Adaptation choices, community perceptions, livelihood linkages and income dynamics for district producer communities surrounding Nyatana Game Park in Zimbabwe

University of Fort Hare
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A Thesis Submitted in Fulfilment of the Requirements for the Degree of Doctor of Philosophy (Ph.D) in Agricultural Economics

by

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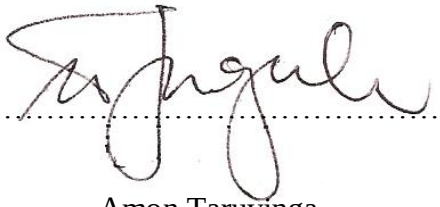
Declaration

I, the undersigned, hereby certify that, unless specifically indicated to the contrary in the text, this thesis is the result of my original work and that I have not previously submitted it to any University for a degree.

Dated: ……20 …… Day of ……November……2011



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Amon Taruvinga

Dedication

Dedicated to my future wife:

"*Because of you I have decided to go all this far, thanks for your patience*"

Acknowledgements

I wish to express my sincere gratitude to my promoter Dr. A. Mushunje for his continued guidance and constructive criticism on the whole project. Without your guidance this study would not have been possible, I thank you. My further utmost gratitude shall be extended to the Government of Zimbabwe (GoZ) for funding my studies. Special mention also goes to Nyatana Joint Management Trust for allowing me to conduct this study. Lastly but not least I wish to thank all those who helped in the study whose names are not mentioned to include the Taruvinga family.

Abstract

This thesis explores human-wildlife interactions under community managed game parks. The thesis consists of an introductory chapter, study location chapter and four self-contained studies based on different samples from created clusters surrounding Nyatana Game Park, which make up the rest of the thesis chapters.

Chapter one presents an introductory overview of wildlife management in Zimbabwe, specifically looking at human-wildlife interactions under CAMPFIRE projects, welfare dynamics and conservation implications for the surrounding communities who share boundaries with community-managed game parks. The chapter concludes by highlighting the challenges facing community-based wildlife conservation in Zimbabwe as well as the key concepts that will be the subject of the rest of the thesis.

Chapter two presents the study location; it highlights the road map to the study area, starting with the provincial location, and indicates the specific districts from which respondents were selected. A brief agro-ecological summary of the study area is also presented; it looks specifically at climate, vegetation and a demographic data of the study area.

Chapter three: Can game parks be trusted as livelihood sources? To answer this topical question, **Chapter three** explores livelihood adaptation strategies for households who share boundaries with Nyatana Game Park. Most of the community managed game parks, under CAMPFIRE principles in Zimbabwe, were established with the primary objective of generating revenue for the surrounding communities; this was done in the hope of using positive returns from game farming to promote the conservation of wildlife. Has this materialised in practice? Descriptive results from this study seem to suggest otherwise, where mixed farming and gold panning were the major livelihood adaptation choices reported by most households. The revenue from game farming was reported to be too low and

inconsistent, to such an extent that the majority of the community regarded it as risky and unreliable. A multinomial logistic regression model for correlates of adaptation choices indicated that access to credit, markets, and extension may be some of the current institutional constraints inhibiting households from accessing off-farm sources for their livelihoods. In addition, household size, gender and age may enhance the adaptive capacity of households to move out of risky crop faming into other off-farm portfolio diversifications. The study, therefore, suggests that game parks, according to the evidence uncovered by the study, may not be trusted as a reliable and sustainable livelihood source.

If local communities who share boundaries with game parks do not view them as reliable and sustainable livelihood sources, as concluded in **Chapter three**, how can they (local communities) be trusted to conserve them? To assess their perceptions of game parks, **Chapter four** presents a multinomial logistic regression model for perceptions of society on game parks using the African elephant as a typical example. The results suggest that Problem Animal Control (PAC) perceptions, livestock predation and issues of low and poor revenue distribution may be some of the critical perceptions capable of influencing surrounding communities to negatively participate in the conservation of wildlife. The results further suggest that using wildlife proceeds to finance observable local common pool infrastructure may positively influence the surrounding communities to conserve wildlife. The chief conclusion regarding game parks, therefore, was that the surrounding communities were in favour of the obliteration pathway, although minimal conservation perceptions were also available.

Given the negative conclusions regarding game parks, as suggested in **Chapters three** and **four,** citizens would then wonder if any meaningful hope for community managed game parks exists. **Chapter five** probes the buffer zone livelihood link under community managed

game parks, using evidence from the Nyatana Game Park. The binary logistic regression model results, for buffer zone participation and resource extraction combinations by surrounding communities, suggest that resource extraction may be market driven rather than focussing on domestic consumption. The study therefore concludes that the buffer zone livelihood link as currently practiced, though potential, may fail to address the livelihood expectations of the sub-district producer communities. The study therefore calls for extreme caution whenever the buffer zone livelihood link is considered, because several institutional and design conflicts exist within this dynamic.

In **Chapter six,** the study further probed the buffer zone income dynamics for the sub-district producer community. The results of descriptive statistics suggest that the contribution of buffer zone activities to household income may be significant with a positive correlation to household agricultural income for communities who reside inside or close to the park (primary sub-district producer community). Using the Gini decomposition approach and Lorenz curves, the study concluded that a buffer zone income may be capable of contributing to more equally distributed incomes for rural communities who share boundaries with game parks. With respect to the correlates of household income, the results suggest that household size and age may negatively influence income from buffer zone activities, while gender may have a positive effect. This was also true for education and Livestock Units (LUs) with respect to income from self employment; the former positively and the latter negatively related. The results further suggest that land size may also be positively significant in order to explain income from agriculture as well as total income. With regard to the distance from the buffer zone, the results suggest a negative influence with respect to the buffer zone, agriculture and total income.

The implied message therefore suggests that buffer zones may provide active livelihood sources which are capable of financing rural household agriculture. The income equalizing

effect which is portrayed may also further imply that, if correctly targeted and promoted, a buffer zone income could possibly address the current income inequality which is generic in rural areas. However, this potential may not be realized due to the current buffer zone design status (created for local secondary use as opposed to commercial primary use), restrictive policies and poor institutional support.

With this dilemma facing community managed game parks (threats as summarised in **Chapters three and four** amid the potential hope summarized in **Chapters five and six**), **Chapter 7** concludes the study by suggesting that the human-wildlife interaction model, though currently theoretical, may have significant practical potential in addressing the livelihoods of the surrounding communities as well as promoting the conservation of wildlife. This could be possible if available challenges that range from low revenue, insecure property rights, high human-elephant conflict and institutional design conflict for buffer zone utilization are corrected by means of the free market system. This would allow market forces to deliver on the expectations of the "human-wildlife interactions model" – sustainable livelihoods for the former and intergenerational conservation for the latter.

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Abbreviations

AA	Appropriate Authority
CA	CAMPFIRE Association
CAMPFIRE	Communal Areas Management Programme for Indigenous Resources
CBNRM	Community Based Natural Resources Management
CITES	Convention on International Trade of Endangered Species
CSO	Central Statistics Office
DNLA	Distanced Normal Limited Access
DNPWLM	Department of National Parks and Wildlife Management
FEC	Foundation for Environmental Conservation
GoZ	Government of Zimbabwe
GPS	Geographical Positioning System
IFAW	International Fund for Animal Welfare
IUA	Illegal Unlimited Access
JMC	Joint Management Committee
LCC	Local CAMPFIRE Committees
LMC	Local Management Committee
LU	Livestock Unit
MEA	Millennium Ecosystem Assessment
NJMT	Nyatana Joint Management Trust
NLA	Normal Limited Access
OLS	Ordinary Least Squares
PA	Problem Animal
PAC	Problem Animal Control
RDC	Rural District Council
SO	Safari Operator

SPSS	Statistical Package for Social Scientists
UMP	Uzumba Maramba Pfungwe
WTP	Willingness To Pay

Chapter One

Introduction and background information

1.0 Introduction

In principle, where human-wildlife interactions exist, mutual positive and negative benefits may be possible for the two partners although they are not obvious. The "human-wildlife interaction model" may, therefore, face several challenges to enhance a mutual win-win status in practice. With this background, the Millennium Ecosystem Assessment (MEA) (2005) acknowledges that forests (wildlife) play a significant role in terms of biodiversity and as economic resources for the state. In support of this view, several studies also acknowledge the role of wildlife as safety nets, income sources, coping strategies and a pathway out of poverty for the rural poor (Cavendish, 2003; Fisher, 2004; Narain *et al*. 2005). From another dimension, several studies also suggest that the potential benefits that the poor can derive from forests (wildlife) are not always forthcoming (Child, 1995; Patel, 1998; Hasler, 1999) and the poor are sometimes the agents of forest (wildlife) degradation (Shively, 2004).

Remarkably, in as much as wildlife can be a safety net for poverty, it may also be a poverty trap due to the low returns from most non-timber products (Angelsen and Wunder, 2003) and institutional frameworks which are skewed in favour of pure conservation (Redford and Fearn, 2007) at the expense of direct benefit to surrounding communities. Regrettably, in most developing countries, local communities were evicted from their homes and told that they were not allowed to harvest wild animals and plants when wildlife reserves were created (Brandon and Wells, 1992; Lynagh and Urich, 2002; Grimble and Laidlaw, 2002; Muchapondwa, 2003).

Thomas and O`Connor (2007) recently noted that the growing international concern for biodiversity conservation which emerged in the late 1970s concentrated on areas where coincidence of poverty and natural resources is most pronounced, thus changing the conservation debate to issues of how much biodiversity can be saved in the face of suffering local communities. Human rights lobby groups have also taken the debate to a higher level by accusing park authorities of the illegal imprisonment, eviction and even genocide of local communities (Chatty and Colchester, 2002; Brockington *et al*. 2006). This scenario has made the creation of wildlife reserves a highly contested area; it is currently being labelled as the greatest biodiversity conservation exercise that has the largest illegitimate taking of private property and resources in the history of the world (Redford and Fearn, 2007).

With that tricky contested background, the sustainable "human-wildlife interaction model" therefore faces several conservation and utilization trade-offs. Initially created for recreation and the conservation of nature to enhance biodiversity, wildlife reserves are now also expected to address livelihood sources for the ever-growing surrounding community (Muchapondwa, 2003), through direct benefits, and possibly contributing to poverty reduction (Straede and Treue, 2006; Redford and Fearn, 2007). The challenge facing wildlife managers is, therefore, to design a "human-wildlife interaction model" with practical potential to provide direct benefits to an increasing population of the surrounding community in exchange for conservation. This is against a practical reality that, in principle, wildlife reserves seem to be capable of providing a lucrative livelihood source for communities (Fernandez *et al*. 2009) while, in practice, several studies caution against blanket success recommendations on community gains from wildlife reserves (Child, 1995; Muchapondwa, 2003).

The economics behind the "human-wildlife interaction model" thus remains an over-generalized and highly contested area, whose win-win potential is primarily claimed from a

theoretical perspective (Robinson, 1993; Brown, 2004; Christensen, 2004; Thomas and O`Connor, 2007) based on flagship examples without much supportive wide-range practical evidence. Unfortunately, the theoretical win-win potential (mutual benefit assumption) seems to have dominated perceptions of most wildlife policy makers (Governments, CITES). Thus far, wildlife policies have been crafted with the assumption that wildlife reserves can provide meaningful livelihood sources for surrounding communities (Muchapondwa, 2003; Straede and Treue, 2006). As a result, community managed game parks under the banner of Community Based Natural Resources Management (CBNRM) approaches have mushroomed across most African countries hoping to tap into the claimed mutual benefit assumption made possible under human-wildlife conduct.

The win-win "human-wildlife interaction model" could thus be summarized as follows: humans and wildlife in principle compete for the scarce land for survival. For the sustainability of both species, some of the wildlife must therefore "die"[1] to unlock their direct economic benefits for the surrounding communities; hence, paying for the "existence cost" of the remaining wildlife. To that end, survival and the future of wildlife depends largely on whether the local society, with the practical potential to conserve or destroy wildlife, considers the wildlife to be assets (harvestable with direct sustainable economic value) or liabilities (un-harvestable with indirect benefits – biodiversity) (Child, 1995; Muchapondwa, 2003).

The assessment of the local society's perceptions on wildlife will be of interest in the policy realm, given that some people may potentially consider wildlife as a public good while others may consider it as a public bad (Muchapondwa, 2003). If the economic value of wildlife is significant, based on evidence from the local community, then it may imply that wildlife

1 Sustainable harvesting (≤ MSY level of the Verhulst model: killing for conservation)

conservation may be economically enhanced through the promotion of positive perceptions and the reduction of negative perceptions, as shared by local communities.

There is therefore a need to provide an economic valuation of the "human-wildlife interaction model" under a clear and unambiguous locality-based analysis which reflects the true economics and trade-offs behind interaction in rural areas. The real issues are; firstly, whether game parks can provide meaningful livelihood sources for rural communities; secondly, what are society`s perceptions on elephants and their relative influence towards the conservation of wildlife; thirdly, how sustainable is the buffer zone livelihood link under community managed game parks and finally, what are the likely buffer zone income dynamics for the sub-district producer community.

In light of this background, there may be more questions than benefits behind human-wildlife interaction as currently practiced. A need therefore arises to provide a pragmatic economic body of information with regard to human-wildlife conduct under community managed game parks in rural areas. Otherwise, the current elephant poaching syndrome and invasion of game parks by surrounding community signals errors of commission and omission in current wildlife management policies.

1.1 Background information

This section presents a brief background summary of the study focussing on the following concepts; potential of CBNRM programmes, the Zimbabwe Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) approach and Nyatana Game Park.

1.1.0 Potential of Community Based Natural Resources Management (CBNRM) programmes

The potential of the human-wildlife interaction livelihood and conservation link gave birth to a lot of community managed wildlife projects in Africa, hoping to empower local communities to sustainably benefit from their natural resources. However, the practical potential benefit that the surrounding communities can reap from wildlife is a highly controversial area in resource economics.

By devolving wildlife property rights to communities, CBNRM aims to direct the claimed benefits of wildlife to communities. Libanda and Blignaut (2007) note that, several countries from southern Africa, including Namibia, were pursuing the CBNRM concept. Bond (1994; 1999) previously noted that, in Botswana, the CBNRM involved both non-consumptive and consumptive tourism; while in Zimbabwe 80% of incomes were primarily from consumptive activities, such as trophy hunting.

Based on cost benefit analysis studies from the Okavango delta, Barnes (2006) shows that, the benefits from CBNRM projects generally far outweigh the costs generated by wildlife (elephants) to communities. Similar results were inferred by Jones and Barnes (2007) based on studies from the Caprivi Strip in Namibia. In summary these studies suggest that the negative externalities generated by wildlife (elephants) can be internalized with CBNRM projects. In support of this conclusion, Libanda and Blignaut (2007) found that Namibian households do, generally, benefit significantly from CBNRM projects. Contrary to this, Muchapondwa (2003), based on a study of the Nyatana CAMPFIRE Game Park in Zimbabwe, noted that most of the communities from the Mudzi district (62%) were against the idea of elephant conservation. Mixed suggestions therefore surround the human-wildlife interaction livelihood link.

1.1.1 The Zimbabwe CAMPFIRE approach

In Zimbabwe, the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE) approach mimics the CBNRM idea. Gadgil and Rao (1994, 1995) argue that this new paradigm attempts to involve the masses of rural people as partners, to marry conservation with development, and to employ positive rewards in place of bureaucratic regulations, as the main instrument of conservation.

Legally, in Zimbabwe all wild-animals belong to the state under the Department of National Parks and Wildlife Management (DNPWLM) as provided for by the provisions of the Zimbabwe Parks and Wildlife Act of 1982. For the purposes of transferring legal authority to CAMPFIRE, Gadgil and Rao (1995) noted that in 1989, the DNPWLM through the provisions of the Parks and Wildlife Act conferred Appropriate Authority (AA) status to Rural District Councils (RDC). This was meant to locally empower communities to directly benefit from and possibly conserve their wildlife.

Muchapondwa, (2003) noted that, for districts to qualify for the AA status, RDCs were supposed to satisfactorily demonstrate to the DNPWLM that they were capable of managing their resources fulfilling two key conditions as follows;

- disburse at least 50% of the CAMPFIRE revenues to the sub-district producer community and
- devolve management functions to those communities with time.

With time, more and more districts were conferred as CAMPFIRE districts as shown in Figure 1.1 which presents CAMPFIRE districts which had AA status by 2000.

Figure 1.1: CAMPFIRE districts with appropriate authority (AA) status, as at 2000

Source: Campfire Association (CA), 2000

1.1.2 Nyatana Game Park – community managed CAMPFIRE project

The Nyatana Game Park is a community CAMPFIRE managed game park surrounded by three districts (Mudzi, UMP and Rushinga), which were active CAMPFIRE districts during the study period. The game park covers approximately 75 000ha [Nyatana Joint Management Trust (NJMT), 2010]. Wildlife, of all forms, has been convinced by this natural wilderness to partner in existence; thus making Nyatana a multifaceted biodiversity wilderness safe for both aquatic and terrestrial wildlife. Elephant trophy hunting is the main economic activity for the park which hosts an estimated elephant population of 300 (NJMT, 2010). Two perennial rivers (Mazowe and Nyadire) define the hydrological setting of Nyatana, supported by a dense network of streams (NJMT, 2010). Surrounding communities have managed to

coexist with this wilderness by harvesting natural resources offered by the game park to their benefit (NJMT, 2010).

1.1.2.0 The "default conservation" history of Nyatana Game Park

The Nyatana Game Park borders the Mazowe River into the Tete province of Mozambique, thus creating a natural wildlife corridor especially for elephants which use this route seasonally. The area is also reportedly to have been infested with tsetse flies which significantly reduce livestock populations and pose a threat to humans (NJMT, 2010). The harsh climatic conditions of this area also technically excluded cropping, which made it difficult for any agricultural activity to take place. Combined, these factors changed the survival strategies of the early inhabitants of Nyatana into communities pursuing wildlife livelihoods (NJMT, 2010). In essence, this defines the forced conservation history of Nyatana. With the eradication of tsetse flies in this area, more and more people were attracted to Nyatana while the hybridization programme saw the introduction of drought tolerant crops, also motivating people to stay around Nyatana with some form of subsistence cropping (NJMT, 2010).

1.1.2.1 Formalised conservation

The Parks and Wildlife Act of 1982, through its CAMPFIRE programme and creation of RDCs that could apply for AA status to manage their wildlife, formed the basis for formalised conservation in the Nyatana Game Park. Since the surrounding communities were already "wildlife farmers" it was easy for the three councils to introduce wildlife management ideas *cum* formation of wildlife management committees. By as early as 1984, a Joint Management Committee, (JMC) was in place; it was formed by members from the three councils representing the surrounding communities to which Nyatana is geographically located (NJMT, 2010).

After being granted AA status by DNPWLM in the mid 1990s, the committee managed to attract and seal contracts with several safari operators which concentrated primarily on trophy hunting. Although benefits to the JMC were low, which meant low benefits to surrounding communities, community projects were targeted instead of distributing the cash proceeds (NJMT, 2010). Projects like dip tanks, toilets and contributions to clinics were implemented and financed by proceeds from the game park (NJMT, 2010). Personal harvest yielded more benefits than proceeds coming through JMC to most households, implying that the surrounding communities were against the idea of introducing a safari operator (NJMT, 2010). What made the situation worse was that safari operators also banned the harvesting of natural resources by surrounding communities, thus creating conflict which is still pronounced in some parts of the surrounding communities (Dewa area UMP district and Rushinga) (NJMT, 2010).

In an effort to improve the competitiveness of Nyatana Game Park (NJMT, 2010), it is noted that the JMC developed a business investment plan for possible funding by the CAMPFIRE Association, Zimbabwe. Critical to this plan was the transformation of JMC into a TRUST with absolute authority and decision-making powers on Nyatana issues. In addition, this transformation was earmarked to empower the TRUST to attract better competitive international partners. Several strategies were also recommended for improving the species composition of wildlife and several infrastructure initiatives were proposed to enhance competitive non-consumptive ecotourism.

By 2002, the JMC was successfully transformed into a TRUST (NJMT, 2010). In 2003, Nyatana lost funding due to the closure of USAID operations in the country; this was the main funder of the CAMPFIRE Association, Zimbabwe. The TRUST quickly engaged a private safari operator (Mudzi Hunters) to complete the outstanding developmental milestones so as to put Nyatana Game Park on the international ecotourism map, since its

lease was to expire in 2008 (NJMT, 2010). The TRUST signed a new five year lease contract, with Blacky Safaris, which expires in 2012 (NJMT, 2010).

1.2 Problem Statement

Wildlife is a complex and multifunctional ecological system of nature whose direct and indirect contributions to human welfare are not obvious. This scenario has presented a dilemma to several stakeholders who wish to benefit from or protect it. Local communities who share boundaries with wildlife reserves subscribe to the notion of more direct household benefits against the more global precautionary conservation stance taken by most African governments. In countries where natural resource user rights have been de-centralized (Zimbabwe – CAMPFIRE systems), devolution has partially been done to the level of RDCs (Child *et al*. 1997; Muchapondwa, 2003), for precautionary measures.

Necessary (for developing common pool rural infrastructure – roads, dip tanks and clinics) but not sufficient (for addressing household income) revenue is also reported in literature as a result of such approaches [CAMPFIRE Association (CA), 2000; Muchapondwa, 2003; Brown, 2004; Christensen, 2004; Thomas and O`Connor, 2007]. On the other hand, rural communities have responded by accommodating poachers, especially those who killed animals raiding their crops or animals which compete with their livestock (Child *et al.* 1997), illegally invading game parks for purposes of commercial harvesting of tradable resources and opening up of cultivation fields to address the missing component – household income.

Effectively, the estimated 6 million hectares of wildlife area in Zimbabwe (Child 1995) faces an almost similar human-wildlife interaction dilemma. Rampant elephant poaching (Child *et al*. 1997; Wesser *et al.* 2010) and the illegal invasion of game parks by surrounding communities is therefore becoming a norm in most wildlife reserves in Africa. Slowly, the observable African natural resources (elephants) are therefore declining (Douglas –

Hamilton, 2009). The study therefore seeks to develop a "human-wildlife interaction model" through uncovering the following issues as they affect households who share boundaries with game parks;

- livelihoods adaptation choices, constraints and correlates of adaptation choices of households who share boundaries with game parks,
- society`s perceptions of elephants and their relative influence towards conservation,
- the potential of the buffer zone livelihood link and
- the buffer zone income dynamics for the sub-district producer community.

1.3 Research impasse *cum* policy errors

Societies differ greatly in as far as the best sustainable human-wildlife interaction approach is concerned. On one extreme, this is dominated by local communities who share boundaries with wildlife reserves; share the conclusion of more direct monetary household benefits as the best sustainable approach capable of addressing livelihoods of communities and possibly promoting the conservation of wildlife (Child, 1995; Edwards, 2001; Muchapondwa, 2003; Straede and Treue, 2006; Redford and Fearn, 2007). On the other extreme, this is mainly dominated by the global community with powers to craft policies, subscribe to the school of thought of a more precautionary approach which is skewed in favour of pure wildlife conservation for purposes of sustaining biodiversity and bequest values of nature for the future generation (Akama, 1996; Edwards, 2001). Environmental policies have, therefore, been crafted in line with the beliefs of the global community at the expense of local communities` demands.

1.4 Operational research objectives

The broad objectives of this study are four pronged, as summarised below, and detailed in standalone studies that constitute the rest of the chapters of this study;

1. To investigate the livelihood adaptation choice of communities who share boundaries with community managed game parks
2. To assess community perceptions of game parks (elephants) and their relative influence on conservation
3. To assess the potential of the buffer zone livelihood link under community managed game parks
4. To investigate the buffer zone income dynamics for the sub-district producer community under community managed game parks

1.5 Operational research questions

1) Can game parks be trusted as livelihood sources for the surrounding communities?
2) What are communities` perceptions of game parks (elephants) and to what extent can they influence conservation?
3) Can buffer zones provide significant livelihoods for surrounding communities?
4) What are the buffer zone income potentials of the sub-district producer community?

1.6 Hypothesis

1) H_0: Game parks can be trusted as a livelihood source for surrounding communities.

2) H_0: Possible revenue generation and employment are some of the perceptions capable of influencing conservation.

3) H_0: Buffer zones can provide significant livelihoods for the surrounding communities.

4) H_0: Buffer zones can provide significant incomes for surrounding communities.

1.7 Thesis Statement

In light of the above, the underlying thesis of this work is that human-wildlife interaction, if mutually designed, has dual benefits (livelihoods sources and wildlife conservation) for the two partners.

1.8 Justification of Study

The motivation of this study is based on the fact that, although society understands intuitively that wildlife is important, this may not be enough if wildlife provides more indirect values at the expense of direct values, specifically for the surrounding communities who are expected to be its custodian. Also, although it could be obvious that wildlife is multifunctional, it is not obvious how much biodiversity should be saved in the face of suffering local communities (Thomas and O`Connor, 2007). That is, it may be meaningful to sustainably harvest wildlife for the direct benefit of surrounding communities; whereas, for others, it may be essential to 'hold on' to wildlife in its natural state for the global benefit of enhanced biodiversity and to bequest value to future generations. To that end, economic valuation may provide a necessary tool to assist in sustainable policy design that balances utilization and conservation for the mutual benefit of society at large.

1.9 Research method

This section presents a brief summary of the research design in an effort to explain how the study was conducted and justification for standalone studies that make chapters of this thesis.

1.9.0 Research design

The study used a case study complemented by an evaluative approach as the main research techniques. A case study technique, according to Hofstee (2006), is a research design approach that examines a single case in a tightly structured way, towards testing a hypothesis about the case itself as well as gaining principles that can be extrapolated to similar cases. In this study, a case study approach was used to capture detailed knowledge on the human-wildlife interaction based on evidence from communities that share boundaries with Nyatana Game Park. On the other hand, an evaluative approach seeks to come to a conclusion about the effects or success of some happening or intervention (Hofstee, 2006). In this study, an evaluative approach was used to complement the case study technique through appraising the buffer zone livelihood link towards addressing wildlife conservation and the livelihoods of surrounding communities.

1.9.1 Methods and research instruments

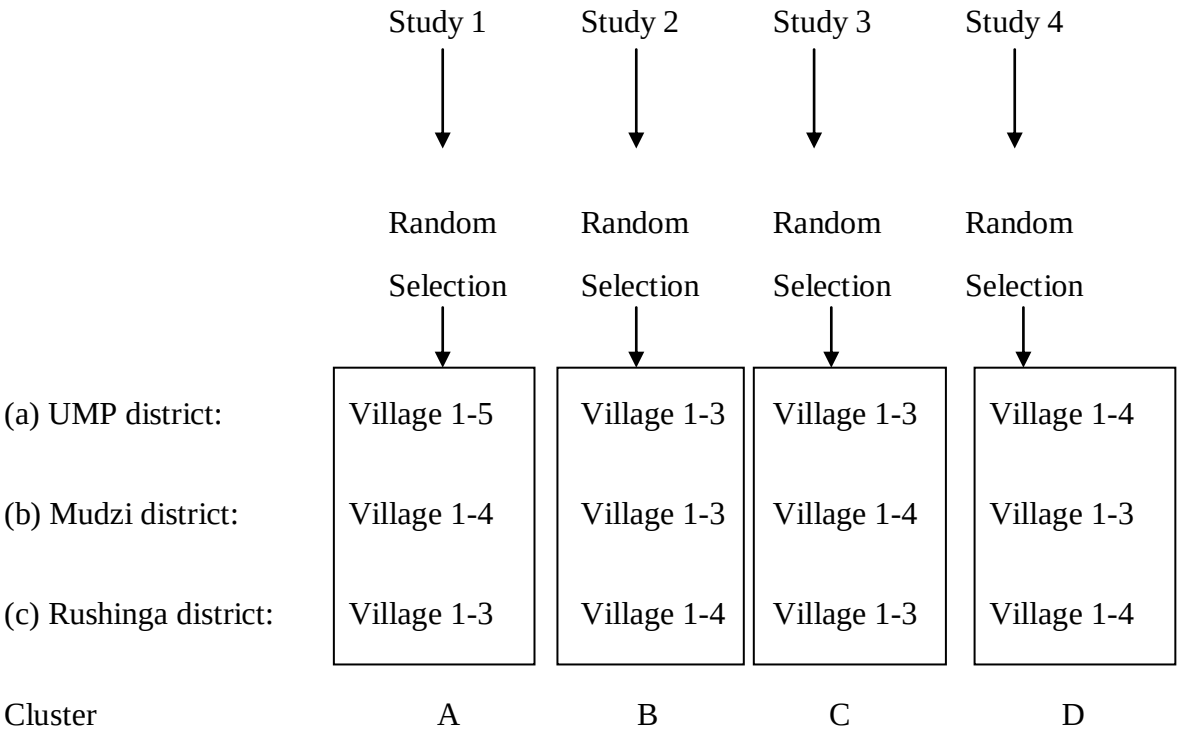
The study was carried out in two major phases. In phase one, the main objective was to obtain a series of qualitative data in as far as human-wildlife interaction is concerned. The main approach at this level was through participatory rural appraisal surveys. Interviews with key informants from a technical level to grassroots level were the main method used to gather information. Phase two of the study was dominated with a much more substantive baseline survey which targeted both qualitative and quantitative data. A baseline survey captures events as they are on the ground for future referencing. This included data on the

demographics of the household, farming activities, off-farm buffer zone activities and the socio-economic status of households. Questionnaires (annexure 1-4) were used as the main instrument to gather data pertaining to the abovementioned information.

1.9.2 Sampling frame

The proposed study encompassed all primary and secondary sub-district producer communities surrounding Nyatana Game Park, as the sample frame. Primary sampling units were then considered depending on the objective as contained in different self contained studies that make up the chapters of this study.

The study used cluster sampling by grouping villages into "area sampling units" then randomly select respondents as follows;



- Study 1 (chapter 3) effectively randomly selected respondents from cluster A which were stratified according to districts a – c.

1.9.3 Enumerator selection and training

Five enumerators were selected, all of which had received graduate training in agriculture, applied environmental science, rural sociology or geography from various universities in Zimbabwe. All the chosen enumerators were resident in study areas of Mashonaland East and Central Provinces at the time of the study and fluent in the local language. This team was trained over five days so as to familiarize themselves with the different sections of the questionnaires. On the fourth day, a pre-testing exercise was conducted at one of the study sites. Each enumerator managed to interview at least 10 households. The last day was used for brain storming and reflection on the different sections of the questionnaires, based on the pre-test results. Several adjustments to the questionnaires were done and the skills needed to approach the households were also highlighted.

1.9.4 Analysis

Data were entered into and managed in the Statistical Package for Social Scientists (SPSS) version 19.0. Details of the econometric models used are captured in self contained studies which make up the chapters of this study. Effectively, this section presents a summary of the statistical models used. The majority of the analysis, which included the following analytical techniques, was done using a combination of SPSS and Microsoft EXCEL:

1. To investigate the livelihood adaptation choice of communities who share boundaries with community managed game parks
    - Descriptive statistics
    - Multinomial logistic regression model
2. To assess community perceptions of game parks (elephants) and their relative influence towards conservation

- Descriptive statistics
- Multinomial logistic regression model

3. To assess the potential of the buffer zone livelihood link under community managed game parks
    - Descriptive statistics
    - Binary logistic regression model
4. To investigate the buffer zone income dynamics for the sub-district producer community under community managed game parks
    - Descriptive statistics (Gini coefficients and Lorenz curves)
    - Linear regression model (OLS)

1.10 Organization of the Study

Chapter one presents the introduction and background of the research study, specifically looking at issues of the "human-wildlife interaction model" as currently practiced in southern Africa with particular reference to Zimbabwe. Chapter two highlights the road map to the study area starting with the provincial location with respect to specific districts from which respondents were selected. The major issues highlighted in this chapter include an agro-ecological summary of the study area and the demographic data of the districts.

Chapter three presents a self contained study on livelihood adaptation choices, constraints and correlates of adaptation choices for households who share boundaries with game parks, using evidence from Nyatana Game Park. In Chapter four, the study presents a second self-contained study on society`s perceptions on elephants and their relative influence on the

conservation of elephants. Chapter five presents a third self-contained study which models the buffer zone livelihood link under community managed game parks.

Chapter six concludes the self-contained studies by querying the buffer zone income dynamics for the sub-district producer community, tracking implications for the rural off-farm income, income inequality and development of household agriculture. Chapter seven concludes the study by presenting the research summary, conclusions, recommendations and areas of further study.

1.11 Challenges facing community managed wildlife in Zimbabwe and key concepts

The following challenges are generic to community-based wildlife management in Zimbabwe;

- Insecure property right to users – communally owned
- High legal restriction on commercial utilization and access (Communal Lands and Forestry Produce Act, Environmental Management Act)
- Lack of institutional support with regards to extension, markets and financial support
- High uncontrolled PA challenges (Muchapondwa, 2003)
- Poorly defined buffer zones
- Low revenue potential from game farming and buffer zone extracts

Key concepts

- Wildlife in this study shall be defined as wild animals and vegetation, especially animals living in a natural undomesticated state. Depending on the main economic activity or challenge faced by wildlife users, components of the broader wildlife shall be used as a proxy representative of wildlife.

- Sub-district producer community shall be deemed to mean households that reside close to a game park and by default rely on the game park for their livelihoods. Those residing within 0 – 2.5km from the buffer zone treated as primary sub-district producer community while those beyond 2.5km as secondary sub-district producer community.
- Consumptive ecotourism shall be defined as tourism that uses the culling approach and trophy hunting activities to generate revenue.
- Non consumptive ecotourism shall be defined as tourism that does not destroy wildlife but rather generates revenue through nature viewing and photographing.
- The competitive exclusion concepts borrows the idea of "the survival of the fittest concepts" defined in revenue principles, where low revenue generating activities will be substituted by high revenue generating activities (Sutton, 2001).
- Expecting potential active members shall be deemed to mean primary sub-district producer households expected to directly benefit from game park revenues.

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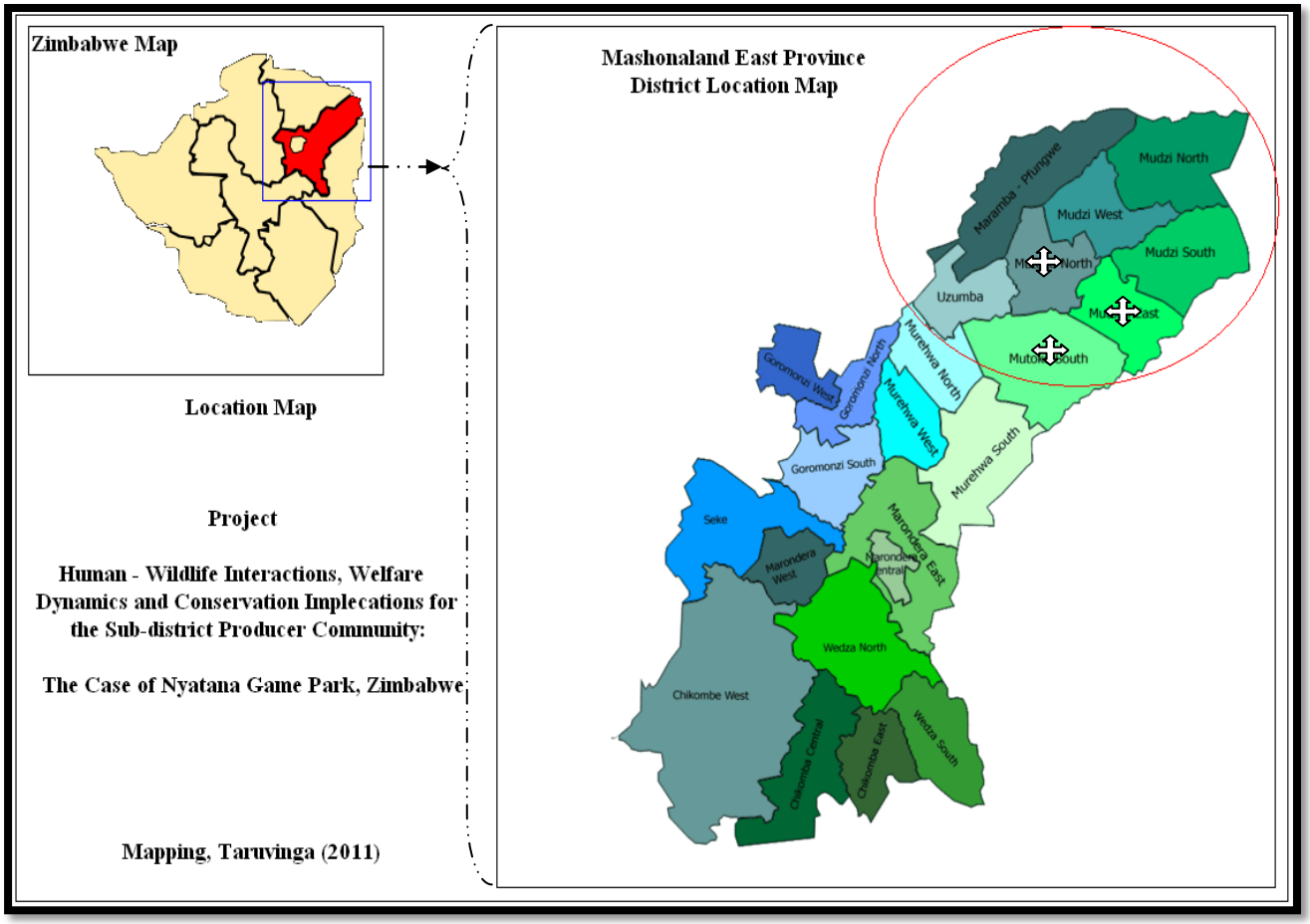
Chapter Two

Description of study site

2.0 Introduction and description of study site

This section presents a detailed review of the geographical location of the study site as a road map to the study area. Figure 2.1 presents Mashonaland East Province in relation to the country of Zimbabwe with the following coordinates; **$17^0$30`S: $32^0$00`E.**



Key:

✣: *Indicates parts of Mutoko district not covered by Nyatana Game Park*

Figure 2.1: Location Map, Mashonaland East Province

Source: Available from http://en.wikipedia.org/wiki/Mashonaland_East_Province

Nyatana Game Park, from its southern boarders, shares boundaries with two districts under the Mashonaland East Province namely; Uzumba Maramba Pfungwe (UMP) and Mudzi, as circled in Figure 2.1.

Figure 2.2 presents Mashonaland Central Province in relation to the country of Zimbabwe with the following coordinates; **$17^0$00`S: $31^0$00`E**.

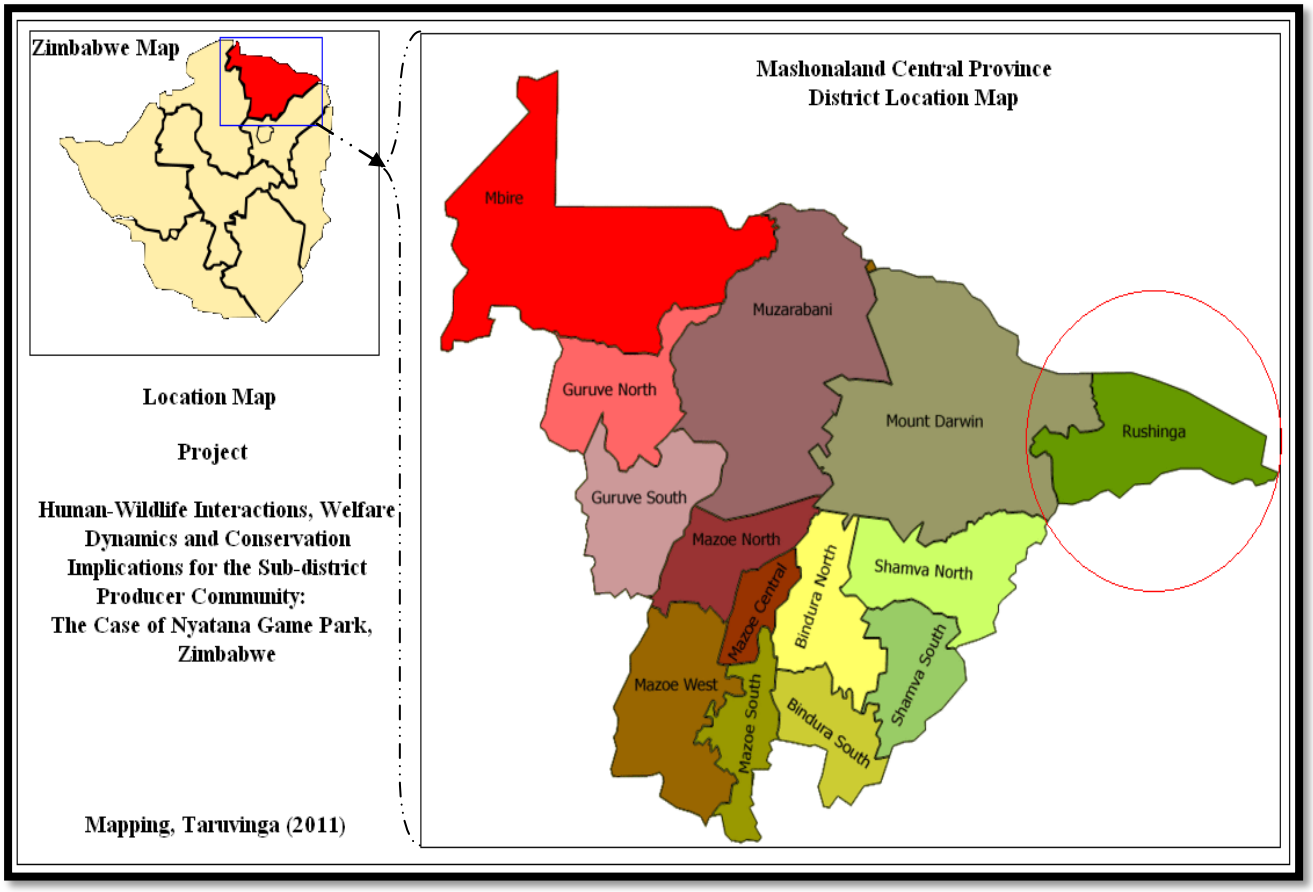


Figure 2.2: Location Map, Mashonaland Central Province

Source: Available from http://en.wikipedia.org/wiki/Mashonaland_Central_Province

Also, from its northern boarders, Nyatana Game Park shares boundaries with one district – Rushinga under Mashonaland Central Province, as circled in Figure 2.2. Figure 2.3 presents the schematic location map of Nyatana Game Park in relation to the country of Zimbabwe, given by the following coordinates; **16^0 44`17.60``S: $32^0$34`41.25``E**. To the entire north, the

park shares boundaries with Rushinga district, Mudzi district to the south and the UMP district to the southwest.

Figure 2.4 presents the schematic map for Nyatana Game Park, not to scale, indicating the major hydrological pattern (Mazowe and Nyadire Rivers), main road networks, major attraction points (Hippo pools, Guyu dam) and the two camp sites. Included in the map is the operation buffer zone around the Park and some human encroachment, as evident during the time of study.

Two boundary lines are drawn on the schematic Nyatana Game Park map in Figure 2.4, illustrating the buffer zone boundary which is 2km from the boundaries on surrounding communities into the game park. Surrounding communities would use this entire area for the harvesting of natural resources for their local domestic use.

Human encroachment was also pronounced more specifically in Rushinga and UMP districts, as captured in Figure 2.4. These households were deemed illegal by available regulations.

To the extreme right, the game park shares boundaries with the Tete Province of Mozambique. This created a corridor for elephants to move from Zimbabwe to Mozambique in search of green pastures. This facility has significant potential for a possible trans-frontier approach. During the time of the study, the trans-frontier concept position papers were being shared between the two countries.

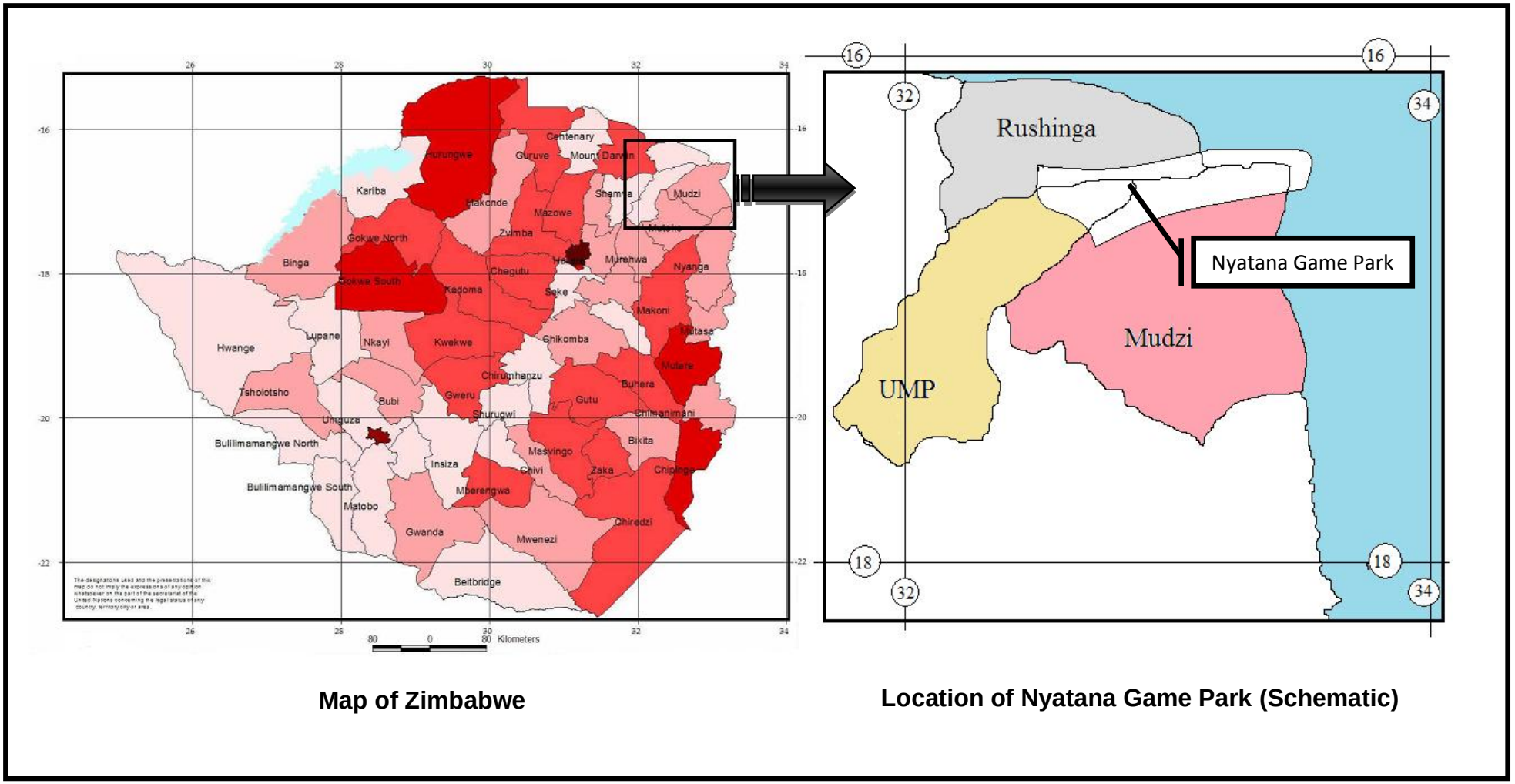


Figure 2.3: Study Location Map: Nyatana Game Park

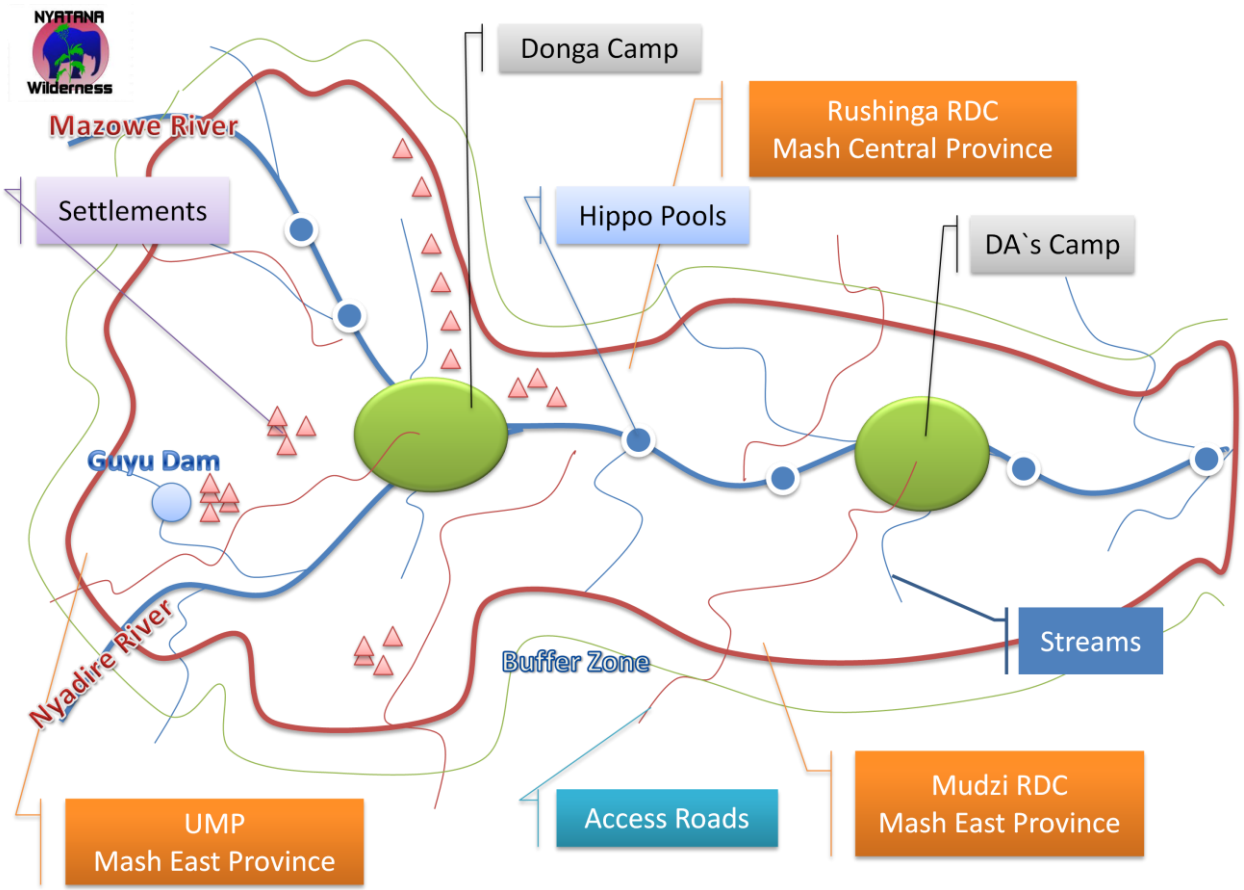


Figure 2.4: Schematic Map of Nyatana Game Park

2.1 District demographic and agro-ecological summaries

2.1.0 UMP district

This section provides the demographic and agro-ecological summaries for the three districts that share boundaries with Nyatana Game Park. Mashonaland East Province has a total estimated surface area of 32 230km^2 with an estimated population of 1 127 413 (Central Statistics Office (CSO), 2002a; Utete, 2003). In terms of administration districts, the province has a total of nine districts, viz: Chikomba, Goromonzi, Marondera, Mudzi, Murehwa, Mutoko, Uzumba Maramba Pfungwe (UMP), Seke and Wedza (CSO, 2002a). Mashonaland East Province lies in agro-ecological regions IIa to IV, which makes it suitable for intensive crop farming, dairy, horticulture and the production of small grains (Utete, 2003).

