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Household Welfare and Natural Resource Management around National Parks in Zambia

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Abstract

Game management areas in Zambia aim to combine nature conservation with economic empowerment of rural households. By looking at households inside and outside game management areas, this study advances the knowledge of the impact of community based natural resource management on household welfare. The paper focuses on the economic welfare of households living inside game management areas. It tries to answer the question: Do the households in game management areas enjoy higher levels of welfare relative to the conditions they would have been in had the area not been designated as a game management area? Within the game management area, the paper tries to determine the factors that influence household participation in natural resource management, and whether the participating households get any extra benefits. Also of interest is whether such benefits of living in a game management area, and, once in such an area, those of participating accrue more to the poorer segments of the communities. The study finds that the gains from living in a game management area and from active participation in natural resource management are large but unevenly distributed. Only game management areas near Kasanka, Lavushi, Isangano, and South Luangwa national parks in the sample show significant benefits to general and participating households. And in those areas, the poor do not seem to gain even when they participate actively. More even distribution of gains from game management areas across households near different park systems and across the poor and the non-poor should be a continuing goal of national policy makers.

This paper—a product of the Environment Department—is part of a larger effort in the department to understand the linkages between poverty and environment. Policy Research Working Papers are also posted on the Web at http://econ.worldbank.org. The corresponding author may be contacted at sbandyopadhyay@worldbank.org.

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Introduction

Strict protected area wildlife management programs have been complemented by community based natural resource management in many countries since the 1980s and 1990s. These efforts emerged as a result of international and local resistance to strict protected regimes and greater awareness of the difficulties of state-run conservation without engaging the local communities. Community management of natural resources has the added advantage that it frees state resources at the center and allows for local political, administrative and fiscal decentralization. Over the years international organizations and governments have invested in community based programs and institutions to help manage natural resources (USAID, 2003, UNDP-GEF, 2004, Shyamsundar et al. 2005, Emerton et al. 2005).

Most community-based wildlife management programs try to meet at least two complex goals: conservation of nature, and economic empowerment of rural households. To this end decentralization of wildlife management may be characterized by two overlapping phases. The first phase is sometimes called Integrated Conservation and Development Programs (ICDPs) and the second phase is known as community based natural resource management (CBNRM). Both programs create economic incentives for local communities to conserve natural resources. ICDP focuses on generating alternatives to nature-based economic activities in order to reduce the use of natural resources (Brandon and Wells, 1992). CBNRM emphasizes sustainable resource use through greater decision making power to the local communities.

A Game Management Area (GMA) in Zambia is a buffer zone around a national park in which licensed safari and subsistence hunting is permitted. It is a communal area in which people live by semi-subsistence agriculture, coexisting with wildlife. The CBNRM program allows Zambia Wildlife Authority (ZAWA) to share hunting license revenue and wildlife management responsibilities with the communities living in GMAs. The communities allocate the revenue resources between employment of village scouts, and local infrastructure and developmental projects through Community Resource Boards (CRBs) and Village Action Groups (VAGs).

The Government of the Republic of Zambia identifies tourism as one of the growth frontiers for the country. Several interventions have been introduced in the areas around the national parks designated as GMAs. However, the effectiveness of these interventions by government, private sector and the respective communities, and their impacts on the households' living conditions remain unknown. Recent increases in nature tourism also beg the question whether nature tourism has had any impact on the welfare of the communities and households living in GMAs. This knowledge is the key to identifying strategies necessary for increasing the contribution of nature-based tourism to the gross domestic product. Lodges and campsites may employ local labor. Increased demand for handicraft and other nature based products may provide new enterprising opportunities. Traditional entertainment and culture may increase revenue potential from the tourists.

This paper focuses on the economic welfare of households living inside GMAs. It tries to answer the question, do the households in GMA enjoy higher levels of welfare relative to the conditions they would have been in had the area not been designated as a GMA? Within the GMA, the paper tries to determine the factors that influence household participation in CRB/VAG activities, and whether the participating households get any extra benefits. Also of interest is whether such benefits of living in the GMAs, and, once in the GMA, of participating in CRB/VAG activities (if they exist) accrue more to the poorer segments of the communities[1].

To answer these questions, we use household and community level survey data from GMAs and other areas near national parks (non-GMAs). The rest of the paper is organized as follows: Section 2 focuses on methods and procedure. Section 3 presents the estimation results. Section 4 summarizes and concludes.

1.1 Background

Zambia's national parks and Controlled Hunting Areas (CHAs) were reorganized into national parks and GMAs in 1972 when the National Parks and Wildlife Act of 1968 came into force. Subsequently the National Parks and Wildlife Act of 1991 replaced the 1968 version and in turn it was replaced by the Zambia Wildlife Act of 1998. There were no substantial changes in the subsequent Acts in terms of national parks. The national parks are almost exclusively reserved for conservation and enhancement of wildlife, ecosystem, biodiversity and natural beauty. All forms of land use in GMAs are subject to provisions of management plans developed by CRBs (Zambia Wildlife Act, 1998, Section 7).

The CBNRM program in Zambia evolved out of the ADMADE program financed by USAID in the 1990s. By 1997 the current community institutional structures were established. In this system, VAGs are composed of five to ten elected representatives from a cluster of villages of populations of 500-1,000. Each VAG elects its representative to sit on the CRB. Each CRB consists of 9-10 members and elects a chairperson. An officer of ZAWA is assigned to the area under a CRB, as its unit leader.

The revenue stream to CRB originates from ZAWA and is called "Wildlife Conservation Revolving Funds (WCRF)." (ZAWA, 2007) Fifty percent of all ZAWA revenue is allocated to CRBs for community development out of which 5 percent goes directly to the chiefs. Each CRB may employ one or more local game scouts to assist ZAWA in enforcing anti-poaching regulations from the 45 percent allocation. CRBs enjoy wide latitude in deciding how the remaining WCRF is used.

The early days of the CBNRM program witnessed widespread misappropriation of funds. (Astle, 1999, Grant Thornton Associates et al, 2005). In light of such criticisms of the CBNRM program, this study seeks to differentiate between the poor and the non-poor

[1] In line with the primary justification for the establishment of the GMA institution.

households[2] and measure differences in welfare gains between poor and non-poor households that may be attributable to residing in GMA and participating in CRB/VAG activities. Estimations of welfare impacts for the poor and non-poor allow us to measure the possibility and extent of elite capture of benefits derived from the GMA within the communities.

2. Methods and Procedures

2.1 Sample design and sampling

The "Impact of Game Management Areas on Household Welfare" (IGMAW) survey was commissioned in 2006 to study the impact of the GMA institutions on the welfare of the households living in GMAs.

The first step was to understand the nature and spatial distribution of Zambia's national parks and game management areas. For logistical convenience, the national parks in the north and north-western parts of the country were omitted. For purposes of this survey the country's remaining national parks were grouped into what came to be known as 'park systems', which in some cases constituted a combination of national parks that are within the same geographical location. The study was conducted in the GMAs of four park systems:

a) Bangweulu (including Kasanka, Lavushi, and Isangano national parks),
b) Kafue (Kafue, Blue Lagoon, and Lochinvar national parks),
c) Lower Zambezi (Lower Zambezi national park), and
d) Luangwa (North and South Luangwa national park)[3].

Each of these park systems was regarded as a reporting domain in the sampling process. A stratified two-stage cluster sampling procedure was used, involving selection of SEAs (the clusters) at the first stage and selection of sample households from each selected SEA at the second stage. To sample the SEAs within the park systems, the GMA digital maps from ZAWA were overlaid on digital maps of standard enumeration areas (SEA) from the Central Statistical Office. The sampling frame of SEAs was drawn by selecting all the SEAs in the GMAs.

