AN EFFECTIVE MONITORING FRAMEWORK FOR COMMUNITY BASED NATURAL RESOURCE MANAGEMENT: A CASE STUDY OF THE ADMADE PROGRAM IN ZAMBIA

By

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Monitoring is an important element of community based natural resource management (CBNRM) which has emerged as one of the dominant conservation models for the tropics. Monitoring provides the basis for adaptive management, ecological and social impact studies, and ensuring accountability. This study presents the Effective Monitoring Framework, a conceptual model which describes the various components of effective monitoring in terms of design, implementation, application, and sustainability. The framework is based upon an iterative action research model and emphasizes the importance of internal feedback loops to integrate monitoring results back into the design and implementation of a monitoring program. The framework provides a template which can be used to help describe, evaluate, and plan resource monitoring systems in the context of CBNRM. The ADMADE conservation program in Zambia has ten years of experience in working with rural communities to monitor wildlife and provides an excellent case study to test the Effective Monitoring Framework. The framework provided an organized structure to describe comprehensively ADMADE's large and multi-tiered monitoring program, as well as analyze its strengths and weaknesses. Using the Effective Monitoring Framework as a analytical guide, this study helped identify the major bottlenecks in ADMADE's monitoring program and address system weaknesses through two interventions: an upgrade of the master monitoring database and a new course for village scouts on advanced data collection skills and analysis. More case studies of CBNRM monitoring are needed to further test and refine the Effective Monitoring Framework so that it may be applied to a greater diversity of programs using different natural resource strategies and administrative structures.

CHAPTER 1
LITERATURE REVIEW

Principles of CBNRM

Community based natural resource management (CBNRM) is broad rubric encompassing a wide-array of resource management programs that share a recognition of the importance of the participation of people who live near and are interconnected with threatened natural resources. Similar in focus to the terms *Community Based Conservation* (CBC) and *Integrated Conservation and Development Project* (ICDP), CBNRM grew out of the failure and disillusionment of older protectionist styles of management (Child, 1996a; Lewis & Carter, 1993). Colonial-era management practices based on "fines and fences" frequently failed to achieve conservation goals because they alienated people from their traditional resource base, thereby reducing the economic and social value of natural resources and causing over-exploitation and mismanagement (Child, 1996b). Protectionist practices were also limited because they only afforded protection in legally protected areas, thereby missing the majority of wildlife and habitat which lies outside of national parks and reserves (Gibson & Marks, 1995).

CBNRM and its variants attempt to restore the focus of natural resource management to rural communities, whose lives are the most immediately linked to the well-being of resources and whose cooperation is required to achieve conservation objectives (Brandon & Wells, 1992; World Resources Institute, 1992). Although the roots of community based management can be found in ancient pre-colonial practices, the recent shift from top-down exclusionary management to community-centered conservation has been gradual, and only really coalesced in the last two decades. The switch to CBNRM was prompted by a gradual realization of the fundamental flaws of previous strategies, donor pressure, national economic crises which slashed funding for protectionist policies, democratization, and the recognition of the inherent rights of rural people (Child, 1996b; Larson, Freudenberger, & Wyckoff-Baird, 1997; Lewis & Carter, 1993).

Although some authors argue that CBNRM programs have in general made limited progress toward their twin goals of conserving natural resources and improving human standards of living (Gibson & Marks, 1995; Hackel, 1999; Southgate & Clark, 1993), many others claim success for specific projects (Bodmer, 1994; Lewis & Alpert, 1997; Metcalfe, 1994). Reviewing the literature of CBNRM programs which consider themselves successful, as well as those which struggle to achieve their goals, is a useful exercise for exploring the validity of the CBNRM model and identifying factors and principles which contribute to or hinder success.

Economic Framework

CBNRM works best when there is high potential to earn revenue from natural resources through enterprises such as tourism (Alpert, 1996). Hence a prerequisite to successful CBNRM is ensuring that the full economic value has been restored to resources. Artificial government price controls on marketed resources, or subsidies for competing land uses (e.g., agriculture) and commodities (e.g., cattle) reduce the value of resources and hamper the success of CBNRM (Child, 1996b). However it is not enough just to bestow a natural resource with economic value. Proprietorship plays an important role and marketing should be open and competitive (Child, 1996a). Some sort of external control is also needed, because leaving policy and conservation incentives exclusively to a free market economy favors powerful corporations that will likely overexploit the resource. Lohmann (1991) states that if the benefits of the resource accrue to irresponsible stewards, such as corporations with few long-term interests, there will be little opportunity for either conservation or community development.

Policy Framework

Government policies or their inefficient application are the root of most threats encountered by CBNRM projects in or near protected areas (Brandon, 1998). Communities must have legal ownership of the resource for CBNRM to work most effectively (Brandon, 1998; Gibson & Marks, 1995; Lewis & Carter, 1993; Noss, 1997). However granting legally recognized resource rights requires that communities form legal entities, and the conditions of ownership of fugitive resources such as wildlife are spelled out (Child, 1996b). Rules of tenure and resource access must be clear and widely known, otherwise people may feel insecure and "make a run on the bank" (Brandon, 1998). Creating this conducive legal and policy framework for CBNRM programs has been a slow process, which still is not complete (Naughton, Hansen, Kiker, & Jones, 1998). However due to the severity of threats on resources, most CBNRM programs can not afford to wait for new legislation to be passed before beginning activities (Lewis, Mwenya, & Kaweche, 1991).

