coming up with a time line for the introduction and revision of the various policies and comparing to the effect on population, livelihoods, and land cover changes (concept from Tsegaye et al., 2010).

3. This study highlighted the households' livelihood activities. Further research to assess specific income from these livelihoods would shed more light on the level of household reliance on the GMA relative to farming.

4. Although firewood use is essential among the local people, the use of charcoal is not, as shown by this study. Charcoal is used mostly in urban areas and mostly produced illegally. Although it is argued that charcoal production mostly leads to degradation, the increased demand for it from urban areas could lead to deforestation. This makes charcoal production one of the topical issues around deforestation (ILUA- Phase II, 2016; Msuya et al., 2011). Understanding the role of charcoal production in forest loss is vital, especially with increased demand from urban areas.

5. Conflicting theories on protected lands' ability to support farming persist (Child & Wojcik, 2014). On the one hand, researchers claim that PAs are set on marginal lands that do not favour farming. On the other hand, local people claim they depend on farming as land use in the GMA. This study indicates that households claim the GMA's conservation zone offers fertile land. There is a need to scientifically establish which narrative applies to Mumbwa GMA through land-use suitability tests.

6. The use of combined social-ecological systems (SES) and institutional analysis and development (IAD) framework (CIS) as a follow up or a similar study would be useful to unpack some of the challenges that come with research in complex social ecological systems such as the GMA.

7. With increased concern for climate change amidst deforestation, accounting for carbon loss from the GMA, and possibly how the GMA forests can contribute towards reducing carbon loss, could enrich the debate on how PAs can mitigate climate change. Investigations into the prospects of carbon payments as an additional income source that could also slow down deforestation should be undertaken.

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Appendices

Appendix 1: Department of National Parks and Wildlife intervention measures and results in response to the illegal settlements in Mumbwa Game Management Area.

Year	Intervention measure	Result of intervention
1995	National Parks and Wildlife Service (NPWS) commissioned the development of a land-use plan with WWF funding.	The proposed intervention failed because of a standoff on the issue of the settlers in the Conservation Zone.
1997	NPWS eviction of illegal settlers	The evicted settlers sought legal recourse, but the case was only resolved in 2013
2004	Chiefs Chibuluma, Kabulwebulwe and Mulendema resolved that evicted people be provided with transport	Transport was not provided.
2006	Meeting between the three Chiefs and the Central Province Permanent Secretary.	All stakeholders attended the meeting except Chief Mulendema.
2010	The Mumbwa GMA General Management Plan was formulated, including the Zoning Map to guide settlement patterns and land use in the GMA.	Chiefs Kabulwebulwe and Chibuluma upheld the provisions of the General Management Plan. Chief Mulendema did not.
2011	Government, local leadership and other stakeholders meeting resolved to evict settlers by the first week of October 2011	Change of government disrupted evictions
2012	Government, local leadership and other stakeholders meeting resolved to evict settlers by 31st August 2012. The government organised a screening process to register all illegal settlers in Mumbwa GMA.	More people moved to the GMA with "Let us wait and see" attitude. 1,1011 households were registered and the total conservation zone population estimated at 9,311
2013	The Minister of Chiefs and Traditional Affairs, Deputy Minister from Office of	Although all three chiefs agreed to this resolution, Chief Mulendema continued

	the Vice President and other top Government officials met with the three chiefs and resolved to evict the illegal settlers by 31st July 2013. A government delegation led by Director of Resettlement visited the GMA to sensitise the community about the resolution to evict settlers from the Conservation Zone by 31st July 2013.	allocating land and appointing headmen in Conservation zone. The court granted the illegal settlers a stay of execution against being evicted, but later ordered all settlers in the Conservation, Buffer and Special Use Zones to vacate the said areas. The original Chungu settlers were to be given alternative land. Chief Mulendema's Palace Secretary represented the illegal settlers.

Note. Reprinted from "Status Report on the Encroachment of Illegal Settlers in Mumbwa GMA," by ZAWA, 2013.

Appendix 2: Focus group discussion schedule used for the study

1. Could we please introduce ourselves and state which areas we are coming from.
2. What do you use your land for? (Rank based on hectarage and importance)
3. What changes have you observed in land use in the last thirty years?
4. What problem are you experiencing with land use in your area? (Rank)
5. Where do you think is the origin of these problems?
6. How do you think these problems can be solved?
7. What benefits are the illegal settlers getting from different land uses? (Rank)
8. What benefits are the legal settlers getting from different land uses? (Rank)
9. Why do you think people settle in the conservation zone?