ZAWA classifies its GMAs into five categories based on wildlife stock level (and tourist activity). To control for variation arising from the differences in stock levels, the sampling scheme recognized this stratification and sub-divided the frame of GMA SEAs into the five strata. However, the fifth stratum, depleted, was dropped after realizing that only one SEA was classified as such, leaving four GMA strata. To be able to decipher the impact of the interventions in the GMAs, the research design used all SEAs in non-GMA areas that border

[2] The poor in this study are defined as households in the bottom two quintiles with respect to consumer durable asset values. Conversely, the top three quintile asset owning households are considered non-poor. This asset based indicator of poverty is based on indicators of household wealth as opposed to household income or consumption.
[3] Some GMAs in the northern edge of North Luangwa national park were dropped from the sample due to the absence of corresponding control areas close to the park.

the national parks (or park systems) as control SEAs. This brought the total number of (GMA and non-GMA) strata to five:

a) Prime
b) Secondary
c) Specialized
d) Understocked

} Game Management Areas (GMAs)

e) Non-GMA

A sample of 139 SEAs was drawn from the frame described above using probability proportional to size (PPS), where the size is based on the 2000 census of population and housing. The second stage of sampling was implemented using a list of households generated through a listing exercise, and a systematic probability sampling scheme. Two thousand eight hundred (2,800) households were sampled in total of which about half were from GMAs and the rest from non-GMAs. Very few observations (about 32) were lost due to non-response problems. Data were collected using household and community questionnaires, following a comprehensive pre-test in one non-sample GMA (Luano GMA) and one non-sample non-GMA (East of Chongwe).

2.2 Impact evaluation methods

Many factors affect household welfare, and living in GMAs and participation in the CRB/VAGs are but some of them. Other factors include socio-demographic characteristics of the household, such as being female-headed, household size, age/sex composition of the members, the highest level of education within the household, etc. Yet other factors have community-wide effect on household welfare, such as levels of physical capital in infrastructure, social capital in community based organizations within the community, and access to markets. Under such circumstances, it is important to separate out the effects of the various confounding factors.

Many of the same factors that affect household welfare also influence the probability that the household lives in a GMA, or, if in GMA, that the household participates in CRB/VAG decisions. Indeed, 'selection bias' arises because some households may choose to move into GMAs and social, economic, or other conditions may not allow some households to move out of GMAs. Once in the GMA, they self-select themselves to participate or not to participate in CRB/VAGs.

Historical factors for creations of CHAs, which were later converted to GMAs, as well as criteria used by ZAWA to create recent GMAs are not always available in quantitative form, usable in the analysis. Such unobserved factors may also result in selection bias. One of the important implications of the selection bias is that the simple differences in average welfare between households living in and outside GMAs, or that for participants and non-participants in CRB/VAGs are not an accurate measure of respective impacts. Fortunately, a number of empirical techniques have been developed over the years for cross-sectional data that help to

minimize this bias, such as propensity score matching (PSM), and Maddala's treatment regression (two-stage or joint estimation) (Maddala 1983).

With only cross-sectional data from households and communities in GMAs and those in carefully chosen comparison areas, we use Maddala's treatment regression techniques (Maddala 1983; Bandyopadhyay and Shyamsundar 2004; Stata Corp 2003) to estimate the impact on household welfare. We measure and represent welfare by per capita consumption expenditure, which is arguably more reliable than most other measures, such as income. The estimable equations for the treatment regression can be written as:

$$\text{Prob}(\text{G} = 1 | \mathbf{x}) = \varphi(a + \boldsymbol{\delta}' \mathbf{x} + e) \quad (1)$$

$$\ln y = \alpha + \boldsymbol{\beta}' \mathbf{x} + \gamma G + \varepsilon \quad (2)$$

where G takes the value 1 if a household lives inside a GMA and 0 otherwise, **x** is a vector of household and community characteristics and ***y*** is per capita consumption expenditure. The error terms ***e*** and ***ε*** are assumed to be correlated with the correlation coefficient ρ. For the estimation of the impact of participation in CRB/VAGs by the households living in GMAs, G is interpreted as participation in CRB or VAG.

Although the treatment regression can be estimated in two stages, we estimate the two relationships – participation and welfare regression equations – jointly using maximum likelihood techniques. Joint estimation of the treatment model (equations 1 and 2) corrects for selection biases from observed data in the model as well as bias resulting from unobserved and unknown factors. Maximum likelihood joint estimation of participation and outcome equations also allows us to test whether selection biases from unobserved and unknown factors are statistically significant.

The results obtained from the treatment regression were corroborated with those obtained from propensity score matching (PSM) based on a Gaussian kernel function and bootstrapped standard errors. For the PSM approach, the conditional probability of participation, or propensity score, $\text{Prob}(\text{G} = 1 | \mathbf{x})$, estimated from equation (1) was used to match the treatment households with comparison households. Unlike the fully parametric treatment regression, no definite functional form is assumed in the PSM for the impact equation (2). Instead, the impact is estimated as the mean difference in the outcome variable between participants and non participants in the matched sub-sample. Inferences are made possible by using bootstrapped standard errors of the impact estimates, a procedure that produces consistent estimates of standard errors when combined with Gaussian kernel-based matching methods (see, for example, Gilligan and Hoddinott 2007).

If the effects of selection bias from unobserved and unknown factors are not statistically significant, as indicated by ρ, treatment regression and propensity-score matching estimations should be close to each other. Where selection bias from unobserved and unknown factors are statistically significant, the propensity-score matching estimates would be biased and the differences between the estimates using the two methods should depend on the direction of the bias. We found significant selection bias from unobserved and unknown factors using

treatment regression maximum likelihood joint estimation approach in some of the estimation results. In these situations the propensity-score matching estimations were different as expected from the direction of the bias. Where the bias was not statistically significant the estimation results from the two methods were very similar.

3. Results

Table 1 presents the descriptive statistics for the variables used in the analysis based on the full sample (Column 1), as we as for the non-GMA (Column 2) and GMA (Column 3) sub-samples. About half (49 percent) of all the interviewed households (or 1,289 households) were in non-GMA, or control, areas. The asterisks at the end of the last column represent the level of significance based on an unequal variance t test between means. On average, a typical household has a per capita consumption expenditure of ZMK 846,000 per annum. When disaggregated by sub-sample, consumption is 1.7 percent higher in non-GMAs than it is in GMAs. However, the difference is statistically not significant at any acceptable level of significance. Other than per capita consumption expenditure and a couple of distance variables, the rest of the variables are significantly different between non-GMAs and GMAs.

Table 1. Comparison of GMAs and non-GMAs on selected characteristics, August 2006

		Sub-samples		
Variable description	Full sample	Non-GMA	GMA	
	(1)	(2)	(3)	
Number of sample households	2,649	1,289	1,360	
Per capita consumption expenditure in ZMK	846,331	853,750	839,359	
Household participation in CRB/VAG dummy	0.09	0.06	0.13	***
Age of household head in years	42.42	43.6	41.29	***
Female Headed Household	0.25	0.22	0.28	***
Education of the most educated hh member in years	6.87	7.45	6.33	***
Number of children below 15 years	2.55	2.66	2.44	***
Number of female members 15-60 years	1.27	1.3	1.24	*
Number of male members 15-60 years	1.19	1.22	1.15	**
Number of adults above 60 years	0.26	0.3	0.23	***
Distance to the nearest all-weather road in km	5.25	3.58	6.86	***
Distance to the nearest basic school in km	4.88	4.96	4.8	
Distance to the nearest health centre in km	11.52	11.27	11.77	
Value of consumption durable assets in million ZMK	0.44	0.58	0.3	***
Participation in cooperatives dummy	0.15	0.19	0.11	***
Number of projects in the community	2.01	1.84	2.16	***
CRB generated and got funds from ZAWA past three years	0.09	0.05	0.14	***
Number of households participating in the CRB/VAG	1.86	1.16	2.51	***

Significance: *=Significance at 10%; **=Significance at 5%; ***=Significance at 1%
Source: Authors' calculation

Although there is some CRB activity in non-GMAs, it is more intense in the GMAs. Proportionately, participation in non-GMAs (6 percent) is only about half that of the households in GMAs (13 percent). A similar pattern can be observed with respect to the number of households participating in the CRB. The proportion of households participating in CRBs that have been funded through community funds from ZAWA in GMAs is almost three times as high as that in non-GMAs.