Decentralization. The most effective CBNRM programs are those which have political support from the national government (Alpert, 1996). Conservation programs must devote significant resources to building support to guard against intrusions or attempts from other political bodies to seize resources or reduce autonomy (Child, 1996a; Gibson, 1999). Empowering local people to benefit from conservation requires that resource ownership and authority to make policy are devolved from state institutions to lower levels. However many central governments have been reluctant to devolve resource ownership and policy making, instead decentralizing only administration and management activities (Hackel, 1999). Resource and conservation agencies rarely trust their constituency enough to devolve fiscal responsibility which is a meaningful part of decentralization (Child, 1996a). Empowering communities requires weakening of bureaucratic controls, which can be threatening to state institutions (Gibson, 1999). Ironically, a national economic crisis may serve as a catalyst to decentralization, as can be seen in the examples of Zambia and Zimbabwe (Child, 1996b).

Partnerships. Few institutions, be they government agencies, NGOs, or private sector enterprises, possess all the skills and resources required to plan and manage

programs as multi-faceted as CBNRM. International conservation organizations sometimes try to provide all required services, but have a greater impact when working as a facilitator of partnerships, rather than as initiators and implementers (Larson et al., 1997). Many times the roles and expectations of project partners are based on informal agreements and good-faith. While this type of relationship might work well in the short-term, partnerships are more likely to survive changes in leadership or institutional structure if the relationships are based on formal memorandums of understanding and enforceable contracts (Rocha, 1997).

Linkages Between Conservation Behavior and Benefits

The CBNRM model requires that the benefits from resource management must be directly linked to conservation practices as transparently and as immediately as possible for those conservation practices to become integrated into local livelihood strategies and institutions (Child, 1996a). Handouts do not have nearly as much as an effect as benefits which are "earned" by conservation behavior (Lewis & Phiri, 1998). To achieve conservation through CBNRM, the unit of production should also match the unit of management and benefit (Child, 1996a). Public goods are among the least effective conservation incentives because everyone in the community benefits regardless of their individual behavior (Gibson & Marks, 1995).

The benefits of regulating access to natural resources must also meet basic human needs that were fulfilled by the former resource use. Social infrastructure projects, such as schools and clinics, may help improve conservation attitudes, but do not address basic needs such as food security which drive poaching (Lyons, 1998). Development projects such as grinding mills and schools also require cash payments which may not be possible for many households, thereby minimizing potential benefits for the vulnerable groups which need it the most. When the benefits from foregoing resource use are non-existent or insufficient, the incentives to conserve the resource will be weak (Gibson & Marks, 1995).

Development activities outside of protected areas do not always translate into reduced pressure on the resources, especially if they do not address the threats to the resource. Indeed development activities can have the reverse effect by attracting migrants to the area (Brandon, 1998; Noss, 1997). Delays can also erode the perceived linkage between conservation behavior and benefits (Gibson & Marks, 1995).

Distribution of Benefits

Domination by elite groups is a common threat to development programs (Larson et al., 1997). Inequitable distribution of benefits is caused by power differentials within the community, which are often not acknowledged in program design (Gibson & Marks, 1995). Rural communities are not homogenous entities, and there are always social divisions based on gender, livelihood strategies, tribe, or lineage. Each group will have its own interests, needs, and level of political and economic influence. Even traditional authorities, which are often used by conservation programs to get a foothold in the community, often do not represent the broader interest of all subgroups.

Equitable distribution of the benefits of CBNRM among all social groups is desirable not only on ethical grounds but also because it has been linked to lower levels of land degradation (IIED, 1998). Inequity in the distribution of benefits retards conservation progress particularly for CBNRM programs, which require the cohesion of a entire

community to achieve goals (Gibson & Marks, 1995). Effective CBNRM requires that equity exists not only in the distribution of benefits, but also in the selection of targets of interventions such as law enforcement and restricted access policies. If a group is singled out as the target of an action, and other groups which also impact the resource are not affected, then the action will be perceived to be unjust. When people of influence are allowed to circumvent regulatory mechanisms ill will also be bred (Brandon, 1998).

Concurrence with Local Practices and Culture

CBNRM must be triggered by a sense of resource depletion, whether real or imagined (Rettig, Berkes, & Pinkerton, 1989). The community's recognition of the need for management of the resource is a precursor to CBNRM and in fact is equally if not more important than the specific type of management introduced (Bodmer, 1994). CBNRM is more likely to be successful where there are amenable local practices and traditions (Alpert, 1996). Incentives used to change behavior can not be based solely on simplistic formulas such as the economic bottom line and caloric budgets. Resource practices are embedded deeply in cultural traditions and social institutions. For example, pastorialists or traditional hunters are not easily switched to agriculture, even if agriculture is proven to be economically and ecologically more sustainable. An understanding of the forces which drive personal identity, social order, and livelihood strategies is needed to plan effective conservation programs (Gibson & Marks, 1995).

However Redford and Stearman (1993) state that biologists involved in conservation often ignore indigenous people's concerns in conservation dialogues. They sometimes claim to represent the interests of indigenous people without having the mandate or authority to do so. When programs fail to integrate traditional management practices and ideas, they are unlikely to benefit rural people (Lohmann, 1991).

Social Change

Community based conservation is less successful in areas of economic and social growth (Alpert, 1996; Brandon, 1998). CBNRM is predicated on local people remaining at a certain level of standard of living (Mano Consultancy Services, 1998). If incomes rise above subsistence levels, then available capital will increase which may make alternative land-use (e.g., intensive agriculture) more attractive than sustainable use of wild resources. The level of income that is generated by CBNRM must remain appealing and meet the needs of impacted people. If their development aspirations or standard of living increase, then the benefits of CBNRM may no longer be attractive or be able to keep up with the influx of people and new demands. The low levels of resource use required for sustainability may not allow people to achieve the levels of development they desire (Brandon, 1998).