Appendix 3: The structured questionnaire used to collect data from household heads.

Afternoon/ morning. I am doing a survey on behalf of Copperbelt University in Kitwe/ Stellenbosch University in South Africa. We are interested in the local communities and how they have been using their land for the last thirty years. This information will be used to make recommendations on how to harmonise land use practices and human well-being. I would be very grateful if you would answer a few questions about the land uses in Mumbwa GMA.

The information that you provide will be kept strictly confidential.

The interview lasts about 30-60 minutes. Do you agree to be interviewed? If so, is this an appropriate time?

ENUMERATOR CODE: …….
DATE/ TIME: …….. GPS CORDINATES……..

SECTION A (1): Demographics

Respondent profile

1.1 Respondent's name……

1.2 Chiefdom a) Kabulwebulwe ☐ b) Mulendema ☐ c) Chibuluma

1.3 Area a) Kabulwebulwe ☐ b) Mulendema ☐ c) Chibuluma d) Mulendema Chungu ☐ e) Tefula

1.4 Village……

1.2 Gender a) Male ☐ b) Female ☐

1.3 Ethnic group: a) Nkoya ☐ b) Kaonde ☐ c) Ila ☐ d) Tonga ☐ e) Lozi ☐ f) Luvale ☐ g) Others…….…….

1.4 Age: ……..

1.5 Head of household a) Yes ☐ b) No ☐

1.6 Total Number of adults living permanently in the household (18 years and above)……

1.7 Total Number of Children living permanently in the household (below 18) ……

SECTION B (2): Land Use

2.1 How much land do you use for the following?

Land Use Type	Approximate area (acres)
Forest	
Residential/ infrastructure	
Cropland	
Fallow	
Pasture	
Grassland	
Wetlands	
Others (specify)	
Total area	

2.2 Do you have plans to increase your area by getting more land a) Yes ☐ b) No ☐ c) Not sure☐

2.3 How easy/ difficult is it to get more land? a) Very easy ☐ b) Easy ☐ c) Not sure ☐ d) Difficult ☐ e) Very difficult ☐

2.4 Which of these forest products do you utilize?

Product	Y/N	Collection place*	Ranking**
Charcoal			
Sand			
Firewood			
Timber			
Medicinal plants			
Grass			
Caterpillars			
Mushrooms			
Fruits			
Honey			
Others (specify)			

* OF = Own Forest, GMAF= GMA Forest, NPF = National Park Forest, O= others (specify)
** 1= most important to you, 2= second most important to you.

2.5 Are you restricted on how you use your land? a) Yes ☐ b) No ☐ c) Not sure☐

2.6 *If yes to 2.5* who restricts how you use your land? a) Government departments (specify)……..☐ b) Chief ☐ c) Headman ☐ d) Others☐ (specify)……

2.7 How often do you cut down trees in the forest area? (Years)……

2.8 What are the reasons for cutting down the trees? a) Making roads ☐ b) Cattle grazing ☐ c) Permanent cultivation ☐ d) Shifting cultivation ☐ e) Charcoal ☐ f) Commercial poles ☐ g) Home poles ☐ h) Firewood ☐ I) Build houses ☐ j) Others (specify) ☐…….

2.9 When was the last time you cut down trees in the forest? .....

2.10 What were the reasons for cutting down the trees? a) Making roads ☐ b) Cattle grazing ☐ c) Permanent cultivation ☐ d) Shifting cultivation ☐ e) Charcoal ☐ f) Commercial poles ☐ g) Home poles ☐ h) Firewood ☐ I) Build houses ☐ j) Others (specify) ☐…….

2.11 How many acres of the forest did you clear? .....

2.12 How have the forest areas changed during the last 30 years? a) Increased ☐ b) No change ☐ c) Reduced ☐

2.13 If there is an increase in forest area, why do you think this is so? a) Government Restriction ☐ b) Reduced farming c) Climate changed) Local initiatives restriction ☐ e) NGO initiatives ☐ f) Forest not important to community ☐ g) Replanting of trees ☐ e) Others ☐ (specify)……

2.14 Of the above reasons, which of them do you consider most and second most important? a) Government Restriction ☐ b) Reduced farming c) Climate changed) Local initiatives restriction ☐ e) NGO initiatives ☐ f) Forest not important to community ☐ g) Replanting of trees ☐ e) Others ☐ (specify)……