3.1 Impacts of being in GMA and participation in VAGs and CRBs

Tables 2 and 3 show, respectively, the average impacts on household welfare of living in GMAs and, for those in GMAs, the impact of participation in CRB/VAGs, comparing PSM and TRE estimates. In the areas where the treatment regression estimates are statistically significant, negative selection bias from unobservable factors could not be rejected. As expected, the PSM estimates of the impact of GMA and participation are significantly smaller than the TREestimates. As a result, we focus on the treatment regression estimates for the rest of the paper.

Table 2. Comparison of propensity score matched (PSM) and treatment regression (TRE) of average GMA effect on the households in GMA

	PSM		Treatment Regression			
Outcome: per capita consumption	Estimates		Estimates		ρ	
	(1)		(2)		(3)	
Bangweulu	-0.151	**	0.729	***	-0.76	***
Kafue	-0.029		-0.444		0.51	
Lower Zambezi	-0.118		-0.362		0.26	
Luangwa	0.260	**	0.744	***	-0.39	***
Overall	-0.005		0.665	***	-0.58	***

Significance: *=Significance at 10%; **=Significance at 5%; ***=Significance at 1%
ATT: Average treatment effect on the treated
Source: Authors' calculations, Data from the IGMAW survey, 2006

Substantial differences between the actual and the counterfactual average per capita consumption expenditures of households in GMAs near Bangweulu and Luangwa park systems, as well as for the overall sample show significant welfare gains to the households associated with the GMA institutions (Table 2). Unconditional comparisons of the welfare of households in GMA and non-GMA areas in Table 1 hide these relatively large benefits as other household and community characteristics of GMA households make them worse off relative to households in non-GMA areas (see Column 2 in Table 2).

For the overall sample, 66 percent of the average per capita consumption expenditure may be associated with the GMA institution. However, this impact of GMA is not evenly distributed across all park systems. Households in GMAs near Bangweulu and Luangwa park systems show significant welfare gains while those near Kafue and Lower Zambezi park systems appear not to benefit at all.

Table 3. Comparison of propensity score matched (PSM) and treatment regression (TRE) of average participation effect on the participating households in GMA (ATT)

Outcome: per capita consumption	PSM Estimates		Treatment Regression Estimates		ρ	
	(1)		(2)		(3)	
Bangweulu	-0.074	**	0.858	***	-0.56	***
Kafue	-0.240		-0.286		0.13	
Lower Zambezi	-0.118		0.494		0.37	
Luangwa	0.034		0.530	***	-0.42	**
Overall	0.083		0.438	***	-0.30	*

Significance: *=Significance at 10%; **=Significance at 5%; ***=Significance at 1%
Source: Authors' calculations, Data from the IGMAW survey, 2006

Among the households living in GMAs, some households participate in CRB/VAGs. If CRB/VAGs provide broad social infrastructures from the hunting licensing revenue, we expect all households in the GMA to gain in welfare, on average. However, if active participants in these institutions restrict benefit sharing to themselves, we would expect participants to gain more in welfare relative to non-participants.

Table 3 shows the impact of participation in CRB/VAG activities on household welfare. Households in the GMA areas of Kafue and Lower Zambezi park systems obtain no welfare gains from participating in CRB/VAGs. The residents of the GMAs near the other two park systems, Bangweulu and Luangwa, seem to obtain significant benefits from participation in CRB/VAGs. Overall, GMA households participating in CRB/VAGs consume 44 percent more per than their non-participating counterparts. The complete estimation results in Tables A1 and A2 show various factors and their effects on household welfare.

3.2 Determinants of being in GMA and participation in VAGs and CRBs

The decision of a household to live in a GMA and, once in the GMA, the decision to participate in natural resource management decisions through CRB/VAGs are influenced by the circumstances that the household faces both within the household and in and around the community. Several factors were considered and the significance of their contributions towards explaining these decisions tested with the joint estimations of equations (1) and (2).[4] In this section we focus on the equation (1).

The results indicate that an average household's probability to reside in a GMA is directly and significantly related to its average distance to the nearest main road, the number of social projects in the area, and the viability of the CRB/VAG as measured by its ability to generate resources and number of participating households (Column 1; Table A1 in the Annex). Female-headed households are also 19 percent more likely to reside in GMAs than are their male-headed counterparts. The results further indicate an inverse and significant relationship between the household's GMA status and age of the household head, education of the most educated member, value of consumer durable assets, and participation in other area cooperatives. All these clearly suggest that households that reside in GMAs are relatively more disadvantaged than are those in non-GMAs.

[4] The estimation results of the full models are in the annex tables.

Within the GMAs, household participation in resource management decisions through CRB/VAGs is directly and significantly related to education level of the most educated member, distance to the nearest main road, distance to the nearest health center, participation in other area cooperatives, level of donor project activity in the area, and viability of the CRB/VAG (Column 2; Table A1 in the Annex). Thus, the more educated segments of the population in the remotest parts of the GMAs are more likely to participate in resource management, regardless of the age and sex of the household head and regardless of the household's wealth status.

3.3 Welfare and other factors

As earlier postulated, household welfare, as measured by per capita consumption expenditure, is indeed influenced by a variety of household and community factors. We control for a set of 16 variables to find the impact of GMA and CRB/VAG participation on per capita consumption expenditure. The results indicate the majority of the factors postulated to be associated with welfare are strongly significant, most at 1 percent level. Most of the coefficients also have signs that are consistent with *a priori* expectations.

An additional year of education for the most educated member and an additional one million Zambian Kwacha of consumer durable assets would raise the household's per capita consumption by 2-4 percent and 4-10 percent, respectively. Households that participate in cooperatives have 24-36 percent more per capita consumption expenditure than non-participating households. On the contrary female-headed households have between 15 and 19 percent less per capita consumption expenditure than their male-headed counterparts.

Similarly, every additional kilometer to the main road or health center is associated with 0.2-0.6 percent less per capita consumption expenditure. The results also seem to imply that larger household sizes are associated with lower welfare levels, regardless of the household composition. This is shown and confirmed by the unambiguously negative effects of additional members in all the four age/sex groups. The fact that additional working-age adults (15-60 years) have an adverse effect on welfare may imply that there are limited income-generating opportunities in these areas. As expected, children under 15 years and old members over 60 years old have greater welfare-depressing effects than the working-age groups.

3.4 The poor and non-poor

We define asset-poor households as those with values of consumer durable assets below the bottom two quintiles. It measures relative poverty in the households living near national parks. The impact of the GMA institution as well as participation in CRB/VAG activities on per capita consumption is large and positive only for the non-poor households. The impact of GMA and participation on the poor households are not statistically significant.

Table 4. GMA and Participation impact on welfare of poor and non-poor households

	GMA Effect		Participation Effect	
Outcome: per capita consumption	Estimates		Estimates	
	(1)		(2)	
Asset Poor: Bottom 2 quintile	0.205		0.137	
Asset Non-Poor: Top 3 quintile	0.596	***	0.536	***
Alternate Definition				
Asset Poor: Bottom 3 quintile	0.323		0.182	
Asset Non-Poor: Top 2 quintile	0.657	***	0.541	***

Significance: *=Significance at 10%; **=Significance at 5%; ***=Significance at 1%
Source: Authors' calculation, Data from the IGMAW survey, 2006

Table 4 shows 54 to 60 percent of the welfare benefits to the non-poor households are associated with GMA and participation effect. However, asset poor households enjoy none of the welfare gains that their non-poor counterparts are enjoying. This suggests that the GMA institution does not benefit the poorest in the community. Moreover, the poor do not gain any welfare benefits even when they actively participate in CRB/VAG activities. The results do not change when we redefine asset non-poor as the top 2 quintiles. Thus, the bottom 60 percent of the household appear to gain nothing and the top 40 percent benefit both from being in the GMA and participating in CRB/VAG. It appears that elites in the GMA capture all the benefits.

