This is to certify that the
thesis entitled

WILDLIFE CONSERVATION IN ZAMBIA
IMPACT OF GAME MANAGEMENT AREAS ON
HOUSEHOLD WELFARE

presented by

Ana Fernández

has been accepted towards fulfillment
of the requirements for the

M.S. degree in Agricultural Economics

Major Professor's Signature

March 30, 2010

Date

MSU is an Affirmative Action/Equal Opportunity Employer

WILDLIFE CONSERVATION IN ZAMBIA
IMPACT OF GAME MANAGEMENT AREAS ON HOUSEHOLD WELFARE

By

Ana Fernández

A THESIS

Submitted to
Michigan State University
In partial fulfillment of the requirements
For the degree of

MASTER OF SCIENCE

Agricultural Economics

2010

ABSTRACT

WILDLIFE CONSERVATION IN ZAMBIA
IMPACT OF GAME MANAGEMENT AREAS ON HOUSEHOLD WELFARE

By

Ana Fernández

This research investigates the impact of wildlife conservation policies on the welfare of communities living in Zambian Game Management Areas (GMAs). The study first uses simple OLS to measure the overall effect that living in a GMA has on household welfare. Findings indicate that households living in prime GMAs enjoy 17% higher incomes than those living in non-GMA areas and that these benefits are captured by the wealthier segments of the community. Secondly, a two-step procedure (the Cragg double hurdle model) is used to explore the avenues through which this GMA effect is generated by quantifying the impact that living in a GMA has on self employment, wage employment, farm- and nonfarm incomes and crop damage. Households in prime (well stocked) GMAs are found to be more likely to participate in off-farm wage and self-employment compared to households living in non-GMAs. With respect to crop damage, results clearly show that households living in prime GMAs are more likely to suffer crop loss due to wildlife, an unresolved conflict that needs further exploration.

To my parents, for everything

AKNOWLEDGEMENTS

There are a significant number of institutions and people that have made this thesis possible. Firstly, I would like to thank the Agriculture Food and Research Economics Department (AFRE) for giving me the opportunity to participate in the masters program. I would like to acknowledge the World Bank (WB) and the Zambia Wildlife Authority (ZAWA) for sharing the Impact of Game Management Areas on Household Welfare survey (IGMAW) for use in this thesis. I am also grateful to USAID for their financial support and interest in this study.

I would like to give special thanks to my thesis guidance committee, Dr. David Tschirley, Dr. Robert B. Richardson and Dr. Steve Haggblade for their continuous encouragement, advice and patience during the conceptualizing and writing process. I have greatly enjoyed working with them and highly benefited from their knowledge. I am also indebted to Dr. Songqing Jin and Bill Burke for their assistance with the econometric section of the study.

From the Zambian side, I am extremely grateful to Dr. Gelson Tembo, from the University of Zambia (UNZA), whose previous work on Game Management Areas (GMAs) and local welfare has been a fundamental reference for this thesis. I am also grateful to Betty Misimuko, from ZAWA for sharing her vast knowledge and experience on Community Based Natural Resource Management and for facilitating arrangements to meet with various informants in Chiawa and Lupande GMAs.

Finally, I would like to thank my MSU colleagues and friends who have been extremely helpful, especially Nicky Mason and Joleen Hadrich who are always willing to help new students.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

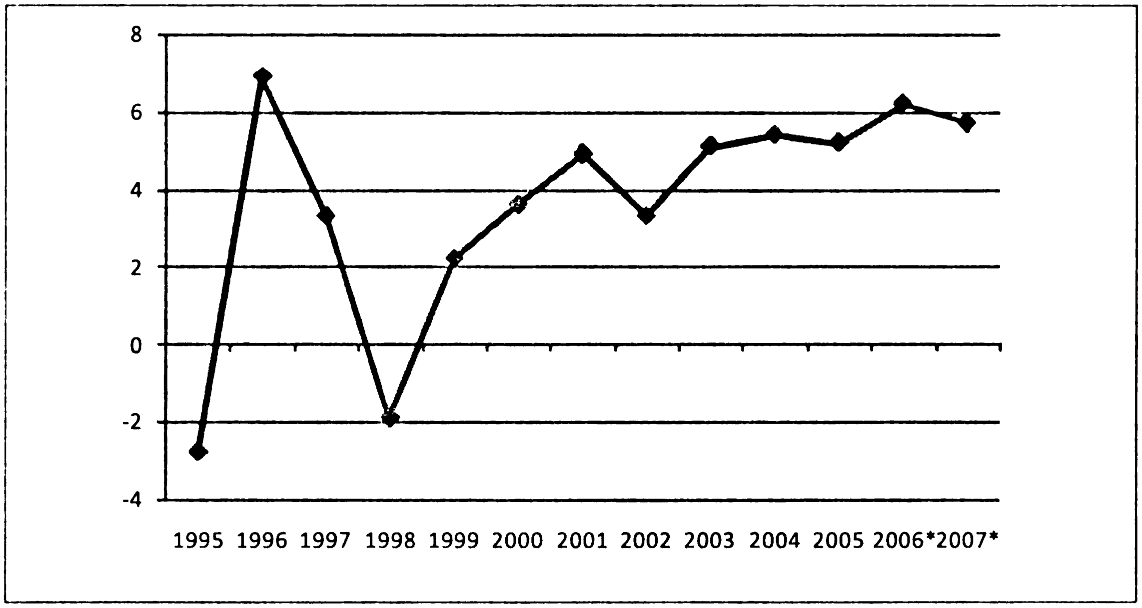
Most rural households in Zambia are poor. The majority of these households rely on subsistence agriculture as their main livelihood, which is typically insufficient to ensure food security. Although most households seek income diversification opportunities as part of their strategy for risk management and income generation, these are often out of reach for the poorer households, due to capital or labor constraints as well as a general lack of off-farm employment opportunities. Providing access to off-farm employment in rural areas is one of the Zambian Government's key objectives for the 2006-2010 period. One of the identified sectors for pro-poor growth is the tourism industry, a growing sector in the country though still underdeveloped. It is the vision of the Government that the development of the tourism industry can boost rural economies, especially in the areas surrounding national parks where most of the tourist investments are currently concentrated.

1.1 Economic Growth and Poverty

During the first decade of independence (1964-1974) Zambia was one of the wealthiest countries in sub-Saharan Africa. Prosperity was mainly a result of the successful mining industry which benefited from high international prices. The oil crisis in 1973-74 coupled with the fall in world copper prices began an extended period of decline in real income. High oil and energy prices triggered global inflation which made imported capital and manufactured goods very expensive. The balance of payments deteriorated and the country became heavily dependent on foreign borrowing to minimize the decline in living standards (Government of the Republic of Zambia, 2002).

Since the late 1990s, however, the economy has experienced a steady recovery (Figure 1). After a steep decline of the economy from 1996 to 1998, partly due to the East Asian financial crisis (which lowered the demand for copper) and donors' withdrawal of support to the balance of payments, GDP began a positive growth trend. Favorable global economic conditions, the impact of the economic reforms that started in the early 1990s, rapid expansion of the mining industry boosted by an increase in international prices, and growth of the construction sector through private investments have been some of the key drivers (Government of the Republic of Zambia, 2006).

Figure 1. Percentage GDP growth in Zambia (1995-2007)

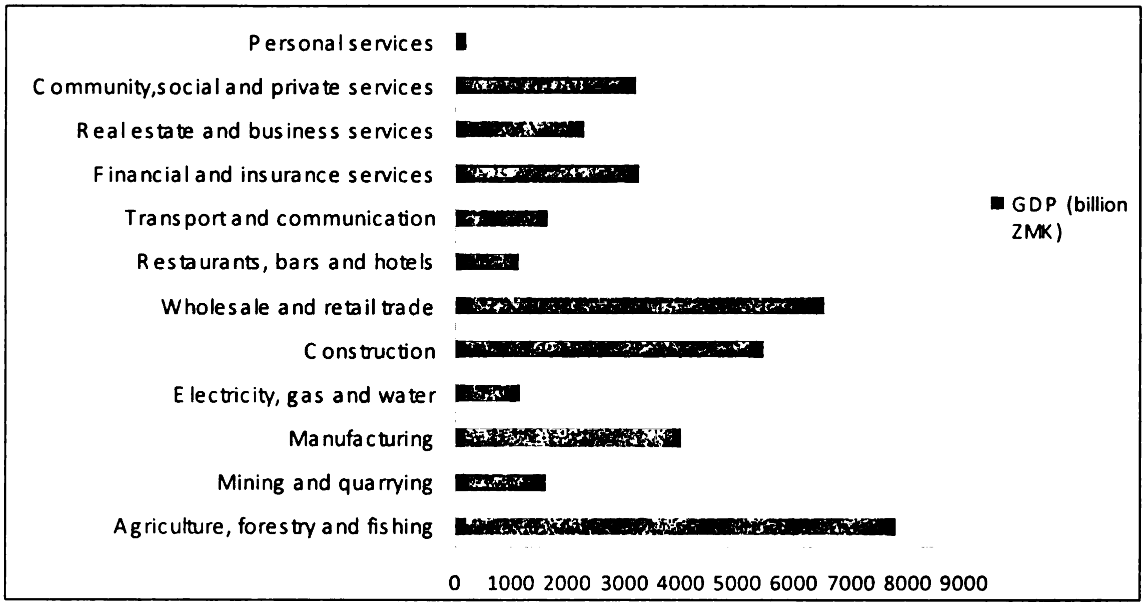


Source: Elaborated with data from the Central Statistics Office of Zambia (2008). Data for years 2006* and 2007* are estimates.

However, despite the rapid acceleration of the economy Zambia still suffers from persistent income poverty. The economic benefits have not translated into a significant reduction of rural poverty, which still ranks among the highest in sub-Saharan Africa.

According to the 2006 Living Conditions Monitoring Survey (LCMS), 80% of the population in rural Zambia is poor and 67% is extremely poor. Farmers remain highly vulnerable to erratic weather patterns and generally lack access to markets, credit, fertilizer and other inputs. These conditions translate into very low productivity, a phenomenon that has resulted in chronic food insecurity and high prevalence of malnutrition among children and adults (Government of the Republic of Zambia, 2002). Mining, wholesale and retail trade and construction, the pillars of economic growth (Figure 2), are urban-based and capital-intensive, and generate little additional employment due to weak linkages with the rest of the economy (Government of the Republic of Zambia, 2006); relatively little investment has taken place in sectors that generate rural employment and income diversification.

Figure 2. GDP distribution by economic sector (in billion Kwacha)



Source: Elaborated with data from the Central Statistics Office (CSO) of Zambia using estimates for 2006.

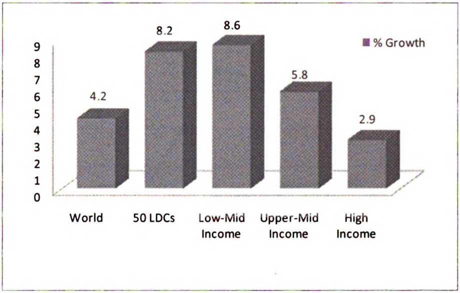
Still, notwithstanding the high incidence of rural poverty, total rural poverty rates have shown a slight decline over the last decade, diminishing from 92% to 80% from 1993 to 2006. In rural areas, the decline in poverty levels can be partly explained by the increased supply of food crops such as cassava, sweet potatoes and groundnuts, as well as export commodities like cotton and tobacco, which have helped boost rural incomes (Fynn and Haggblade, 2006; Jayne et al, 2007; Tschirley and Kabwe, 2007). In urban areas, Jayne et al (2007) explain the increasing poverty as a consequence of the declining mining industry after the fall in copper prices during 1998-2001, and the elimination of consumer food subsidies in the early 1990s.

Acknowledging the need to focus on economic activities that generate broad-based wealth and job creation, the Government of Zambia plans to promote sectors thought to be pro-poor and labor intensive. Since poverty is more acute in rural Zambia, agriculture is one of the main areas of attention for national development. The Government seeks to transform the country's economic structure by promoting large-scale commercial farms, more modern technologies and upstream linkages (agro processing) that can boost rural incomes and translate into higher demand for locally manufactured goods. Apart from agriculture, the Government envisions the expansion of a diversified export base and a stronger tourism sector as engines of pro-poor growth.

1.2 The Importance of the Tourism Sector

Tourism is one of the fastest growing economic sectors in the world. Global tourism revenues grew 11.2% per year between 1950 and 2005 (WTO 2008). International tourism arrivals grew at an average annual rate of 6.5%, increasing from 25 million to 806 million visitors. The sector has become one of the major businesses in international commerce, and represents one of the main income sources for many developing countries. The increasing importance of the sector in developing countries is reflected by the growth of tourism in low-mid and least developed countries (LDCs) compared to growth worldwide and in higher income countries (Figure 3).

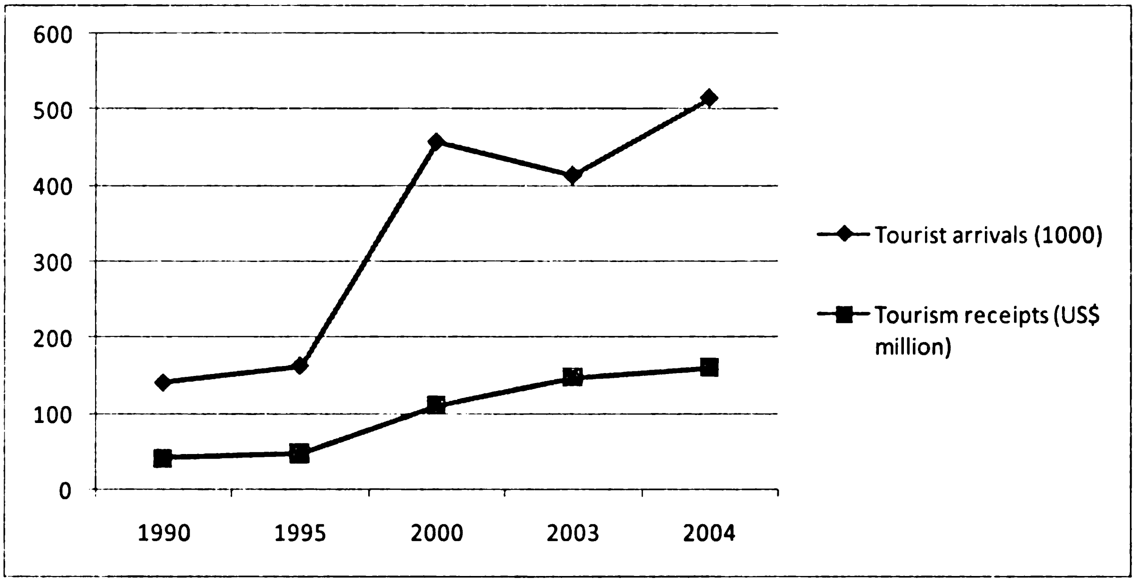
Figure 3. Average annual worldwide tourism growth by income classification (1990-2005)



Source: World Tourism Organization

In Zambia, the tourism sector has been steadily growing over the past years in terms of arrivals and tourism receipts (Figure 4), ranking 15th out of 73 countries in the list of emerging tourism destinations during 1995-2004.

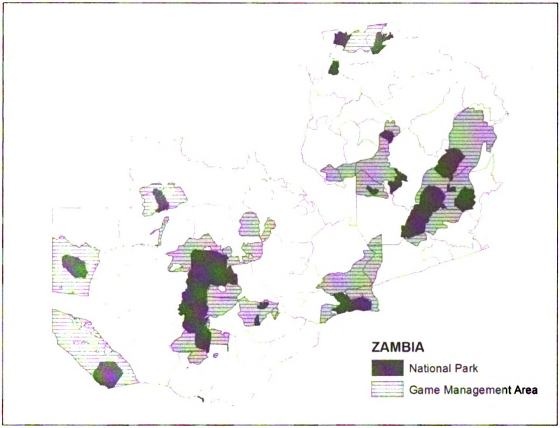
Figure 4. International tourism receipts and arrivals in Zambia, 1990-2004 (US$ million)



Source: Elaborated with data from the World Tourism Organization

The industry relies on the country's impressive natural resources; there are 19 national parks and 35 Game Management Areas (GMA) in the country, representing 30% of the total territory. Figure 5 shows the current network of protected areas in the country which are classified as national parks and GMAs. National parks are intended for the protection and enhancement of wildlife, ecosystems and biodiversity. No human settlements are permitted and only photographic safaris, also known as non-consumptive wildlife use, are allowed. GMAs act as buffer zones between the national parks and farming areas. They are intended to promote sustainable harvest of wildlife through hunting as an alternative to other economic activities not compatible with wildlife protection. GMAs also offer wildlife viewing but allow human settlements and licensed hunting (consumptive wildlife use).

Figure 5. Zambian National Parks and Game Management Areas



Approximately 88% of international visitors that arrive in Zambia are nature tourists who primarily seek scenery, wildlife viewing and adventure activities such as rafting and canoeing. The country offers excellent wildlife viewing in an uncrowded landscape, cultural and adventure opportunities, and the unique Victoria Falls, the largest waterfall in the world and top tourist attraction in Zambia, situated at the border with Zimbabwe in Southern Province. The next most popular attraction is South Luangwa national park, situated in Eastern Province and internationally renowned for its wildlife population and scenery. Other popular national parks are Mosi-Oa-Tunya (conveniently close to Victoria Falls), Kafue and Lower Zambezi (Table 1).

Table 1. Zambian national parks and numbers of visitors (2003-2005)

National Parks	2003	2004	2005
Lower Zambezi	4413	6059	6040
Mosi-oa-Tunya	23497	17762	19972
South Luangwa	19728	23929	25814
Kafue	3812	3789	6202
Lochnivar	390	415	784
Other Parks *	700	2024	2588
Total	52540	53978	61400

* (North Luangwa, Liuwa, Kasanka, Luambe, West Lunga, Sioma Ngwezi, Sumbu, Chete Island)
Source: Hamilton et al. (2007) from ZAWA Commercial section, 2007

The full potential of the tourism industry in Zambia is still emerging (Hamilton et al., 2007). The sector is strongly oriented toward nature tourism and is characterized by small-scale investments; at least 250 nature-tourism accommodation providers are licensed countrywide. The major tourism hubs have developed around a few key urban and national park locations, especially around Livingstone where tourists can visit the Victoria Falls and the nearby Mosi-Oa-Tunya Park (Hamilton et al., 2007). Overall, tourists spend an average of 6.3 days in the country, which is low compared to its neighbors Bostwana (8.6 days) and Namibia (12.4 days). One of the major constraints for tourists willing to visit different parts of the country is the lack of adequate infrastructure (roads, airports) that can easily facilitate travel between Livingstone in Southern Province and the other parks or sites of interest in the country.

Other factors contributing to the limited development of the sector are the extreme seasonality of Zambia's holiday tourism, which in some areas is limited to five or six months in the year due to the poor or non-existent all weather road network that restricts transport during the rainy season (Adrian Coley, pers. comm.). Growth in the sector is further restricted by limited capital, the lack of properly trained personnel, poorly developed marketing at the national level and limited policy, legislation and planning for the sector (Hamilton et al., 2007).

1.3 Tourism Sector and Poverty Reduction

Since the 1980s, the concept of ecotourism and nature based tourism has emerged in Latin America, Africa and Asia as a strategy to conserve biodiversity and reduce poverty (Honey, 1999). The philosophy is to find models of tourism that minimize impact on natural resources while generating income for local communities. A more recent concept is the definition of pro-poor tourism (PPT). This term was first coined by the British Department for International Development (DFID) in 1999 and has since received support from other institutions like the World Tourism Organization. According to the definition provided by the PPT Partnership, "PPT enhances the linkages between tourism businesses and poor people, so that tourism's contribution to poverty reduction is increased and poor people are able to participate more effectively in product development" (Ashley, 2004:1).

The Government of Zambia has included tourism as one of the key sectors to combat poverty, giving it a prominent place in its strategy for economic growth and poverty reduction. The Government envisions the country as a "major tourism destination of choice with unique features, which contributes to sustainable economic growth and poverty reduction by 2030" (Government of the Republic of Zambia, 2006:125). The Government plans to strengthen the sector by tackling some of the shortcomings mentioned earlier such as investing in infrastructure and tourism facilities, diversifying tourism products beyond its current heavy focus on wildlife, enhancing human resources through training, restocking of species with declining populations, and encouraging the participation of communities as business partners.

Community participation in tourism development is one of the major avenues for promoting pro-poor tourism. During the last two decades, the Government of Zambia has been implementing co-management agreements for wildlife use (consumptive and non-consumptive) with communities in GMAs. The Zambia Wildlife Authority[1] (ZAWA), the quasi governmental agency in charge of wildlife protection and management, promotes the organization of communities in Community Resource Boards (CRB) to become partners in wildlife protection and in the sharing of benefits from trophy hunting and photographic safaris. This approach, known as Community Based Natural Resource Management (CBNRM), has the dual goal of improving the welfare of local communities and creating incentives for the protection and conservation of natural resources.

