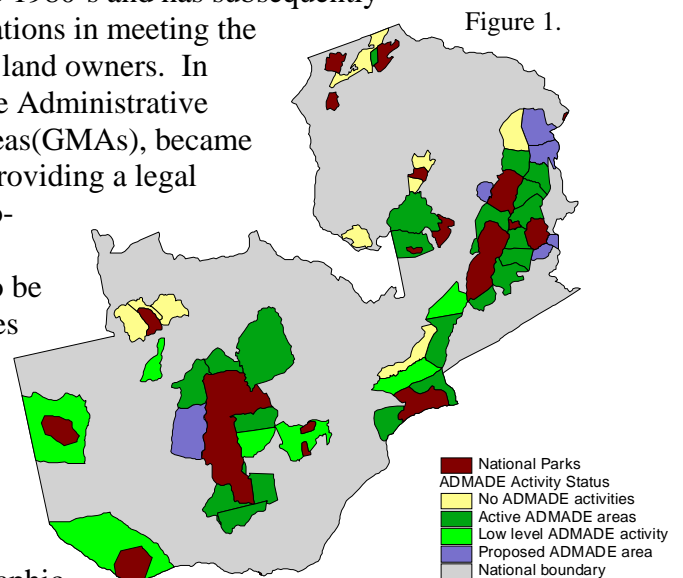


## Introduction

The Government of Zambia has embarked on a wildlife conservation and development policy that decentralizes much of the resource management responsibility for areas surrounding national parks to locally elected community authorities, called Community Resource Boards. This policy has progressively evolved from a pilot study carried out in the mid-1980's and has subsequently undergone numerous transformations and adaptations in meeting the needs of both the resource and local community land owners. In 1999, this policy, referred to as ADMADE or the Administrative Management Design for Game Management Areas(GMAs), became an integral part of the Wildlife Act of Zambia, providing a legal framework for integrating communities into a co-management relationship with Government and private sector investors. ADMADE continues to be an evolving program, actively applying principles of adaptive management to identify, test and refine methodologies that support community-based natural resource management (CBNRM). The vast geographic extent of ADMADE activity (shown in Figure 1) provides host to a diverse set of interacting variables, including a varied megafauna, assorted cultural and demographic characteristics, and numerous geophysical features, that potentially influence ADMADE results for a given area. Most of Zambia's game management areas are at different stages of ADMADE activity with more than a third not yet implementing the policy. For this reason there is a practical and strategic need to identify and understand how different variables affect the likely success of CBNRM goals and activities in a given area.



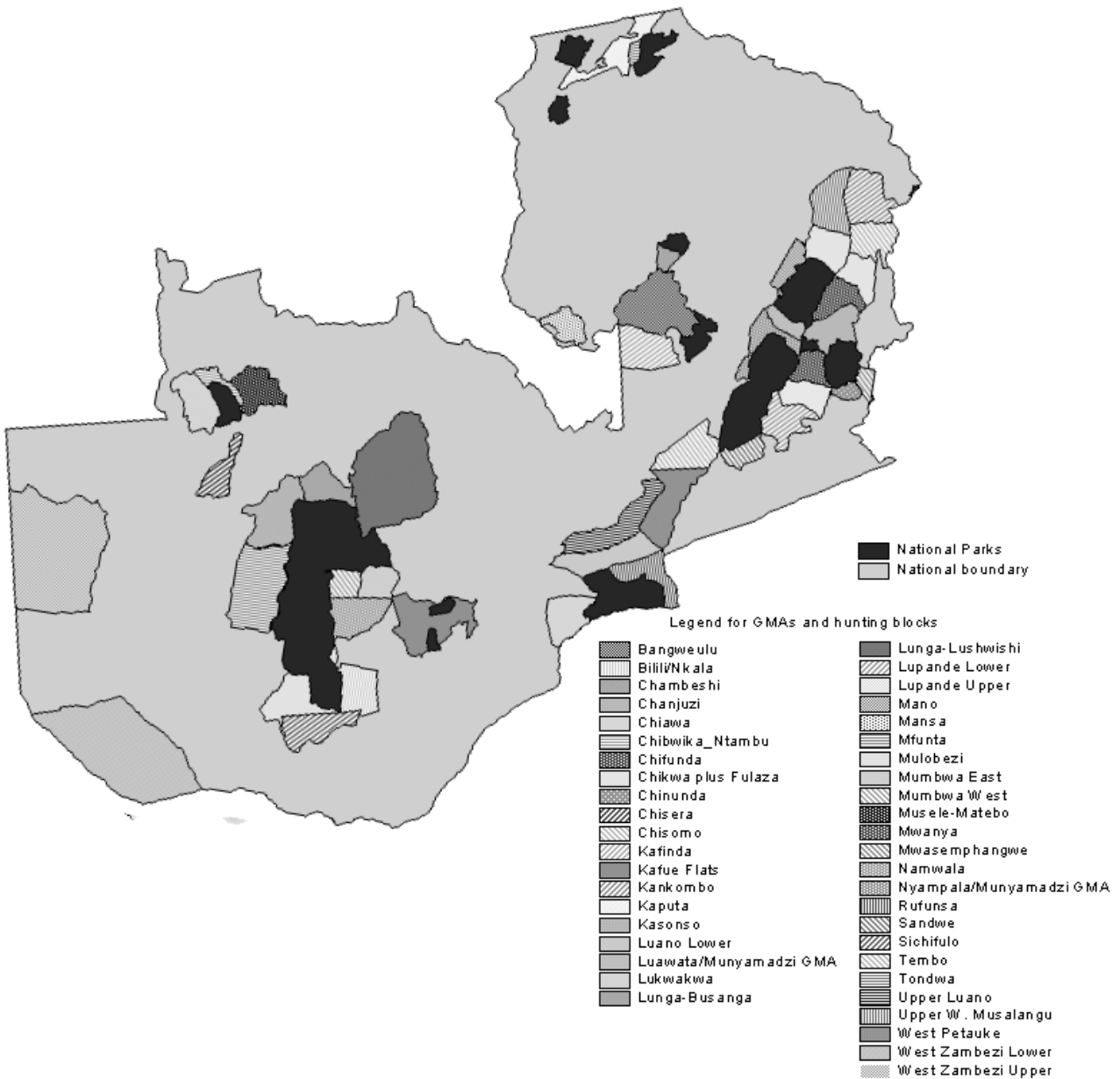
From such an analysis, additional questions can be asked as to how best to adapt ADMADE to these variables in achieving bio-diversity conservation, supporting community development needs, and promoting private sector profits. The past ten years of experience in the ADMADE program provide a rich set of comparative experiences to improve understanding on factors influencing CBNRM success in Zambia. This study attempts such an analysis to help synthesize key lessons that will help make the ADMADE approach more likely to succeed over the long-term as Government, together with its donor partners, plan for the program's future expansion and continued strengthening.