3.5 Community gains

One of the main results of this study is that the economic gains from living in GMA and participating in CRB/VAG activities do not go to the poorer sections of the community. The top 40 percent of the households appear to appropriate the benefits. One possible reason of this variation is that the gains from the GMA institutions may be invested in community infrastructure such as schools and health clinic buildings. The economic impact of education may not be evident in the short term and newer buildings do not always imply better health care. However, if GMAs are associated with improved community infrastructure, they may benefit all the sections of the community. To understand investments in community infrastructure in the GMAs we look at the average age of the newest infrastructure in the community in the GMAs around the four National Park Systems.

In the Park Systems with no household welfare impacts the infrastructure are relatively recent (Table 5). For example, in Kafue and Lower Zambezi the average age of the newest infrastructure is between 2 and 5 years, whereas in Bangweulu and Luangwa the average age of the newest infrastructure is between 8 and 10 years. Thus, it may appear that GMAs that show no measurable economic impact at the household level indicate some community infrastructure improvements.

Table 5. Age of the newest infrastructure in GMA and control areas across park systems

(Age in years)	Kafue	Lower Zambezi	Bangweulu	Luangwa
GMA areas	1.9	4.8	10.4	7.8
Control Areas	4.1	9.3	7.4	2.6

Source: Authors' calculation, Data from the IGMAW survey, 2006

However, the age of newer infrastructure in itself does not indicate the impact of GMA. The newer infrastructure may be built with the help of other NGOs and CBOs working within the GMAs in the Kafue and Lower Zambezi areas. After we control for wealth, community size, frequency of meetings by the leadership, number of droughts the past ten years, distance to the all-weather roads, NGO-funded projects in the community, and labor contribution by the community, the impact of the GMA on the age of new infrastructure disappears for the Kafue and Lower Zambezi areas.[5] The new infrastructure is older in Bangweulu and Luangwa not only with respect to the respective control areas but also as compared with the GMAs in the other two park systems. Multivariate analysis shows no significant impact of GMA on the age of new infrastructure in these park systems as well.

3.6 Other regularities

The benefits from the GMA institution as well as participation in CRB/VAG activities are unevenly distributed across different park systems. GMAs near Bangweulu and Luangwa National Park areas are associated with positive household welfare effects while those near Kafue and Lower Zambezi National Parks are not. We outline other regularities shared by these park systems that may have positive or negative influences on the welfare of the households living in these GMAs.

There are two types of factors, (a) those likely to have a negative effect on welfare, and (b) those likely to have a positive effect on welfare. The impact results in Tables 2 and 3 are net of some of these confounding factors. In other words these are factors other than the GMA itself that may influence household welfare in these areas. The average levels of these factors are presented in Table 6. More female headed households, less education, longer distances to all-weather roads and less livestock indicate less human resources, man-made resources, and economic opportunities in and near Bangweulu and Luangwa National Parks. Thus, the households living in these GMAs are more likely to be dependent on natural resources and to seek benefit from the GMA institution.

The second group of factors in Table 6 also supports this hypothesis. The less economic opportunities in and near Bangweulu and Luangwa may explain the migration pressure in these areas and higher dependence on income from nature-based activities. Households in these areas are more effective with utilizing cooperatives and CBOs as they pay less in fees as compared with households in GMAs near Kafue and Lower Zambezi, but earn more from cooperatives and CBOs. Households in GMAs near Luangwa show the highest level of involvement in CRB/VAGs among the four areas, followed by those in GMAs in and near Bangweulu. Higher involvement with CRB/VAGs combined with more effective use of cooperatives by the households may indicate a higher level of social capital in these areas as compared with those near Kafue and Lower Zambezi.

[5] We don't report these regression results as the coefficients are not statistically significant.

Table 6. Similarities and differences in confounding factors in four National Park Systems

	Kafue	Lower Zambezi	Bangweulu	Luangwa
Variables with negative effects				
Percent of female headed household	22%	24%	36%	27%
Education in years	7.5	7.4	5.5	6.4
Value of livestock in ZMK	1,156,841	449,612	76,987	187,715
Distance to all-weather road in km	4.8	3.1	6.0	10.5
Variables with positive effects				
Migration in 5 Years	11.4	10.3	5.5	1.7
Income from Nature-based Activities	115,253	412,158	695,262	860,078
Fees paid to Community Based Organizations	1,376	1,905	697	766
Income from Community Based Organizations	1,722	1,951	2,683	4,009
Involvement in the CRB/VAG relative to Luangwa	41%	43%	57%	100%

Source: Authors' calculations, Data from the IGMAW survey, 2006

The significance of these factors is that they are different in Bangweulu and Luangwa as compared with Kafue and Lower Zambezi. They do not directly explain why Bangweulu and Luangwa show the GMA and participation effect on welfare while Kafue and Lower Zambezi do not. The impacts are calculated after taking into account these and other confounding characteristics of the communities and households in the four areas.

4. Conclusions

Game management areas in Zambia were conceived as controlled hunting grounds where people coexist with nature. In recent years ZAWA has started sharing some of the revenue and responsibilities with the local communities. The result of this devolution of responsibilities and resources has been uneven with respect to wildlife management (Simwanza, 2007). This study focuses on the human aspect of the impact of the devolution of rights and responsibilities in the GMA. To be precise, we look at the impact of GMA on household welfare of those living in it. For those households in GMAs, we also measure the impact of participating in two community institutions, CRB/VAGs, which allow households to actively take part in natural resource management and decide on how the revenue from it is spent within the community.

We find substantial gains associated with living in GMAs and participating in CRB/VAGs. Since GMAs are located in relatively remote areas on land unsuitable for intensive agriculture, comparison of average consumption welfare between households in GMAs and non-GMA areas does not reflect welfare differences attributable to the GMA institutions alone. We find significant welfare gains in some GMAs after controlling for household and community characteristics. However, these gains are unevenly distributed across various park systems around which GMAs are clustered. In particular, households living in GMAs near Bangweulu and Luangwa park systems appear to gain substantially from the GMA institution while those in GMAs near the other two park systems do not.

We find that not all households in GMAs gain equally. Those households who actively participate through CRB/VAGs gain substantially more than those who do not. The gains from

participation follow the same special pattern of uneven distribution between the park systems. Elite capture of all the benefits from GMAs has been a long standing concern from the days of ADMADE. The local institutions such as CRB/VAGs were created to allow broader participation of households in GMA related community decisions and prevent elite capture of the resources. We find wealth, as measured by consumer durable assets, is not a significant factor in participation in CRB/VAGs. Other things being equal, the poor and non-poor households are equally likely to participate in CRB/VAGs. However, we find no evidence of welfare gains to the poor households associated with living in the GMAs or participation in CRB/VAGs. Rather, the top 40 percent of the households derive all the benefits from living in GMAs and participating in CRB/VAG s. Thus, while the poor are not prevented from participating, they do not derive any welfare gains from it.

Consumption expenditure measures welfare in a narrow economic sense for households. GMA institutions may concentrate on improving community infrastructure instead of distributing the gains to the households. Indeed, GMAs in some park systems have newer infrastructures than other. However, when we control for other factors, such as NGO and community labor contributions, we find no evidence of impact of GMA on the age of new infrastructure.

In conclusion, some GMAs are associated with significant welfare gains to those living in them and more gains to those who participate in CRB/VAGs. However, these gains are captured by the relatively elite households in the community. Community benefits as measured by newer infrastructure may not be associated with GMAs, but other contributing factors. The devolution of community rights and responsibilities for natural resource management in Zambia is not complete. The coexistence of traditional and modern local and national institutions makes the devolution of power and resource sharing a complex issue. Historically powerful national institutions like ZAWA and local elites have vested interests in maintaining the status quo in revenue sharing. More even distribution of gains from GMAs across households near different park systems and across the poor and the non-poor should be the continuing goal of the national policy makers.