2.15 If there is a reduction in forest area, why do you think this is so? Please tick

No	Reason	Tick
A	**Proximate causes**	
1.0	**Infrastructure extension**	
	Roads	
	Near markets	
	Settlements	
2.0	**Agricultural expansion**	
	Permanent cultivation	
	Shifting cultivation	
3.0	**Wood extraction**	
	Charcoal	
	Commercial poles	
	Home poles	
	Firewood	
	Forest fires	
B	**Underlying Causes**	
4.0	**Demographic**	
	Population increment	
	Migration	
5.0	**Economic**	
	Urbanization	
	NGO Services	
	Projects	
	Market growth	
6.0	**Technological**	
	Agro machinery	
	Agricultural inputs	
7.0	**Policy and institutions**	
	Government policy (property rights)	
8.0	**Cultural**	

	Public attitudes, beliefs, values (e.g. unconcern for public forests)	
9.0	**Others**	
	Climate change	
	In search of water	
	Others (specify)	

2.16 Of the above reasons, which of them do you consider most important? List in order of importance 1…… 2……..

2.17 Have you noticed the reduction in numbers of some tree species during the last 30 years? a) Yes☐ b) No☐ c) Not sure☐

2.18 If your answer to 2.17 is Yes, specify which ones……

2.19 Have you noticed an increase in the number of some tree species during the last 30 years? a) Yes ☐b) No ☐ c) Not sure☐

2.20 If your answer to 2.19 is yes, specify which ones……

SECTION C (3) Benefits of living in either the conservation or development zones

3.1 Do you think people should be allowed to stay in the conservation zone? a) Yes ☐ b) No ☐. *If yes, answer 3.2, if no answer 3.3 before proceeding to 3.4*

3.2 Why do you think people should be allowed to stay in the conservation zone? .....

3.3 Why do you think people should not be allowed to stay in the conservation zone? .....

3.4 What do you think are the advantages of living in the conservation or Development zone?

Conservation Zone	**Tick**	**Development zone**	**Tick**
Cropland		Clinics	
Fertile land		Schools	
Settlement land		Agricultural inputs	
Pastureland		Boreholes	
More rain		NGO help	
Dams		Concession money	
Meat		Peace of mind	
Honey		Communication	
Fish		Job opportunities	
Caterpillars		No Tsetse flies	
Charcoal		Markets	
Wood		Others (specify)	
Others (specify)			

3.5 Of the above reasons, which one of them do you consider the most important advantages for the conservation zone? List in order of importance 1…… 2…….

3.6 Of the above reasons, which one of them do you consider the most important advantage for the Development zone? List in order of importance 1…… 2…….

SECTION D (4) Migration patterns

4.1 Were you born in this village? a) Yes ☐ b) No ☐. *If yes proceed to 4.8, if no proceed to 4.2*

4.2 How long have you lived here? …… years

4.3 Where did you come from? a) Conservation zone ☐ b) Other parts of same GMA ☐ b) Other GMA ☐ c) Southern province ☐ d) Other ☐ (specify)……

4.4 Apart from where you are now staying, how many locations within this GMA have you stayed at in the last 30 years? ……

4.5 How did you hear of this GMA? a) Family ☐ b) friends ☐ c) Government d) Others (specify) ☐ ……..…….

4.6 Did you find other people already staying in your current location? a) Yes ☐ b) No ☐

4.7 Who allocated you this land a) inherited ☐ b) Friends ☐ c) Relatives ☐ d) Headman ☐ e) Chief ☐ f) Government ☐ g) Others ☐ (specify) ……

4.8 Do you intend to move to another location in future? a) Yes ☐ b) No ☐. c) Not sure ☐*If yes to 4.8, answer 4.9 and 4.10*