### Objectives of analysis

The primary objective of this study is to generate a quantitative basis for planning and successfully implementing CBNRM in Zambia by building on the extensive knowledge acquired from ADMADE and other CBNRM activities in the country. In particular, the study examines how a set of variables common to most GMAs influence the efficacy of CBNRM approaches in achieving goals of resource conservation and rural development. Results of this study are organized into five broad sets of analyses:

- 1) Identification and analysis of environmental factors likely to influence an area's capacity to generate wildlife revenues for CBNRM activities. These factors are referred to as GMA 'environmental' variables.
- 2) Description of these variables for the different GMAs in Zambia.
- 3) An analysis of how these variables are impacting on CBNRM performance.
- 4) A comparison of these results with expected results from other resource management approaches
- 5) A synthesis of lessons learned for future strengthening of the ADMADE program

To facilitate the discussion of these results, the following map (Figure 2) provides the names of all GMAs (and proposed GMAs) in Zambia.



## Analysis of the GMA 'Environment'

### 1. Bio-geophysical factors

ADMADE depends largely on local community leadership and participation to manage and protect wildlife and other natural resources around national parks on communally owned lands. These efforts are both supported and rewarded from revenues derived from the sustainable and commercial use of these resources. ADMADE has adopted a number of steps for converting these revenues into resource management support and community development. Each step relies on local skills in terms of how communities receive and manage funds, their capacity to identify households needs that may contribute to resource degradation, their managerial skills in implementing projects that meet these needs, and so forth.

Underlying this process are bio-geophysical features that may limit how much income a given area can generate from its biodiversity and relate to the geographical location of an area as well as the particular ecological or geological characteristics of the area itself. If such factors constrain sustainable income, then revenues may be too low to sufficiently motivate local households to adopt ecologically viable land use practices. In these cases the likelihood of ADMADE's success will be weakened.

#### Variables and general concepts

Some of the bio-geophysical variables that may influence ADMADE success used in this analysis were as follows:

- 1) Proximity to major roads linking GMAs to urban markets.  
Major roads currently provide easy access to urban markets for illegal game meat, charcoal and other renewable resources. Without controls, the high volume of commercial traffic on these roads help diminish resource production in a GMA.
- 2) Proximity to urban centers that impose resource use demands on nearby GMAs  
GMAs located relatively close to urban centers will be at greater risk of resource degradation from unsustainable exploitation and commerce of natural resources.
- 3) Availability of natural watering sites for wildlife throughout the year  
Availability and distribution of watering sites, including perennial water holes and perennial streams, influence the carrying capacity of most species of wildlife occurring in GMAs
- 4) Boundary effects with protected or semi-protected areas for restocking wildlife in GMAs  
Most CBNRM areas practice consumptive wildlife management and have a shared border with a protected or semi-protected areas thus providing a reservoir of animals for restocking if cross-boundary wildlife crossings are unimpeded.
- 5) Year-round secondary road access into GMAs for supplying management staff and local residents with commodities and supplies.  
Road access into a GMA increases the chances that management staff will be provisioned to carry out their duties during critical wet season months when illegal hunting is most common. Road access also enables critical commodities to reach local residents in bulk, thus reducing living costs and risks of food shortages that might otherwise be mitigated by increased pressures on wildlife.
- 6) Species available in a GMA, their market value, and population sizes.  
Species present in a GMA represent the resource capital ADMADE ultimately depends on to derive most of its income, which is dependent on their respective market value and the number of animals on sustainable hunting quotas.