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TableA1. Factors affecting the household's probability to live in the GMA and, once in the GMA, the probability to participate in the CRB/VAG

Variable	Variable description	Probit models for the household's probability to Live in the GMA		Participate in the VAG/CRB[a]	
		(1)		(2)	
cons	Intercept	0.707	**	-2.612	***
		(0.279)		(0.262)	
park2	Kafue dummy variable	-1.099	***	-0.247	
		(0.332)		(0.190)	
park3	Lower Zambezi dummy	-0.523		-0.123	
		(0.330)		(0.106)	
park4	Luangwa dummy	-0.512		-0.336	***
		(0.340)		(0.121)	
hage	Age of the household head in years	-0.006	*	0.001	
		(0.003)		(0.006)	
fhhh	Female-headed household dummy	0.193	**	-0.018	
		(0.088)		(0.138)	
maxedu	Education of the most educated household member in years	-0.033	**	0.034	**
		(0.013)		(0.015)	
c0to14	Number of children below 15 years	-0.026		0.015	
		(0.019)		(0.030)	
f15to60	Number of female members 15-60 years old	0.009		0.071	
		(0.039)		(0.076)	
m15to60	Number of male members 15-60 years old	0.058		0.055	
		(0.036)		(0.071)	
m61plus	Number of members older than 60 years	-0.062		-0.125	
		(0.075)		(0.158)	
kroad	Distance to the nearest main road in km	0.008	*	0.008	***
		(0.004)		(0.002)	
kbsch	Distance to the nearest basic school in km	0.004		-0.011	
		(0.010)		(0.010)	
kheal	Distance to the nearets health centre in km	-0.002		0.006	*
		(0.004)		(0.004)	
vacast	Value of consumer durable assets in ZMK	-0.020	**	-0.003	
		(0.008)		(0.018)	
dcoop	Participation in cooperatives dummy	-0.388	***	0.552	***
		(0.098)		(0.157)	
nproj	Number of projects in the community	0.042	**	0.055	***
		(0.019)		(0.017)	
dcfnd	CRB funded dummy variable	0.617	***	0.829	***
		(0.159)		(0.155)	
npart	Number of participants in the CRB/VAG	0.097	*	0.203	***
		(0.058)		(0.019)	

[a]Based only on the sub-sample of households that are located in the GMAs
Level of significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

Table A2. Impact of living in the GMA and, once in the GMA, of participating in the VAG/CRB

		Treatment Regression models for the impact on per capita consumption expenditure of			
Variable	Variable description	Living in GMA[a]		Participating in VAG/CRB[b]	
		(1)		(2)	
cons	Intercept	13.020	***	13.580	***
		(0.209)		(0.086)	
park2	Kafue dummy variable	0.400	***	0.192	**
		(0.143)		(0.088)	
park3	Lower Zambezi dummy variable	0.416	***	0.217	***
		(0.127)		(0.063)	
park4	Luangwa dummy variable	0.434	***	0.537	***
		(0.100)		(0.096)	
hage	Age of the household head	-0.001		-0.001	
		(0.001)		(0.002)	
fhhh	Female-headed dummy	-0.186	***	-0.150	***
		(0.047)		(0.054)	
maxedu	Education of the most educated member (years)	0.043	***	0.022	**
		(0.010)		(0.010)	
c0to14	Number of children less than 15 years old	-0.132	***	-0.145	***
		(0.011)		(0.011)	
f15to60	Number of female members 15-60 years	-0.063	**	-0.091	***
		(0.025)		(0.029)	
m15to60	Number of male members 15-60 years	-0.100	***	-0.090	***
		(0.022)		(0.022)	
m61plus	Number of members older than 60 years	-0.140	***	-0.186	***
		(0.037)		(0.051)	
kroad	Distance to the nearest main road in km	-0.005	***	-0.006	***
		(0.002)		(0.002)	
kbsch	Distance to the nearest basic school in km	0.001		0.010	***
		(0.003)		(0.003)	
kheal	Distance to the nearest health centre in km	-0.002		-0.004	***
		(0.002)		(0.002)	
vacast	Value of consumer durable assets in ZMK	0.045	***	0.107	***
		(0.014)		(0.024)	
dcoop	Participation in cooperatives dummy	0.357	***	0.237	***
		(0.051)		(0.066)	
gma or dvcrb	Participation dummy variable[a,b]	0.665	***	0.438	**
		(0.237)		(0.205)	
Number of observations		2,209		1,112	
Log-likelihood value		-3,405		-1,333	
Goodness of fit Chi-Square		297.73	***	407.06	***
Rho		-0.583	***	-0.301	*

[a]Participation dummy variable refers to the GMA dummy, equal to 1 if the household is located in a GMA
[b]The participation dummy variable refers to the CRB/VAG dummy, equal to 1 if the household participates in the VAG/CRB. This model uses a sub-sample of households that are located in the GMA
Significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

TableA3. Factors affecting the non-poor household's probability to live in the Bangweulu Park System GMA and, once in the GMA, the probability to participate in the VAG/CRB

	Bangweulu	Probit models for the household's probability to			
Variable	Variable description	Live in the GMA		Participate in the VAG/CRB[a]	
		(1)		(2)	
hage	Age of the household head in years	-0.014	**	-0.018	**
		(0.006)		(0.008)	
fhhh	Female-headed household dummy	0.709	***	0.061	
		(0.112)		(0.286)	
maxedu	Education of the most educated household member in years	-0.081	***	0.018	
		(0.028)		(0.036)	
c0to14	Number of children below 15 years	0.011		0.108	**
		(0.033)		(0.045)	
f15to60	Number of female members 15-60 years old	0.197	**	0.167	
		(0.083)		(0.125)	
m15to60	Number of male members 15-60 years old	0.233	**	0.282	**
		(0.092)		(0.111)	
m61plus	Number of members older than 60 years	0.017		0.188	
		(0.162)		(0.235)	
kroad	Distance to the nearest main road in km	0.012		0.015	***
		(0.008)		(0.004)	
kbsch	Distance to the nearest basic school in km	0.018		-0.021	
		(0.022)		(0.020)	
kheal	Distance to the nearets health centre in km	-0.002		0.009	
		(0.006)		(0.007)	
vacast	Value of consumer durable assets in ZMK	0.161		0.023	
		(0.155)		(0.054)	
dcoop	Participation in cooperatives dummy	-0.540	***	0.741	***
		(0.177)		(0.201)	
nproj	Number of projects in the community	0.017		0.183	**
		(0.029)		(0.081)	
dcfnd	CRB funded dummy variable	0.413	**	1.190	***
		(0.171)		(0.177)	
npart	Number of participants in the CRB/VAG	0.015		0.185	***
		(0.056)		(0.048)	
cons	Intercept	0.769	*	-2.942	***
		(0.425)		(0.387)	

[a]Based only on the sub-sample of households that are located in the GMAs
Level of significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

Table A4. Impact of living in the GMA and, once in the Bangweulu Park System GMA, of participating in the VAG/CRB on the non-poor households