UMP district is geographically located 176 km north east of Harare the capital city of Zimbabwe, 91km to the north east of Murehwa district along the Murehwa-Madecheche highway (Taruvinga, 2009). According to Utete (2003), the entire district is wholly communal with agriculture and mining as the major livelihood sources. CSO (2002a) estimated that the entire district had a population of 104 336 with three communal areas and a sex ratio[2] of 91,53. Of the three communal areas, only one communal area (Pfungwe) shares boundaries with Nyatana Game Park.

2.1.1 Mudzi district

Mudzi district is located approximately 200km north east of Harare, along the Harare-Nyamapanda highway. CSO (2002a) estimated that the entire district had a population of

[2] Sex ratio, according to CSO, (2002a) may be defined as the average number of males per 100 females: a number above 100 therefore indicates an excess of males over females while a ratio below 100 depicts the opposite.

128 174 people and three communal areas with a sex ratio of 92,05. One communal area from Mudzi district (Mudzi north) shares boundaries with the Nyatana Game Park. Utete (2003) noted that the entire district was also wholly communal with agriculture and mining as its major livelihoods sources.

2.1.2 Rushinga district

Mashonaland Central Province has a total estimated surface area of 28 347km^2 with an estimated population of 998 265 (Central Statistics Office (CSO), 2002b). In terms of administrative districts the province has a total of eight districts, viz: Mbire, Guruve, Muzarabani, Mazowe, Mt Darwin, Rushinga, Bindura and Shamva (CSO, 2002b). Rushinga district is located approximately 286km to the north east of Harare. The district which is wholly communal had an estimated population of 67 134 people (CSO, 2002b) with agriculture and mining as the main livelihood sources. Four communal areas share boundaries with Nyatana Game Park (Utete, 2003).

2.2 Agro-ecological summary

Nyatana Game Park is located in agro-ecological region IV. Daily ambient temperatures are high with maximum summer temperatures of 40^{o}C and a minimum of 11^{o}C with no incidence of frost (Ministry of Agriculture, 2009). Rainfall is very erratic with an annual total of 450mm, most of it occurring between December and January, as shown in Figure 2.5. This is normally poorly distributed across the growing season, thus making rain fed crop cultivation a risky venture. Livestock farming is, however, a successful venture as a result of "sweet *velds"* and high browse value from the *Colophospermum mopane* and *Acacia* species which are dominant in this area. Figure 2.5 provides summaries of rainfall and temperature

estimates for the Nyatana Game Park based on averages provided by the Ministry of Agriculture district database for the three districts.

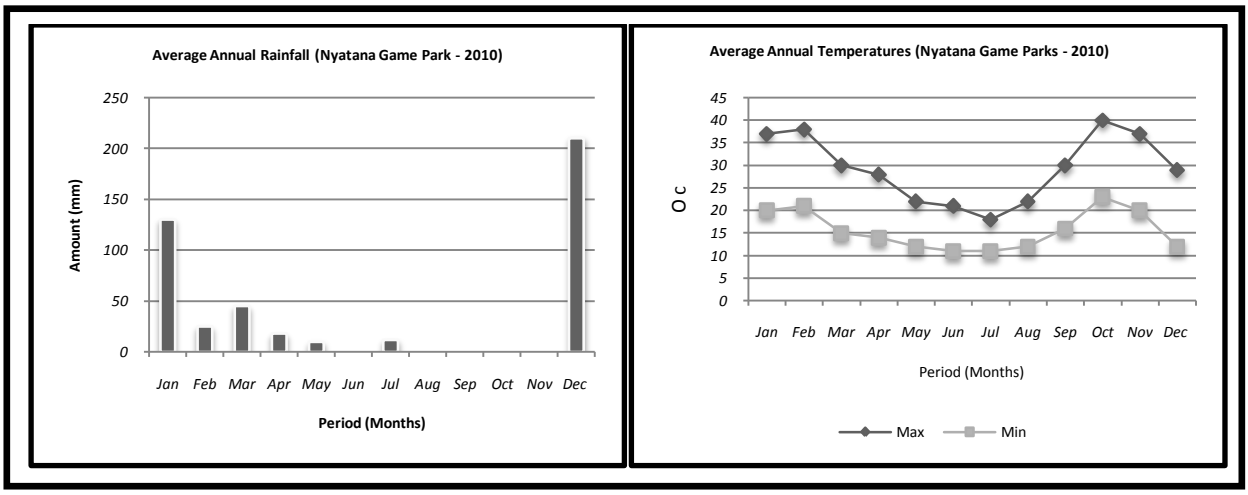


Figure 2.5: Rainfall and temperature estimates for Nyatana Game Park

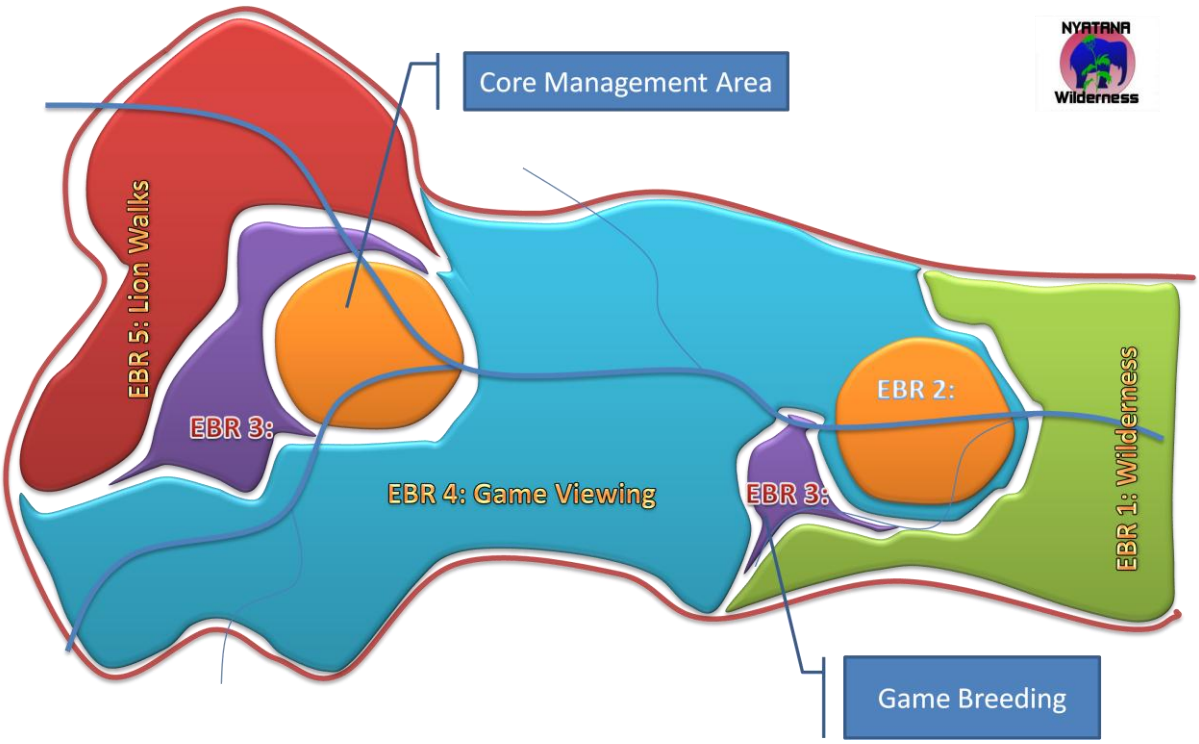
Source: Ministry of Agriculture, (2010)

2.3 Vegetation codding

Vegetation type and composition data were collected at randomly selected points within the study area. Standardised vegetation monitoring plots, measuring 15 by 15 metres, were randomly generated. Selection of the plots was based on a stratified random sampling technique using geology as means to identify respective strata.

The study identified four major geological formations within the study area and then applied a random selection technique to determine sampling points within each strata. Navigation to the randomly selected points was done using a hand-held GPS. Within each plot, the study identified and counted all woody plants and later calculated plant densities within each plot. By combining this information with field knowledge, the study produced a vegetation map, as captured in Figure 2.6. Note that riverine vegetation occured roughly along the drainage network, implying that no specific demarcation was done on the generated vegetaion map in Figure 2.6. Effectively, four major vegetation types were observed from the game park as

follows: (a) Miombo/Mopane mixture, (b) Miombo woodland, (c) Mopane woodland, (d) Riverine woodland.



Major Physiognomic Vegetation types from Nyatana Game Park

- EBR1*: Miombo* Woodland
- EBR2: Highly modified as a result of infrastructural development
- EBR3: *Savanna* Woodland
- EBR4: *Mopane* Woodland
- EBR5: *Miombo* & *Mopane* Mixture

Figure 2.6: Vegetation types from Nyatana Game Park

Source: Author schematically generated

The highest density of trees was observed in the Riverine type of vegetation as summarised in Figure 2.7. Common tree species identified in this vegetation class include the *Dichrostachys*

cineria, Acacia karoo and *Acacia ataxacantha* forming dense thickets along the main streams which, however, are dry during the driest months of the year.

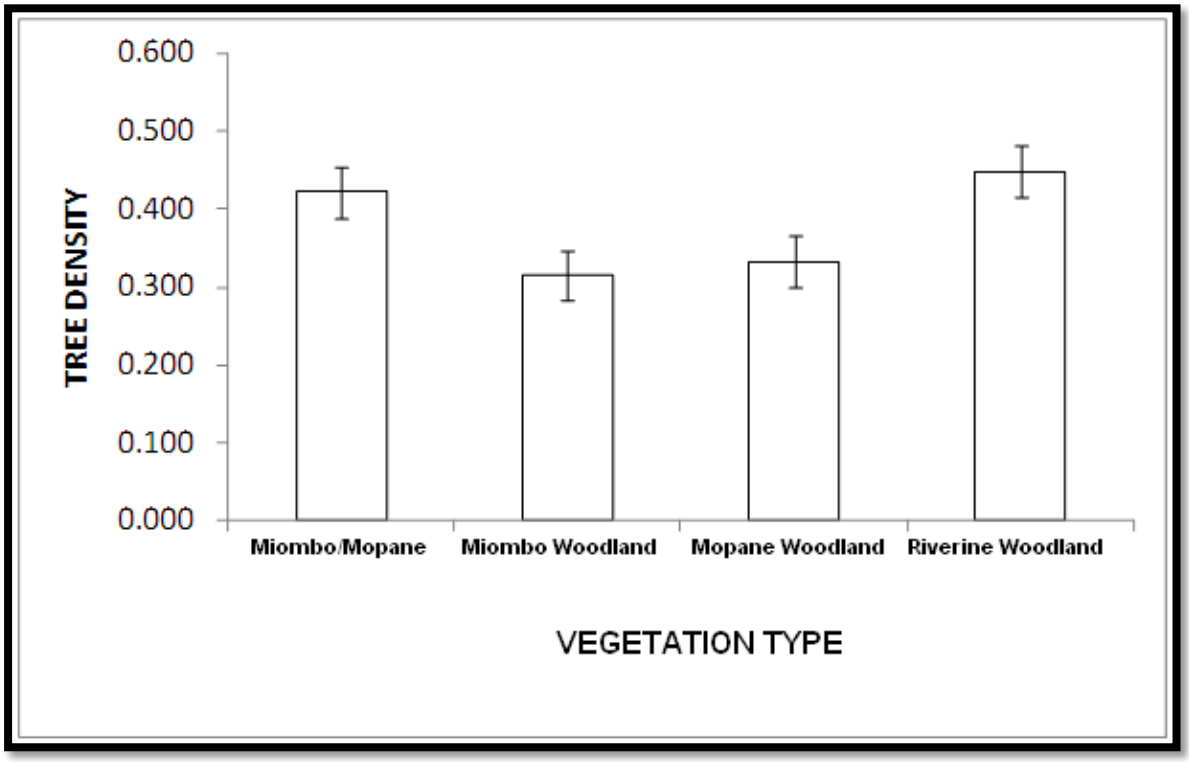


Figure 2.7: Tree densities within major vegetation types

Miombo/*Mopane* mixture had the second highest trees as illustrated in Figure 2.7. Common tree species in this class include the *Julbernadia globiflora, Brachystegia speciformis, Terminalia sericea* and *Colophospermum mopane*.

Miombo and M*opane* woodland vegetation classes had the lowest tree densities of the four vegetation classes as summarised in Figure 2.7. Common tree species in the *Miombo* woodland type include the *Julbernadia globiflora, Brachystegia speciformis and Terminalia sericea.* *Xeromphis obovata* emerged as the most dominant species in the shrub layer especially in the disturbed agricultural areas. On the other hand, *Colophospermum mopane* was the most dominant tree species in the *Mopane* woodland class.

2.3.0 Grass Species

Grass types occurring from the study area were identified in this assessment and their relative abundance was estimated within quadrants, measuring 1 by 1 metre. A stratified random sampling method was used in identifying sampling points based within the four dominant vegetation types identified above. The main assumption to the grass-animal link was that the dominant grass type occurring at a site is related to the types of animal life utilising the sites. For example, high relative abundance of fibre and nutrient rich grass types can support good assemblages of ungulates. On the other hand, nutrient rich soils have the capacity to support a nitrogen rich grass type which, in turn, attracts the presence of herbivores.

Aristida canescens and *Pogonathria squarossa* emerged as the most dominant grass types, with the former dominating *Mopane* woodlands while the latter dominating the *Miombo* vegetation types. Both grass types are poor forage species and thus do not attract significant levels of herbivores. The two grass species combined contribute more than 50 percent of the total grass biomass while the rest of the grass species comprise less than 50 percent of the total grass biomass, as captured in Figure 2.8.

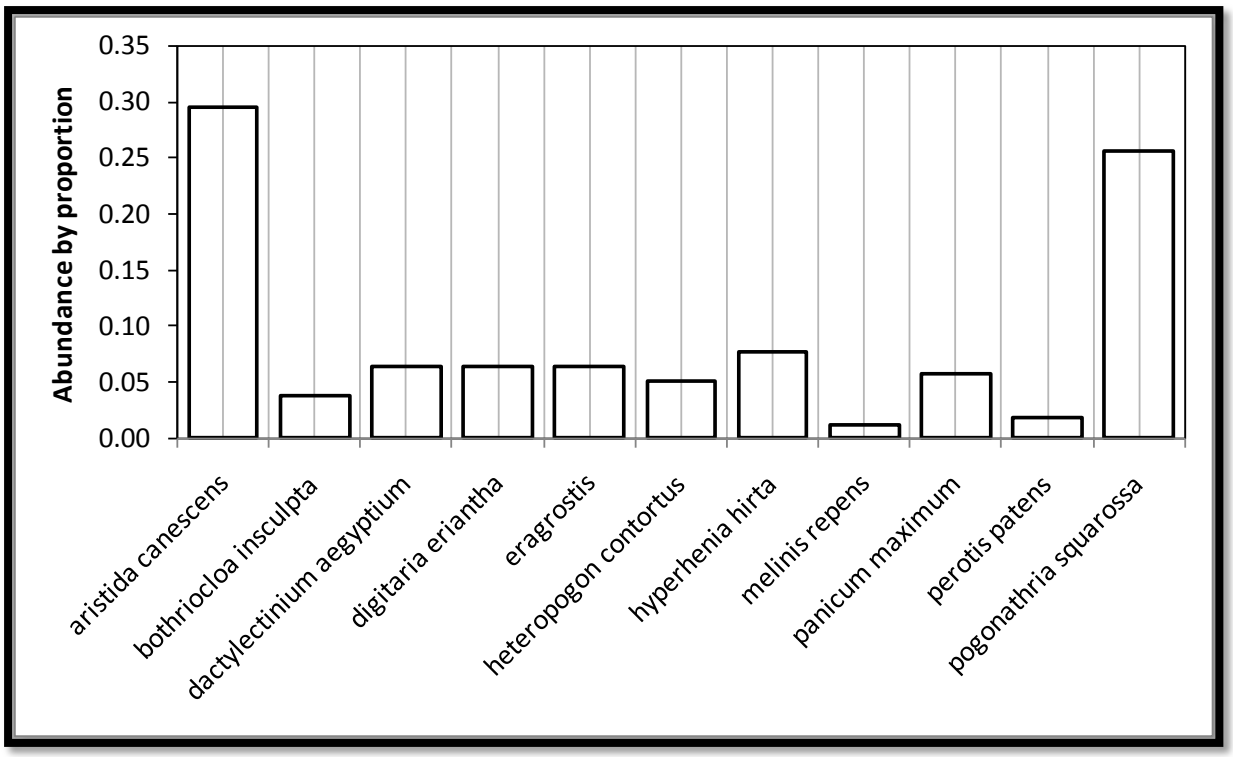


Figure 2.8: Relative abundance of common grass species

2.4 Justification for the study site

Nyatana Game Park is one of the oldest community managed CAMPFIRE projects in Zimbabwe, covering an estimated 75,000 hectares stretching across two Provinces and covering three districts (NJMT, 2010). In addition, the project is managed under both consumptive and non consumptive ecotourism approaches with trophy hunting as the main revenue generator for the Game Park (NJMT, 2011). The entire game park does not have a boundary fence; this implies that game animals and surrounding communities easily interact, occasionally. The Park has an estimated elephant population of 200 (Muchapondwa, 2003) and, more recently, 300 (NJMT, 2011).

Nyatana Game Park has an active buffer zone boundary which is partially agreed upon between the safari operator and surrounding communities (Mudzi district – Chingamuka area; UMP district Nyanzou area) in some areas, while in other areas communities oppose the

current buffer zone boundary (UMP district Dewe and Masunzwa area; the whole of Rushinga district) (NJMT, 2010). Local CAMPFIRE Communities (LCC) are also active in some areas (Mudzi district) and missing entirely in others (Rushinga district and part of UMP district). The Park has some pockets of illegal communities who have managed to illegally resettle themselves inside the Park – UMP and Rushinga districts. With this background, the study therefore assumes that a fair representation of the "human-wildlife interaction model" could be estimated using the Nyatana Game Park as a case study.

2.5 References

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Chapter Three

Livelihood adaptation choices, constraints and correlates of adaptation choices for households who share boundaries with game parks: Can game parks be trusted as livelihoods sources?

Abstract

The study investigated livelihood adaptation choices, possible constraints and correlates of adaptation choices for households who share boundaries with Nyatana Game Park in Zimbabwe. The motivation of the study was based on conflicting conclusions that surround the practical potential of game parks to address livelihoods in rural areas. Based on household survey data obtained between November and December 2010, the results suggest that game parks may not be trusted as a reliable and sustainable livelihood source due to low returns and insecure property rights.

The multinomial logistic regression model for correlates of livelihood adaptation choices suggests that gender, financial status, market and age may increase the likelihood of households choosing the mineral portfolio with the exception of the latter that may decrease this likelihood. Also, results further suggest that gender, extension and land size may decrease the likelihood of households choosing the flora portfolio with the exception of the latter that may increase the likelihood. Lastly, results suggest that access to market for fauna activities (game farming) may decrease the likelihood of households choosing the fauna portfolio.

The study results therefore suggest that while game parks may be possible livelihood sources for rural communities who share boundaries with open wildlife reserves as suggested in the literature, current gains may be far too low, indirect and unreliable in comparison to the

associated social costs of having game parks. In essence, if this scenario remains, rational households may find it difficult to consider game farming as a livelihood source worth choosing. Strategies to unlock the total economic value hidden in game parks for the direct benefit of surrounding communities may, therefore, be the missing critical policy intervention strategy. Strategies to lower the associated social costs of having game parks may be equally important to households; this implies reducing human-wildlife conflict so that the accrued benefits remain higher to attract the willingness of households to consider game parks as reliable and sustainable.

Full devolution of user rights to local communities from the current statutory rights to use natural resources as part of a local authority, may be another missing policy link which makes game farming an insecure and risky venture for the surrounding communities. The current status quo of game parks in relation to surrounding communities (insecure property rights, low and unreliable revenue amidst high social costs) may therefore provide no incentive for communities to consider them as a livelihood adaptation option. In essence, there seems to be a high incentive to destroy game parks because they interfere with other sustainable livelihood sources which are critical for the survival of communities (crop damage and livestock predation).

Key words: Livelihoods adaptation choices, game parks as livelihoods sources

3.0 Introduction

Most rural areas in the marginal areas of Zimbabwe are characterised by adverse climatic conditions (Child, 1995; Rukuni *et al*. 2006). These conditions are typically characterised by high temperatures with low rainfall that is poorly distributed across the growing season of most crops (Bradley and McNamara, 1993). Also, soils are inherently poor as they consist primarily of sand soils with a lot of rock out-crop in the plough zone. Crop farming is therefore a gamble in these areas, a condition that significantly affects livelihood sources for most rural communities who are farmers by default (Bradley and McNamara, 1993).

Ellis (2000) noted that farming, on its own, does not provide a sufficient means of survival in rural areas. Effectively, most households from rural areas depend on a diverse portfolio of activities and income sources skewed in favour of natural resources, in order to complement farming (Ellis, 2000). Unfortunately, most of these natural resource activities, in rural areas, are not institutionally supported to enhance the livelihoods of rural communities for most African governments have been trying to foster farming activities (Carswell, 2000) at the expense of non-farm activities.

Against this backdrop, the livelihoods adaptation capacity of households may, therefore, strongly depend on the availability of adaptation choices, the constraints associated and communities` perceptions of the various portfolio diversification activities. In an effort to boost livelihood sources in the rural areas of Zimbabwe, formalised community managed Game Parks under the banner of Communal Areas Management Programmes for Indigenous Resources (CAMPFIRE) principles were established (Muchapondwa, 2003).

Literature suggests that game parks, in principle, could provide a potential livelihood source (Fernandez *et al.* 2009). This is specifically applicable to rural areas where wildlife is abundant and its management authority has been devolved to local communities; the likes of

CAMPFIRE in Zimbabwe (Gadgil and Rao 1995) and Game Management Areas (GMAs) in Zambia. Mixed reporting, however, dominates the practical potential of community managed game parks as livelihoods sources, (Muchapondwa, 2003). Many researchers therefore caution against blanket success recommendations on the gains of community-based wildlife conservation (Child, 1995; Patel, 1998; Hasler, 1999), based on flagship examples.

In this regard, and for the purpose of understanding the practical potential of community managed game parks as livelihoods sources in rural areas, this study was tailor-made to consider households sharing boundaries with an operational community managed game park. The study surveyed 240 households from the Uzumba Maramba Pfungwe (UMP), Mudzi and Rushinga communal areas of Zimbabwe, surrounding Nyatana Game Park. The objective was to assess livelihood adaptation strategies, possible constraints to adaptation choices and the socio-economic as well as institutional factors capable of influencing adaptation choices for surrounding communities.

These three communal areas (UMP, Mudzi and Rushinga) surround Nyatana Game Park, a wilderness area of approximately 75000ha [Nyatana Joint Management Trust (NJMT), 2011]. The entire game park is managed under consumptive and non consumptive ecotourism using CAMPFIRE principles with elephant trophy hunting as the main economic activity (NJMT, 2011). The study primarily aimed to generate policy information regarding households` livelihoods adaptation strategies and policy targeting on enhancing the adaptation capacities of rural households who share boundaries with game parks.

3.1 Problem statement

Community managed game parks have been created on the assumption that possible ecotourism revenue may act as a livelihood source for surrounding communities capable of promoting wildlife conservation (Gadgil and Rao 1994, 1995; Muchapondwa, 2003;

Fernandez *et al*. 2009). However, in practice, game parks seem to have failed to generate the necessary and sufficient revenue to address livelihood requirements for the ever-growing "livelihood-hungry" surrounding rural communities.

Several studies, therefore, question the practical potential of community game parks to address the livelihoods of their surrounding communities (Child, 1995, Patel, 1998 and Hasler, 1999). The current rampant elephant poaching (Wasser *et al*. 2010), under community managed game parks, and the invasion of game parks by surrounding communities may be clear warning signals of the failure of community managed game parks to act as a livelihood source.

Therefore, the need arises to evaluate the potential of game parks as community livelihood sources, the associated constraints and socio-economic correlates of livelihood adaptation choices for communities who share boundaries with community managed game parks.

3.2 Research objectives and hypotheses

The study addressed the following research objectives;

1. to identify livelihood sources for communities that share boundaries with game parks,
2. to identify the barriers faced by households as they try to adapt to available non-farm livelihood sources and
3. to estimate the correlates of households` livelihoods adaptation choices.

The first objective was motivated by the need to evaluate the potential of game parks to provide a significant livelihood source for rural communities given the mixed conclusions that surround the potential of game parks as livelihood sources (Child, 1995; Patel, 1998; Hasler, 1999). The study hypothesized that, game parks under the banner of the fauna

portfolio are one of the major non-farm livelihood adaptation strategies for surrounding communities.

The motivation behind the second objective was centred on the assumption that the reluctance of rural households to adapt to several livelihood options, that may appear lucrative, may be due to constraints that make those livelihood sources risky in the minds of the local communities. Effectively, the study hypothesized that, non-farm livelihood adaptation choices may be conditioned by institutional variables like property rights and markets.

Lastly, the study estimated the socio-economic and institutional factors that may influence the adaptation choices of communities. This objective was motivated by the quest to understand the direction of association and significance of several socio-economic and institutional factors capable of "pushing" communities out of on-farm livelihood activities into non-farm choices. Household socio-economic variables, like household-head age, gender and education were therefore hypothesized to condition this possible transition.

3.3 Related Literature

Several studies of livelihoods sources, at the household level, broadly classify livelihood strategies as agricultural intensification, diversification and migration (Valentine 1993; Adams and He, 1995; Dercon and Krishnan, 1996; Barrett *et al.* 2001; Galab *et al.* 2002; Adugna, 2005; Berehanu, 2007). Diminutive attention is, however, given to the specifics of what comprises the non-farm activities and under which localities these are constituted. As a result, gaps still exist in literature with regard to the specific activities that comprise the non-farm activities at various household localities, their relative contribution and factors inhibiting their adoption.

Many studies also report the general influence of household and institutional factors towards the adaptation of livelihood strategies, ranging from gender, education to credit and extension (Bezemer and Lerman, 2002; Rao *et al.* 2004; Holden *et al.* 2004; Brown *et al.* 2006). More effort is, however, focused on econometric modelling with regard to the direction and significance of influence at the expense of soliciting for specific reasons, as reported by respondents.

More often than not, policy insights based on such approaches bear errors of commission and omission. Thus, this study targets the non-farm livelihood activities, as reported by households sharing boundaries with an operational community managed game park, with the implicit goal of understanding locality based livelihood adaptation strategies.

3.4 Methodology

The study was conducted in Mashonaland East and Central Provinces of Zimbabwe, specifically focusing on the three districts that surround Nyatana Game Park. Two hundred and forty households were randomly selected from "cluster A" that share boundaries with Nyatana Game Park (UMP = 80 respondents; Mudzi = 80 respondents; Rushinga = 80 respondents). For purposes of understanding households` livelihoods adaptation strategies, stratified (based on districts) and randomly selected respondents from the three districts under "cluster A" were asked about their livelihood adaptation strategies using open-ended questions.

Accordingly, four livelihood adaptation categories were created, as detailed below. This paved the way for an analysis of the contribution made by each adaptation strategy. The created livelihood adaptation categories were further treated as the dependent variable in the multinomial logistic regression model. This was done to enhance the estimation of the

manipulative and directional power of households and institutional factors that may influence households` adaptation choices.

3.4.0 Livelihood adaptation choices at household level

Ellis (2000) defined livelihood as comprising assets (natural, physical, human, financial and social capital), activities and access to these (mediated by institutions and social relations) that together determine the living gained by households. Chambers and Conway (1992) define livelihood as the capability, assets and activities required for a means of living. This study considers the latter, narrow definition of livelihood specifically looking at activities deemed critical for a means of living at the household level. Livelihood adaptation, according to Davies and Hossain (1997), may be defined as the continuous process of changes to livelihoods (assets and activities) which either enhance existing security and wealth or try to reduce vulnerability and poverty. With reference to the livelihood adaptation choices reported by residents from the selected wards, four categories were created, namely:

(a) Mixed farming portfolio representing an aggregate of choices undertaken to spread risk to include, (i) field crop production mainly small grains, (ii) horticulture, wetland, cultivation, and (iii) animal production mainly cattle, goats, sheep and poultry.

(b) Mineral portfolio summarising an aggregate of choices undertaken to spread risk to include, (i) small scale gold mining, (ii) gold panning that is abundant in the form of alluvial in most streams and rivers in the three districts, and (iii) any other mining activity.

(c) Flora portfolio representing an aggregate of choices considered to spread risk to include (i) collection of wild fruits, (ii) processing of wild fruits, (iii) collection of wild mushrooms, (iv) collection of wild edible leaf vegetables, (v) timber, (vi) collection of reeds and (vii) firewood.

(d) Fauna portfolio summarising an aggregate of choices considered critical for spreading risk to include, (i) community CAMPFIRE game proceeds, (ii) beekeeping (iii) hunting of small mammals, birds and reptiles, (iv) collection of caterpillars and termites, (v) fishing, and (vi) collection of bat droppings used as organic manure.

The mixed farming portfolio was treated as the base category in this study because crop and livestock production are the common household livelihood adaptation strategies in rural areas (Bradley and MacNamara, 1993; Ellis, 2000). This implies that almost every one considers this adaptation portfolio as a livelihood source although it is not secure. In this study, efforts were targeted at understanding the potential of households to consider other portfolio diversification strategies, specifically game farming (game parks) as defined by the fauna portfolio. It is against this background that the mixed farming portfolio was treated as the base, or reference category.

3.4.1 Econometric modelling

A decision regarding whether or not to choose any livelihood adaptation strategy was assumed, in this study, to fall under the general framework of utility and profit maximisation. Taking the case of a rational household, which seeks to maximise the present value of expected benefits of production over a specified time, and that must choose among a set of *j* livelihood adaptation options, household *i* would rationally be expected to use *j* livelihood adaptation option if the perceived benefit from option *j* is greater than the utility from other options (say, *k*) depicted, as suggested by Gbetibouo, Hassan and Ringler (2010) in equation 3.1.

$$Uij\left(\beta_j^{\prime} X_i + \varepsilon_j\right) > Uik\left(\beta_k^{\prime} X_i + \varepsilon_k\right), k \neq j \quad \ldots\ldots (3.1)$$

Where;

- U_{ij} and U_{ik} shall be the perceived utility by household *i* of livelihoods adaptation options *j* and *k* respectively
- X_i shall be the vector of explanatory variables that influence the choice of adaptation option
- β_j and β_k shall be parameters to be estimated
- ε_j and ε_k shall be error terms

Based on the revealed preference assumption that the household practices an adaptation option that generates net benefits, and does not practice an adaptation option otherwise, the study relates the observable discrete choice of practice to the unobservable (latent) continuous net benefit variables as $Y_{ij} = 1$ if $U_{ij} > 0$ and $Y_{ij} = 0$ if $U_{ij} < 0$ (Gbetibouo, Hassan and Ringler, 2010).

Based on this formulation, *Y* shall be a dichotomous dependent variable, taking the value of 1, when the household, chooses an adaptation option in question and 0 otherwise. Effectively, the probability that household *i* will choose livelihood adaptation option *j* among the set of livelihood adaptation options shall be defined as follows (Gbetibouo, Hassan and Ringler, 2010);

$$P(Y = 1/X) = P(U_{ij} > U_{ik}/X) \quad \text{.....(3.2)}$$

$$= P(\beta_j^{\backprime} X_i + \varepsilon_j - \beta_k^{\backprime} X_i + \varepsilon_k > 0/X)$$

$$= P(\beta_j^{\backprime} - \beta_k^{\backprime})X_i + \varepsilon_j - \varepsilon_k > 0/X$$

$$= P(\beta^{*}X_i + \varepsilon^{*} > 0/X) = F(\beta^{*}X_i),$$

Where;

- ε^* shall be a random disturbance term

- β^* treated as a vector of unknown parameters that can be interpreted as the net influence of the vector of explanatory variables influencing adaptation
- F ($\beta^* X_i$) shall be the cumulative distribution of ε^* evaluated at $\beta^* X_i$.

With reference to utility measurement, O' Sullivan, Sheffrin and Perez (2006) explain that it is difficult to measure utility directly; it is therefore assumed, in this study, that households make livelihood adaptation choices depending on the option that maximizes their utility. That is, subject to household socio-economic and institutional factors, decisions to choose the mineral, floral or fauna portfolios from the mixed farming portfolio signifies the direction which maximizes their utility. Based on this assumption, multinomial logistic regression was used to relate the decisions to adapt in mineral, flora or fauna portfolios from the mixed farming portfolio strategy and household socio-economic and institutional factors that influence these choices.

Following an approach used by Gbetibouo, Hassan and Ringler (2010), the probability that household i with characteristics X chooses livelihood adaptation portfolio option J is therefore specified as follows;

$$Pij = prob\ (Y = 1) = \frac{e^{x`\beta}}{1+\sum_{j=1}^{j} e^{x`\beta}}, j = 1 \ldots\ldots..j, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots..(3.3)$$

Where;

- β is the vector of parameters that satisfy $\ln(P_{ij}/P_{ik}) = X`(\beta_j - \beta_k)$.

Greene (2003) notes that to avoid bias and maintain consistent parameter estimates of the multinomial logistic model in equation 3.3, (given the true reality that a household can choose more than two adaptation strategies) the assumption of independence of irrelevant

alternatives (IIA)[3] must hold. By differentiating equation 3.3 with respect to each predictor variable, the marginal effects of these variables may also be estimated as shown in equation 3.4.

$$\frac{\partial P_j}{\partial x_k} = P_j \left(\beta_{jk} - \sum_{j=1}^{j-1} P_j \, \beta_{jk} \right) \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \text{(3.4)}$$

3.4.2 Model variables and hypothesis to be tested

Mixed farming portfolio was treated as the baseline group taking the value of 0, mineral portfolio 1, flora portfolio 2 and fauna portfolio 3. Explanatory variables were chosen based on data availability and inferred conclusions from other similar studies. Table 3.1 gives a summary of explanatory variables and their expected direction of influence on adaptation choices.

Household characteristics

Barrett *et al.* (2001) note that education was one of the most important determinants of non-farm earnings, especially in more remunerative and skilled employment in rural Africa. Contrary to this, Galab *et al.* (2002) and Berehanu (2007) report a negative association between education and diversification into non-farm activities. Comparable conclusions were also inferred by Muchapondwa (2003) who notes that the more educated households become, the more unlikely they are to participate in non-farm activities like elephant management programmes. Either a positive or a negative association was therefore conjectured for this variable in this study.

[3] The IIA assumption requires that the likelihood of a household using a certain adaptation strategy needs to be independent of alternative adaptation strategies used by the same household. Thus, the IIA assumption implies independent and homoscedastic disturbance terms of the adaptation model in Equation (1) (Gbetibouo, Hassan and Ringler, 2010).

With regard to age, Rao *et al.*, (2004) observe a negative relationship between age and willingness to diversify into non-farm livelihood sources. Lack of agricultural land may be the pushing factor for young households which may opt to consider other livelihood sources. Depending on the nature of available non-farm activities, Vedeld *et al*., (2004) and Kohlin and Parks (2001) further argue that older people may lack the physical strength and time to engage in most non-farm, forest activities. A negative correlation was, therefore, expected for this variable.

Several studies suggest that female headed households may be less likely to participate in non-farm activities mainly because of culture, social mobility limitations and differential ownership/access to assets (Galab *et al.* 2002; Adugna, 2005). In contrast, literature also suggests that women in general may be more willing to participate in common pool property resources than men and may be more involved in gathering activities than men (Folbre, 1994; Grossman, 1996; Narain *et al*. 2005). With this background, either a positive or a negative influence was expected for this variable in the study.

With reference to the wealth status of households, Tembo, Bandyopadhyay and Pauy (2009) observe that rich and educated community members may be more likely to participate in community resource boards, lending support to the positive correlation between wealth status and participation in non-farm activities. Earlier, Adhikari (2005) has noted that household wealth endowment may be expected to influence benefits from forests directly, as productive wealth creates more opportunities for better-off households to use biomass resources. In addition, several studies suggest that wealthier households, with larger herds of cattle and more land, may have a greater need for animal fodder and agricultural compost (Varughese and Ostrom, 2001; Narain *et al*. 2005). A positive association was therefore conjectured for this variable in the study.

Institutional and other factors

Samuel (2003) reports a positive association between frequency of extension services and diversification into non-farm activities. Similar earlier conclusions were inferred by Gaspert *et al*., (1999) who suggest that access to institutions may enhance awareness of the potential gains from forests. More recently, Adhikari (2005) further argues that access to institutions raise awareness on policy information that may directly affect forest communities. A positive association was, therefore, expected for this variable.

Recent observations suggest that communities` willingness to participate in non-farm actives may be based on the ability of exchanging resultant non-farm extracts in a competitive market for income generation (driven demand). The availability of markets for non-farm products may reduce risks and act as a livelihood source guarantee with respect to the specific non-farm livelihood source supported by the market, from a community point of view. Therefore, a positive link was expected for this variable.

Several studies reveal that the larger the land size, the less likely will owners be willing to diversify into other non-farm activities (Lanjouw and Lanjouw, 1995; Berehanu 2007), provided that owners are getting meaningful returns. On the contrary, several studies suggest a positive association based on the complementary nature of the farming system and forests (Fisher, 2004; Adhikari, 2005) notably agricultural compost (Varughese and Ostrom, 2001; Narain *et al*. 2005). Either a positive or a negative association was, therefore, conjectured for this variable.

Table 3.1 presents a summary of the variables expected to influence the adaptation choices of households. A brief description of each variable is given together with the unit of measurement and the expected sign.

Table 3.1: Variables hypothesised to affect adaptation choices of households

Variable	Description and Measurement	Unit	Expected sign
Household characteristics			
1. Education	Level of education classified as follows; uneducated, educated to primary level; educated to secondary level and above	Uneducated = 0; educated to primary level = 1; educated to secondary level and above = 2	-/+
2. Age	Age of household-head	Years	-
3. Gender	Household head gender	1 = male , 0 female	-/+
4. Wealth status	An index was constructed using household`s ownership of 6 agreed livelihoods strategic assets[4]. Those with a score < 3 were deem rural poor and those with a score ≥ 3 deemed rural rich	0 = Poor , 1 = rich	+
Institutional factors			
1. Extension	Access to extension	1 = yes, 0 = no	+
2. Market	If markets exists for natural resources to be traded competitively	1 = yes, 0 = no	+
Other factors			
1. Land size	Estimate of size of farming area (≤ 2ha deemed small and > 2ha deemed large	1 = small land size , 2 = large land size	-/+

[4] Kabubo-Mariara (2008) notes that a more permanent measure of classifying rural communities into either rich or poor may be one that takes into account more permanent measures of wealth such as land holding, livestock units and other fixed assets. It is against this background that this study used the following six livelihood strategic assets as suggested by local communities from the study area: (a) Land holding, (b) Total livestock units, (c) Farm capital inputs, (d) Household assets (e) Quality of dwelling (f) Household-head`s education

3.5 Results and discussion

This sub-section presents study results initially based on descriptive findings and econometrics results latter.

3.5.0 Descriptive results

This section provides descriptive results with respect to livelihood adaptation choices, as reported by respondents from the study area. The section begins by summarising statistics for the basic sample characteristics for purposes of understanding the distribution of key sample variables. Major constraints faced by respondents were also noted with the objective of understanding the potential barriers facing communities as they try to adapt to various livelihood strategies. Using graphs, the study also explored the portrayed distribution of various household variables with respect to livelihood choices.

Table 3.2 provides the basic sample characteristics from the study area. A total of 240 respondents were considered for this study with a mean household-head age of 37 years. The median education level was 1, implying that, on average, respondents were educated up to a primary level. Basic sample statistics also suggest that the considered sample had more males than females. The asymmetry of distribution was both positively and negatively skewed, as shown in Table 3.2. Livelihood choices, education, age and extension were positively skewed, while gender, wealth status, market and land size were negatively skewed. Most of the characteristics had skewness values below 1, with the exception of gender and extension; this suggests that the distribution did not differ significantly from a normal symmetric distribution.

Table 3.2: Basic sample characteristics from the study area

Statistics								
	Livelihood Choices	Education	Age	Gender	Wealth Status	Extension	Market	Land Size
N	240	240	240	240	240	240	240	240
1. Mean	.87	.85	37.10	.78	.53	.28	.69	1.60
2. Median	1.00	1.00	31.00	1.00	1.00	.00	1.00	2.00
3. Std. Deviation	.910	.794	12.174	.418	.500	.447	.463	.490
4. Skewness	.805	.275	.641	-1.325	-.101	1.014	-.835	-.429
5. Minimum	0	0	22	0	0	0	0	1
6. Maximum	3	2	56	1	1	1	1	2

Key:

- **Livelihoods Choices:** 0 = mixed farming; 1 = mineral portfolio; 2 = flora portfolio; 3 = fauna portfolio
- For other variables coding is as described in Table 3.1

3.5.1 Livelihood adaptation choices

This section focuses on reported livelihood adaptation choices from the study area. Livelihood adaptation choices were investigated against a null hypothesis that fauna portfolio diversification provides a significant livelihood source for communities that share boundaries with game parks. Table 3.3 summaries the descriptive results of livelihood adaptation choices as reported by households who share boundaries with Nyatana Game Park.

Four major livelihood portfolio strategies (mixed farming, mineral, flora and fauna) were common in the three communal areas. The descriptive findings reveal that mixed farming was the dominant livelihood adaptation choice (42.1% share) for most of the households. Similar comparable observations were inferred by Carswell (2000) who notes that

contributions made by off farm livelihoods in rural areas, has often been neglected by policy makers who have chosen to concentrate on agriculture.

Table 3.3: Reported livelihood choices from the study area

Reported livelihood choices					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1. Mixed Farming	101	42.1	42.1	42.1
	2. Mineral Portfolio	86	35.8	35.8	77.9
	3. Flora Portfolio	37	15.4	15.4	93.3
	4. Fauna Portfolio	16	6.7	6.7	100.0
	Total	**240**	**100.0**	**100.0**	

In Latin America, several studies from Bolivia also observed that although there is a significant share of total household income from non-agricultural activities, agricultural production was still the most important source of income (Comisión Europea, 2000; Jimenez and Lizarraga 2003).

Respondents noted the significant potential of livestock production complemented by grazing land from the game park although predation, conflict with SO and disease outbreak were some of the potential threats. Cropping activities were largely confined to small grains and groundnuts with minor contributions implying that livestock production was the dominant activity. Although mixed farming was the dominant livelihood source (specifically livestock), respondents cited several challenges with respect to crop farming. These challenges include: crop invasion risk from game animals, unreliable rainfall, poor soils and low unreliable yields.

The mineral portfolio (gold panning) was the second best livelihood adaptation choice for most households after mixed farming, with 35.8% share. Respondents reported a lucrative

potential of small scale mining activities although this was deemed illegal. The "pull" factors, according to the respondents, were the quick returns (quick cash), specifically for alluvial gold, and easy entry requirements. Surprisingly, the participating (illegal miners) respondents were happy with the illegal nature of this activity, for the following reasons;

- if the mineral portfolio was formalised, local communities would lose illegal buyers that were offering higher prices,
- entry requirements would be complicated and they would prohibit local communities under formalised mining, and
- environmental management strategies required during and after the mining era would significantly reduce profits for the local community.

This was followed by the flora portfolio with a 15.4% share and, lastly, the fauna portfolio with a 6.7% share. The fauna portfolio was, to a large extent, defined by proceeds from the game park. Although all respondents were fully aware of the existence of the Nyatana Game Park, considering it as a livelihood adaptation choice was deemed risky and unreliable. Respondents labelled the game park as more of a pest than a livelihood source worth choosing. Similar findings were inferred by Muchapondwa, Carlsson and Kohlin (2008) who noted that 62% of the households from the Mudzi rural area in Zimbabwe, adjacent to Nyatana Game Park, did not support elephant preservation but rather preferred their translocation. Fernandez *et al.*, (2009) also noted that losses from crop damage by wildlife were a threat to some positive benefits from game parks.

Based on these limited descriptive results, the study therefore rejects the null hypothesis that fauna portfolio diversification provides a significant livelihood source for communities that share boundaries with game parks. Thus, there is no sufficient evidence to suggest that game

parks can be trusted as a strategic livelihood source for surrounding communities based on responses from sampled respondents.

3.5.2 Constraints to non-farm adaptation choices as reported by respondents

In this section, the study tries to uncover potential constraints faced by households in trying to adapt to non-farm livelihood sources. More attention was given to the "Fauna Portfolio" that was hypothesized to provide a significant livelihood source. Several constraints were reported from the three communities, as shown in Table 3.4.

The last column gives the average percentage share of each constraint across all districts and portfolios. An insecure property rights system, typical of most non-farm activities, was cited as the major barrier across all possible non-farm livelihood adaptation choices. Regardless of how lucrative livelihood sources may appear, if not supported by tradable and secure rights, such sources are normally deemed risky and insecure according to the respondents. The security of livelihood sources may therefore mean a lot to rural communities for their day-to-day survival seems wholly dependent on such livelihoods.

Effectively, insecurity in livelihood sources may translate into insecurity in their day-to-day survival. In this regard, households may therefore be rational by holding on to mixed farming activities where rights are more secure, even though these communities are faced with more threats than non-farm activities full of lucrative potential, but with insecure property rights.

Table 3.4: Constraints to adaptation choices as reported by respondents

Constraints	UMP			Mudzi			Rushinga			Average % share of constraints across all districts and portfolios
	Fauna	Flora	Min	Fauna	Flora	Min	Fauna	Flora	Min	
	% of the respondents									
1. No constraints	1	1	2	1	2	1	2	3	1	**1.56**
2. Restrictive policies	0	60	74	0	54	78	0	56	78	**44.44**
3. Lack of knowledge	10	35	17	5	20	74	7	56	82	**34.00**
4. Lack of credit to kick-start	0	8	66	0	32	54	0	21	67	**27.56**
5. Lack of formal market	0	45	90	0	77	85	0	89	100	**54.00**
6. Low returns	86	11	8	75	23	13	98	14	13	**37.89**
7. Limited extractable area	0	98	43	0	73	27	0	81	52	**41.56**
8. High risk	0	2	80	0	8	98	0	17	100	**33.89**
9. Insecure property rights	50	51	75	32	84	68	77	100	76	**68.11**
10. Lack of extension services	30	44	60	11	69	56	20	73	80	**49.22**
11. Poor infrastructural support	0	7	48	0	47	54	0	27	69	**28.00**
12. Other	4	0	9	0	2	6	0	2	1	**2.67**
% share of constraints / portfolio	**15.08**	**30.17**	**47.67**	**10.33**	**40.92**	**51.17**	**17.00**	**44.92**	**59.92**	
a) Pooled average % share of constraints for the Fauna Portfolio = 14%										
b) Pooled average % share of constraints for the Flora Portfolio = 39%										
c) Pooled average % share of constraints of the Mineral Portfolio = 53%										

Key: Min- mineral

With reference to the Fauna Portfolio of 50%, 32% and 77% of the respondents from UMP, Mudzi and Rushinga respectively, reported elements of insecurity in game farming and several fauna extracts from the game park. These results suggest that the devolved user rights to communities under CAMPFIRE principles may be procedural but not substantive. Although Muchapondwa (2003) noted that, under CAMPFIRE, people living in Zimbabwe's

marginalized communal areas essentially claim the same right of proprietorship as private landholders, but through their RDC. These results suggest that the application of such "technical principles"[5] at the grassroots level may be a challenge.