Social Versus Biological Management

CBNRM is more about managing people than managing biological systems. Biological systems are adapted to withstand ecological fluctuation and tend to take care of themselves if anthropogenic disturbances can be minimized. Although both social and ecological management are necessary, conservation programs are frequently guided by biologists who fail to appreciate the complex socioeconomic context. Programs which only focus on technical solutions and do not consider the interpersonal context and

institutional relationships will be undermined by a lack of motivation from community members, reduced confidence, aversion to take risks, and non-cooperation (Child, 1996a).

Law enforcement is an important management component to all community based conservation programs (Hackel, 1999). Increased law enforcement is the most effective short-term means to reduce illegal resource use (Jachmann & Billiouw, 1997). Investigations are more cost-effective than patrolling, although both are helpful (Jachmann, 1998). There are advantages to using local residents for law enforcement, including lower cost and performance (National Parks & Wildlife Services, 1999d).

Co-management

Rural communities rarely have the resources and skills to manage natural resources completely on their own. Even though indigenous communities may at one time have had effective systems for sustainable use, the social, economic, and technological foundations of those systems are often eroded or completely gone, and present-day communities are often less concerned and equipped to conserve their resource base. The modern variants of traditional practices often do not meet the needs of growing populations and increasing aspirations (Redford & Stearman, 1993). A system of co-management with government and NGOs is more likely to prove effective (Bodmer, 1994).

The roles of communities and government agencies in a co-management partnership need to be modified from their colonial legacy, which was often characterized by opposition and mutual distrust. The need to build trust and confidence between parties historically in conflict is an issue that needs to be specifically recognized and addressed by programs (Marks, 1991). Government needs to play a supportive and regulatory role as opposed to issuing decrees and policing (Child, 1996a).

Community-Based Organizations

Unlike some other forms of rural development, the success of CBNRM is contingent on cooperation from all members of a community, not just a targeted group within the community (Mano Consultancy Services, 1998). Thus to avoid the tragedy of the commons, whereby members of a community exploit communal resources as quickly as possible so others in the community do not exploit them first, the diverse members of the "community" must be cohesive enough to function as a single management unit (Hardin, 1968). Community based organizations (CBOs) are therefore integral to CBNRM for tying together a community and developing management capacity. CBOs are more likely to exist and be successful when scarcity or pressure on resources is apparent and livelihoods are threatened (Brandon, 1998). Institutional structures must be cohesive enough and legally recognized to be granted ownership and management responsibilities (Child, 1996b). The organizational units of the community must be small enough to regularly meet face to face, in other words not more than approximately 200 households within 10 km radius (Child, 1996a). This principle may be difficult to follow in areas such as Zambia where human populations in game management areas tend to be sparse and thinly spread.

CBOs should be given all functions they are capable of performing, but new roles and functions should not be added until a CBOs has the interest and capacity to adopt them (Child, 1996a). It takes time to develop the capacity of CBOs and build the interest of local people to try new social structures and economic strategies. A CBNRM program

which is truly community-based will also be community-paced (National Parks & Wildlife Services, 1998). Problems, including misappropriation of funds, should be expected as part of the necessary learning process for both the project staff and community leaders, and incorporated into the project timetable (Child, 1996a). For this reason it is hard to introduce CBNRM in a crisis situation where immediate action is needed. Unfortunately donor time frames often do not concur with a realistic pace of progress, which has prompted calls to lengthen the 'incubation period' of CBNRM projects (Byers, 1998).

Monitoring in CBNRM

Roles of Monitoring

Monitoring is an important element of any natural resource management project. Monitoring provides the informational basis of adaptive management, which is often the most effective strategy for managing natural systems characterized by high levels of human use and natural fluctuation (Holling, 1978). Monitoring also provides mechanisms for ensuring accountability for resource use, building local management capacity, and planning public education (Lyons, 1999). Monitoring systems can serve to build confidence and trust between central government departments and local management systems, facilitating the decentralization process. Monitoring also fulfills legal mandates at national and international levels. Unless ownership of resources have been completely turned over to local institutions, government is ultimately responsible for monitoring to ensure that resources are being used sustainably (Child, 1996a).

Because the majority of CBNRM programs are fueled by the consumptive use of a natural resource, it is important that the biology of the resource is well understood to avoid over-exploitation and population crashes. Monitoring programs can provide data that help managers understand the impact that consumptive or non-consumptive resource uses have on a species or ecosystem. For this to be possible, both the level of resource use as well as biological parameters of interest (e.g., population size, reproductive success, age and sex structures, migration patterns, feeding ecology) need to be monitored simultaneously.

Thus although many monitoring programs are designed with a narrow focus in mind, monitoring is potentially one of the few activities which straddles the realms of management and science, and the social and biological fields.

Whatever the role of monitoring, articulation and consensus of the objectives has been identified as one of the key determinants of success (Stout, 1993). Monitoring programs should be developed at the outset of program design, and not as an add-on (Larson et al., 1997).

Monitoring Case Studies

Although the need for monitoring to improve management and research in conservation projects is frequently identified (Alpert, 1996), few projects have adequate monitoring programs in operation (Kremen, Merenlender, & Murphy, 1994). This deficiency is due to constrains such as a lack of physical resources, lack of skilled manpower, and the perception that monitoring is among the least urgent aspects of a project. Monitoring was seen as a burden and a donor requirement, rather than a tool

which can improve project effectiveness. There has also a tendency to avoid monitoring and risk revealing failure because of the repercussions from donors (Larson et al., 1997). Many CBNRM projects, particularly the earlier efforts, were designed quickly as a response to a funding opportunity or urgent conservation threat, and did not establish monitoring systems due to lack of time (Larson et al., 1997).