1.4 Problem Statement

The co-management of wildlife resources presents opportunities and threats for communities living in GMAs. Through the CBNRM program, communities receive a share of the revenues generated from trophy hunting and concession fees paid by hunting outfitters. The development of the tourism industry also offers opportunities for wage employment and creation of small businesses, in addition to the benefits from increased

[1] In 1999, the Government of Zambia transformed the former Department of National Parks and Wildlife Service (NPWS) into an autonomous body, the Zambia Wildlife Authority (ZAWA). ZAWA is governed by the Zambia Wildlife Act of 1998 and has its own Board of Directors. The Board is responsible for managing ZAWA under the policy guidance of the Ministry of Tourism, Environment and Natural Resources.

access to infrastructure and services created to cater for tourists. However, the realization of these opportunities depends on various factors, such as the ability of the tourism industry to create employment and revenues through hunting licenses, the appropriate planning of land use and human settlements, the transparency with which the main actors (ZAWA, area chiefs, community representatives) manage the program, the degree of devolution of decision making to communities, and the community's commitment to protect wildlife. The effectiveness of the program is also threatened by potential unintended negative effects, namely greater crop destruction as wildlife populations increase, and the pressure that in-migration puts on land other natural resources.

The livelihoods of communities located near national parks are similar to other rural Zambian communities, though they face additional hardships. Farmers are routinely affected by crop destruction, especially by elephants which are the most destructive species. The Tsetse fly, carried by large mammals, affects the health of livestock and traction animals, limiting their productivity. Bandyopadhay and Tembo (2009) found that the average annual per capita consumption in areas surrounding national parks is between ZMK 839,000 and 850,000, approximately 30% lower than the average for a rural community, estimated at ZMK 1.2 million (Simasiku et al., 2008)[2].

In some cases, poaching is a coping strategy for poor households who turn to it for a source of cash and meat that would be inaccessible otherwise. Illegal use of wildlife persists where there are limited income alternatives and communities perceive no

---

[2] This calculation is based on the results in Bandyopadhay and Tembo (2009) who studied the welfare of communities living in areas adjacent to National Parks. The results where compared to the Living Conditions Monitoring Survey results (2006) for rural annual per capita consumption.

incentives for wildlife protection. To reduce poaching that had started to threaten wildlife species, international development agencies including the United Nations (UN), the United States Agency for International Development (USAID) and the Department for International Development (DFID), in the 1980s began advocating for increased community participation in wildlife management decisions and increased community sharing in benefits from wildlife use. In response, the Zambian Government introduced CBNRM programs in GMAs.

CBNRM programs aim at increasing household welfare and conserving natural resources. The idea is to provide communities with an incentive in the form of revenues from trophy hunting licenses that outweigh the benefits they would get from illegal hunting. The program makes two assumptions: a) that community participation in wildlife management is a more effective way of conserving wildlife than a centralized regulatory approach, and b) that sustainable wildlife utilization is a profitable land use option for local communities as opposed to farming or grazing for example.

In CBNRM programs, communities assume certain rights and responsibilities. They agree to protect wildlife resources by preventing residents from engaging in all forms of illegal use of wildlife and to engage in only the land use activities agreed upon with ZAWA. This ensures that commercial activities dependent on wildlife are not threatened. In exchange, communities benefit from the wildlife resources found on community land and from participation in the decisions regarding resource use[3].

---

[3] The first decentralization policy for co-management of natural resources was named The Administrative Management Design for Game Management Areas (ADMADE). ADMADE drafted a constitution to set

There are clear potential benefits for communities that participate in CBNRM programs. They are empowered to negotiate agreements with safari and tour operators to engage in commercial activities and share in the revenues generated from concession fees and hunting licenses. A percentage of the funds that communities receive are used to hire local scouts to patrol the areas, which provides income for some households. Another portion of the funds is used in community projects such as schools and clinics. Communities can also benefit from the creation of employment by the tourism industry and (though barriers are likely higher here) business opportunities to provide services to the sector. Communities near popular tourist attractions benefit from an increase in the amount and quality of infrastructure and services provided such as electricity, roads, and communications. These opportunities for income diversification in the non-farm sector can have a strong positive effect on household welfare (Barrett et al., 2001; De Janvry and Sadoulet, 2001; Reardon, 1997). However, there could be unintended negative effects emerging from the CBNRM programs. New job opportunities and an improvement in social services derived from the CBNRM programs could lead to high in-migration, putting pressure on resources such as firewood and land that could eventually dilute the intended positive effects (Ahmed et al., 2001).

Communities may also incur the opportunity cost of not engaging in alternative land uses such as farming or grazing. Despite the usually low land productivity in GMAs, the conditions under which access to open areas for grazing or gathering of forest products generates more benefits for community members than a tourist lodge or a safari hunting

---

the general guidelines for the establishment of agreements between the Zambia Wildlife Authority (ZAWA) and the community. The rights and responsibilities cited are extracted from the draft constitution.

operator needs to be explored empirically. The balance between these effects will ultimately depend on the potential of tourism to generate employment and hunting revenues to make an impact on local welfare. Land is administered through customary law by the area chiefs, who decide to whom they want to lease or allocate land and for what purposes. An approach that takes into consideration the interests of the communities will be needed to ensure that they actually attain benefits from the CBNRM programs.

As mentioned earlier, the human-animal conflict is another threat to the welfare and livelihoods of communities, with elephants being a special problem. Villages in close proximity to high elephant populations are regularly threatened by crop destruction. The implementation of CBNRM programs could have an ambiguous effect on the problem. On one hand, the increased efforts to prevent poaching are likely to have a positive effect on elephant populations, which can add to the number of conflicts. On the other hand, larger populations of elephants can attract more tourists, and generate more revenues for the communities. Elephant hunting was resumed in Zambia in 2004 after the country gained approval from the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) to export 20 trophies per year. Hunting is restricted to two regions, the Luangwa Valley and the Lower Zambezi Valley, and only a few GMAs within those areas have elephant quotas. There is an ongoing controversy over the legalization of elephant hunting. Some argue that carefully controlled hunting can help communities with crop destruction and provide them with revenues from trophy fees. Others argue that CITES's ban on ivory trade helped recover elephant population and that a change in policy would drive numbers down again (Ahmed et al., 2001).

1.5 Objectives of the Study

For the consideration of Government's policies to promote tourism as a pro-poor tool to combat poverty, it is crucial to understand whether CBNRM programs have the potential to improve local welfare. Given the alternative uses of land and the negative effects that CBNRM programs could have in terms of in-migration and resulting pressure on land and forest resources, as well as on crop destruction, there is a need to understand whether the program is an effective strategy to enhance community welfare.

To assess the effectiveness of GMA policies, this study presents three analyses. It first tests econometrically whether households living in GMAs have higher incomes than those living in non-GMAs. It then endeavours to understand the channels through which GMA policies affect household welfare (positively or negatively), using two-step econometric techniques to identify the impact of living in a GMA on i) wage income, ii) self-employment income, and iii) the value of crop loss from animal damage.
This study complements Bandyopadhay and Tembo (2009) based on the data collected through the Impact of Game Management Areas on Household Welfare (IGMAW) survey. Bandyopadhyay and Tembo analyze the impact of GMA policies on household welfare, as measured by household expenditure. They examine the factors that influence household participation in natural resource management[4] and whether participating households benefit more than non-participants. They also examine the distribution of the impact among the poor and non-poor segments of the community. Their main findings indicate a strong association between living in a GMA and higher levels of consumption

---

[4] The participation of a household in resource management refers to the participation in Community Resource Boards or Village Action Groups, the two organizations that represent community interests in wildlife management decisions.

expenditure, and that the benefits are more likely to be attained by the non-poor segment of the communities and by those participating in resource management.

This study contributes to the literature by: i) providing a cross-check of the findings on GMA impact on household welfare using a different indicator, income, for household welfare and ii) complementing the findings by examining the impact of GMAs on different sources of income (wage and self-employment earnings, income from crop harvest, and income losses from crop damage).

1.6 Organization of the Study

The study is organized into six chapters. Chapter two gives an overview of the creation of protected areas, the evolution of management policies from the colonial times until present, the origin and evolution of CBNRM programs in Zambia and the effectiveness of the programs illustrated with various examples from the existing literature. Chapter three provides a description of the survey data, sampling strategy, and the areas of study used for the analysis. Chapter four analyzes the impact of GMA policies and regulations on household income and selected components thereof. Chapter five discusses the results and implications for wildlife management policy. Finally, Chapter six outlines potential topics for further research.

2. GAME MANAGEMENT AREAS

This chapter describes the history, characteristics and policies of GMAs which are the focus of this study. It gives an overview of the evolution of wildlife management policies in Zambia and the decentralization process towards a co-management approach that has taken place in recent years. It reviews the performance of CBNRM projects and discusses the achievements and shortcomings of the wildlife management system.

2.1 History and Decentralization of Resource Management

The traditional land tenure system in Zambia is regulated by customary law. Under the territory where customary law is applicable (94% of the country), land belongs to the communities for their own use and exclusive individual rights are not recognized. Traditional authorities are responsible to ensure that all capable members of the community (criteria for assessing capability are left to the discretion of the chief) are allocated land (Mudenda, 2006). Individual rights are not recognized in terms of registered proprietorship but in terms of occupancy rights which can be inherited (van Loenen, 1999).

Prior to colonization, the responsibility for wildlife protection and use was vested in the communities. The village chief controlled the allocation of land and access to and use of forest and wildlife resources. That changed in the 1940s when the colonial Government passed legislation that established Control Hunting Areas (CHA). Initially, the objective of CHAs was to secure subsistence (unlicensed) hunting for residents and to keep the Tsetse fly from spreading to livestock. In 1954, however, all hunting in the better stocked CHAs was restricted to holders of licenses, allowing European hunters access to areas formerly reserved for local populations (Ooi, 1982). By virtue of this new policy, ownership of and access to wildlife resources was taken away from local chiefs and the State took over their management and exploitation. Land remained administered by customary law, but wildlife and natural resource administration was transferred to the Government.

Detailed policy for wildlife protected areas first appeared in a ministerial annual report in 1958. This report was followed by a series of guidelines regarding the use and management of game reserves as well as the formulation of protected area legislation. The national parks and GMAs were formally established under National Park and Wildlife Act No. 57 of 1968, which authorized the President to declare any area a national park. A few years later, the Game Management Area Declaration Order of 1971, the National Parks Declaration Order of 1972, and Statutory Instrument No. 44 of 1972 established the current network of national parks and Game GMAs (Chundama et al., 2004).

Notably, communities were left out of this legislative process. As in most African countries, post-independence conservation legislation emulated the style of the colonial government, which had little if any regard for the traditional land uses of local populations. Communities were seen as a threat to wildlife instead of a pivotal element for its sustainability (IIED, 1994). The new policies deprived communities of traditional wildlife food sources, the opportunity to trade wildlife products, and the use of wildlife for ceremonial and traditional customs (Wright, 1995). All revenues from hunting were sent back to the Ministry of Finance or kept by the hunting outfitters that were allowed to operate in the areas (Chundama et al., 2004). As a result, conflicts began to emerge between villagers and authorities. As it became clear that alienating communities was counterproductive to conservation efforts, initiatives emerged to include communities in the benefits generated from wildlife use. In the 1970s, the UNESCO Man and the Biosphere Program promoted the creation of buffer zones between strictly preserved areas and human settlements. Buffer zones were conceived as lands adjacent to parks and reserves where human activities were limited to those compatible with maintaining the ecological security of the protected area, while providing benefits from wildlife management (e.g., wages, income from hunting licenses or meat) and from development programs (e.g., schools and clinics) to local communities (Neumann, 1997).

The Government of the Republic of Zambia (GRZ) followed this philosophy and made a first attempt to involve communities in wildlife management. The Game Management Area Declaration Order of 1971 introduced the objective of conserving wildlife and integrating its management into the rural economy (Lungu, 1990). The idea was to involve communities in wildlife management decisions and transfer a share of the hunting revenues to them in an effort to stop or reduce other land-degradation activities that threatened wildlife habitat. However, the legislation embedded in the Game Management Area Declaration Order of 1971 did not include specific provisions to enable communities to meaningfully participate in wildlife management (Lungu, 1990). Conflicts between communities, government and safari hunters escalated. Locals saw no benefit from conservation, but commercial poaching was becoming a profitable business as western countries increased their demand for wildlife products (Gibson and Marks, 1995). By the 1980s, the Zambian wildlife population was compromised and some species, like elephant and rhino, were close to extinction. The black rhino population in the Luangwa Valley shrank from about 8,000 head in the early 1970s to less than 100 by the mid 1980s, and disappeared soon thereafter. Over the same period, elephant populations fell from 90,000 to 15,000 (Child and Dalal Clayton, 2004).

In 1983, subsidiary legislation was approved to try a new approach aimed at decentralizing power to the individual GMAs and allowing communities to participate in the revenues generated from trophy hunting (Lungu, 1990). The new approach was called Administrative Management Design for Game Management Areas (ADMADE) and fell under the jurisdiction of the Department for National Parks and Wildlife (DNPW, predecessor of the Zambia Wildlife Authority). Under the new framework, a pilot program, the Lupande Development Project (LDP) was tested in Lupande GMA, adjacent to South Luangwa national park. The program was intended to involve the local community in wildlife management and its benefits. With the revenues from hunting licenses and park fees, the project established a revolving fund that was managed by the GMA. The funds were partly utilized to train and hire village scouts (108 as of 1989), which were recruited among the young members of the community. It became a very attractive financial opportunity for otherwise unemployed people and an alternative to poaching. Other key features of the new project were that communities received 35% of the hunting funds to finance community projects and game culling was implemented to provide game meat for the community (Lungu, 1990).

At the same time that ADMADE was initiated, another initiative emerged with similar goals to those of the LDP. With funding from the Norwegian Agency for Development Cooperation (NORAD) and personal involvement from Zambian President Kenneth Kaunda, the Ministry of Finance launched the Luangwa Integrated Resource Development Project (LIRDP). The two programs shared the goal of involving communities in wildlife management, though their approaches differed. The LIRDP was the first to introduce grass-roots level institutions (Village Action Groups, or VAGs) to ensure local participation and administration of funding. In time, the policies of both programs were harmonized and transferred to Zambia Wildlife Authority (ZAWA) jurisdiction[5].

Learning from the Lupande experience, CBNRM programs were introduced in the rest of the GMAs throughout the country. To date, a total of 63 CRBs have been formed countrywide (ZAWA, 2007).

2.2 Game Management Area Policy

In 1998, the Zambia Wildlife Act introduced ZAWA, the institution that would be in charge of managing wildlife in protected areas of Zambia. ZAWA is responsible for the establishment, control and management of GMAs; provides for the sustainable use of

[5] For a detailed background on the creation and evolution of the LIRDP program see "Lessons from Luangwa. The Story of the Luangwa Integrated Resource Development Project, Zambia" (Child and Dalal Clayton,2003).

wildlife and the effective management of the wildlife habitat; balances benefits between local communities and wildlife; and involves local communities in the management of GMAs (Zambia Wildlife Act, 1998). ZAWA provides wildlife protection, licensed hunting, regulations for entry in wildlife protected areas, management planning requirements for national parks and game management areas and the enforcement of wildlife related activities in compliance with international agreements (Chundama et al., 2004).

Legal hunting is the principal non-farm economic activity in GMAs (Simasiku et al., 2008). GMAs with significant wildlife populations are divided into hunting blocks. Exclusive rights to run trophy hunting operations are leased out to hunting outfitters by the GRZ's Tender Board Authority for a period of three years (Lewis and Alpert, 1997).

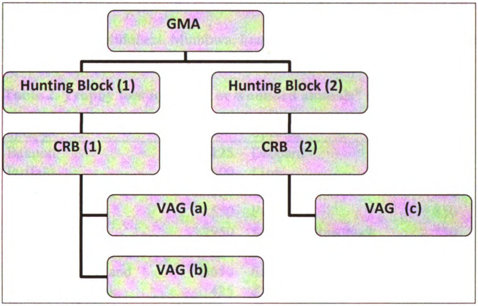
ZAWA is responsible for establishing the annual hunting quotas, according to animal stocks. The process is participatory: communities, scouts and hunting outfitters contribute to the estimation of animal populations, although there has been some criticism of the accuracy of the numbers, which are said to have been inflated in order to generate more funds (Adrian Coley, pers. comm..; Simasiku et al., 2008). The issuing of licenses and the establishment of license fees are also regulated by ZAWA. Hunting game or any protected species without the appropriate license is an offense and penalized by law with imprisonment or fines, depending on the species and whether the hunting is done inside a national park, GMA or open area. For example, the penalty for possessing, buying or selling any protected animal or trophy of a protected animal is imprisonment for a period of five to 15 years. Unlawful hunting within a national park is penalized with one to 15 years of imprisonment. Outside a national park, the penalty is reduced to a maximum imprisonment of 6 months or a fine not exceeding 20,000 penalty units (Zambia Wildlife Act, 1998)

The responsibility for wildlife management in GMAs is shared between ZAWA and local communities which are organized in CRBs. The Zambia Wildlife Act stipulates that "a local community along geographic boundaries contiguous to a chiefdom in a GMA or an open area or a particular chiefdom with common interest in the wildlife and natural resources in that area, may apply to the Authority for registration as a community resources board" (Zambia Wildlife Act, 1998: 17). The CRB represents the highest management authority at a community level regarding aspects of wildlife management. Each CRB includes a maximum of 12 members: no more than 10 and not less than seven representatives democratically elected by the local community, one representative of the local authority in the area and one representative of a chief in whose area a board is established to represent that chief. GMAs that are divided into more than one hunting block will have a CRB representing each hunting block.

Several Village Action Groups (VAG) may be organized under each CRB (Figure 6). VAGs are constituted by groups of households interested in managing natural resources. VAGs form VAG committees whose representatives are democratically elected by the community and are the key structure to represent the interests of the community on the

CRBs. One or more VAGs can have representation on a CRB, depending on the number of villages that share boundaries with the hunting block.

Figure 6. Structure of community representation in a GMA



Source: Author's elaboration

The functions of a CRB are to promote and develop an integrated approach to the management of human and natural resources in a GMA or an open area falling within its jurisdiction. CRB responsibilities are, theoretically, quite broad. They have the power to negotiate co-management agreements with hunting outfitters and photographic tour operators, they co-manage the wildlife under their jurisdiction, with quotas specified by ZAWA, and they appoint village scouts to control poaching. However, CRBs frequently have difficulty fulfilling all these roles due to inadequate funding and local capacity.

ZAWA collects 100% of safari animal trophy fees and concession fees generated in GMAs. It distributes 45% of the total revenues obtained from animal fees to CRBs and 5% to chiefs as CRB patrons, keeping 40% for its own administrative expenses and sending 10% to the central Government. Out of the revenues obtained from concession fees, 15% goes to CRBs, 5% to the chief and 80% to ZAWA.

Table 2 provides an example of current trophy fees for the year 2009 for hunting concessions in Mulobezi, Mumbwa, Luangwa, Bangweulu and Kafue Flats.

Table 2. Trophy fees for killed or wounded animals* (US$)

Species	US$	Species	US$
Baboon	125	Leopard	6500
Buffalo	2600	Lion	9500
Chobe Bushbuck	850	Oribi	550
Bushpig	550	Puku	850
Black Lechwe	2950	Southern Reedbuck	750
Southern Bush Duiker	550	Southern Roan	5700
Livingstone's Eland	3650	Sable	4850
Sharpe's Grysbok	425	Zambezi Sitatunga	4500
Lichtenstein's Hartebeest	1150	Tsesseby	2750
Hippopotamus	2500	Warthog	550
Hyena	550	Common Waterbuck	1250
Southern Impala	300	Blue Wildebeest	1875
Kafue Lechwe	2950	Zebra	1150
Klipspringer	1150	Crocodile	2600
Southern Greater Kudu	2450		

Source: Swanepoel & Scandrol (2009).
*Trophy fees correspond to 2009 fees for concessions in Mulobezi, Mumbwa, Luangwa, Bangweulu and Kafue Flats.

The CRBs are mandated to distribute 45% of the revenues received from ZAWA to resource protection (hiring of scouts and other logistic operations are the main expenses), 35% to the implementation of community projects and 20% to administration costs (ZAWA, 2008). All projects funded through the CRBs have to be designed to benefit all members of the community. Examples of community projects include construction of community schools, health clinics, wells, boreholes, police posts and transport services.