Thus, in as much as a private landholder may use a land title deed to claim ownership, Child *et al.*, (1997) argue that a villager on communal land only has statutory rights to use such resources as part of a local authority i.e. the RDC that has been granted Appropriate Authority (AA) status by the Department of National Parks and Wildlife Management. Full devolution of user rights may therefore enhance the non-farm livelihood adaptation choices of rural communities.

The lack of a formal market for most extractable game park natural resources was also cited as a second critical constraint by most respondents, with the exception of the Fauna Portfolio. Respondents noted the significant potential of the Flora Portfolio, specifically timber extracts (*Mopane* poles and fire wood) and forest edible products. Unfortunately, the available formal markets classify such products as illegal. From a legal perspective, the Zimbabwean Communal Lands and Forest Produce Act prohibits the commercial harvesting of all forest produce. The reported "missing markets" may therefore be a result of legal restrictions. Respondents suggested that the available flora products were too much for local usage and since their location were not suitable for cropping; the commercial sustainable harvesting of flora products supported by formal markets may significantly address their livelihoods.

With respect to the mineral portfolio, the lack of formal markets was also cited as a critical barrier which inhibits local communities. For this portfolio, gold panning from surrounding streams and, to a greater extent, from inside the game ark (Mazoe River) was the dominant activity reported from the three communities. In as much as those venturing in gold panning

[5] Claiming the right of proprietorship as private landholders, through their Rural District Councils

were comfortable with their illegal activities, for purposes of enjoying high "black market" prices and avoiding environmental mitigation measures, most aspiring respondents noted that they were deterred from such activities due to the lack of formal markets.

A lack of extension was also noted as a potential barrier across all portfolios. This development may not be surprising for the flora and mineral portfolio, mainly because of the current sectorial policy conflict. Extension officers teach the concept of domestic utilization of forest produce in line with procedures specified in the Communal Lands and Forest Produce Act. Contrary to this pure conservation approach, respondents suggested that due to their meagre livelihood sources, as a result of their location, the sustainable commercial harvesting of natural resources was the only hope. Unfortunately, no extension advice with respect to such approaches was available.

Restrictive policies were also cited as a potential barrier with respect to the flora and mineral portfolios. These findings suggest that the available environmental policies seem to be more skewed in favour of pure conservation, at the expense of actual utilisation with commercial components. The limited extractable area was also cited as a potential barrier; this suggests that the existing buffer zone may have, with time, become too small to accommodate an increasing number of surrounding communities.

The pooled percent share of constraints, per source of livelihood, suggests that the fauna portfolio may have the lowest constraints followed by the flora and, lastly, by the mineral portfolio, as shown in Table 3.4. Surprisingly, households were choosing other livelihood sources with higher constraint levels (mineral and flora) instead of the fauna portfolio with few barriers. These findings suggest that the few reported constraints for the fauna portfolio (low returns; insecure property rights) may be significant enough to deter respondents. Public policies that address issues of insecure property rights and meaningful returns may, therefore,

go a long way towards unlocking non-farm livelihood sources for rural communities. Specifically addressing the current reported low revenue, possible under game farming and full devolution of user rights to local surrounding communities, may promote the interest of local communities to participate in game farming, hence the conservation of wildlife.

Based on the descriptive statistics presented here, low returns and insecure property rights may be some of the major barriers deterring surrounding communities from choosing game farming as a reliable and sustainable livelihood source. Results further suggest that the mineral portfolio may, therefore, be a potential livelihood source in this area. These findings further provide sufficient descriptive evidence to reject the null hypothesis that game parks can be trusted as a livelihood source for surrounding communities, based on responses from the respondents.

3.5.3 Determinants of non-farm livelihood adaptation choices

In this section, the study presents descriptive results of estimated determinants of non-farm livelihood adaptation choices. The study focuses on the observed distribution of respondents by various household variables, with respect to their reported livelihood adaptation choices. This was against a null hypothesis that these household variables could influence the possible transition from mixed farming to other non-farm livelihood sources (mineral, flora, and fauna).

The level of education of the household-head was one of the variables conjectured to negatively condition the possible transition of households from mixed farming to other non-farm livelihood sources. Table 3.5 presents the distribution of respondents by education levels with respect to livelihood sources. The distribution, as shown in Table 3.5, suggests that education may negatively influence households` diversification into non-farm activities as a result of high risk associated with harvesting non-farm resources. These findings confirm

previous conclusions from comparable studies which note a negative association (Berehanu, 2007; Muchapondwa, 2003; Galab *et al*. 2002). Descriptive results reveal that a significant number (49%) of uneducated respondents prefer the mineral portfolio choice against the common livelihood strategy in the area (mixed farming – 27%). For all other categories the base reference point (mixed farming) was the dominant livelihood choice.

Table 3.5: Distribution of respondents by education with respect to reported livelihood choices

Crosstab					
		Education			Total
		Uneducated	Educated to Primary level	Educated to Secondary level and above	
Livelihood Choices	Mixed Farming	26 (27)	38 (45)	37 (62)	101 (42)
	Mineral Portfolio	47* (49)	36 (43)	3 (5)	86 (36)
	Flora Portfolio	12 (13)	6 (7)	19 (32)	37 (15)
	Fauna Portfolio	11 (11)	4 (5)	1 (1)	16 (7)
Total		**96 (100)**	**84 (100)**	**60 (100)**	**240 (100)**

*: potential influence; % in brackets

This was also further supported by a large number of educated respondents who preferred mixed farming against other non-farm portfolio options, as shown in Table 3.5. Respondents noted a high risk attached to the mineral portfolio and low returns for other non-farm activities as the main barriers for the educated households. The study, therefore, accepts the null hypothesis that education may negatively condition the possible transition from mixed farming to non-farm livelihood portfolios.

Household age was hypothesized to negatively influence a household's choice of non-farm livelihood sources. The distribution of respondents by age with respect to livelihood sources, as portrayed in Figure 3.1, suggests that on average, from 22 to 32 years, age may be a condition towards choosing the mineral portfolio option. Similar comparable findings were

also noted by Rao *et al*., (2004) who suggested the lack of agricultural land was the pushing factor for young households into other non-farm activities. From the study area, young households noted a high return and "quick cash" signal from the mineral portfolio as the main reason why they ventured into such a risky activity.

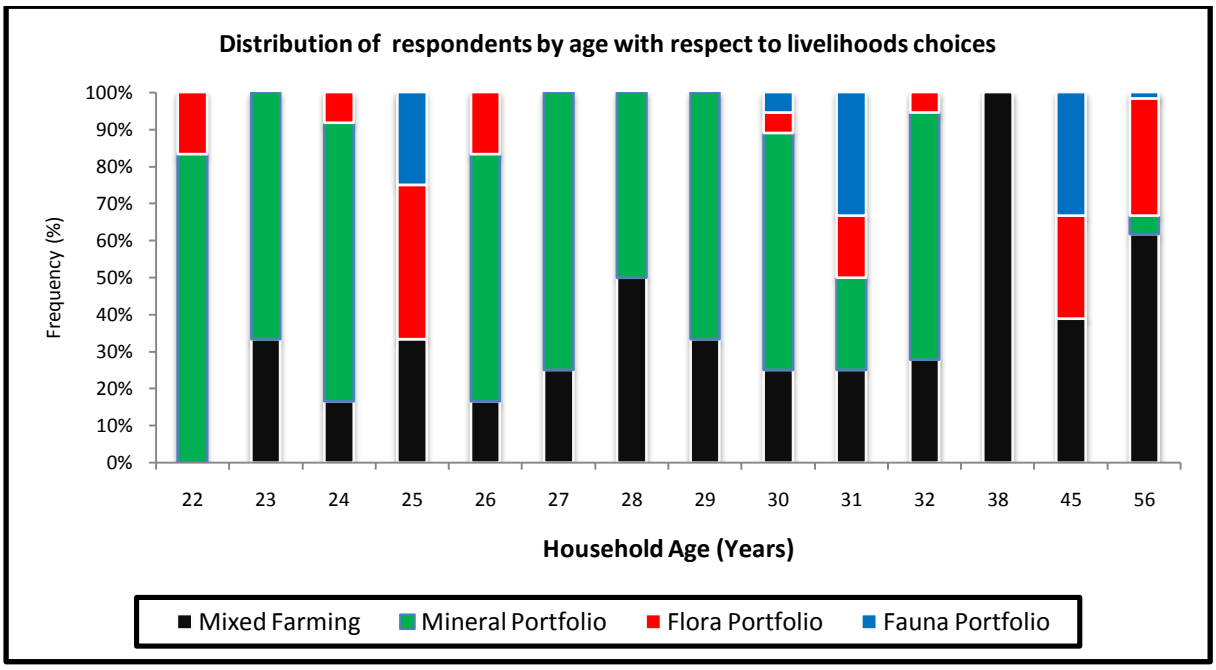

Figure 3.1: Distribution of respondents by age with respect to livelihood choices

This express trend, however, disappears above the 38 year age group, in which other non-farm livelihoods options like the flora and the fauna loosely dominate. Older households seem to prefer more risk free activities with more secure, although low, output. This could be a possible reason why the respondents beyond the age of 38 years were more "locked up" in mixed farming activities, than diversification into non-farm livelihoods. Previous findings by Vedeld *et al*., (2004) and Kohlin and Parks (2001) also argue that, depending on the nature of available non-farm activities, older households may lack the physical strength and time to engage in most non-farm forest activities. These findings may, therefore, provide sufficient descriptive evidence to accept the null hypothesis that the youth may be more willing to diversify into non-farm activities.

With reference to gender, the radar distribution in Figure 3.2 suggests that male headed households may be more capable of considering other non-farm livelihood sources than their female counterparts. This was under the conjectured hypothesis that the gender of the household-head positively conditioned the choice of non-farm livelihoods. The distribution portrayed in Figure 3.2 suggests that male headed households may be more willing to consider the mineral portfolio followed by mixed farming, flora and fauna as livelihood sources. On the other hand, female headed households were more concerned with mixed farming than any other non-farm livelihood choices available. Similar comparable findings were suggested by Galab *et al*., (2002) and Adugna (2005) who cite culture, social mobility limitations and differential ownership to assets. From the study area, respondents cited the high risk attached to non-farm livelihoods sources as the main barriers for female headed households.

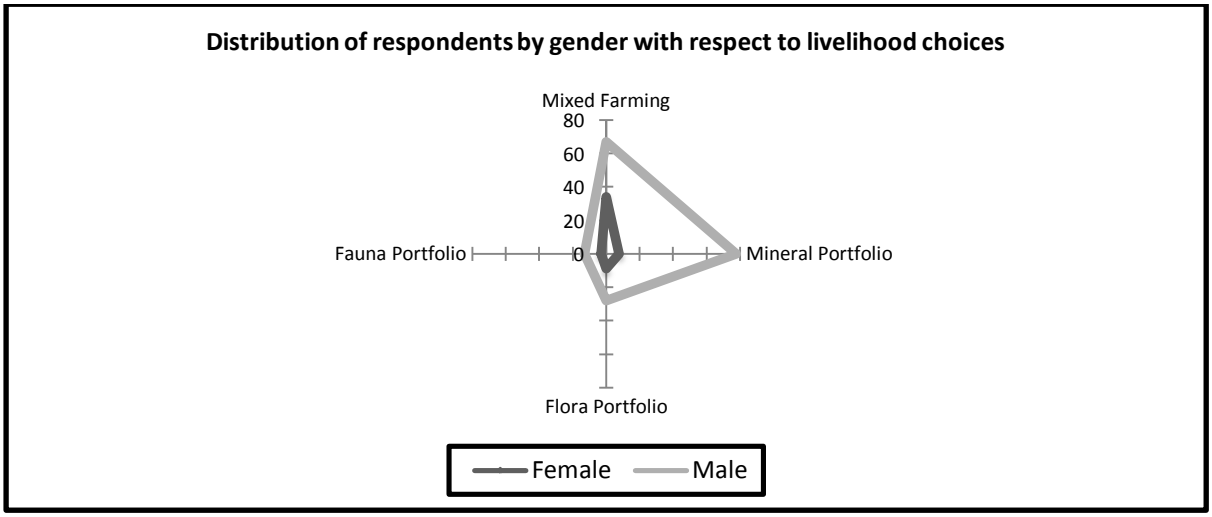

Figure 3.2: Distribution of respondents by gender with respect to livelihood choices

These descriptive findings, therefore, provide evidence to accept the null hypothesis that gender may positively condition non-farm livelihood adaptation choices. Reducing elements of risk highlighted as constraints in Table 3.4 may enhance livelihood adaptation choices for rural communities.

With reference to wealth status, Table 3.6 summaries the distribution of respondents according to wealth status, with respect to their livelihood choices. The assumed hypothesis was that wealth status may positively influence non-farm livelihood adaptation choices. The distribution suggests that rich households may be more willing to choose the mineral portfolio than their poor counterparts who remain "locked up" in low return mixed farming activities.

Table 3.6: Distribution of respondents by wealth status with respect to livelihood choices

Crosstab				
		Wealth Status		
		Poor	Rich	Total
Livelihood Choices	Mixed Farming	67 (59)	34 (27)	101 (42)
	Mineral Portfolio	13 (11)	73* (58)	86 (36)
	Flora Portfolio	24 (21)	13 (10)	37 (15)
	Fauna Portfolio	10 (9)	6 (5)	16 (7)
Total		**114 (100)**	**126 (100)**	**240 (100)**

*: potential influence, % in brackets

Descriptive results indicate that more households (58%) which are deemed 'rural rich' reported a willingness to consider the mineral portfolio while more of their counterparts (rural poor) reported a willingness to consider mixed farming (59%). These findings support comparable earlier studies which suggest a positive association between wealth status and the adaptation of non-farm livelihood strategies (Adhikari, 2005; Tembo *et al*. 2009). However, the observed distribution did not uncover any potential influence of wealth status with respect to the flora and fauna portfolios. The study, therefore, loosely accepts the null hypothesis that wealth status positively influences non-farm livelihood adaptation choices based on the positive link observed for the mineral portfolio.

Table 3.7 presents the distribution of respondents by access to extension service with respect to livelihood choices. The assumed hypothesis was that extension positively influences non-farm livelihood adaptation choices. The distribution reveals that respondents with poor access to extension services may be more willing to venture into the mineral diversification portfolio (45%), which suggests a negative influence for extension. On the other hand, respondents with good access to extension services reported willingness to remain in mixed farming (71%); this suggests a positive influence of extension with regard to on-farm livelihoods.

Table 3.7: Distribution of respondents by extension with respect to livelihood choices

Crosstab				
		Extension		
		No	Yes	Total
Livelihood Choices	Mixed Farming	54 (31)	47 (71)	101 (42)
	Mineral Portfolio	78* (45)	8 (12)	86 (36)
	Flora Portfolio	29 (17)	8 (12)	37 (15)
	Fauna Portfolio	13 (7)	3 (5)	16 (7)
Total		**174 (100)**	**66 (100)**	**240 (100)**

*: Potential influence; % in brackets

No significant descriptive influence was noted with respect to the flora and fauna livelihood portfolios under both extremes of extension. These findings contradict previous studies (Gaspert *et al*. 1999; Samuel, 2003; Adhikari, 2005) and the study hypothesis which suggest a positive influence of extension to diversification into non-farm livelihoods. A possible reason for this, with respect to the flora and fauna portfolios, may be the fact that surrounding communities were more interested in commercialising flora and fauna extracts which was not supported by current environmental regulations and extension services in Zimbabwe. In addition, with respect to the mineral portfolio the dominant activity (i.e. gold panning) from the study area was and is deemed an illegal operation by current Zimbabwean environmental laws. Access to extension would, therefore, be expected to negatively influence participation

in gold panning as suggested by the distribution of respondents in Table 3.7. These findings, therefore, provide sufficient descriptive evidence to reject the null hypothesis that access to extension positively influences non-farm livelihood adaptation choices.

Lately, participation in non-farm activities has been more closely linked to the availability of formal markets for non-farm resources. Accordingly, Table 3.8 presents the distribution of respondents by access to formal markets with respect to livelihood choices. This was against a null hypothesis that access to formal markets may positively influence the adaptation choices of households towards non-farm livelihood activities. The observed distribution suggests that access to formal markets may positively influence the willingness of households to adopt non-farm activities, in this case mineral portfolio. Although the study did not uncover any significant influence with regard to the flora and fauna portfolios, the observed positive influence with respect to the mineral portfolio (50%) may provide descriptive evidence to accept the null hypothesis.

Table 3.8: Distribution of respondents by access to formal market with respect to livelihood choices

Crosstab				
		Market		
		No	Yes	Total
Livelihood Choices	Mixed Farming	44 (59)	57 (34)	101 (42)
	Mineral Portfolio	3 (4)	83* (50)	86 (36)
	Flora Portfolio	14 (19)	23 (14)	37 (15)
	Fauna Portfolio	13 (18)	3 (2)	16 (7)
Total		**74 (100)**	**166 (100)**	**240 (100)**

*: Potential influence; % in brackets

Finally, with respect to land size, as presented in Table 3.9, the study did not uncover any significant descriptive influence of land size towards households` choices of non-farm livelihood sources.

Table 3.9: Distribution of respondents by ownership of land size with respect to livelihood choices

Crosstab				
		Land Size		
		Small	Large	Total
Livelihood Choices	Mixed Farming	43 (45)	58 (40)	101 (42)
	Mineral Portfolio	42 (44)	44 (30)	86 (36)
	Flora Portfolio	7 (7)	30 (21)	37 (15)
	Fauna Portfolio	3 (3)	13 (9)	16 (7)
Total		**95 (100)**	**145 (100)**	**240 (100)**

3.5.4 Summary and implied message

Based on the descriptive statistics presented, the study suggests that education, age, extension, gender, wealth status and market may condition the transition of households from mixed farming to other non-farm livelihood sources. Specifically, the observed distribution seems to suggest that respondents were more interested in choosing the mineral portfolio than other non-farm livelihood activities available (flora and fauna).

The observed distribution further suggests that for a household to be rich by rural standards, the household-head has to be uneducated, young and male. This household then needs to venture into mineral livelihood activities supported by formal markets with low access to extension services. Three implied messages emerge from these findings, as follows;

- Dominance of the mineral portfolio by the uneducated, young and male households may mean high risk on one end and high potential on the other end.

- Also, dominance of the mineral portfolio against other non-farm sources (flora and fauna) suggest low returns and several constraints, as noted in Table 3.4, attached to other non-farm activities.
- The mineral portfolio-formal market positive link may also suggest a negative impact of missing formal markets for the non-farm livelihood resources capable of limiting households` adaptation rates.
- Considering legislation that prevents venturing into livelihood choices such as gold panning, the uneducated male youth are therefore more prone to taking risk.

These findings further provide sufficient descriptive evidence to suggest that game parks cannot be trusted as livelihood sources for surrounding communities. To complement these descriptive findings, the following section presents the inferred findings from the regression analysis.

3.6 Inferred econometrics results

This section presents the econometric results of correlates of non-farm livelihood choices for communities who share boundaries with Nyatana Game Park. The practical applicability of the multinomial logistic regression model used is summarised in classification Table 3.10. The statistics suggest that, of the cases used to create the model, 70 of the 101 respondents who chose the mixed farming portfolio were correctly classified (69.3%). Seventy six of the 86 respondents who chose the mineral portfolio were correctly classified (88.4%). Lastly 9 of the 37 respondents who chose the flora portfolio were correctly classified (24.3%). Finally, of the cases used to create the model, 6 of the 16 respondents who chose the fauna portfolio were correctly classified (37.5%). The classification table suggests that, on average, 67.1% of the cases were correctly classified.

Table 3.10: Classification table for the multinomial logistic regression model used

Classification					
	Predicted				
Observed	Mixed Farming	Mineral Portfolio	Flora Portfolio	Fauna Portfolio	Percent Correct
Mixed Farming	70	21	7	3	69.3%
Mineral Portfolio	10	76	0	0	88.4%
Flora Portfolio	20	5	9	3	24.3%
Fauna Portfolio	10	0	0	6	37.5%
Overall Percentage	45.8%	42.5%	6.7%	5.0%	67.1%

The multinomial logistic regression results for determinants of non-farm livelihood adaptation choices are presented in Table 3.11. With reference to the proportion of variance in the dependent variable associated with the predictor variables, a pseudo R^2 of 0.555 was obtained, as shown in Table 3.11; this suggests that more of the variation was explained by the model. The model fit, as summarised by the likelihood ratio test (LR) of the model (final) against one in which all the parameter coefficients are null (0), resulted in a significant Chi-Square (169.905: 0.000) suggesting that the final model outperformed the null.

The results, as presented in Table 3.11, suggest that gender, wealth status, market and age condition non-farm livelihood choices of households with reference to the mineral portfolio. Gender, extension and land size condition non-farm livelihood choices of households with reference to the flora. Access to formal markets also influences the non-farm livelihood choices of households with reference to the fauna portfolio.

Table 3.11: Correlates of non-farm livelihood adaptation choices

Predictor Variables	Reported livelihoods adaptation choices		
	Mineral Portfolio	**Flora Portfolio**	**Fauna Portfolio**
1. Education	-0.084 [0.855]	-0.183 [0.710]	-1.156 [0.162]
2. Age	-0.090 [0.008]**	0.041 [0.255]	-0.046 [0.423]
3. Gender	2.217 [0.004]**	-1.434 [0.034]*	-0.910 [0.496]
4. Wealth Status	1.415 [0.002]**	0.070 [0.886]	1.018 [0.233]
5. Extension	0.793 [0.318]	-2.059 [0.002]**	-0.190 [0.894]
6. Market	1.572 [0.041]*	0.345 [0.502]	-2.718 [0.007]**
7. Land Size	0.703 [0.128]	1.429 [0.029]*	1.483 [0.137]
Intercept	-2.272 [0.146]	-3.515 [0.016]*	-0.323 [0.894]
a) Base Category	Mixed farming		
b) No. of Observations	240		
c) LR chi-square (21)	169.905**		
d) Overall Classification %	67.1		
e) Pseudo R -Squared	0.555		

Notes: ** and * indicates significance at 0.01 and 0.05 probability level respectively; *p-value* in square brackets [].

With reference to age, the results (-0.090: 0.008) suggest that young households currently absorbed in mixed farming may be more willing to choose the mineral portfolio than older households. These findings support earlier descriptive statistical results which suggest that the young may be more willing than their older counterparts to venture into mining activities, with 38 years as the cut-off point. The high return – low investment and "quick cash" possible with gold panning may be its "pulling" factors, regardless of several constraints associated with the mineral portfolio for the young who are normally risk takers. The observed reluctance to choose mining as an option, by older households, may be due to the

fact that older people may have less time and physical strength to engage in mining activities. In addition, older households may have more experience and accumulated high social capital capable of assisting them to survive under farming. Similar comparable conclusions were inferred by Kohlin and Parks (2001) and Vedeld *et al*., (2004) with reference to the willingness to participate in forest activities.

Male-headed households may be more likely to choose the mineral portfolio diversification option as a livelihood adaptation strategy, while female-headed households may be more likely to opt for the flora portfolio. The observed positive association between gender and the mineral portfolio (2.217: 0.004) may be explained by the risky nature of mining activities, specifically gold panning, capable of technically excluding female headed households from participating. On the other hand, the observed negative association between gender and the flora portfolio (-1.434: 0.034) may be based on the fact that the collection of wild fruits, edible vegetables under the banner of the flora portfolio livelihood diversification is normally a female adaptation strategy (Folbre, 1994; Grossman, 1996; Narain *et al*. 2005).

The more wealth that households have, the greater their willingness to diversify into non-farm activities, in this case the mineral portfolio option (1.415: 0.002). A similar positive association between wealth status and the diversification into non-farm activities was noted by Adhikari (2005), as explained under section 3.4.2. Respondents labelled mining as one of the potential rural livelihood sources from the study area, with meaningful returns (although very risk). Though the analysis could not confirm causality between the two variables, both descriptive and inferential results suggest that risk takers (miners, male and young households) comprised of the rich group from the study area. Removing the current constraints associated with mining activities and formalising its operations, supported by markets that recognise small scale gold panners, may address poverty in the study area.

The model results suggest that access to extension may negatively influence the probability of choosing the flora portfolio (-2.059: 0.002). These results contradict previous studies which suggest a positive association (Gaspert *et al*. 1999; Samuel, 2003; Adhikari, 2005). Current extension services offered in Zimbabwe promote the sustainable harvesting of natural resources for domestic use, in line with the available laws (Communal Lands and Forestry Produce Act).

In contrast, local communities were commercialising forestry produce to enhance their livelihoods. The choice of considering the flora portfolio from a community point of view may, therefore, be based on the ability to commercialise forestry products - specifically timber and firewood. Unfortunately, such activities are not currently supported by available laws and extension services in Zimbabwe. The observed negative association between extension and the flora portfolio may suggest a conflict of interest between extension and communities, the former targeting sustainable domestic use of forestry produce while the latter targets the sustainable commercialisation of forest harvests.

As expected, access to markets increased the likelihood of choosing the mineral portfolio adaptation option (1.572: 0.041). In as much as current miners were comfortable with the illegal nature of gold panning for personal benefits, the majority of aspiring miners cited the lack of a formal market for gold panning as a crucial barrier which deters them from choosing such activities. The results therefore suggest that policies which create formalised markets for small scale miners may have multiple effects. Firstly these could include, improved livelihoods for more communal households in areas rich with minerals, and secondly, environmental conservation through the internalisation of negative externalities as small scale miners will be forced to pay for social costs (polluter pays principle) under formalised mining.

With reference to the fauna portfolio, the results suggest a decrease in the likelihood of choosing this option with increased access to markets (-2.718: 0.007). Though surprising, respondents argue that better access to markets for game animals would mean more elephants in the park and effectively more PA conflicts. These findings suggest that the surrounding communities were facing more problems from the Game Park than available benefits. Similar conclusions were also inferred by Muchapondawa (2003) who used household data from one community that shares boundaries with the same Game Park – Mudzi communal area.

Finally, the results suggest a positive likelihood of choosing the flora portfolio with respect to increase in land size (1.429: 0.029). Respondents noted that they were getting a lot of manure from the game park for their fields. These findings suggest that forests may be seen as important sources of intermediate products that serve as input in the farming system (Fisher, 2004; Adhikari, 2005). Effectively, the promotion of easy and secure access to Game Park floral activities may positively influence the development of household agriculture.

3.7 Study summary

The first objective was to identify livelihood adaptation sources for communities that share boundaries with game parks. The null hypothesis to this objective was that game parks under the banner of the fauna portfolio are one of the major non-farm livelihood sources for surrounding communities. The major findings, drawn from the analytical chapter, suggest that mixed farming is the major on-farm livelihood source, followed by the mineral portfolio. The study, therefore, concludes that game parks under the banner of the fauna portfolio may not be trusted as a reliable livelihood adaptation source by surrounding communities.

Secondly, the study focused on the constraints faced by households as they try to adapt to available non-farm livelihood sources. The study hypothesized that non-farm livelihood adaptation choices may be conditioned by institutional variables like property rights and

markets. The findings suggest that insecure property rights, lack of formal markets, lack of extension, restrictive policies and a limited resource extraction base were some of the major constraints deterring surrounding communities from adapting non-farm livelihood activities. The study, therefore, concludes that the available constraints, as noted above, may be significant enough to force households to remain in mixed farming actives at the expense of diversification into available non-farm livelihoods activities.

Lastly, the study estimated correlates of non-farm livelihood adaptation choices. The null hypothesis for this objective was that household socio-economic variables like the household-head's age, gender and education may condition non-farm livelihood adaptation choices. Results from the multinomial regression model suggest that gender, wealth status and access to market may positively condition the adaptation of non-farm livelihood choices of households with reference to the mineral portfolio. With reference to age, the results suggest a negative influence with respect to the mineral portfolio. Model results further suggest a negative influence of gender and extension, with reference to the flora portfolio, with land size capable of sending a positive influence to the same portfolio. Lastly, the results suggest a negative influence of access to formal markets with reference to the fauna portfolio. The study, therefore, accepts the null hypothesis which concludes that household socio-economic and institutional characteristics (age, gender, wealth status, access to extension, access to market and land size) condition the non-farm adaptation choices of households.

3.8 Conclusions

The study concludes that mixed farming still remains the dominant livelihood adaptation strategy for communities who share boundaries with game parks in rural areas. Available non-farm livelihood adaptation sources (mineral, flora and fauna portfolios) potentially face several constraints (insecure property rights and low returns) that deter surrounding

communities from participating, thereby forcing them to remain locked up in mixed farming. The possible transition from mixed farming to non-farm livelihood sources, by households who share boundaries with Game Parks, is however conditioned by several household socio-economic (age, gender and wealth status) and institutional (extension, market and land size) factors.

3.9 Policy Issues

The study results suggest that while game parks may be possible livelihood sources for rural communities who share boundaries with wildlife reserves, as suggested in the literature; current gains may be far too low, indirect and unreliable compared to the associated social costs of having game parks from the community`s point of view. In essence, if this scenario remains, rational households may find it difficult to consider game farming as a livelihood source worth choosing and investing into. The expected conservation of wildlife, by surrounding communities in exchange of a livelihood, as suggested by Muchapondwa (2003), may therefore fail to materialize. This scenario may trigger the degradation of wildlife by surrounding communities.

Strategies to unlock the total economic value hidden in game parks for the direct benefit of surrounding communities may therefore be the missing critical policy intervention; if households who share boundaries with wildlife reserves are ever to consider the fauna portfolio, as a non-farm livelihood adaptation option. The following approaches may boost the total economic value of game parks to surrounding communities;

- promotion of both consumptive and non consumptive ecotourism,
- devolution of user rights from RDC to producer wildlife communities and
- legalising the commercial trade of buffer zone extracts from CAMPFIRE districts using the quota and branding systems.

Strategies to lower the associated social costs of having game parks may be equally important to surrounding households. This implies a reduction in the human-wildlife conflict so that the accrued benefits remain higher to attract the willingness of households to consider the fauna portfolio as a reliable and sustainable livelihood adaptation option. The following approaches may reduce social cost of having game parks to surrounding communities;

- adopting biological bee fence as suggested by King (2010) to deter elephants from evading fields of surrounding communities
- internalisation of social costs (negative externalities) by safari operators

An insecure property rights regime for game farming was also cited as one of the possible constraints inhibiting surrounding communities from considering game farming as a livelihood source. The following approach may enhance secure property rights to producer communities;

- full devolution of user rights to local communities, from the current statutory rights to use natural resources as part of a local authority.

The current status quo of game parks in relation to surrounding communities (insecure property rights, low and unreliable revenue amidst high social costs) may provide no incentive for communities to consider them as a livelihood adaptation option. In essence, there is high incentive to destroy game parks because they interfere with other sustainable livelihood sources which are critical for the survival of communities (crop damage and livestock predation).

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Chapter Four

Society`s perceptions of African elephants and their relative influence towards the conservation of elephants

Abstract

Societies share different perceptions with regard to elephant conservation. The available evidence indicates that societies which reside close to elephants share greater obliteration perceptions while the global community, which resides far from elephants, subscribes conservation perceptions. Policies by the global community (CITES; Governments) to protect African elephants seem to have failed to save them from decimation. In this study, we therefore argue that for purposes of saving elephants, policies should come from local communities who share boundaries with game parks rather than impositions from the global community. By estimating local communities` perceptions of elephants and their relative influence towards conservation using the multinomial logistic regression model, we were able to expose perceptions that mould local communities towards conservation from those that promote the obliteration.

The model results suggest that crop damage, threats, injury, livestock predation and social instability may be significant perceptions shared by local communities. These perceptions may not only be capable of negatively influencing the conservation of elephants but could also signal a lack of effective Problem Animal Control (PAC) measures. This could also imply that available PAC measures (fence-in, guns and guards) may fail to deter elephants from invading the fields and properties of local communities. Perceptions on inconsistent revenue, poorly distributed to local communities, were also significant factors widely shared by local communities, and it is a factor capable of negatively influencing the conservation of elephants by local communities.

The study, therefore, noted that these perceptions may be some of the primary causes of elephant decimation in Africa capable of inducing elephant poaching syndrome in local communities. Also these could trigger conversion of elephant habitat to competitive land use options, as locals try to define their survival lines and unlock themselves from the high social costs caused by elephants. Lastly, the building of local common pool infrastructure from elephant revenue was a significant perception positively influencing conservation. The study, therefore, concludes that high human-elephant conflict and low revenue from elephant farming may discourage the interests of surrounding communities from the conservation of elephants. On a constructive note, the study suggests that the direct, observable, positive returns from elephant proceeds may be used as a conservation promotion incentive for surrounding communities.

Key words: Society`s perceptions of elephants, conservation of African elephants

4.0 Introduction

The African elephant (*Laxodonta africana*) is perceived differently across and within various societies in Africa (Akama, 1996; Edwards, 2001). These perceptions shape and define societies` attitudes towards the conservation or decimation of African elephants. To a relatively effluent person, from a developed country with no elephant population, Edwards (2001) acknowledges that elephants might be seen as great, intelligent animals to be preserved at all costs. This is in line with earlier studies by Vredin (1999), who estimated that median Swedish households` willingness-to-pay (WTP) for the preservation of African elephants was, on aggregate, around US$53.7 million.

To a farmer in an area with a booming elephant population, Edwards (2001) noted that elephants might be viewed as pests capable of consuming a year`s worth of hard labour in a single night. This perception was later supported by Muchapondwa (2003) who noted that 30% of the households in the Mudzi district of Zimbabwe adjacent, to Nyatana Game Park, were willing to pay for elephant preservation while 60% of the households displayed negative willingness to pay for elephants – instead, they were willing to pay to have elephants removed from their area.

To a government official in a developing African nation, Edwards (2001) believes that elephants might represent economic resources although African nations differ significantly on how to tap into these resources. Most countries from North Africa[6] believe in non consumptive ecotourism supported by a ban in ivory trade as the best sustainable way in which elephants can be managed [Stiles & Martin, 2001; Courouble *et al.* 2003; Martin & Stiles, 2003; International Fund for Animal Welfare (IFAW), 2004]. Contrary to this view,

[6] Kenya, Ghana, Liberia, Mali, Sierra Leone, Togo, Democratic Republic of Congo, Rwanda, Tunisia, Nigeria, Algeria and Burkina Faso

southern African countries[7] believe in a combination of both consumptive and non consumptive ecotourism (Novelli *et al*. 2006) supported by free trade as the best sustainable way to conserve elephants (Sutton, 2001; Muchapondwa, 2003). The former countries strongly believe that legal ivory trade induces elephant poaching which is the primary cause of elephant decimation in Africa (Blake *et al*. 2007). The latter countries share a completely different story, in that they believe that poaching is not a root cause, but that it is a symptom of elephant decimation (Cumming, 2000; Sutton, 2001; Muchapondwa, 2003).

The contradiction is also observed in the recent rejection of Zambia and Tanzania`s proposals, by the Convention on International Trade of Endangered Species (CITES), to delist their elephant population to Appendix II[8] for purposes of disposing their stockpile of ivory (CITES, 2010). Also, the current attempts by countries from north Africa, spearheaded by Kenya, to spread and increase the moratorium[9] to all African countries and extend it to a twenty year period during the 15th Conference of Parties' CITES meeting (CITES, 2010), signifies the strong belief in the poaching paradigm as the main cause of the decimation of African elephants. This is an observation previously noted by several authors (Stiles & Martin, 2001; Courouble *et al.* 2003; Martin & Stiles, 2003; IFAW, 2004).

[7] South Africa, Zimbabwe, Botswana, Tanzania, Zambia, Mozambique

[8] Roughly 5,000 species of animals and 28,000 species of plants are protected by CITES against over-exploitation through international trade (CITES, 2010). Each protected species or population is included in one of three lists, called Appendices (explained below). The Appendix that lists a species or population reflects the extent of the threat to it and the controls that apply to the trade. Appendix I species, are species that are threatened with extinction and are or may be affected by trade (CITES, 2010). Appendix II species, are species that are not necessarily threatened with extinction, but may become so unless trade in specimens of such species is subject to strict regulation in order to avoid utilization incompatible with the survival of the species in the wild (CITES, 2010). Appendix III species, are species that are listed after one member country has asked other CITES Parties for assistance in controlling trade in a species. The species are not necessarily threatened with extinction globally and trade is not restricted (CITES, 2010).

[9] In 2008 Botswana, Namibia, South Africa and Zimbabwe sold their 110 tons of stockpiled ivory to China and Japan accompanied by a 9-year moratorium (CITIES 2010; Wasser et al, 2010). The moratorium according to Wasser *et al*., (2010) was intended to provide time to enhance enforcement and monitor the impact of sales in the absence of further legal trade. During the 15th CITES CoP meeting that was held in Dohoa (Qatar) in March 2010, Kenya on behalf of the 23 African ranges lands introduced a draft decision for adoption in place of the existing moratorium (CoP 15 Prop No. 6) suggesting to spread the moratorium to all African member states and extending it from 9 years to 20 years (CITES, 2010).

Moreover, the continued support by southern African countries to maintain their elephant population under Appendix II, to allow them free ivory trade (CITES, 2010) further signifies the strong belief - by southern African countries and some of the Gulf countries - in a free ivory trade paradigm where poaching is viewed as a secondary symptom (Cumming, 2000; Sutton, 2001; Muchapondwa, 2003) that should be addressed by tracking its causes.

These mixed perceptions as shared by local societies may shape and define societies` attitudes towards the conservation or obliteration of elephants. To that end, any perception that moulds society`s attitudes towards the conservation of elephants, through their promotion, may enhance the sustainable utilisation of African elephants. Contrary to this, any perceptions that mould society`s attitude towards the obliteration of African elephants may be considered as proxy root causes of elephant decimation, capable of inducing elephant poaching.

Policies that target the reduction *cum* elimination of such factors (perceptions) and the promotion of positive enhancement attitudes in societies that share boundaries with elephants may be a lasting solution to the current decimation of African elephants. This study, therefore, estimated various societal perceptions of elephants and their relative influence on the conservation or obliteration of elephants. The objective was to expose factors that enhance the conservation and those that promote the obliteration of elephants as reported by societies that share boundaries with elephants. This is based on their first-hand interaction with elephants, thus implying that they have greater significant potential to harbour poachers, become poachers themselves (Child *et al*. 1997), or save elephants.

4.1 Problem statement

Societies from across and within Africa share different perceptions with regard to elephant management pathways (Akama, 1996; Edwards, 2001). Societies which reside close to

elephants share greater obliteration perceptions (Edwards, 2001) while the global community, with powers to craft conservation policies, share conservation perceptions (Martin & Stiles, 2003; IFAW, 2004). Unfortunately, policies (skewed in favour of conservation perceptions) by the global community (CITES; Governments) to protect elephants seem to have failed to save them from decimation as currently witnessed by rampant decline in elephant population in Africa (Wesser *et al*. 2010).

Need therefore arises to understand perceptions shared by local communities with regards to elephants. Through mitigation of obliteration perceptions as shared by local communities, sustainable elephant management policies can be crafted to save elephants from decimation. Also through promotion of conservation perceptions as shared by local communities, current elephant management policies may be enhanced.

4.2 Study objectives and hypotheses

The broad objective of the study is to identify societal perceptions of elephants and their relative influence on the conservation or obliteration of African elephants, based on evidence from Nyatana Game Park, in Mashonaland East and Central Provinces of Zimbabwe. In pursuit of this broad objective, the study focused on the following specific objectives;

(a) to identify societal perceptions of elephants, and

(b) to estimate determinants of elephant conservation pathways.

The first objective was motivated by the fact that society`s perceptions of elephants may mould the conservation behaviours of surrounding communities with a greater potential to conserve or destroy elephants (Child *et al*. 1997). Knowing and understanding may go a long way towards shaping elephant management policies in line with the expectations of local surrounding communities. The study therefore hypothesized that issues of crop damage,

revenue source and predation are some of the perceptions shared by societies with regard to elephants.

The second objective was motivated by the quest to complement the first objective through policy targeting on identified perceptions and their direction of influence. With respect to the second objective, the study hypothesized that elephant conservation pathways may be conditioned by societal perceptions like crop damage, predation and revenue generation.

4.3 Study operational questions

(a) What are society`s perceptions of African elephants?

(b) What are the determinants of elephant conservation pathways?

4.4 Study setting and data

This study is based on data obtained from communities that share boundaries with Nyatana Game Park in Zimbabwe. The park is surrounded by rural communities from the UMP, Mudzi and Rushinga districts. Of interest to this study, is the high human-elephant conflict resultant of the lack of a boundary fence and high elephant populations in this game park. In this regard, this study targeted surrounding communities with the implicit objective of understanding societies` perceptions regarding game parks. The elephant was taken as a representative species for the entire game park, for the following reasons;

(a) Elephant trophy hunting is the highest income generator for most community managed game parks in Zimbabwe (Muchapondwa, 2003).

(b) Elephants cause the following damages: (i) crop damage – 78%, (ii) threat to humans – 9%, (iii) property damage – 3%, and (iv) livestock predation – 10% (Jones, 1994).

(c) With respect to problem animal species, elephants present the highest share with 87% followed by lions (8%) and, lastly, by other species with a 5% share (Jones, 1994).

(d) Elephants affect the following types of crops: maize – 30%, millet – 30%, cotton - 3%, vegetables – 7%, and sorghum – 30% (Jones, 1994).

(e) As elephants are allowed to exist they generate costs in the form of damage to crops, infrastructure and predation to livestock and surrounding communities (Sutton, 2001)

(f) Banes (2006) using a crop enterprise approach to estimate value of crop loss due to elephants in Okavango Delta area in Botswana noted that small scale rain-fed crop production profits were reduced by 75% and in some incidences completely eliminated.

It against this background that the elephant was considered a critical component of the entire game park capable of CAMPFIRE generating revenue but also causing high social challenges to surrounding communities more than any other wildlife species.

A sample of 150 households from "cluster B" was randomly selected and distributed, as shown in Table 4.1.

Table 4.1: Distribution of respondents by district and gender

	UMP		**Mudzi**		**Rushinga**	
	Male	Female	Male	Female	Male	Female
	32	18	12	38	33	17
Total	**50**		**50**		**50**	
Male total	**77 Households**					
Female total	**73 Households**					
Grand Total	**150 Households**					

Using random sampling, two villages from each district under "cluster B" were then selected. From the randomly selected villages, household-heads were randomly selected, thus yielding a final sample of 77 male-headed households and 73 female-headed households, as shown in

Table 4.1. A detailed questionnaire (annexure 2) was used to collect data regarding households` perceptions of elephants. Household level data was augmented by a community survey for each of the sampled villages.

4.5 Literature review

Very little work has been done on assessing the local society`s perceptions towards the conservation or obliteration of African elephants. More attention has been given to the debate on the ivory trade ban, elephant poaching and listing of elephants by CITES (Wasser *et al*. 2010) as critical areas worth noting, if ever African elephants are to be conserved (Edwards, 2001). Interestingly, the conclusions from these studies have been used to shape and define the direction of elephant conservation policies across all elephant rangelands in Africa [Foundation for Environmental Conservation (FEC), 2009].

In as much as such studies may add value to the generic understanding of elephant problems, this study suggests that tackling elephant problems based on the global community`s conservation perceptions, and using such perceptions to deduce conservation policies, may be using theoretical simulations to dictate conservation policies to local communities. In essence, such approaches may be viewed as proxy to autocracy in policy formulation, which may risk errors of commission and omission.

Twyman (2001) notes that, in order to understand the links and the conflicts between nature, wildlife utilisation and community development, it is necessary to gain a deeper understanding of people`s relationships with nature. These are critical missing links in literature worth investigating for the purpose of inspiring elephant conservation policies, thereby involving the masses of local communities as active players in elephant policy formulation.

Earlier studies by Gadgil and Rao (1995) note that an increase in rural populations resulted in competition for land between agriculture and wildlife leading communities in order to convert the natural habitat, crucial for wildlife, for crop cultivation and livestock pasture. Addressing livelihood sources of rural communities who reside close to elephant Game Parks may be the critical gaps in literature that are capable of saving African elephants.

Child *et al*., (1997) note that in most rural areas, local people treat poachers as heroes. This is especially true for poachers who kill animals raiding their crops or competing with their livestock. Concentrating research on strategies of mitigating such conflicts and competition between the two species (livestock and elephants) may also be some of the missing links crucial for harmonising local and global communities towards sharing the same conservation perception.

Muchapondwa, (2003) acknowledges that, in many cases, when game parks and other protected areas were created, local communities were evicted from their homes and told that they were not allowed to harvest wild animals and plants as they had done for centuries. Understanding how this affects local communities and influences their decision towards the conservation of elephants are some of the critical unknown areas worth focusing, given the practical potential of local communities to host poachers or to become poachers themselves.

The study therefore suggests that understanding the extent and context, implying the significance and direction of influence, of such perceptions across various societies may go a long way towards probing why local communities may not conserve elephants. By delineating conservation perceptions from obliteration perceptions, as enshrined in local communities, and their relative significance and direction of influence, policy targeting may be used to both promote conservation perceptions and discourage obliteration perceptions. Once such perceptions are fully understood and strategically accommodated through policy

targeting, the global and local communities` perceptions can easily be harmonised, thereby conserving African elephants through a holistic participatory approach.

4.6 Methodology

The study was conducted in the Rushinga, Mudzi and UMP communal areas of Mashonaland Central and East Provinces of Zimbabwe. These areas surround the Nyatana Game Park, a community owned CAMPFIRE[10] project managed under consumptive and non consumptive ecotourism principles, with an estimated elephant population of 300 [Nyatana Joint Management Trust (NJMT), 2010].

For the purpose of capturing all the spectrum of preferences in society, with regard to how societies view elephants, respondents were split into three sub-samples according to their stated preferences for Nyatana elephants. A screening question was used to allocate respondents to their sub-categories of preference. Following an approach used by Muchapondwa (2003), the spectrum of preferences for Nyatana elephants were obtained by first asking respondents to weigh the costs and benefits their households would assign to the current elephant populations in Nyatana. Three possible responses were expected, as follows;

(1) Benefits exceed costs (positive WTP[11] for elephant conservation; WTP>0)

(2) Benefits equal costs (indifferent group; WTP = 0)

(3) Benefits are lower than costs (negative WTP for elephant conservation; WTP<0)[12]

Using stratified systematic sampling, based on a spectrum of preferences for Nyatana elephants of the initial sample randomly selected from "cluster B", three homogeneous mutually exclusive strata were created (stratum "A"; "**Benefits exceed costs: (WTP>0)**": n =

[10] Communal Areas Management Programme for Indigenous Resources
[11] Willingness To Pay a concept used in estimating how respondents value natural resources
[12] Households in this category were assumed to have characteristics that mimic elements of poaching

43, stratum "B"; "**Benefits equal costs: (WTP=0)**": n=88 and stratum "C"; "**Benefits are lower than costs: (WTP<0)**": n = 19) for independent analysis as shown in Table 4.2.

Table 4.2: Distribution of respondents after the screening exercise

Case Processing Summary			
		N	Marginal Percentage
Participation options	Indifferent (WTP = 0)	88	58.7%
	Conservation (WTP >0)	43	28.7%
	Obliteration (WTP <0)	19	12.7%
Valid		150	100.0%
Total		150	

After the screening exercise, 88 respondents were categorised as the indifferent group, 43 as the conservation and 19 as the obliteration group, as shown in Table 4.2. The multinomial logistic regression model was used to investigate the manipulative and directional power of perception based factors that may influence societies not to conserve elephants that are deemed, by the global community, to improve their welfare. Multinomial logistic regression can be used to predict a dependent variable, on the basis of continuous and/or categorically independent variables, where the dependent variable takes more than two forms (Hill, Griffiths and Judge, 2001). To this end, the three created preferences (WTP > 0; WTP = 0 and WTP <0) were taken as the dependent variable.

In this study, society is faced with three choices: conserving elephants, obliterating elephants and not participating in either of these two options. Naturally, society decides whether to interact with elephants or not. When they choose to interact, they then decide on the interaction pathway (either "positively"[13] or "negatively"[14]). However, these decisions are

[13]Positive to the expectation of the global community

[14]Negatively to the expectation of the global community

assumed to be made on the basis of an option which maximizes their utility, subject to perceptions and attitudes as enshrined in individuals.

The empirical findings show that many households fail to participate positively in elephant conservation because of the high "accommodation and social costs"[15] of elephants (Muchapondwa, 2003) and a lack of necessary and sufficient revenue on a consistent basis, from elephants. The existence of such factors lowers the overall utility of having elephants, in the eyes of local communities, thus shifting utility from positive to negative and finally becoming indifferent.