Despite the obstacles, many conservation efforts do recognize the importance of monitoring and are able to maintain effective monitoring programs. Conservation projects which are based upon the participation of local residents are best served by monitoring programs that also actively involve local communities (Lewis 1993). However, when attempting to incorporate the involvement of local residents into the monitoring process, one must also consider the livelihoods, needs, and knowledge levels of the people involved. Unless the monitoring system concurs with the socio-economic reality of the primary users, local participation will likely be minimal (Bodmer, 1994).

The Makira Conservation in Development Program, a CBNRM program in the Solomon Islands, established a community based monitoring program in 1996 to evaluate human impacts on growth, production, and reproduction of ngali nut trees. Local community members harvest wild ngali nuts for the project's nut oil extraction enterprise, thereby creating an incentive to conserve the forest. With technical assistance from Conservation International and other project partners, local people were trained in survey methods and conducted the first survey of ngali nut trees for harvested and non-harvested sites in three different ecological zones. Although few concrete conclusions could be reached after only one survey, the very process of conducting the survey yielded new insights, enthusiasm for monitoring, and an enhanced sense of self-empowerment for the local people conducting the survey.

The protocols and methods for the survey were kept simple and low-cost to maximize the likelihood that the survey will become a standard component of the project. However the survey was designed and supervised largely by outside technical experts, with community participation mainly coming in the form of field assistants and interpretation of results, so sustainability of this type of monitoring is rather tenous (Parks, Kohaia, & Tarihao, 1996).

The Masoala Integrated Conservation and Development Program developed a comprehensive monitoring program as part of the establishment of a new national park in Madagascar. The suite of variables being monitored includes measures of deforestation, poaching levels, lemur populations, tourism management, attitudes of local people, water quality, and resource exploitation. The methods employed include household surveys, focus groups, harvest counts, transects, law enforcement records, reforestation plots, and tour guide notebooks. The project has also created a spatial database of the park and surrounding area using satellite imagery, GPS data, and digitized maps. Monitoring data have proven useful for delineating the boundaries of the park and buffer zones to maximize the amount of biodiversity protected and minimize the potential conflicts with local communities. Monitoring data is also used to target management activities such as law enforcement and public education, develop plans for timber harvesting, and guide development activities that promote sustainable use of the park's resources. By basing the design and implementation of the park on sound environmental and social science, the

viability of Masoala, both ecologically and politically, has been greatly enhanced (Kremen, 1998; Kremen, Isaia, & Lance, 1998; Kremen et al., 1999).

Although some CBNRM projects have made an effort to document their monitoring systems, the field of monitoring is hindered by a lack of documentation from project monitoring units. In a comprehensive case study of participatory monitoring and evaluation programs, Estrella and Gaventa (1998) report that systematic documentation of monitoring is rarely undertaken in practice. Most project reports focus on findings and results of monitoring, with only a passing reference to the methodology. The few case studies which do exist often fail to elaborate on how, under what conditions, and by which stakeholders participatory monitoring and evaluation was developed. This is alarming not only because it deprives conservation professionals from the experience of others in designing effective monitoring systems, but also because the design and operation of monitoring strongly influences the final outcomes.

Monitoring Frameworks

Developing conceptual frameworks for processes such as monitoring serves a variety of purposes. A framework can help focus dialogue on a process, because the underlying assumptions, terminology, factors, and causative relationships are visible and understood. A framework can also serve as a diagnostic tool, suggesting a logical sequence of examination questions and explanations for the behavior of different parts of the system. Finally, a framework can lead to an implementation plan, providing a template which can be adapted to the local characteristics of a program and site.

Conceptual frameworks are not static entities, nor is there necessarily a single best framework for a particular process. On the contrary, our knowledge of systems can be significantly advanced when alternative frameworks for the same process are contrasted or applied to the same system. Simplicity is usually a desired quality of conceptual frameworks, however frameworks which are more generic also tend to lose much of their utility to frame dialogue and evaluate specific systems.

The Project Cycle Model

Not many frameworks have been developed for participatory natural resource monitoring for conservation programs. Perhaps the most well developed framework for conservation monitoring is the Project Cycle model developed by the Biodiversity Support Program (Margoluis & Salafsky, 1998b). This framework (Figure 1) emphasizes the role of monitoring in a larger context of project planning and evaluation. It also stresses the iterative nature of monitoring and project design.