In addition to sharing hunting revenues, some communities may sign *ad hoc* contracts involving other arrangements. For example, communities in Chiawa and Bangweulu GMAs have signed agreements with ZAWA and tour operators that operate photographic safari lodges (game viewing). These agreements provide the community with an alternative source of income. They receive a 50% share of the annual land use fees paid by the lodges (Table 3). As in the case of hunting, communities make a commitment to preserve wildlife and use part of the revenues for poaching patrol (Sydney Tembo, pers. comm.). There are other conditions for the lodges such as having to hire at least 80% of the staff locally. In addition, tourist lodges make individual pledges to contribute to the building of schools, clinics, and other development projects.

Table 3. Land use fees by tourist lodge category

	Annual Fees (US$)	
Lodge category	Fixed (per category)	Variable (per # beds)
A	2,000	216
B	1,500	144
C	1,000	72
D (camp sites)	n/a	n/a

Source: Prepared with information from ZAWA's Tourism and Commercial Office. (Sidney Tembo, pers. comm.)

A report commissioned by the Ministry of Tourism, Environment and Natural Resources (Chundama et al., 2004) to examine the institutions and policies governing protected areas revealed legislative weaknesses in the Zambia Wildlife Act. It highlights the following weaknesses and areas for improvement: "a) user rights definition, b) appropriate guidelines for communities; c) review of policy and Act, especially in relation to compensation for crop damage and loss of human life; d) sharing of costs of management of protected areas is not clearly stated and e) need for transparency and inclusion in the policy of revenue sharing formula" (Chundama et al., 2004: 110). It also highlights the lack of definitions for other protected areas in addition to national parks or GMAs, such as Wildlife and Bird Sanctuaries (Chundama et al., 2004). In addition, ZAWA's jurisdiction is limited to the regulation of wildlife use and its protection but not over the habitat. GMAs are created on trust lands, which are communally owned. They are administered by traditional authorities (chiefs and headmen) who decide on their allocation and use. This has created conflicts as chiefs may encourage the use of land for activities that are not compatible with wildlife needs (Lewis and Alpert, 1997).

2.3 Wildlife Management and Hunting Policy Outside GMAs

ZAWA defines open areas as areas other than national parks and GMAs where wildlife is found. Although they are not officially designated as protected areas by the legislation, ZAWA has jurisdiction over the protection and management of wildlife in open areas. Hunting is allowed provided that the hunter has the appropriate license and permission from the land owner. Permission to hunt in open areas is generally sought at ZAWA Headquarters, while in GMAs, the permits are released by the area wardens (decentralized at GMA level). Animal quotas in open areas are usually lower as populations are normally sparse but the animal fees are the same (Betty Msimuko, pers. comm.).

For members of the community, hunting in open areas is as restricted as in GMAs. Hunting of any game or protected animal is restricted to hunters who have paid the corresponding fee, which is unaffordable for the majority of locals. In addition, whereas in GMAs the license fees are paid to the area warden and shared between ZAWA and the communities as per the current co-management agreements, in open areas the fees are paid directly at ZAWA Headquarters, and the funds remain with the administrative authority. Although ZAWA supports the establishment of CRBs in open areas, knowledgeable observers suggest that there is little interest from hunting outfitters or game viewing lodges to establish business in those areas, since wildlife populations are often too low to sustain tourism, limiting the capacity of communities to tap into the revenues from legal hunting that could be generated. Even if there were a hunting operator, the revenue sharing adopted in GMAs would not be automatically applied in open areas. Communities would have to negotiate the terms of revenue sharing on a case-by-case basis with hunting outfitters, photographic safari operators or private game ranching businesses (Betty Msimuko, pers. comm.).

Given these restrictions, it is clear that communities in open areas face additional obstacles to benefitting from wildlife in a legal and sustained manner. Recognizing the situation, ZAWA promotes community game ranching for local economic development in order to make wildlife conservation profitable for the communities in open areas. Game ranches are "owned by individuals and or consortiums (including business, trusts, associations, non-governmental organizations, community based organizations, and the state), to sustain or enhance wildlife production for financial, economic, or social purposes" (Davies et al., 1997 quoted in Chundama et al. 2004: 35). The idea is to promote the establishment of joint ventures by private investors, chiefdoms and CRBs as well as ZAWA. ZAWA has even indicated its willingness to restock such areas, for a fee, to help develop these initiatives (Chundama et al., 2004).

2.4 Community Based Natural Resource Management

The new decentralized approaches to wildlife management and conservation were partly a consequence of an international recognition that communities need to play a key role if conservation objectives are to be met. Globally, donors (including USAID, the Norwegian Agency for Development Co-operation and the Danish International Development Agency, among others) have promoted initiatives that involve communities in the decision making process, giving rise to various CBNRM initiatives in Africa and Asia. Also, developing countries had found the centralized approach to be highly burdensome, given their usually limited budgets, and had generally failed to control poaching effectively (Leader-Williams and Albon, 1988).

The premise of the CBNRM programs is that "people who live close to a resource and whose livelihoods directly depend upon it have more interest in sustainable use and management than state authorities or distant corporations" (Li, 2002: 265). The CBNRM model is based on the assumption that local communities will be interested and willing to adopt and implement wildlife conservation programs as long as they are entitled to any resultant ownership of resources and benefits (Songorwa, 1999). The proposition behind CBNRM schemes is that they can serve two different goals at the same time: conservation objectives (preservation of national parks, wildlife) and improved welfare of communities.

In Zambia, building on the experience of the pilot project in Lupande GMA, the National Parks and Wildlife Act (1991) made provisions for formal community participation and benefit. Public debate, with the involvement of Parliament, began to focus on the participation of local communities in wildlife conservation (Child, 2004; Chundama et al., 2004). Wildlife management policies gradually evolved to incorporate mechanisms for decentralization so the ADMADE approach could be replicated in GMAs throughout the country.

2.4.1 Wildlife Management and Communities

CBNRM programs assume that the community is a homogeneous group of individuals with similar interests, asset endowments, incomes and power relationships that facilitate collective action. In fact, homogeneity of individual characteristics and interests is not the reality in rural villages as pointed out by Agrawal and Gibson (1999). The incentive to preserve wildlife is indeed strong, though only for some. Poaching is a coping mechanism in GMAs where there is chronic food insecurity; it provides income and is one of the only sources of protein for many households. For others such as farmers and livestock owners, wildlife is mainly a threat to their livelihood (Songorwa, 1999).

The lack of attention to individual differences in communities has led to problems of inequitable access to resources and distribution of benefits, and has subsequently jeopardized the commitment of locals to preserve the resource base in the long run. In the Lupande GMA, restrictions on female participation in community gatherings and discussions, as well as the support for boys' education over girls' resulted in women being further marginalized within the community, as their male counterparts became better educated and had greater access to outside opportunities (IIED, 1994). Wainwright and Wehrmeyer (1998) suggest that the lack of support for women in the Lupande GMA "may impede development goals as it appears to focus narrowly on half of the human population". Key informants interviewed in Lupande and Chiawa GMAs in 2008 pointed out that lodges rarely employ women (Adrian Coley, pers. comm.), due in part to the remoteness of the lodges, which are often located far away from the villages and with limited accessibility. This makes it difficult for women to take care of the household and the children while spending long periods of time at the lodges. This is another example of how some groups within the communities might not benefit equally due to social imbalances.

2.4.2 Costs and Benefits of CBNRM

For a CBNRM project to be successful, it has to "improve both the well-being among local people and maintain (if not increase) biodiversity" (Wainwright and Wehrmeyer, 1998: 934). After two decades of CBNRM implementation, a body of literature has emerged that examines the success of the co-management of natural resources (Gibson and Marks, 1995; Marks 2001; Barret and Arcese, 1995; Mutandwa and Gadzirayi, 2007; Child and Dalal-Clayton, 2004; Bwalya, 2003). Most of the case studies used primary and secondary data. For example, focus groups and meetings with traditional leaders were used to characterize the views of the CBNRM programs from local communities, such as whether they thought it had a positive impact on their welfare. Other studies relied on quantitative data such as number of arrests, total revenues received by the

CRBs, the level of employment generated through hiring of scouts, guides or cooks for the safari lodges or the levels of meat consumed as tools to measure achievements. They also describe the costs associated with the programs such as crop damage, loss of access to meat, loss of wildlife use for traditional ceremonies or the social implications of preventing hunting.

In Zambia, the majority of studies have been conducted in the Lupande GMA, where the first CBNRM programs were implemented[6]. Based on a survey conducted in 1996, Wainwright and Wehrmeyer (1998) identified some positive impacts of the LIRDP program on attitude towards wildlife. Most respondents claimed that poaching had decreased, and by a factor of more than two to one, local people claimed that wildlife was more important at the time of the survey than before the project. However, poor management, lack of accountability, and insufficient involvement of the community in decision making were reported as some of the negative aspects. Approximately 57% of respondents indicated that the implementation of the program had not increased their living standards, 15% were neutral, 16% responded that the program had increased their living standards "somewhat" and 12% responded that their living standards had increased "very much".

Dalal-Clayton and Child (2003) also examined the impact of the LIRDP program in Lupande. Their study distinguishes between two stages of implementation. The first stage, up to 1996, was marked by a concentration of decision making power among

---

[6] Namely the LDP and the LIRDP.

district authorities and chiefs, who were trusted to act in the interest of community members. Chiefs approved projects without adequate consultation with residents and often appropriated meat intended for the community. As a consequence, community members mistrusted the system and felt disenfranchised by the program. A change of the LIRDP policy in 1996 shifted power from chiefs to grass-roots level institutions; VAGs were set up to democratically decide on the use of the revenues. Accountability systems were also put in place so the use of funds was transparent. The study makes reference to studies conducted in 1998 that showed a change in communities' perception about wildlife, with a better understanding of the economic potential of wildlife and a greater sense of ownership.

Bwalya (2003) analyzed the performance of the ADMADE program in the Blue Lagoon GMA, which surrounds the Blue Lagoon National Park. He cites an increase in the number of patrols and arrests as one of the achievements that reduced poaching and contributed to increasing populations of large mammals. However, he describes the shortcomings of the project in terms of weak community participation and involvement in decision making, lack of transparency and accountability regarding the management of funds, and poor information sharing on community entitlements. Although the conservation revolving fund was established, local communities were not properly informed about their entitlements. Furthermore, they felt that the revenues received from ZAWA did not left much remaining for community development projects. As a result, despite local interest in the programs, communities perceived a high opportunity cost of wildlife management against other competing land uses such as livestock grazing, thereby raising the incentive to poach. Wildlife farming was perceived to be economically unprofitable, making the competition for pasture and water between wildlife and cattle a source of dispute.

The findings in Bwalya (2003) coincide with the views of people interviewed in Chiawa and Lupande GMAs during visits in July 2008. Chairpersons of CRBs and villagers complained of inadequate funding received by the CRBs and lack of transparency by ZAWA. They had no access to reports indicating the total revenues from hunting, so they had to trust ZAWA's management for equitable distribution. They also complained about delayed payments, impeding the proper planning and prioritizing of projects. As a consequence, locals often remain indifferent to the program. Although overall they seemed to link the wellbeing of animals with potential benefits for themselves, they also perceived costs, mainly due to conflict with elephants, which were unanimously blamed for causing the worst crop damage. Elephant attacks destroy farms and houses and in some cases claim the lives of villagers. Scouts are reluctant to kill the animals; rather they try to scare them away by beating drums or shooting in the air which is not an effective deterrent in the long-term. There is no official compensation mechanism for losses or damages due to wildlife. Only some GMAs that receive significant funding such as Lupande, can sometimes release money to rebuild a house or to buy food for affected households.

In summary, the effectiveness of CBNRM programs is unclear. While there seems to be some progress in terms of increasing wildlife populations, especially for large mammals, and a change in attitudes towards wildlife, it remains unclear if communities actually benefit, if at all, from the current arrangements given the losses they experience. The studies cited above provide insight into community views and data on employment or hunting revenues, but generally lack an analytical approach that accounts for the gains and losses that communities might experience. For example, the revenues from hunting and from employment in tourism can be significant, but these could be outweighed by crop losses and the opportunity cost of alternative land uses.

The work conducted by Bandyopadhay and Tembo (2009), mentioned in Chapter one provides the major contribution to the analytical work on the performance of GMA policies in Zambia. The "Impact of Game Management Areas on Household Welfare" (IGMAW) survey was commissioned by the Government of Zambia to study the impact of GMAs on the welfare of the households living in them. The results of this study, which has been a key source for the elaboration of this paper, will be extensively referenced in the following chapters.

3. SURVEY DATA

The research uses data collected by the Impact of Game Management Areas on Household Welfare (IGMAW) survey. The author conducted additional data cleaning with the collaboration of Dr. Gelson Tembo, from the University of Zambia.

3.1 Coverage and Sample Design

The IGMAW survey was jointly commissioned by the Natural Resources Consultative Forum (NRCF), the World Bank (WB) and ZAWA as part of an effort to inform policy on the effectiveness of GMA interventions carried out by government, private sector and the respective communities. The objective of the survey was to determine the impact of game management areas on the living conditions of the households residing in the GMAs.

3.2 Coverage

The survey covered areas adjacent to almost all the National Parks; only those in the north and north-western part of the country were omitted for logistical reasons. The remaining parks were grouped in park systems based on geographical location, as follows: Bangweulu (including Isangano, Lavushi and Kasanka NPs), Kafue (including Kafue, Blue Lagoon and Lochinvar NPs), Lower Zambezi (Lower Zambezi NP) and South Luangwa NP. Each of the Park systems was considered a reporting domain in the sampling process.

3.3 Sampling Process

Sampling was done in two stages. In the first stage the list of Standard Enumeration Areas (SEAs) within GMAs was obtained by overlaying GMA digital maps from ZAWA with maps of SEAs from the Central Statistical Office (CSO). All SEAs outside GMAs but bordering a national park were also listed to serve as control areas. A sample of 139 SEAs was drawn from the two lists using probability proportional to size (PPS), and drawing upon the 2000 census of population and housing.

At the second stage, all households in each SEA were listed, and sample households were selected for interviewing using a systematic sampling scheme. The total number of households interviewed was 2,769 out of a target of 2,800, reaching a 99% success in response. Approximately half of the respondents reside in GMAs (58%) and the other half in non-GMA or control areas (42%). Data were collected at the household and community levels using household and community questionnaires, respectively. For the community questionnaire, key informants were interviewed including the headmen, chairpersons of CRBs, school headmasters, chairpersons of VAGs, and others.

3.4 Stratification of GMAs and non-GMAs

Following ZAWA classification of GMAs based on wildlife stocks and tourism activity, the GMAs were classified into prime, secondary, specialized and understocked (see table 4 for distribution of SEAs among park systems and GMA vs. non-GMA areas). Prime areas are those in which trophy species such as lion, leopard, roan, and sable antelope are abundant and can sustain classic and mini safari hunting. Classic safari hunting permits licensed hunters to hunt trophy species while mini safaris permit hunting of seven minor species but exclude lion, leopard, and roan and sable antelopes. GMAs classified as secondary are areas in which species are less abundant but can still sustain mini safari hunting. Specialized GMAs are found in wetland areas and are characterized by the presence of only a few species such as lechwe, sitatunga and tsessebe. In understocked areas, wildlife populations are sparse and hunting quotas are limited (Simasiku et al., 2008). ZAWA also classifies GMAs as depleted if wildlife is very fragmented and is therefore not suitable for safari hunting. Because only one SEA belonged to this category, it was dropped from the study.

Table 4. Sample SEAs by National Park and GMA classification

	Park systems				
Sample stratification	Bangweulu	Kafue	Lower Zambezi	South Luangwa	Total
Primary		4		19	23
Secondary		2	16		18
Specialized	6	5			11
Understocked	20	6		2	28
Non-GMA	10	21	17	11	59
Total	36	38	33	32	139

Source: Compiled from IGMAW survey.

4. ANALYTICAL APPROACH AND HYPOTHESIS TESTING

The objectives of this research are to analyze the impact of GMA policies on local welfare, to identify the avenues through which this effect might be felt and finally, to estimate the impact that each of these effects may have on household welfare.

Chapter one described the potential benefits and costs that households living in GMAs may experience as a result of decentralized wildlife management policies. Greater access to off-farm income opportunities through the tourism sector is the most direct link to higher levels of income. However there could be other avenues for households to benefit from (or be disadvantaged by) GMA policies. The following list enumerates the main avenues through which GMAs may positively and negatively affect household incomes:

i) Hunting and photo-safari revenues are invested to fund community projects such as the construction of schools, clinics, wells and health centers;
ii) Employment opportunities arise as community members are hired as scouts to patrol the areas;
iii) Communities are given free access to game meat from trophy hunting;
iv) Opportunities for off-farm employment through the tourism sector generate greater levels of off-farm income;
v) Self-employment or business opportunities are generated through increased economic activity in the area;
vi) Social capital rises as communities recognize the need to organize in democratically elected CRBs/VAGs to administer local resources. These

organizations can be the base for other initiatives that communities may explore with the private or public sector; for example the establishment of game ranches or other business ventures.

On the other hand, there are potential costs associated with living in a GMA:

i) Communities give up the opportunity to utilize land in other ways that might generate greater benefits than game management does (for example through accessibility of land for livestock grazing or for cultivation);

ii) Households might be negatively affected by crop loss in well stocked GMAs;

iii) The ever present possibility of animal attack instills fear in the villagers and may prevent some of the innovations for making money; night life, for example, is greatly minimized.

The potential for the above mentioned factors to influence the income of households living in GMAs will in turn depend on certain conditions, for example, on the effective implementation of CBNRM policies. If hunting revenues are properly managed and efficiently distributed to CRBs, they can be used to help better plan for the recruitment of scouts and the implementation of development projects. Also, the status of wildlife stocks will affect the ability of the GMA to generate funding and to sustain the CBNRM programs. GMAs with higher numbers and variety of species will have a greater chance to generate funding from hunting revenues and attract a larger number of tourists, increasing the opportunities for off-farm employment. All these factors that influence household income and the conditions described above constitute what this research calls the "GMA effect".

The research is conducted in two stages. Stage one (Model 1) will estimate the GMA effect on the level of household income. The specific question to be answered is: do households living in GMAs realize higher average incomes from the current wildlife management policies?

The first stage determines the existence and magnitude of a GMA effect. The second stage (Model 2) represents the major contribution of this paper, which is to reveal information about the avenues through which the GMA effect, if found, influences household income. A positive GMA effect on household income could be generated through increased non-farm employment opportunities in the tourism sector or through the direct effect of CBNRM programs (development projects, hiring of scouts, and free access to game meat). A negative GMA effect could be the result of increased crop damage on the farms, which could outweigh the potential gains from the GMA policies. To better understand the paths through which the GMA effect is felt, stage two will analyze the GMA effect on i) sources of income; including crop agriculture and non-farm earnings from wage and self employment, and ii) crop damage.

4.1 Model 1: Impact of GMA Policies on Household Income

As advanced in Chapter one, the livelihoods of households living in areas adjacent to national parks are similar to the average rural Zambian. According to data from the

IGMAW survey, subsistence agriculture stands out as the main livelihood in both GMA and non-GMA areas (see Table 5).

Table 5. Economic activities in GMA and non-GMA areas

Economic activities	GMAs			Non GMAs		
	% of households engaged in this activity	Mean earnings among those engaged	Income share over all households	% of households engaged in this activity	Mean earnings among those engaged	Income share over all household
Crop agriculture (total)	87%	1,010,918	38%	90%	1,338,792	41%
-Crop agriculture (sold)	43%	263,515	8%	49%	583,477	15%
-Crop agriculture (retained)	86%	747,404	30%	88%	755,314	26%
Livestock agriculture	67%	172,632	6%	73%	332,362	9%
Forest products	13%	231,491	1%	14%	431,947	2%
Wage employment	11%	5,373,789	9%	6%	9,791,228	4%
Self employment	50%	2,918,647	34%	46%	4,940,745	31%
Remittances	15%	1,618,911	5%	15%	1,736,153	6%
Other activities	19%	1,333,838	6%	19%	2,600,525	8%

Source: Calculated from IGMAW survey

The great majority of households in both areas participate in crop agriculture. This activity has the largest income share over all households, with 41% in non-GMAs and 38% in GMAs. In both GMA and non-GMA areas, livestock agriculture is the second activity in terms of number of households engaged, followed by self-employment, other activities (including income from pensions, gifts, rents, game meat and sales of honey), remittances, forest products and wage employment. Table 5 shows that the relative importance of self employment and wage employment is greater within GMAs in terms of number of households engaged and income share over all households. This could reflect the existence of additional off-farm opportunities in GMAs as a result of the CBNRM programs or the result of land use plans that allocate arable land to the tourism sector.