- 7) Area of a GMA. Spatial extent of a GMA contributes a variety of influences on ADMADE success. The smaller an area the more easy and cost-effective it is to manage the area's resource use activities. However, if a GMA is too small, its own area may not be able to sustain a commercially viable hunting quota unless adjacent areas provide a source of animals for restocking. Conversely, an area too large may suffer inefficiency under a single administration for coordinating and implementing CBNRM.
- 8) Suitability of soils. Soils are an important determinant to competing land uses. In cases where soils are suitable for farming, wildlife and other natural resource may be threatened by growing pressures of agricultural activities. On the other hand, limited arable soils tend to create food shortages among resident communities, and as a result, households are forced to over-exploit wildlife as a commodity to barter for maize.

Urban area and roads

Figures 3 - 8 are national maps describing urban population centres, major road networks, GMA boundary effects, and biodiversity and population characteristics based on quota statistics. One general conclusion these maps suggest is that there is considerable variation in potential risk that GMAs are exposed to in terms of how these variables may be influencing ADMADE success. The elliptic circles in Figures 3 and 4 suggest those GMAs most vulnerable to urban pressures because of proximity to major roads and highly populated urban areas. Not surprisingly, the GMAs most vulnerable to the effects of urban centres are also the same most vulnerable to major

Figure 3. Urban centres



Figure 4. Major roads



roads.

Boundary effects

Figure 5

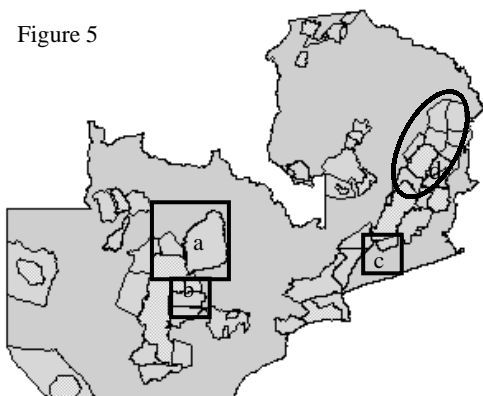


Figure 5 presents a variety of boundary effects on restocking rates from national park reservoirs, highlighted by elliptic and square outlines. In case 'a', the park boundary with Lunga-Lushwishi GMA consists of two deep rivers that impede the free movement of

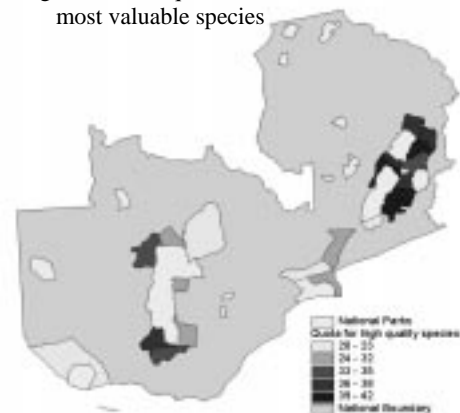
animals into the GMA. Case 'b', affecting Mumbwa and Namwala GMA is similar, except the northern boundary of Mumbwa is adjacent to a relatively small section of the park, which is also cut off from the main park by a deep, impassable river. In all three of these GMAs, buffalo numbers have declined over the past decade. Buffalo is a species much preferred by both legal and illegal hunters. Without access to a protected area capable of supporting a safe reservoir of buffalo, these areas may not be able to sustain their own herds by natural recruitment from losses attributed to hunting and poaching. Chiawa GMA, which is among those vulnerable to proximity effects of major roads and urban centres, is also isolated from the national park adjacent to its boundary by a deep river. It too has critically low numbers of buffalo.

In case 'c', depicting Sandwe GMA, its relatively small area shares much of its boundary with South Luangwa National Park but animal movements across the park boundary are impeded by a major river, which animals can cross only seasonally, and by escarpment hills. Case 'd' is a generalized problem in much of Luangwa Valley where many GMAs share a border with either the South or North Park. Though the Luangwa River represents only a partial barrier to most wildlife species, local residents typically construct fishing camps and actively fish along the river during the dry season when the river is most easily crossed by wildlife. This human activity increases the barrier effect the Luangwa River has on wildlife, especially for those species sensitive to human presence.

### Biodiversity effects

Figures 6 – 8 examine some of the possible effects of wildlife biodiversity and population abundance on ADMADDE success. Figure 6 illustrates a measure of variation in economic value for key wildlife species that occur in GMAs currently being hunted by safari clients. This measure is based on the total number of animals on safari hunting quota for the 7 most valuable species sold to overseas safari clients (excluding the wetland species found only in specialized habitats): lion, leopard, eland, buffalo, hippo, roan and sable. In particular, buffalo, lion and sable are among the most popular species sought by safari clients.

Figure 6. Total quota for the 7 most valuable species



GMAs with the lowest values tend to be those nearest towns, major roads, or relatively isolated from a park in terms of boundary effects on wildlife crossings. This pattern was not simply a function of total huntable species on quota, as is suggested in Figure 7, which illustrates total species on quota for each GMA. Unlike the previous figure, Figure 7 shows species numbers allowed on quota were relatively high for those GMAs having relative low economic value from the prime safari species. Figure 8 shows variation in total number of animals on quota among the hunting areas. Lowest scoring areas again are those nearest urban centres, near major paved roads or with limited access to wildlife border crossings with an adjacent national park.