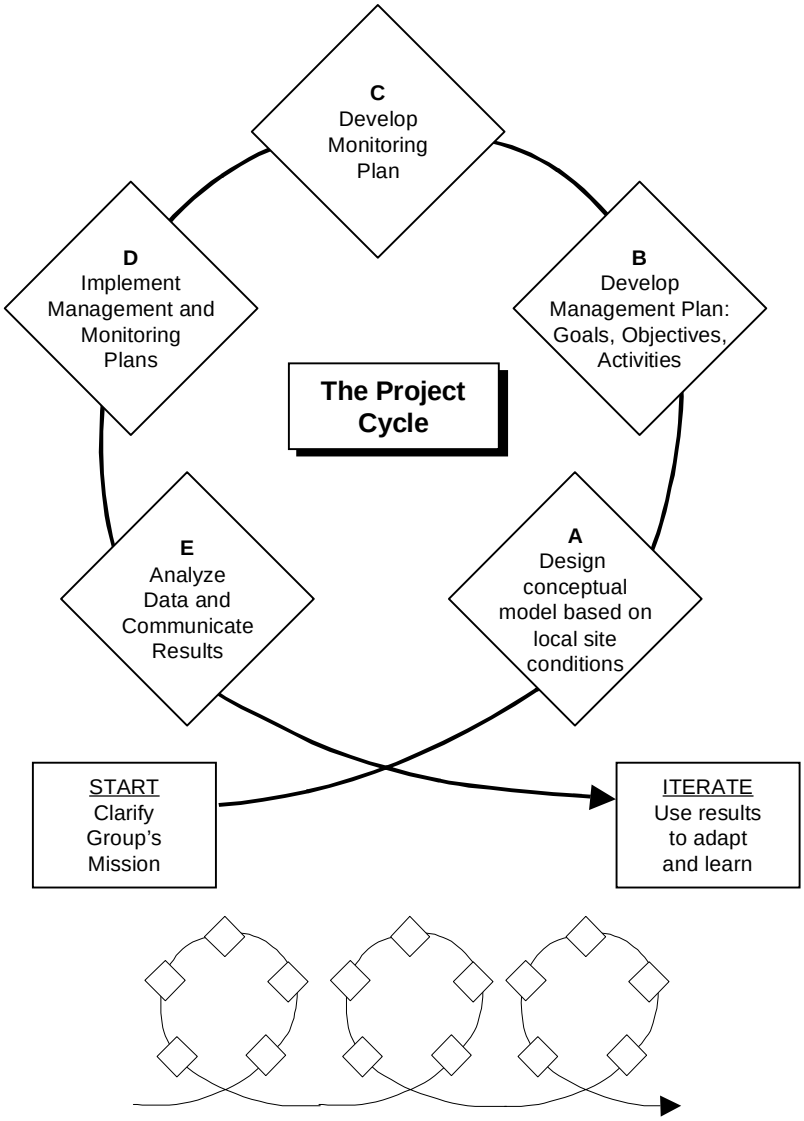

Figure 1 – The project cycle (Margoluis and Salafsky, 1998)

Action Research

The project cycle model and other iterative planning frameworks are based upon a methodology called action research which was developed by a social scientist named Kurt Lewin in the 1940s. Action research offers a problem solving methodology which has been applied to fields as diverse as education, community development, economics, clinical medicine, and many other human service professions. Action research presents an alternative to the more traditional way of approaching a problem or study, where a long period of study is undertaken before any action is taken, goals and hypotheses are developed, and evaluation only occurs after the plan is fully implemented. Action research calls for participants to become actively engaged in defining a problem or issue, defining the criteria for success, and developing an action plan. The plan is then implemented, monitored, and evaluated. This leads to further refinement of the plan and another iteration of the loop. Thus all attempts to address the problem, whether they achieve the goals or not, provide valuable knowledge of the system. This process continues until the

problem is solved to the satisfaction of the participants. Action research is therefore characterized by ongoing tentativeness, recursion, collection of empirical evidence, analysis of connotations and context, and collegial sharing. Action research is particularly appropriate in situations where it is difficult or impossible to verify or replicate observations, separate the observer from the observed, and isolate and control for many confounding variables (Longstreet, 1982; Wals, Beringer, & Stapp, 1990). These are some of the very constraints that characterize natural resource monitoring in CBNRM, hence Action Research provides a good model upon which to build a framework for monitoring.

Effective Monitoring Framework

For this research, I developed and tested the Effective Monitoring Framework for community based natural resource monitoring (Figure 2). This framework is similar to the project cycle model however focuses more on the details of monitoring design and implementation. However like the project cycle model it highlights the importance of internal feedback loops to link analysis with design and implementation.

A discussion of the main elements of the framework follows below.

Environment

That effective monitoring can only exist within a conducive project environment may appear self-evident, however it is important to emphasize that monitoring in CBNRM is but one element of a much larger and more complex system. Like other project activities, monitoring requires that the main components of the CBNRM model be present and functioning. All CBNRM programs rely on one or more natural resources which are valued by people based on consumptive or non-consumptive use. Without an exploitable resource, management activities and the monitoring of those resources are not likely to be effective. Numerous authors have also highlighted the importance of an appropriate legal framework that empowers local users to own and manage their resources (Child, 1996b; Lewis & Carter, 1993; Naughton et al., 1998). Committed and capable leadership, effective community organizations, material and human resources for training and management, and a host of other factors outlined above all set the stage for a successful CBNRM program with an effective monitoring system.

However monitoring may still play a valuable role even when one of the critical pieces of the CBNRM model is not functioning. Monitoring can serve as a smoke detector, helping to detect when something is wrong and providing the stimulus for corrective action. However for this role to be feasible, monitoring must also be protected from "sinking with the ship," by being as insolated as possible from potential problems such as inadequate revenue generation, weak leadership, or resource management failures. The ability to detect a melt down can be an important function of monitoring, however insulated monitoring systems may also be less effective in other functions where local participation and integration with daily activities are most important.