Table 6 shows a breakdown of income share of activities among households by income quartiles. The share of income from agricultural (crop and livestock) activities rapidly decreases as income increases. In GMAs, for the poorest 25% of hhs (1st quartile) crop agriculture represents 56% of total income among all households, while for the least poor 25% (4th quartile) this share drops to 19%. In non-GMAs the trend is similar, where the share of crop agriculture declines from 62% for the 1st quartile to 17% for the 4th quartile. Conversely, the income share of self and wage employment increases as income rises. For example, wage employment accounts for 0.4% of income over all households for the 1st quartile, rising to 13% for the 4th quartile in GMAs and from 0.4% to 22% in non-GMAs.

Table 6. Income share over all households by income quartiles

Economic activities	GMAs				Non GMAs			
	1st qrtile *(a)*	2nd qrtile	3rd qrtile	4th qrtile *(b)*	1st qrtile	2nd qrtile	3rd qrtile	4th qrtile
Crop agriculture (total)	56%	48%	41%	19%	62%	46%	27%	17%
- Crop agriculture (sold)	14%	17%	19%	8%	10%	12%	8%	4%
- Crop agriculture (retained)	42%	32%	21%	11%	52%	34%	19%	13%
Livestock agriculture	15%	9%	7%	3%	9%	8%	4%	2%
Forest products	2%	2%	2%	1%	2%	2%	1%	0%
Wage employment	0.4%	1%	4%	13%	0.4%	4%	11%	22%
Self employment	18%	26%	30%	49%	19%	31%	44%	43%
Remittances	4%	8%	9%	4%	5%	4%	4%	8%
Other activities	6%	6%	8%	11%	2%	5%	10%	7%

Source: Calculated from IGMAW survey
(a) Lowest income
(b) Highest income

The descriptive statistics of the main variables selected for the analysis are presented in Table 7. The total number of observations in the sample is 2,717 after excluding the zero observations for total income. The subsamples for non-GMA and GMA are approximately divided in half (58% of the surveyed households reside in GMAs and 42% in non-GMAs). The t test for differences in means shows that the majority of variables are significantly different across GMA and non-GMA areas. Households living in GMAs are typically smaller in size, have younger heads of household, are more likely to be headed by a female, have lower levels of education, are farther away from all-weather roads, have fewer consumption and production assets and live in more densely populated areas. The overall average household income is 4.2 million ZMK (801,544 ZMK per capita). In GMAs the average income per capita is 706,844 ZMK while in non-GMAs the average is 920,599 ZMK.

Table 7. Comparison between variable means for the full sample and the GMA and non-GMA subsamples.

Variable description	Full sample	Subsamples GMAs	Non-GMAs	Sig.[a]
Number of households	2,717	1,574	1,143	
Total household income	4,235,762	3,591,253	5,123,301	
Household size	5.28	5.08	5.57	***
Total household income per capita	801,544	706,844	920,599	
Age of household head in years	42.46	41.00	44.48	***
Sex of household head (=1 if male)	0.74	0.73	0.76	**
Maximum education of hh member (in years)	6.78	6.42	7.27	***
Number of children (<15 years)	2.55	2.46	2.67	***
Number of female adults (15-60 years)	1.10	1.08	1.12	
Number of male adults (15-60 years)	1.03	1.00	1.07	**
Distance to nearest all-weather road (in km)	5.09	6.08	3.80	***
Cropped area (in hectares)	0.92	0.93	0.92	
Value of consumption durable assets (in ZMK)	401,588	285,362	561,641	**
Value of production durable assets (in ZMK)	618,036	256,729	1,115,584	***
Population density (in sq km)	35.2	41.4	26.9	***
Types of existing Infrastructure (#)	3.62	3.64	3.59	
Tourist lodge in the community (=1)	0.07	0.10	0.02	***
Household lives in prime GMA (=1)	0.17	0.30	-	n/a[b]
Household lives in secondary or specialized GMA (=1)	0.20	0.35	-	n/a

Source: Calculated from IGMAW survey data

[a]Significance based on variance t test between means: *10% significance, **5%significance, ***10%significance

[b] n/a: not applicable

These results are similar to those obtained by Bandyopadhay and Tembo (2009), though the absolute figures vary due to additional data cleaning conducted for this study. They found that per capita expenditure levels are, on average, higher in non-GMAs (853,750 ZMK) compared to GMAs (839,359 ZMK), although the difference was not statistically significant. This is also the case for per capita income; the average is found to be higher outside GMAs than within GMAs (896,070 ZMK vs. 829,622 ZMK) but the difference is not significant. The rest of the common variables used in both analyses (age, sex, maximum education, number of children, female adults, male adults, distance to all-weather road and value of consumption durable assets) follow the same pattern. The mean comparison results suggest that households living in GMAs face more difficult conditions (remoteness, lower education levels, lower incomes) than those living outside GMAs. However, the comparison between means does not control for other factors that affect household income. To isolate the GMA effect, other variables need to be kept constant. The following sections present results of various econometric models that allow us to control for most of these other variables.

4.1.1 Model Specification

In this study, household welfare is measured by total income. All welfare indicators have advantages and disadvantages. Barret et al. (2001) advocate for the use of multiple welfare indicators to cross check on inference. Although measuring household income can be less straightforward than measuring expenditure, and is sensitive to underreporting, it allows comparison with the results obtained by Bandyopadhay and Tembo (2009), which was based on total household expenditure as a measure of welfare. In addition, the income variable can be broken down into different sources, which will allow exploring the channels through which the GMA effect is felt. Finally, the mean income and expenditure figures calculated from the survey are very close, suggesting that under-enumeration of income was not a serious problem in the survey.

Household income in rural areas comes from many sources. An income indicator is created to capture the total value of household income, including farm income (total value of sold and retained harvest, value of livestock sold and consumed and value of livestock products sold), value of sales from honey, value of forest products consumed and sold, income from hiring of equipment, income from game meat sold and off-farm income (from wage employment and self employment).

To estimate the GMA effect, all other factors that affect household income need to be held constant. Typically, the determinants of household income include human capital, physical assets, locational characteristics, and other social and institutional assets (De Janvry and Sadoulet, 2001). The relationship can be generally represented as:

$$Y = f(HC, PC, LC, SA) \qquad (1)$$

Where

Where	Y	is the level of household income;
	HC	is a vector of human capital and socio-demographic variables;
	PC	is a vector of physical capital variables;
	LC	is a vector of locational variables; and
	SA	is a vector of social and institutional asset variables.

Human capital variables such as gender composition, household size, age of household head and educational levels have an impact on the income strategies and earnings of households. For example, households that have older members may tend to participate less in the agricultural wage labor market and focus more on livestock activities, particularly if the household head is male (De Janvry and Sadoulet, 2001). A married household head may have higher earnings from farming than a female headed household because of the availability of additional household labor, and may receive remittances from children living outside the area. Education levels of adult members have an impact on the allocation of labor. Education raises the marginal productivity off the farm as well as the reservation wage, increasing the likelihood of entering the higher end of the labor market. Households with better educated adults are expected to be wealthier as they are able to attain the most remunerative income opportunities (De Janvry and Sadoulet, 2001).

In a rural economy where agriculture predominates, land access becomes a key asset for household welfare. Jayne et al. (2003) find a positive association between household per capita land holdings and per capita income in Ethiopia, Kenya, Rwanda, Mozambique and Zambia. For small farms, a very small increment in land holdings is associated with a large relative rise in income. The study also shows that the bottom 25% of rural agricultural households have access to only 0.1 hectares per capita or less in each of the examined countries. However, although this result might point towards a policy to facilitate access to land, dynamic studies recognize the importance of off-farm income for household growth, as will be discussed in the next section.

Locational characteristics determine household income opportunities and constraints in a variety of ways. Access to markets, proximity to towns and higher population densities generally enhance the capability of households to diversify their activities and participate in the rural nonfarm sector. Income levels will be higher in areas with favorable agro climate due to higher yields and the availability of jobs generated through production linkage activities (Reardon, 1997). De Janvry and Sadoulet (2001) found that the number of commercial centers within an hour traveling distance enhances nonagricultural wage income in rural Mexico. Shorter distances to schools and clinics are generally positively correlated with higher household welfare. Population density itself may have an additional effect on income opportunities since it is typically positively correlated with infrastructure variables, hence having the additional effect of facilitating exchange for any given level of infrastructure.

Among social and institutional assets, De Janvry and Sadoulet (2001) found a positive correlation between access to technical assistance and formal credit and household income. Other variables that are likely to affect household income are related to community structure and cohesion, for example communities that are able to organize themselves and work together would be more likely to participate in CBNRM programs which require a high level of community organization.

4.1.2 Model Estimation

The first consideration for selecting the model estimation is the distribution of the dependent variable. In this case the dependent variable, household income, is continuous with a small number of zero observations reported. Since the survey included an exhaustive list of income sources, including farm and off-farm, gifts in-kind or in cash, remittances and pensions, it is likely that the reported zero observations correspond to missing or incorrectly recorded data. Since missing observations represented only 1.9% of the total sample, they were dropped for the purposes of this study. Eliminating the zero values makes the income variable positive for all observations and allows the use of Ordinary Least Square (OLS) estimation.

Although OLS is a simple and trusted estimation technique, one obstacle for its proper implementation is the potential presence of endogeneity, which creates bias and inconsistency in the parameters. For the case of household incomes in this study, endogeneity is suspected to be present, because of sample selection bias derived from the household's decision to migrate to or from GMAs. Households migrating into GMAs may be attracted by employment opportunities or existing amenities derived from the investment in community projects. Those households emigrating from GMAs (perhaps those most oriented towards agriculture) might do so as a consequence of human-wildlife conflicts. Bandyopadhay and Tembo (2009) acknowledge the problem of endogeneity and note that the absence of quantitative historical data for the creation of GMAs could indicate that there are unobserved factors that cause selection bias. To control for the bias they use Maddala's (1983) treatment effects model. This model considers the effect of an endogenously chosen binary treatment (in this case, living in a GMA) on another endogenous continuous variable, conditional on two sets of independent variables. The model uses either a two-step consistent estimator or full maximum likelihood to obtain the estimates (Cong and Drukker, 2001).

Effective control of selection bias in treatment models requires a set of instrumental variables (IV) that are correlated with the probability of living in a GMA (the endogenous treatment variable) and uncorrelated with the level of household income (the dependent variable of the continuous equation) as explained in Wooldridge (2002: 463). Yet in this specific application, all of the variables thought to affect the probability of living in a GMA (for example household participation on a VAG committee or the number of community projects funded by the CRB) are also likely to influence the level of income. Moreover, a comparison of results obtained from treatment effects models using various combinations of these IVs shows that results are highly sensitive to which IVs are chosen (see Appendix A).

Appendix A investigates further the extent to which household migration to or from GMAs should be a concern for this analysis. It compares migration percentages in GMAs and non-GMAs and conducts a series of tests to determine i) whether the total percentage of migration is large enough to suggest a serious potential sample selection bias and ii) whether there are structural differences between the subsample of households that have not migrated vs. those that have migrated. The decision is to estimate the model using OLS given the relatively low levels of migration and the results of the Chow (1960) test for structural differences (see Appendix A).

The basic OLS estimation for the determinants of income takes the form[7]:

$$lnY_i = \alpha + \beta_1 HC + \beta_2 PC + \beta_3 LC + \beta_4 SA + \mu_i \qquad (2)$$

Where i takes the values from 1 to 2,717

- lnY_i is the logarithm of income for each household. The logarithm is used as the right hand side variables are expected to affect the dependent variable in percentage terms
- HC is the vector of variables associated with human capital and associated demographic factors
- PC is the vector of variables associated with physical capital
- LC is the vector of variables associated with location and community characteristics
- SA is the vector of variables associated with social and institutional assets
- α is the intercept term
- β_1 is the vector of parameters associated with the human capital vector, HC
- β_2 is the vector of parameters associated with the physical capital vector, PC

[7] Stata's *hettest* suggested strong heteroskedasticity with respect to the set of right hand side variables. All inference in this model is therefore made on the basis of standard errors robust to this problem (produced through the *hc3* option under the regression command).

β_3 is the vector of parameters associated with the location vector, *LC*

β_4 is the vector of parameters associated with the social and institutional vector, *SA*

μ_i is the error term

4.1.3 Stage 1: Empirical Estimation and Results

The selection of variables included in the model is guided by a review of literature on the determinants of rural household income (Barret et al., 2001; De Janvry and Sadoulet, 2001; Yúnez-Naude and Taylor, 2001; Reardon, 1997), the factors hypothesized to have a positive or negative impact on household income, and data availability.

Human capital and socio-demographic variables include household characteristics such as the age in years of the household head; the sex of the household head, represented by a dummy variable that takes the value 1 for male headed households; the level of education, measured by the number of years of schooling of the highest educated household member; and the gender distribution of the adult members of the household (number of females and males between 15 and 60 years).

Total area cropped in hectares is used as a proxy for land holdings since the latter is not available from the survey data. Other assets are represented by a productive assets variable, generated by adding the ZMK value of assets such as tractors, ploughs, wheel barrows, fishing nets and traction animals (e.g., oxen, donkeys). The consumer durables variable represents items such as radios, refrigerators, cell phones, bicycles, and sewing machines.

The vector of locational variables describes community characteristics in terms of location and availability of amenities which are hypothesized to have an effect on opportunities for employment and access to markets. The selected variables include the distance in kilometers to the nearest all weather road; an infrastructure index created by counting the existing types of infrastructure funded by Government, non-governmental organizations (NGOs) or private companies, including schools, clinics, wells, and dip tanks; a dummy variable to indicate the existence of a tourist lodge in the community; and the population density of the SEA. The density variable is included in order to capture (a) any remaining unobserved aspects of infrastructure and (b) opportunities for exchange, holding infrastructure constant.

Finally, to analyze the effect of the GMA on household income, the model includes dummy variables to indicate whether the household lives in a GMA. Since we hypothesize that the stock and variety of wildlife has an impact on the potential to generate hunting revenues and the level of crop destruction, the GMA variable is classified into GMA1 for prime areas and GMA2 for secondary and specialized areas. The former takes the value of 1 if the household lives in a prime GMA (well stocked with a high variety of species; otherwise, the value is zero) and the latter takes the value of 1 if the household lives in a secondary or specialized area (lower stocks and variety than in prime areas[8]; otherwise, the value is zero).

[8] See Chapter 3 for a description of ZAWA's GMA classification.

The results of the OLS regression are presented in Table 8. The coefficients obtained from the OLS estimation have the *a priori* expected signs and for the most part are significant at a 1%, 5% or 10% level. The age of the household head is negatively and significantly associated with household income. Male-headed households show a positive but insignificant association. The level of education (maximum education level of any household member) is, as expected, significantly associated with higher levels of income. An additional year of education of the highest educated household member increases total household income by 4.3%. The number of adults (men and women) is significant and positive, which is an expected result since income is aggregated at household level. Distance to the nearest all-weather road has a negative effect on income by 5%. This result is consistent with the hypothesis that remoteness has a negative effect on household welfare by limiting opportunities for off-farm employment, raising the cost of transport, limiting access to markets, and increasing transaction costs (e.g., access to information, search costs).

Other factors positively and significantly affecting household income are the existing level of infrastructure, population density, and the presence of a tourist lodge in the area. Infrastructure and population density have been found to be positively associated with wage earnings by Reardon (1997) and Haggblade et al. (1989). Infrastructure levels may be associated with a reduction in transport costs, increased access to markets, greater provision of services (banks, extension services) and facilities (clinics, schools, wells) and greater access to employment opportunities. Population density is generally positively associated with income too; for any given level of infrastructure, population density generates greater opportunities for exchange.

Table 8. OLS regression on the GMA effect on total household income

Variable description	Coefficient (standard error)	Significance
Intercept	13.101	***
	(0.12)	
Age of household head in years	-0.003	*
	(0.00)	
Sex of household head (=1 if male)	0.069	
	(0.06)	
Maximum education of hh member (in years)	0.043	***
	(0.01)	
Number of children (<15 years)	0.019	
	(0.01)	
Number of female adults (15-60 years)	0.113	***
	(0.03)	
Number of male adults (15-60 years)	0.070	**
	(0.03)	
Distance to nearest all-weather road (in km)	-0.005	***
	(0.00)	
Cropped area (in hectares)	0.039	*
	(0.02)	
Value of consumption durable assets (in ZMK)	0.020	***
	(0.00)	
Value of production durable assets (in ZMK)	0.010	***
	(0.00)	
Population density (in sq km)	0.001	***
	(0.00)	
Types of existing Infrastructure (#)	0.032	***
	(0.01)	
Tourist lodge in the community (=1)	0.186	*
	(0.10)	
Household lives in primary GMA (=1)	0.170	**
	(0.08)	
Household lives in secondary or specialized GMA (=1)	0.022	
	(0.07)	
Dependant variable: Total household income (in logarithm)		
Number of Observations	2264	
R-squared	0.21	

Source: Calculated from survey data.

*10% significance level, **5% significance level, ***1% significance level

Finally, results show that living in a prime GMA increases households incomes by 17% over what they would be without the GMA designation. For households living in secondary or specialized GMAs, the result is positive though not significant and relatively low in absolute terms. This finding confirms the results in Bandyopadhay and Tembo (2009) who found a positive association between living in a GMA and household welfare (measured by consumption expenditure). However, by breaking GMAs down by classification, we show that the GMA effect is dependent on the level and variety of wildlife population. The results suggest that any loss from crop damage is more than offset by the positive impacts.

To investigate how the positive GMA effect is distributed across households, we stratified households by the value of their durable asset holdings (the variable consumer durable assets is stratified by quintiles), then repeated the OLS analysis while interacting the GMA variables with the dummies for lowest two quintiles, lowest three quintiles and upper two quintiles (Appendix B). The results indicate that the GMA effect is more likely to be attained by wealthier households (see Table 9).

Table 9. Comparison of GMA effect on household income by welfare level

Consumer durable assets	GMA 1	GMA 2
Lowest 2 quintiles	0.033	-0.059
Lowest 3 quintiles	0.031	0.04
Upper 2 quintiles	0.046**	-0.008

**5% Significance level

The lowest 2 quintiles refer to the poorest 40% of the population, who according to the results are not significantly impacted by living in a GMA; the same result applies if the analysis is expanded to include the poorest 60% segment of the population. Only when the upper two quintiles are considered do the results become positive and significant, indicating that the gains derived from living in a GMA are likely to be attained by the non-poor segment of the population; this too is consistent with Bandyopadhay and Tembo (2009). It is also worth noting that the impact is insignificant for all segments living in secondary or specialized GMAs. That wealthier households capture the positive impact of the GMA effect is not surprising. They are in a better position (in terms of access to financial, human and political capital) to take advantage of the opportunities offered in the non-farm sector as entrepreneurs and as wage employees (Haggblade et al., 2007).

An additional regression by park systems was conducted (for full results see Appendix B), interacting the park dummy variables with a single GMA variable.[9]. The results of the coefficients are presented in Table 10. The highest GMA effect is found in Luangwa where households have, on average, 18% higher incomes in GMAs than in non-GMAs. In Kafue, households in GMAs have 14% higher incomes and in Lower Zambezi, the GMA effect is positive though not significant. The results are probably a consequence of the distribution of prime GMAs across the parks: Luangwa includes 19 prime GMAs and Kafue 4, while Lower Zambezi has no prime GMAs.

---

[9] The two GMA variables were collapsed into one because using park dummy variables introduces its own control for wildlife population and variety that was previously captured with the two GMA dummies

Table 10. GMA effect by park system

Variable description	Coefficient	Significance
Households living in GMA within Luwangwa Park system	0.177	**
Households living in GMA within Kafue Park system	0.135	*
Households living in GMA within Zambezi Park system	0.046	

Source: Calculated from IGMAW survey data.
Control park system: Bangweulu.
Full results shown in Appendix B.

In summary, the results suggest that, *ceteris paribus*, there is a positive association between prime GMAs and household income. The benefits derived from living in a GMA (mainly through tourism and CBNRM programs) seem to outweigh the potential costs associated with living in GMAs (mainly the possible opportunity cost of land use and the increased probability of crop damage). The fact that the effect is only significant in GMAs classified as prime, indicates that the state of wildlife population is a key factor for the potential of tourism and CBNRM programs to generate employment and hunting revenues. The results also reveal that benefits are more likely to be attained by those groups in the upper quintiles of the welfare scale, suggesting an uneven distribution of the GMA effect among community members, a common finding in the literature of welfare and non-farm rural income (Haggblade et al., 2007).

4.2 Model 2: Avenues through which the GMA Effect is Generated

The results of the first analysis identify the effect of GMAs on total income but provide no insight into the specific avenues through which the GMA effect is generated. To shed light on this, Model 2 analyzes the GMA effect on a) the different sources of income; namely wage employment earnings, self employment earnings and crop agriculture and b) crop damage.