As such, the utility maximizing function can be given as:

$$\text{Max } U = U(C_k, R_{fk}, R_{ik}; H_u) \quad \text{..... (4.1)}$$

Where: Max U denotes the maximum utility that can be attained from elephant conservation.

C_k represents the utility gained by being indifferent by a household

R_{fk} represents the utility gained from positive participation

R_{ik} represents the utility gained from negative participation

H_u represents a set of perception based factors shifting the utility function

From the utility maximizing function, it can be assumed that households make decisions to interact/associate with elephants, subject to perception based factors. It therefore follows that, if the costs that are associated with interacting to a particular association pathway are greater than the benefits, households may be discouraged from aligning themselves to it; they will thus shift to the option that maximizes their utility.

[15]Muchapondwa, (2003) summarised the "accommodation costs" of elephants as crop damage, livestock crowd-out and predation, human threat, injury, death, opportunity cost of the land on which they live, social instability, due to fear of wild animals, direct management costs and loss of leisure time as people have to sleep in fields guarding against wildlife intrusion during cropping seasons.

O' Sullivan, Sheffrin and Perez (2006) explain that it is difficult to measure utility directly; it is, therefore, assumed that households make participation choices depending on the option that maximizes their utility. That is, subject to perception based factors, decisions to participate in either conserving elephants or obliterating them, or even not participating, signifies the direction which maximizes utility. Based on this assumption, multinomial regression was used to relate the decisions to participation in elephant conservation, elephant obliteration or non participation, together with the perception based factors that influence these choices.

In this study, non participation (indifferent; WTP = 0) has been chosen as the baseline group; therefore, it takes the value of zero. Positive participation (conservation; WTP > 0) takes the value of one and negative participation (obliteration; WTP < 0) takes the value of two. (Non participation = 0; Positive participation = 1; Negative participation = 2).

A typical logistic regression model used took the following form:

$$\text{Logit}\,(P_i) = ln\,(P_i / 1 - P_i) = \alpha + \beta_1 X_1 + \ldots + \beta_n X_n + U_t \quad (4.2)$$

Where: $ln\,(P_i / 1 - P_i)$ = logit for elephant participation choices

P_i = not participating in elephant conservation (WTP = 0)

$1\text{-}P_i$ = participating in elephant conservation (WTP> 0 or WTP < 0)

β = coefficient

X = covariates

U_t = error term

The probability that a household prefers one participation/interaction pathway compared to the other is restricted to lie between zero and one ($0 \leq P_i \leq 1$). P_i represents the probability of not participating in elephant conservation and $(1 - P_i)$ represents either a positive

participation/interaction pathway or a negative participation/interaction pathway. In other words, the model was used to assess the odds of: negative participation versus not participating; and positive participation versus not participating. Logit (P_i) therefore ranges from negative infinity to positive infinity (Gujarati, 1992). By fitting the variables into the model, the model is presented as:

$$ln\ (P_i / 1 - P_i) = \beta_0 + \beta_1\ EDCP + \beta_2\ AEIPC + \beta_3\ AETIDH + \beta_4\ AECSIFWA + \beta_5\ AERLTHSFGC + \beta_6\ ETLUG + \beta_7\ AERLC + \beta_8\ ERGAL + \beta_9\ EFWDDS + \beta_{10}\ EBRCFIA + \beta_{11}\ EPRRSC + \beta_{12}\ EKSOITC + \beta_{13}\ REBLI + \beta_{14}\ ENCR + \beta_{15}\ EPMCHTH$$

Table 4.3 presents a summary of perception based factors specified in the multinomial logistic regression of their measurement and their expected signs.

Table 4.3: Variables specified in the multinomial logistic model and their expected signs

Variable name	Variable description	Type of Measure	Expected Signs	
			Conservation	Obliteration
1) EDCP	Elephants damage crops and are as good as pests (EDCP)	(1= YES; 0= NO)	-	+
2) AEIPL	Availability of elephants cause injury and predation to livestock (AEIPL)	(1= YES; 0= NO)	-	+
3) AETIDH	Availability of elephants induce threat, injury and death to humans (AETIDH)	(1= YES; 0= NO)	-	+
4) AECSIFWA	Availability of elephants causes social instability due to fear of wild animals (AECSIFWA)	(1= YES; 0= NO)	-	+
5) AERLTHSFGC	Availability of elephants reduces leisure time, for households are forced to sleep in fields to guard crops (AERLTHSFGC)	(1= YES; 0= NO)	-	+
6) ETLUG	Elephants take up land for the upcoming generation: children (ETLUG)	(1= YES; 0= NO)	-	+
7) AERLC	Availability of elephants reduce land for cultivation (AERLC)	(1= YES; 0= NO)	-	+
8) ERGAL	Elephants reduce grazing area for livestock: no buffer zone for livestock (ERGAL)	(1= YES; 0= NO)	-	+
9) EFWDDS	Elephants finish open water sources during the dry season (EFWDDS)	(1= YES; 0= NO)	-	+
10) EBRCFIA	Elephants bring revenue to complement farm incomes hence they are as good as assets (EBRCFIA)	(1= YES; 0= NO)	+	-
11) EPRRSC	Elephants provide revenue, but all the revenue is taken by Safari Operators and Councils (EPRRSC)	(1= YES; 0= NO)	-	+
12) EKSOITL	Elephants are ok, but Safari Operators ill-treat locals: chase locals out of the Park with guns (EKSOITL)	(1= YES; 0= NO)	-	+
13) REBLI	Revenue from elephants help to built local infrastructure: roads, clinics, schools, dip tanks etc (REBLI)	(1= YES; 0= NO)	+/-	-
14) ENCR	Elephants are necessary for our cultural rituals (ENCR)	(1= YES; 0= NO)	+	-
15) EPMLHTH	Elephants provide meat for locals during hunts by trophy hunters (EPMLHTH)	(1= YES; 0= NO)	+/-	+/-

4.6.0 Description of variables specified in the model

This section focuses on a description of the variables specified in the multinomial logistic regression model. Using conclusions inferred from other studies and empirical findings from the study area, the *a priori* influence of various household perceptions on elephants, in general, were estimated. Table 4.3 provides definitions of the variables used in the model and their expected signs.

Elephants damage crops and are as good as pests (EDCP)

Elephants have been reported to cause serious crop damage within a few minutes when they invade the fields of surrounding communities (Edwards, 2001). Jones (1994) reports that 78% of all the possible damage caused by elephants was mainly crop-related. Based on a study conducted in Binga, Zimbabwe, Jones (1994) notes that the frequency and choice of crop damage by elephants were as follow: maize 30%, millet 30%, sorghum 30%, vegetables 7% and cotton 3%. In relation to elephant conservation, Muchapondwa (2003) notes that crop damage by elephants was one of the key factors capable of negatively affecting the anticipated co-existence of humans and elephants. It is against this background that a negative correlation was anticipated for this variable, with respect to elephant conservation and a positive association with elephant obliteration.

Elephants cause injury and predation to livestock (EIPL)

Injury and predation of livestock, from elephants, is either not very common or it is not reported; however, a study by Jones (1994) in the Binga district of Zimbabwe indicates that 10% of the damages caused by elephants were primarily attributed to the predation of livestock. Logically, this scenario would send a negative attitude towards elephant conservation, given the fact that livestock is a key source of income for rural households who

are located in marginal areas close to game parks where cropping is limited. A negative association was therefore conjectured for this variable with respect to elephant conservation and a positive association with respect to elephant obliteration.

Elephants induce threat, injury and death to humans (ETIDH)

Several reports of human-elephant conflicts are common in the elephant rich areas of Africa. Jones (1994) notes that 9% of the damages caused by elephants were attributed to human threat and out of all the wild game species, the elephant was the greatest troublemaker with an 87% share, followed by lions with 8%, and other animals with 5%. This development is unfortunate and is capable of having a longstanding negative impact on elephant conservation, by local communities in Africa. A negative association was, therefore, anticipated for this variable with respect to the conservation of elephants and a positive association with the decimation of elephants.

Elephants cause social instability to humans due to fear of wild animals (ECSIFWA)

Local communities share boundaries with elephants; this means that their fields and residential areas are regular routes upon which elephants ply day and night. So, as households work in their fields they are always on the lookout for elephants. At home, the story is the same, whether cooking, sleeping inside houses or outside, elephants can be a threat to both property and human life. Such incidences make elephants very unpopular in rural areas, where this study expects them to be popular for conservation. A negative association was, therefore, conjectured for this variable with respect to their conservation and a positive correlation with respect to their decimation.

Elephants reduce leisure time, since households are forced to sleep in fields to guard crops (ERLTHSFGC)

It is a public fact that, in rural areas where there is a booming population of elephants, these animals can destroy a year`s harvest in one night (Edwards, 2001). It is also public knowledge, in rural areas, that crops are crucial food sources for rural communities. Last, but not least, it is also public fact that leisure and free time for rural communities is normally at night (Rukuni *et al*. 2006). It is unfortunate that night-time is also the best feeding time for elephants, since temperatures are cool.

Of greater concern is the fact that, even where there are electrified game fences, elephants have managed to cross fenced boundaries with ease in search of grazing grounds to include fields of surrounding communities (King, 2010). For the purpose of protecting their fields, households are forced to guard their year`s worth of hard labour and potential harvest, thus effectively sacrificing their leisure time (sleeping time).There is thus no reason to expect locals to conserve elephants; hence, a negative correlation was anticipated for this variable with respect to the conservation of elephants and a positive association was expected with respect to their decimation.

Elephants take up land for the upcoming generation: children (ETLUG)

As the human population increases, more land is required for the accommodation and cultivation of upcoming generations. To that end it may not make logical sense, from a rural perspective, for elephants to enjoy the luxury of a wilderness of land, while humans are crowded within small spaces. This perception was therefore anticipated to negatively influence the way societies view elephant conservation, and would be positively related to elephant decimation.

Elephants reduce land for cultivation (ERLC)

The cultivation land in marginal areas where the parks are located is rocky, sandy and inherently poor in nutrients essential for crop production. Also, landholding sizes are too small, thus making crop production a mere gambling enterprise. Adjacent to these land challenges, elephants enjoy an unlimited wilderness in the name of game parks. Naturally, communities that are adjacent to these Parks would think that eliminating elephants may pave the way for more land, to their advantage. Gadgil and Rao (1995) note potentially serious competition for land between elephants and humans. A negative correlation was therefore conjectured for this predicator variable with respect to elephant conservation and positively related to elephant decimation.

Elephants reduce grazing area for livestock: no buffer zone for livestock (ERGAL)

Livestock production seems to be the only promising farming venture, by default, in the marginal areas where the parks are located. In this regard, most of the households in these areas have livestock which define their survival lines; the welfare of their livestock thus means a lot to them. The carrying capacities in these areas are fast becoming too low in relation to the available livestock. Adjacent to these land challenges, the wilderness of parks exists for elephants, and very limited grazing access is allowed in these parts. Intuitively, the elimination of elephants would be a noble idea in the eyes of these communities in order to unlock the grazing land for their livestock (Child *et al*. 1997). In this light, a negative association was anticipated for this variable with regard to elephant conservation, with a positive association with respect to their decimation.

Elephants finish open water sources during the dry season (EFWDDS)

Livestock and humans depend on open water sources like earth dams, pools and main rivers during summer and especially during the dry season. Elephants also target these water sources as their drinking points during the dry seasons (Bothma, 2006). The 200 litre daily water intake of an elephant may mean a significant quantity, given the number of elephants and livestock in the surrounding areas. Owners of livestock may feel the impact of this. Thus, a perception capable of negatively affecting conservation of elephants with a positive association with respect to elephant obliteration may develop.

Elephants provide revenue but it is too little and inconsistent (EPRTLC)

This is more of a public fact by local communities who share boundaries with elephants (Muchapondwa, 2003). Given the population of producer communities and realistic annual revenues that can be generated by an average park, little may end up in the hands of communities. Disbursements to producer communities by Safari Operators (SO) or councils may also be inconsistent due to several logistical issues. Although such revenues may be necessary in their small amounts, the influence they generate towards the conservation of elephants may be negative given the high social costs incurred by locals from the existence of elephants in their area. A negative association was, therefore, anticipated for this variable with respect to elephant conservation and a positive correlation further conjectured with respect to elephant decimation.

Elephants provide revenue, but all the revenue is taken by Safari Operators and Councils (EPRRSC)

This is also a widely shared view by local communities who reside close to game parks (CA, 2000). The fact that SO remain in business and councils seem to maintain contracts with SO

sends a sceptical message to local communities who receive little to nothing from the proceeds of game parks. If SO are private business operators who seek to maximise profit, the moment communities see them operating any game park, it means all the profit is recouped by SO. So, if local communities are little to nothing game parks in their areas, why would the global community expect them to conserve elephants? (Child, 1995; Child *et al.* 1997; Patel, 1998; Hasler, 1999; Muchapondwa, 2003). This perception is more than enough to send a disincentive signal towards elephant conservation. A negative correlation was, therefore, anticipated for this variable with respect to elephant conservation, and a positive association with respect to elephant obliteration.

SO ill-treat locals (SOITL)

Several reports where locals are ill-treated after they cross boundary fences, sometimes genuinely in search of harvestable natural resources like honey or reeds, are common in rural areas (Chatty and Colchester, 2002; Muchapondwa, 2003; Brockingto *et al*. 2006). SO believe that they are in control of Game Parks, through lease agreements from Councils or Government, which implies that no one should enter the Game Park without their knowledge. Under such conditions, society is deemed to be rational if it decides to negatively conserve such natural resources. A negative association was, therefore, anticipated for this variable with respect to elephant conservation and a positive association with respect to elephant obliteration.

Revenue from elephants helps to build local infrastructure: roads, clinics, schools and dip tanks (REBLI)

So many "common pool infrastructural developments"[16] are reported in the CAMPFIRE districts of Zimbabwe (Child, 1995; Muchapondwa, 2003). Such projects may send mixed perceptions to communities who, on one extreme, may see those projects as an achievement that will go a long way towards addressing common pool problems of their area. Contrary to this widely shared view, communities may see such projects as a way of robbing them of their revenue from elephants, based on the fact that dip tanks, clinics, roads and schools are public goods that must be provided by government. Locals would argue that these facilities are also provided in other areas, by Government, where there are no elephants. This suggests that the proceeds from elephants must not finance common pool local infrastructure. Instead it must compensate the livelihood sources of communities who share boundaries with game parks. Either a positive or a negative association was, therefore, expected for this variable with respect to both elephant conservation pathways (conservation or obliteration).

Elephants are necessary for our cultural rituals (ENCR)

Muchapondwa (2003) argues that households headed by the young had a tendency to undervalue the religious and traditional values of elephants to such an extent that these households would view elephants as a nuisance. Mixed feelings are therefore possible in that the old may value the traditional and cultural benefits of elephants and thus easily manipulated by such perceptions towards conserving elephants, while the youth may see things differently. To this end, either a positive or negative association was expected for this variable, with respect to both elephant conservation pathways (conservation or obliteration).

[16] Public infrastructure like roads, dip tanks, clinics

Elephants provide meat for locals during hunts by trophy hunters (EPMLHTH)

Meat in rural areas is not a regular dish, but rather a special dish which is only available during special occasions (Child 1995; CA, 2000). If communities regularly get meat from elephants killed during trophy hunting, this could be an enticing factor to improve their dish, and could be capable of sending a positive signal towards the conservation of elephants. On the other hand, this may actually promote the illegal harvesting of elephants or accommodate ivory poachers if the supply from the legal practice by trophy hunters is not regular. Either a negative or positive association was, therefore, expected for this variable with regards to both elephant conservation pathways (conservation or obliteration).

4.7 Results and discussions

This section presents both descriptive and inferred econometrics results. For descriptive results, the section covers issues of the observed elephant conservation pathways and households` perceptions' of elephants.

4.7.0 Elephant conservation pathways

To achieve the first objective, a detailed descriptive analysis of household perceptions of elephants is presented. Initially, the study presents reported elephant conservation pathways, as summarised in Table 4.4. Three major elephant conservation pathways (indifference, conservation and obliteration) were common from the study area.

Table 4.4: Reported elephant conservation pathways from the study area

Reported elephant conservation pathways					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Indifferent (WTP = 0)	88	58.7	58.7	58.7
	Conservation (WTP > 0)	43	28.7	28.7	87.3
	Obliteration (WTP < 0)	19	12.7	12.7	100.0
	Total	150	100.0	100.0	

The results suggest that indifference was the dominant elephant conservation perception shared by most households (58.7%). This category of households suggested that possible benefits from elephants were equal to possible costs, implying that the availability or unavailability of elephants in the Nyatana Game Park did not matter much to them.

The above was followed by a significant number of households that reported a conservationist attitude (28.7%). For this group, the potential benefits from elephants exceeded potential costs, suggesting that conserving elephants in Nyatana Game Park was their preferred conservation pathway.

Lastly, a few households (12.7%) reported an attitude leaning towards obliteration. For this group, the potential benefits from elephants were lower than the associated costs. Effectively, the obliteration of elephants in Nyatana Game Park was assumed to be their preferred latent pathway.

4.7.1 Households` perceptions of elephants

In this section, the study tried to uncover household perceptions of elephants. The elephant was used as representative specie for all game animals due to its high revenue generation capacity (CA, 2000; Muchapondwa, 2003) and high negative impact on surrounding communities, as explained under section 4.4. Several perceptions were noted, from the three communities, as summarised in Table 4.5.

The perception of crop damage, emblematic to communities who share boundaries with game parks, was noted as one of the major perceptions (100%) shared across all three districts. Similar comparable conclusions were inferred by earlier studies which argued that losses from crop damage by wildlife may be a threat to some of the positive benefits of game parks significant and large enough to be meaningful to households (Jones, 1994; Child *et al*. 1997; Muchapondwa, 2003; Fernandez *et al*. 2009), with a potential of reducing profits under rain-fed crop production by 75% (Barnes, 2006).

Equally critical from the three districts, was the perception of injury and predation to livestock. A majority of the respondents (93%) cited the perception of livestock predation as a major issue. Similar comparable findings were also forwarded by Jones (1994) who notes that 10% of the damage caused by elephants was attributed to the predation of livestock.

Injury and death to humans, as well as loss of leisure time, as a result of elephants was also cited as a serious perception shared by the three communities, with a 79% and 53.3% share, respectively. These findings support earlier conclusions by Jones (1994) who notes that 9% of the damages caused by elephants was attributed to human threat. The abovementioned perceptions summarise the animal control challenges which are primarily caused by lack of effective PAC measures.

With respect to the perception of revenue generation from elephants, respondents noted that the revenue available to them was low, inconsistent and they believed that the bulk of it was siphoned by SO and councils. Similar beliefs were previously noted in the work of Child *et al*. (1997), Hasler (1999), and Muchapondwa (2003). These two perceptions suggest poor revenue distribution from Game Parks to surrounding communities.

Table 4.5: Perceptions of elephants as reported by respondents

Households` perceptions of elephants	Rushinga	Mudzi	UMP	Average
% of respondents				
1. Elephants damage crops and are as good as pests (EDCP)	100	100	100	100.0
2. Availability of elephants cause injury and predation to livestock (AEIPL)	100	80	100	93.3
3. Availability of elephants induce threat, injury and death to humans (AETIDH)	80	75	82	79.0
4. Availability of elephants causes social instability due to fear of wild animals (AECSIFWA)	50	35	60	48.3
5. Elephants reduces leisure time, for households are forced to sleep in fields to guard crops (ERLTHSFGC)	60	25	75	53.3
6. Elephants take up land for the upcoming generation: children (ETLUG)	45	20	55	40.0
7. Availability of elephants reduce land for cultivation (AERLC)	26	15	45	28.7
8. Elephants reduce grazing area for livestock: no buffer zone for livestock (ERGAL)	60	20	44	41.3
9. Elephants finish open water sources during the dry season (EFWDDS)	30	10	30	23.3
10. Elephants provide revenue but it`s too little and inconsistent (EPRTLC)	73	44	84	67.0
11. Elephants provide revenue, but all the revenue is taken by Safari Operators and Councils (EPRRSC)	62	30	77	56.3
12. Elephants are ok, but Safari Operators ill-treat locals: chase locals out of the Park with guns (EKSOITL)	80	40	90	70.0
13. Revenue from elephants help to built local infrastructure: roads, clinics, schools, dip tanks etc (REBLI)	12	74	22	36.0
14. Elephants are necessary for our cultural rituals (ENCR)	25	11	10	15.3
15. Elephants provide meat for locals during hunts by trophy hunters (EPMLHTH)	35	40	14	29.7
Average % share of perceptions per district	**55.9**	**41.3**	**59.2**	

Lastly, the issue of ill-treatment of locals by SO was noted as a critical perception, with a 70% share. These findings are in agreement with previous conclusions by Muchapondwa (2003) who acknowledges that, in many cases, when parks were created; local communities were evicted from their homes and told they were not allowed to harvest wild resources. More recently, in support of this perception, the creation of wildlife reserves has been labelled as the greatest biodiversity conservation exercise that has the largest illegitimate taking of private property and resources in the history of the world (Redford and Fearn, 2007).

These above descriptive findings suggest that majority of the respondents that share boundaries with Nyatana Game Park, held indifferent attitudes with respect to elephant conservation. The major perceptions shared by these respondents are issues of crop damage, predation to livestock and death to human. In addition, issues of low revenue and the ill-treatment of surrounding communities are some of the currently shared perceptions. Public policies that target these perceptions may mould community attitudes in line with the required conservation pathway.

4.7.2 Determinants of elephant conservation pathways

In this section, the econometric results of determinants of elephant conservation pathways for surrounding communities are presented. This was against a null hypothesis that these household perceptions may influence the possible transition of the indifferent category to other elephant conservation pathways (conservation or obliteration). Table 4.6 presents the classification table for the multinomial logistic regression model used while Table 4.7 presents the multinomial logistic regression results for elephant conservation pathways. Firstly, statistics suggest that, of the cases used to create the model, 65 of the 88 respondents who indicated that they were indifferent, were correctly classified (73.9%). Fourteen of the

43 respondents who indicated a positive willingness to pay, were correctly classified (67.4%). Four of the 19 respondents who indicated a negative willingness to pay were correctly classified (12.7%). Overall, 72.7% of the cases were correctly classified, as shown in Table 4.6

Table 4.6: Classification table for the multinomial logistic regression model used

Classification				
	Predicted			
Observed (150)	Indifferent	Conservation	Obliteration	Percent Correct
Indifferent (WTP = 0)	65	21	2	73.9%
Conservation (WTP > 0)	14	29	0	67.4%
Obliteration (WTP < 0)	4	0	15	78.9%
Overall Percentage	55.3%	33.3%	11.3%	72.7%

With reference to the model fit, as presented in Table 4.7, a pseudo R^2 of 0.665 was obtained, suggesting that more of the variation was explained by the model. The likelihood ratio test (LR) of the model (final) against one in which all the parameter coefficients are null (0), resulted in a significant Chi-Square (123.926: 0.000) suggesting that the final model outperformed the null.

Crop damage perception (EDCP)

Crop damage (EDCP) was one of the perceptions conjectured to condition the possible transition of households from the indifferent category to other elephant conservation pathways. This was against a null hypothesis that the EDCP perception may positively or negatively influence the transition of the indifferent group into either the obliteration or conservation pathway. A negative significant (-1.791: 0.030) correlation was confirmed between the EDCP perception and the conservation pathway. These results suggest that it may be less likely for households to change from the indifferent category (WTP = 0) to the

elephant conservation choice, as long as the crop damage perception remained unsolved. On the other hand, a positive significant (7.773: 0.015) association was confirmed between the crop damage perception and the obliteration choice. These findings suggest that the continued existence of the crop damage perception may offer a positive incentive for the indifferent group to consider the obliteration pathway.

Table 4.7: Multinomial logistic regression results for elephant conservation pathways

Predictor Variables (Perceptions)		Elephant Conservation Choices for Surrounding Communities			
		Conservation Pathway (WTP > 0)		Obliteration Pathway (WTP < 0)	
		B	Sig	B	Sig
Intercept	β_0	.190	.551	-3.856	.010*
1. EDCP	β_1	-1.791	.030*	7.773	.015*
2. AEIPL	β_2	-1.226	.014*	-2.182	.306
3. AETIDH	β_3	-1.639	.048*	3.970	.019*
4. AECSIFWA	β_4	-1.161	.269	4.238	.031*
5. AERLTHSFGL	β_5	-.778	.322	-1.273	.579
6. ETLUG	β_6	-.869	.266	2.002	.387
7. AERLC	β_7	.668	.508	.823	.633
8. ERGAL	β_8	.119	.883	-1.720	.373
9. EFWDDS	β_9	.494	.594	-2.395	.232
10. EPMLHTH	β_{10}	-.031	.979	-.619	.762
11. ENCR	β_{11}	1.099	.234	1.032	.581
12. REBLI	β_{12}	1.479	.418	-4.226	.042*
13. EKSOITC	β_{13}	.853	.326	4.168	.181
14. EPRRSC	β_{14}	-1.806	.039*	-5.081	.047*
15. EPRTLC	β_{15}	-.241	.823	-4.042	.112
Base Category		**Indifferent (WTP = 0)**			
No. of observations		150			
LR chi-square (30)		123.926 **			
Overall classification %		72.7			
Pseudo R – Squared		.665			

Notes: ** and * indicates significance at 0.01 and 0.05 probability level respectively

Predation to livestock perception (EIPL)

The perception that elephants cause the predation to livestock (EIPL) was statistically significant and negatively related to the conservation pathway (-1.226: 0.014). These

findings suggest that, for as long as surrounding communities share this perception, it may be less likely to expect the indifferent group to subscribe to the conservation pathway although results did not uncover a potential significant influence of this perception towards obliteration (- 2.182: 0.306).

Injury and death perception (ETIDH)

For the perception that elephants induce threat, injury and death to the surrounding communities (ETIDH), the model results suggest a negative association for this perception with reference to the conservation pathway (-1.639: 0.048) and a positive association with reference to obliteration (3.970: 0.019). Results therefore suggest that a high human - elephant conflict discourage conservation and promote the obliteration of elephants.

Availability and distribution of revenue perception (EPRRSC)

The perception of availability and distribution of revenue from elephants (EPRRSC) was significant and negatively related to the conservation pathway (-1.806: 0.039). Surprisingly, it was also significant and negatively related to obliteration (-5.081: 0.047). These findings suggest that the current revenue distribution and availability for local community was poorly done, with the bulk of these profits remaining with SO and councils. The model results suggest that the current scenario may discourage local communities from the conservation of elephants. Contrary to this, and interestingly, the model results further provide significant evidence to suggest that, regardless of the discouragement that communities may have, this perception may not have significant influence on the promotion of obliteration. These findings point to the power of using revenue as positive returns to dictate natural resource conservation.

Financing local infrastructure perception (REBLI)

Further, and with reference to issues of revenue, the model results confirm a negative association between the perception that revenues from elephants help to build local infrastructure and the obliteration pathway (-4.226: 0.042). The implied message is that, as long as communities observe direct common pool local infrastructural development, funded by revenue from elephants, surrounding communities may be discouraged from considering the obliteration pathway. However, the study did not uncover any significant influence of this perception on conservation.

Social instability perception (ECSIFWA)

Lastly, a positive significant (4.238: 0.031) correlation was confirmed between the perception that elephants cause social instability due to fear of wild animals and the obliteration pathway. The implied message centres on the fact that it may be more likely for households to consider the obliteration pathway, as long as elephants continue to cause social instability amongst local communities. The results, therefore, suggest that there may be sufficient evidence to claim that as long as elephants continue to cause social instability, households may be more likely to partner with poachers (Child *et al*. 1997) or become poachers themselves. Effectively this may lead to decimation of elephants as communities join the obliteration pathway.

4.8 Implied message

Even if elephants are kept inside protected areas or outside, they still share boundaries with communities in marginal areas where such communities are congested and their sources of livelihood are primarily from natural resources, including elephants (Novelli *et al*. 2006). By default, these communities have a much greater practical potential to conserve African

elephants (Child *et al*. 1997; Muchapondwa, 2003) or assist in their extinction, depending on the available shared perceptions (Twyman, 2001). Understanding a community`s perceptions on elephants may, therefore, go a long way towards their conservation (Novelli *et al*. 2006), through policy targeting on enhancing the perceptions that mould communities towards the conservation choice as well as discouraging perceptions that promote the obliteration choice.

Three messages from the model results emerge as follows: firstly, the perceptions of crop damage, predation of livestock, threats, injury and social instability point to a lack of effective PAC measures. Secondly, the perception that the bulk of revenue is taken by SOs and RDCs points to the lack of an effective distribution of revenue, to the critical target group that should benefit from elephant proceeds. Thirdly, the perception related to the building of a local common pool infrastructure points to the power of using positive returns to dictate natural resource conservation pathways in communities.

4.9 Policy targeting

4.9.0 The accommodation and social cost argument

With the increase in the human population, amidst a static land size, elephants may be forced to pay for their accommodation costs and significantly reduce their social costs to surrounding communities, if ever they are to secure a piece of land to reside in Africa. The conventional belief that nature must accommodate elephants free of charge, may be a misplaced wishful thinking in the current era; especially since wildernesses have been converted into pasture lands, cropping lands, industries, cities and road networks in order to generate food and revenue for the ever-increasing human population, as earlier acknowledged by Akama (1996).

In essence, a natural wilderness no longer exists; those remaining are heavily surrounded by communities who also largely depend on them for their livelihoods. The accommodation costs referred to in this study are generated social costs to surrounding communities because elephants are allowed to exist as similar to what Muchapondwa, (2003) labelled 'social costs'[17] with regards to wildlife management. In reality, as elephants exist they induce accommodation and social costs to surrounding communities, thus creating a variety of conflicts with humans. These costs *cum* perceptions were found to be significant issues capable of shaping communities` attitudes towards elephants. Of interest was their significant influence towards changing the indifferent group (WTP = 0) towards pursuing the obliteration pathway (WTP < 0). Moreover, based on evidence from the study area, the existence of these perceptions was sufficient to send a disincentive signal for the indifferent group to consider the conservation pathway (WTP > 0), a position that was also confirmed by Muchapondwa, (2003).

Policy may, therefore, target accommodation and the social costs induced by elephants to surrounding communities, for they may be the true primary causes of the extinction of African elephants. Poaching, in this regard, may be viewed as an induced symptom caused by the high accommodation and social costs of elephants, but it is not a primary cause of extinction. Similar conclusions were also inferred by Sutton (2001) who noted that the ban on the ivory trade assumed that poaching was the primary cause of elephant decimation. To that end, targeting poaching from a policy point of view may be a misguided approach that may fail to remove the primary causes, which are; accommodation and social costs.

[17] (i) crop damage, (ii) livestock crowd-out, injury and predation, (iii) human threat, injury and death especially by lion, leopard, buffalo and elephant, (iv) opportunity costs of the land on which they live, (v) social instability due to fear of wild animals, (vi) direct management costs, and (vii) loss of leisure time as people have to sleep in fields guarding against wildlife intrusions during cropping seasons.

Rethinking how to solve the issue of PAC caused by elephants amongst communities, may be the first step towards reconciling the differences that exist between local communities and elephants worth considering given the greater practical potential to conserve or obliterate elephants by surrounding communities (Child *et al*. 1997; Muchapondwa, 2003). Available PAC measures (electric fences, guards with guns) have proved to be expensive and ineffective in deterring elephants from invading crops of surrounding communities (King *et al*. 2009; King, 2010). More research and effort should therefore focus on sustainable, effective and user friendly measures that deter elephants from invading the crops of surrounding communities as well as minimising their conduct within the properties of the same communities. Alternatively, the growing elephant poaching syndrome may be an induced effect to reduce high accommodation and social costs caused by elephants.

4.9.1 The competitive exclusion argument

The competitive exclusion concepts borrows the idea of "the survival of the fittest concepts" defined in revenue principles, where low revenue generating activities will be substituted by high revenue generating activities (Sutton, 2001). Effectively if land is scarce the highest revenue generating activity will compete out low revenue generating activities. Sutton (2001) acknowledges that the competitive exclusion principle could perhaps help to account for the decline in the elephant population due to the fact that two species simultaneously seek an essential resource of the environment, which is scarce. Muchapondwa, (2003) notes that, the creation of parks led to eviction of local communities from their homes and exclusion from harvesting wild animals and plants as practiced for centuries. Jones (1994) also notes possible livestock predation from elephants. In essence, two species (elephants and humans (and their livestock)) are competing for a scarce static resource (land).

Unfortunately, the population of both these species is increasing, thus making the available static land unable to accommodate the desired needs of the two species. On one end, elephants expect an unlimited wilderness in Africa. Contrary to this, communities strongly believe that the limited available land must provide food for their day-to-day survival and grazing land for their livestock. In the event that elephant farming is deemed to be the appropriate land use option in these areas, sufficient revenue available on consistent basis should be generated and accrue to surrounding communities, so that they do not consider alternative options.

The model results, as presented in Table 4.7, suggest a possible association between issues of revenue and the attitudes of communities towards elephants. The perception of the availability and distribution of revenue, from elephants, was significant and negatively related to the conservation pathway. The implied message may, therefore, be that as a result of the created competition for land, elephants must economically complete with other alternative activities that can be employed on the land on which they exist. Policy should, therefore, target how to maximise the total economic value from elephants and its distribution to local communities in sufficient amounts so as to address their day-to-day livelihood needs, on a consistent basis. A similar conclusion was inferred by Barbier *et al.*, (1990) who cautioned the issue of ability to capture a sufficient proportion of the rent from elephants, by African governments, if ever the competitive nature of elephant farming was to be maintained.

Research efforts should, therefore, focus on how to boost revenue potentials from sustainable elephant farming, possibly through combining both consumptive and non consumptive ecotourism activities (Novelli *et al*. 2006). Policies should also further focus on the devolution of elephant user rights to local communities so as to reduce possible revenue siphoning by RDC and SO. Effectively, this may empower local communities to own their

natural rural resources and directly benefit from them (Muchapondwa, 2003; Smith and Duffy, 2003). This approach involves the intergenerational masses of communities as partners in the promotion of conservation and development. Positive incentives (revenue from elephants) will therefore be used to dictate conservation pathways to be pursued in resource utilization.

4.9.2 The absent species preservation argument

There is a growing belief that "zero revenue dictates conservation" (Sutton, 2001), especially by northern African countries from the production side, and most of the EU and western countries as well as the USA from the ivory demand side (Foundation for Environmental Conservation, 2009). This belief seems to have influenced the current CITES ban in ivory trade, which is supported by yet another belief that poaching is the primary cause of elephant decimation. This study strongly believes and shares Sutton's (2001) notion that "zero revenue dictates conservation" may be a flawed belief based on gut feelings and lacking in empirical evidence from real elephant producer communities.

Elephants exist on land which has a positive value with multiple uses to society. The positive value of elephant habitation, in this case land and vegetation, presents an opportunity cost to society as a whole, but specifically for local communities that would be better-off by using that land and vegetation for other economic activities (timber, crop land, grazing land). Conferring zero revenue to elephants, with the flawed belief of dictating conservation, may create an absence of the "species preservation price" for elephants amongst those who have the practical capacity to eliminate or conserve them, i.e. local surrounding communities (Sutton, 2001). The elephant habitat preservation price automatically becomes zero from the producer communities` point of view, for there will be no incentive to preserve elephant

habitats (land and vegetation) that are generating zero, if not negative, revenue (accommodation/social costs of their existence amidst zero revenue) for local communities.

The conversion option is, therefore, logically conjectured to win (Pearce and Turner, 1990), as communities look for the best alternative use of the land and vegetation that generates revenue, or food, for their daily requirements. Perceptions based on low revenue were found to be significant (Table 4.7) in shaping the attitudes of local communities towards the obliteration of elephants. These findings support the absence species preservation argument in that any policy that reduces the potential revenue from elephants may in fact promote the consideration of elephant obliteration amongst surrounding communities. Thus far, increasing revenue from elephants may dictate conservation. Policy may, therefore, target the unlocking of all revenue sources from elephants (consumptive and non-consumptive uses) and ensure that all those revenues reach the rightful recipients in time, through the full devolution of user rights to communities, as suggested by Muchapondwa (2003). Under such circumstances, communities may be expected to jealously guard elephants for they would be sustainable livelihood sources for them.

4.10 Study summary

The first objective of this study was to identify societal perceptions of African elephants. The H_0: hypothesis for this objective was that crop damage, revenue sources and the predation of livestock are some of the major perceptions shared by surrounding communities. The descriptive results suggest that the following perceptions are commonly shared by the surrounding communities from the three districts: crop damage, predation of livestock, human injury, death, ill-treatment of locals, little and inconsistent revenue, poor revenue disbursement to locals and loss of leisure time.

Secondly, the study estimated the determinants of elephant conservation pathways. The H_0: hypothesis for this objective was that elephant conservation pathways may be conditioned by household perceptions like crop damage, predation and revenue potential. Results from the multinomial regression model suggest that perceptions of crop damage, predation of livestock, threat and injury to human beings, poor revenue disbursements to surrounding community negatively condition households` elephant conservation choices in line with the conservation pathway.

On the other hand, with reference to crop damage, threat, injury and death to human beings and social instability perceptions, the results suggest a positive influence with respect to the obliteration pathway. Lastly, with regard to the financing of local infrastructure and disbursement of revenue to local community perceptions, the results suggest a negative correlation with respect to the obliteration pathway.

4.11 Conclusions

The study concluded that perceptions of crop damage, predation to livestock, human injury and death, ill-treatment of locals, little and inconsistent revenue, poor revenue disbursement to locals and the loss of leisure time were commonly shared by surrounding communities from the three districts. With reference to the determinants of elephant conservation pathways, the study concluded that the crop damage, threats, injury and death to humans, livestock predation and social instability were significant perceptions shared by local communities; these perceptions are capable of negatively influencing the conservation of African elephants.

These perceptions signal to lack of effective Problem Animal Control (PAC) measures, implying that available PAC measures (fence-in, guns and guards) may fail to deter elephants from invading the fields and properties of local communities. Perceptions of poor revenue

disbursement to local communities were also widely shared by local communities; they too are capable of negatively influencing the elephant conservation pathway. The study, therefore, noted that these perceptions may be some of the primary causes of elephant decimation in Africa; they are deemed capable of inducing elephant poaching syndrome in local communities and the conversion of elephant habitats to competitive land use options, as locals try to define their survival lines and unlock themselves from high social costs caused by elephants.

Lastly, the building of a local common pool infrastructure, from elephant revenue, was also a significant perception capable of positively influencing conservation. The study, therefore, further concludes that the high human-elephant conflict and low revenue from elephant farming may discourage the interests of surrounding communities from the conservation of elephants. On a constructive note, the study suggests that direct observable positive returns from elephant proceeds may be used as a conservation promotion device for surrounding communities.

4.12 References

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Chapter Five

Modelling the buffer zone livelihood link under community managed game parks: Evidence from Nyatana Game Park, Zimbabwe

Abstract

Buffer zones have been in existence for a long time, especially where wildlife share boundaries with local communities. The available institutional support structures that created buffer zones had in mind the use of buffer zone products to supplement domestic requirements for the sub-district producer community, thereby sustainably combining conservation and development. For community managed game parks, the revenue was assumed to be the primary livelihood source of the sub-district producer community, while buffer zone products would be used as supplements, domestically. In this regard, the buffer zone livelihood link gained popularity and is currently an agreed sustainable pathway followed by several wildlife practitioners.

The study investigated the dynamics of the buffer zone livelihood link as practiced under community managed game parks using the Nyatana Game Park in Zimbabwe as a case study. The results of this study seem to suggest that buffer zone participation and resource extraction, by surrounding communities, is more market driven than intended for domestic consumption, as a result of the meagre game park revenues. With respect to correlates of the buffer zone, actual resource extraction the binary logistic regression results suggest that access to markets, wealth, gender, household size and livestock units, may be the primary factors capable of positively influencing participation in buffer zone resource extraction. Extension and age were negatively related to participation in various buffer zone resource extraction combinations.

The study concluded that the buffer zone livelihood link, as currently practiced under community managed game parks, though potential, may fail to address the livelihood expectations of the sub-district producer community. Major obstacles to this link may be institutional and conflicting design objectives. Irrespective of the lucrative potential of the link, available markets and legal frameworks are not supportive because they were never created to accommodate the commercialization of buffer zone products.

The study, therefore, calls for extreme caution whenever the buffer zone livelihood link is considered as a possible livelihood source under community managed game parks. This is because several institutional and conflicting design objectives exist. The confirmed positive relationship between access to markets and resource extraction may signal a market driven demand capable of causing over exploitation amid low revenues from game parks. A group approach to harvesting, supported by a quota and permit system which is monitored by Local Management Committees, (LMCs) may be a solution to avoid the scramble of buffer zone products.

Key words: The buffer zone livelihood link, community game parks.

5.0 Introduction and background information

This section presents the introduction and background information; specifically focussing on the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE), potential conflict, dilemma of the sub-district producer community and the buffer zone livelihoods linkage in Zimbabwe.

5.1 The CAMPFIRE approach in Zimbabwe

Community managed Game Parks, under the CAMPFIRE principles in Zimbabwe, were designed to allocate the rights to use communal resources to local communities [CAMPFIRE Association (CA), 2000; Muchapondwa, 2003]. RDC would get the AA status in order to be a CAMPFIRE district upon satisfactory demonstration that they are capable of managing natural resources in their area, in a sustainable way, by satisfying the following conditions;

- disbursement of at least 50% of CAMPFIRE revenues to the primary sub-district producer communities [with a disbursement target of 80% while the remaining 20% would be used for CAMPFIRE (management in the entire district – 15%, and general council administration and development – 5%)], and
- they must agree to transfer management functions to the primary sub-district producer community over time (CA, 2000; Muchapondwa, 2003).

Muchapondwa (2003) further notes that it is necessary for the game parks to generate sufficient incentives to promote good conservation and to create disincentives for inhibiting the abuse of resources. Effectively, meaningful returns were necessary to cover the operational cost of RDCs while leaving sufficient revenues for the primary sub-district producer community. In theory, the proposed 80% share of total CAMPIRE revenue was deemed to be enough for the primary sub-district producer community, and 20% for the

RDCs. Councils and the primary sub-district producer community leadership would therefore identify competent SO for partnership. SO would run the entire game park, on a lease or joint venture agreement, and share revenue, normally on a 50-50 basis, after tax. In addition, the Game Park would be officialised into a commercial Park with strict access restrictions to enhance smooth ecotourism (CA, 2000).

5.1.1 Potential conflicts

The following assumptions have dominated the CAMPFIRE concept;

- **Assumption 1:** The introduction of SOs was assumed to enhance professionalism in managing community owned game parks (CA, 2000).
- **Assumption 2:** It was assumed that there is a positive linear correlation between the engagement of professional SOs and high CAMPIRE revenue (CA, 2000).
- **Assumption 3:** Lastly, through the concept of Build Operate and Transfer (BOT), it was assumed that in the long-run full management will be transferred to the primary sub-district producer community, thereby empowering local communities [Nyatana Joint Management Trust (NJMT), 2011].

While the assumptions were promising in theory, the following challenges were noted on implementation:

Challenge 1: The positive linear correlation between professional SO and high CAMPFIRE revenues seem to be in absolute value at the expense of real value to the primary sub-district producer community (NJMT, 2010). Thus, by engaging SO, through seeking professionalism, the sub-district producer community was forced to sacrifice significant revenue through profit sharing. Normally, the primary sub-district producer community encompasses surrounding villages which share boundaries with established game parks,

implying a higher number of expecting active beneficiaries[18]. Effectively, such a huge number of active producer communities would be forced to share 80% of the total CAMPFIRE revenue (after RDCs deduct 20% for their administration fees) with the SO on a 50:50 basis, accruing once per year.

Challenge 2: Formalised game parks, as a result of engaging SO, are characterised by access restrictions for local communities (CA, 2000). Safari operators, after signing lease agreements, normally take advantage of silent issues of access by local communities so as to harvest natural resources and use legal measures to threaten and inhibit access by local communities. Effectively, local communities find it difficult to continue harvesting natural resources from their Game Parks as soon as they enter into agreements with SO.

Challenge 3: Local communities are normally employed as security guards and tour guides (NJMT, 2010). These communities are rarely absorbed into management or senior level posts by SO. The BOT concepts, therefore, remain a theoretical aspiration that will never materialise since game parks have been and are still managed by SO (NJMT, 2010, 2011).

5.1.2 Dilemma of sub-district producer community

In their original state, sub-district producer communities cannot commercially operate successful game parks (CA, 2000). In a bid to engage competent SOs, the sub-district producer community sacrifice half of its potential CAMPFIRE revenue through profit sharing. The actual benefit accruing to individual active members is therefore significantly reduced. Other livelihood options, that are purely defined in the natural environment (the park area), also become inaccessible. The knowledge transfer, anticipated through partnership, also fails to materialise (NJMT, 2010, 2011).

[18] Primary sub-district producer communities who receive CAMPFIRE revenue

5.1.3 Buffer zone livelihoods linkage

Buffer zones comprise of an agreed area where communities can harvest natural resources from the park. These are common where game parks meet with human populations (Lynagh and Urich, 2002) and are often considered as a means to substitute the local people`s use of game park resources (Heinen and Mehta, 2000). Nepal and Weber (1995) acknowledge that, in Nepal, buffer zone community forestry has for some time been promoted under the assumption that it can supply adequate substitutes for the resources extracted from protected areas and further fulfil its dual objective of nature protection and rural development.

Stræde and Treue (2006) note that, in geographical terms, buffer zones might be defined entirely inside or outside of, or as overlapping with, the original boundary of the protected area. Stræde and Treue (2006) further argue that the legal and, effectively, the official management authority over buffer zones might therefore rest entirely with the protected area managers, local communities or it might be shared between a number of different stakeholders.

Buffer zone dependence may, therefore, be more important for the sub-district producer community than CAMPFIRE revenue from park activities. Poorly defined buffer zones, and total restriction to access by local communities, may seriously affect the welfare of the sub-district producer community. Improving total game park CAMPFIRE revenue for local communities may be a necessary, but not sufficient condition, given the total number of expecting potential active members. Unlocking the buffer zone livelihood link becomes a promising paradigm given the fact that Game Park CAMPFIRE revenue may never be sufficient to address the livelihood needs of all sub-district producer communities. Game

park CAMPFIRE revenue would, therefore, be used to develop common pool infrastructure like roads, schools, clinics and dip tanks.

5.2 Statement of the research problem

Lynagh and Urich (2002) acknowledge that buffer zones for the purpose of promoting conservation and development have, since 1968, been introduced specifically where conserved regions meet with human populations. Heinen and Mehta (2000) argue that buffer zones are often considered a means to substitute the local people`s use of protected resources. Based on evidence from Nepal, buffer zone community forestry has been promoted under the assumption that it can substitute for resources extracted from protected areas (Nepal and Weber, 1995).

However, Wells (1995) notes that, in practice, people situated in or near biologically-diverse ecosystems often capture little economic benefits from conservation or sustainable resource use. McNeely (1988) also suggests that measures designed to conserve biodiversity must provide economic incentives in order to increase the net local benefits of conservation and sustainable resource use. Effectively, this has meant a revived emphasis on sustainable approaches driving income from wild-lands and biological resources (Wilson, 1992). From a political and ethical point of view, Wells (1995) acknowledges that it is increasingly recognised that it is neither politically feasible nor ethically justifiable to attempt to deny the poor the use of natural resources without providing them with an alternative means of livelihood. Therefore, focus has recently been placed on innovative land use strategies that accommodate local communities.

In southern Africa, where CAMPFIRE principles are dominant, the focus has been on ways of increasing game park CAMPFIRE revenues through the devolution of user rights to local communities (Child *et al*. 1997; Muchapondwa 2003), negotiating for free trade of ivory and

combining consumptive and non consumptive ecotourism (Barnes, 1996, 1998; Muchapondwa, 2003; Novelli *et al*. 2006). By transferring user rights to local sub-district producer communities, the target objective has been to eliminate potential profit sharing stakeholders in the system, thereby increasing total game park CAMPFIRE revenue. Through negotiating for the free trade of ivory, southern African countries wish to increase their game park CAMPFIRE revenue through ivory sales. Lastly, by combining consumptive and non consumptive ecotourism, southern African countries further wish to boost game park CAMPFIRE revenue to address local communities` livelihoods in exchange for resource conservation.

Little success has, however, been registered with regard to this pathway, since game park CAMPFIRE revenue continues to grow at a very slow rate amid a fast growing number of landless livelihood void sub-district producer communities. This study, therefore, seeks to investigate the much assumed potential of the buffer zone livelihood link (Lynagh and Urich, 2002; Heinen and Mehta, 2000; Stræde and Treue, 2006) against a background in which several authors question its practical significance (Sayer, 1991; Wells and Brandon, 1993; Wells, 1995; Oldfield, 1988; Newmark and Hough 2000; Ferraro 2001; Agrawal and Redford 2006).