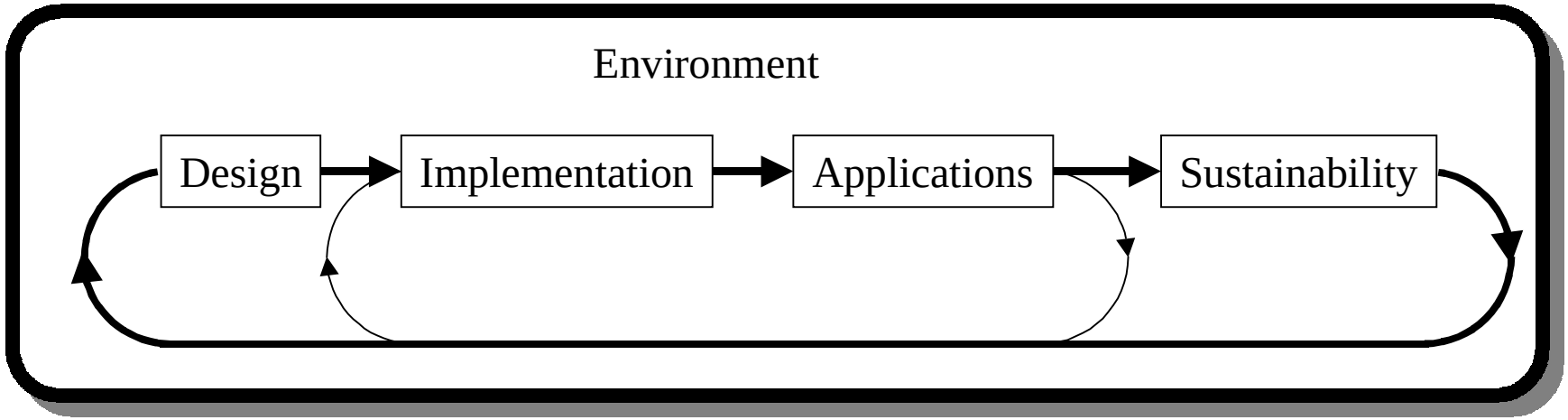

Figure 2 – The Effective Monitoring Framework for community based natural resource management programs

Environment
- natural resource with economic value
- legal and policy framework
- leadership
- community organizations

Design
- analysis of stakeholder information needs
- identification of monitoring goals
- inclusive participation
- indicator selection
- temporal and spatial scales
- sampling
- feasibility
- incentives

Implementation
- identification of data collectors
- training
- observations
- supervision
- information flow
- data processing system
- timeliness
- data quality evaluation

Applications
- adaptive management practices
- feedback for monitoring implementation
- dissemination routes
- presentation of results

Sustainability
- perceived value in information
- participant willingness to reinvest in monitoring
- validation of project conceptual model
- sustainable management of resource

Design

The design of a monitoring program should both describe the conceptual basis for monitoring and provide the blueprints for data collection, processing, analysis, and dissemination. The need for a good design may also seem self-evident, however probably more problems with monitoring programs can be traced to a faulty or incomplete design than any other cause (Salafsky & Margoluis, 1999). Design begins with well-articulated goals, which are themselves derived from a solid understanding of the project mission and a site-specific conceptual framework of the many factors influencing a target condition (Margoluis & Salafsky, 1998b). Participation in the design phase should include all stakeholders who will play an eventual role in the monitoring system. A monitoring plan should also address which indicators will be monitored, how those indicators will be measured, the sampling scheme to be used, and the temporal and spatial scales required. Spatial scale refers to both the total geographic area monitored as well as precision of the spatial measurements. Likewise temporal scale consists of both the total span of time which measurements are made in, as well as the frequency of measurements during that period. Indicators should be SMART (Specific, Measurable, Attainable, Relevant, Time-framed), and resonate with the intended audience (Abbot & Guijt, 1998). All of the steps in the master plan, from data collection to dissemination of final results, must be feasible by not exceeding available manpower and material resources. The monitoring plan should also describe the incentives for each stakeholder's participation, which will ultimately determine the sustainability of the monitoring program.

Implementation

Implementing monitoring requires mobilizing the necessary human and physical resources to put the plan into action. It begins with identifying data collectors and providing training in the proper measurement techniques. Training usually requires more than a one-time workshop, so refresher courses and follow-up support in the field will likely to be necessary. Once data collectors begin to make measurements, observations need to be somehow recorded and stored for analysis. Depending on the complexity of measurements and the volume of data, this may require a paper filing system and/or computerized database. Checks for data quality should be embedded along the information path, and provide immediate feedback on the effectiveness of the system. Postponing an evaluation of data quality until the end affords no opportunity to take corrective measures in design or implementation. The many elements of a monitoring program must work smoothly together for the ultimate results to be disseminated in timely manner.

Applications

Some authors divide monitoring systems into 'adaptive management' and 'impact monitoring' (Abbot & Guijt, 1998; Estrella & Gaventa, 1998; Salafsky & Margoluis, 1999). However in the present framework these divisions are simply treated as different applications of data. Examples of adaptive management applications include setting harvest levels, planning law enforcement, public education, ensuring accountability, and planning community development interventions. Examples of impact monitoring applications include determining the cost-effectiveness of law enforcement strategies, measuring changes in wildlife populations, or evaluating the impact of project activities on

conservation attitudes and household standard of living. Monitoring for impact often requires collecting baseline data, formulating specific hypotheses about expected changes, and finally monitoring the system and measuring actual change. The objective of impact monitoring is not only to assess whether a program did or did not make an impact, but also determine *why* the observed outcome occurred. Thus the ultimate application of impact monitoring is an evaluation of the conceptual framework of the project, which describes the socio-ecological context and the expected results of each of the project's interventions (Margoluis & Salafsky, 1998a).

Another application of monitoring is to review the monitoring system itself. Feedback from the implementation of the monitoring plan can be used to identify problems in the monitoring design (such as sampling regimes which are inadequate or unfeasible) or implementation (such as insufficient supervision of data collection).

Each type of application has its own specific requirements for disseminating and presenting results. A village committee estimating the number of scouts needed to patrol an area requires a dissemination strategy and presentation format which is much different than that needed by project staff who are preparing a quarterly report for an international donor. A common constraint of many monitoring programs is trying to use the same analyses, dissemination tools, and presentation formats for all applications.