Participation in non-farm activities is typically associated with relatively high levels of welfare. Therefore, this study investigates the GMA effect on the probability of participating in off-farm activities and on the level of earnings conditional on participation. The analysis also looks at the GMA effect on agriculture to evaluate whether the land use planning and crop damage associated with GMA policies impact the probability of farming and the value of the total crop. Finally, living in GMAs could negatively impact income via higher crop damage by wildlife. Model 2 analyzes each of these effects separately. The specific questions of interest are:

i) Does living in a GMA increase the likelihood that a household will participate in non-farm employment activities? If so, how does living in the GMA affect the total value of non-farm earnings?[10]
ii) Does living in a GMA increase the likelihood that a household will participate in crop agriculture? And if so, how does living in the GMA affect total crop value?
iii) Does living in a GMA increase the likelihood that a household is affected by crop damage? And if so, how does living in the GMA affect the total value of crop loss?

4.2.1 GMA Effect on Off-Farm Earnings

Empirical studies show that non-farm activities are typically positively associated with income and wealth in Africa (Barret et al., 2001; Reardon, 1997). "Push factors" capture the fact that some households diversify not so much due higher income earnings

---

[10] For the purpose of this paper, non-farm earnings are defined as wage earnings received from the farm or non-farm sector and self-employment earnings from non-farm businesses.

possibilities but rather to manage risk and a cope with adverse shocks. The dependency on rain-fed agriculture and the absence of credit markets are two examples of the risks that farmers face. Participating in the wage labor market (typically on neighboring farms) or setting up their own micro-enterprises are some strategies to assure food security in the event of a drought or a sudden reduction in commodity prices for example. Non-farm employment is also sought by rural households in the presence of land constraints derived from population growth and decreased productivity (Reardon, 1997; Barret et al., 2001). "Pull factors" capture household response to greater income earnings opportunities off the farm. For example, households that reach certain levels of labor productivity on the farm can release labor to the non-farm labor market. Others may diversify to take advantage of production-linkage activities, for example milling and hog production (Barret et al., 2001). Education is also positively associated with off-farm income, as better educated households have more opportunities for wage employment and typically access higher remunerated jobs.

Of the 2,717 households included in this analysis, 242 (9% of the total sample) reported wage earnings and 1,322 (almost half) reported earnings from non-farm businesses; 79 households (3%) reported having earnings from both sources. Table 11 shows that households employed in the wage labor market have higher average incomes (4.6 times higher) compared to households not receiving wage or self employment earnings. They are also more likely to be younger and male-headed, better educated and larger in size. The average distance to a main road is 2.9 km for wage-earning households compared to 4.8 km for non-wage and non self-employed households. Tschirley and Benfica (2001) find the same pattern in rural Mozambique when comparing household and community characteristics of wage-earning and non-wage households. The table also shows that households participating in the wage labor market are more likely to live in more densely populated areas with greater access to infrastructure. Wage earning households are also more likely to live in places where there is a tourist lodge and in GMAs as compared to the group of households not participating in wage or self-employment earning activities.

Table 11. Mean comparison between households earning wage income and households not earning wage income

	Mean values for subsamples		
Variable description	Households earning wage income	Households earning self-employment income	Households not earning wage or self-employment
Total income per capita	2,225,952	1,070,635	487,190
Age of household head in years	39.13	40.20	45.43
Sex of household head (=1 if male)	0.83	0.78	0.69
Maximum education of hh member (in years)	9.28	6.77	6.46
Number of children (<15 years)	2.63	2.69	2.42
Number of female adults (15-60 years)	1.29	1.17	1.01
Number of male adults (15-60 years)	1.20	1.08	0.96
Distance to nearest all-weather road (in km)	2.91	5.70	4.77
Cropped area (in hectares)	0.74	0.84	1.03
Value of consumption durable assets (in ZMK)	1,026,838	464,244	278,084
Value of production durable assets (in ZMK)	761,126	718,125	491,208
Population density (in sq km)	89.70	39.38	26.42
Infrastructure (#)	3.78	3.80	3.45
Tourist lodge in the community (=1)	0.17	0.08	0.05
Household lives in prime GMA (=1)	0.33	0.20	0.12
Household lives in secondary or specialized GMA (=1)	0.35	0.20	0.19
Number of Observations	242	1,322	1,232

Source: Calculated from IGMAW survey
Significance based on variance t test between means among indicated households compared to those with neither wage nor self-employment income: *10% significance, ** 5% significance, *** 1% significance

As with wage-earning households, households that operate their own businesses (i.e., self-employed) have higher mean total income compared to the third group (households not earning off-farm income). They are also better educated, more likely to be headed by a male, have younger household heads and are larger in size than households not receiving wage or self-employment earnings. However, self-employed households are more isolated than wage-earning households or those with no wage or self-employment income (the average distance to a main road is higher for self-employed households). Like wage-earning households, self-employed households tend to live in more densely populated areas with higher access to infrastructure and are also more likely to live in GMAs.

These results suggest that households participating in the wage labor market and those who are self-employed are generally better off than non wage-earning and non self-employed households. However, as indicated by Tschirley and Benfica (2001), using cross-sectional data does not allow for the observation of trends over a period of time, so the differences could be due to specific events that occurred during the year the data were collected rather than long-term factors. In any case, literature on rural welfare (Barret el al., 2001; De Janvry and Sadoulet, 2001; Reardon, 1997) and off-farm income presents compelling evidence for the positive relationship between income diversification and higher total income, which points to income diversification as a way out of poverty. However, other studies have shown that wealthier households have greater opportunities to enter the non-farm labor market (Barret et al., 2001), and that once they have accessed the high end of the wage labor market, they tend to stay there and build up advantages over time (Tschirley and Benfica, 2001). Less privileged community members are likely to face entry barriers to participate in the non-farm employment sector, further intensifying welfare disparities within the population.

4.2.1.1 Model Specification

The number of households reporting wage earnings and self-employment earnings is 9% and 49% respectively. This model falls under the category of corner solution models (Gujarati, 2003; Wooldridge, 2002), in which the dependent variable takes a zero value for a non-trivial part of the population and the values greater than zero are continuous.

The presence of a large number of zeros for the dependent variable leads to biased and inconsistent parameter estimates from OLS. Excluding the zero observations would not guarantee that $E(u_i)=0$ which is a violation of the Gauss-Markov Theorem (Wooldridge, 2002).

The Tobit model is often used in corner solution samples. It is commonly expressed in the following form:

$$Y_i = \beta_1 + \beta_2 X_i + u_i \quad \text{if RHS}>0 \qquad (3)$$
$$= 0 \quad \text{otherwise}$$

Where RHS represents right-hand side explanatory variables and Y_i is the observed value of the dependent variable.

The technique for Tobit models involves maximum likelihood (ML) estimation. The method defines a latent variable Y_i^* as:

$$Y_i^* = X_i\beta + \varepsilon_i \qquad \text{where } \varepsilon_i \sim \text{Normal } (0, \sigma^2) \qquad (4)$$

The latent variable satisfies the classical liner model assumptions; it has a standard normal and homoskedastic distribution with a conditional mean (Gujarati, 2003).

The relationship between the observed Y_i and the latent variable Y_i^* is expressed as follows:

$$Y_i = \begin{cases} Y_i^* & \text{if } Y_i^* > 0 \\ 0 & \text{if } Y_i^* < 0 \end{cases}$$

or alternatively, $Y_i = max\ (0, X_i\beta + \varepsilon_i)$ (5)

Because Y_i^* is normally distributed, Y_i has a continuous distribution over strictly positive values. The density of Y given X is the same as the density of Y_i^* given X for positive values. It follows that:

$$P\ (Y_i^* \leq 0 |\ X_i) = 1 - \Phi\ (X_i\beta / \sigma) \text{ and} \qquad (6)$$
$$P\ (Y_i^* > 0 |\ X_i) = (1/\sigma) - \varphi\ [(Y_i - X_i\beta)/\sigma] \qquad (7)$$

Combining both probabilities we obtain the log likelihood function:

$$l_i(\beta, \sigma) = 1\ (Y_i \leq 0)\ \log\ [1 - \Phi\ (X_i\beta/\sigma)] + 1(Y_i > 0)\ \log\ \{(1/\sigma) - \varphi\ [(Y_i - X_i\beta)/\sigma]\} \quad (8)$$

Where l_i is the log likelihood function
Φ is the standard normal cumulative distribution function (cdf)
φ is the standard normal density
σ is the standard deviation

Finally, the estimates of β and σ are obtained by maximizing the log likelihood.

One shortcoming of the Tobit model is that it calculates the determinants of the probability of an outcome being positive and the magnitude of the effect of these determinants on the dependent variable simultaneously. The model estimates only one set of coefficients, which are assumed to be equal for both equations (the probability and the level of output). However, it is not always reasonable to assume that the explanatory variables should be the same for both estimations and affect the probability of $y > 0$ and the total value of y in the same way. Lin and Schmidt (1984) illustrate this providing an example of fire loss using a random sample of buildings. If the dependent variable is the "value of loss due to fire" then the Tobit model would assume, for example, that the age of the houses would have the same effect on the probability of a fire as it would have on the effect of total value lost in the fire. However, it is possible that while newer houses may have a lower probability of fire (due to improved wiring, updated appliances, and modern materials), once involved in a fire, the losses from newer houses could be considerably higher.

For this analysis, it is unclear how some of the variables will affect the probability and the level of Y respectively. For example, the age of the household head could be negatively associated with the probability of accessing a remunerated job, but once it is accessed, the individual could have greater earnings due to accumulated experience. A model that estimates the probability and amount equations separately is preferred since it will reveal more information about the effect of the independent variables on access to different income sources.

The Cragg Tobit alternative model (Cragg, 1971) presents a variation of the Tobit model that allows for the two estimations to be determined in two different stages or hurdles. In this study, the "double hurdle" model takes into account that individuals have to pass two hurdles to participate in off-farm work. First they have to desire to participate in off-farm work and second they have to be able to overcome potential barriers to join the labor market such as transaction costs, gender barriers, etc. (Woldehanna et al., 2000).

Non-farm employment can be treated as a latent variable, which may be observed when a household decides to participate in non-farm work and is able to participate in the labor market. Let D_i be the household's decision to work outside their own farm. As Woldehanna et al. (2000:2) point out, "in an agricultural household model an individual is willing to participate in non-farm work when his reservation wage (w_{ri}), is less than the non-farm wage (w_{mi}) net of commuting and expected transaction costs" (Woldehanna et al., 2000:2). D_i or the participation decision can be expressed as a latent variable:

$$D_i^* = X_i' \gamma + \mu_i \qquad where \ \mu_i \sim Normal\ (0, \sigma^2) \qquad (9)$$

$$D_i = \begin{cases} 1 & \text{if } D_i^* > 0 \text{ or } (w_{ri} < w_{mi}) \\ 0 & \text{if } D_i^* < 0 \text{ or } (w_{ri} \geq w_{mi}) \end{cases} \quad (10)$$

The next step is to specify the relationship between the participation decision and the level of the outcome. The Cragg double-hurdle model is specified by modifying the standard Tobit model where is a latent variable as defined in equation (4). The relationship between the latent variable Y_i^*, the observed variable Y_i, and the participation decision can be expressed as follows:

$$Y_i = \begin{cases} Y_i^* & \text{if } Y_i^* > 0 \text{ and } D_i = 1 \\ 0 & \text{if } D_i = 0 \ (Y_i^* \leq 0) \end{cases} \quad (11)$$

In this specification, the model allows separate sets of factors to influence the decision to participate in non-farm employment and the level of non-farm earnings. X_i' and X_i are the vectors of explanatory variables that affect the two-stage processes. The error terms in both equations are assumed to be normally and independently distributed, which implies that any unobservable variables do not affect both stages.

In the independent double hurdle model, the probability that non-farm income (Y_i) is zero is the product of the probability that the latent variable representing non-farm income (Y_i^*) is negative and the probability that (Y_i^*) is positive, introducing the possibility that the household would chose to participate in the non-farm labor market but there are barriers that prevents it from doing so (Woldehanna et al., 2000). Consequently, the log likelihood function for the independent double hurdle takes the form:

$$l_i = 1(Y_i \leq 0)\ log[1 - \Phi(X_i' \gamma)\ \Phi(X_i\beta/\sigma)] + 1(Y_i > 0)\ log\{[(1/\sigma)\ \varphi[(Y_i - X_i\beta)/\sigma]\ \Phi(X_i' \gamma) \quad (12)$$

(a) (b)

The first term (a) corresponds to the contribution of all the observations with an observed zero. It indicates that the zero observations are obtained not only from the households that decided not to participate in the non-farm labor market but also from the households that decided to participate but could not do so due to entry barriers.

As with the Tobit model, the parameter estimation of γ, β and σ is done through maximum likelihood. The parameter results can be obtained using the command Craggit built for Stata9 (Burke, 2009).

4.2.1.2 Model Estimation

Given the advantages of Cragg over the Tobit model, the former is used to estimate the probability of households receiving non-farm income and the determinants of the total non-farm household earnings.

The independent variables selected for the analysis are the same as were used in the model for total farm income as these are also hypothesized to influence the probability of participating in non-farm employment and the total value of non-farm earnings. The Cragg model for the following analysis can therefore be expressed as:

$$P(D_i = 1 | X_i) = \gamma X_i + \mu_i \qquad (Tier\ 1) \qquad (13)$$

$$Ln\ Y_i = \alpha + \beta X_i + \varepsilon_i \qquad (Tier\ 2) \qquad (14)$$

Where D_i is the participation decision variable which takes the value 1 if the household decides to enter the non-farm employment sector

Y_i is the total value of earnings from non-farm employment

X_i is the vector of household and community characteristics, assumed to be the same for equations (1) and (2)

γ is the vector of coefficients associated with the X_i in the probability equation

β is the vector of coefficients associated with X_i in continuous equation

α is the intercept in the continuous equation

4.2.1.3 Empirical Results of GMA Effect on Wage Employment

As mentioned in the previous section, one of the advantages of the Cragg model is that it allows one to obtain different coefficients for the two stages, making it possible to analyze the impact of the explanatory variables on both the household's probability of entering the wage labor market and on the total value of the wage earnings. The results of the Cragg estimation are presented in Table 12.

The first two tiers show the results of the probit and continuous regressions respectively. For easier interpretation, the coefficient for the first tier is displayed as the marginal effect in the third column (probit mfx) and the second tier is displayed as average partial effects (APE) in the last two columns (for calculation of APEs, see Burke, forthcoming). The third column (probit mfx) represents the marginal effects of the independent variables on the probability of participating in the wage labor market. The fourth column (CAPE) represents the average partial effect[11] on the conditional expected value of wage earnings $E(Y|X_i, Y>0)$. This coefficient measures the effect of the independent variables

[11] The terms "marginal effect" and "partial effect" are used to be consistent with the literature on these techniques but refer to the same thing.

on the level of earnings only for the households who participate in wage earnings. The fifth column (UAPE) represents the average partial effect of the unconditional expected value $E(Y|X_i)$. This coefficient measures the effect of the independent variables on the level of wage earnings, unconditional on household participation in wage income. The UAPEs are therefore dependent on both stages of the estimation, the probit and the truncated regression, and their interpretation must consider both results. From a policy perspective, the UAPEs represent the overall expected impact of a GMA on the variable of interest, and are therefore useful as a summary indicator of the benefit of the GMA approach.

Table 12. Cragg results for wage employment earnings

Variable description	Tier 1	Sig.	Tier 2	Sig.	Marginal Effects Probit	Sig.	CAPE	Sig.	UAPE	Sig.
Intercept	-3.084	***	15.533	***	n/a		n/a		n/a	
Age of household head in years	-0.004		-0.017		-0.0004		-0.017		-0.009	
Sex of household head (=1 if male)	0.259	**	-3.172	**	0.023	**	-3.109	*	0.234	
Max. education hh member (years)	0.156	***	0.169		0.015	***	0.166		0.331	***
Number of children (<15 years)	-0.008		-0.306		-0.001		-0.300		-0.043	
Number of female adults (15-60 years)	0.001		0.166		0.0001		0.162		0.175	
Number of male adults (15-60 years)	0.015		2.502	***	0.001		2.452	**	0.259	*
Distance to nearest road (km)	-0.008	**	-0.016		-0.001	**	-0.016		-0.018	
Cropped area (in hectares)	-0.046		-0.086		-0.005		-0.085		-0.101	
Value of consumption assets (ZMK)	0.017	***	0.021		0.002	***	0.021		0.037	***
Value of production assets (ZMK)	-0.010	***	-0.002		-0.001	***	-0.002		0.035	***
Population density (in sq km)	0.002	***	0.000		0.003	***	0.0002		0.004	***
Infrastructure (#)	0.028	*	-0.207		0.003	*	-0.203		0.038	
Tourist lodge in the community (=1)	0.476	***	0.718		0.066	***	0.703		1.031	***
Prime GMA (=1)	0.577	***	-0.090		0.078	***	-0.088		1.160	***
Secondary or specialized GMA (=1)	0.567	***	1.046		0.074	***	1.025		1.245	***
Number of observations: 2264										
Log likelihood: -527.9										

Source: Calculated from survey data.
*10% significance level, **5% significance level, ***1% significance level
n/a: not applicable

The results of the probit (third column) have in general the *a priori* expected signs. Male headed and better educated households have a higher probability of entering the wage labor market (De Janvry and Sadoulet, 2001; Reardon, 1997). Distance to the nearest all-weather road also has the expected sign; an additional 10 km from a main road decreases the probability of being employed by 1% (a rather low figure, though it should be noted that only 9% of the sampled population have such employment). Population density and infrastructure are also found to be positively associated with the probability of wage earnings; more densely populated areas with better infrastructure are likely provide opportunities for wage employment. The existence of a tourist lodge has a comparatively large impact on the probability of wage earnings: households living in communities where there is a tourist lodge are 6.6% more likely to earn a wage compared to households living in areas in which there is no tourist accommodation.

The coefficient for the variable representing consumer durable assets has a positive and significant effect on access to wage labor. This can be an indication that, as highlighted by the empirical literature on non-farm income, wealth and participation in wage employment are typically positively associated. Conversely, agricultural productive assets and cropped area decrease the probability of participating in wage employment. The negative association may reflect the cumulative effect over time of decisions to focus on agriculture. This result could also point to the fact that households that do not access enough land to attain food security may search for off-farm opportunities to complement their incomes (Beyene, 2008). The negative or statistically insignificant relationship between land holdings and participation in wage employment is consistent with the findings of other studies (Tschirley and Benfica, 2001; Yúnez-Naude and Taylor, 2001).

The main variable of interest, the GMA effect, shows positive and significant results. Households living in prime GMAs are 7.8% more likely to be employed than households living in non-GMAs. The results are similar for households living in secondary or specialized GMAs, in which they are 7.4% more likely to enter the wage labor market. This result can be interpreted as being a consequence of greater employment opportunities in GMAs through the tourism sector and through the employment of scouts; however, it could also suggest that households living in GMAs have lower reservation wages due to lower agricultural productivity and higher chances of crop destruction (push factors), and therefore are more prone to search for off-farm wage employment opportunities, though not necessarily outside the agricultural sector. The second stage provides useful insights for a more careful interpretation of results.

Significance testing levels for CAPEs and UAPEs was done through bootstrapping. In the case of CAPEs, only the sex of the household head and the number of male adults in the households are significant. The CAPE for the variable representing sex of household head indicates that wage earnings are three times lower for those households that participate in wage employment, which contradicts the *a priori* expectation. However, the number of male adults is positively associated with level of wage earnings for those households engaged in the labor market.

The interpretation of UAPEs takes into account the entire population and the results of both tiers. For example, the UAPE indicates that the prime GMA effect on the level of wage earnings is positive and statistically significant (116%) despite a negative CAPE (-8.8%). The positive UAPE reflects the effect of the higher probability (7.8%) of a household having wage earnings when living in a prime GMA, which outweighs the lower wage incomes in prime GMAs for those engaged in the labor market. In summary, the UAPE indicates that, in the absence of any *ex ante* knowledge of a household's employment status, households in prime GMAs can be expected to earn 116% more on average from wage labor than households outside GMAs. Note also that this effect obtains even while controlling for the presence of a tourist lodge. Due probably in part to this control for a lodge, results are similar in secondary or specialized GMAs: households living in such GMAs earn, on average, 124% more than households living outside GMAs.

One explanation for the negative CAPE for prime GMAs is the effect of in-migration on local wages. Prime GMAs are likely to attract job seekers in search of job opportunities given by the tourism sector which could eventually saturate the labor market and drive wages down.