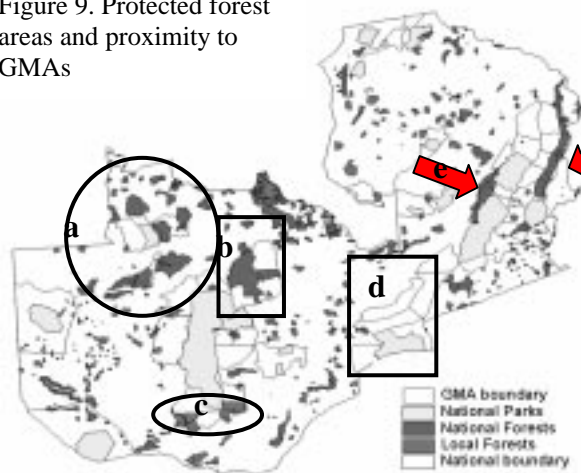
Figure 7. Total species on quota



Figure 8. Total animals on quota



Figure 9. Protected forest areas and proximity to GMAs



### Protected forests

Figure 9 illustrates the locations of protected forest areas in relation to game management areas and various threats and opportunities that exist within the various matrix of situations that occur in Zambia. In **Area a**, there is a high concentration of protected forested areas that either overlap or border with 4 different GMAs (Chisera, Lukwakwa, Musele-Matebo, and Chibwika-Ntambu). Given their relative isolation in terms of only one small national park that borders three of the GMAs, there exists

the opportunity of significantly adding to the range of managed wildlife areas by consolidating these forest areas as part of these GMAs. This would increase the total area of the GMAs from 11,236km<sup>2</sup> to 20,050km<sup>2</sup> and would also give increased protected status to wildlife since settlements are not allowed in protected forests. In **Areas b and c**, four of the major GMAs surrounding Kafue National Park have significant areas gazetted as either national forests (Lunga-Lushwishi) or local forest (Mulobezi, Sichifulo, and Bilili). Those located in Mulobezi and Sichifulo extend well beyond the GMA boundaries and offer an opportunity to consolidate the two land classifications for increased protection for wildlife under ADMADE management. Increased wildlife revenues derived from a protected forest area would theoretically enhance the value of a forest by managing it as a wildlife protected ADMADE area. Lunga-Lushwishi has one of the largest protected forest areas contained in any GMA and with improved management and protection of this forest, wildlife production would likely increase as well, thus creating an economic synergy between the two respective resources.

**Area d** represents a complete converse of **Areas a,b,and c** by having a near total absence of protected forest areas. Moreover, these GMAs (Chiawa, Luano Upper and Lower, and Rufunsa) are located near Lusaka and have major roadways passing near or along their borders. All four GMAs are sources of large scale, unregulated charcoal production for the Lusaka and outerlying markets. This situation represents a serious threat to these areas as continued charcoal exploitation slowly erodes prime

wildlife habitat in the effected areas and attracts increased settlements to a potentially lucrative but destructive land use practice.