5.3 Research gaps

Zimbabwe and most southern African countries have been focusing on ways of increasing Game Park CAMPFIRE revenue (Muchapondwa, 2003) at the expense of the buffer zone livelihood link. Redford and Fearn (2007) acknowledge that, to bolster support for biodiversity conservation, it is critical to produce a more nuanced approach to the interaction between protected areas and local communities as most of these areas have been responsible for diminishing the livelihood prospects of people sharing boundaries with them. Redford

and Fearn (2007: 3) further argue that, “left largely unexplained, however, are the benefits that protected areas may provide for these same people”.

Stræde and Treue (2006) also note that, irrespective of buffer zone community forestry, there is still a gap between the local people`s needs for supplementing natural resources and their rights to satisfy them on a legal basis. Moreover, little emphasis has been placed on documenting the differential nature of returns to different interest groups within forest (buffer zone) resource using communities (Kabubo-Mariara, 2008). The study, therefore, seeks to address these gaps through exploring the nature and extent to which resource-poor primary and secondary sub-district producer communities depend on buffer zones for their livelihoods.

The study addresses the following research question; (1) What are the socio-economic determinants of participation in buffer zone activities and actual resource extraction (combination of buffer zone resource extractions reported by respondents)?

5.4 Study objective

The broad objective of the study was to investigate the link between buffer zones and the livelihoods of sub-district producer households. The specific objectives are to investigate socio-economic correlates of participation in buffer zone activities and determinants of buffer zone resource extractions.

5.5 Study setting, sampling and data collection procedures

The data used in this study was collected from “cluster C” yielding a sample of 289 households. The survey was carried out in November and December 2010, and January 2011. Purposive sampling methods were used to select the game park (Nyatana), by taking into account the presence of the characteristics of interest and the scope of the study. All three

districts (Mudzi, UMP and Rushinga) from the primary[19] and secondary[20] sub-district producer wards were included in the sample specifically covered by "cluster C". Two communities were randomly selected from each of the three districts covered under "cluster C". Efforts were made to ensure representation of respondents from both primary and secondary sub-district producer communities. Table 5.1 presents the distribution of respondents with respect to location and their buffer zone user registration status.

Table 5.1: Category of households with respect to location and buffer zone user groups

Group	Registered	Not Registered	Total
Primary sub-district producer community (<2.5km from buffer zone outer boundary)			
(A) < 1 km from buffer zone outer boundary	90 (63.4%)	6 (4.1%)	96
(B) 1 – 2.5 km from buffer zone outer boundary	34 (23.9%)	15 (10.2%)	49
Secondary sub-district producer community (> 2.5km from buffer zone outer boundary)			
(C) 2.5 – 3 km from buffer zone outer boundary	13 (9.2%)	54 (36.7%)	67
(D) > 3km from the buffer zone outer boundary	5 (3.5%)	72 (49.0%)	77
Grand Total	**142 (100%)**	**147 (100%)**	**289**

Local CAMPFIRE Committees (LCCs) in place are responsible for the day-to-day administration of buffer zone activities. In some areas, these committees are very active (Chingamuka - Mudzi and Nyanzou - UMP). However, in other areas such committees are nonexistent (Dewe, Masunzwa - UMP). The same committees are also responsible for creating a database for all buffer zone user households and monitor abuse - activities deemed

[19] Households located within 2.5km from the outer boundary of the buffer zone

[20] Households located beyond 2.5km from the outer boundary of the buffer zone

to cause degradation (NJMT, 2010). In principle, all households willing to use the buffer zone are supposed to register with the LCC and attend regular management meetings with the SO. Further, non registered households are, in principle, not supposed to use the buffer zone.

The actual sample yielded 289 respondents, 145 from the primary and 144 from the secondary sub-district producer communities. A total of 149 registered households were considered and 140 nonregistered. A detailed questionnaire (annexure 3) was used to gather the required data and probe the socio-economic characteristics of households, their economic activities and buffer zone collection activities. Household data was further augmented by a community survey for each of the sampled villages[21], targeting group consensus information on local market price for buffer zone products, extension services, and extractable buffer zone products.

5.6 Related literature from a general perspective

There is a growing body of literature on reconciling economic development and biodiversity conservation in developing countries, for it is widely recognised that protected areas affect the livelihoods of local people (Lynagh and Urich, 2002; Wild and Mutebi, 1997; Kothari *et al*. 1995; Skonhoft, 1995; Wells, 1995). Furthermore, there is a growing body of literature which attempts to calculate the economic value of protected areas and the costs and benefits incurred by people living in the vicinity of such areas (Muchapondwa, 2003; Godoy *et al.* 2000; Shyamsundar and Krammer, 1997; Melnyk and Bell, 1996). Stone (1991) acknowledges an increasing number of demonstration projects with the objective of linking biodiversity conservation with improvements in human welfare. Wells (1995) points out that such projects have largely been based on land use strategies, including biosphere reserves,

[21] Three groups per village were targeted comprising of key local informants like villages heads, local CAMPFIRE committee leaders and other leaders from local social network groups available

multiple-use conservation areas, buffer zones on protected area boundaries, extractive reserves, social forestry and a variety of other approaches.

More recent studies have, however, focused on the buffer zone-livelihood link (Kabubo-Mariara, 2008; Redford and Fearn, 2007; Stræde and Treue, 2006; Johannesen and Skonhoft, 2005; Vedeld *et al.* 2004). A two way link between buffer zones and poverty is suggested; where, on the one hand, the literature argues that the poor depend on buffer zones (forests) as safety nets and, on the other, it states that forest communities are poor due to a reliance on forest activities which have a low return (Kabubo-Mariara, 2008). Other studies suggest that both the poor and rich depend on forests, only that the level of dependence is determined by differential socio-economic characteristics of the two groups (Narain *et al.* 2005; Vedeld *et al.* 2004; Fisher, 2004).

Several ideas emerge from the literature as follows: Firstly, the literature suggests that reconciling biodiversity conservation and the welfare of surrounding communities seems to be an agreed upon sustainable pathway. Secondly, the literature further suggests that the actual benefits of wildlife (Game Parks and forestry areas) to surrounding communities are not obvious and evenly distributed across active wildlife user groups. With this, the suggested sustainable pathway (reconciling biodiversity conservation and welfare of surrounding communities) may be complicated with high possibilities of being doomed. The need therefore arises to further understand location based scenarios and to produce location based recommendations, rather than relying on "blue prints" and blanket prescriptions.

5.7 Methods of analysis - exploring buffer zone dynamics

The study initially estimated correlates of buffer zone participation following the utility assumption that participation may mean dependence and effectively relative importance. The registration status of households was used as a proxy measure of participation as explained in

section 5.5. Effectively, this created two distinct groups across all the sub-district producer community, as follows: registered (participants) and not registered (non participants). To complement the assumed dependence, the study further estimated correlates of actual buffer zone resource extractions based on reported extraction combinations. The two hypotheses were conjectured as follows: The poor are more dependent on buffer zone resources than the rich. Buffer zone user group heterogeneity is therefore an important determinant of buffer zone participation and actual buffer zone resource extraction is conditioned by other household level heterogeneities such as gender. The study employed both descriptive and econometric methods to test the conjectured hypotheses.

Econometrically, the study proceeded as follows: Firstly, the study investigated the socio-economic correlates of participation in buffer zone activities. The participation status of households, as revealed by the registration status of respondents with LCCs, was therefore used as the dependent variable. Secondly, the study estimated the correlates of actual buffer zone resource extraction combinations. Four buffer zone resource extraction combinations from a total of seven, as summarised below, were suggested as common by the majority of the respondents, as shown in Table 5.2.

(a) **Wild foods and fire wood combination** represent an aggregate of combinations to include (i) fire wood for both domestic use and resale, and (ii) wild foods collection to include both flora and fauna species.

(b) **Wild foods and construction combination** represent an aggregate of combinations to include (i) wild foods collection to include both flora and fauna species and (ii) construction poles, thatching grass and reeds.

(c) **Fire wood and construction combination** represent an aggregate of combinations to include (i) fire wood for both domestic and commercial use and (ii) construction poles, thatching grass and reeds.

(d) **Wild foods only** represents wild foods collection to include both flora and fauna species.

(e) **Fire wood only** represents fire wood for both domestic use and resale.

(f) **Construction only** represents construction poles, thatching grass and reeds.

(g) **All extractions combination** represents an aggregate of all the combinations at once.

Table 5.2 presents the reported buffer zone resource extraction combinations in their order of priority. Considering the main four combinations, four binary logistic regression equations were formulated to assess the correlates of each combination. Four dependent variables were formulated for each combination. Based on this formulation, *Y* was assumed to be a dichotomous dependent variable, taking the value of 1, when the household chooses a combination in question and 0 otherwise.

Table 5.2: Buffer zone resource extraction combinations

Reported buffer zone resource extraction combinations	Primary sub-district producer community	
	A: (< 1km)	B: (1-2.5km)
Resource extraction combinations (% respondents)		
1) Wild foods & Firewood	**33**	**36**
2) All Extractions	**26**	**20**
3) Wild foods & Construction	**21**	**20**
4) Firewood & Construction	**20**	**15**
5) Wild foods only	**0**	**3**
6) Fire wood only	**0**	**1**
7) Construction only	**0**	**0**

In the following section, the study only considered model specification based on "participation". The typical binary logistic regression for participation was therefore

formulated as follows: Household participation in buffer zone activities was based on an assumed underlying utility function of attaining secure livelihoods sources from the buffer zone. According to this theory, households were conjectured to participate more in buffer zone activities if the utility obtained from participation exceeds that of non-participation. The binary logistic regression model, as specified in equations 5.1 to 5.5, following an approach by Kidane *et al.*, (2005), was used to investigate socio-economic correlates of participation in buffer zone activities.

$$\phi_i = E\left(\gamma_i = \frac{1}{\chi_i}\right) = \frac{1}{1+\ell^{-\left(\beta_i + \sum_{i=1}^{k=n} \beta_{ij}\chi_{ij}\right)}} \quad \text{..... (5.1)}$$

ϕ_i = is the probability of household (*i*) being a participant in buffer zone activities

γ_i = is the observed buffer zone participation status of the household

i, χ_{ij} = are the factors determining buffer zone participation status for households

i and β_j = stands for parameters to be estimated.

By denoting $\beta + \sum_{j=1}^{k=n} \beta_{ij}$ *as* Z, equation (1) can be written to give the probability of buffer zone participation status of household (*i)* as:

$$\phi_i = \mathrm{E}\left(\gamma_i = \frac{1}{\chi_i}\right) = \frac{1}{1+\ell^{-Z_i}} \quad \text{..... (5.2)}$$

From equation (2), the probability of a household being a participant in buffer zone activities is given by $(1-\phi_i)$ which gives equation (5.3) as follows;

$$(1-\phi_i) = \frac{1}{1+\ell^{Z_i}} \quad \text{..... (5.3)}$$

According to Kidane *et al.*, (2005), the odds ratio would therefore be $\phi_i/(1-\phi_i)$ as given by equation (5.4);

$$\left(\frac{\phi_i}{1-\phi_i}\right) = \frac{1+\ell^{Z_i}}{1+\ell^{-Z_i}} = \ell^{Z_i} \quad \text{..... (5.4)}$$

The natural logarithm of equation (4) gives rise to equation (5.5);

$$Ln\left(\frac{\phi_i}{1-\phi_i}\right) = \beta + \sum_{j=1}^{k=n} \beta_{ij} + \varepsilon_i \quad \text{..... (5.5)}$$

5.7.0 Definition and measurement of variables

The study explored the impact of various household characteristics that may be expected to affect participation and actual resource extraction from the buffer zone. Community variables included: Distance to buffer zone, market access of buffer zone products, access to extension services and participation in Local CAMPFIRE groups. Household variables included: Household wealth, age of household head, gender of household-head, education level of household head, livestock units and household size. Lastly, arable land size and access to wetland gardens were also some of the important variables conjectured to affect a household's reliance on buffer zones.

Distance to buffer zone

Households which live closer to the buffer zone were expected to participate in resource extraction, hence their dependence on buffer zones more than distant residents (Varughese and Ostrom, 2001; Kabubo-Mariara, 2008). Two distinct groups (primary and secondary sub-district producer communities) based on distance to the buffer zone were created for purposes

of analysis of the likely influence of distance. Effectively, a negative association was expected.

Access to markets for buffer zone products

Access to markets for buffer zone products was expected to positively influence participation in buffer zone activities. Extractable buffer zone resources (fire wood, wild foods and construction materials) were expected to present a lucrative business opportunity for local communities, since operational costs were mainly on collection and transaction. Access to and availability of a market was, therefore, expected to positively influence participation and actual resource extraction.

Wealth status of household-head

With regard to wealth, Fisher (2004) argues that households with more wealth, defined on the basis of land and livestock holdings, may be expected to reap greater benefits from buffer zones because buffer zones may be important sources of inputs critical in the farming system. These (inputs) could be in the form of animal fodder and compost (Narain *et al.* 2005). Contrary to this, in the event that access to buffer zones is limited and high predation exists, the opposite effects were also expected. In this study, wealth status was defined based on the strategic livelihood household assets owned[22]. Either a positive or negative influence was therefore expected.

Age of household-head

The age of the household-head may be expected to reduce buffer zone dependence for older households which may lack the time and physical strength to engage in buffer zone activities

[22](a) Land holding, (b) total Livestock Units, (c) farm capital inputs, (d) household assets, (e) quality of dwelling and (f) household-head`s education

(Kabubo-Mariara, 2008; Vedeld *et al.* 2004; Kohlin and Parks, 2001). A similar approach and influence was adopted and assumed in this study based on the age of the household-head. The household-head's gender may be expected to influence participation in buffer zone activities, for women are expected to participate in common property resources more than men (Narain *et al.* 2005; Grossman, 1996; Folbre, 1994).

Education of household-head

Education was conjectured to be negatively correlated to participation in buffer zone activities, for education may open alternative employment opportunities and divert households from subsistence and gathering activities (World Resource Institute, 2005; Shively and Pogiola, 2004; Angelsen and Wunder, 2003). Four categories were created as follows: (a) uneducated households, (b) households educated up-to primary level, (c) households educated up to secondary level and (d) households educated up-to tertiary level.

Household size

Household size was conjectured to have a positive correction with buffer zone activities because gathering activities are more labour intensive (Gunatilake *et al*. 1993; Shively, 2004; Kabubo-Mariara, 2008). A similar approach and influence was adopted and assumed in this study, where household size was measured according to family size.

Access to extension services

Extension was expected to positively influence participation and sustainable resource extraction. Access to and the availability of extension services was used to measure the likely influence of extension on participation and resource extraction. Three categories were created based on personal assessments by respondents, as follows; (a) respondents accessing poor

extension services (b) respondents accessing fair extension services and (c) respondents accessing good extension services.

Livestock Units (LUs)

Generic wealth indicators in rural areas were treated separately, as follows: (a) livestock units, (b) arable land size and (c) access to wetland gardening. Livestock Units based on key bovine species (cattle, sheep, goats and donkeys) were expected to positively influence participation because the buffer zone may create grazing land for livestock (Varughese and Ostrom, 2001). With respect to predation, Jones (1994) reports a 10% elephant-livestock predation in Binga, Zimbabwe. In the event of high predation, especially for small livestock like goats and sheep, a negative influence may be expected.

Arable land size

Narain *et al*. (2005) report a positive association between land size and participation in forests, attributing the link to sources of immediate inputs, like compost. Contrary to this, land size can also lock labour in cropping activities. Either a positive or negative influence was therefore expected.

Access to wetland gardens

With respect to wetland welfare economics, Taruvinga (2009) reports a positive correlation between wetland cultivation and household food security. A negative association was, therefore, expected in the event that wetland cultivation would present pressure on the labour demand given that forestry gathering is also a labour intensive activity (Gunatilake *et al*. 1993; Shively; 2004). Table 5.3 summaries predictor variables considered in this study, their measurement and expected signs.

Table 5.3: Predictor variables, their measurement and expected signs

Variable	Description	Unit	Expected sign
Household characteristics			
Education	Highest level of education achieved	Uneducated = 0; Primary = 1; Secondary = 2; Tertiary = 3	+
Age	Age of household head	Years	-
Gender	Household head gender	1 = male , 0 female	-
Household size	Number of family members	Number	+
Wealth status	An index was constructed using household`s ownership of assets	Poor = 0; Rich = 1	+/-
Livestock Units	Number of Livestock Units owned	(< 4 LUs) = 0; (4 – 8 LUs) = 1; (> 8 LUs) = 2	+/-
Community factors			
Extension	Household`s own perception on quality of extension	1 = yes, 0 = no	+
Distance	Location of respondents with respect to buffer zone	(<1km) = 0; (1 – 3km) = 1; (> 3km) = 2	+
Market	If markets exists for natural resources to be traded competitively	1 = yes, 0 = no	+
Other factors			
Land size	Estimate of size of farming area	(<.05ha) = 0; (0.5 – 1ha) = 1; (>1ha) = 2	+/-
Wetland garden	Access to wetland garden by households	No = 0; Yes = 1	-

5.8 Results and discussion

This section presents the study results based on descriptive statistics first, and the econometrics results later. Table 5.4 summarises the general sample characteristics in terms of the measure of central tendency, measure of dispersion and measure of distribution for various household characteristics. The mean and the median did not vary greatly which, according to Norusis, (2004), implies that there were no significant outliers, for each household characteristic considered in the study. The asymmetry of distribution of household characteristics was both negatively and positively skewed.

The following household characteristics were positively skewed: household size, household head age, access to wetland garden, arable land size, livestock units and wealth status. Distance to buffer zone, access to markets, access to extension, household head education, and the gender of the household head were negatively skewed. The skewness and kurtosis values for all the household characteristics were below 1 (with the exception of wealth status; skewness 1.4), thus indicating that the distribution did not differ significantly from a normal symmetric distribution (Norusis, 2004), as shown in Table 5.4.

Table 5.4: Basic sample characteristics

Variable	Mean	Median	Std. Dev	Skewness	Kurtosis
N	289	289	289	289	289
a) House hold size	5.1	5.0	2.2	0.6	0.5
b) Household head gender	0.5	1.0	0.5	-0.1	-2.0
c) Household head age	53.7	55.0	20.7	0.1	-1.0
d) Household head education	1.6	2.0	1.2	-0.1	-1.5
e) Access to wetland garden	0.4	0.0	0.5	0.3	-1.9
f) Arable land size	1.8	2.0	0.8	0.3	-1.2
g) Livestock units	1.8	2.0	0.8	0.3	-1.5
h) Access to extension	2.2	2.0	0.9	-0.3	-1.6
i) Wealthy status	1.2	1.0	0.4	1.4	-0.1
j) Access to markets	2.2	2.0	0.7	-0.2	-1.1
k) Distance to buffer zone	2.5	3.0	0.6	-0.7	-0.5

5.8.1 Determinants of participation in buffer zone

This section presents the empirical findings on the distribution of household social-economic factors with respect to their buffer zone participation status. The implied objective was to establish the determinants of buffer zone participation at the household level. Inferences made at this level were only limited to descriptive statistics. Figure 5.1, below, provides a graphical summary based on the observed distribution of respondents by household size with respect to buffer zone participation.

Household size, measured by number of family members, was one of the factors expected to influence the decision of a household to participate in buffer zone activities, as explained under section 5.7.0. The median household size for both categories (participants and non participants) was five members. The non participant group dominated up to five members. The participant group dominated above five members.

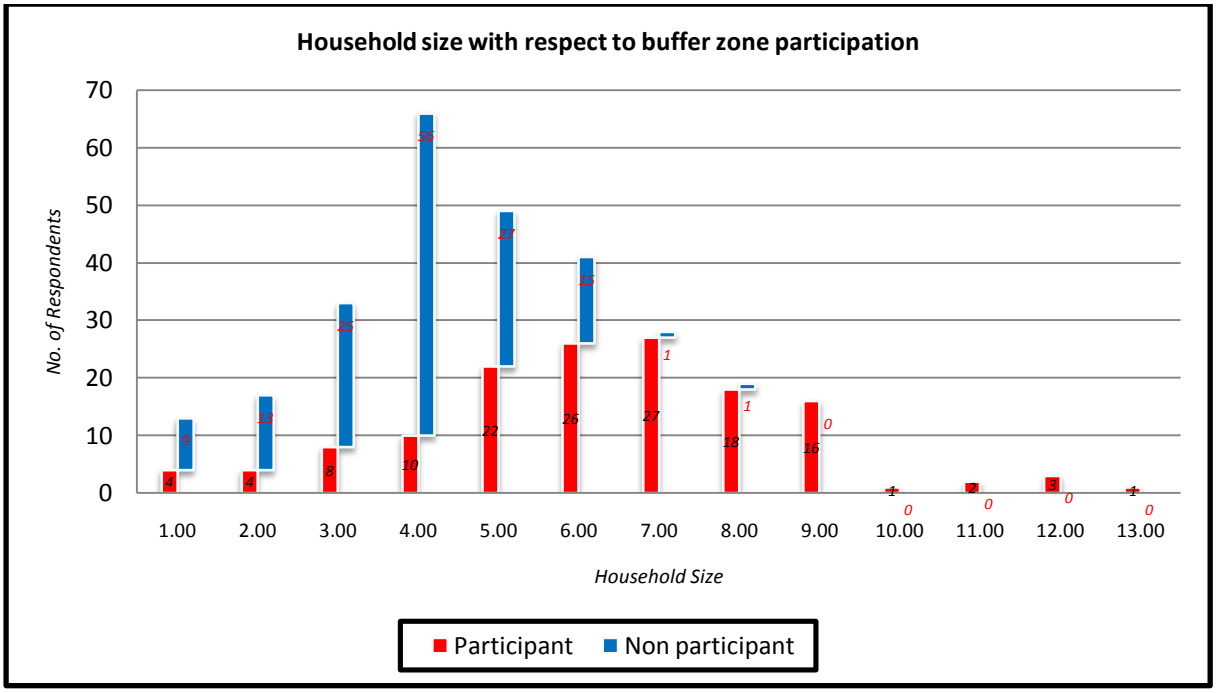


Figure 5.1: Distribution of respondents by household size with respect to buffer zone participation

The results suggest that a large household size may influence participation in buffer zone activities. Since most buffer zone activities are labour intensive (collection and gathering) as suggested by Shively (2004), it would be logical to expect a larger household to spread its labour in anticipation of gathering more from the common pool resources (Kabubo-Mariara, 2008) which are generic to buffer zones.

The association between gender and participation was also investigated. Figure 5.2 presents a graphic summary of the observed distribution of respondents by household-head gender with respect to buffer zone participation. A total of 150 respondents from the sample were male and 139 were female. Males dominated the participating group while females dominated the non participating group as shown in Figure 5.2.

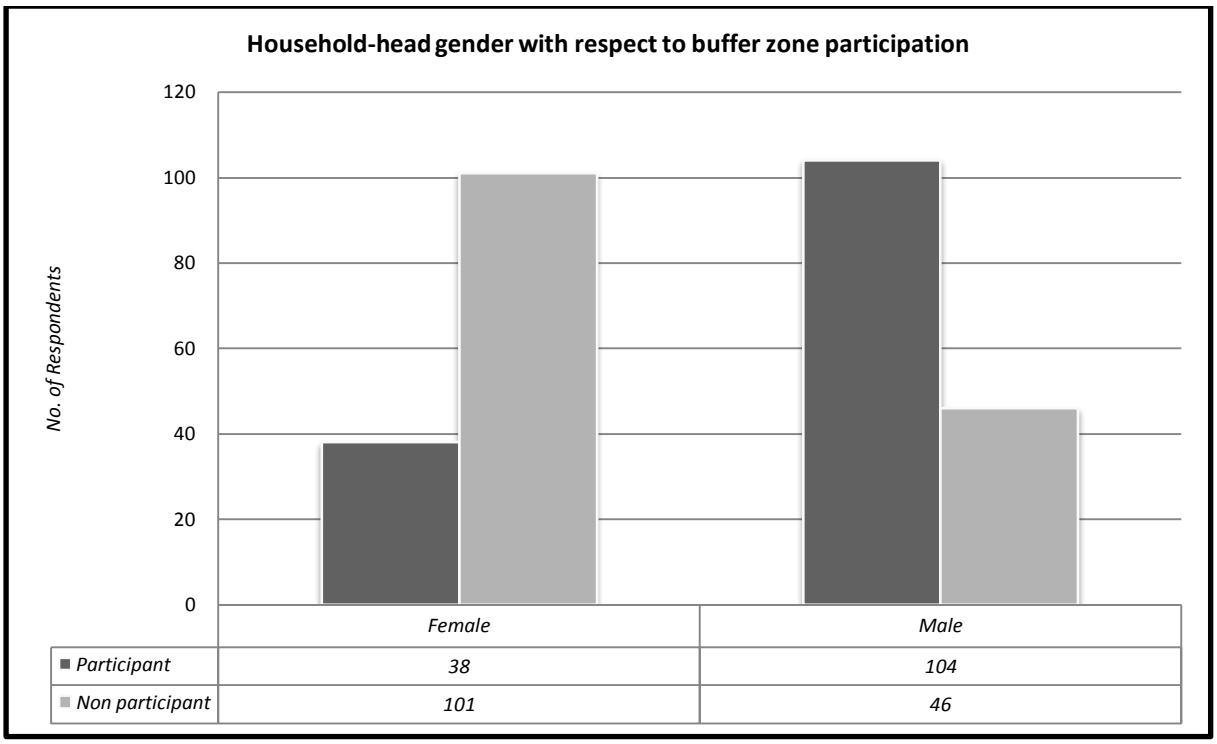


Figure 5.2: Distribution of respondents by household-head gender with respect to buffer zone participation

The results suggest that the buffer zone livelihood link may be a male activity. These results contradict several earlier findings which suggest that females may be more willing to participate in common property resources than men (Folbre, 1994; Grossman, 1996; Narain *et al*. 2005). Buffer zone common pool activities, especially from Game Parks with dangerous wild species like elephants and lions, may deter females from freely participating. The observed results are therefore not unique for females may be active participants in common pool resources from safe environments.

The age of the household-head was investigated in relation to its potential influence on buffer zone participation. Figure 5.3 presents a radar summary of the observed distribution of respondents by household-head age with respect to buffer zone participation. The median household head age, from the sample, was 55 years.

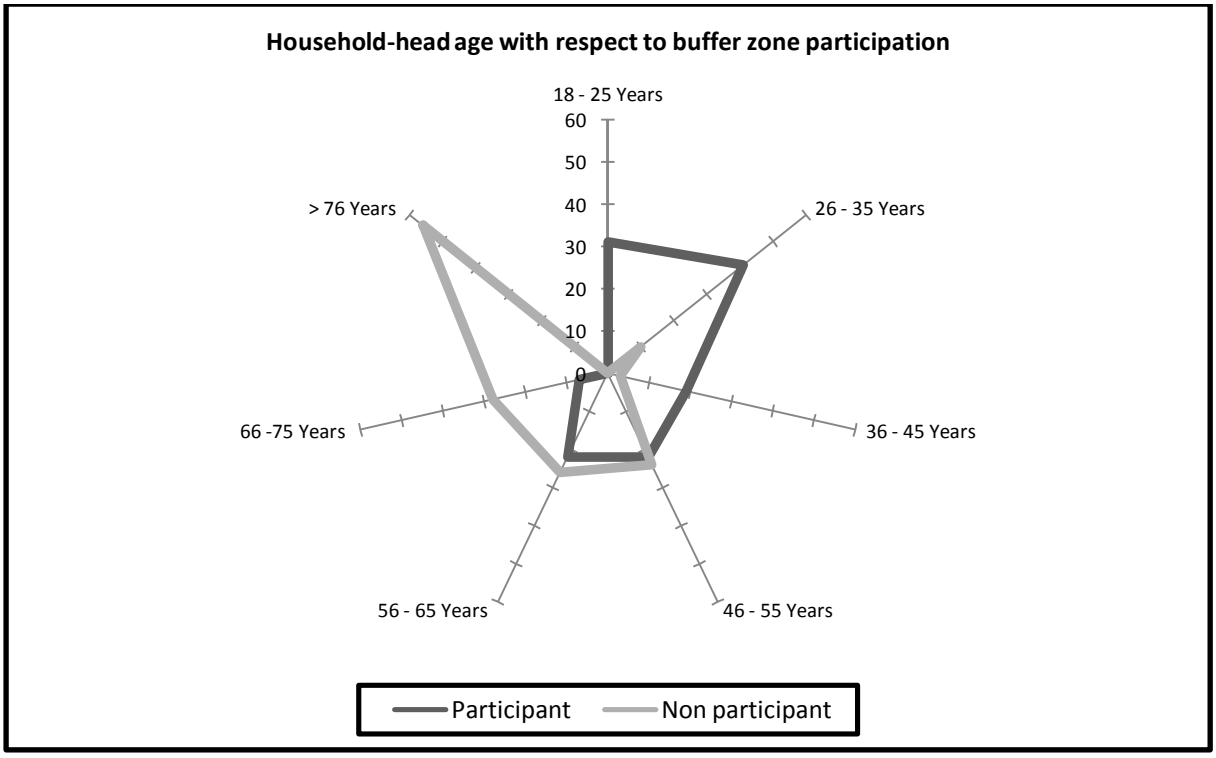


Figure 5.3: Distribution of respondents by household-head age with respect to buffer zone participation

This distribution suggests that buffer zone participation may be more of a young age activity, for participation was more pronounced in the 18 - 45 year age range than it was in the 46 - 76 year age range. Comparable results were also forwarded by Vedeld *et al.* (2004) and Kohlin and Parks (2001) who attributed such an association to the lack of time and physical strength by elderly people to engage in forestry activities.

The education of the household-head was categorized into four strata, as follows: uneducated, educated up to primary level, educated up to secondary level and educated up to tertiary level. At least 72.3% of the sample could be classified as educated (primary and above), and only 27.7% an uneducated. This distribution, although slightly lower, is consistent with national literacy statistics estimates (95%) for the two districts - Mudzi and UMP (CSO, 2002). Figure 5.4 presents a summary of the observed distribution of respondents by household-head education with respect to buffer zone participation.

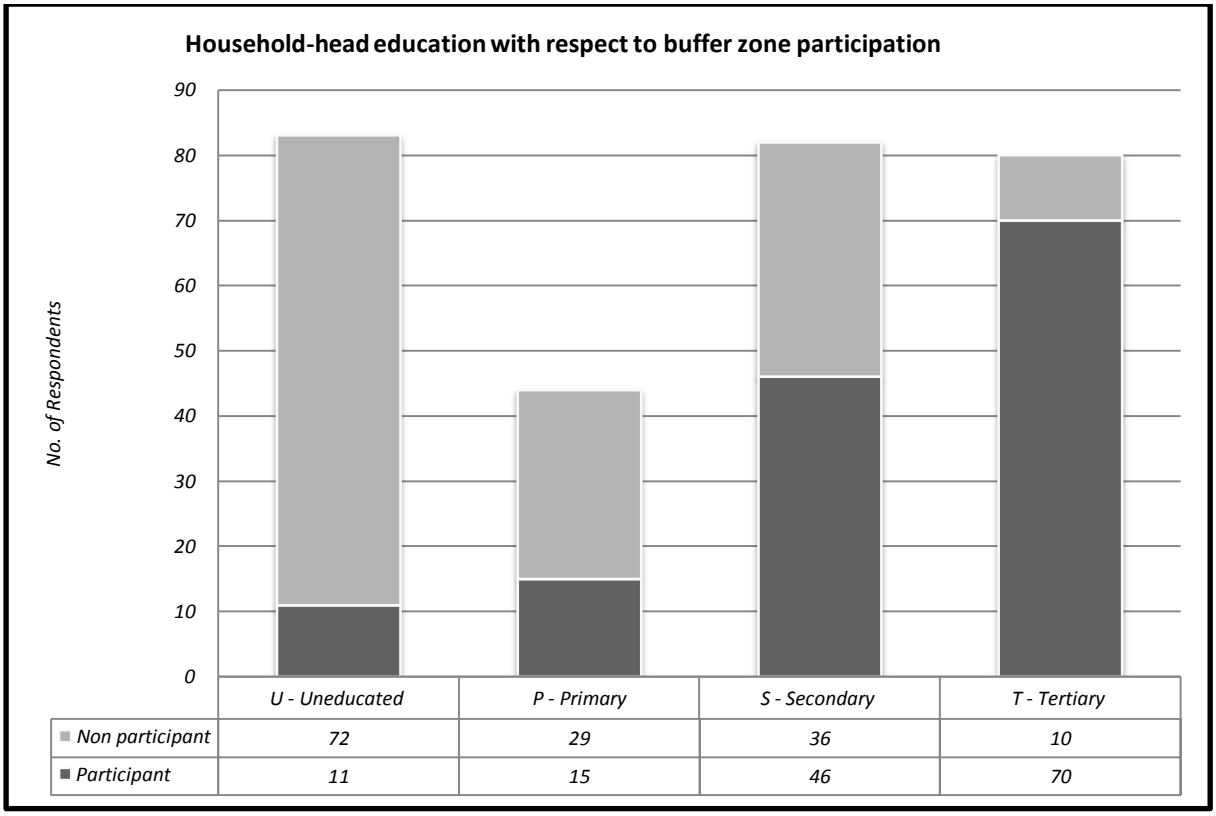


Figure 5.4: Distribution of respondents by household-head education with respect to buffer zone participation

The results suggest that the buffer zone livelihood link may be a livelihood strategy for the educated possibly because of the high unemployment rate in the country forcing even educated people to pursue buffer zone activities normally deemed an activity for the uneducated. These findings contradict previous observations, by Shively and Pagiola (2004) which suggest a negative link. The World Resources Institute (2005) attributed this association (negative link) to a lack of better alternatives as a possible reason why uneducated households end up pursuing the forestry livelihood link which has low entry requirements (Angelsen and Wunder, 2003).

Arable land size was expected to influence the decision of household heads to participate in buffer zone activities as explained under section 5.7.0. The mean arable land size from the

sample was 1.8ha. Figure 5.5 presents a summary of the distribution of respondents by arable land size with respect to buffer zone participation.

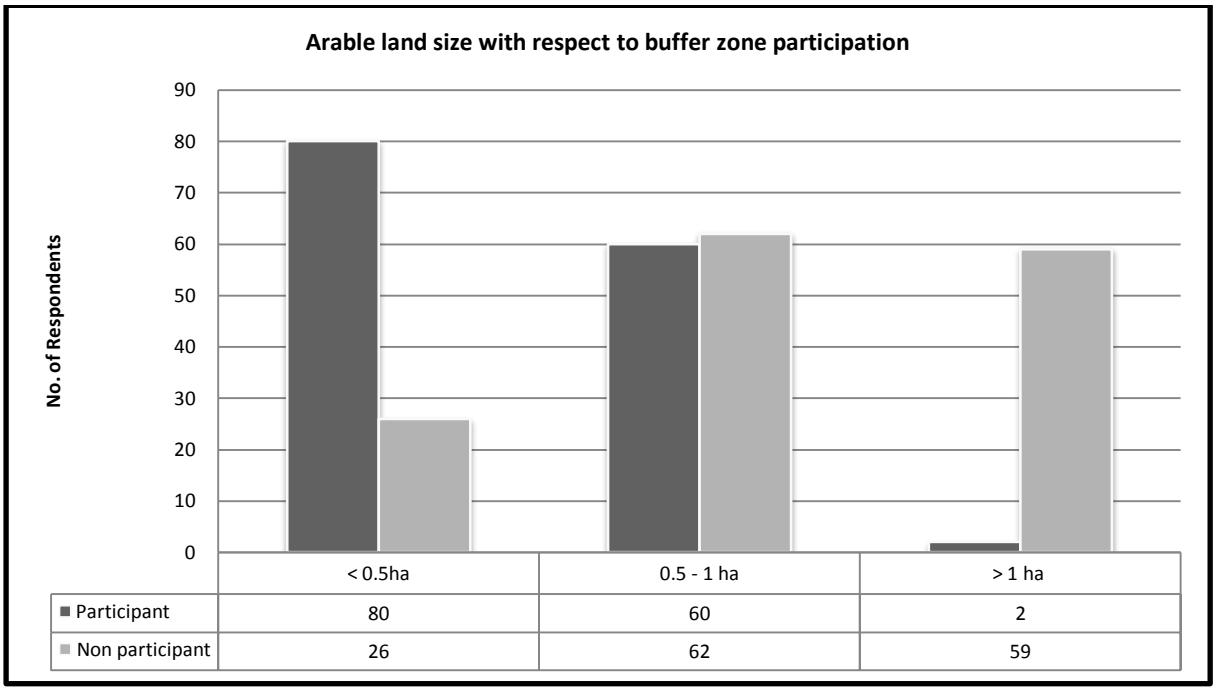


Figure 5.5: Distribution of respondents by arable land size with respect to buffer zone participation

The results suggest that households with smaller arable land may be more willing to participate in buffer zone activities than their counter parts with larger arable land. These findings contradict previous conclusions by Adhikari (2005) which suggest a positive association based on the complementary nature possible between cropping and forests products – agricultural compost. The observed negative association from the study area may therefore suggest lack of compost extraction area from the buffer zone as a result of high entry restrictions to surrounding communities.

In pursuit of the above negative association between cropping and buffer zone participation, the study considered a much more lucrative cropping venture from the study area, for the purpose of understanding the possible connection between cropping and participation. Wetland gardens have, of late, been treated as livelihood sources for rural communities

(Lannas and Turpie, 2009; Taruvinga, 2009). From the sample, 57.8% of the respondents had wetland gardens. Figure 5.6 presents a summary of the distribution of respondents by access to wetland gardens with respect to buffer zone participation.

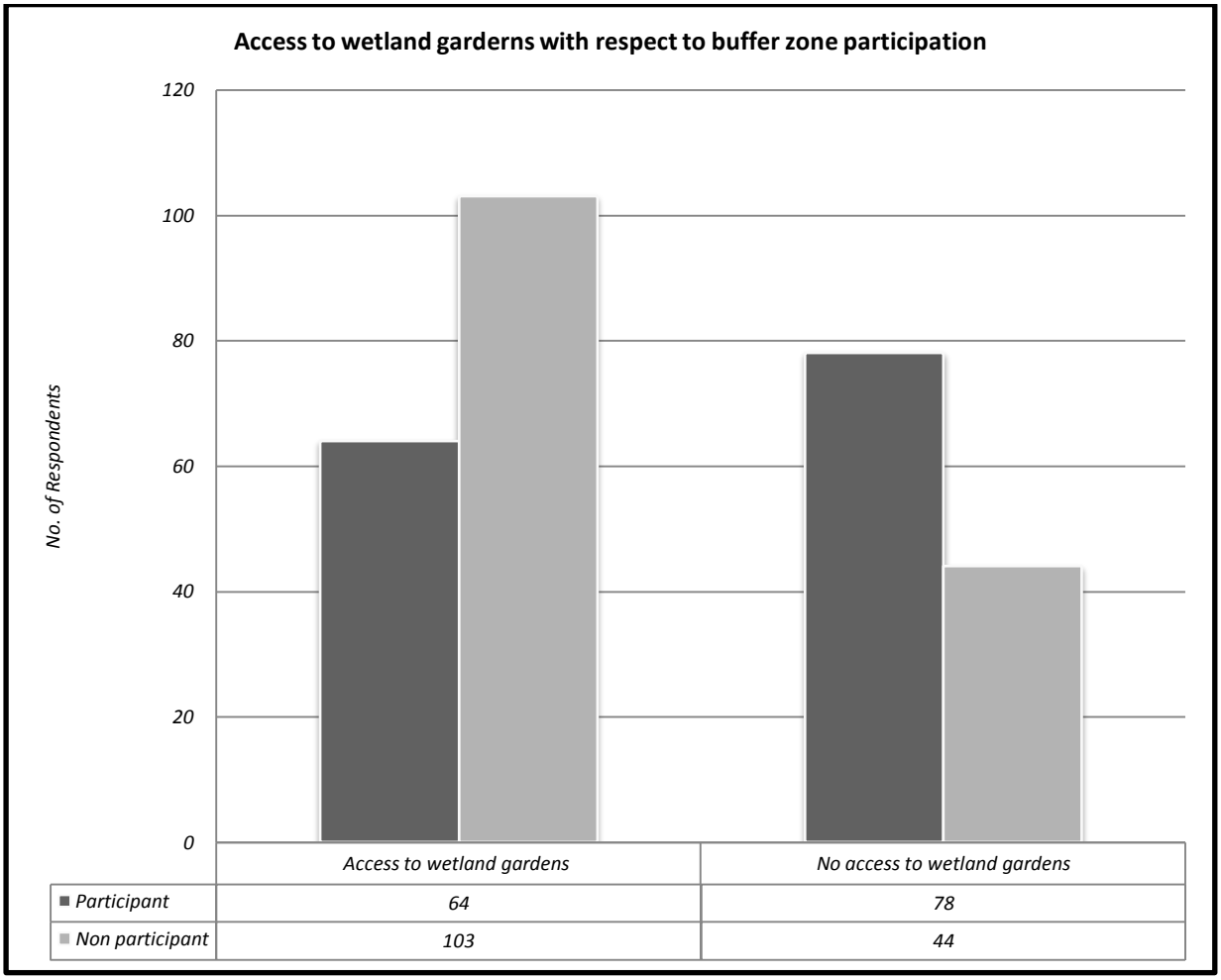


Figure 5.6: Distribution of respondents by access to wetland gardens with respect to buffer zone participation

The results suggest that buffer zone participation may be more of an activity for households with no access to wetland gardens than those with access to wetland gardens. The labour intensive nature of the forestry livelihood link (Shively, 2004) may present a labour allocation challenge for households with access to wetland gardens. Also, the missing complementary nature of buffer zones and cropping activities - agricultural compost

(Adhikari, 2005), in this case, may further signal high buffer zone access restrictions to surrounding communities.

Livestock production is one of the most promising farming ventures in agro-ecological regions IV and V as a result of "sweet *velds*" common in these areas. The study also investigated the potential influence of this variable for buffer zones which could be used as good grazing areas (Fisher, 2004) by sub-district producer communities. Figure 5.7 presents a graphic summary of the distribution of respondents by Livestock Units with respect to the observed buffer zone participation.

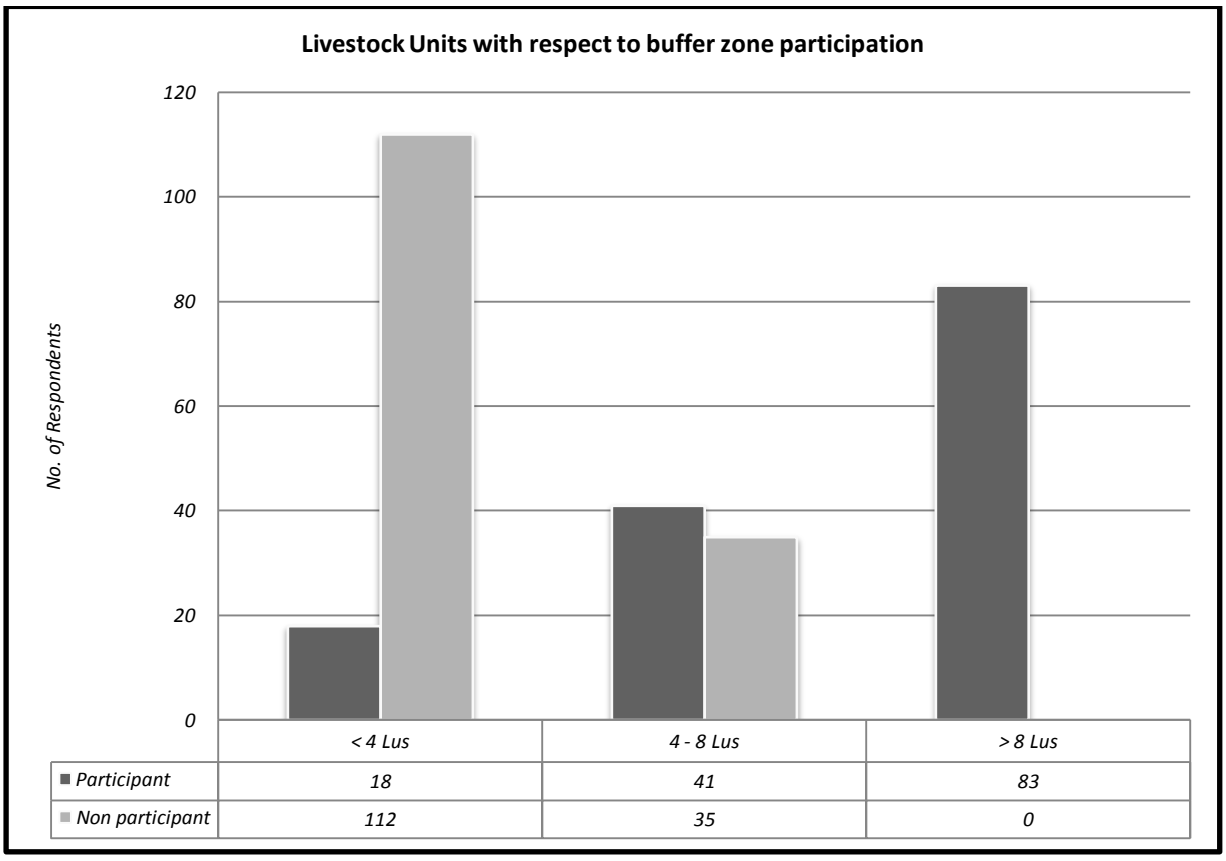


Figure 5.7: Distribution of respondents by Livestock Units with respect to buffer zone participation

The results suggest a positive association between the ownership of more livestock and buffer zone participation possibly due to availability of grazing land to surrounding communities.

These findings are in agreement with previous studies which suggest that forests may be used as important sources of intermediate complements in the farming system – grazing land (Fisher, 2004; Narain *et al*. 2005; Adhikari, 2005).

Previous results seem to suggest both a positive and a negative association between household wealth variables (livestock, land size and access to wetland gardens) and participation in the buffer zone. Figure 5.8 summarises the distribution of respondents by wealth status with respect to their participation in buffer zone. From the sample, 21.8% could be classified as rich and 78.2% as poor.

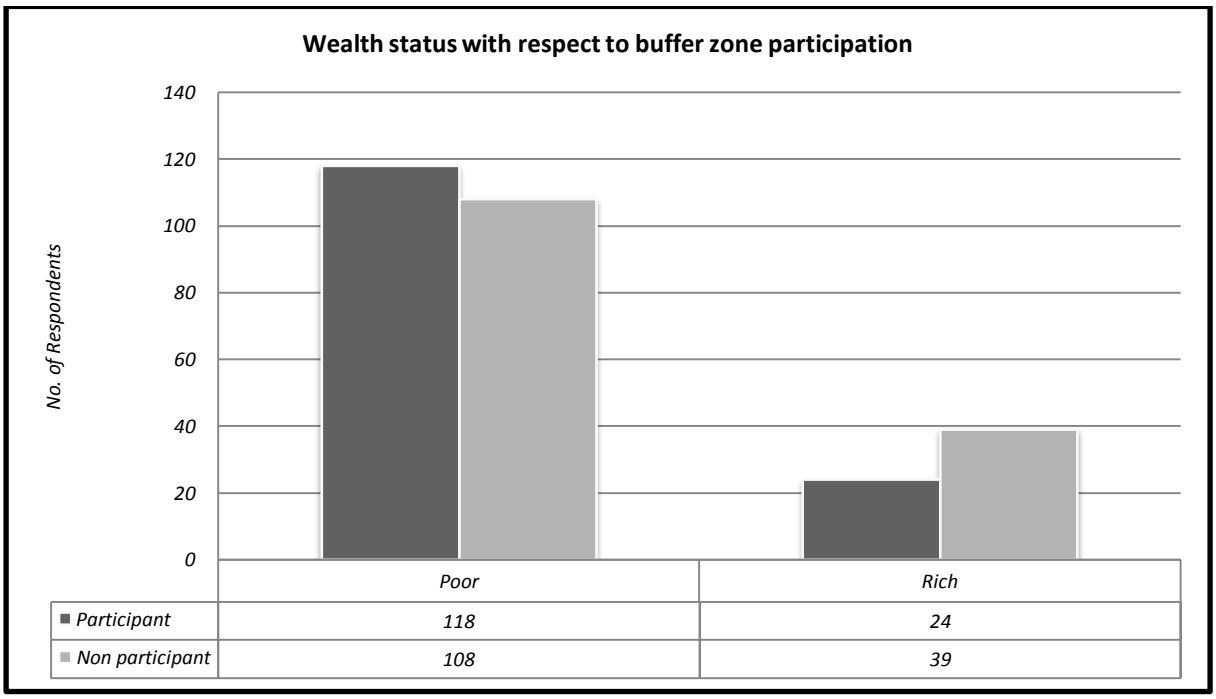
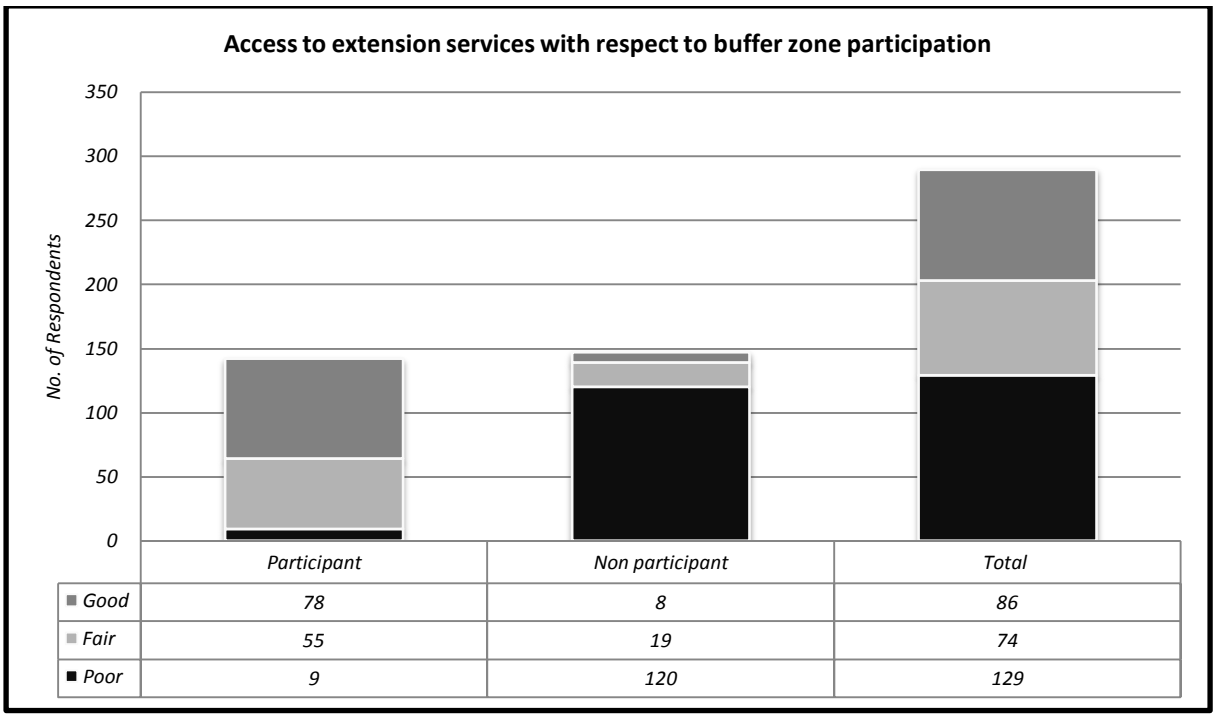


Figure 5.8: Distribution of respondents by wealth status with respect to buffer zone participation

The results loosely suggest that buffer zone participation may be an activity for the poor defined on the basis of ownership of strategic livelihood assets as explained under section 5.7.0. These findings support previous studies which suggest that forest communities are poor because of reliance on forest activities which have a low return (Kabubo-Mariara, 2008).