An analysis of the GMA effect on wage income by welfare segments in presented in Table 13. The Cragg estimation was conducted by welfare subsamples (lowest two wealth quintiles and highest two wealth quintiles) using the consumer durable assets as a welfare indicator. The results clearly show a positive and significant GMA effect on the probability and level (UAPE) of wage employment for all households, poor and non-poor. The effect is slightly higher for the highest two quintiles though this difference might not be statistically significant.

Table 13. GMA effect on wage income by welfare levels

GMA type/wealth quintile	Tier 1	Tier 2	Probit mfx	CAPE	UAPE
Prime GMAs					
Lowest 2 wealth quintiles	0.618***	-0.38	0.057***	0.34	0.784**
Top 2 wealth quintiles	0.762***	-1.406	0.144***	-1.400	1.726***
Secondary GMAs					
Lowest 2 wealth quintiles	0.655***	2.055	0.057***	1.838	0.900**
Top 2 wealth quintiles	0.424**	-0.290	0.071**	-0.288	1.031**

Source: Calculated from IGMAW survey.
Note: The significance level of CAPE could not be calculated.
See full results in Appendix C.

4.2.1.4 Empirical Results of GMA Effect on Self Employment

The next analysis examines the GMA effect on self-employment in a similar way. The results of the Cragg estimation are presented in Table 14.The negative sign of the probit marginal effects for age suggests that older headed households are less likely to be self-employed. Interestingly though, the CAPE shows that those that are self-employed tend to have higher returns to labor than younger households, possibly due to the effect of their accumulated experience. The UAPE has a negative sign, indicating that the negative effect on the probability of being self-employed outweighs the positive effect on the level of earnings. Education has the opposite impact here compared to its impact on wage earnings; households with more educated members are less likely to be self-employed, as perhaps they tend to be hired in the wage labor market. Education also has a negative impact on the level of earnings as indicated by the sign and significance of the UAPE and the CAPE. The number of children and adults are positively associated with self-employment; the extra labor force can free time for the household head to attend to their own business, and may also push the head into starting such businesses. These variables also have a positive effect on the level of earnings (both CAPE and UAPE are positive and significant). Hectares of cropped area are negatively associated with the probability of self-employment, arguably for the same reasons as for wage employment. The coefficient of the value of consumer durable assets is positive, which follows the notion that better off households are more likely to participate in off-farm activities.

Table 14. Cragg estimation results: determinants of the probability and total level of self-employment earnings

					Marginal Effects					
Variable description	Tier 1	Sig.	Tier 2	Sig.	Probit	Sig.	CAPE	Sig.	UAPE	Sig.
Intercept	0.031		11.380	***	n/a		n/a		n/a	
Age of household head in years	-0.010	***	0.056	***	-0.004	***	0.052	***	-0.037	**
Sex of household head (=1 if male)	0.137	*	0.843		0.055	*	0.787		1.267	*
Max. education hh member (years)	-0.032	**	-0.183	*	-0.013	**	-0.171	*	-0.287	***
Number of children (<15 years)	0.029	*	0.089		0.012	*	0.083		0.231	*
Number of female adults (15-60 years)	0.101	*	1.781	***	0.040	*	1.663	**	1.456	***
Number of male adults (15-60 years)	0.066	*	1.241	***	0.026	*	1.158	**	0.984	***
Distance to nearest road (in km)	0.003		-0.020		0.001		-0.019	*	0.110	
Cropped area (in hectares)	-0.106	***	0.019		-0.042	***	0.018		-0.675	***
Value of consumption assets (ZMK)	0.006	*	0.016		0.002	*	0.015		0.043	*
Value of production assets (ZMK)	0.00001		-0.002		0.000		-0.002		0.035	
Population density (in sq km)	0.0003		0.007	**	0.000		0.0070		0.005	
Infrastructure (#)	0.045	***	-0.072		0.018	***	-0.067		0.261	***
Tourist lodge in the community (=1)	0.057		-0.494		0.023		-0.461		0.146	
Prime GMA (=1)	0.174	*	0.084		0.069	*	0.078		1.164	*
Secondary or specialized GMA (=1)	-0.132	*	0.330		-0.053	*	0.308		-0.707	
Number of observations: 2264										
Log likelihood: -5144.9										

Source: Calculated from survey data.
***1% significance level, **5% significance level, *10% significance level
n/a: not applicable

Higher levels of infrastructure impacts the probability that a household is self-employed, though as in the case of wage earnings, it has a negative (though insignificant) effect on the level of earnings for the sub-sample of self-employed households (CAPE). This might be the effect of excess labor supply in areas where services and infrastructure attract job seekers.

Finally, prime GMAs have a significant and positive impact on the probability of being self-employed, though both the magnitude and the significance are lower than for wage earnings. As advanced in the introduction of Chapter 4, one of the benefits of living in GMAs is the generation of opportunities for micro-enterprises as a result of the tourism sector; for example, the increasing population and economic activity in Lupande GMA creates opportunities for small business (selling mobile phone "talk time", owning restaurants, providing accommodation for local workers). In secondary and specialized GMAs, the GMA effect on the probability of being self employed is negative and significant, which does not have an intuitive explanation. Additional data is needed to formulate a sound hypothesis for this result.

An analysis of the GMA effect on self-employment earnings by welfare level of the household is presented in Table 15. Poorer households living in prime GMAs seem to enjoy higher chances to earn income from small businesses and obtain higher levels of income than those in non-GMAs. However, for those that live in secondary or specialized GMAs the effect is the opposite. For the two upper quintiles the GMA effect is insignificant in probability and level.

Table 15. GMA effect on self-employment earnings by welfare levels

GMA type/wealth quintile	Tier 1	Tier 2	Probit mfx	CAPE	UAPE
Prime GMAs					
Lowest 2 wealth quintiles	0.360**	-1.167	0.143**	-1.107	1.680*
Top 2 wealth quintiles	-0.151	1.435	-0.060	1.310	-0.352
Secondary GMAs					
Lowest 2 wealth quintiles	-0.223*	-1.446	-0.087*	-1.371	-1.953*
Top 2 wealth quintiles	-0.106	0.728	-0.042	0.665	-0.379

Source: Calculated from IGMAW survey data.
Note: The significance level of CAPE could not be calculated.
See full results in Appendix C.

4.2.2 GMA Effect on Crop Agriculture

We analyze the GMA effect on crop agriculture with the same Cragg model and same explanatory variables as were used for off-farm earnings. The dependent variables for this model are the probability of reporting income from crop agriculture and the total value of crop agriculture. The results are presented in Table 16.

Table 16. Cragg estimation results: determinants of the probability and total level of crop agriculture

					Marginal Effects					
Variable description	Tier 1	Sig.	Tier 2	Sig.	Probit	Sig.	CAPE	Sig.	UAPE	Sig.
Intercept	0.753	***	20.101	***	n/a		n/a		n/a	
Age of household head in years	0.001		-0.025		0.0001		-0.02		-0.02	
Sex of household head (=1 if male)	-0.028		-1.483	*	-0.001		-1.172		-1.15	
Maximum education hh member (years)	-0.030	**	0.041		-0.002	*	0.033		-0.07	
Number of children (<15 years)	0.033		0.434	*	0.002		0.343		0.421	
Number of female adults (15-60 years)	-0.070		0.359		-0.004		0.284		0.022	
Number of male adults (15-60 years)	0.015		0.126		0.001		0.099		0.138	
Distance to nearest road (in km)	-0.005	*	0.005		-0.0002	*	0.004		-0.01	
Cropped area (in hectares)	1.440	***	3.163	***	0.076	***	2.5		7.054	
Value of consumption assets (ZMK)	-0.001		0.079	*	-0.00003		0.062		0.054	
Value of production assets (in ZMK)	0.007	**	0.105	***	0.0004	*	0.083		0.073	
Population density (in sq km)	-0.001	***	-0.024	***	-0.0001	***	-0.019		-0.02	
Infrastructure (#)	0.009		-0.351	*	0.0005		-0.278		-0.22	
Tourist lodge in the community (=1)	-0.357	*	0.974		-0.026	*	0.77		-0.49	
Prime GMA (=1)	0.016		-0.382	***	0.001		-0.302		-0.22	
Secondary or specialized GMA (=1)	-0.328	***	-8.115	***	-0.021	***	-6.415		-6.88	
Number of observations: 2264										
Log likelihood: -8,517.6										

Source: Calculated from survey data.
*10% significance level, **5% significance level, ***1% significance level
n/a: not applicable
Note: the bootstrapping of the CAPE and UAPE could not be calculated using the available programming

The results of the probit show that the probability of crop agriculture is negatively associated with the level of education, reflecting the possibility that better educated households have employment opportunities outside the farming sector. Distance to roads has a negative impact on the probability of farming, possibly a reflection of the disincentive that distance to markets can have on the decision to engage in farming activities. Population density and the existence of a tourist lodge in the community are negatively associated with the probability of farming, both variables being linked to the existence of off-farm employment opportunities. Finally, the GMA effect on the probability of having crop agriculture is positive though insignificant for prime GMAs, and negative and significant in secondary or specialized GMAs.

With regard to the GMA effect on the value of crops, though the significance levels for the UAPE and CAPE could not be computed using the available bootstrapping program, it is notable that all the coefficients are negative, both for prime (GMA1) and secondary or specialized GMAs (GMA2). This could be the result of a number of influences, including the effect that wildlife damaged crops can have on the value of crops, the effect of encroachment due to in-migration (which may put pressure on access to land) or the availability of off-farm employment (which may reduce the time dedicated to farming).

An analysis of the GMA effect on crop agriculture by wealth level of the household is presented in Table 17. It should be noted again, the significance levels for the CAPEs could not be computed using the available bootstrapping program. Still, the results suggest that GMA2 could have a negative effect on the probability of engaging in cropping agriculture and the income of those who do engage, both for the lowest two quintiles and the upper two quintiles. This can perhaps be explained by the fact that secondary or specialized GMAs may generate lower revenues from hunting than prime GMAs to be invested in hiring of scouts that can help protect the crops.

This result might also explain why all households living in secondary or specialized GMAs, and those from the poorest segment of prime GMAs, do not earn higher overall incomes by being in the GMA (see Model 1). For households living in secondary or specialized GMAs, the gains from access to wage earnings appear to be offset by negative effects on business income and (though these are not statistically significant) crop income. For the poorest households in prime GMAs, their higher earnings off the farm appear to be more than offset by lower earnings in crop income.

Table 17. GMA effect on crop agriculture by welfare level

GMA type/wealth quintile	Tier 1	Tier 2	Probit mfx	CAPE	UAPE
Prime GMAs					
Lowest 2 wealth quintiles	-0.001	-1.027	-0.0001	-0.781	-0.702***
Top 2 wealth quintiles	-0.060	-0.661	-0.0004	-0.557	-0.673
Secondary GMAs					
Lowest 2 wealth quintiles	-0.399**	-5.661*	-0.047**	-4.304	-5.189
Top 2 wealth quintiles	-0.392*	-9.113***	-0.003	-7.683	-8.125

Source: Calculated from IGMAW survey.
Note: The significance level of CAPE could not be calculated.
See full results in Appendix C.

4.2.3 Impact of GMA policies on crop damage

Human-wildlife conflict represents one of the biggest challenges for communities living in GMAs. As mentioned in Chapters 1 and 2, farmers are routinely affected by crop destruction, mainly by elephants which have proven to be extremely difficult to control. Despite efforts from NGOs and ZAWA to help communities with electric fences and other strategies to keep elephants away from crops (e.g., chili fences, beating of drums), the problem continues to be serious in areas where significant elephant populations are found. In addition, the combined efforts from ZAWA, hunting and photographic safari outfitters and CRBs to control poaching in popular tourist areas may exacerbate the problem for households whose prime economic activity is farming. The hypothesis is that households living in well stocked GMAs are more likely to experience crop damage and report higher values of crop loss than households living in lower stocked GMAs and in non-GMAs.

4.2.3.1 Model estimation

Since only 14% of respondents reported crop loss, the analysis uses a Cragg model to examine the GMA effect on both the probability of sustaining crop damage and the value of crop loss. The model is specified analogously to the case for non-farm employment:

$$P(CD_i = 1 \mid X_i) = \gamma X_i + \mu_i \qquad \textit{(Tier 1)} \qquad (15)$$

$$Ln\, Y_i = \alpha + \beta X_i + \varepsilon_i \qquad \textit{(Tier 2)} \qquad (16)$$

Where CD is the crop damage variable which takes the value 1 if the household reported crop loss

Y_i is the total value of crop loss

X_i is the vector of household and community characteristics, assumed to be the same for equations (1) and (2)

γ is the vector of coefficients associated with X_i in the probability equation

β is the vector of coefficients associated with X_i in the continuous equation

α is the intercept in the continuous equation

The selected variables for the analysis are shown in Table 18. The model includes four variables not included in previous models: the percentage of households that reported crop damage, the value of crop damage (these first two are the dependent variables), the number of scouts hired in the community, and the total value of harvest, which is inclusive of the reported value of harvest and the reported value of crop lost due to wildlife, to control for the effect that the total value of harvest will have on crop damage.

Table 18. Comparison between variable means for the full sample and the GMA and non-GMA subsamples

		Subsamples		
Variable description	Full sample	GMAs	Non-GMAs	Sig.[a]
Number of households	2,717	1,574	1,143	
Number of households that reported crop damage	369	251	110	
Value of crop damage	28,423	30,079	26,140	
Age of household head in years	42.46	41.00	44.48	***
Sex of household head (=1 if male)	0.74	0.73	0.76	**
Household size	5.28	5.08	5.57	***
Distance to nearest all-weather road (in km)	5.09	6.08	3.80	***
Cropped area (in hectares)	0.92	0.93	0.92	
Value of consumption durable assets (ZMK)	401,588	285,362	561,641	**
Value of production durable assets (ZMK)	618,036	256,729	1,115,584	***
Population density (in sq km)	35.2	41.4	26.9	***
Infrastructure (#)	3.62	3.64	3.59	
Number of scouts hired in the community (#)	1.00	1.56	0.24	
Total value of harvest (ZMK)	120,884	628,249	681,214	
Prime GMA (=1)	0.17	0.30	-	n/a[b]
Secondary or specialized GMA (=1)	0.20	0.35	-	n/a

Source: Calculated from IGMAW survey data
*10% significance level, **5% significance level, ***1% significance level

The means for the GMA and non-GMA subsamples indicate that on average, more households report crop damage in GMAs compared to non-GMAs (16% vs. 9.6%) as expected. However, while the average value of crop loss is also higher in GMAs, this difference is not statistically significant. The average number of scouts hired in the community is also higher within GMAs (1.6) compared to non-GMAs (0.2).

The effect of the number of scouts on the probability and value of crop damage is difficult to predict *a priori*. On one hand, more scouts could more effectively control poaching, thereby exacerbating the human-animal conflict by maintaining higher animal populations. On the other, scouts can help communities scare away offending elephants, or in rare occasions even kill them with the permission of ZAWA. The second additional variable included in this analysis is the total value of harvested plus lost crop, which controls for the impact that higher value crops have in the potential total value of crop loss.

It is suspected that the variable number of scouts may be endogenous to the crop damage regression, since higher stocks of wildlife (and thus higher crop damage) are likely to lead to the hiring of more scouts, using revenues from hunting through the CBNRM programs, especially in GMAs where wildlife is abundant and revenues are sufficient to support adequate staff. This possibility was tested using stata's ivtobit command and the Hausman test for endogenous regressors (Hausman, 1978). Instruments for number of scouts were a dummy variable indicating whether the VAG had received funds from ZAWA, and three park system dummies. All four instruments were statistically significant above 0.01, and the Hausman test generated a Wald p-value of 0.33, which leads to failure to reject the null hypothesis of exogeneity. Therefore, we conclude that the number of scouts is not an endogenous regressor in the two-stage model of crop damage associated with wildlife conflicts (full results in Appendix D).

4.2.3.2 Empirical estimation and results

Household size has a negative impact on the probability of crop loss, indicating that access to extra manpower can help contain wildlife and protect the fields. The total value of loss can also be reduced, as indicated by the signs of the CAPE and UAPE. The distance to all weather roads is positively associated with the probability of crop damage, suggesting that, logically, more remote places are likely to have greater wildlife populations. Cropped area and total value of the harvest are control variables to account for the effect that larger areas under cultivation and higher value crops (or higher yields per unit area) will have in the probability and total value of crop loss. As expected, both are positively associated with the probability of crop damage, though interestingly, for those households that suffered crop damage, the cultivated area is negatively associated with the total value of loss (CAPE).

Table 19. Cragg results: GMA effect on probability and total value of crop loss

Variable description	Tier 1	Sig.	Tier 2	Sig.	Marginal Effects Probit	Sig.	CAPE	Sig.	UAPE	Sig.
Intercept	-2.324	***	5.587		n/a		n/a		n/a	
Age of household head in years	-0.002		0.013		-0.0002		0.002		-0.001	
Sex of household head (=1 if male)	-0.041		0.249		-0.006		0.032		-0.046	
Household size (#)	-0.039	*	-0.020		-0.006	*	-0.003		-0.076	*
Distance to nearest road (km)	0.006	*	-0.014		0.001	*	-0.002		0.009	*
Cropped area (in hectares)	0.068	*	-0.003	*	0.010	*	-0.051	*	0.077	
Value of consumption assets (ZMK)	-0.002		-0.015		-0.0003		0.000		-0.005	
Value of production assets (ZMK)	-0.004	*	-0.394		-0.001	*	-0.002		-0.009	*
Population density (in sq km)	0.000		-0.001		-0.00002		0.000		0.000	
Types of existing Infrastructure (#)	-0.006		-0.014		-0.001		-0.002		-0.013	
Number of scouts (#)	0.025		0.047		0.004		0.006		0.053	*
Total value of harvest (in ZMK)	0.041	***	0.189	***	0.006	***	0.024	***	0.102	***
Prime GMA (=1)	0.780	***	0.080		0.161	***	0.010		1.486	***
Secondary or specialized GMA (=1)	0.643	***	0.172		0.122	***	0.022		1.238	***
Number of observations: 2266										
Log likelihood: -1513.7										

Source: Calculated from IGMAW survey data
*10% significance level, **5% significance level, ***1% significance level

The number of scouts hired in the community has a significant and positive effect on both the probability and the value of crop damage. This finding could suggest effective anti-poaching patrol which may help to increase wildlife population; but it could also reflect the likely endogeneity of this variable, since higher stocks of wildlife are likely to lead to the hiring of more scouts, using revenues from hunting through the CBNRM programs, especially in GMAs where wildlife is abundant and revenues are sufficient to support adequate staff.

Finally, the GMA effect on the probability of crop loss is, as expected, positive and significant, more so in prime GMAs than in secondary or specialized. The results clearly confirm the hypothesis that households are more likely to be affected by crop loss in better stocked GMAs. As mentioned before, the human-animal conflict represents one the biggest threats for the success of CBNRM programs.

An analysis of the GMA effect on crop damage by wealth level of the household is presented in Table 20. Households seem to be equally affected by crop damage regardless the welfare level. There are slight differences in the probability and level of crop damage but in general the effect is significant and positive for all households.

Table 20. GMA effect on crop damage by welfare level

GMA type/wealth quintile	Tier 1	Tier 2	Probit mfx	CAPE	UAPE
Prime GMAs					
Lowest 2 wealth quintiles	0.922***	-1.246	0.185***	-1.185	1.388***
Top 2 wealth quintiles	0.635***	1.080	0.132***	0.951	1.473***
Secondary GMAs					
Lowest 2 wealth quintiles	0.544***	-0.864	0.087***	-0.821	0.804**
Top 2 wealth quintiles	0.712***	2.072*	0.156***	1.826	1.794***

Source: Calculated from IGMAW survey data.
Note: Significance test for CAPE could not be calculated.
See full results in Appendix C.

The table below presents a summary of the results of the Cragg model by welfare levels (based on the UAPEs). The GMA effect on total household income is positive for the non-poor households. When disaggregating by source of income however we see that poorer households living in prime GMAs do enjoy higher levels of wage and self employment income compared to those living outside GMAs. This effect might be offset by the negative impact on crop harvest, which neutralizes the overall effect on total income. The GMA effect on crop loss is clearly significant (and positive) across all types of GMAs and all levels of welfare.

Table 21. Summary of Cragg results on sources of income by welfare level.

Type of income	Prime GMA			Secondary/Specialized GMA		
	Overall	Non-poor	Poor	Overall	Non-poor	Poor
Total	+ sig	+ sig	insig	insig	insig	insig
Wage	+ sig	+ sig	+ sig	+ sig	+ sig	+ sig
Self employment	+ sig	insig	+ sig	insig	insig	- sig
Crop harvest	- ?	insig	- sig	- ?	insig	insig
Crop loss	+ sig	+ sig	+ sig	+ sig	+ sig	+ sig

Source: Calculated from IGMAW survey data.