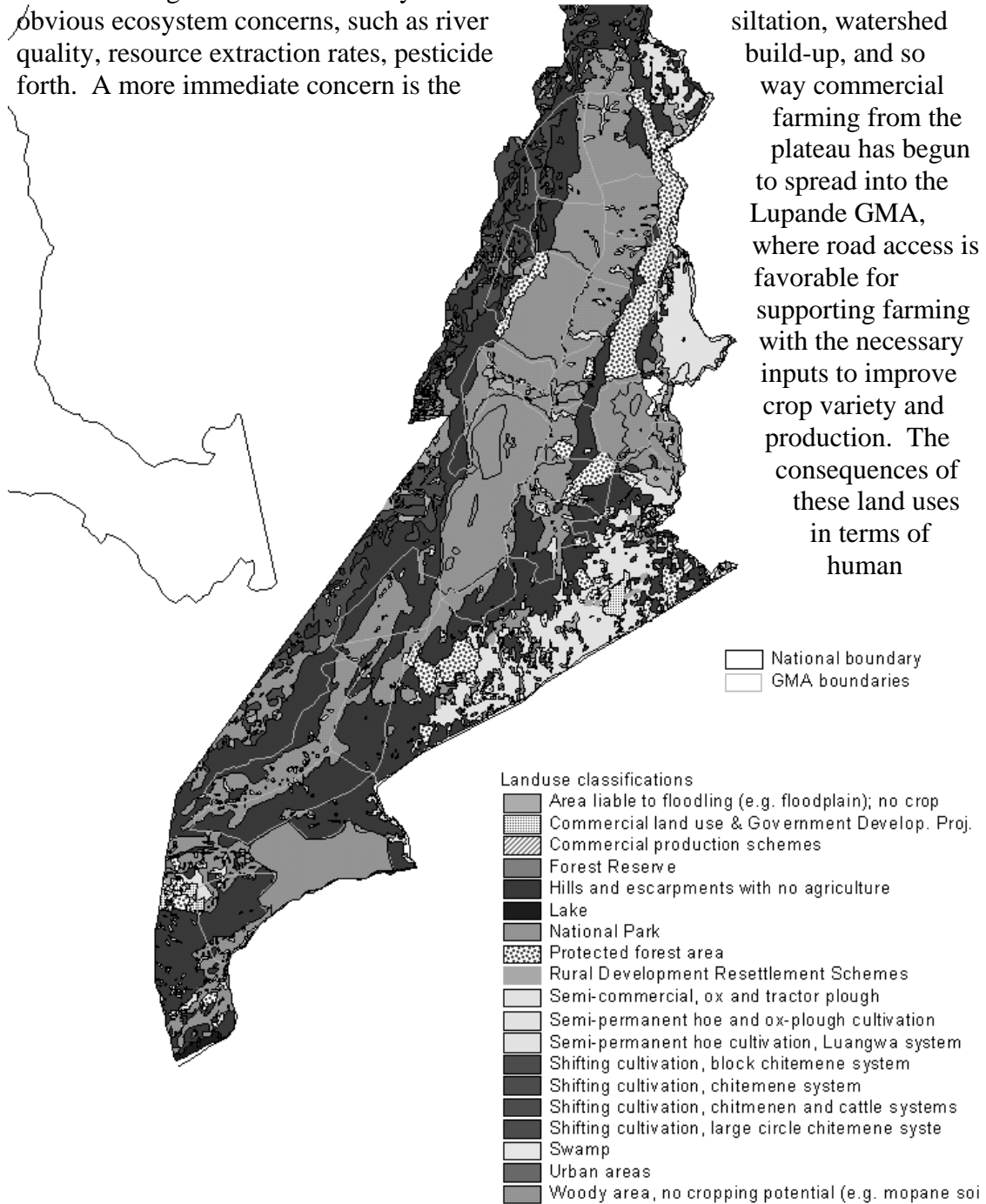
*Areas e*, pointed to by the large red arrows, are protected forests representing important watersheds along the escarpment hills of Luangwa Valley. They also overlap with about half of the GMAs in the Valley and represent an important ecological function of recharging the water table that feeds into the Valley below. Management of these areas and other surrounding forests should be a long-term concern for maintaining permanent water holes for wildlife populations if the Luangwa Valley is to remain the core of Zambia's wildlife tourism industry.

### Soil suitability

Figure 10, shown on the following page, is a land use soil suitability map for the Eastern Province and includes portions of the Northern and Lusaka Provinces. A total of 22 potential ADMADE areas (existing ones and those being proposed or requested among resident communities) are over-laid on this map. Within the extent of these GMAs, less than 6% of the total land area is arable and suitable for farming. Much of the land area is either hilly and rocky or characterized by valley clay soils not easily plowed and subject to water-logging.. The arable land is primarily along river or stream drainages having alluvial deposits with relatively fertile, tillable soils. These soils are quite restricted and provide the mainstay for food production among resident communities. As populations expand over time, families are forced into less arable land along the fringes. These soils tend to be heavier in clays and food production is significantly less, forcing many households to supplement food production with game meat as a commodity to exchange for maize or sorghum with their more successful neighbors farming on better soils. Access to ground water also tends to be reduced on these clay soils and households often have to compete for the same waterholes used by wildlife. These conflicts and limitations of soil fertility in Luangwa Valley are a major challenge for ADMADE in this region and pose a serious threat for the sustainability of wildlife in Luangwa Valley.

Beyond the escarpment perimeter of the Valley on the plateau above (see Figure 10 below), the availability of arable land is dramatically improved, particularly in the Eastern Province. It is no surprise that this area of Zambia is becoming a major producer of maize and cash crops (e.g. cotton and tobacco) for Zambia with parallel increases in human populations. The impact such land use pressures may be having on the existing GMAs in the Valley below obvious ecosystem concerns, such as river quality, resource extraction rates, pesticide forth. A more immediate concern is the

raises a number of siltation, watershed build-up, and so way commercial farming from the plateau has begun to spread into the Lupande GMA, where road access is favorable for supporting farming with the necessary inputs to improve crop variety and production. The consequences of these land uses in terms of human



settlement patterns and the influx of people into the area present serious challenges for CBNRM, and wildlife in particular. Similar pressures are being experiences among the two proposed GMAs, Mwasemphangwe and Chinunda, whose areas provide a potential link between Kasungu National Park in Malawi and Lukusuzi National Park in Zambia.

## Summary of variables

Table 1 lists the environmental variables for the different GMAs examined in this study. These include the actual area of the hunting block, boundary effects with adjacent GMAs and national parks, proximity effects to town centres, number of months the area can be accessed by a 4-wheel-drive vehicle, and total distance of rivers that contain water throughout the year.