Sustainability

For a monitoring program to be sustained, it must be relevant to the needs of the end user and their institutions (Tobin, 1999). The information benefits must be perceived to be valuable enough that the primary stakeholders are willing to reinvest in the monitoring activities. If a donor or national agency is the only stakeholder which perceives monitoring information to be valuable, then monitoring will likely cease if that donor or agency withdraws as an active partner in the project.

Ultimately, natural resource management projects seek to attain a level of sustainability in both resource conservation and social development. Monitoring systems certainly can not achieve sustainability on their own, however in a conducive environment with a well conceived monitoring design and smooth implementation, monitoring can play an important role in both measuring sustainability as well as providing feedback for the most effective methods to achieve it.

Study Objectives and Significance

The purpose of this study was to test the adequacy of the Effective Monitoring Framework to describe and guide analysis of the monitoring system of an actual community based natural resource management project, namely the ADMADE conservation program in Zambia. By using the framework as a template to describe the components of ADMADE's monitoring program, analyze its strengths and weaknesses, and plan interventions, this study sought to demonstrate how the Effective Monitoring Framework can be helpful in documenting and strengthening the monitoring component of community based natural resource management.

Studies like this one help to refine models, such as the Effective Monitoring Framework, and identify their limits and assumptions. The case study method employed also records in-depth information about an actual monitoring program, so that other

frameworks may also be tested against the same real-world system and refined. This iterative process of model making mirrors the iterative nature of monitoring, and ultimately leads to a more comprehensive and robust collection of analytical frameworks available for planning, structuring dialogue, and targeting interventions.

CHAPTER 2
METHODS

Study Area

Zambia is a landlocked nation in South-Central Africa, occupying some 750,000 km^2 on a central elevated plateau interspersed with ancient rifted troughs and river valleys. Three quarters of the country drains into the Indian Ocean through the Zambezi river system, which includes the Kafue, Luano, and Luangwa rivers. The extensive river systems, floodplains, and escarpments have allowed the formation of a wide variety of habitats, including large wetlands, riverine ecosystems, and forested plateaus. Miombo woodland is the dominant vegetation community, covering about 80% of the country (Aspinwall, Bingham, Chundama, Jeffery, & Sinkamba, 1996; Wildlife Conservation Society of Zambia, 1991).

Zambia's 10 million people are highly urbanized, with 47% living in cities primarily along the main transportation corridors. However population density in the country as a whole is low, with only 4.5 people per km^2. After peacefully winning independence from Britain in 1964, Zambia prospered for its first decade fueled by the mining industry. However a long-term decline in the global prices for copper coupled with rising debt and inefficient centralized economic policies eventually drove the economy to rock bottom in the late 1980s. In 1991 a new government was elected and initiated structural reform. However the economy remains crippled by a $6.7 billion foreign debt, government control of failing industries, and annual inflation near 30%. The human population has also been hard hit by AIDS, with an estimated 20% of the population infected. The impact of this epidemic, which is more severe in urban areas, will be felt for decades to come (Economist Intelligence Unit, 1999).

Zambia is richly endowed with fauna. At least 240 species of wild mammals have been identified, including most of the large game animals (Aspinwall et al., 1996). Zambia has not lost any of its large vertebrates, with the exception of the black rhino which was all but extirpated by poachers in the late 1980's. Some species such as wild-dog and the cheetah remain threatened, however elephants, which were also decimated by poaching during the 1970s and 1980s, are slowly recovering and believed to be near carrying capacity in much of the country. There are 733 species of birds known to live in Zambia, including migrants (Zambian Ornithological Society, 1993). The diversity of habitats, including several large wetlands, allow for such rich avian diversity. Although there is relatively little endemism in fauna, Zambia hosts several important sub-species of large mammals including Thornicroft's Giraffe *(Giraffa camelopardalis thornicrofti)*, Cookson's Wildebeest (*Connochaetes taurinus cooksoni)*, Kafue Lechwe *(Kobus leche kafuensis)*, and Black Lechwe *(Kobus leche smithemani)* (Alden, Estes, Schlitter, & McBride, 1995; Wildlife Conservation Society of Zambia, 1991).

About 10% of Zambia is protected in national parks which prohibit all human activity except tourism (Figure 4). Another 20% falls under semi-protected game management areas (GMAs) which are multiple-use zones which typically buffer the national parks. GMAs permit human settlement and low-impact land uses such as small scale agriculture and fishing, however large settlements and high-impact land uses such as mining or commercial forestry are prohibited. All wildlife in Zambia are owned by the state and administered by the Zambia Wildlife Authority[1].