Access to extension services was also considered a critical variable capable of influencing a household's decision to participate in buffer zones. Figure 5.9 summarises the observed distribution of respondents by access to extension with respect to buffer zone participation. From the entire sample, 44.6% reported that their exposure to extension services was poor, 25.6% fair and 29.8% good.



	Participant	Non participant	Total
Good	78	8	86
Fair	55	19	74
Poor	9	120	129

Figure 5.9: Distribution of respondents by access to extension with respect to buffer zone participation

The results seem to suggest that buffer zone participation may be associated with access to good extension since the participant group was dominated by respondents who reported accessing good (54.9%) and fair (38.7%) extension services. In contrast, the non participant group was dominated by respondents who reported accessing poor (81.6%) extension services.

Distance to buffer zone, defined by kilometres measured from the outer boundary of the buffer zone into the sub-district producer communities, was investigated to ascertain its

influence on participation. Figure 5.10 summarises the observed distribution of respondents by distance to buffer zone with respect to participation.

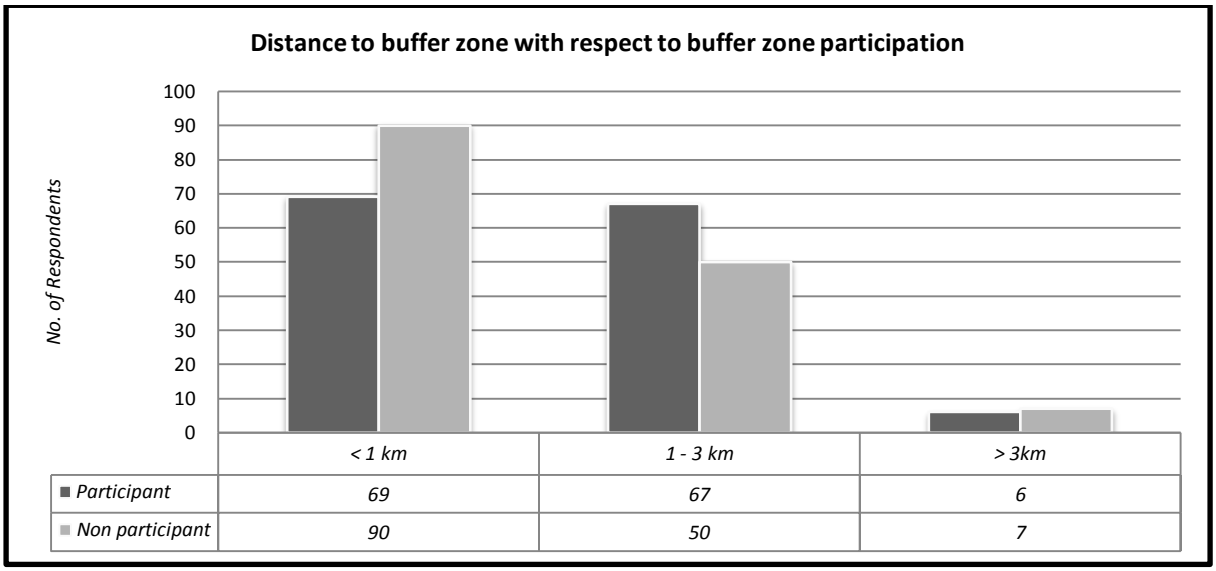


Figure 5.10: Distribution of respondents by distance to buffer zone with respect to participation

Non participants from the 0 – 1km radius dominated in the study and significantly declined after the 1km peg. On the contrary, the participant group dominated after the 1km peg and declined slightly after the 3km radius. Both categories (participants and non participants) presented a declining trend with distance to buffer zone. These results loosely suggest that the closer households are to the buffer zone, the more likely they are to participate. These findings support previous studies which suggest that closer residents may have more secure access to buffer zones than their distanced counterparts (Varughese and Ostrom, 2001; Kabubo-Mariara, 2008).

Access to markets for buffer zone products like fire wood, wild fruits (*Adonsonia digitata* and mushrooms), game meat (fish), honey, reeds, and construction timber was considered critical in encouraging surrounding communities to participate. Figure 5.11 presents a

graphical summary of the observed distribution of respondents by market access with respect to participation in buffer zone activities.

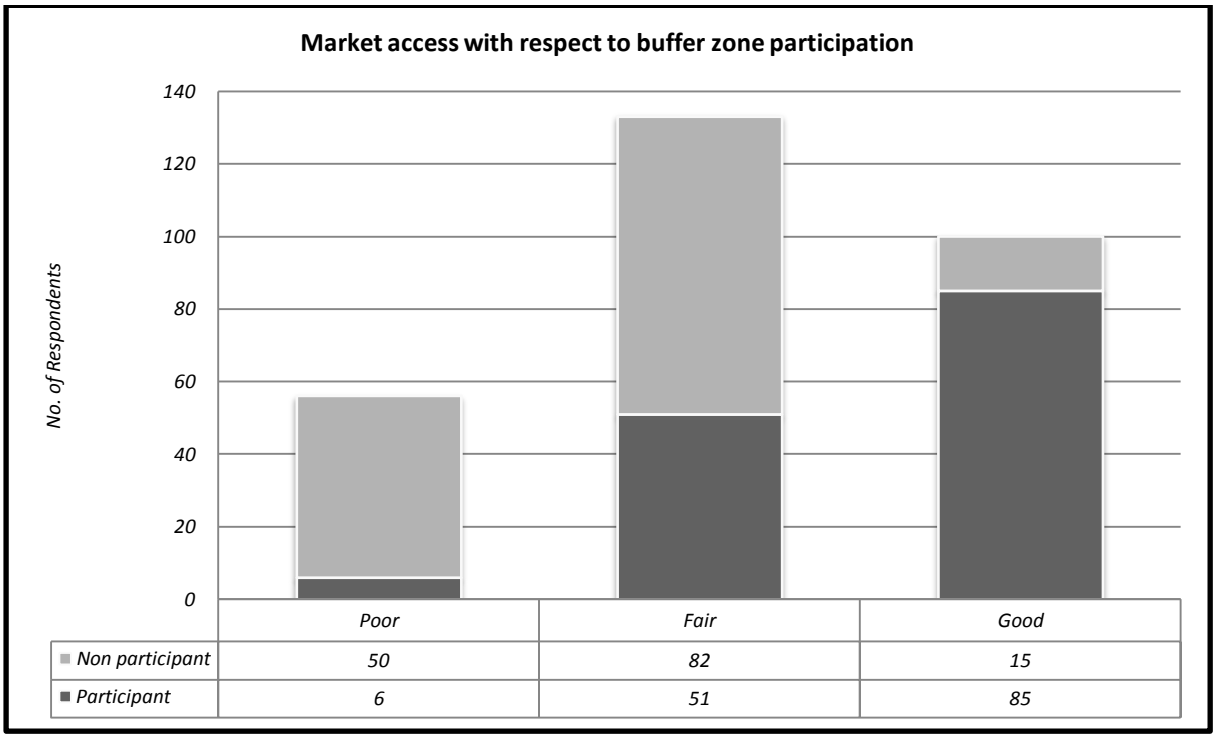


Figure 5.11: Distribution of respondents by market access with respect to buffer zone participation

The results suggest that access to a good market may be associated with participation in buffer zone activities. These findings may suggest that participation in the buffer zone, by surrounding communities, may be market driven for purposes of trading buffer zone extracts.

Summary

Several household variables (access to markets, distance to buffer zone, good extension, wealth status, wetland gardens, arable land, higher livestock units, gender, education, age and household size) show some elements of association with participation in buffer zone activities, using descriptive statistics. The next section revisits the observed association by using an econometric analysis for the purpose of uncovering the direction and significance of the observed association.

5.9 Inferred findings

This section presents the inferred results of this study. With regard to the model fit, the Lemeshow Goodness-of-Fit test statistic was 1.00, implying that the model`s estimates fit the data at an acceptable level. Since R^2 cannot be exactly computed for Logistic Regression (Norusis, 2004), a pseudo R^2 was therefore computed. *Nagelkerke* R^2 was computed in this study as a proxy estimate to R^2 in OLS regression which, according to Norusis (2004), measures the proportion of the variation in the response that is explained by the model. In this study, *Nagelkerke* R^2 of 0.95 was obtained; this indicates that more of the variation was explained by the model with an overall prediction percentage of 97.6, as shown in Table 5.5.

From the eleven predictor variables fitted in the binary logistic regression model, seven variables (household size, household head gender, household head age, access to wetland gardens, access to extension, distance to buffer zone and amount of Livestock Units) had a significant impact on influencing household participation in buffer zone activities, while four variables (household head education, arable land size, wealth status and access to markets) were not significant.

Of the seven significant predictor variables, two had positive signs (household head age and access to extension), thus implying an increase in either of these variables may be associated with an increase in household participation in buffer zone activities. The other five predictor variables (household size, household head gender, access to wetland gardens, Livestock Units and distance to buffer zone) had negative signs; this means that an increase in either of these variables may be associated with a decrease in the participation level, as shown in Table 5.5.

Table 5.5: Determinants of participation in buffer zone activities

Predictor Variables		B	S.E.	Wald	Sig.
Constant	β_0	24.625	8.919	7.623	.006
1. House hold size	β_1	-1.019	.408	6.240	.012*
2. Household head gender	β_2	-3.948	1.426	7.661	.006**
3. Household head age	β_3	.082	.032	6.421	.011*
4. Household head education	β_4	-1.164	.599	3.773	.052
5. Access to wetland garden	β_5	-4.399	1.586	7.687	.006**
6. Arable land size	β_6	-.146	.882	.027	.868
7. Livestock Units	β_7	-4.235	1.250	11.481	.001**
8. Access to extension	β_8	2.421	.908	7.114	.008**
9. Wealth status	β_9	-3.827	1.965	3.793	.051
10. Access to markets	β_{10}	-1.923	1.180	2.654	.103
11. Distance to buffer zone	β_{11}	-2.435	1.213	4.030	.045*

a) Chi-Square (df = 11)	364.008
b) (-2)Log Likelihood	36.554
c) Accuracy of prediction; Overall (%)	97.6
d) Nagelkerke R^2	0.95

Notes: ** and * indicates significance at 0.01 and 0.05 probability level respectively

Household size

Household size was significant (*p-value:* 0.012) but negatively related to participation in buffer zone activities. The results suggest that, for every unit increase in household size there is a 1.019 decrease in the log odds of participation in buffer zone activities by households,

holding all other independent variables constant. These results contradict previous conclusions which report a positive association between household size and forestry dependence, as a result of the labour intensive nature of forestry gathering activities which are common in the forestry livelihood link (Kabubo-Mariara, 2008; Shively, 2004; Gunatilake *et al*. 1993).

Respondents from the study area cited heavy entry restrictions to the buffer zone, by the Safari Operator (SO) for the existing buffer zone, was not negotiated with surrounding communities. Effectively, the available buffer zone was very small, highly congested and provided few livelihood sources, specifically fire wood and grazing area. It is, therefore, logical to expect larger households to spread and trade their labour to more guaranteed and lucrative livelihood sources in the area, like gold panning, mining and cultivation (both arable and wetlands).

Household-head gender

With respect to gender, the results suggest a negative significant influence on participation in buffer zone activities (*p-value:* 0.006). Per every unit increase in male headed households, the results suggest a 3.948 decrease in the log odds of participation in buffer zone activities holding all other independent variables constant. These results confirm earlier findings which link greater participation of women in common pool resources, as opposed to men for gathering activities are deemed to be a female domain in African cultures (Narain *et al.* 2005; Grossman, 1996; Folbre, 1994). Contrary to these conclusions, Kabubo-Mariara (2008) notes that households headed by males were more likely to participate in forestry activities, thus supporting previous descriptive results.

High entry restrictions and the low livelihood potential of the current legal buffer zone may have driven male headed households to better, but riskier (gold panning and reef mining),

livelihood sources which are available in the area. Female headed households may have been forced to continue relying on the buffer zone where livelihood sources are low but not risk.

Household-head age

The positive significant (*p-value:* 0.011) coefficient of household-head age may suggest its positive influence on participation in buffer zone activities. Per every unit increase in household-head age, the results reveal a 0.082 increase in the log odds of participation in buffer zone activities, holding all other independent variables constant, as shown in Table 5.5. Similar findings were obtained by Vedeld *et al.* (2004) who attribute the association to the dominance of the young in cropping activities; this implies that young household heads may wish to open up more forestry land for cropping, rather than participating in forestry collections. Similar arguments were forwarded from the study area where young household heads were invading the Game Park and opening up residential areas and cropping fields from UMP (Dewe and Guyu dam area) and Rushinga districts.

Kohlin and Parks (2001) and Kabubo-Mariara (2008) also argue that it could be possible to expect a negative correlation between age and participation, for older people may have less time and physical strength to engage in forestry activities. Contrary to this, observations from the study area seem to suggest that older people have mastered the art of resource collection activities (wild fruits, honey, mushroom and reeds for crafting) from the buffer zone, more so than their younger counter parts. This could explain why older household heads kept on using buffer zones as livelihood sources amid calls from most respondents that the available buffer zone was congested and highly restricted, with few meaningful resources.

Access to wetland gardens

Access to wetland gardens was negatively correlated to participation in buffer zone activities with a *p-value* of 0.006. The results suggest that, for every unit increase in access to wetland gardens, a 4.399 decrease in the log odds of participation in buffer zone activities holding all other independent variables constant was likely, as shown in Table 5.5. Previous studies reveal the potential of partial wetland cultivation in rural areas, where normal field cropping is limited (Lannas and Turpie, 2009; Taruvinga, 2009). Access to wetland gardens may force households to channel more of their labour to wetland cultivation where returns seem to be guaranteed and more immediate (horticultural crops with short life-span) than buffer zone activities.

Livestock Units (LUs)

Households with higher numbers of LUs would be expected to be sceptical of buffer zone grazing for they weigh the grazing benefits against potential predation and the spread of diseases. Nyatana Game Park has no boundary fence, which means that livestock graze beyond the available buffer zone, thus mixing with wild game animals. In addition, when trying to collect livestock once they are beyond the buffer zone presents these households with tensions and conflicts between themselves with the Safari Operator (SO). In this study, the observed negative correlation between LUs and buffer zone participation may imply that, for every unit increase in LUs, there may be a 4.235 decrease in the log odds of participation in buffer zone grazing by households, holding all other independent variables constant, as shown in Table 5.5. Earlier studies suggest that households with more LUs are expected to reap greater benefits from forests because forests may be important sources of input to the farming system (Kabubo-Mariara, 2008; Adhikari, 2005; Fisher, 2004).

Access to extension services

Access to extension services was positively related to participation in buffer zone activities. The results reveal that, per unit increase in access to extension by households, a 2.421 increase in the log odds of participation holding other independent variables constant may be possible. The results suggest that although extension services were poor in the area, to those households that managed to access good extension services, the influence was positive with respect to participation in buffer zone activities.

Distance to buffer zone

The greater the distance at which buffer zones are located in relation to households, the fewer households would want to participate in buffer zone activities, *ceteris paribus*. The results suggest that, for every unit increase in distance of buffer zone from households, a 2.435 decrease in the log odds of participation in buffer zone by households was expected, holding all other independent variables constant. These results are consistent with previous studies which suggest a negative association based on the fact that, households closer to forests may have more secure access to the supply of forestry products (Kabubo-Mariara, 2008; Varughese and Ostrom, 2001).

The following section investigated the correlates of actual resource extraction from the buffer zone, based on common resource extraction combinations from the three districts. Descriptive results are presented first for purposes of understanding distribution of respondents by various household characteristics with respect to different resource extraction combinations. This is followed by econometrics results for determinants of resources extraction.

5.10 Determinants of resource extraction

This section seeks to uncover the observed variation in resource extraction among households using descriptive statistics. The implied objective was to establish the determinants of buffer zone resource extraction at the household level. A combination of resource extraction options were effectively created based on common combinations reported by respondents, as follows; (a) wild foods and fire wood, (b) wild foods and construction, (c) fire wood and construction, and (d) all extractions. Following an approach by Kabubo-Mariara (2008), the same factors affecting participation were assumed to influence the level of resource extraction.

Figure 5.12 presents a graphic summary of the observed distribution of respondents by household size, with respect to the extraction combination. At a household size of fewer than five members, the all extraction combination was insignificant. In a household of six or more members, the all extraction combination seems to be the main livelihood option pursued by respondents. This distribution was also true for all other buffer zone resource extraction combinations. The results, therefore, suggest that household size may positively influence buffer zone resource extraction. The implied message seem to suggest that households with larger sizes may be forced to spread their labour force across various buffer zone resource extraction combinations meaning high dependence or reliance on buffer zone for purposes of increasing possible net collection.

Surprisingly, these findings contradict inferred participation results which suggest a negative association as shown in Table 5.5. Effectively, the observed contradiction may suggest initial misrepresentation by larger households at registration, portraying as if they are not participants, while they are active users as suggested by their actual resource extraction behaviour as summarised in Figure 5.12.

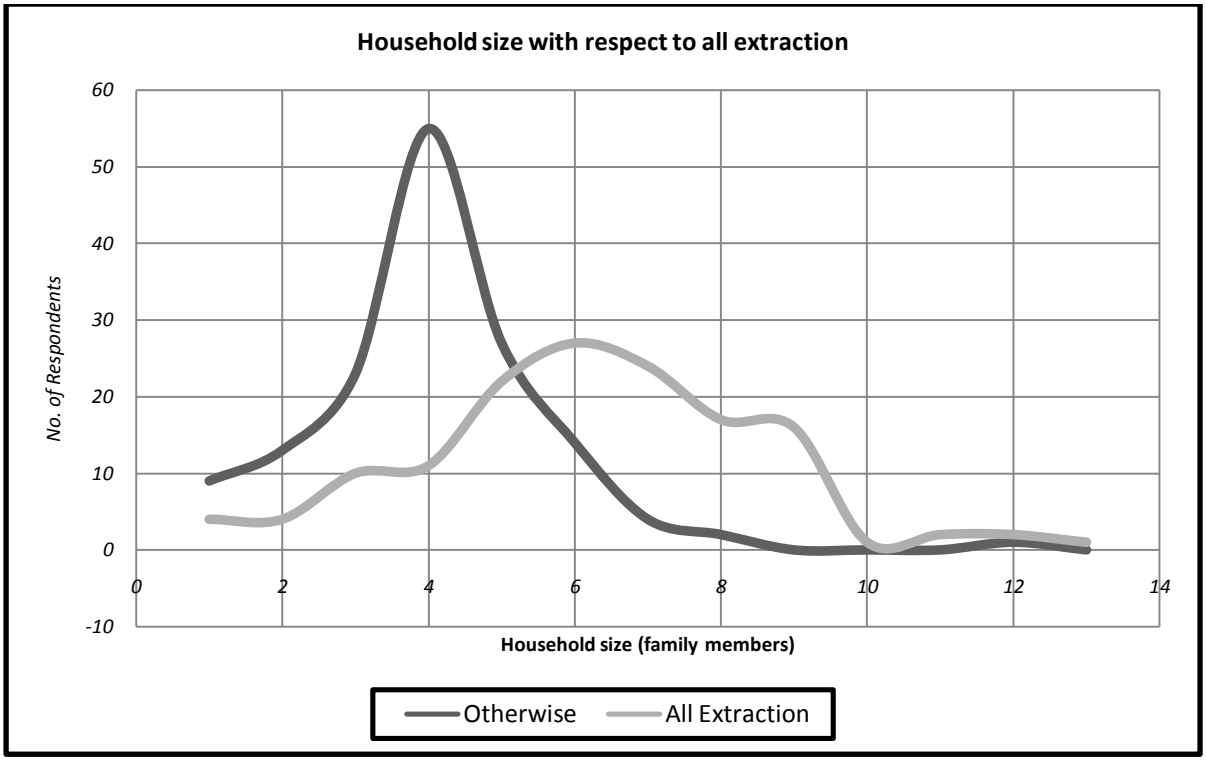


Figure 5.12: Distribution of respondents by household size with respect to all extraction combinations

Of the four resource extraction combinations, household gender was clearly distributed to wild foods and fire wood extraction. Figure 5.13 summarises the observed distribution of respondents by household gender with respect to the wild foods and fire wood extraction combination. Although females participate in wild foods and fire wood extraction from the buffer zone, the observed distribution suggests that the wild foods and fire wood extraction combination was an activity in which males were more likely to participate.

The high risk associated with Game Parks which do not have boundary fences may explain the observed trend of the technical exclusion of females from actual resource extraction activities. These findings contradict the inferred participation results which suggest a negative association (Table 5.5). The observed contradiction my further suggest misrepresentation by males at registration, portraying as if they are not participants while they are active buffer zone resource users as suggested by the distribution shown in Figure 5.13.

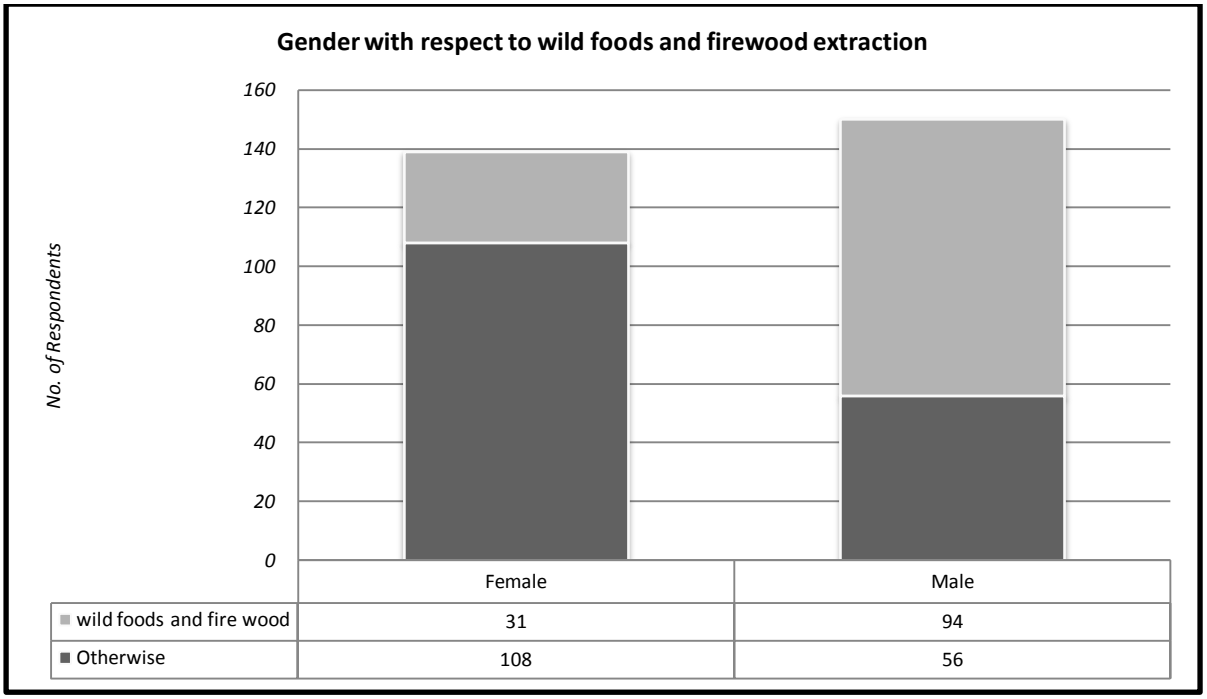


Figure 5.13: Distribution of respondents by household gender with respect to the wild foods and fire wood combination

With respect to household age, a similar trend was observed across the four resource extraction combinations. Figure 5.14 presents a typical graphic summary of the observed distribution of respondents by household age, with respect to the all extraction combination which was also true for all other buffer zone resource extraction combinations. Buffer zone extraction activities seem to be dominated by households aged 30 years and under. The households aged 30 years and older seem to pursue other options. The observed distribution seems to suggest that buffer zone resource extraction may be an activity of younger households with more time and physical strength to engage in buffer zone activities (Veldeld *et al*. 2004).

These findings further contradict inferred participation results which suggest a positive association (Table 5.5). Misrepresentation by the young household heads at registration, possibly to avoid common pool buffer zone conservation activities, may explain the observed contradiction where the young will not register as active users of the buffer zone, but use

"back-door" entry systems to harvest buffer zone resources since the monitoring system by the LCCs was inefficient.

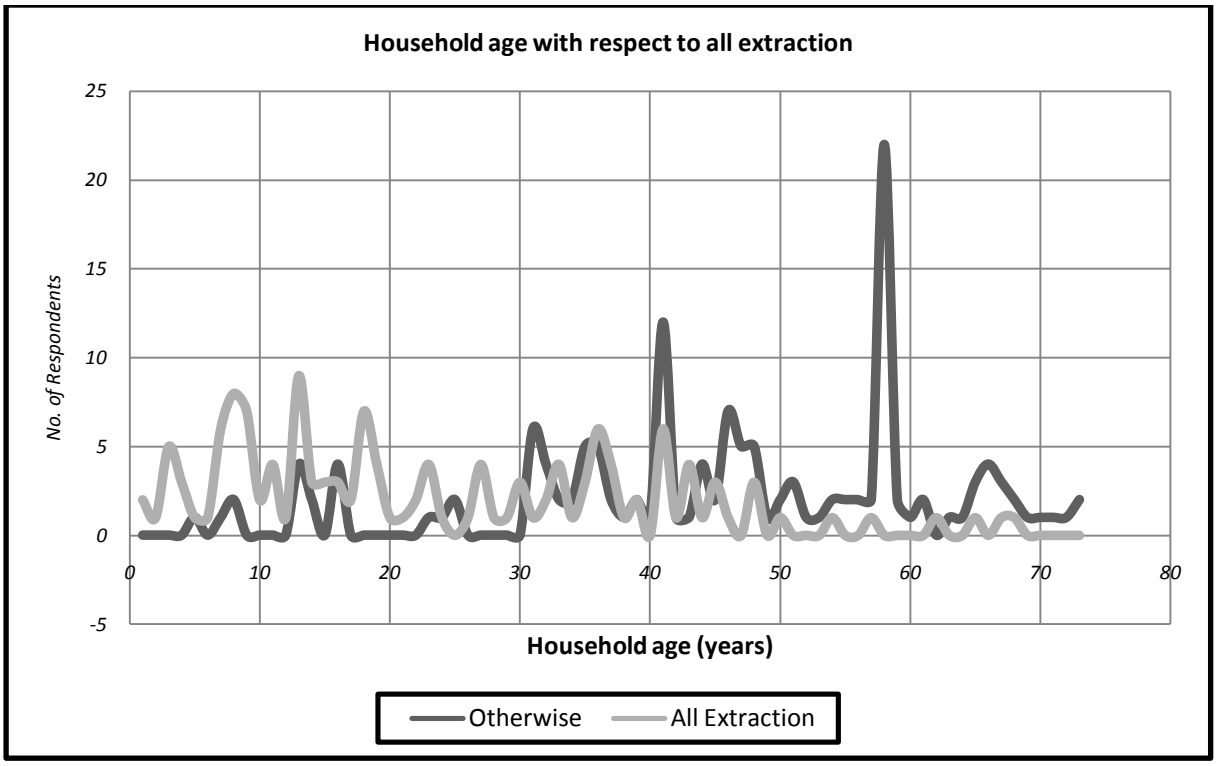


Figure 5.14: Distribution of respondents by household age with respect to all extraction combinations.

Distribution of LUs followed a similar trend for all extractions, wild foods and fire wood and wild foods and construction. Figure 5.15 presents a typical summary of the observed distribution of respondents by LUs with respect to all extraction which was also the same with wild foods and fire wood as well as the wild foods and construction combinations. For households with fewer than 4 LUs, the all extraction combination seemed to be insignificant. For those with 4 LUs and above, the all extraction combination activities increase.

This distribution seems to suggest that households with higher LUs participate more frequently in buffer zone extraction activities than their counter parts with lower LUs; this is possibly because of the buffer zone livestock grazing link (Varughese and Ostrom, 2001;

Fisher, 2004; Adhikari, 2005; Narain *et al*. 2005). These findings further contradict the inferred participation results (Table 5.5) suggesting misrepresentation.

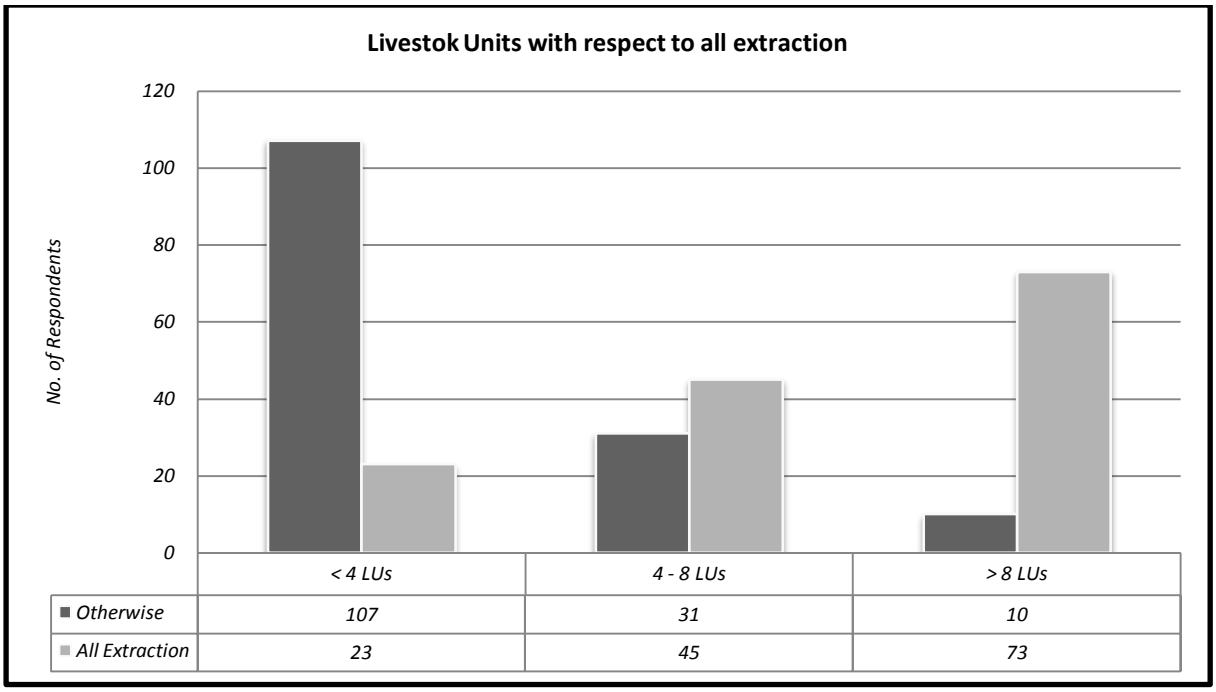


Figure 5.15: Distribution of respondents by Livestock Units with respect to all extraction combinations

Extension was also considered a critical factor capable of influencing the level of buffer zone resource extraction. Figure 5.16 presents a graphical summary of the observed distribution of respondents by extension, with respect to buffer zone resource extraction. The results seem to suggest that buffer zone resource extraction for all combinations was more pronounced in areas where the extension service was reported to be poor.

The distribution therefore seems to suggest a negative influence of extension with regard to buffer zone resource extraction, possibly as a result of the current ban on the commercialisation of forestry produce. These findings contradict inferred participation results (Table 5.5). The observed contradiction may, therefore, suggest that extension services promote participation as supported by the participation results (Table 5.5) but it discourages

the commercial extraction of buffer zone resources, as supported by the extraction descriptive results in Figure 5.16.

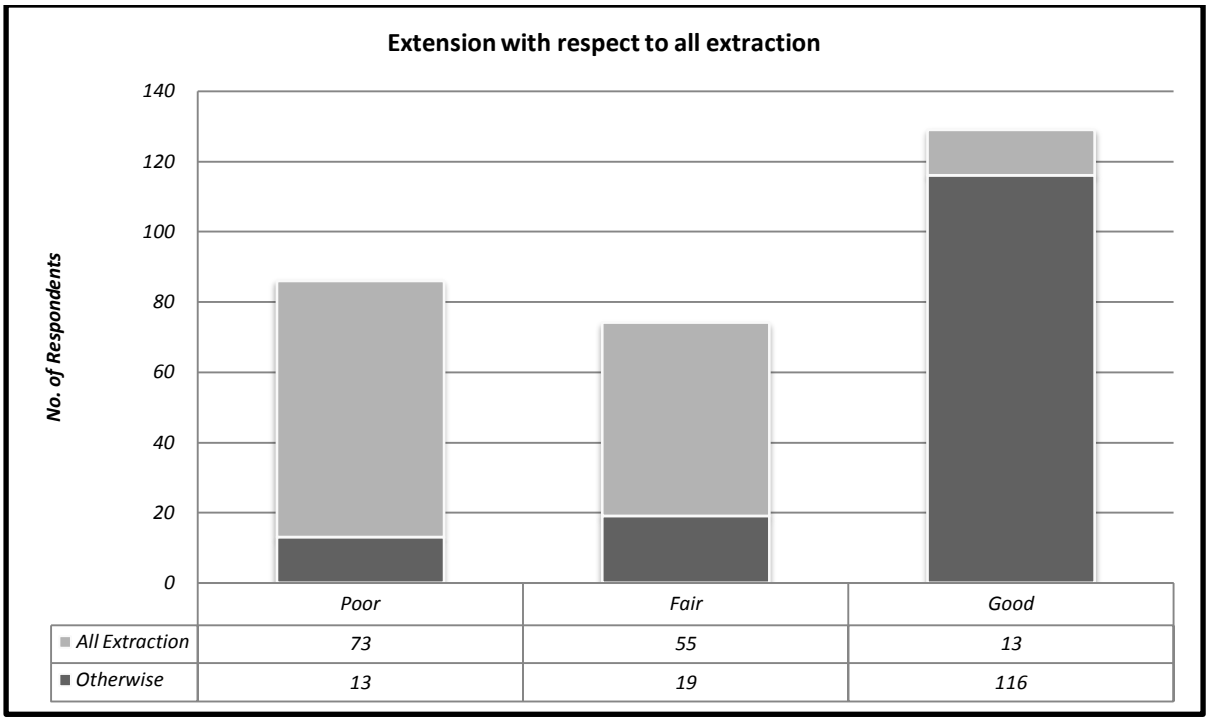


Figure 5.16: Distribution of respondents by extension with respect to all extraction combinations

A clear distribution of wealth status with respect to buffer zone resource extraction was observed on the fire wood and construction combination. Figure 5.17 presents the observed distribution of respondents by the wealth status of households, with respect to the fire wood and construction combination. For the poor category, participation in the fire wood and construction extraction combination seems to be an insignificant option (97 against 129). However, for the rich category, the fire wood and construction combination seems to be a significant option (28 against 35).

The results therefore suggest that wealthy households may consider the fire wood and construction combination as more important than poor households would. These findings contradict the previous participation descriptive results with participation inferred results

suggesting that the link may be statistically insignificant (Table 5.5). Based on descriptive findings, the observed distribution may therefore suggest that the rich are reluctant to register as potential active users of buffer zones, as supported by the participation results but being very active in actual buffer zone resource extraction; in this case, the fire wood and construction extraction combination as portrayed in Figure 5.17.

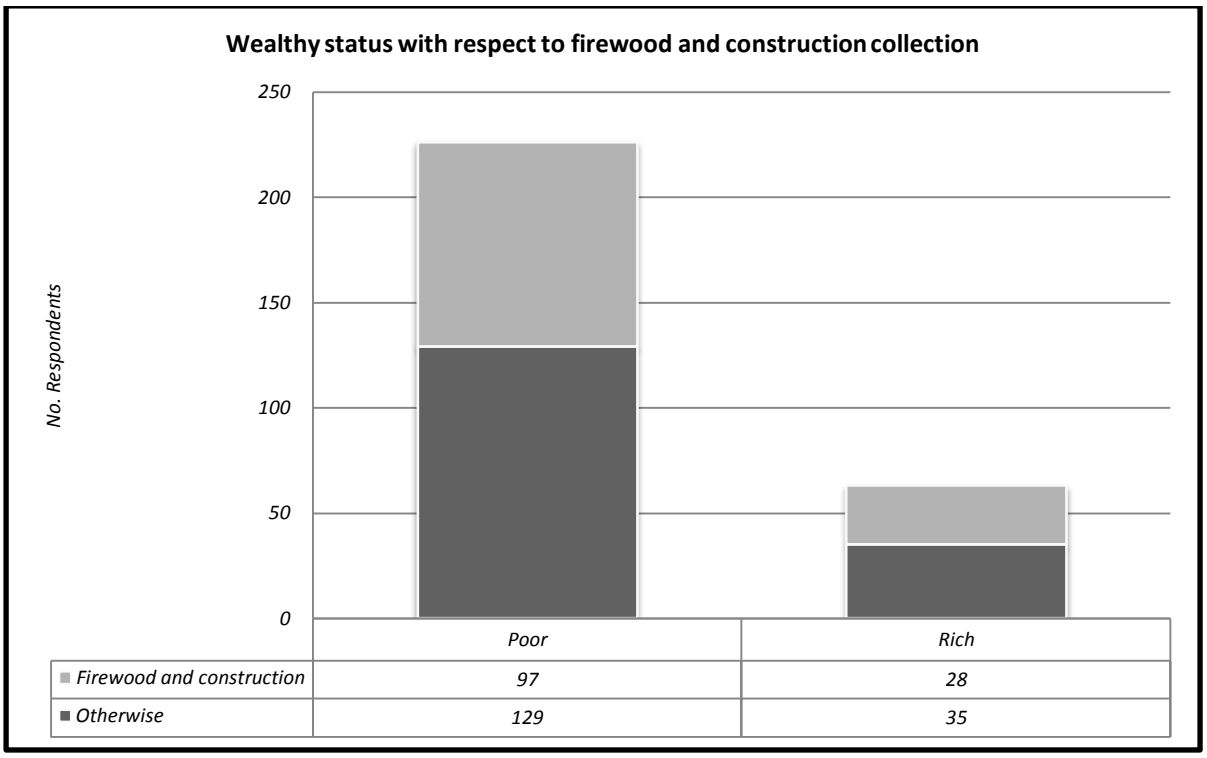


Figure 5.17: Distribution of respondents by wealth status with respect to the fire wood and construction combination

The availability of and access to markets for buffer zone products was also considered a factor capable of influencing buffer zone resource extraction by surrounding communities. A positive distribution seems to be displayed by all categories of resource extraction combinations. Figure 5.18 summarises the observed distribution of respondents by access to markets with respect to the all extraction combination. In areas where access to markets was reported to be poor, participation in the all extraction combination by surrounding communities was also poor.

In areas where access to markets was reported to be fair, participation in the all extraction combination was also reported to be fair. Finally, in areas where access to markets was reported to be good, participation in the all extraction combination was also reported to be good. Effectively, as access to markets improves, the observed distribution seems to suggest an improvement in the participation of the all extraction combination by surrounding communities. The results therefore suggest that availability of and access to markets for buffer zone products may positively influence buffer zone resource extraction activities by surrounding communities; this implies a derived demand for the purpose of commercialising buffer zone resources.

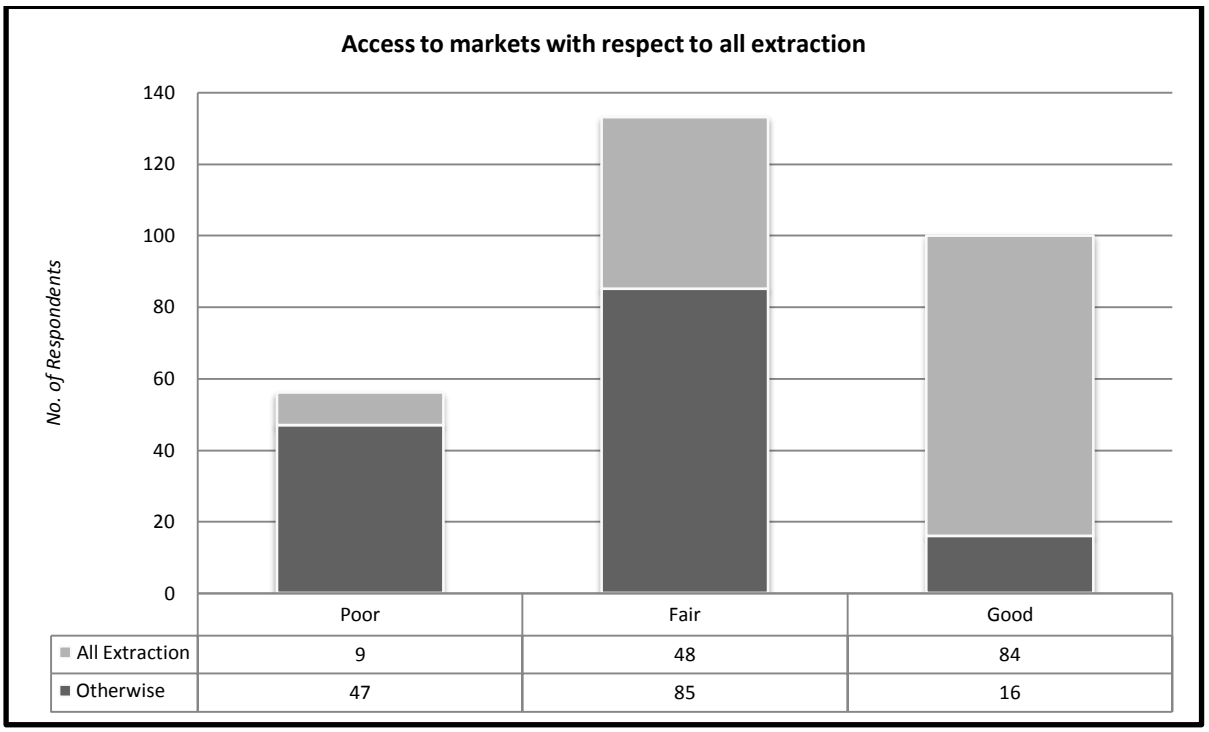


Figure 5.18: Distribution of respondents by access to markets with respect to the all extraction combination

These findings support previous participation descriptive results (Figure 5.11) although the participation inferred results suggest that the link may not be statistically significant (Table

5.5). The observed descriptive link may, therefore, suggest that households participate in buffer zone resource extraction for the purpose of trading extractable buffer zone resources.

Summary

A descriptive approach seems to suggest a positive influence of the following factors, with respect to participation in buffer zone extraction activities; access to markets, wealth, LUs, gender and household size. The results also portray a negative influence of the following factors, with respect to participation; age and extension. The following section presents the regression results of estimated correlates of buffer zone resource extraction, so as to complement the descriptive results here.

5.11 Correlates of buffer zone resource extraction

For the purpose of complementing the descriptive results presented in the previous section, a regression analysis was conducted on the reported buffer zone resource extraction combinations. These include (a) fire wood and construction, (b) wild foods and construction, (c) wild foods and fire wood, and (d) all extractions. The same factors determining participation were assumed to also influence buffer zone resource extraction. Binary logistic specification was used to relate each reported buffer zone resource extraction combination to predictor variables, as presented in Table 5.6.

With regards to the model fit, the Lemeshow Goodness-of-Fit test statistics for the overall fit of the models showed that the explanatory variables were jointly significant in explaining each of the dependent variables at an acceptable level. As in the participation equation, the following *Nagelkerke* R^2 were obtained 0.60, 0.68, 0.79 and 0.73, thus indicating that more of the variation was explained by the models with overall prediction percentages of 84.8%, 90.0%, 91.0% and 91.7%, respectively, as shown in Table 5.6.

Table 5.6: Correlates of buffer zone resource extraction

Predictor Variables		Reported buffer zone resource extraction combinations			
		All Extractions	Wild foods & Firewood	Wild foods & Construction	Firewood & Construction
Constant	β_0	-5.057 [.031]	-8.860 [.001]	-6.498 [.003]	-4.376 [.028]
1. Household size	β_1	.230 [.026]*	.409 [.000]**	.303 [.002]**	.305 [.001]**
2. Household head gender	β_2	.242 [.577]	1.361 [.003]**	.439 [.276]	-.290 [.443]
3. Household head age	β_3	-.029 [.019]*	-.037 [.008]**	-.035 [.004]**	-.027 [.009]**
4. Household head education	β_4	.392 [.056]	.416 [.068]	.315 [.098]	.289 [.098]
5. Access to wetland garden	β_5	.159 [.717]	-.406 [.397]	-.414 [.316]	-.487 [.192]
6. Arable land size	β_6	.310 [.387]	.497 [.247]	.477 [.173]	.478 [.145]
7. Livestock Units	β_7	.974 [.004]**	1.100 [.003]**	1.166 [.000]**	.295 [.310]
8. Access to extension	β_8	-1.100 [.000]**	-.744 [.021]*	-.650 [.019]*	-.674 [.010]*
9. Wealth status	β_9	.549 [.289]	.786 [.170]	.644 [.191]	1.266 [.005]**
10. Access to markets	β_{10}	.945 [.006]**	1.694 [.000]**	.823 [.009]**	1.467 [.000]**
11. Distance to buffer zone	β_{11}	.716 [.064]	.248 [.520]	.622 [.077]	-.427 [.158]
a) Chi-Square (df = 11)		21.743	6.323	31.735	8.871
b) (-2)Log Likelihood		172.525	140.267	191.775	225.030
c) Accuracy of prediction; Overall (%)		91.7	91.0	90.0	84.8
d) Nagelkerke R^2		0.73	0.79	0.68	0.60

Notes: ** and * indicates significance at 0.01 and 0.05 probability level respectively; *p-value* in [] brackets

The results suggest that the education of the household-head, access to wetland gardens, arable land size and distance to the buffer zone may be insignificant in influencing buffer zone resource extraction. However, results also suggest that household size, household-head gender, household-head age, LUs, access to extension, wealth status and availability and access to markets may be statistically significant to influence buffer zone resource extraction as shown in Table 5.6.

Although the participation inferred results suggest a negative association between household size and participation in buffer zone activities, as shown in Table 5.5, with respect to actual resource extraction, a positive correlation was confirmed for all buffer zone extraction combinations, as presented in Table 5.6. These contradictions suggest that larger households may be reluctant to register[23] as active buffer zone users while, in actual fact, they are very active in resource extraction. The results therefore suggest that household size seems to matter in as far as actual buffer zone resource extraction is concerned. The labour intensive and time allocation nature of buffer zone resource extraction activities, as acknowledged by Shively (2004), under forest conditions may explain why a larger household size may be more willing to pursue various resource extraction combinations.

Under participation, the available buffer zone was reported to be small, highly congested with only a few meaningful livelihoods. In this regard, spreading household labour across all possible buffer zone resource extraction combinations, as noted in the study area, would be logical for the purpose of maximising the net collection so as to compensate for the general scarcity of extractable resources amid survival pressure from higher household sizes.