HBlockName	Area (km <sup>2</sup> )	Boundary Value	Town Factor	Road access	Water holes	Rivers (km)	High value quota	Total quota
Bilili/Nkala	400	376	126.8	7	10	96	32	125
Chanjuzi	2555	404.2	75.2	11	20	32	33	101
Chifunda	2104	1143.5	95.2	10	25	87	40	117
Chikwa plus Fulaza	5051	225.1	84.9	11	34	255	36	139
Kasonso	4592	299.1	91.6	12		287	35	130
Luano Lower	4901	88	4158	9			20	61
Lunga-Busanga	2094	322	17.2	9	1	133	29	130
Lunga-Lushwishi	13323	32	1197.2	9	6	682	23	108
Mulobezi	3573	460.1	320.8	9	6	0	38	129
Mumbwa West	1580	175.5	305.9	12	14	56	31	108
Luawata	1284	1206.2	171.7	6	3	126	37	116
Nyampala	1893	2615.3	171.7	6	5	201	39	121
Mwanya	1587	704.2	256.5	10	18	48	36	109
Rufunsa	3180	718	4092.3	12	8	76	31	79
Sandwe	1492	673	84.9	9	9	62	23	80
Sichifulo	3478	190.5	393.6	12	7	0	35	103
West Petauke	4354	82	50.9	8	11		30	84

Boundary effects were defined as the potential benefit adjacent parks and GMAs may have on restocking a given GMA. Its value, referred to as 'Boundary Value', was based on the following equation:

$$\text{Boundary Value} = ((A-B)*\log(C)*D) + (F-G), \text{ where}$$

- a) A=km shared boundary between given GMA and national park
- b) B=km of this shared boundary not passable by wildlife
- c) C=km<sup>2</sup> of national park accessible to GMA
- d) D=wildlife abundance factor of the national park (scaled from 0 to 1, values given subjectively based on authors experience and anecdotal information available)
- e) F=km shared boundary with adjacent GMA
- f) G=km of shared GMA boundary not passable by wildlife.

Proximity effects to town centres were defined as the possible influence urban centres may have on illegal game meat marketing as a function of distance to a town centre and its urban population. Population data were based on 1990 Zambian census data. Referred to as 'Town Factor', these effects were calculated by dividing the population of a town by the road distance from the urban centre to the centre of a GMA. Selection of town was based on the largest urban population as long as its road distance was less than 300 km.

Possible influence of these variables is shown in the graphs below:

Figure 11

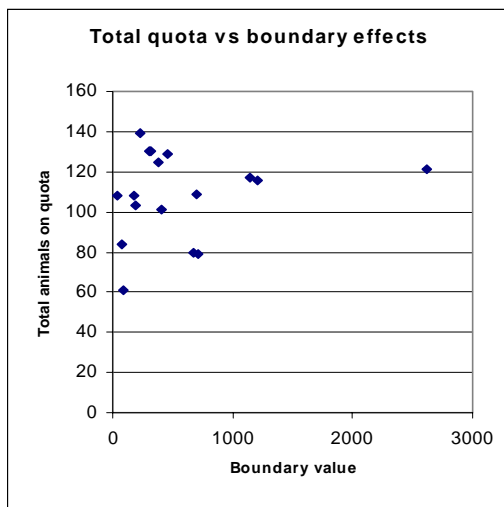
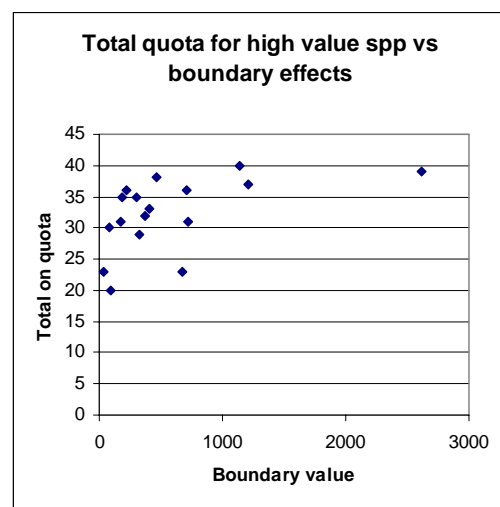


Figure 12



Total animals on quota (Figure 11) were not influenced by boundary effects of protected lands adjacent to a GMA, possibly because most species on quota do not have large ranges and infrequently cross between the two areas. In contrast, Figure 12 suggested higher value, larger body species (buffalo, hippo, lion, leopard, roan, sable, eland) are more likely to maintain larger populations when their range is adjacent to a national park or game management area. Given that these species are generally low density (with the exception of buffalo and hippo) and in relatively high demand, this conclusion is not surprising, if over the history of safari hunting in Zambia the effects of hunting in GMAs have tended to lower populations. Since these species tend to range further than smaller species, the possible effects of parks as a reservoir for restocking would more likely be beneficial to these species, as the graph suggests, while also suggesting the possibility of historical over-hunting.

Figure 13 shows a possible inverse relationship between hunting quotas and proximity to town centres. This relationship is presumed to be caused by the higher rates of illegal game meat trafficking from those areas closest to major urban areas, as was also suggested in Figure 8. This situation underlies the critical importance of having a legal market that out-competes illegal ones in terms of benefits derived for the local community. If the benefits of the wildlife industry are not substantial enough to benefit households in the community, risks of illegal trafficking will likely increase among those areas within commercial range of urban areas. This problem will undoubtedly worsen