	Bangweulu	Treatment Regression models for the impact on per capita consumption expenditure of			
Variable	Variable description	Living in GMA[a]		Participating in VAG/CRB[b]	
		(1)		(2)	
hage	Age of the household head	0.006	**	0.004	
		(0.003)		(0.003)	
fhhh	Female-headed dummy	-0.289	***	-0.161	**
		(0.096)		(0.078)	
maxedu	Education of the most educated member (years)	0.068	***	0.030	***
		(0.013)		(0.009)	
c0to14	Number of children less than 15 years old	-0.166	***	-0.175	***
		(0.016)		(0.015)	
f15to60	Number of female members 15-60 years	-0.187	***	-0.130	***
		(0.043)		(0.042)	
m15to60	Number of male members 15-60 years	-0.191	***	-0.166	***
		(0.037)		(0.029)	
m61plus	Number of members older than 60 years	-0.222	**	-0.253	***
		(0.089)		(0.092)	
kroad	Distance to the nearest main road in km	-0.007		-0.005	
		(0.004)		(0.004)	
kbsch	Distance to the nearest basic school in km	-0.007		0.004	
		(0.007)		(0.005)	
kheal	Distance to the nearest health centre in km	-0.001		-0.004	*
		(0.003)		(0.002)	
vacast	Value of consumer durable assets in ZMK	0.097		0.104	
		(0.092)		(0.092)	
dcoop	Participation in cooperatives dummy	0.495	***	0.189	
		(0.125)		(0.146)	
gma or dvcrb	Participation dummy variable[a,b]	0.729	***	0.858	***
		(0.193)		(0.147)	
cons	Intercept	12.960	***	13.566	***
		(0.136)		(0.137)	
Number of observations		513		380	
Log-likelihood value		-696		-422	
Goodness of fit Chi-Square		222.31		.	
Rho		-56	***	-0.56	***

[a]Participation dummy variable refers to the GMA dummy, equal to 1 if the household is located in a GMA
[b]The participation dummy variable refers to the CRB/VAG dummy, equal to 1 if the household participates in the VAG/CRB. This model uses a sub-sample of households that are located in the GMA
Significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

TableA5. Factors affecting the non-poor household's probability to live in the Kafue Park System GMA and, once in the GMA, the probability to participate in the VAG/CRB

	Kafue	Probit models for the household's probability to			
Variable	Variable description	Live in the GMA		Participate in the VAG/CRB[a]	
		(1)		(2)	
Hage	Age of the household head in years	0.011	**	0.030	
		(0.005)		(0.022)	
Fhhh	Female-headed household dummy	-0.440	**	-0.361	**
		(0.176)		(0.150)	
Maxedu	Education of the most educated household member in years	-0.003		0.062	
		(0.033)		(0.058)	
c0to14	Number of children below 15 years	0.106	***	0.019	
		(0.031)		(0.058)	
f15to60	Number of female members 15-60 years old	-0.034		-0.119	
		(0.087)		(0.140)	
m15to60	Number of male members 15-60 years old	-0.054		-0.150	
		(0.064)		(0.201)	
m61plus	Number of members older than 60 years	-0.099		-0.828	
		(0.136)		(0.804)	
Kroad	Distance to the nearest main road in km	0.013	**	-0.004	
		(0.005)		(0.006)	
Kbsch	Distance to the nearest basic school in km	0.018		0.009	
		(0.031)		(0.038)	
Kheal	Distance to the nearets health centre in km	-0.029	**	-0.018	
		(0.014)		(0.029)	
Vacast	Value of consumer durable assets in ZMK	-0.432	*	0.358	
		(0.243)		(0.425)	
Dcoop	Participation in cooperatives dummy	-0.699	**	0.392	
		(0.325)		(0.609)	
Nproj	Number of projects in the community	-0.256	***	-0.171	
		(0.082)		(0.114)	
Dcfnd	CRB funded dummy variable	0.013		0.120	
		(0.249)		(0.477)	
Npart	Number of participants in the CRB/VAG	0.205	*	0.228	***
		(0.109)		(0.022)	
Cons	Intercept	-0.716	*	-3.320	***
		(0.434)		(0.908)	

[a]Based only on the sub-sample of households that are located in the GMAs
Level of significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

Table A6. Impact of living in the GMA and, once in the Kafue Park System GMA, of participating in the VAG/CRB on the non-poor households

	Kafue	Treatment Regression models for the impact on per capita consumption expenditure of			
Variable	Variable description	Living in GMA[a]		Participating in VAG/CRB[b]	
		(1)		(2)	
Hage	Age of the household head	-0.001		0.000	
		(0.002)		(0.002)	
fhhh	Female-headed dummy	-0.238	***	-0.442	***
		(0.078)		(0.072)	
maxedu	Education of the most educated member (years)	0.028	**	0.016	
		(0.011)		(0.014)	
c0to14	Number of children less than 15 years old	-0.125	***	-0.135	***
		(0.016)		(0.021)	
f15to60	Number of female members 15-60 years	-0.003		-0.050	*
		(0.054)		(0.028)	
m15to60	Number of male members 15-60 years	-0.079	**	-0.122	***
		(0.035)		(0.045)	
m61plus	Number of members older than 60 years	-0.152	***	-0.329	***
		(0.058)		(0.067)	
kroad	Distance to the nearest main road in km	0.004		0.000	
		(0.002)		(0.002)	
kbsch	Distance to the nearest basic school in km	0.002		0.008	
		(0.007)		(0.013)	
kheal	Distance to the nearest health centre in km	-0.004		-0.008	
		(0.005)		(0.009)	
vacast	Value of consumer durable assets in ZMK	0.020	*	0.448	***
		(0.012)		(0.128)	
dcoop	Participation in cooperatives dummy	0.170		0.235	
		(0.118)		(0.216)	
gma or dvcrb	Participation dummy variable[a,b]	-0.445		-0.287	
		(0.389)		(0.231)	
cons	Intercept	13.792	***	13.860	***
		(0.148)		(0.172)	
Number of observations		612		166	
Log-likelihood value		-862		-167	
Goodness of fit Chi-Square		249.10			
Rho		0.51		0.13	

[a]Participation dummy variable refers to the GMA dummy, equal to 1 if the household is located in a GMA
[b]The participation dummy variable refers to the CRB/VAG dummy, equal to 1 if the household participates in the VAG/CRB. This model uses a sub-sample of households that are located in the GMA
Significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

TableA7. Factors affecting the non-poor household's probability to live in the Lower Zambezi Park System GMA and, once in the GMA, the probability to participate in the VAG/CRB

	Lower Zambezi	Probit models for the household's probability to			
Variable	Variable description	Live in the GMA		Participate in the VAG/CRB[a]	
		(1)		(2)	
Hage	Age of the household head in years	-0.009		0.037	***
		(0.007)		(0.012)	
Fhhh	Female-headed household dummy	-0.081		-0.104	
		(0.113)		(0.792)	
Maxedu	Education of the most educated household member in years	-0.005		0.036	
		(0.014)		(0.042)	
c0to14	Number of children below 15 years	-0.068	*	-0.193	
		(0.039)		(0.165)	
f15to60	Number of female members 15-60 years old	-0.084		-0.022	
		(0.064)		(0.123)	
m15to60	Number of male members 15-60 years old	0.032		-0.019	
		(0.065)		(0.162)	
m61plus	Number of members older than 60 years	-0.099		-0.397	
		(0.161)		(0.457)	
Kroad	Distance to the nearest main road in km	-0.054		-0.018	
		(0.035)		(0.052)	
Kbsch	Distance to the nearest basic school in km	0.012		-0.054	
		(0.011)		(0.102)	
Kheal	Distance to the nearets health centre in km	0.016	*	0.024	*
		(0.009)		(0.013)	
Vacast	Value of consumer durable assets in ZMK	-0.092		0.097	
		(0.112)		(0.081)	
Dcoop	Participation in cooperatives dummy	0.049		0.437	
		(0.226)		(0.362)	
Nproj	Number of projects in the community	-0.112		0.139	***
		(0.078)		(0.051)	
Dcfnd	CRB funded dummy variable	-0.343		1.891	
		(0.398)		(1.534)	
Npart	Number of participants in the CRB/VAG	1.103	*	0.274	***
		(0.599)		(0.058)	
Cons	Intercept	0.075		-4.187	***
		(0.610)		(1.317)	

[a]Based only on the sub-sample of households that are located in the GMAs
Level of significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

Table A8. Impact of living in the GMA and, once in the Lower Zambezi Park System GMA, of participating in the VAG/CRB on the non-poor households