Household gender was positively and significantly (1.361: 0.003) correlated with wild foods and fire wood resource extraction, but did not seem to matter much for the other resource

[23] Possibly to evade common pool buffer zone conservation activities

extraction combinations, as presented in Table 5.6. With regard to actual resource extraction under forestry conditions, Kabubo-Mariara (2008) suggests that household gender may not be a significant factor. The participation inferred results suggest a negative association, where previous studies associate the gathering nature of common pool resources with femininity (Narain *et al*. 2005). Respondents from the study area argue that, while females dominated the sphere of fire wood collection for domestic use, males dominated that of fire wood collection for sale. In addition, the collection of wild foods was dominated by fishing, the gathering of edible fruits and honey collection which was considered to be a male domain, within the bounds of the study area. Based on this, the observed positive correlation was normal. The observed contradiction may also suggest that male headed households may be reluctant to register with LCCs as active buffer zone users, whilst they are very active in resource extraction; in this case the collection of wild food and firewood.

Age was negatively related to all buffer zone resource extraction combinations as shown in Table 5.6, implying that the actual resource extraction may be an activity for younger households who seem to have indicated a negative attitude towards buffer zone participation, as shown in Table 5.5. Kohlin and Parks (2001) note a similar correlation suggesting that older households may have less time and physical strength to engage in forestry activities. Contrary to this, Vedeld *et al*., (2004) argue that since the young may be more interested in clearing forests for building and cropping land, their association with forestry activities may be expected to be negative. The results suggest that, although older households participated in buffer zones through registering as potential active users (Table 5.5), in terms of actual resource extraction, younger households dominated this activity (Tale 5.6) possibly due to the physical work required for cutting construction poles, and firewood for sale.

The total LUs owned did not seem to be an important predictor variable of buffer zone resource extraction for the firewood and construction combination as presented in Table 5.6.

However, the amount of livestock owned had a positive significant effect on wild foods and construction (1.166: 0.000), wild foods and fire wood (1.100: 0.003) and the all extraction combination (0.974: 0.004). These results support earlier findings by Varughese and Ostrom (2001) and Kabubo-Mariara (2008) which attribute the association to fodder requirements to supplementing livestock feeding. Surprisingly, these results do not support participation inferred results which suggest a negative association as a result of fear of predation and contamination through disease. The contradiction suggests that households with larger LUs, although they may show reluctance in registering as official buffer users, are active buffer zone users specifically targeting wild foods and construction, wild foods and firewood and all extraction combinations.

Extension was negatively associated with all resource extraction combinations, as shown in Table 5.6. These results do not support the participation inferred results which suggest a positive association. Actual resource extraction was dominated by the cutting of firewood for sale, the cutting of *Mopane* construction poles for sale, and the bulk collection of wild foods for sale. All these activities are deemed illegal according to the Zimbabwe Communal Lands and Forestry Produce Act (CLFPA), which is used by natural resources extension officers. In light of this, the initial observed positive association between extension and participation (Table 5.5) signals general extension advice towards educating communities to wisely participate in natural resource usage. The negative association between extension and actual resource extraction (Table 5.6) points to conflicts in policies where, on the one hand, the available natural resource regulations currently being used by extension officers (CLFPA) holistically restrict the commercial harvesting and resale of natural resources. On the other hand, the AA status conferred to local communities by the Parks and Wildlife Management Act (PWMA) under CAMPFIRE principles empowers local communities to commercially benefit from their natural resources.

Wealth status did not seem to be a significant predictor for all other buffer zone resource extraction combinations, with the exception of the firewood and construction combination (1.266: 0.005) as shown in Table 5.6. Firewood for sale was reported to be an economic business, especially for wealthy households who could transport firewood in bulk for resale in nearby Growth Points (GPs) (Chimhanda in Rushinga; Kotwa in Mudzi and Mutawatawa in UMP). The same was also true for *Mopane* construction poles which were used as a substitute for gum poles. A follow up study revealed that firewood and construction poles from the Nyatana Game Park were networked to ready middle-man buyers who further transported the products to urban centres.

Access to markets was positively and significantly associated with all resource extraction combinations, as shown in Table 5.6, although the participation inferred results suggest that the link may be negative and statistically insignificant (Table 5.5). The observed contradiction may suggest that, with reference to registration as an active buffer zone user, access to markets may not matter much; however, markets may matter for the enhancement of trade once the resources have been obtained. The results therefore suggest that buffer zone resource extraction may be a more market driven activity, rather than a local consumption activity. That is, as households collect firewood and construction resources from the buffer zone their primary aim may be to resell these products for financial gain. In addition, as households collect wild foods from the buffer zone, the results suggest that their primary objective may be to resell them for financial benefits.

5.12 Implied message

The extension conflict revealed in this study may signal a policy conflict that requires harmonisation. Sectorial policy approaches seem to be the dominant legal structure in as far as natural resource utilisation is concerned. The CLFP Act, which is currently used by

extension officers, prohibits the commercial harvesting and resale of forestry products. The PWM Act empower CAMPFIRE districts to commercially harvest and resell their natural resources. In harmonising the two Acts, the challenge would be to distinguish similar natural resources (firewood, wild foods and construction poles) from CAMPFIRE and non CAMPFIRE districts.

Market influence, as suggested in this study, may point to the fact that buffer zone resource extraction or willingness to participate is more market driven than local and personal consumption are. This is further supported by the positive association between the wealthy and the fire wood and construction combination. The positive association between gender and the wild foods and firewood combination, and the negative association between age and all resource extraction combinations, further support the market influence dominated by young male households which are labelled as risk takers.

Three challenges emerge, as follows; Firstly, buffer zone extractions were created in view of local non commercial consumption by sub-district producer communities in order to supplement their livelihoods, based on the assumption that their main livelihood sources would be from game park revenues. Secondly, legal and formal markets for buffer zone products are currently absent for their initial creation (buffer zones) was never meant to accommodate commercial harvesting, but was meant to foster local consumption. Thirdly, overexploitation may be a possibility given the high market demand which is capable of creating buffer zone boundary conflicts as surrounding communities require a larger area to extract natural resources. Moreover, residences that are distant from other wards and, possibly, other districts may scramble for sellable buffer zone resources.

These findings suggest that game park revenue may be insufficient to address the livelihood requirements for surrounding communities. Surrounding communities are therefore

converting secondary livelihood sources (buffer zone extracts), which were initially meant for local consumption, into primary livelihood sources. Unfortunately, the institutional framework (markets and the legal framework) is not supportive because it was never meant to support these activities (i.e. commercial harvesting of buffer zone resources). The buffer zone livelihood link, as conventionally practiced, may therefore fail to address livelihood requirements for the sub-district producer community.

Finally, the dominant contradiction observed between the participation and actual extraction inferred results may suggest the ineffective functioning of LCCs, where non-registered community members would be allowed to extract buffer zone resources. This may also suggest misrepresentation by surrounding communities who would not register as active buffer zone users so as to avoid common pool conservation duties, while they would free-ride and extract buffer zone resources. This scenario further suggests that surrounding communities may not be organised enough to be expected to share uniform conservation views.

5.13 Conclusion

The study concluded that the buffer zone livelihood link, as currently practiced under community managed game parks, though displaying potential, may fail to address the livelihood expectations of the sub-district producer community. Major obstacles to this link may be the institutional and conflicting design objectives. Irrespective of the lucrative potential of the link, available markets and legal frameworks are not supportive because they were never created to accommodate the commercialization of buffer zone products. The results suggest that buffer zone participation and resource extraction by surrounding communities is more market driven than used for domestic consumption. Low Game Park

revenues may be the primary cause for surrounding communities considering commercializing their buffer zone extractions.

Access to markets, wealth, gender, household size and Livestock Units, were the primary factors capable of positively influencing the participation of households in various buffer zone resource extraction combinations. Extension and age were negatively related to participation in various buffer zone resource extraction combinations. The study, therefore, calls for extreme caution whenever the buffer zone livelihood link is considered as a possible livelihood source under community managed Game Parks. The positive relationship between access to markets and resource extraction may signal a market driven demand capable of causing overexploitation amid low revenues from Game Parks.

5.14 Policy challenges

In this section, current policies, relevant to the environment, shall be reviewed in light of research findings; this is done with the sole objective of improving the involvement of scientific research in policy formulation. The Zimbabwean Communal Lands and Forestry Produce (ZCLFP) Act restricts the commercial sale of forestry produce for the purpose of protecting it from the overexploitation of natural resources. The sale of forestry produce is therefore illegal. The Zimbabwean Parks and Wildlife Management (ZPWM) Act, through provisions of the AA status clause, empowers local communities to sell natural resources in their areas of jurisdiction. When buffer zones were established the objectives were to allow local communities to harvest forestry products to supplement their livelihoods; this was done on the assumption that the revenue from Game Parks would provide the primary livelihood source.

Game park revenues seem to have failed to provide adequate primary sources of livelihoods for surrounding communities. Communities have resorted to commercial harvesting of buffer

zone products to supplement the low revenues received from Game Parks. In trying to sell forestry produce, communities face restrictive laws (ZCLFP Act), since the AA status seems to only authorise the sale of game species (elephants, lions, hippos etc) for trophy hunting. The buffer zone livelihood link may therefore have significant potential as a sustainable pathway, but be institutionally doomed. In this regard, the following policy recommendations are inclined towards shaping current wildlife policies to accommodate the welfare requirements of current generations without compromising the ability of future generations to meet their own needs from the same wildlife.

Policy harmonisation: The Zimbabwean Environmental Management Act (latest environmental policy in the country) still accommodates several clauses from the ZCLFP Act that inhibits the commercial harvesting of forestry products. On the other hand, little mention is made of the Appropriate Authority status, by the local community, to commercially harvest forestry products (as provided by the Parks and Wildlife Management Act), which still remain limited to trophy hunting of game animals. Legalising the sustainable harvesting of all buffer zone products from CAMPFIRE certified districts may be the missing legal link.

Institutional support: Extension support is missing as well as supportive legal markets. The results suggest a positive correlation between extension and willingness to participate in buffer zone activities (Table 5.5). However, the resource extraction results reveal a negative correlation (Table 5.6). The implied message seems to be that the current extension support is limited to encourage communities to harvest buffer zone products solely for domestic use. Given the medicinal value of wild foods and the premiums that consumers are willing to pay for organic products, local communities are likely to benefit significantly if markets for forestry products are formalised. Timber from *Mopane* species, sustainably harvested, can also present a lucrative business opportunity for surrounding communities. Firewood which is sustainably harvested (dry wood and side brunch pruning firewood harvested by local groups

created and certified by the Local CAMPFIRE Committees, to encourage group benefits) can also present a lucrative opportunity for the sub-district producer community.

Approach: To avoid the scramble for buffer zone products, the group approach together with quota and permit systems, as well as product branding, is recommended. Only local groups from the sub-district producer community formed and authorised by the Local CAMPFIRE Committees are encouraged. Harvesting quotas and permits shall be issued and monitored by the LCCs to avoid overexploitation. Branding is also further encouraged, so that each product can be traced back to its source.

For the approach to work communities need to be organised first so that they share the same vision. Misrepresentation observed on participation (registration) and actual buffer zone resource extraction suggest inefficiency of available local management committees and unorganised communities. Need may therefore arise to educate local communities in group dynamics skills for purposes of organising them so that they share the same vision before introducing such approaches.

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Chapter Six

Buffer zone income dynamics for the sub-district producer community: Implications for rural off-farm income, income inequality and the development of household agriculture.

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Abstract

This study explores the role of buffer zones in household welfare in Zimbabwe by using primary household level data collected between November and December 2010 from communities that share boundaries with Nyatana Game Park. The descriptive statistics suggest that the contribution of buffer zone activities to household income may be significant, with a positive correlation to household agricultural income for communities that reside inside or close to the park (primary sub-district producer community). For distant communities (secondary or tertiary sub-district producer community), the contribution of the buffer zone to household income may be low, with self-employment as the main livelihood source. The results further portray a negative association between self-employment and the development of household income.

Using the Gini decomposition approach and Lorenz curves, the study concludes that buffer zone income may be capable of contributing to more equally distributed incomes for rural

communities who share boundaries with game parks. With respect to the correlates of household income, the results suggest that household size and age may negatively influence income from buffer zone activities, while gender may have a positive effect. This was also true for education and Livestock Units (LUs) with respect to income from self employment, the former positively and the latter negatively related. The results further suggest that land size may also be positively significant to explain income from agriculture and total income. With reference to distance from the buffer zone, the results suggest a negative influence with respect to the buffer zone, agriculture and total income.

The implied message is that buffer zones may provide active livelihood sources capable of financing rural household agriculture. The income equalizing effect portrayed here may also imply that, if correctly targeted and promoted, the buffer zone income could possibly address the current income inequality generic in rural areas. However, this potential may not be realized because of the current buffer zone design status (created for local secondary use, not for commercial primary use), restrictive policies and poor institutional support. The study therefore recommends promotion of buffer zones mutually agreed between SO and surrounding users given their income potential, income equalizing effect and possibility of financing development of household agriculture.

Key words: Buffer zone incomes, income inequality, household agriculture

6.0 Introduction and background information

Many community managed game parks were established with the primary assumption that revenue from ecotourism activities would provide the main livelihood source for the surrounding communities (Muchapondwa, 2003; Fernandez *et al*. 2009). The idea was to involve the masses of rural communities as active partners so as to marry conservation and development by using the positive benefits (revenue) from game parks as incentives for surrounding communities to conserve wildlife (Gadgil and Rao, 1994, 1995). Buffer zones were therefore seen as secondary livelihood sources for complementing local requirements of surrounding communities.

The low and sometimes missing revenue from game parks, amid a growing number of the sub-district producer communities, may have turned community game farming into a high risk livelihood source. Due to the agro-ecological locations of most game parks (regions IV and V), crop farming is also very risky and unreliable for surrounding communities (Child, 1995). With this, the sub-district producer community seems to be responding to distress diversification strategies in response to "push" and "pull" factors.

Buffer zones that were initially created as a secondary livelihood source have been turned into primary livelihood sources which send "pull" signals to even secondary and tertiary sub-district producer communities. Recent studies suggest that the rural poor are dependent on forest resources for sustaining their livelihoods (Millennium Ecosystem Assessment (MEA), 2005). A forest-poverty linkage model has therefore emerged as a possible safety net, and a path out of poverty (Cavendish, 2003; Vedeld *et al*. 2004; Fisher, 2004; Narain *et al*. 2005; Kabubo-Mariara, 2008; World Bank, 2008).

Other studies, however, suggest that the potential benefits that the poor can derive from forests are not obvious and/or always positive (Beck and Neshmith, 2001; Campbell *et al*.

2001; Shively, 2004; Adhikari, 2005). The literature, therefore, suggests a two way causal relationship between buffer zone and poverty (Kabubo-Mariara, 2008). Angelsen and Wunder (2003) argue that a forest may be a poverty trap rather than a safety net due to the low returns of most non-timber forest products, poor physical infrastructural development in rural areas and missing markets. MEA (2005) further acknowledges that many developing countries have not effectively used forest resources in support of development efforts due to the widespread corruption of the political and economic elites in the forest sector.

More questions than answers surround the potential of buffer zones to address the livelihoods of rural communities who share boundaries with such ecosystems. In addition, the actual income benefits that rural poor communities can derive from buffer zones are questionable given that most developing countries prohibit the commercial sale of forest produce. Adhikari (2005) notes that while the poor may attempt to minimise risk by using forest resources to mitigate the shortfalls in consumption, the rich may be interested in enhancing their incomes through the commercial trade of these resources, when there are good market opportunities.

Locked up in risk community game farming and crop farming, rural communities may have been "pushed" out of such activities targeting buffer zones as their only hope due to lucrative opportunities (grazing land and several extractable buffer zone natural resources), although its potential in this regard is highly debated in literature. This study analyses the buffer zone income dynamics for the sub-district producer community with the implicit objective of understanding communities` dependence on buffer zones (forests). It focuses specifically on the implications for rural off-farm income, income inequality and the development of household agriculture.

6.1 Problem statement

Most community managed game parks have failed to provide consistent and meaningful primary livelihood sources for surrounding communities (Child, 1995; Patel, 1998; Hasler, 1999; Muchapondwa, 2003). This may have forced communities to consider buffer zones that were initially created as secondary livelihood sources for local domestic use. Literature on the subject, however, suggests that the potential of buffer zones (forests) may not be that obvious and/or always positive (Beck and Neshmith, 2001; Campbell *et al*. 2001; Shively, 2004; Adhikari, 2005). The need therefore arises to consider the potential of buffer zones to address livelihoods as primary sources for the sub-district community, given the recent attention to buffer zones amid failing community game farming.

The study analyses the income dynamics for three categories of communities for purposes of understanding contribution of buffer zone incomes. The first group were primary sub-district producer communities with normal limited access to the buffer zone (NLA), who relied strictly on the established buffer zone for a livelihood through harvesting of buffer zone products like fire wood, wild mushroom, reeds and timber. The second group comprised of primary sub-district producer communities with illegal unlimited access to the entire game park (IUA); they relied directly on the entire game park since they were able to illegally establish their accommodation inside the game park and could therefore access resources beyond the established buffer zone, for a livelihood through harvesting game park products. The third group comprised of the secondary sub-district producer community with distanced, normal, limited access to the buffer zone (DNLA), who partially relied on the established buffer zone for a livelihood.

6.2 Study questions

The study addresses the following research questions:

- What is the level of household reliance on buffer zone environmental incomes?
- What is the distribution of buffer zone environmental incomes between the three different buffer zone user groups from the sample?
- What is the contribution of the buffer zone to income distribution?
- What are the determinants of household income for different buffer zone user groups?

6.3 Study objectives

The general objective of the study was to analyse the buffer zone income dynamics for the sub-district producer community. The specific objectives were structured as follows;

1. To investigate the level of dependence on buffer zone incomes by different user groups as defined by their location.
2. To investigate the distribution of buffer zone incomes between different user groups.
3. To assess the contribution of buffer zone to income distribution.
4. To uncover the correlates of household income for different buffer zone user groups.

The first two objectives were motivated by recent findings which suggest that forests may play a significant role as safety nets that cushion households during periods of hardship as they are capable of reducing rural poverty (Kabubo-Mariara, 2008) and financing rural household agricultural development (World Bank, 2008; Zahonogo, 2011), although not always in ways that are obvious and/or positive (Beck and Neshmith, 2001; Campbell *et al*. 2001; Shively, 2004; Adhikari, 2005).

The third objective was motivated by mixed reporting that surrounds the possible income distribution effect of non-farm activities as acknowledged by Reardon *et al*. (2001). Studies by van den Berg and Kumbi (2006) in Ethiopia, Lanjouw (1998) in Ecuador, Fisher (2004) in Malawi and Kabubo-Mariara (2008) in Kenya indicate that off-farm activities may reduce rural income inequality, while Reardon (1997) finds that off-farm income contributes to increasing inequality in a review of case studies from several countries in Africa (Khan and Riskin, 2001; Elbers and Lanjouw, 2001; Escobal, 2001). In light of the above, the third objective focused on sources of income inequality among different buffer zone user groups, using the Gini decomposition analysis and Lorenz curves.

The fourth objective tried to uncover factors capable of influencing the magnitude of incomes from different major sources within the study area. The motivation, as it were, was based on the assumption that if forest activities increase household income and reduce poverty and inequality (Kabubo-Mariara, 2008), understanding the correlates of household income may help in the identification of potential entry barriers and constraints.

6.4 Study site

The study was based on data gathered from community managed buffer zones surrounding Nyatana Game Park, in Zimbabwe. One community residing inside the park was considered for purposes of estimating the full potential of game parks in the event that communities are aloud unlimited access to the park. The specific location of Nyatana Game Park is **$16^0$51`08.71`` S: $32^0$35`11.30`` E** supported by a modified Google Earth map in Figure 6.1.

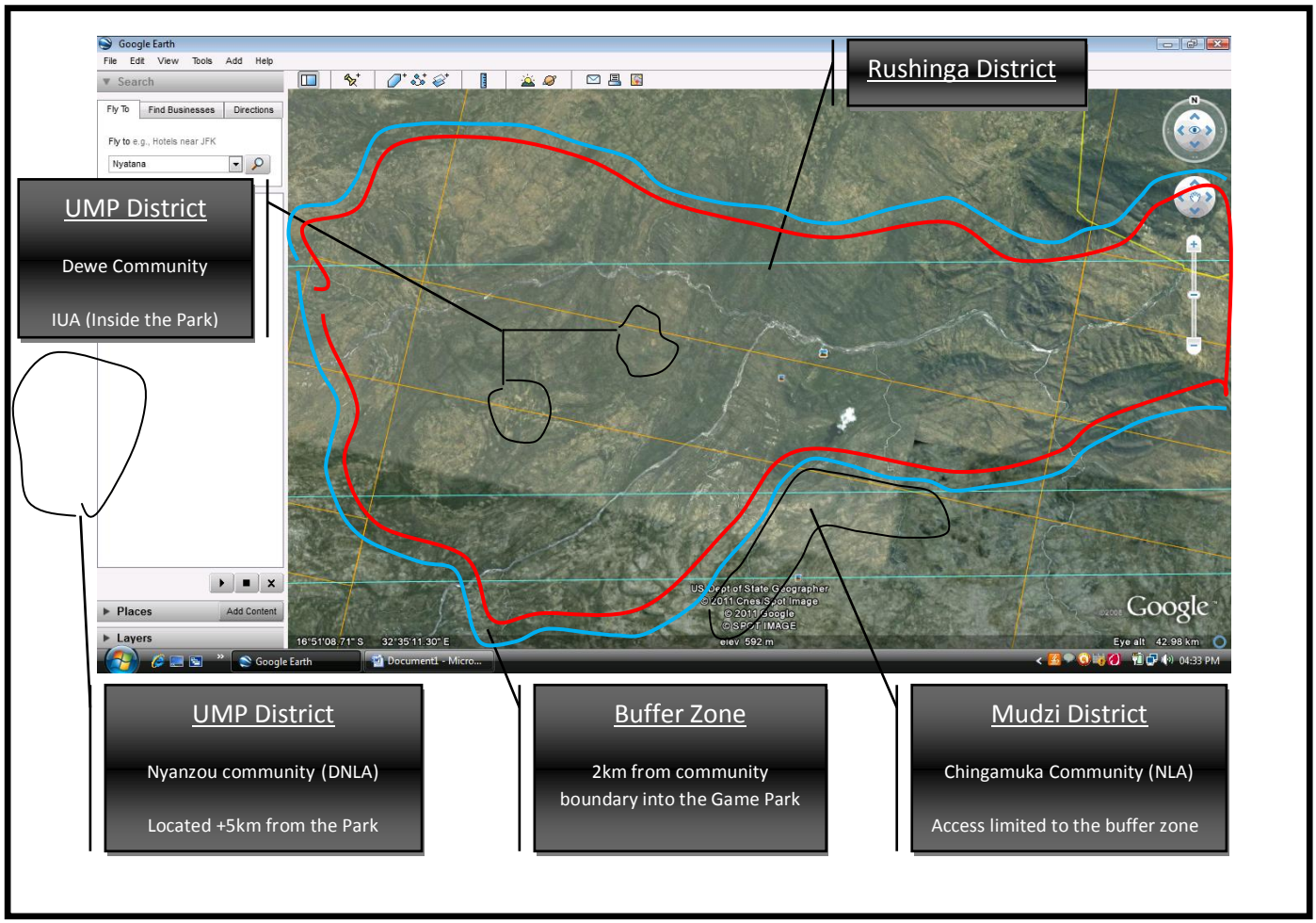

Figure 6.1: Study location map (Nyatana Game Park)

6.4.1 Sampling and data collection procedure

The data used in this study was collected from "cluster D" yielding a sample of 120 households. The survey was conducted in December 2010 and January 2011. The study employed a multi-stage sampling technique with stratified and random components. Samples were drawn from three communities, namely those who were: illegally residing inside the game park (IUA - 20), legally residing outside the game park within 3km from the buffer zone (NLA - 50), and legally residing outside the game park beyond 3km from the buffer zone (DNLA - 50).

Initially, purposive stratified systematic sampling was employed with community characteristics (location), as the basis for sampling. Participation in income generating activities and the income derived from them was assumed to vary in relation to the distance away from the buffer zone. From each of the three groups of communities each community was selected using a simple random sampling technique. Finally, households were further randomly selected for enumeration. Three districts surround the Nyatana Game Park, namely UMP, Mudzi and Rushinga. From the three districts, all three categories of communities (IUA, NLA and DNLA) were present. However, the illegal unlimited access group (IUA) was more pronounced in UMP and Rushinga districts.

From the UMP district, specifically from Dewe and Masunzwa communities, several households were illegally residing inside the Nyatana Game Park. This was also true for the Rushinga district. Figure 6.2 illustrates how communities were grouped for sampling purposes so as to include the levels involved from the district down to household level. From the created groups (IUA, NLA and DNLA) based samples obtained from "cluster D", in level I, one community was randomly selected for the purpose of drawing households for interviews. For the IUA group, Dewe community from the UMP district was randomly chosen, Chingamuka from Mudzi for the NLA and Nyanzou from UMP for the DNLA group.

The actual sample survey yielded 120 households, 20 from the IUA, 50 from the NLA and 50 from the DNLA group. Due to the practical difficulties of interviewing illegal households, the study only managed to interview 20 respondents from the IUA group. A detailed questionnaire was used to collect the required data and probed household socio-economic characteristics, income sources and buffer zone collection activities. Household data was also augmented by focus group discussions from each of the sampled villages, for the purpose of understanding community shared norms and values with respect to buffer zone incomes. This was mainly done to gather group consensus for it was feared that households may

misrepresent themselves, for fear of prosecution because the sale of forestry produce was illegal.

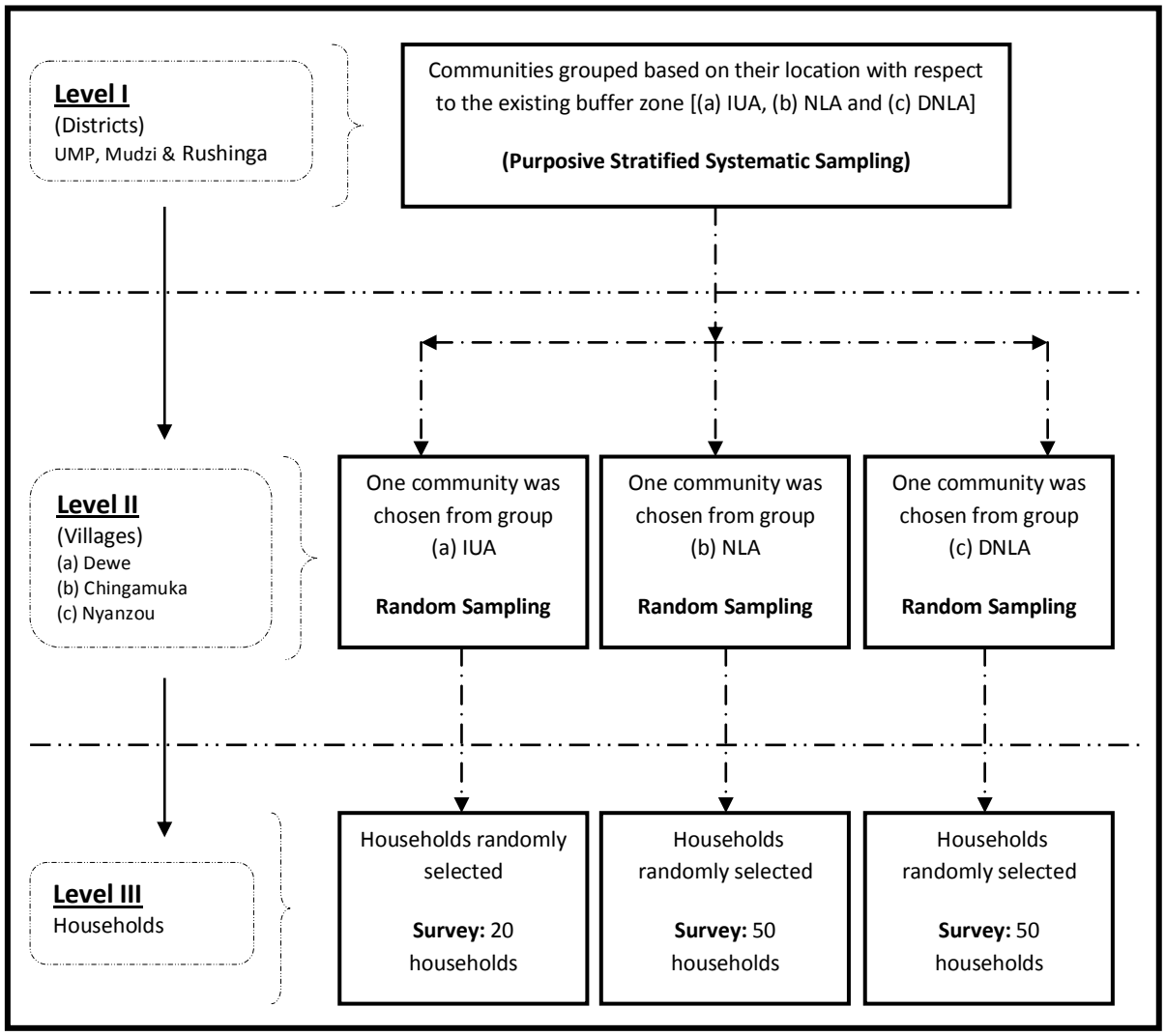

Figure 6.2: Sampling procedure

6.5 Literature review

This section reviews the literature presented on the relative importance of off-farm activities to household incomes, with special reference to societies that share boundaries with community managed Game Parks or common pool forest areas. The concepts reviewed here include issues on the potential of non-farm activities in rural areas as livelihood and income sources; the potential of forests (buffer zones) in rural areas as livelihood and income

sources; the contribution of non-farm incomes to household agriculture development and the contribution of non-farm activities to household income equality.

6.5.0 The potential of non-farm activities in rural areas as livelihood and income sources

Several authors acknowledge that while many households in rural areas are involved in farm activities, many get the bulk of their incomes from non-farm activities and, recently, the latter has been viewed as an important pathway out of rural poverty (Reardon, 1997; Bryceson and Jamal, 1997; Rosenzweig, 1988; Kimhi, 2000; Ellis, 2000; Barrett *et al*. 2001; Lanjouw, 2001; Ruben and van den Berg, 2001; de Janvry and Sadoulet, 2001; Haggblade *et al*. 2007; World Bank, 2008; Chikwama, 2010; Zahonogo, 2011). With special reference to developing countries, between one third and half of rural households are reported to generate their income from non-farm sources with a share of income between 20% and 70% of the total household income (Rosenzweig, 1980; Benjamin, 1992; Rizov *et al*. 2000; Adams, 2001).

Research conducted by ICRISAT in Burkina Faso over the 1981 to 1985 periods seems to suggest that between 26% and 57% of the total household income come from non-farm activities (Reardon *et al*. 1992). Zahonogo (2002) notes that recent studies in the same zones seem to suggest that non-farm income may represent between 22% and 40% of the total household income. Contrary, studies in Latin America, specifically from Bolivia, have noted that agricultural production is still the most important source of income (Comisión Europea, 2000; Jimenez and Lizarraga, 2003).

6.5.1 Potential of forests (buffer zones) in rural areas as livelihood and income sources

Tropical forests have also been reported to provide significant livelihood sources, cash incomes and vital safety nets in times of need (Hegde and Enters, 2000; Godoy *et al*. 2000;

Pattanayak and Sills, 2001). Earlier, Cavendish (2000) suggested that since forests represent a basket of highly differentiated goods and services, more empirical evidence examining forest dependence, in a robust analytical framework, is necessary. As a result, recent studies have focused on the poverty-forest-link and the contribution of forests and other common pool resources (Vedeld *et al*. 2004). These studies argue that, other than being a safety net and gap-filler, forest income may be part of household livelihood diversification strategies capable of representing a significant income source (Cavendish, 2000; Angelsen and Wunder, 2003; Pattanayak *et al*. 2004; Takasaki *et al*. 2004; Stifel, 2010) with an average contribution of 22% (Vedeld *et al*. 2004) and possibly 30% (Fisher, 2004).

6.5.2 Contribution of non-farm incomes to household agriculture development

Some previous studies suggest that earnings from farm and off-farm activities may be positively correlated (Haggblade *et al.* 1989; Hazell *et al*. 1991) through unlocking constraints on credit and liquid assets required for agricultural production, hence boosting agricultural competitiveness (World Bank, 2008). In situations where there are no credit constraints, Zahonogo (2011) suggests that the non-farm income may become a determinant in the rural households' strategy for farming investment. This observation has attracted considerable attention from policymakers and rural development agencies for policy targeting towards improving agricultural performance in developing countries (Bernstein *et al*. 1992; Cater, 1997; Ellis, 2000; Barrett *et al*. 2001; Lanjouw *et al*. 2001; Chikwama, 2010). Contrary to this interesting development, some studies argue that the expansion of the rural off-farm sector may have adverse effects on the development of household agriculture (Lipton, 1980; Low, 1986; Ellis; 1998). As previously noted by Lanjouw (2001), there is still no consensus on the exact direction of influence between rural off-farm activities and household agricultural development.

6.5.3 Contribution of non-farm activities to household income equality

The distributional role of non-farm activities to household income equality, from rural areas, is still controversial. To a larger extent, the direction of influence is affected by the types of non-farm activities involved and the capacity of different households to access such activities. Quite a number of studies suggest that non-farm income may be more unequally distributed than farm incomes (Shand, 1987; Reardon and Taylor, 1996; Leones and Feldman, 1998; Barham and Boucher, 1998; Khan and Riskin, 2001; Elbers and Lanjouw, 2001; Escobal, 2001).

Contrary to this commonly shared conclusion, a significant number of studies share the view that non-farm incomes may contribute to more equally distributed incomes in rural areas, especially when the proportion of non-farm income in relation to total income increases (Chinn, 1979; Stark *et al*. 1986; Adams, 1994, 1999; Adams and He, 1995; Lachaud, 1999). Fisher (2004), based on a study of economic reliance on forests and its impact on the welfare of low-income households in rural Malawi, notes that forest income reduced measured income inequality by 12%. Similar findings were recently shared by Kabubo-Mariara (2008), based on a study of forest dependence and household welfare in Kenya. Kabubo-Mariara (2008) notes that forest incomes from the study area contributed a small proportion (4%) to total income inequality. These results are in agreement with previous conclusions which suggest that forests contribute to more equally distributed incomes (Cavendish, 2000, 2003; Angelsen and Wunder, 2003; Fisher, 2004).

General conclusions from the reviewed literature are therefore varied. Firstly, the literature suggests that non-farm activities contribute significantly to rural incomes (World Bank, 2008; Chikwama, 2010; Zahonogo, 2011) and diversification into non-farm activities, therefore,

seems to be the norm (Barrett *et al*. 2001) especially among agricultural households whose livelihoods are vulnerable to climatic uncertainties (Stifel, 2010). Secondly, several studies suggest a positive correlation between non-farm incomes and the development of household agriculture (Haggblade *et al.* 1989; Hazell *et al*. 1991; World Bank, 2008), although some studies suggest a negative correlation (Lipton, 1980; Low, 1986; Ellis; 1998).

The literature suggests that forests and other common pool resources also contribute significantly to rural household incomes (Godoy *et al*. 2000; Pattanayak and Sills, 2001; Vedeld *et al*. 2004; Kabubo-Mariara, 2008). Regardless of the reported potential of forests and common pool natural resources, the Millennium Ecosystem Assessment (2005) notes that many developing countries have not effectively used forest resources to support rural development. The problem, from an African perspective, seems to emanate from lack of more accurate and adequate data compared to other regions (Sale, 1981; Campbell, 1996; Cavendish, 2000; Fisher 2002; Campbell and Luckert, 2002; Kaimowitz, 2002). Thirdly, literature also suggest that forests may contribute to more equally distributed incomes (Cavendish, 2000, 2003; Angelsen and Wunder, 2003; Fisher, 2004), although other studies show that the reverse may also be true (Khan and Riskin, 2001; Elbers and Lanjouw, 2001; Escobal, 2001).

6.6 Methods of analysis

The study analyses the income dynamics of sub-district producer communities defined by three distinct buffer zone user groups: (a) illegal unlimited access users (IUA), (b) normal limited access users (NLA) and (c) distanced normal limited access users (DNLA). Four working hypotheses were addressed, as follows; firstly, the illegal unlimited access users (IUA) are more dependent than the normal (NLA) and the distanced (DNLA) normal limited access users on buffer zone resources; secondly, location is an important determinant of

buffer zone incomes; thirdly, buffer zones contribute to more equally distributed incomes; and fourthly, buffer zone dependence (income) is conditioned by other household heterogeneities (gender, household-head education and household-head age).

In order to test the above hypotheses, the study employed both descriptive and econometric research methods. The estimation of buffer zone dependence by different user groups and the distribution of buffer zone incomes was done using descriptive statistics in the form of tables, frequencies, graphs and percentages. With respect to the contribution that the buffer zone makes to income distribution and inequality dominance, the study adopted the Lorenz curve and Gini index, as follows;

6.6.1 The Lorenz curve

The Lorenz curve maps the cumulative income share on the vertical axis against the cumulative distribution of the households on the horizontal axis. If each household had the same income, the income distribution curve would be straight. This is the line of total equality. The further away the Lorenz curve is from the line of total equality, the greater the inequality. Following Duclos and Araar (2006), the Lorenz curve can be illustrated as shown in equation 6.1.

$$L(P) = \frac{\int_0^P Q(q)dq}{\int_0^1 Q(q)dq} = \frac{1}{\mu}\int_0^P Q(q)dq \quad \text{.....6.1}$$

Where;

- The numerator sums incomes from the bottom P: proportion (poorest 100P %) of the population.
- The denominator sums incomes from all the population.

Duclos and Araar (2006) further suggest that the Lorenz curve can be used for testing inequality dominance. If the Lorenz curve say LBZ (P) of a distribution BZ is everywhere above the Lorenz curve LAG (P), distribution AG is more unequal than distribution BZ. Thus, all the inequality indices that obey the Pigou-Dalton principle should indicate that inequality in AG is higher than inequality in BZ.

6.6.2 Decomposition of income inequality

The Gini coefficient is a measure of statistical dispersion most prominently used as a measure of inequality of income distribution or the inequality of wealth distribution. It is defined as a ratio with values between 0 and 1. A low Gini coefficient indicates more equal income distribution, while a high Gini coefficient indicates more unequal distribution. A value of 0 corresponds to perfect equality (everyone having exactly the same income) and 1 corresponds to perfect inequality (where one person has all the income, while everyone else has zero income) (van den Berg and Kumbi, 2006).

The decomposability of income inequality allows inequality to be partitioned either over subpopulations or sources (Adams, 1999). In this technique, total inequality is divided into a weighted sum of inequality by various income sources (for example, non-farm and agricultural income) and it encompasses source decomposition of the Gini coefficient. The Gini coefficient is frequently used for the analysis of the distribution of income because it can be decomposed by income source; this illustrates the effects of alternative income sources on total income equality. In their recent study, van den Berg and Kumbi (2006) used a similar approach to obtain estimates of the contribution of selected sources of income on inequality in Oromia, Ethiopia. Their analysis follows the common expression for the Gini coefficient (G) for the distribution of total income within the group and is defined as in equation 6.2:

$$G = \frac{2\,\mathrm{cov}[Y, F(Y)]}{\mu} \quad \text{.....6.2}$$

Where;

- cov*[Y, F(Y)]* is the covariance of total income (Y with mean μ) with its cumulative distribution (F).

6.6.3 Equation of income

The analysis considered setting simple linear equations to estimate the reduced form models of household income from different sources. Conceptually, it is possible to think of a number of variables, which could influence household income. The variables could be location based (e.g. distance from buffer zone – IUA, NLA and DNLA groups), human capital related (e.g. education and level of access to extension by household) or socio-economic related variables (e.g. household size, age and gender). The analysis of income employed here also included a location dummy variable to capture the location endowments important for household income generation. In order to identify the determinants of household income, from different sources, this study estimated the income determination function for the year 2010. The total income equation was estimated using OLS for all the different categories of incomes separately. The general model of all the estimated equations, following an approach by Pindyck and Rubinfeld (1991), can be written as shown in equation 6.3 for each category of income:

$$Y_j = \beta_0 + \beta_i X_i + u \quad \text{.....6.3}$$

Where;

y_j = the dependent variable representing income earned from each income category, explained by,

b_i = the vector of parameters and

X_i = the vector of exogenous explanatory variables with

b_0 = the constant term and

u = the error term.

6.6.3.0 Definition and measurement of variables

In this section the study explores the impact of several household characteristics that may influence incomes for households which rely on the buffer zone. These included: household size, gender of household-head, age of household-head, education of household-head, arable land size (plot size), Livestock Units, access to extension by households and distance to buffer zone.

Household size

Household size, as measured by the number of adult household members, was expected to have a positive influence on buffer zone incomes, based on the generic understanding that buffer zone activities may be labour intensive (Gunatilake *et al*. 1993; Shively, 2004). A similar positive influence was also expected with respect to self-employment as rural households respond to "push" factors (high risk and lack of access to credit) which may push households into non-agricultural activities, in this case self employment, and "pull" factors such as higher returns to labour that could be obtained from working off the farm (Reardon, 1998; Lanjouw and Lanjouw, 2001; Sanchez, 2005). Effectively, a negative influence was therefore expected with reference to agricultural income.

Household-head gender

Gender was included to test whether there was a significant difference between the incomes of male headed households and female headed households. A negative association was expected with respect to buffer zone incomes based on the conventional understanding that

women may participate more actively in common pool gathering resources than men (Narain *et al*. 2005). A positive influence was expected with respect to self-employment based on "push" and "pull" factors.

Household-head age

The age of the household, as measured by its number of years, was expected to uncover the extent to which labour allocation changes over the life span of the household-head, as suggested by Adhikari (2005). Earlier studies suggest a positive association between age and incomes based on the fact that age may mean experience in managing common resources and the accumulation of capital (Kabubo-Mariara, 2008). In contrast, other studies suggest a negative association, specifically with respect to buffer zone incomes, for older households which may have less time and physical strength to engage in forest activities (Kohlin and Parks, 2001; Vedeld *et al*. 2004). Either a positive or a negative influence was therefore conjectured for all the main sources of income from the study area.

Household-head education

Education was expected to be negatively related to agricultural and buffer zone incomes and positively related to self employment. Previous studies noted that education may be expected to influence the extraction of fewer forest resources because education normally opens up alternative employment opportunities which are capable of diverting households from subsistence agriculture and gathering activities (Vedeld *et al*. 2004; Shively and Pagiola, 2004).

Land size

Land size, as measured in hectares of arable land, was expected to positively influence incomes generated from agriculture; households with a larger plot size were expected to

spread agronomic risk through crop diversity and rotations made possible by the larger plot size. This scenario was expected to negatively influence buffer zone participation and the resultant incomes from that source. Alternatively, previous studies suggest a positive influence based on the understanding that forests may be seen as important sources of intermediate products that serve as input in the farming system (Fisher, 2004; Adhikari, 2005). Livestock Units (LUs) for key bovine species (cattle, sheep and goats) from the study area was one of the factors also expected to positively influence agricultural incomes as a result of "sweet *velds*" common in agro-ecological regions IV and V.

Access to extension

Extension was expected to positively influence income from agriculture and self employment. A negative influence was expected with reference to incomes from the buffer zone, based on the current restrictive legal framework that prohibits the commercial harvesting of forest produce. Previous studies, however, suggested that institutions may be an important source of relevant information, including information on policy changes that directly affect forest communities (Gaspert *et al.* 1999; Adhikari, 2005).

Distance to buffer zone

Distance to buffer zone was expected to negatively influence incomes from agriculture (livestock) and buffer zone resources. Households who live closer to the buffer zone were expected to have a more secure and accessible supply of buffer zone products regardless of the existence or absence of allocation rules (Varughese and Ostrom, 2001). On the same note, households that live closer to the buffer zone (IUA and NLA) were further expected to have more secure access for grazing their livestock in comparison to their distant counter parts (DNLA). The risks generic in farm activities were, therefore, expected to push the DNLA group out of agricultural activities into non-farm activities (self-employment) and thereby

positively influencing incomes from self-employment. Table 6.1 summaries the description, measurement and expected signs for the considered variables.

Table 6.1: Variables hypothesized to affect household income

Variable	Description	Unit	Expected Sign		
			Buffer	Agric	Self Em
1. Household size	Number of adult family	Number	+	-	+
2. Household gender	Household head gender	0 = F; 1 = M	-	-	+
3. Household age	Age of household head	Years	-/+	+	+
4. Household education	Highest level of education achieved	0 = U; 1 = P; 2 = S; 3 = T	-	-	+
5. Arable land size	Estimate of arable farming area	1 = < 0.5ha; 2 = 0.5 - 2.5ha; 3 = > 2.5ha	-/+	+	*
6. Livestock units	Number of livestock units owned	1 = < 2LUs; 2 = 2 - 3LUs; 3 = > 3LUs	*	*	+
7. Access to extension	Household`s access to extension	1 = Poor; 2 = Fair; 3 = Good	-	+	+
8. Distance to buffer zone	Location of respondents with respect to buffer zone	IUA = 1; NLA = 2; DNLA = 3	-	-	+

Key:

- *: Influence could not be established *a priori*
- Household gender: F = Female; M = Male
- Household Education: U = Uneducated; P = Educated to primary level; S = Educated to secondary level; T = Educated to tertiary level
- Distance to buffer zone: IUA = Illegal Unlimited Access group (Inside the Park); NLA = Normal Limited Access group (0 – 5km from the buffer zone); DNLA = Distanced Normal Limited Access group (> 5km from the buffer zone).

6.7 Results and discussion

This section presents the research findings. Firstly, the study presents descriptive statistics for all sampled households. For the purpose of addressing the first and second objectives, a detailed descriptive analysis of data was conducted to explore the nature of household income sources and household income shares by source and buffer zone user groups. To achieve the third objective, the study used the Gini index and Lorenz curves to uncover the contribution

of buffer zones to income distribution. Finally, using econometric results, the study estimated the correlates of household incomes from different main income sources within the study area.

6.7.0 Descriptive statistics of all sampled households

Table 6.2 presents the socio-economic characteristics of all sampled households. The data displays a mean household size of 6, with a minimum of 1 and a maximum of 12. The average age of household-heads was 41, with a minimum of 18 and a maximum of 78.

Table 6.2: Descriptive statistics of all sampled households

	Household Socio-Economic Characteristics						
	Household Size	Household Head Sex	Household Head Age	Household Head Educ	Plot size	Livestock Units	Extension
N	120	120	120	120	120	120	120
Mean	6.13	.69	41.36	2.20	1.55	2.47	2.23
Median	6.00	1.00	36.00	3.00	2.00	3.00	2.00
Std. Deviation	2.449	.464	15.809	.984	.563	.744	.750
Skewness	-.241	-.841	.396	-1.006	.375	-1.005	-.396
Minimum	1	0	18	0	1	1	1
Maximum	12	1	78	3	3	3	3

The statistics also indicate a high average level of education, which was an average of secondary education for most households. These findings are in line with nationwide statistics based on the 2002 population census. Households had an average plot size of 1.55ha and 2.47 Livestock Units with fair access to extension. The mean and the median did not vary significantly, which implies that there were no major outliers for each household

characteristic. In addition, the asymmetry of distribution was both positively and negatively skewed. Age and plot size were positively skewed, while the rest of the characteristics were negatively skewed. Most of the characteristics had skewness values below 1 with the exception of education and livestock units. The statistics, therefore, suggest that the distribution did not differ significantly from a normal symmetric distribution.

6.7.1 Household incomes by sources

Previous studies suggest that common pool forest resources play a major role in poverty reduction through the diversification of household income sources (Vedeld *et al*. 2004). This section presents the results of average household incomes and shares of incomes from different activities by different buffer zone user groups. Figure 6.3 presents household incomes by source and buffer zone user groups.