Figure 13

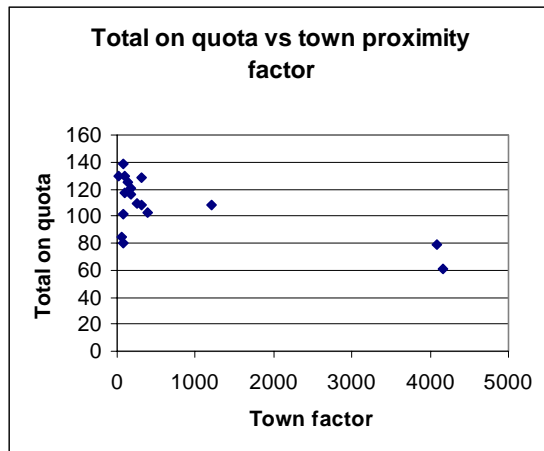
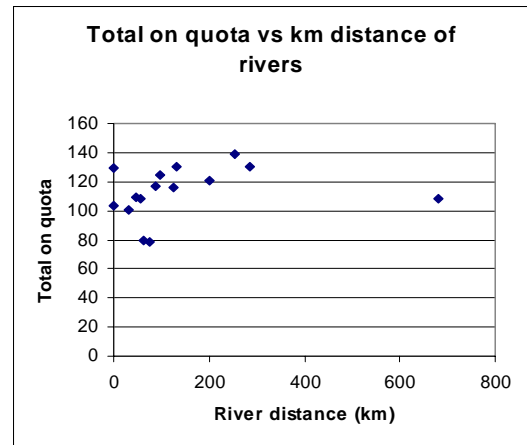


Figure 14

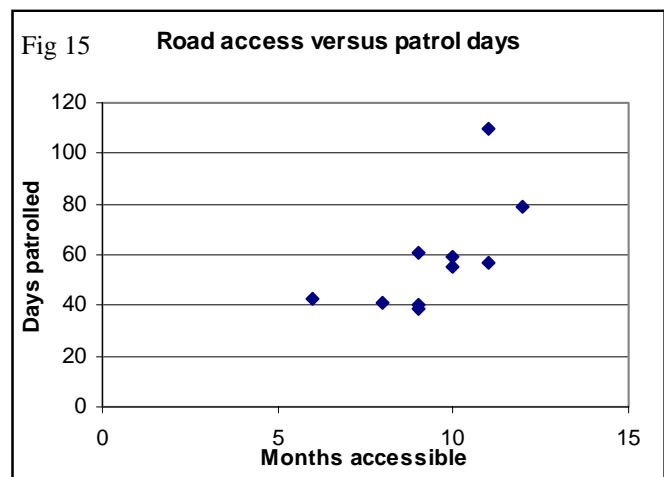


as urban areas grow and road access improves. Associated with this relationship to urban proximity is the network of paved highways that lead to Zambia’s larger towns and cities and that help facilitate the movement of game meat on these commercial routes. Another conduit for game meat is by rail and is especially relevant to Sichifulo and Mulobezi GMAs where the train linking these areas with Livingstone has become a major supplier of illegal game meat to Livingstone.

Though the number of waterholes did not show any relationship to quota size, Figure 14 suggests quotas or total population sizes for hunted species are positively related to total rivers distance having water throughout the year. Basic road infrastructure that facilitates management operations in a GMA may also be a factor influencing ADMADE success, especially in terms of year-round access for supporting patrol requirements, dispatching poachers when they are arrested, facilitating completion of community projects and so forth. This relationship was tested in Figure 15 by relating the number of months a 4-wheel drive vehicle can reach the unit HQ throughout the year to total number of days scouts went on patrol during the wet season months of January to May, averaged for 1998 and 1999. As might be expected, those units with poor access tended to have fewer days of patrolling during the wet season, suggesting greater difficulty in preparing for wet season patrol requirements.

Somewhat surprising was the result that size of the hunting area did not correlate with quota size or ADMADE income (based on 1998 safari hunting season, see Figure 16). In contrast, Figure 17 shows a clear relationship between total quota size among all hunted areas in

Zambia and their expected revenues based on individual species’ license values. The fact that area of the hunting concession did not influence quota size suggested at least two possible reasons, each with important implications for CBNRM success. First, from a management perspective, areas that exceed a certain size become increasingly



difficult to patrol and police due to a disproportionately higher cost of maintaining and supervising increased number of scouts as the size of the area increases. This is especially true if income levels do not correlate with concession areas. It therefore follows that as the size of an ADMADE or CBNRM unit increases, it becomes increasingly difficult to maintain adequate levels of law enforcement and resource protection. As a result the overall quality of the area in terms of available trophy animals on quota will likely decline.

Another likely explanation is that a single safari operator having a relatively large hunting concession will be less likely to hunt the entire areas unless hunting roads cover the full extent of the concession. This is particularly true if lease periods are too short for operators to see a return on an investment to improve hunting roads. This factor will be treated separately under the section, ‘private sector variable’.