	Lower Zambezi	Treatment Regression models for the impact on per capita consumption expenditure of			
Variable	Variable description	Living in GMA[a]		Participating in VAG/CRB[b]	
		(1)		(2)	
Hage	Age of the household head	-0.004		-0.002	
		(0.004)		(0.008)	
fhhh	Female-headed dummy	-0.065		0.103	
		(0.097)		(0.145)	
maxedu	Education of the most educated member (years)	0.021	*	0.000	
		(0.012)		(0.010)	
c0to14	Number of children less than 15 years old	-0.128	***	-0.149	***
		(0.026)		(0.036)	
f15to60	Number of female members 15-60 years	-0.105	***	-0.056	
		(0.033)		(0.055)	
m15to60	Number of male members 15-60 years	-0.083	**	-0.102	***
		(0.033)		(0.036)	
m61plus	Number of members older than 60 years	-0.171	***	-0.138	
		(0.060)		(0.163)	
kroad	Distance to the nearest main road in km	-0.009	**	0.000	
		(0.004)		(0.010)	
kbsch	Distance to the nearest basic school in km	0.003		0.007	***
		(0.004)		(0.003)	
kheal	Distance to the nearest health centre in km	-0.003		-0.004	*
		(0.002)		(0.002)	
vacast	Value of consumer durable assets in ZMK	0.031		0.211	***
		(0.026)		(0.039)	
dcoop	Participation in cooperatives dummy	0.327	***	0.239	**
		(0.066)		(0.101)	
gma or dvcrb	Participation dummy variable[a,b]	-0.362		0.494	
		(0.239)		(0.744)	
cons	Intercept	14.238	***	13.897	***
		(0.223)		(0.239)	
Number of observations		540		230	
Log-likelihood value		-765		-229	
Goodness of fit Chi-Square		.		.	
Rho		0.26		-0.37	

[a]Participation dummy variable refers to the GMA dummy, equal to 1 if the household is located in a GMA
[b]The participation dummy variable refers to the CRB/VAG dummy, equal to 1 if the household participates in the VAG/CRB. This model uses a sub-sample of households that are located in the GMA
Significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

TableA9. Factors affecting the non-poor household's probability to live in the Luangwa Park System GMA and, once in the GMA, the probability to participate in the VAG/CRB

	Luangwa	Probit models for the household's probability to			
Variable	Variable description	Live in the GMA		Participate in the VAG/CRB[a]	
		(1)		(2)	
Hage	Age of the household head in years	-0.009		-0.005	
		(0.007)		(0.010)	
Fhhh	Female-headed household dummy	0.328	*	-0.056	
		(0.172)		(0.217)	
Maxedu	Education of the most educated household member in years	-0.039	*	0.024	
		(0.023)		(0.033)	
c0to14	Number of children below 15 years	-0.056		-0.023	
		(0.039)		(0.057)	
f15to60	Number of female members 15-60 years old	0.116		0.138	
		(0.085)		(0.149)	
m15to60	Number of male members 15-60 years old	0.109		-0.201	
		(0.072)		(0.140)	
m61plus	Number of members older than 60 years	0.048		-0.077	
		(0.194)		(0.226)	
Kroad	Distance to the nearest main road in km	0.031	*	0.008	***
		(0.016)		(0.002)	
Kbsch	Distance to the nearest basic school in km	-0.044		-0.010	
		(0.039)		(0.014)	
Kheal	Distance to the nearets health centre in km	-0.003		0.012	**
		(0.013)		(0.005)	
Vacast	Value of consumer durable assets in ZMK	-0.012		-0.012	
		(0.025)		(0.017)	
Dcoop	Participation in cooperatives dummy	-0.430	***	0.565	*
		(0.165)		(0.302)	
Nproj	Number of projects in the community	0.138	***	0.045	**
		(0.033)		(0.020)	
Dcfnd	CRB funded dummy variable	1.344	***	0.677	***
		(0.365)		(0.243)	
Npart	Number of participants in the CRB/VAG	0.083		0.212	***
		(0.086)		(0.021)	
Cons	Intercept	-0.058		-2.304	***
		(0.478)		(0.437)	

[a]Based only on the sub-sample of households that are located in the GMAs
Level of significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

Table A10. Impact of living in the GMA and, once in the Luangwa Park System GMA, of participating in the VAG/CRB on the non-poor households

	Luangwa	Treatment Regression models for the impact on per capita consumption expenditure of			
Variable	Variable description	Living in GMA[a]		Participating in VAG/CRB[b]	
		(1)		(2)	
Hage	Age of the household head	-0.003		0.000	
		(0.002)		(0.004)	
fhhh	Female-headed dummy	-0.134		-0.127	
		(0.086)		(0.101)	
maxedu	Education of the most educated member (years)	0.060	***	0.063	***
		(0.011)		(0.012)	
c0to14	Number of children less than 15 years old	-0.133	***	-0.126	***
		(0.018)		(0.023)	
f15to60	Number of female members 15-60 years	-0.099	**	-0.161	**
		(0.043)		(0.064)	
m15to60	Number of male members 15-60 years	-0.051		-0.039	
		(0.040)		(0.053)	
m61plus	Number of members older than 60 years	-0.157	**	-0.181	*
		(0.069)		(0.105)	
kroad	Distance to the nearest main road in km	-0.007	***	-0.008	***
		(0.002)		(0.002)	
kbsch	Distance to the nearest basic school in km	0.024	**	0.027	***
		(0.010)		(0.008)	
kheal	Distance to the nearest health centre in km	-0.001		-0.004	
		(0.004)		(0.003)	
vacast	Value of consumer durable assets in ZMK	0.085	***	0.086	***
		(0.012)		(0.021)	
dcoop	Participation in cooperatives dummy	0.283	***	0.212	*
		(0.068)		(0.110)	
gma or dvcrb	Participation dummy variable[a,b]	0.744	***	0.530	***
		(0.164)		(0.197)	
cons	Intercept	13.282	***	13.738	***
		(0.174)		(0.162)	
Number of observations		544		336	
Log-likelihood value		-777		-432	
Goodness of fit Chi-Square		.		.	
Rho		-0.39	***	-0.42	**

[a]Participation dummy variable refers to the GMA dummy, equal to 1 if the household is located in a GMA
[b]The participation dummy variable refers to the CRB/VAG dummy, equal to 1 if the household participates in the VAG/CRB. This model uses a sub-sample of households that are located in the GMA
Significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

TableA11. Factors affecting the non-poor household's probability to live in the GMA and, once in the GMA, the probability to participate in the VAG/CRB

		Probit models for the household's probability to			
Variable	Variable description	Live in the GMA		Participate in the VAG/CRB[a]	
		(1)		(2)	
park2	Kafue dummy variable	-1.014	***	-0.366	
		(0.341)		(0.257)	
park3	Lower Zambezi dummy	-0.532		-0.340	**
		(0.340)		(0.149)	
park4	Luangwa dummy	-0.434		-0.323	**
		(0.350)		(0.132)	
hage	Age of the household head in years	-0.005		-0.002	
		(0.004)		(0.008)	
fhhh	Female-headed household dummy	0.255	**	-0.092	
		(0.120)		(0.184)	
maxedu	Education of the most educated household member in years	-0.039	**	0.051	**
		(0.019)		(0.022)	
c0to14	Number of children below 15 years	-0.045	*	0.032	
		(0.024)		(0.037)	
f15to60	Number of female members 15-60 years old	0.023		-0.059	
		(0.050)		(0.100)	
m15to60	Number of male members 15-60 years old	0.085	*	0.065	
		(0.044)		(0.089)	
m61plus	Number of members older than 60 years	-0.109		0.045	
		(0.097)		(0.218)	
kroad	Distance to the nearest main road in km	0.006		0.010	***
		(0.005)		(0.002)	
kbsch	Distance to the nearest basic school in km	0.006		-0.011	
		(0.009)		(0.010)	
kheal	Distance to the nearets health centre in km	-0.004		0.015	***
		(0.005)		(0.004)	
vacast	Value of consumer durable assets in ZMK	-0.020	**	-0.005	
		(0.008)		(0.019)	
dcoop	Participation in cooperatives dummy	-0.353	***	0.466	***
		(0.114)		(0.178)	
nproj	Number of projects in the community	0.044	**	0.065	***
		(0.020)		(0.019)	
dcfnd	CRB funded dummy variable	0.612	***	0.572	***
		(0.172)		(0.174)	
npart	Number of participants in the CRB/VAG	0.083		0.189	***
		(0.054)		(0.024)	
cons	Intercept	0.734	**	-2.438	***
		(0.325)		(0.311)	