4.9 Where do you intend to go? a) Back to original home ☐ b) Another place within GMA ☐ c) Others ☐ (specify)……

4.10 Why do you intend to leave? .....

4.11 Do you have relatives in the village? a) Yes ☐ b) No ☐.....*If No, proceed to 4.16*

Name	Relation

4.12 Were you invited by relatives to settle in this village a) Yes ☐ b) No ☐

Name	Relation

4.13 Have you invited other relatives to settle in this village a) Yes ☐ b) No ☐

Name	Relation

4.14 Who influences where people settle in this village?

Name	Relation	Position

4.15 Do you have relatives outside the village (but in same GMA)?a) Yes ☐ b) No ☐ ..... *If No, proceed to 4.20*

Name	Relation	Village

4.16 Were you invited by relatives to settle in this GMA? a) Yes ☐ b) No ☐

Name	Relation	Village

4.17 Have you invited other relatives to settle in this GMA a) Yes ☐ b) No ☐

Name	Relation	Village

4.18 Who has influence where people settle in this GMA?

Name	Relation	Position

4.19 If you wished to discuss land allocation who would you go to?

Name	Village

SECTION E (5) Livelihoods

Change in general household well-being

5.1 How has the general well-being of your household/community changed in the last 10 years?

a) Improved ☐ b) No change ☐ c) Worse ☐

5.2 If improved, what were the main causes of this improvement? (List all then rank top 2).....

1)……

2)……...

5.3 If worsened, what were the main causes of this worsening? (List all then rank top 2)……

1)……..

2)……..

5.4 How have you coped with your worsened well-being? .....

5.5 How has the number of your possessions changed since you moved to your new location? a) Increased ☐ b) No change ☐ c) Reduced ☐

Change in Food Security

5.6 Do you still have the same number of meals you used to have over a year ago? a) Yes ☐ b) No ☐. *If yes, proceed to 5.7; if no proceed to 5.11*

5.7 How has the number of meals changed? a) Increased ☐ b) Reduced ☐

5.8 If your answer to 5.7 was increased, what were the main causes of this increase? (column 1 below)

5.9 If your answer to 5.7 was reduced, what were the main causes of this reduction? (column 3 below)

Increased meals (column 1)	**Tick**	**Reduced meals (column 3)**	**Tick**
Found employment		Crop failure	
Found better job		Illness- self	
New business		Illness- family	
Increased forest resources		Death of a family member	
Better prices		Eviction conflict	
NGO support		Livestock loss	
Government support		Asset loss	
GMA funds		Lost employment	
Good economy		Costly social event	
New roads		Poor economy	
Good harvest		Restricted resource use	
Political stability		Reduced forest products	
Joined cooperative		Others (specify)	
Others (specify)			

5.10 How have you coped with the reduced meals? .....

Sources of income

5.11 What have been your sources of livelihood in the past year? a) Employed ☐ b) Hunting ☐ c) Fishing ☐ d) Growing crops ☐ e) Keeping animals ☐ f) Charcoal burning ☐ g) Gathering ☐ h) Dependant on others ☐ I) business j) Dependant on others ☐ k) Others ☐ (specify)……

5.12 Of these livelihood sources, list which is the most and second most important (in order importance) ……

5.13 What were your sources of livelihood 10 years ago? a) Employed ☐ b) Hunting ☐ c) Fishing ☐ d) Growing crops ☐ e) Keeping animals ☐ f) Charcoal burning ☐ g) Gathering ☐ h) Dependant on others ☐ I) business k) Others ☐ (specify)……

5.14 Of these livelihood sources, list which was the most and second most important (in order importance) …….

5.15 Is there a difference between the former and present livelihood sources?

5.16 If there is a difference, why is this so? (Distinguish positive from negative).....

5.17 Did you own animals? a) Yes ☐ b) No ☐

If yes, proceed to the next question, if No, proceed to 5.20

5.18 What animals do you own a) Cattle ☐ b) Pigs ☐ c) Goats ☐ d) Poultry ☐ e) Others ☐ (specify)……

5.19 Among these animals, which two bring you the most benefits? (Rank)……

5.20 Did you own animals more than a year ago? a) Yes ☐ b) No ☐

If yes, proceed to the next question, if No proceed to 5.23

5.21 What animals did you own a) Cattle ☐ b) Goats ☐ c) Pigs ☐ d) Chickens ☐ e) Others ☐ (specify)……

5.22 Among these animals, which two used to bring you the most benefits? (Rank) ……

5.23 How has the number of your livestock changed in the last 10 years? a) Increased ☐ b) Reduced ☐ c) No change ☐ d) Not sure ☐

5.24 If response to 5.23 is increased, why do you think this is so? a) NGO support ☐ b) Government support ☐ c) Good water ☐ d) Improved pasture ☐ e) Less animal diseases ☐ f) Better knowledge ☐ g) Access to capital ☐ h) Others (specify) ……

5.25 If response to 5.23 is reduced, why do you think this is so? a) No NGO support ☐ b) No Government support ☐ c) Drought ☐ d) Reduced pasture ☐ e) Animal diseases ☐ f) Tsetse fly ☐ g) Others ☐ (specify) …….