Figure 16

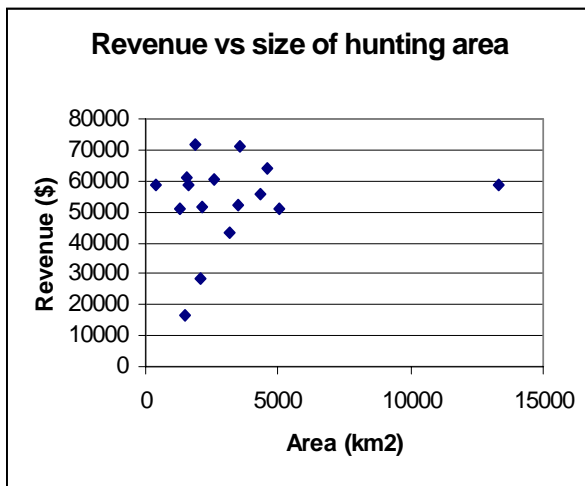
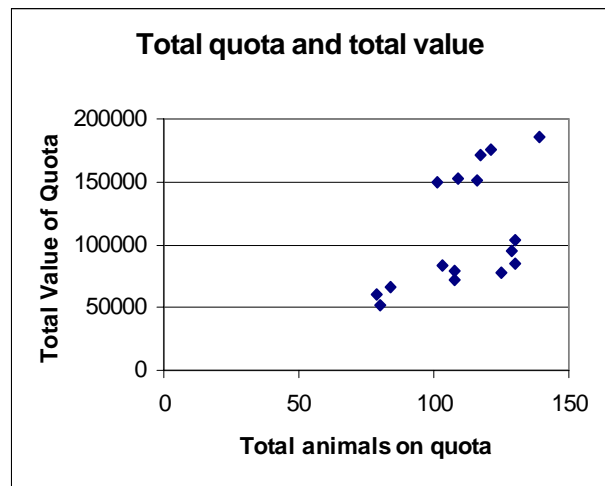


Figure 17



### Conclusion: impact on CBNRM performance

1. Wildlife CBNRM areas isolated from any adjacent protected area, particularly large, well stocked national parks, are at much greater risk of having sustainable hunting quotas too low to support economic incentives for managing wildlife as a land use. Unless non-consumptive options exist to produce comparable wildlife revenues (e.g. Chiawa), CBNRM will have much greater difficulty in succeeding. While the exact effects on wildlife crossings caused by different geophysical features are not well understood, it is safe to conclude that deep rivers, high escarpment hills, and well-settled zones impede the free movement of animals to and from more protected wildlife areas. Such effects need to be appreciated in the CBNRM planning process in order to take necessary precautions for those species most effected, primarily the larger and more valuable species. Otherwise the cost of restocking species once locally extinct will likely be prohibitive for most communities and their private sector partners. This problem is particularly relevant for Chiawa, Mansa and Chizera areas, which are almost totally isolated and lack the key species needed to support the higher paying classical safaris.

Boundary effects are also becoming more apparent for even those areas adjacent to national parks where the parks themselves are small or have suffered a recent history

of heavy poaching with severely depleted wildlife stocks. In these cases, the CBNRM process must be extremely conservative on setting hunting quotas to ensure the critical economic species are not over-hunted. This is especially relevant for Mumbwa, Lunga-Lushwishi, Lunga-Busanga, Kasonso, and Mwasemphangwe. Even areas with favorable crossing opportunities for certain species on one side of the GMA may not offer any added cushion for restocking species found only in regions on the opposite side where border effects may be less favorable. Many of the Valley areas face this problem for hartebeest, roan and eland, and in certain areas (e.g. Upper Lupande) roan and possibly hartebeest have become essentially extinct.

2. In such cases where GMA's are isolated and where ADMADE has been introduced, extending GMA boundaries to enclose protected forest areas, should they exist (as they do for Chizera, Mutele-Matebu, Lukwakwa, and Chibwika-Ntambu), could be an important option. Increased protected land areas will reduce risks of population extinction if portions of the contiguous area can be more extensively protected to ensure certain core wildlife populations provide a reserve of breeding stock. Since human settlements are not allowed on national forests, including such forests as part of a GMA would make this option viable.

3. Agricultural build-up in surrounding regions may create increased markets for illegal game meat, especially if CBNRM areas are unable to produce sufficient food for themselves and local residents use game meat to exchange for maize. This imbalance of food security will lessen the likelihood of CBNRM success since wildlife will be used as an exchangeable commodity instead of supporting the much higher commercial markets of wildlife tourism .

An appropriate CBNRM approach to this problem might be to use ADMADE funds to purchase maize from the high maize communities able to produce a surplus to meet the food shortfalls that cause local famines in wildlife rich ADMADE areas. In exchange, maize producing areas will find a ready market for their produce and may come to realize the advantage of not encouraging residents to exploit wildlife illegally in ADMADE areas where their maize markets are supported by revenues derived legally from wildlife. 4. Size of an area may be an important factor for achieving CBNRM success if there is an upper limit for the size of an area that a single operator can effectively utilize. Similarly, management efficiency in monitoring and policing wildlife as a single CBNRM unit may decline beyond a certain size limit of the area, especially if revenues needed to support wildlife protection does increase in proportion to the size of the area. Figure 18 below shows the distribution of concession size for Zambia's GMAs. Results presented in Figure 16 suggest that those concessions that approach or exceed 5000km<sup>2</sup> are too large and need to be divided into two smaller concessions, each with their own respective CBNRM management and administration. The concessions that this recommendation applies to are Upper and Lower Zambezi areas, Lunga-Lushwishi, Lower Luano and Chikwa-Fulaza. The less favorable portions of the two sub-divisions will likely require different tendering arrangements to favor more private sector investment.