[a]Based only on the sub-sample of households that are located in the GMAs
Level of significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

Table A12. Impact of living in the GMA and, once in the GMA, of participating in the VAG/CRB on the non-poor households

		Treatment Regression models for the impact on per capita consumption expenditure of			
Variable	Variable description	Living in GMA[a]		Participating in VAG/CRB[b]	
		(1)		(2)	
park2	Kafue dummy variable	0.372	***	0.262	***
		(0.129)		(0.086)	
park3	Lower Zambezi dummy variable	0.406	***	0.203	**
		(0.128)		(0.082)	
park4	Luangwa dummy variable	0.456	***	0.546	***
		(0.100)		(0.092)	
hage	Age of the household head	0.000		0.001	
		(0.002)		(0.002)	
fhhh	Female-headed dummy	-0.127	*	-0.158	*
		(0.071)		(0.081)	
maxedu	Education of the most educated member (years)	0.045	***	0.020	
		(0.015)		(0.013)	
c0to14	Number of children less than 15 years old	-0.120	***	-0.141	***
		(0.013)		(0.013)	
f15to60	Number of female members 15-60 years	-0.030		-0.052	*
		(0.029)		(0.030)	
m15to60	Number of male members 15-60 years	-0.093	***	-0.075	***
		(0.024)		(0.024)	
m61plus	Number of members older than 60 years	-0.178	***	-0.303	***
		(0.043)		(0.057)	
kroad	Distance to the nearest main road in km	-0.004	***	-0.006	***
		(0.001)		(0.002)	
kbsch	Distance to the nearest basic school in km	-0.001		0.009	***
		(0.003)		(0.003)	
kheal	Distance to the nearest health centre in km	-0.001		-0.004	**
		(0.002)		(0.002)	
vacast	Value of consumer durable assets in ZMK	0.036	***	0.090	***
		(0.012)		(0.019)	
dcoop	Participation in cooperatives dummy	0.308	***	0.249	***
		(0.051)		(0.078)	
gma or dvcrb	Participation dummy variable[a,b]	0.596	***	0.536	***
		(0.193)		(0.183)	
cons	Intercept	13.055	***	13.564	***
		(0.201)		(0.115)	
Number of observations		1370		688	
Log-likelihood value		-2071		-806	
Goodness of fit Chi-Square		252.05	***	315.46	***
Rho		-0.559	***	-0.427	***

[a]Participation dummy variable refers to the GMA dummy, equal to 1 if the household is located in a GMA
[b]The participation dummy variable refers to the CRB/VAG dummy, equal to 1 if the household participates in the VAG/CRB. This model uses a sub-sample of households that are located in the GMA
Significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

TableA13. Factors affecting the poor household's probability to live in the GMA and, once in the GMA, the probability to participate in the VAG/CRB

		Probit models for the household's probability to			
Variable	Variable description	Live in the GMA		Participate in the VAG/CRB[a]	
		(1)		(2)	
park2	Kafue dummy variable	-1.284	***	-0.029	
		(0.348)		(0.297)	
park3	Lower Zambezi dummy	-0.442		0.131	
		(0.349)		(0.236)	
park4	Luangwa dummy	-0.633	*	-0.523	*
		(0.369)		(0.314)	
hage	Age of the household head in years	-0.007	*	0.003	
		(0.004)		(0.010)	
fhhh	Female-headed household dummy	0.104		0.081	
		(0.113)		(0.227)	
maxedu	Education of the most educated household member in years	-0.022		0.028	
		(0.017)		(0.021)	
c0to14	Number of children below 15 years	0.020		-0.067	
		(0.029)		(0.071)	
f15to60	Number of female members 15-60 years old	-0.023		0.414	***
		(0.057)		(0.145)	
m15to60	Number of male members 15-60 years old	-0.004		-0.056	
		(0.063)		(0.142)	
m61plus	Number of members older than 60 years	-0.018		-0.290	
		(0.109)		(0.328)	
kroad	Distance to the nearest main road in km	0.012	**	0.000	
		(0.005)		(0.005)	
kbsch	Distance to the nearest basic school in km	0.004		-0.019	
		(0.014)		(0.028)	
kheal	Distance to the nearets health centre in km	0.000		-0.026	**
		(0.004)		(0.011)	
vacast	Value of consumer durable assets in ZMK	-5.937		-3.690	
		(3.705)		(8.503)	
dcoop	Participation in cooperatives dummy	-0.449	**	1.032	***
		(0.181)		(0.326)	
nproj	Number of projects in the community	0.012		0.018	
		(0.041)		(0.037)	
dcfnd	CRB funded dummy variable	0.543	*	1.599	***
		(0.284)		(0.296)	
npart	Number of participants in the CRB/VAG	0.158	**	0.247	***
		(0.077)		(0.035)	
cons	Intercept	0.725	**	-2.858	***
		(0.334)		(0.505)	

[a]Based only on the sub-sample of households that are located in the GMAs
Level of significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors

Table A14. Impact of living in the GMA and, once in the GMA, of participating in the VAG/CRB on the poor households

		Treatment Regression models for the impact on per capita consumption expenditure of			
Variable	Variable description	Living in GMA[a]		Participating in VAG/CRB[b]	
		(1)		(2)	
park2	Kafue dummy variable	0.192		0.083	
		(0.237)		(0.112)	
park3	Lower Zambezi dummy variable	0.290	**	0.317	***
		(0.129)		(0.073)	
park4	Luangwa dummy variable	0.255	**	0.459	***
		(0.123)		(0.128)	
hage	Age of the household head	-0.001		-0.003	
		(0.002)		(0.002)	
fhhh	Female-headed dummy	-0.048		0.001	
		(0.055)		(0.064)	
maxedu	Education of the most educated member (years)	0.023	**	0.015	
		(0.010)		(0.013)	
c0to14	Number of children less than 15 years old	-0.193	***	-0.182	***
		(0.013)		(0.019)	
f15to60	Number of female members 15-60 years	-0.163	***	-0.167	***
		(0.031)		(0.053)	
m15to60	Number of male members 15-60 years	-0.168	***	-0.175	***
		(0.029)		(0.042)	
m61plus	Number of members older than 60 years	-0.152	***	-0.090	
		(0.048)		(0.067)	
kroad	Distance to the nearest main road in km	-0.003		-0.005	*
		(0.003)		(0.003)	
kbsch	Distance to the nearest basic school in km	0.002		0.005	
		(0.004)		(0.007)	
kheal	Distance to the nearest health centre in km	-0.005	**	-0.005	**
		(0.002)		(0.003)	
vacast	Value of consumer durable assets in ZMK	5.114	***	4.291	**
		(1.705)		(1.993)	
dcoop	Participation in cooperatives dummy	0.231	**	-0.066	
		(0.095)		(0.103)	
gma or dvcrb	Participation dummy variable[a,b]	0.205		0.137	
		(0.436)		(0.308)	
cons	Intercept	13.602	***	13.751	***
		(0.397)		(0.131)	
Number of observations		839		424	
Log-likelihood value		-1209		-446	
Goodness of fit Chi-Square		329.82		229.86	
Rho		-0.205		-0.05	

[a]Participation dummy variable refers to the GMA dummy, equal to 1 if the household is located in a GMA
[b]The participation dummy variable refers to the CRB/VAG dummy, equal to 1 if the household participates in the VAG/CRB. This model uses a sub-sample of households that are located in the GMA
Significance: *=Significant at 10%; **=Significant at 5%; ***=Significant at 1%
Values in parentheses are standard errors