5.26 Did you grow crops? a) Yes ☐ b) No ☐

If yes proceed to 5.27, if No, proceed to 5.29

5.27 What crops do you grow? a) Maize ☐ b) Cotton ☐ c) Groundnuts d) Soya beans ☐ d) Sweet potatoes ☐ e) Tomato f) Vegetables ☐ g) Others ☐ (specify)……

5.28 Among these crops, which two bring you the most benefits? (Rank)

5.29 Did you grow crops more than a year ago? a) Yes ☐ b) No ☐

If yes, proceed to the next question, if No proceed to 5.32

5.30 What crops did you grow? a) Maize ☐ b) Cotton ☐ c) Groundnuts d) Soya beans ☐ d) Sweet potatoes ☐ e) Tomato f) Vegetables ☐ g) Others ☐ (specify)……

5.31 Among these crops, which two used to bring you the most benefits? (Rank)……

5.32 How has your crop yield changed in the last 10 years? a) Increased ☐ b) Reduced ☐ c) No change ☐ d) Not sure ☐

5.33 If the response to 5.32 is increased, why do you think this is so? a) NGO support ☐ b) Government support ☐ c) More rain ☐ d) Improved soil fertility ☐ e) Fewer crop diseases ☐ f) Improved methods ☐ g) Better knowledge ☐ h) Access to capital I) Others ☐ (specify) ……

5.34 If the response to 5.32 is reduced, why do you think this is so? a) No NGO support ☐ b) No Government support ☐ c) Drought ☐ d) Floods ☐ e) Reduced soil fertility ☐ f) Crop diseases ☐ g) Poor methods h) Destroyed by animals ☐ I) Others ☐ (specify) …….

5.35 Has your community received any direct benefits in kind or in cash related to the GMA in the last 1 year? a) Yes ☐ b) No ☐

5.36 If yes to 5.35, what was the payment for? a) Tourism ☐ b) Hunting ☐ c) Carbon payment ☐ d) Biodiversity conservation ☐ e) Compensation from investors ☐ f) Help from NGO ☐ g) Government h) Community projects ☐ I) Others ☐ (specify) …….

5.37 Have you as an individual received any direct benefits in kind or in cash related to the GMA in the last 1 year? a) Yes ☐ b) No ☐

5.38 If yes to 5.37, what was the payment for? a) Tourism ☐ b) Hunting ☐ c) Carbon payment ☐ d) Biodiversity conservation ☐ e) Compensation from investors ☐ f) Help from NGO ☐ g) Government h) Community projects ☐ I) Others ☐ (specify) …….

5.39 Has your community received any direct benefits in kind or in cash related to the GMA before a year ago? (last 10 years) a) Yes ☐ b) No ☐

5.40 If yes to 5.39, what was the payment for? a) Tourism ☐ b) Hunting ☐ c) Carbon payment ☐ d) Biodiversity conservation ☐ e) Compensation from investors ☐ f) Help from NGO ☐ g) Government h) Community projects ☐ I) Others ☐ (specify) …….

5.41 Have you as an individual received any direct benefits in kind or in cash related to the GMA before a year ago? (last 10 years) a) Yes ☐ b) No ☐

5.42 If yes to 5.41, what was the payment for? a) Tourism ☐ b) Hunting ☐ c) Carbon payment ☐ d) Biodiversity conservation ☐ e) Compensation from investors ☐ f) Help from NGO ☐ g) Government h) Community projects ☐ I) Others ☐ (specify) …….

SECTION E: Any other comments

Thank you for your time, we will share the results of this survey with you.

Appendix 4: Key informant interview schedule used for this study

1. Could you please introduce yourself and explain your role in this organization.
2. Could you please give a history of how the land has been used (in the last thirty years) in Mumbwa GMA? (land-use types, evolved, and major landmarks like policies, droughts (specific years or periods, eras)).
3. What do you think is diving the land cover change experienced in Mumbwa GMA?
4. What problems are being experienced with land use in the area? (unplanned settlements, migrations).
5. Where do you think is the origin of these problems? (migrations, settlements, changing land uses).
6. How do you think these problems can be solved? (solutions on settlements).
7. Why do you think people settle in the conservation zone?
8. What do you think is the solution for illegal settlements?
9. For headmen, do they know the demarcations?
10. Where people consulted on the land to be given