5. SUMMARY OF RESULTS AND CONCLUSIONS

The main goals of this study were to estimate the effect of living in a GMA on household income and to examine the avenues through which any effect might be generated. These questions are evaluated using econometric techniques that seek to isolate the variables of interest. Three research questions are considered. The first question uses OLS to explore the relationship between GMAs and total household income. The second research question uses a Cragg double-hurdle model to evaluate the effect of GMAs on household participation in and earnings from cropping agriculture, wage employment, and self employment). Finally, the third model, which also uses the Cragg method, seeks to identify the extent to which households living in GMAs are more prone to crop damage.

The results from the first model suggest that prime GMAs positively affect household income, while secondary and specialized GMAs have no effect. This result reinforces the findings in Bandyopadhay and Tembo (2009) who also found a positive association between GMAs and welfare, measured by expenditure. Another result in common with their study is that only households in the upper two quintiles are found to benefit from living in GMAs. However, there is a major difference with respect to the magnitude of the GMA effect. While they find an overall GMA effect (without distinguishing between stocking levels of GMAs) on household expenditures of 66%, the prime GMA effect on household income found in Model 1 in this study is 17%, and insignificant for secondary or specialized GMAs. Another difference emerges when considering the effect of park systems. Bandyopadhay and Tembo (2009) find a very large GMA effect in Bangweulu (73%) and Luangwa (74%) while the effect for Kafue and Lower Zambezi is negative and insignificant. In contrast, this study finds a positive but lower GMA effect in Luangwa (18%) and a positive GMA effect in Kafue (13.5%). The latter results seem sensible, considering the distribution of prime GMAs by park (higher impacts are found where more prime GMAs were sampled).

The results in Model 1 also provide new findings that go beyond those in Bandyopadhay and Tembo (2009). Model 1 supports the hypothesis that the level and variety of wildlife positively influences the income levels of households. This is reflected by the sign and magnitude of the coefficients for the variables representing prime and secondary or specialized GMAs. Specifically, households living in prime GMAs enjoy 17% higher income compared to non-GMA areas. The effect for households living in secondary or specialized GMAs is positive, though insignificant, suggesting that areas with lower wildlife populations have less capacity to generate income. Additionally, the first model highlights the uneven distribution of the potential benefits to living in a prime GMA, which is a common finding in the literature of poverty reduction and rural non-farm income.

Model 2, which investigates the GMA effect on non-farm income and on crop damage, represents an additional new contribution of this study. These results suggest that GMAs have a positive effect on the probability and the value of non-farm earnings. Households living in prime GMAs have a 7.8% higher chance of being employed in the wage labor market than households living in non-GMAs. Similarly, households living in secondary or specialized GMAs have a 7.4% higher chance of participating in the wage labor market. The overall effect (UAPEs) of both types of GMAs on the expected wage earnings is positive, though the effect of prime GMAs on the level of wage earnings for the subsample of households that reported a wage income (CAPE) is negative. This seemingly contradictory result suggests that although GMAs provide more opportunities for households to engage in wage labor, they may also attract job seekers which in turn drive wages down. Another interesting finding is the positive effect of the presence of a tourist lodge in the area on the probability of participating in non-farm income and on the level of wage earnings, confirming the importance of the tourism sector for the generation of non-farm employment opportunities.

Results are similar regarding the GMA effect on income from self-employment. Households living in prime GMAs are 6.9% more likely to be self-employed than those living outside GMA areas. The UAPE indicates that households in prime GMAs are expected to earn 116% more than those outside GMAs. The results for secondary and specialized GMAs however do not show an effect on self-employment. The GMA effect on probability of self-employment is negative and significant but the CAPE and UAPE are insignificant.

The results from the GMA effect on crop damage clearly support the hypothesis that households living in areas with higher wildlife populations suffer more intensely from crop destruction. This reaffirms the statements from people interviewed in two GMAs near the Lower Zambezi and South Luangwa national parks who named the human-elephant conflict the most challenging problem facing households living in a GMA.

5.1 Conclusions

Results in this thesis confirm the potential of GMA policies to generate increased income for households living within their boundaries, and makes a case for the continuation of these programs as a strategy to combat poverty. Additionally, by approaching this question from a number of different angles, this study highlights several crucial details that are relevant for future policy and programmatic design:

First, the GMA effect on total household income is only found in prime GMAs. The level and diversity of wildlife stocks are clearly linked to the potential of these areas to generate benefits for the community. While secondary or specialized GMAs have a positive effect on the probability and level of wage earnings, the effect is insignificant for the probability and level of self-employment. Investing in wildlife restocking and protection in less animal populated areas could maximize the benefits from CBNRM programs.

Second, the results of the analysis of the GMA effect on wage earnings suggest that in-migration to prime GMAs may put negative pressure on wages. This may mean that even if households enjoy higher chances of being employed, their wages may be lower than households living in non-GMAs. The expansion of the tourism industry to other areas outside the main tourist circuits could further broaden the impact of GMA policies on welfare and avoid the problems associated with high levels of in-migration influx. This should be accompanied by marketing campaigns to attract tourists to other areas, and by enhancing existing infrastructure (roads, communications, electricity, etc.).

Finally, notwithstanding the positive link between well stocked GMAs and income, the results also indicate a higher prevalence of crop damage in prime GMAs as opposed to non-GMAs. This threat is further reinforced by the results of the GMA effect on crop agriculture, which indicate a negative association between GMAs, both prime and secondary or specialized, and the probability of participation in and earnings from crop agriculture. While this effect might not only be the result of crop damage by wildlife, crop damage could be one of the contributors. Hence, if the attacks proliferate unabated, there could be a point at which the GMA effect changes sign. Policies should not only focus on wildlife conservation but also on mechanisms to protect or compensate farmers for the losses. This is of particular importance if the goal is to change community attitudes towards wildlife. If households perceive wildlife as a destructive element for their livelihoods rather than a source of income, conservation efforts will continue to face resistance, which will ultimately threaten the sustainability of wildlife populations and the program as a whole.

6. AREAS FOR FURTHER RESEARCH

Evidence that GMA policies positively affect household income is a promising outcome which encourages the continuation of CBNRM programs. Additional research based on the IGMAW survey, complemented with other information, could help refine the current GMA policies and focus on elements that work best in the interest of the communities.

One area of further research should differentiate between consumptive and non-consumptive tourism in estimating the impact of tourism on total household income. While on one hand hunting safaris generate large revenues from relatively few hunting licenses and contribute to the community by sharing game meat, non-consumptive tourism can attract a wider range and greater number of tourists who pay park entry fees and book guided game viewing trips. Knowing the impact of each type of investment on the welfare of the communities could help maximize the returns to land. For this, additional information beyond the data provided by the IGMAW survey is needed, principally, the number of tourist and safari lodges by GMA and the capacity of each tourist lodge and safari camp. Other useful information would be the revenues obtained by hunting licenses for each GMA and the share of these revenues delivered to CRBs. Also knowing the number of locally hired employees and the direct pledges that lodges and safari camp sites make to the community would be beneficial. ZAWA is clearly the institution best placed to generate this type of information.

One issue that clearly threatens the success of the GMA policies towards wealth creation is crop losses associated with wildlife protection. Overall, the findings show that households living in GMAs obtain higher incomes compared to those in non-GMA designated areas, despite these losses. However, there might be a threshold beyond which crop losses could reverse the positive GMA effect, making agriculturally dependent communities even poorer. Finding this threshold would be key to determine the risks associated with the CBNRM programs. Successful GMA policies that increase wildlife populations to a point where they are incompatible with community livelihoods could eventually cause more harm than benefit. Further research could consider a model that tests different scenarios, for example, analyzing the outcome of the GMA effect in case a significantly larger number of farmers are affected by crop loss, or by increasing the average value of crop loss. It would be particularly interesting to test this in prime GMAs where the number of reported incidents is higher, looking at the households that reported the highest level of crop damage to have an indication of what the worst case scenario could be.

Linked to the issue of crop damage, additional research could look into the capacity of scouts to protect wildlife while simultaneously protecting farmers from crop damage. The findings indicate that there is a positive relationship between the number of scouts hired in the community and the probability of crop loss in GMAs, which could indicate on one hand success in protecting wildlife, hence the proliferation of incidents, but could also indicate that scouts are not able to contain wildlife and prevent them from destroying the fields. A review of the scouts' mandate could help clarify the role they are given in terms of community protection. If this is only focused on wildlife protection then there might be a need by ZAWA to review the mandate to reflect the need to protect crops as well as wildlife, and thus minimize conflict. In any case, it would be worth knowing whether hiring larger numbers of scouts would make a difference in protecting farmers or would instead make their situation worse, as the scouts may be more successful in their anti-poaching activities than in their efforts to control offending animals.

APPENDICES

APPENDIX A

ANALYSIS OF THE MIGRATION VARIABLE

In Model 1 of this study, a dummy variable that indicates migration to and from GMAs was generated based on the following question from the IGMAW survey: where was your household residing 5 years ago? The dummy takes the value of one if the household was residing in a different locality (within the same district, in a different district within the same province, in a different province or in a different country), and zero otherwise.

Overall, 11.6% of households surveyed migrated in the past five years. 12.8% of households in GMAs had migrated there within the past five years and 9.9% of those outside GMAs had migrated within the past five years (Table A1). In both cases, the magnitude of the percentage is similar and not large enough to create concern about sample selection bias. There seems to be slightly higher movement to GMAs compared to non-GMAs, which can also be observed when analyzing the migration variable by park systems and GMAs (Table A2). In all park systems with the exception of Bangweulu, the percentage of households in GMAs that had migrated over the past five years is higher than the percentage of households in non-GMAs that had migrated during the past five years. South Luangwa and Kafue attracted the most migrants, which could be related to the development of the tourism industry in those areas (South Luangwa and Kafue were the two parks that hosted the most tourists in 2006).

Table A 1. Mean comparison of the migration variable

	Total Sample	GMA	non-GMA
Number of observations	2717	1574	1143
Mean		11.60%	9.90%

Source: Calculated from IGMAW survey data

Table A 2. Mean comparison of the migration variable by park system

Park Systems	Total Sample	GMA	non-GMA
Bangweulu	7.9%	7.6%	8.5%
Kafue	13.3%	15.5%	11.6%
Lower Zambezi	10.6%	12.9%	8.4%
South Luangwa	14.7%	17.0%	10.1%

Source: Calculated from IGMAW survey data

Another way to analyze whether migration could lead to endogeneity is to test whether there are structural differences between the subsamples of households that migrated vs. those that did not. The Chow test examines whether parameters (slopes and intercepts) of one group (households that migrated) are different from those of other groups (households that did not migrate) (Chow, 1960). If the parameters are equal for both groups, the OLS results are less likely to be biased. For the test, the unrestricted model is built by including in Model 1 the migration dummy plus all the right hand side variables interacted with the migration dummy. The null hypothesis, H_o, is that the two groups have equal parameters.

The F statistic is constructed using the formula: $F=[(RU^2 - RR^2)/q] / [(1- RU^2) / (n-k-1)]$

Where:
- RU^2 is the goodness of fit for the unrestricted model=0.22
- RR^2 is the goodness of fit of the restricted model (Model 1)=0.21
- q =d.f. restricted model– d.f. unrestricted model=16
- n is the total number of observations=2264
- k is the number of parameters of the unrestricted model=31

The F statistic is 1.99. The critical value (c) for an F with d.f.=16, 2233 = 2.46 (at 99% confidence level). Since F < c, the null hypothesis cannot be rejected, therefore the parameters are assumed to be equal for both groups. We can conclude that households that migrated are statistically identical to those that did not migrate.

APPENDIX B

OLS RESULTS BY WELFARE LEVEL AND PARK SYSTEM

Table B 1. Results of the OLS by welfare level

Variable description	Coefficient	Significance level	Standard error
Intercept	13.120	***	(0.12)
Age of household head in years	-0.003		(0.00)
Sex of household head (=1 if male)	0.066	*	(0.06)
Maximum education of hh member (in years)	0.042		(0.01)
Number of children (<15 years)	0.018		(0.01)
Number of female adults (15-60 years)	0.113		(0.03)
Number of male adults (15-60 years)	0.070	***	(0.03)
Distance to nearest all-weather road (in km)	-0.005		(0.00)
Cropped area (in hectares)	0.038		(0.02)
Value of consumption durable assets (in ZMK)	0.020		(0.00)
Value of production durable assets (in ZMK)	0.010	***	(0.00)
Population density (in sq km)	0.001		(0.00)
Types of existing Infrastructure (#)	0.033	**	(0.01)
Tourist lodge in the community (=1)	0.198		(0.10)
Households in lowest two quintiles and living in GMA1	0.033	***	(0.10)
Households in lowest three quintiles and living in GMA1	0.031		(0.05)
Households in upper two quintiles and living in GMA1	0.046	*	(0.02)
Households in lowest two quintiles and living in GMA2	-0.059		(0.07)
Households in lowest three quintiles and living in GMA2	0.040	***	(0.04)
Households in upper two quintiles and living in GMA2	-0.008		(0.02)
Dependant variable: Total household income (in logarithm)			
Observations	2264		
R-squared	0.212		

Source: Calculated from IGMAW survey data

Table B 2. Results of the OLS by park system

Variable description	Coefficient	Significance level	Standard error
Intercept	13.090	***	(0.12)
Age of household head in years	-0.003	*	(0.00)
Sex of household head (=1 if male)	0.066		(0.06)
Maximum education of hh member (in years)	0.042	***	(0.01)
Number of children (<15 years)	0.020		(0.01)
Number of female adults (15-60 years)	0.114	***	(0.03)
Number of male adults (15-60 years)	0.073	**	(0.03)
Distance to nearest all-weather road (in km)	-0.005	***	(0.00)
Cropped area (in hectares)	0.039	*	(0.02)
Value of consumption durable assets (in ZMK)	0.020	***	(0.00)
Value of production durable assets (in ZMK)	0.010	***	(0.00)
Population density (in sq km)	0.001	***	(0.00)
Types of existing Infrastructure (#)	0.031	***	(0.01)
Tourist lodge in the community (=1)	0.199	*	(0.10)
Households living in GMA within Luangwa Park system	0.177	**	(0.08)
Households living in GMA within Kafue Park system	0.135	*	(0.08)
Households living in GMA within Zambezi Park system	0.046		(0.08)
Dependant variable: Total household income (in logarithm)			
Observations	2264		
R-squared	0.212		

Source: Calculated from IGMAW survey data.

APPENDIX C

CRAGG RESULTS BY WELFARE LEVEL

Table C 1. Results of Cragg model on wage employment by welfare level (lower two quintiles)

					Marginal Effects					
Variable description	Tier 1	Sig.	Tier 2	Sig.	Probit	Sig.	CAPE	Sig.	UAPE	Sig.
Intercept	-1.980	***	16.820	***	n/a	***	n/a		n/a	
Age of household head in years	-0.010	*	-0.139	*	-0.001	*	-0.125		-0.019	
Sex of household head (=1 if male)	0.181		-4.996	*	0.010		-4.467		0.014	
Maximum education hh member (years)	0.078	***	0.183		0.005	***	0.164		0.104	
Number of children (<15 years)	0.005		-0.469		0.000		-0.420		-0.013	
Number of female adults (15-60 years)	-0.400	**	-0.812		-0.024	**	-0.726		-0.531	
Number of male adults (15-60 years)	0.118		3.738	***	0.007		3.343		0.304	
Distance to nearest road (km)	-0.004		-0.052		0.000		-0.047		-0.007	
Cropped area (in hectares)	0.025		-0.416		0.001		-0.372		0.014	
Value of consumption assets (ZMK)	0.014		0.324		0.001		0.289		0.031	
Value of production assets (ZMK)	-0.012		0.245	*	-0.001		0.219		0.028	
Population density (in sq km)	0.001	*	-0.001		0.000	*	-0.001		0.002	
Infrastructure (#)	0.048	*	-0.665	**	0.003	*	-0.595		0.031	
Tourist lodge in the community (=1)	0.039		-1.121		0.002		-1.003		0.001	
Prime GMA (=1)	0.618	***	0.380		0.057	***	0.340		0.784	**
Secondary or specialized GMA (=1)	0.655	***	2.055		0.057	***	1.838		0.900	**
Number of observations: 918										
Log likelihood: -274.91										

Source: Calculated from IGMAW survey data
Note: Significant levels of CAPE and UAPE only computed for GMA variables

Table C 2. Results of Cragg model on wage employment by welfare level (upper two quintiles)

					Marginal Effects					
Variable description	Tier 1	Sig.	Tier 2	Sig.	Probit	Sig.	CAPE	Sig.	UAPE	Sig.
Intercept	-3.900	***	18.272	***	n/a	***	n/a		n/a	
Age of household head in years	-0.004		0.028		0.001		0.028		-0.007	
Sex of household head (=1 if male)	0.101		-5.184	***	0.013		-5.161		-0.473	
Maximum education hh member (years)	0.230	***	0.118		0.032	***	0.118		0.597	
Number of children (<15 years)	-0.016		-0.326		-0.002		-0.324		-0.087	
Number of female adults (15-60 years)	0.066		-0.036		0.009		-0.036		0.163	
Number of male adults (15-60 years)	0.025		1.881	***	0.003		1.873		0.326	
Distance to nearest road (km)	-0.011	*	-0.001		-0.002	*	-0.001		-0.028	
Cropped area (in hectares)	-0.004		-0.242		0.000		-0.241		-0.043	
Value of consumption assets (ZMK)	0.023	***	0.010		0.003	***	0.010		0.060	
Value of production assets (ZMK)	-0.011	***	-0.017		-0.002	***	-0.017		0.057	
Population density (in sq km)	0.002	***	0.001		0.000	***	0.001		0.006	
Infrastructure (#)	0.034		-0.103		0.005		-0.103		0.071	
Tourist lodge in the community (=1)	0.602	***	1.076		0.118	***	1.071		1.671	
Prime GMA (=1)	0.762	***	-1.406		0.144	***	-1.400		1.726	***
Secondary or specialized GMA (=1)	0.424	**	-0.290		0.071	**	-0.288		1.031	**
Number of observations: 1346										
Log likelihood: -852.7										

Source: Calculated from IGMAW survey data

Note: Significant levels of CAPE and UAPE only computed for GMA variables

Table C 3. Results of Cragg model on self employment by welfare level (lower two quintiles)

					Marginal Effects					
Variable description	Tier 1	Sig.	Tier 2	Sig.	Probit	Sig.	CAPE	Sig.	UAPE	Sig.
Intercept	-0.135		10.615	***	n/a		n/a		n/a	
Age of household head in years	-0.012	***	0.041	*	-0.005	***	0.039		-0.053	
Sex of household head (=1 if male)	0.136		1.247	*	0.053		1.183		1.342	
Maximum education hh member (years)	-0.013		-0.173		-0.005		-0.164		-0.149	
Number of children (<15 years)	0.052	*	-0.244		0.020	*	-0.231		0.211	
Number of female adults (15-60 years)	0.113	*	2.232	***	0.044	*	2.116		1.617	
Number of male adults (15-60 years)	0.043		1.990	***	0.017		1.888		1.095	
Distance to nearest road (km)	-0.001		-0.014		0.000		-0.014		-0.009	
Cropped area (in hectares)	-0.160	***	0.969	**	-0.063	***	0.919		-0.559	
Value of consumption assets (ZMK)	-0.010		0.065		-0.004		0.062		-0.032	
Value of production assets (ZMK)	0.006	*	0.009		0.002	*	0.009		-0.056	
Population density (in sq km)	0.000		0.011	**	0.000		0.010		0.004	
Infrastructure (#)	0.065	***	-0.022		0.026	***	-0.021		0.381	
Tourist lodge in the community (=1)	0.176		-0.562		0.070		-0.533		0.825	
Prime GMA (=1)	0.360	**	-1.167		0.143	**	-1.107		1.680	*
Secondary or specialized GMA (=1)	-0.223	*	-1.446		-0.087	*	-1.371		-1.953	**
Number of observations: 918										
Log likelihood: -1901.3										

Source: Calculated from IGMAW survey data

Note: Significant levels of CAPE and UAPE only computed for GMA variables

Table C 4. Results of Cragg model on self employment by welfare level (upper two quintiles)