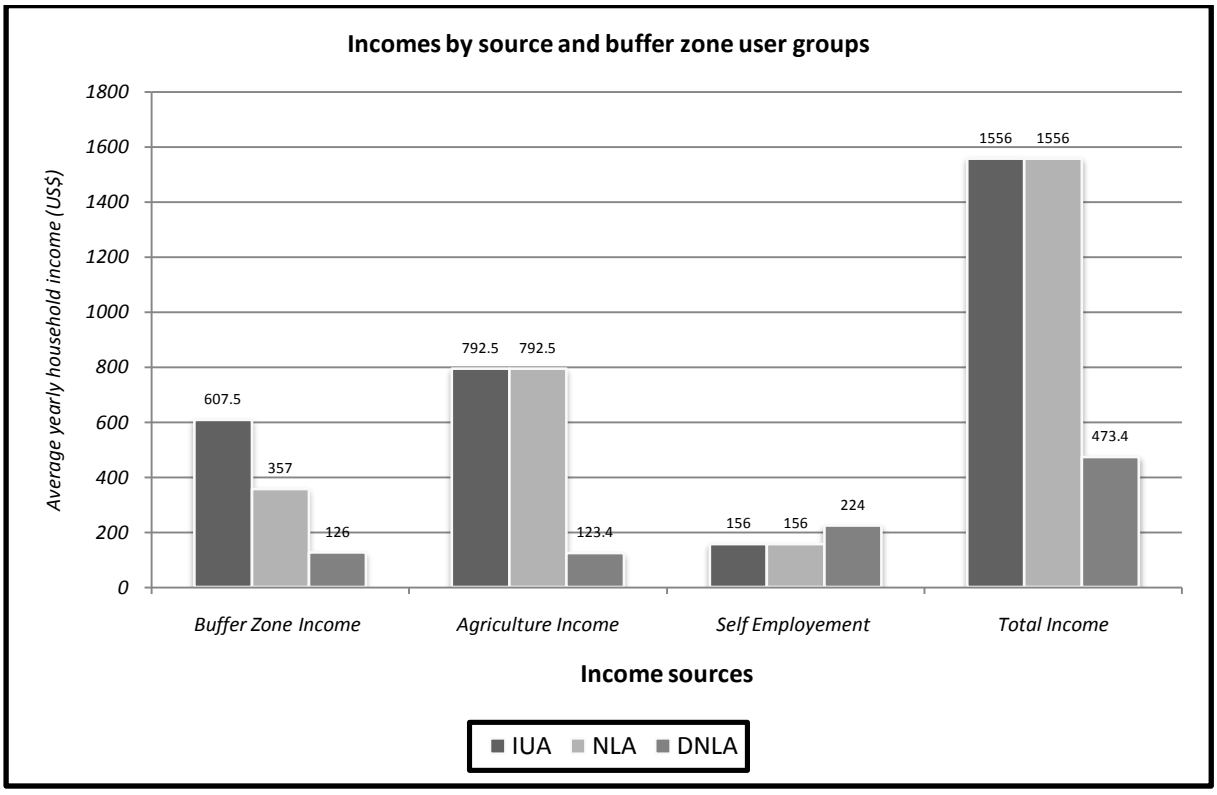

Figure 6.3: Household incomes by source and buffer zone user groups

The results seem to suggest that the illegal unlimited access group (IUA) and the normal limited access group (NLA) receive the bulk of their income from agricultural activities followed by buffer zone activities and, finally, from activities related to self employment. Contrary to this express trend, the distanced normal limited access group (DNLA) receive the bulk of their income from self employment activities, followed by buffer zone activities and, lastly, by agriculture. To augment the relationship portrayed here, Figure 6.4 presents income share by source and buffer zone user groups.

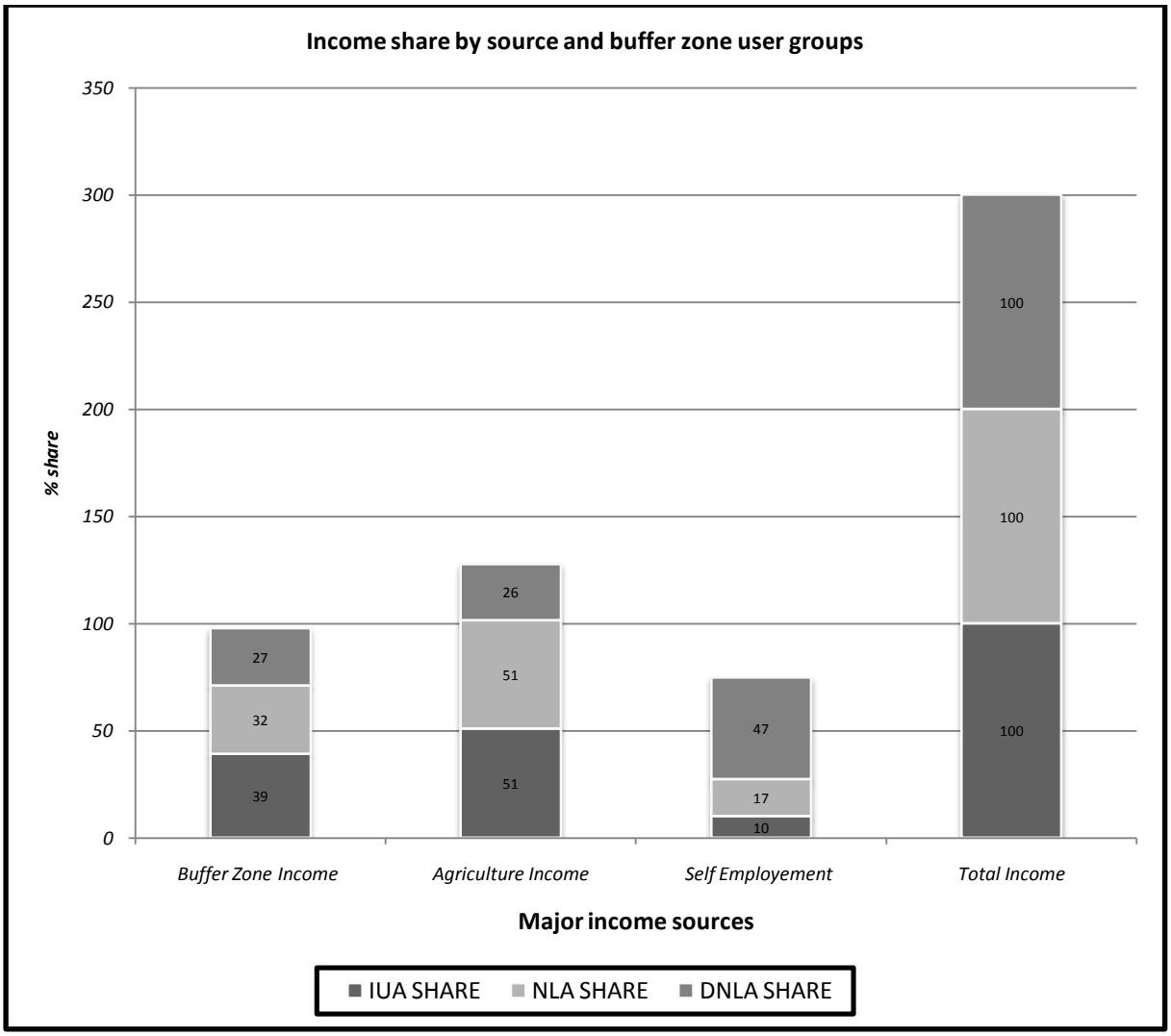

Figure 6.4: Income share by source and buffer zone user groups

For the IUA group, agriculture contributes 51% share to total income, buffer zone contributes 39% and self employment 10%. With respect to the NLA, group agriculture contributes 51% share of total income, buffer zone 32% and self employment 17%. Effectively, agriculture (mainly livestock) dominates as the main source of income for these two groups. In addition, for the IUA and NLA groups, the results seem to suggest a positive link between agriculture and buffer zone income. From the point of view of livestock production, similar comparable findings were inferred by Fisher (2004) and Adhikari (2005) who suggest that forests may be important sources of intermediate products (grazing land) that serve as inputs in the farming system. Using directional measure of association (Somers` d); the results suggest a positive significant (*p-value* 0.014) link between buffer zone and household income, as shown in Table 6.3.

Table 6.3: Directional measure of association

	Value	Approx Sig.
Somers` d	.800	0.014
Buffer zone income : Agricultural income		

These findings may also further suggest the relative importance and potential of buffer zone incomes to finance agriculture. Several studies acknowledge a positive relationship between off-farm and farm income (Haggblade *et al.* 1989; Hazell *et al.* 1991; World Bank, 2008; Zahonogo, 2011). Although respondents cited high income potential from buffer zones, high prohibitive laws were cited as the major challenge which locked incomes from buffer zone activities; this is a possible reason why agricultural incomes seem to dominate for these two groups despite dryness of area.

Lastly, with reference to the DNLA group, agriculture contributes only 26% of the total income followed by the buffer zone with 27% and self employment, as the major contributor, with 47%. These results suggest that agriculture is no longer the main source of income (livelihood source) for most rural people, but rather diversification into other non-farm activities (Ellis, 2000; Barrett *et al*. 2001; Lanjouw, 2001; Ruben and van den Berg, 2001; de Janvry and Sadoulet, 2001; Haggblade *et al*. 2007; World Bank, 2008), in this case buffer zone activities and self employment. Similar recent conclusions were shared by Chikwama (2010) and Zahonogo, (2011) who note that rural off-farm activities may form a significant component of livelihoods in developing countries. Contrary to the suggested positive link between off-farm and farm incomes under the IUA and NLA groups, the results seem to indicate a negative significant (*p-value* 0.014) association between self employment and agricultural income for the DNLA group, as shown in Table 6.4. These results support earlier findings which argue that the expansion of the rural off-farm sector may have adverse effects on the development of household agriculture (Low, 1986; Ellis, 1998; Kinsey, 2002).

Table 6.4: Directional measure of association

	Value	Approx Sig.
Somers` d	-.800	0.014
Self Employment Income : Agricultural income		

Based on the above descriptive analysis, the study can therefore loosely infer that, firstly; households which reside close to buffer zones (forest) may have a positive association with off-farm and farm income. This means that they may be more willing to invest their off-farm (buffer zone) income into agricultural activities, thereby promoting the development of

household agriculture. Secondly; rural communities which are distanced from projects like Game Parks may be more interested in off-farm livelihood diversification activities (self employment) which negatively affect the development of household agriculture.

6.7.2 Contribution of buffer zones to income distribution

In this section, the study uses the Gini index and the Lorenz curve to investigate the contribution of the buffer zone to the distribution of income by various sources and buffer zone user groups. Table 6.5 presents Gini decomposition by income sources and buffer zone user groups. The results suggest that incomes from self employment are grossly unequal across all buffer zone groups, with a Gini index of between 0.46 and 0.50. These findings are not surprising since the respondents were involved (engaged) in different self employment activities which are capable of generating different incomes (Khan and Riskin, 2001; Elbers and Lanjouw, 2001; Escobal, 2001). Similar recent comparable results, with respect to self employment, were reported by Kabubo-Mariara (2008) across different forest user groups, based on a study from rural Kenya.

Table 6.5: Gini decomposition by income sources and buffer zone user groups

Source of Income	Buffer Zone User Groups		
	IUA Group	NLA Group	DNLA Group
1. Buffer zone Activities	0.18	0.36	0.53
2. Agriculture	0.38	0.33	0.43
3. Self Employment	0.46	0.50	0.49
Total Income	**0.20**	**0.21**	**0.25**

Incomes from agriculture indicated a Gini index between 0.38 and 0.43. These results suggest that the agricultural activities from the study area were generating almost similar incomes, hence an equalizing effect. A slightly higher Gini index for the DNLA group (0.43) may be explained by the dominance of wetland gardens in this group; this was virtually absent from the other two groups (IUA and NLA) due to high invading pressure by game animals.

Incomes from the buffer zone seem to portray a relatively equal distributional effect of income for the IUA and NLA groups (0.18 and 0.36) and gross inequality for the DNLA group (0.53). These findings support the results espoused in the literature, in that forests contribute to more equally distributed incomes (Cavendish, 2003; Fisher, 2004). The decomposition of total income inequality suggests that there may be no huge variations in income inequality across the three buffer zone user groups (0.20 to 0.25), although the IUA group showed a relatively lower Gini index of 0.20.

The equality that exists in the three buffer zone user groups and particularly the distribution of income from each source is reflected in the Lorenz curves presented in Figure 6.5. The study further tested for inequality dominance between the different buffer zone income sources using the difference in Lorenz curves (Duclos and Araar, 2006). The results suggest that at the lower level of the distribution, there is more equality among the three sources of income. At the middle level of the distribution, agriculture and buffer zone incomes seem to continue to be equal while self employment incomes seem to be relatively unequal.

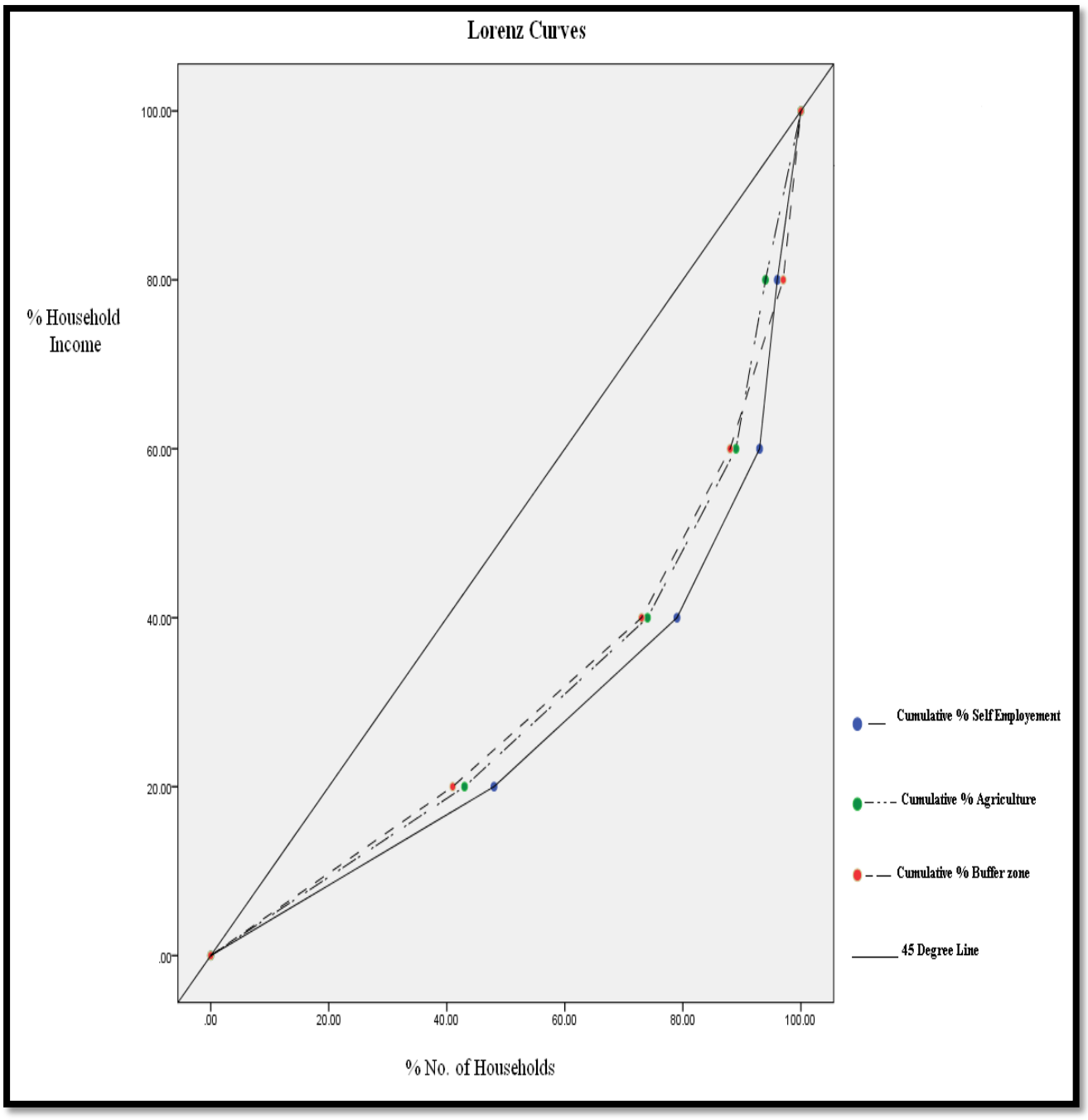

Figure 6.5: Modified Lorenz curves for income distribution by source of income

These findings further support previous literature that suggests that off-farm income may have an inequality effect to rural household incomes (Escobal, 2001; Kabubo-Mariara, 2008) However, at a higher level of the distribution, the Lorenz curves intersect; this suggests that there may be no inequality dominance.

Considering all the groups that the study tried to uncover in relation to the contribution of various income sources to inequality, Table 6.6 presents a depiction of the decomposition of income inequality based on income sources, buffer zone user groups and all buffer zone user groups combined.

Table 6.6: Gini decomposition of income inequality by income source and buffer zone user groups

Source of Income	Buffer Zone User Groups			
	IUA Group	NLA Group	DNLA Group	All Groups
1. Buffer zone Activities	0.18	0.36	0.53	0.47
2. Agriculture	0.38	0.33	0.43	0.51
3. Self Employment	0.46	0.50	0.49	0.49
Total Income	**0.20**	**0.21**	**0.25**	**0.33**

Results suggest that, on average, buffer zone incomes contribute a small proportion to total income inequality compared to other income sources. This relationship is more pronounced for the IUA (0.18) and NLA (0.36) groups than the DNLA (0.53) group. These findings support previous conclusions which suggested that forests contribute to more equally distributed incomes (Angelsen and Wunder, 2003; Cavendish, 2000; Kabubo-Mariara, 2008). An overall Gini index of 0.33 (total income) for all buffer zone user groups may therefore suggest that buffer zones contribute to more equally distributed incomes for rural communities who share boundaries with Game Parks.

Finally, the study tested for inequality dominance between the different buffer zone user groups based on total household incomes. Lorenz curves, for the distribution of incomes, further suggest that there may be no major differences in inequality between the three buffer

zone user groups. Figure 6.6 presents modified Lorenz curves for total household incomes by buffer zone user groups.

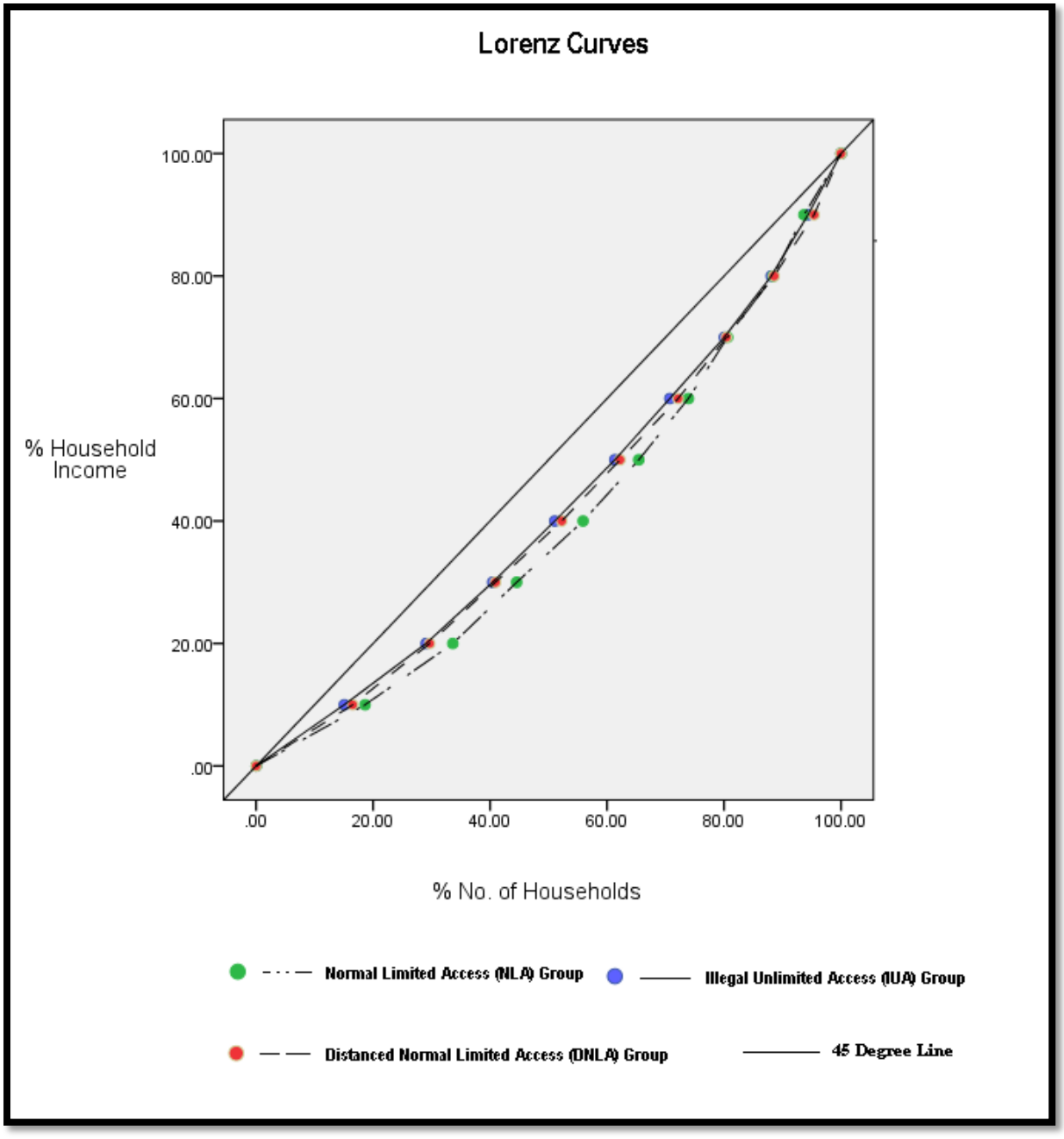

Figure 6.6: Modified Lorenz curves for total household incomes by buffer zone user groups

Figure 6.6 seems to suggest that at the lower and middle level of the distribution, there is more inequality among the NLA group than the other groups. Moreover, at all levels of the distribution, the Lorenz curves seem to suggest that there is more equality among the IUA

and DNLA groups than the NLA group. Finally, at higher levels of the distribution, the Lorenz curves intersect which suggests that there may be no inequality dominance.

The results, therefore, suggest that there is no inequality dominance among the different buffer zone user groups. Similar results were also shared by Kabubo-Mariara (2008) in his study of forest user groups from rural Kenya.

6.8 Econometric results

In this section, the study estimated the correlates of household incomes from different categories deemed to be key sources of incomes from the study area. This analysis was done primarily to uncover characteristics that are critical to determining whether a household will obtain income from various livelihoods sources considered. Effectively, four equations were estimated as follows; (a) total income equation, (b) agricultural income equation, (c) self employment equation and (d) buffer zone income equation.

Total income was defined as all earned net income obtained from the three income sources. Agricultural income was defined as the sum of crop and livestock net incomes. Self employment was defined as net income from all activities (entrepreneurship activities in the agricultural, processing, service provision, mining and manufacturing sectors) regardless of sectorial classification, and which households engage in away from their own farms in exchange for wages (Barrett *et al.* 2001). Buffer zone income was defined as all earned net income from flora and fauna extracts from the buffer zone.

The results, as presented in Table 6.7, were estimated using OLS in SPSS version 19.0. OLS was used because all the respondents reported positive incomes from all four sources of incomes.

Table 6.7: Correlates of household incomes from different main income sources

Predictor Variables		Reported main income sources from the study area			
		Total Income	Agricultural Income	Self Employment Income	Buffer zone Income
Constant	β_0	(2111.094) [9.215]**	(952.202) [5.156]**	(188.881) [2.336]*	(970.011) [9.509]**
1. House hold size	β_1	-0.037 [-0.564]	0.072 [0.977]	-0.125 [-1.274]	-0.132 [-2.025]*
2. Household head gender	β_2	0.25 [.0.385]	0.005 [0.073]	-0.167 [-1.716]	0.135 [2.092]*
3. Household head age	β_3	-0.50 [-0.775]	0.004 [0.060]	0.032 [0.320]	-0.138 [-2.103]*
4. Household head education	β_4	-0.019 [-0.315]	-0.080 [-1.183]	0.195 [2.167]*	-0.017 [-0.282]
5. Arable land size	B_5	0.144 [2.209]*	0.166 [2.231]*	0.173 [1.745]	-0.030 [-0.459]
6. Livestock units	B_6	-0.013 [-0.188]	0.081 [1.019]	-0.241 [-2.285]*	-0.032 [-0.455]
7. Access to extension	B_7	0.116 [0.411]	0.072 [0.222]	0.045 [1.047]	-0.088 [-0.308]
8. Distance to buffer zone	B_8	-0.885 [-3.139]**	-0.777 [-2.406]*	-0.283 [-0.659]	-0.618 [-2.170]*
a) Number of Observations		120	120	120	120
b) F		24.896	15.678	2.897	24.128
c) Sig. F		0.000	0.000	0.006	0.000
d) R^2		0.642	0.5156	0.173	0.635

Notes: ** and * indicates significance at 0.01 and 0.05 probability level respectively; t-value in square brackets [] and un-standardized B coefficient in round brackets () for the constant.

With reference to the overall fit of the models, R^2 suggests that the weighted combination of predictor variables was jointly significant in explaining each of the dependent variables. R^2 test statistic for buffer zone incomes, self employment incomes, agricultural incomes and total incomes were 0.635, 0.173, 0.531 and 0.642, respectively.

Household size, gender and age were statistically significant in influencing income from buffer zone activities. However, the study did not uncover any significant influence of these factors with reference to self employment, agricultural or total income. Education and Livestock Units were significant in influencing income from self employment. Land size was also significant in explaining income from agriculture and total income. Distance to buffer zone, as expected, was also significant in explaining income from buffer zone activities, agriculture and total income. The study did not uncover any significant influence of extension on any of the income sources.

The results suggest that a one standard deviation positive change in household size, holding other predictor variables constant, may yield a decrease of 0.132 standard deviations for buffer zone incomes. The implied message seems to be that, for every increase in participation in buffer zone activities by larger households, incomes from buffer zone activities may decline. These results contradict earlier studies which suggest a positive association, with forest dependence viewed as a labour and time allocation activity (Shively, 2004; Kabubo-Mariara, 2008).

The results obtained from the study area suggest that the available buffer zone resources which are capable of generating income may be scarce and limited to such an extent that the actual income benefits from buffer zone activities may be too low to attract the assumed labour benefits of larger households in gathering common pool resources. Effectively, larger household sizes may be better-off trading their labour elsewhere where incomes are more definite.

With reference to gender, the results suggest that a one standard deviation change in favour of male-headed households holding other predictor variables constant may result in an increase of 0.135 standard deviations for buffer zone incomes. These findings seem to suggest that for

every increase in participation in buffer zone activities, by male-headed households, incomes from buffer zones may increase. However, previous comparable studies seem to suggest otherwise, based on the generic understanding that women may participate more in common property resources than men (Narain *et al*. 2005).

From the study area, reported major buffer zone activities were labour intensive, highly risky from predation (collection of fire wood and construction timber for resale) and highly prohibited by law, thus making participation in buffer zone activities a more male environment.

For a one standard deviation positive change in age of household head holding other predictor variables constant, the results suggest a decrease in income from buffer zones by 0.138 standard deviations. These results imply a negative association between age and income from buffer zones. Vedeld *et al*. (2004) and Kohlin and Parks (2001) note a similar negative association when they argue that older people may have less time and physical strength to engage in forest activities. In contrast, Kabubo-Mariara (2008) notes a positive association suggesting that young households may be more willing to venture into cropping than forest gathering.

As expected, a one standard deviation positive change in the level of education, holding other predictor variables constant was found to increase income from self employment by 0.195 standard deviations. The results suggest a positive association between income from self employment and level of education. Similar results were also shared by Sanchez (2005) who argues that basic literacy may be important for carrying out activities which range from production to services and manufacturing.

Plot size was positively correlated to income from agriculture and total income. The results suggest that a one standard deviation positive change in the plot size, holding other predictor

variables constant, may increase income from agriculture and total income by 0.166 and 0.144 standard deviations, respectively. Comparable results were also inferred by Kabubo-Mariara (2008). These findings suggest that a larger plot size may enable households to perform better agronomic practices, like crop diversity and rotations which are capable of boosting agricultural incomes. The observed positive correlation may mean potential of multiple cropping and crop rotations capable of hedging against crop failure and price fluctuation risks.

With reference to Livestock Units and income from self employment, a negative association was confirmed. The results suggest that a one standard deviation positive change in Livestock Units, holding other predictor variables constant, may decrease incomes from self employment by 0.241 standard deviations. These results seem to suggest that the more Livestock Units that a household keeps, the less likely it would be prepared to venture into self employment activities. Respondents with large Livestock Units cited better returns from livestock sales but high labour requirements to look after large Livestock Units which normally grazed in the Game Park with a high risk of predation (from elephants and lions). The observed negative association may therefore be due to that fact that households with smaller Livestock Units would be more willing to trade their labour in self employment activities to supplement their incomes.

Distance to the buffer zone was negatively related to buffer zone income, agricultural income and total income. The results suggest that a one standard deviation positive change in distance to buffer zone holding other predictor variables constant may decrease incomes from buffer zone, agriculture and total incomes from all sources by 0.618, 0.777 and 0.888 standard deviations, respectively. In comparable studies, Varughese and Ostrom (2001) and Kabubo-Mariara (2008) also observed a negative relationship between distance to forest and

forest incomes; they suggested that households closer to a forest may have a more secure and accessible supply of forest produce. Risk "push" factors generic to agricultural activities may have forced the DNLA group out of agricultural activities (Sanchez, 2005; Stifel, 2010) in pursuit of "pull" factors common in non-farm activities (Reardon, 1998; Lanjouw and Lanjouw, 2001; Haggblade, 2007), in this case self-employment with a 47% share of total income for this group.

6.9 Conclusions

Firstly, the study wanted to uncover the distribution and contribution of buffer zone incomes to family welfare of different user groups. The results from the study area suggest that, for the IUA and the NLA groups, agricultural income followed by buffer zone income and self employment may be the major income sources, in that order. For the DNLA group, the results suggest that self employment followed by buffer zone and, finally, by agricultural income may be the major sources of income. The study also investigated the level of dependence on buffer zone resources by different user groups. The results suggest a high dependence on buffer zone income by the IUA and the NLA groups, with possibilities of financing household agriculture. For the DNLA group, which was taken as proxy to a typical rural community, the results suggest that buffer zone dependence was low with self-employment as the major livelihood source which negatively affected the development of household agriculture.

Effectively communities residing closer to the buffer zone (IUA and NLA groups) had higher incomes compared to their distanced counterparts (DNLA group). This was possibly due to the positive association noted between buffer zone income and agriculture income for the IUA and NLA groups. The negative association suggested between self-employment income

and agriculture income for the DNLA group may also explain their comparatively lower incomes.

With respect to the contribution of the buffer zone to income distribution, the results suggest that buffer zones may be capable of contributing to more equally distributed incomes for rural communities who share boundaries with Game Parks. Lastly, the study estimated the correlates of household incomes from different main income sources from the study area. The results suggest that household size and age may negatively influence income from buffer zone activities, while gender may have a positive effect. This may also be true for education and livestock units with respect to the income gained from self employment, the former positively and the latter negatively related. The results further suggest that land size may also be positively significant to explain income from agriculture and total income. With reference to distance from the buffer zone, the results suggest a negative influence with respect to income from buffer zone activities, agriculture and total income.

6.10 Study insights and policy issues

The study suggests the following policy issues; Firstly, Game Parks with active buffer zones may be capable of generating significant income sources for rural communities who share boundaries with such Game Parks (primary sub-district producer community). Of interest in this regard, is the positive association suggested by the study between buffer zone incomes and agricultural incomes. This may imply that buffer zone incomes may be capable of funding the development of household agriculture.

Secondly, for households far from Game Parks, which could be taken as a proxy representation to typical rural dwellers, livelihood diversification into off-farm activities like self-employment may be the copping strategy and dominant income source. Unfortunately, a negative association may be possible between self-employment incomes and agricultural

incomes, implying off-farm income diversification may have adverse effects on the development of household agriculture.

Thirdly, incomes from the buffer zone may have a relatively equal distributional effect on total incomes for rural communities (Cavendish, 2003; Fisher, 2004). This may imply that public policies which foster access to incomes from such sources may have the potential to address inequality.

Fourthly, the available buffer zones may have been poorly defined, with high access limitation to surrounding communities. This scenario may negate its potential as a possible livelihood source capable of financing household agriculture. Lastly, the dominance of buffer zone incomes by young and male household heads may suggest that the high risks (poor problem animal control) and inhibitory laws (Communal Lands and Forestry Produce Act – that restrict commercial utilisation of forestry produce) could further negatively affect its potential.

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Chapter Seven

Research Summary, Conclusions and Policy Recommendations

7.0 Introduction

This chapter summarizes and concludes the study. The chapter is organized in such a way that it first presents a careful mapping of the major broad objectives outlined in the first chapter in relation to the major findings inferred from the analytical chapters of various self contained studies. This will lead to the conclusion of the study and policy recommendations. Lastly, the chapter exposes areas of further study towards closing the gap that currently exists in the literature.

7.1 Research Summary

This section summarizes the major findings from the analytical chapters of various self contained studies, in order to make inferences from the major broad hypotheses and the thesis of the study. The first broad objective was to investigate the livelihood adaptation choices of communities who share boundaries with community managed game parks. The null hypothesis to this objective was that game arks can be trusted as livelihood sources for surrounding communities. The major findings, drawn from the analytical chapter, were that game parks may not be trusted as livelihood sources for surrounding communities as a result of their low returns and insecure property rights. Therefore, the major conclusion inferred was that the current status of community managed game parks my fail to address meaningful and sustainable livelihood sources for their surrounding communities.

Secondly, the study focused on assessing the community`s perceptions of elephants and their relative influence towards conservation. The principle hypothesis to this objective was that possible revenue generation and employment are some of the perceptions capable of

influencing conservation. The study discovered that Problem Animal Control (PAC) perceptions and issues of low and poor revenue distribution were some of the critical perceptions shared by surrounding communities. Results further suggest a negative correlation between these perceptions and the conservation of wildlife. Lastly, the findings suggest that using wildlife proceeds to finance observable local common pool infrastructure may influence surrounding communities to conserve wildlife. The chief conclusion, therefore, was that current perceptions shared by surrounding communities with regard to Game Parks showed greater favour towards the obliteration pathway, even though minimal conservation perceptions were also available.

Thirdly, a separate study focused on assessing the potential of the buffer zone livelihood link under community managed game parks. The null hypothesis to this objective was that buffer zones can provide significant livelihoods for the surrounding communities. The major findings and conclusions that were inferred suggest that the buffer zone livelihood link, as currently practiced under community managed game parks, may fail to address the livelihood expectations of surrounding communities due to institutional and design conflict. The study, therefore, concluded that the current buffer zones may require institutional design restructuring to unlock their potential, otherwise their current status will negatively influence their potential.

Fourthly, another study investigated the buffer zone income dynamics of the sub-district producer community under community managed game parks. The principle hypothesis to this objective was that buffer zones can provide significant incomes for surrounding communities. The major findings from the study suggest that the contribution of buffer zone activities to household income may be significant with a positive correlation to the development of household agriculture. Using the Gini decomposition approach and Lorenz curves, the study

further suggests that buffer zone incomes may contribute to more equally distributed incomes for rural communities who share boundaries with Game Parks. The study, therefore, concluded that buffer zone incomes may be significant to the livelihoods of surrounding communities with an income equalising effect which is capable of financing the development of household agriculture and, hence, worth targeting to reduce the high Gini coefficient ratios and poverty generic to rural areas.

7.2 Conclusions

The various studies concludes that the "human-wildlife interaction model", though currently theoretical, may have significant practical potential to address the livelihoods of surrounding communities, as well as promoting the conservation of wildlife. However, a fair share of challenges that range from low revenue, insecure property rights, high human-elephant conflict and institutional design conflict for buffer zone utilization, may negatively affect the practical applicability of the model. The studies, therefore, calls for a policy targeting the identified challenges and perceptions to promote a supportive market environment so as to allow market forces to deliver on the expectations of the "human-wildlife interactions model" – sustainable livelihoods for the former and intergenerational conservation for the latter.

7.3 Policy recommendations

In this section, current environmental policies shall be reviewed in light of research findings with the sole objective of improving the involvement of scientific research in policy formulation. The Zimbabwe Communal Land and Forest Produce Act prohibits the commercial harvesting of forest products. The AA status conferred to CAMPFIRE districts by provisions of the Zimbabwe National Parks and Wildlife Management Act empowers local communities through their RDC to own and utilize all natural resources in their

districts. Communities therefore have a secondary statutory ownership to natural resources. "Utilization", as mentioned in the AA status clause, has so far been commercially applied to game animals, specifically those with high trophy hunting value – elephants, lions and hippos.

The rational, as it were, is based on the fact that the AA status was conferred from one Act that covers mainly game animals – Parks and Wildlife Management Act. Effectively, due to the sectorial nature of the environmental legal framework of Zimbabwe, the plant species covered by other laws (Forest Act and the Communal Lands and Forest Produce Act) are still managed under pure conservation approaches that prohibit commercial harvesting. The latest Zimbabwe Environmental Management Act of 2002, which was expected to harmonise the environmental legal framework, unfortunately remained silent on such issues.

Research findings suggest that revenue from normal ecotourism activities, although necessary, may be insufficient to address the sustainable livelihood requirements of surrounding communities. To complement this gap, research findings further suggest that buffer zone resource extraction by surrounding communities may be more market driven than local household usage. Unfortunately, the trade of such forest products is currently illegal in Zimbabwe, thus dooming the buffer zone livelihood link.

This brief policy review background makes it clear that the current poaching syndrome, invasion of Game Parks by communities and the commercialisation of buffer zone extracts may therefore signals to failure of the "human-wildlife interaction model" to translate into a win-win, practical model. The study, therefore, forwards the following policy recommendations;

- Boosting the revenue potential of game parks, through the promotion of both consumptive and non consumptive ecotourism.

- Further devolution of user rights from Rural District Councils to producer wildlife communities.

- Addressing the current high human-wildlife conflict by using user friendly, sustainable and cost effective approaches.

- Legalising the commercial trade of buffer zone extracts from CAMPFIRE districts, using the quota and branding systems.

- Policy harmonisation (the Zimbabwean Environmental Management Act the ZCLFP Act that inhibits the commercial harvesting of forestry products.
- Institutional support for buffer zone extracts (extension support is missing as well as supportive legal markets). Given the medicinal value of wild foods and the premiums that consumers are willing to pay for organic products, local communities are likely to benefit significantly if markets for buffer zone products are formalised. Timber from *Mopane* species, sustainably harvested, can also present a lucrative business opportunity for surrounding communities. Firewood which is sustainably harvested (dry wood and side brunch pruning firewood harvested by local groups created and certified by the Local CAMPFIRE Committees, to encourage group benefits) can also present a lucrative opportunity for the sub-district producer community.
- Approach (to avoid the scramble for buffer zone products, the group approach together with quota and permit systems, as well as product branding, is recommended)
- For the approach to work communities need to be organised first so that they share the same vision. Misrepresentation observed on participation (registration) and actual buffer zone resource extraction suggest inefficiency of available Local Management Committees and unorganised communities. Need may therefore arise to educate local

communities in group dynamics skills for purposes of organising them so that they share the same vision before introducing such approaches.

7.4 Areas of further study

Potential trade-offs *cum* compatibility of consumptive and non-consumptive ecotourism as a management prototype in southern Africa.

Rationale: Limited studies suggest compatibility of consumptive and non consumptive ecotourism capable of boosting high revenue as supported in theory by the Verhulst model (Barnes, 1996, 1998; Novelli *et al*. 2006). More empirical studies from producer countries are required to support the claimed hypothesis on compatibility and high revenue given the current low revenue from community managed Game Parks.

Potential of biological game fences in southern Africa. [see King (2010)].

Rationale: High human-elephant conflicts exist in most areas with Game Parks. The available PAC measures seem to have failed to separate game animals from invading human properties. This has to a greater extent negatively influenced conservation of wildlife by surrounding communities. Need therefore arises to consider other measures to complement current PAC measures, hence the need to evaluate the potential of biological fences.

7.5 References

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APPENDIX 1: QUESTIONNAIRE

University of Fort Hare
Together in Excellence

FACULTY OF Science and Agriculture

DEPARTMENT OF Agricultural Economics and Extension

QUESTIONNAIRE

This research study is instituted by the University of Fort Hare under the auspices of the department of Agricultural Economics and Extension. I am a Doctor of Philosophy (Ph.D) student at the University of Fort Hare conducting a study on "adaptation choices, community perceptions, livelihood linkages and income dynamics for district producer communities surrounding Nyatana Game Park in Zimbabwe"**.** You are kindly requested to answer the questions that follow. This study will be treated with high levels of confidentiality and will safeguard your anonymity. Feel free to contact the below mentioned if you have any concerns or questions.

Kind Regards

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Annexure 1: Household Questionnaire

A **Identification**

	District	Ward	Province
			(1) ME ☐ (2) MC ☐

Location of Respondent: UMP ☐ Mudzi ☐ Rushinga ☐

Proceed from A to D and make sure all sections are completed: Indicate with [x]

B Household Characteristics

	Wealth status	Household Head Age	Household Head Gender	Household Head Education	Land Size	Access to markets	Access to extension
	1	2	3	4	5	6	7
Household Characteristics	Based on the reported 6 assets from B* 0: < 3 (Poor) 1: ≥ 3 (rich)	Indicate age of household head	Is household head male or female? 0: Female 1: Male	Indicate level of education of the household head 0: Uneducated 1: Primary level 2: Secondary level and above	Estimate size of farming area 1: ≤ 2ha 2: > 2ha	Does market exist for natural resources 0: No 1: Yes	Do respondents have access to extension services 0: No 1: Yes
	A	B	C	D	E	F	G
	0 1	--------- Years	0 1	0 1 2	1 2	0 1	0 1

C Livelihood Choices

Mixed Farming	Mineral Portfolio	Flora Portfolio	Fauna Portfolio
0	1	2	3
H	I	J	K
0	1	2	3

Select Main Livelihood Source

D Use D to solicit for constraints to adaptation: Indicate with [X]

8	9	10	11	12	13	14	15	16	17	18	19
No constraints	Restrictive Policies	Lack of knowledge	Lack of credit	Lack of market	Low returns	Limited extraction area	High Risk	Insecure property rights	Lack of extension	Poor Infrastructure	Other
L	M	N	O	P	Q	R	S	T	U	V	W

B* **Households strategic assets:** (a) Land holding, (b) total Livestock Units, (c) farm capital inputs, (d) household assets, (e) quality of dwelling and (f) household-head`s education

For chapter three: Livelihood adaptation choices, constraints and correlates of adaptation choices for households who share boundaries with Game Parks

Annexure 2: Household Questionnaire

A

Identification		District	Ward	Province
				(1) ME ☐ (2) MC ☐

Location of Respondent: UMP ☐ Mudzi ☐ Rushinga ☐

For "C" ask respondents to weigh the costs and benefits their households would assign to the current elephant populations in Nyatana.

Use last raw to assess ratting of each perception as reported by respondents: Mark with [X] if perception is deemed important

B

Household Perceptions of Nyatana Elephants

"Refer to attachment on page 2 (code cracker) for meaning of codes for $B_1 - _7$ & $D_8 - _{15}$"

C

Elephant Conservation Choices

Household Perceptions	EDCP	AEIPL	AETIDH	AECSIFWA	AERLTHSFGC	ETLUG	AERLC	WTP > 0	WTP = 0	WTP < 0
	1	2	3	4	5	6	7			
	0: No 1: Yes	0: No 1: Yes	0: No 1: Yes	0: No 1: Yes	0: No 1: Yes	0: No 1: Yes	0: No 1: Yes	If benefits exceed costs 1	If benefits equal to costs 0	If benefits are lower than costs 2
	A	B	C	D	E	F	G	H	I	J
	0 1	0 1	0 1	0 1	0 1	0 1	0 1	1	0	2

D

ERGAL	EFWDDS	EBRCFIA	EPRRSC	EKSOITL	REBLI	ENCR	EPMLHTH
8	9	10	11	12	13	14	15
0: No 1: Yes	0: No 1: Yes	0: No 1: Yes	0: No 1: Yes	0: No 1: Yes	0: No 1: Yes	0: No 1: Yes	0: No 1: Yes
K	L	M	N	O	P	Q	R
0 1	0 1	0 1	0 1	0 1	0 1	0 1	0 1

For chapter four: Society`s perception of African elephants and their relative influence towards conservation of elephants

Variable name	Variable description
EDCP	Elephants damage crops and are as good as pests (EDCP)
AEIPL	Availability of elephants cause injury and predation to livestock (AEIPL)
AETIDH	Availability of elephants induce threat, injury and death to humans (AETIDH)
AECSIFWA	Availability of elephants causes social instability due to fear of wild animals (AECSIFWA)
AERLTHSFGC	Availability of elephants reduces leisure time, for households are forced to sleep in fields to guard crops (AERLTHSFGC)
ETLUG	Elephants take up land for the upcoming generation: children (ETLUG)
AERLC	Availability of elephants reduce land for cultivation (AERLC)
ERGAL	Elephants reduce grazing area for livestock: no buffer zone for livestock (ERGAL)
EFWDDS	Elephants finish open water sources during the dry season (EFWDDS)
EBRCFIA	Elephants bring revenue to complement farm incomes hence they are as good as assets (EBRCFIA)
EPRRSC	Elephants provide revenue, but all the revenue is taken by Safari Operators and Councils (EPRRSC)
EKSOITL	Elephants are ok, but Safari Operators ill-treat locals: chase locals out of the Park with guns (EKSOITL)
REBLI	Revenue from elephants help to built local infrastructure: roads, clinics, schools, dip tanks etc (REBLI)
ENCR	Elephants are necessary for our cultural rituals (ENCR)
EPMLHTH	Elephants provide meat for locals during hunts by trophy hunters (EPMLHTH)

Annexure 3: Household Questionnaire

A Identification

	District	Ward	Province	Location of Respondent
			(1) ME (2) MC	UMP Mudzi Rushinga

Proceed from A to D and make sure all sections are completed: Indicate with [x]

B Household Characteristics

Household Characteristics	Wealth status	Household Head Age	Household Head Gender	Household Head Education	Land Size	Access to markets	Access to extension
	1	2	3	4	5	6	7
	Based on the reported 6 assets from B* < 3: 0 (Poor) ≥3: 1 (rich)	Indicate age of household head	Is household head male or female? 0: Female 1: Male	Indicate level of education of the household head 0: Uneducated 1: Primary level 2: Secondary level 3: Tertiary level	Estimate size of farming area 0: < 0.5ha 1: 0.5 – 1ha 2: > 1ha	Does market exist for natural resources 0: No 1: Yes	Do respondents have access to extension services 0: No 1: Yes
	A	B	C	D	E	F	G
	0 1	--------- Years	0 1	0 1 2 3	1 2	0 1	0 1

C Registration Status

Group	Registered	Not Registered
	Indicate with [X]	
A: < 1km from BZ		
B :1 – 2.5km from BZ		
C: 2.5 – 3 km from BZ		
D: > 3km from BZ		
H	I	J

D

	Distance	Wetland Gardens		Buffer Zone Extraction Combinations (Only for primary sub-district producer community: A: < 1km and B: 1-2km from BZ): Indicate with [X]						
				Construction Only	Fire wood Only	Wild Foods Only	Firewood and Construction	Wild Foods and Construction	Wild Foods and Firewood	All Extractions
	8	9		M	N	O	P	Q	R	S
A	Location of respondent with respect to buffer zone 0: < 1km 1: 1 – 3km 2: 3km	Access to wetland garden by respondent 0: No 1: Yes	A							
B			B							
	K	L								
	0 1 2	0 1								

B* **Households strategic assets:** (a) Land holding, (b) total Livestock Units, (c) farm capital inputs, (d) household assets, (e) quality of dwelling and (f) household-head`s education

For chapter five: Modelling the buffer zone livelihood link under community managed Game Parks: Evidence from Nyatana Game Park, Zimbabwe

Annexure 4: Household Questionnaire

A

Identification		District	Ward	Province	Location of Respondent
				(1) ME ☐ (2) MC ☐	UMP ☐ Mudzi ☐ Rushinga ☐

Proceed from A to D and make sure all sections are completed: Indicate with [x]

B — **Household Characteristics**

Household Characteristics	Distance	Household Head Age	Household Head Gender	Household Head Education	Land Size	Livestock Units	Access to extension
	1	**2**	**3**	**4**	**5**	**6**	**7**
	Location of respondent with respect to BZ IUA: 1 NLA: 2 DNLA: 3	Indicate age of household head	Is household head male or female? 0: Female 1: Male	Indicate level of education of the household head 0: Uneducated 1: Primary level 2: Secondary level 3: Tertiary level	Estimate size of farming area 1: < .05ha 2: 0.5 – 2ha 3: > 2.5ha	Number of LU owned 1: < 2 LUs 2: 2 – 3 LUs 3: > 3 LUs	Do respondents have access to extension services 0: No 1: Yes
	A	**B**	**C**	**D**	**E**	**F**	**G**
	1 2 3	--------- Years	0 1	0 1 2 3	1 2 3	1 2 3	0 1

C — **Income Sources**

Select Main Income Source		
Agriculture	**Buffer Zone**	**Self f Employment**
If main income is defined by agricultural activities 0	If main Income is defined by buffer zone activities 1	If main income is defined by self employment activities 2
H	**I**	**J**
0	1	2

D

Use $D_{8L} - _{11O}$ to solicit for more information with regards to total average annual income from each source for the previous season:

8	9	10	11
Buffer Zone Annual Income	Agriculture Annual Income	Self Employment Annual Income	Total Annual Income
L	**M**	**N**	**O**
US$.....	US$.....	US$.....	US$.....

Identification Codes for B1

IUA: - Illegal Unlimited Access Group (Inside the Park)

NLA: - Normal Limited Access Group (<3km)

DNLA: - Distanced Normal Limited Access Group (>3km)

For chapter six: Buffer zone income dynamics for the sub-district producer community: Implications for rural off-farm income, income inequality and development of household agriculture