					Marginal Effects					
Variable description	Tier 1	Sig.	Tier 2	Sig.	Probit	Sig.	CAPE	Sig.	UAPE	Sig.
Intercept	0.004		12.686		n/a		n/a		n/a	
Age of household head in years	-0.005		0.075		-0.002		0.069		0.002	
Sex of household head (=1 if male)	0.164		-0.096		0.065		-0.088		1.065	
Maximum education hh member (years)	-0.041	**	-0.289		-0.016	*	-0.264		-0.415	
Number of children (<15 years)	0.013		0.218		0.005		0.199		0.189	
Number of female adults (15-60 years)	0.061		2.183		0.024		1.993		1.438	
Number of male adults (15-60 years)	0.065		0.592		0.026		0.541		0.719	
Distance to nearest road (km)	0.005		-0.031		0.002		-0.029		0.020	
Cropped area (in hectares)	-0.072	**	-0.197		-0.029	**	-0.180		-0.581	
Value of consumption assets (ZMK)	0.009	**	-0.008		0.004	**	-0.007		0.058	
Value of production assets (ZMK)	-0.002		-0.001		-0.001		0.000		0.062	
Population density (in sq km)	0.001	**	0.005		0.000	**	0.005		0.010	
Infrastructure (#)	0.032	*	-0.108		0.013	*	-0.099		0.010	
Tourist lodge in the community (=1)	0.149		0.648		0.059		0.592		1.314	
Prime GMA (=1)	-0.151		1.435		-0.060		1.310		-0.352	
Secondary or specialized GMA (=1)	-0.106		0.728		-0.042		0.665		-0.379	
Number of observations: 918										
Log likelihood: -2234.1										

Source: Calculated from IGMAW survey data

Note: Significant levels of CAPE and UAPE only computed for GMA variables

Table C 5. Results of Cragg model on crop income by welfare level (lower two quintiles)

					Marginal Effects					
Variable description	Tier 1	Sig.	Tier 2	Sig.	Probit	Sig.	CAPE	Sig.	UAPE	Sig.
Intercept	0.574	**	16.619	***	n/a		n/a		n/a	
Age of household head in years	0.003		-0.039		0.000		-0.030		-0.018	
Sex of household head (=1 if male)	-0.107		-1.527		-0.010		-1.161		-1.396	
Maximum education hh member (years)	-0.022		0.086		-0.002		0.065		-0.015	
Number of children (<15 years)	0.025		0.589	*	0.002		0.448		0.486	
Number of female adults (15-60 years)	-0.104		0.292		-0.010		0.222		-0.154	
Number of male adults (15-60 years)	-0.046		-0.039		-0.004		-0.030		-0.182	
Distance to nearest road (km)	0.002		0.035		0.000		0.026		0.030	
Cropped area (in hectares)	1.191	***	3.699	***	0.114	***	2.812		6.530	
Value of consumption assets (ZMK)	0.023	*	-0.049		0.002	*	-0.037		0.043	
Value of production assets (ZMK)	0.019	**	0.195	***	0.002	**	0.148		0.209	
Population density (in sq km)	-0.001		-0.013		0.000		-0.010		-0.011	
Infrastructure (#)	-0.002		-0.211		-0.0002		-0.161		-0.150	
Tourist lodge in the community (=1)	-0.359		-0.175		-0.045		-0.133		-1.330	
Prime GMA (=1)	-0.001		-1.027		-0.0001		-0.781		-0.702	
Secondary or specialized GMA (=1)	-0.399	**	-5.661	***	-0.047	**	-4.304		-5.189	***

Number of observations: 918
Log likelihood: -3395.8

Source: Calculated from IGMAW survey data
Note: Significant levels of CAPE and UAPE only computed for GMA variables

Table C 6. Results of Cragg model on crop income by welfare level (upper two quintiles).

					Marginal Effects					
Variable description	Tier 1	Sig.	Tier 2	Sig.	Probit	Sig.	CAPE	Sig.	UAPE	Sig.
Intercept	0.719	*	23.693	***	n/a		n/a		n/a	
Age of household head in years	0.001		0.014		0.000		0.012		0.014	
Sex of household head (=1 if male)	0.135		-1.292		0.001		-1.089		-0.642	
Maximum education hh member (years)	-0.007		-0.172		-0.00004		-0.145		-0.154	
Number of children (<15 years)	0.015		0.427		0.0001		0.360		0.373	
Number of female adults (15-60 years)	-0.046		0.086		-0.0003		0.072		-0.057	
Number of male adults (15-60 years)	0.011		-0.646		0.0001		-0.545		-0.473	
Distance to nearest road (km)	-0.007		-0.002		-0.00004		-0.001		-0.019	
Cropped area (in hectares)	2.061	***	2.597	***	0.012	***	2.189		7.543	
Value of consumption assets (ZMK)	-0.010		0.078		-0.0001		0.066		0.035	
Value of production assets (ZMK)	0.006		0.090	***	0.00003		0.076		0.044	
Population density (in sq km)	-0.001		-0.027	***	-0.00001		-0.023		-0.023	
Infrastructure (#)	0.014		-0.517	**	0.0001		-0.436		-0.363	
Tourist lodge in the community (=1)	-0.447	*	1.837		-0.005	*	1.5486		0.228	
Prime GMA (=1)	-0.060		-0.661		-0.0004		-0.557		-0.673	
Secondary or specialized GMA (=1)	-0.392	**	-9.113	***	-0.003		-7.683		-8.125	
Number of observations: 921										
Log likelihood: -3500.1										

Source: Calculated from IGMAW survey data

Note: Significant levels of CAPE and UAPE only computed for GMA variables

Table C 7. Results of Cragg model on crop damage by welfare level (lower two quintiles)

Variable description	Tier 1	Sig.	Tier 2	Sig.	Marginal Effects Probit	Sig.	CAPE	Sig.	UAPE	Sig.
Intercept	-2.314	***	6.936	***	n/a		n/a		n/a	
Age of household head in years	-0.002		0.022		0.000		0.021		-0.001	
Sex of household head (=1 if male)	-0.113		0.858		-0.015		0.815		-0.091	
Household size (#)	-0.027		0.127		-0.003		0.121		-0.030	
Distance to nearest road (km)	0.010	**	-0.020		0.001	**	-0.019		0.014	
Cropped area (in hectares)	0.044		0.079		0.006		-0.403		0.026	
Value of consumption assets (ZMK)	-0.010		-0.121	***	-0.001		0.075		-0.008	
Value of production assets (ZMK)	-0.005		-0.424		-0.001		-0.115		-0.031	
Population density (in sq km)	0.00004		0.001		0.00001		0.0005		0.0001	
Infrastructure (#)	-0.020		-0.150		-0.003		-0.142		-0.050	
Number of scouts (#)	0.041	*	0.137		0.005	*	0.131		0.084	
Total value of harvest (in ZMK)	0.042	***	0.204	***	0.005	***	0.194		0.094	
Prime GMA (=1)	0.922	***	-1.246		0.1852	***	-1.185		1.388	***
Secondary or specialized GMA (=1)	0.544	***	-0.864		0.087	***	-0.821		0.804	**
Number of observations: 919										
Log likelihood: -528.4										

Source: Calculated from IGMAW survey data
Note: Significant levels of CAPE and UAPE only computed for GMA variables

Table C 8. Results of Cragg model on crop damage by welfare level (upper two quintiles)

Variable description	Tier 1	Sig.	Tier 2	Sig.	Marginal Effects Probit	Sig.	CAPE	Sig.	UAPE	Sig.
Intercept	-2.598	***	3.587	*	n/a		n/a		n/a	
Age of household head in years	0.003		0.028		0.001		0.024		0.011	
Sex of household head (=1 if male)	0.037		0.762		0.006		0.671		0.186	
Household size (#)	-0.029		-0.028		-0.005		-0.025		-0.064	
Distance to nearest road (km)	0.000		-0.032		0.000		-0.029		-0.004	
Cropped area (in hectares)	0.082	*	-0.061		0.013	*	-0.371		0.110	
Value of consumption assets (ZMK)	-0.007		0.000		-0.001		-0.054		-0.023	
Value of production assets (ZMK)	-0.004		-0.421		-0.001		0.000		-0.014	
Population density (in sq km)	0.000		-0.004		0.000		-0.003		0.000	
Infrastructure (#)	0.019		0.031		0.003		0.028		0.043	
Number of scouts (#)	0.026		0.084		0.004		0.074		0.067	
Total value of harvest (in ZMK)	0.042	***	0.222	***	0.007	***	0.196		0.120	
Prime GMA (=1)	0.635	***	1.080		0.1317	***	0.951		1.473	***
Secondary or specialized GMA (=1)	0.721	***	2.072	*	0.156	***	1.826		1.794	***
Number of observations: 921										
Log likelihood: -684.8										

Source: Calculated from IGMAW survey data
Note: Significant levels of CAPE and UAPE only computed for GMA variables

APPENDIX D

ENDOGENEITY TEST, CRAGG MODEL ON CROP DAMAGE

Table D 1. Results of OLS on number of scouts

Variable description	Coefficient	Significance level	Standard error
Intercept	13.090	**	(0.213)
Age of household head in years	0.032		(0.003)
Sex of household head (=1 if male)	0.019		(0.106)
Household size	-0.002		(0.018)
Distance to nearest all-weather road (in km)	-0.007	**	(0.003)
Cropped area (in hectares)	-0.026		(0.042)
Value of consumption durable assets (in ZMK)	0.003		(0.004)
Value of production durable assets (in ZMK)	-0.003		(0.003)
Population density (in sq km)	0.000		(0.001)
Types of existing Infrastructure (#)	0.058	***	(0.019)
Total value of harvest (in ZMK)	0.006	**	(0.003)
Primary GMA (=1)	1.709	***	(0.163)
Secondary or specialized GMA (=1)	1.110	***	(0.122)
VAG received funds from ZAWA	1.821	***	(0.114)
Luangwa Park system	-0.812	***	(0.162)
Zambezi Park system	-0.401	***	(0.140)
Kafue Park system	-0.821	***	(0.126)
Dependant variable: number of scouts			
Observations	2266		
R-squared	0.25		

Source: Calculated from IGMAW survey data.

Table D 2. Results of the ivtobit on crop damage

Variable description	Coefficient	Significance level	Standard error
Intercept	-2.860	***	(0.263)
Number of scouts	-0.028		(0.062)
Age of household head in years	-0.002		(0.003)
Sex of household head (=1 if male)	-0.045		(0.112)
Household size	-0.049	**	(0.020)
Distance to nearest all-weather road (in km)	0.006	*	(0.003)
Cropped area (in hectares)	0.082	**	(0.040)
Value of consumption durable assets (in ZMK)	-0.003		(0.004)
Value of production durable assets (in ZMK)	-0.005	*	(0.003)
Population density (in sq km)	0.000		(0.001)
Types of existing Infrastructure (#)	0.007		(0.025)
Total value of harvest (in ZMK)	0.050	***	(0.004)
Primary GMA (=1)	1.024	***	(0.164)
Secondary or specialized GMA (=1)	0.848	***	(0.142)
Dependant variable: dummy for crop damage			
Instrumented variable: number of scouts			
Observations	2266		
Log likelihood	-5804.8		

Wald test of exogeneity (/alpha = 0): chi2(1) = 0.94 Prob > chi2 = 0.3327

P value = 0.333

BIBLIOGRAPHY

BIBLIOGRAPHY

Agrawal, A. & Gibson, C. (1999). Enchantment and Disenchantment: The Role of Community in Natural Resource Conservation. *World Development* 27, (4), 629-649.

Ahmad, J., Bergstrom, C., Bryceson, I., Child, B., Francis, J., Khan, P., Ousmane, B., Price, T.L., Senaratna, S., Tareen, N. &. van Daam C. (2001). *Case Studies in Sustainable Use*. International Union for the Conservation of Nature and Natural Resources. Available from http\\www.cbd.int.

Ashley, C., Meyer, D., Roe, D., & Goodwin, H. (2004). Defining Pro-Poor Tourism. *Pro-Poor Tourism Partnership*. Sheet No.1.

Bandyopadhyay S. and Tembo, G. (2009). Household consumption and natural resource management around national parks in Zambia *Forthcoming in Journal of Natural Resources Policy Research.*

Barrett, C. & Arcese., P. (1995). Are Integrated Conservation-Development Projects (ICDPs) Sustainable? On the Conservation of Large Mammals in Sub-Saharan Africa. *World Development*, 23 (7), 1073-1084.

Barrett, C., Reardon, T. & Webb, P. (2001). Nonfarm Income Diversification and Household Livelihood Strategies in Rural Africa: Concepts, Dynamics, and Policy Implications. *Food Policy*, 26 (4), pp. 315-331.

Beyene, A.D. (2008). Determinants of off-farm participation decision of farm households in Ethiopia. *Agrekon*, 47 (1), 140-161.

Burke, W.J. (2009). Estimating and Interpreting Cragg's Tobit Alternative using Stata *Stata Journal (in press)*.

Bwalya, S.M. (2003). Understanding Community-Based Wildlife Governance in Southern Africa: A Case Study from Zambia. *African Journal of Environmental Assessment and Management,* 7, 41-60.

Central Statistics Office, Zambia. 2006. Living Conditions Monitoring Survey (LCMS). Available at http:www.zamstats.gov.zm

Child, B. & Dalal-Clayton, B. (2004). Transforming Approaches to CBNRM: Learning from the Luangwa Experience. Book by McShane, T. O. and M. P. Wells (eds.), *Getting Biodiversity Projects to Work: Towards More Effective Conservation and Development.* New York: Columbia University Press.

Chow, G.C., (1960). Tests of equality between sets of coefficients in two linear regressions. *Econometrica,* 28 (3), 591–605.

Chundama, M., Gumbo, D., Mulonani, D., & Kalyocha, G. 2004. *Institutional and Policy Analysis for Protected Areas under the Reclassification of Zambia's Protected Areas Systems Project.* World Wide Fund for Nature Southern Africa Regional Conservation Programme WWF Zambia Report to the Ministry of Tourism Environment and Natural Resources.

Cong, R. and D. M. Drukker, (2001). Treatment Effects Model. *Stata Technical Bulleting*, 10 (55).

Cragg, J. G. (1971). Some Statistical models for Limited Dependent Variables with application to the demand for durable goods. *Econometrica*. 39 (5).

Dalal-Clayton,.B. & Child, B. (2003). *Lessons from Luangwa: The story of the Luangwa Integrated Resource Development Project, Zambia.* Wildlife and Development Series No. 13. London: International Institute for Environment and Development

De Janvry, A. & Sadoulet, E. (2001). Income Strategies Among Rural Households in Mexico: The role of Off-farm Activities. *World Development.* 29 (3), 467-480.

Fynn, J., & Haggblade, S. (2006). *Impact of the Kwacha Appreciation and Proposed Tax Provisions of the 2006 Budget Act on Zambian Agriculture.* Working Paper 16. Lusaka: Food Security Research Project.

Gibson C.C. & Marks, S.A.(1995). Transforming Rural Hunters into Conservationists: An Assessment of Community-Based Wildlife Management Programs in Africa. *World Development*, 23 (6), 941-957.

Government of the Republic of Zambia, 2002. *Poverty Reduction and Strategy Paper*. Ministry of Finance and National Planning. Lusaka, Zambia.

Government of the Republic of Zambia, 2006. *Fifth National Development Plan 2006-2010*. Ministry of Finance and National Planning Lusaka, Zambia.

Gujarati, D. (2003). *Basic Econometrics: Fourth Edition.* Boston, MA: McGraw-Hill Higher Education.

Haggblade, S., Hazell, P. & Reardon, T. (2007). *Transforming the Rural Nonfarm Economy. Opportunities and Threats in the Developing World.* Johns Hopkins University Press.

Haggblade, S., Hazell, P. & Brown, J. (1989). Farm-nonfarm linakes in rural sub-saharan Africa. *World Development*, 17 (8), 1173-1201.

Hamilton, K., Tembo, G., Sinyenga, G., Bandyopadhyay,, S., Pope, A., Guillon B., Muwele B., & Pavy J. (2007). *The real economic impact of Nature Tourism in Zambia*. Natural Resources Consultative Forum.

Hausman, J.A. (1987). Specification tests in econometrics. *Econometrica*, 46 (6), 1251-1271.

Honey, M. (1999). *Ecotourism and sustainable development: who owns paradise*? Washington, D.C: Island Press

International Institute of Environment and Development (IIED). (1994). *Understanding Whose Eden? An Overview of Community Approaches to Wildlife Management.*

Jayne, T.S., Govereh, J., Chilonda, P., Mason, N., Chapoto, A. & Haantuba, H. (2007). *Trends in agricultural and rural development indicators in Zambia.* Working paper No. 24. Food Security Research Project. Lusaka, Zambia.

Jayne, T.S., Yamano, T., Weber, M.T., Tschirley, D., Benfica, R., Chapoto, A., & Zulu, B. (2003). Smallholder income and land distribution in Africa: implications for poverty reduction strategies. *Food Policy.* 28 (3), 253-275.

Leader-Williams, N. & Albon, S.D. (1988). Allocation of resources for conservation *Nature*, 336 (8), 533-535.

Lewis, D. & Alpert, P. (1997). Trophy Hunting and Wildlife Conservation in Zambia. *Conservation Biology.* 11 (1).

Li, T.M. (2002). Engaging Simplifications: Community-Based Resource Management, Market Processes and State Agendas in Upland Southeast Asia. *World Development.* 30 (2), 265–283.

Lin, T. & Schmidt, P. (1984). A test of the Tobit specification against an alternative suggested by Cragg. *The Review of Economics and Statistics*, 66 (1), 174-177

Lungu, F.B. (1990). *Living with Wildlife: Wildlife Resource Management with Local Participation in Africa.* World Bank Technical Paper number 130. Africa Technical Department Series.

Marks, S.A. (2001). Back to the Future: Some Unintended Consequences of Zambia's Community-Based Wildlife Program (ADMADE) *Africa Today.* 48 (1),121-141.

Mudenda, M.M. (2006). *The Challenges of Customary Land Tenure in Zambia.* TS 50 - Conflicts and Land Administration. Shaping the Change XXIII FIG Congress Munich, Germany.

Mutandwa, E. & Gadzirayi, C.T. (2007). Impact of community-based approaches to wildlife management: case study of the CAMPFIRE programme in Zimbabwe. *International Journal of Sustainable Development & World Ecology.*14, 336-344.

Neumann, R. P. (1997). Primitive Ideas: Protected Area Buffer Zones and the Politics of Land in Africa. *Development and Change*, 28 (3), 559-582.

Ooi, Jin-Bee. 1982. Commonwealth Geographical Bureau. *Natural Resources in Tropical Countries*. Singapure: Singapure University Press Proprietary, Limited.

Reardon, T. (1997). Using Evidence of Household Income Diversification to Inform Study of the Rural Nonfarm Labor Market in Africa. *World Development* 25 (5), 735-747.

Simasiku, P., Simwanza, H.I., Tembo, G., Bandyopadhyay, S., & Pavy, J. (2008). *Game Management Areas in Crisis. The impact of wildlife management policies on communities and conservation.* Natural Resources Consultative Forum.

Songorwa, A.N. (1999). Community-Based Wildlife Management (CWM) in Tanzania: Are the Communities Interested? *World Development* 27 (12), 2061-2079.

Swanepoel and Scandrol. Available from http://www.hunt-africa.com/zambia-hunting-safaris-overview.php. Accessed on February 2009.

Tschirley, D.L. & Benfica, R. (2001). Smallholder agriculture, wage labour and rural poverty alleviation in land-abundant areas of Africa: evidence from Mozambique. *The Journal of Modern African Studies*, 39 (2), 333-358.

Tschirley, D.L. & Kabwe, S.. (2007). *Cotton in Zambia: 2007 Assessment of its Organization, Performance, Current Policy Initiatives, and Challenges for the Future* Working Paper No. 26 Food Security Research Project. Lusaka, Zambia.

Van Loenen, B. (1999). *Land Tenure in Zambia.* University of Maine. Department of Spatial Information Engineering.

Wainwright, C. & Wehrmeyer, W. (1998). Success in Integrating Conservation and Development? A Study from Zambia. *World Development*. 26 (6), 933-944.

Woldehanna, T., Lansink, A.O. & Peerlings, J.. (2000). Off-farm work decisions on Dutch cash crop farms and the 1992 and Agenda 2000 CAP reforms. *Agricultural Economics.* 22, 163-171.

Wooldridge, J.M. (2002). *Introductory Econometrics: A modern approach.* Business & Economics. Thomson-South-Western.

Wright R.M. (1995). Alleviating Poverty and Conserving Wildlife in Africa: An "Imperfect" Model from Zambia. *National Association for the Practice of Anthropology.* 15 (1), 19-32.

Yúnez-Naude, A. & Taylor, J.E. (2001). The Determinants of Nonfarm Activities and Incomes of Rural Households in Mexico, with Emphasis on Education. *World Development.* 29 (3), 561-572.

Zambia Wildlife Authority. Zambia Wildlife Act (1998). Available from: http://www.zawa.org.zm.

Zambia Wildlife Authority (2008). Available from http// www.zawa.org.zm.