Figure 3 – Zambia

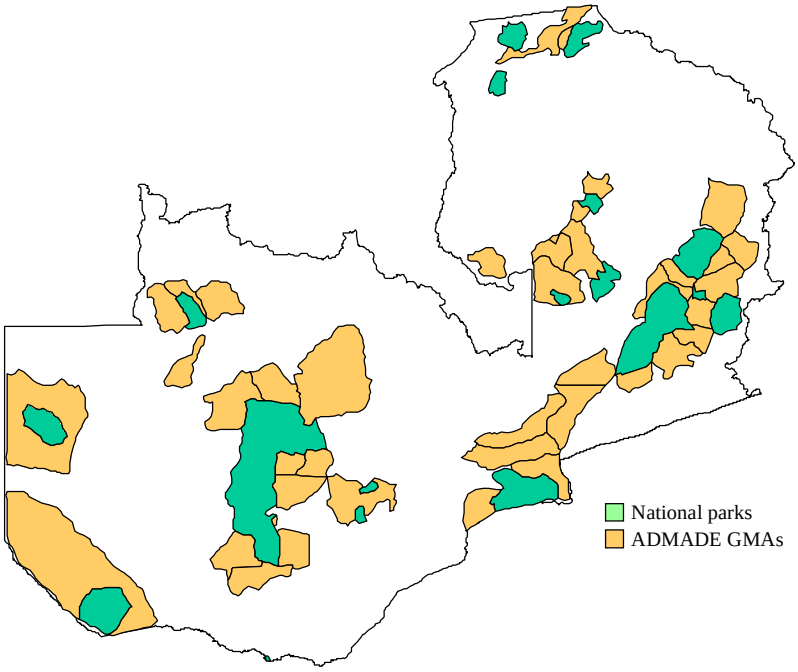

Figure 4 – Protected areas in Zambia

[1] In 1999, the National Parks and Wildlife Services (NPWS) underwent restructuring and was renamed the Zambia Wildlife Authority

ADMADE

The Administrative Management Design (ADMADE) program ironically has its roots in Zambia's economic crisis of the 1970's, which was largely caused by a steady decrease in copper prices on the world market. As the government cut back its budget, resources for wildlife protection dwindled. The cutbacks were coupled with an unpopular and ineffective centralized management approach which alienated local people from the benefits of wildlife, yet forced them to bear the costs of living with wild animals. The combination of budget constraints and backlash to traditional management approaches developed into an atmosphere which culminated in a drastic increase in poaching (Gibson & Marks, 1995).

The poaching epidemic of the 1970s and '80s plagued other African countries as well (Oates, 1999) and served as a wake-up call for governments and conservation interests to explore new approaches to wildlife management. In 1983, the Zambia National Parks and Wildlife Service (NPWS) convened the Lupande Development Workshop, bringing together over 40 government and community representatives, conservation organizations, and donors. The result of this workshop was a manifesto acknowledging the need to use a more community-friendly form of management (Lupande Development Workshop, 1983). Subsequently, two pilot CBNRM projects were launched: the Luangwa Integrated Resource Development Project (LIRDP) funded by the Norweigan Agency for International Development (NORAD), and the Lupande Development Project, a National Parks and Wildlife Service (NPWS) sponsored project which later expanded to become ADMADE (Gibson, 1999; Lupande Development Workshop, 1983).

Defining ADMADE as a program is complicated because it exists in various stages of implementation in many different areas throughout Zambia, maintains a low profile in the field, falls under a government department but with some characteristics of an autonomous NGO, and encompasses a wide array of stakeholders. ADMADE may be best thought of as

- the official policy of ZWA for all wildlife management in GMAs
- a vision of a mutually beneficial relationship between wildlife and people
- a designation, granted by ZWA, for GMAs allowing residents to organize certain structures and have access to certain services. The most significant of these structures and services include
    1) a portion of safari hunting revenue returned to a community controlled bank account through the Wildlife Conservation Revolving Fund (WCRF);
    2) authority to employ local residents as village scouts;
    3) a mandate to establish a three-tiered structure of community organizations;
    4) access to training programs and technical support from Nyamaluma Institute.

ADMADE's system of administration at the GMA level evolved over its first ten years. From 1989 to 1998, each GMA in the ADMADE program maintained a committee called the sub-authority. Members of the sub-authority were appointed by the local chief,

who also served as the sub-authority chairman. The sub-authority decided how community revenue should be used, selected local residents for employment as village scouts, and was responsible for interacting with NPWS staff on management issues. This system of local governance was effective in winning the support of influential traditional rulers, a necessary ingredient to establish the program in an area. However, it also led to many problems with autocratic and non-democratic styles of governance (Alpert & DeGeorges, 1992). Initially there was another committee at the district level, called the authority, which had oversight and veto power over the sub-authority. However authorities gradually became inactive and were effectively phased out by the mid 1990's (Gibson & Marks, 1995; Mano Consultancy Services, 1998).

In 1999, ADMADE began introducing a more democratic three-tiered system of community organizations (Figure 5), building upon the 1998 Wildlife Act which vests more power in community based organizations. Replacing the sub-authority is the community resource board (CRB), a democratically elected body which incorporates the local chief as an honorary patron. The CRB is advised by three management committees also composed of residents of the GMA: the financial management committee, community development committee, and resource management committee. To ensure equitable representation from all geographic areas within a GMA, each GMA has been sub-divided into village area groups (VAGs), and representation on the CRB and management committees is equal across VAGs. Within a VAG, peer groups representing different livelihood groups (e.g., fishermen, honey collectors, farmers) help ensure the interests of all sub-groups within the GMA are represented (Ngulube et al., 1998). Although the revised community structures are still quite new and have not seen the test of time, the general move to more democratic administration has popular support and represents an effort to redress some of the local level institutional problems that constrained progress for achieving equitable socio-economic development for most of the 1990's (Mano Consultancy Services, 1998).

Methods

This research was conducted in Zambia between October 1998 and June 1999. During this period I was based at the Nyamaluma Institute for Community Based Resource Management[2], ADMADE's training and research facility, located near Mfuwe in the Luangwa Valley in eastern Zambia (Figure 6). Additional preliminary research was conducted in Lusaka between July 1998 and September 1998. The following types of research methods were used:

- document review
- meetings and workshop participation
- interviews
- database analysis
- organizing a monitoring workshop
- field visits

[2] In 1999, Nyamaluma changed its name to the *African College for Community Based Natural Resource Management*. However during the period in which this study was conducted it was called Nyamaluma, so that is the name which is used throughout this paper.

Data from these methods were used to test each component of the Effective Monitoring Framework (Table 1).

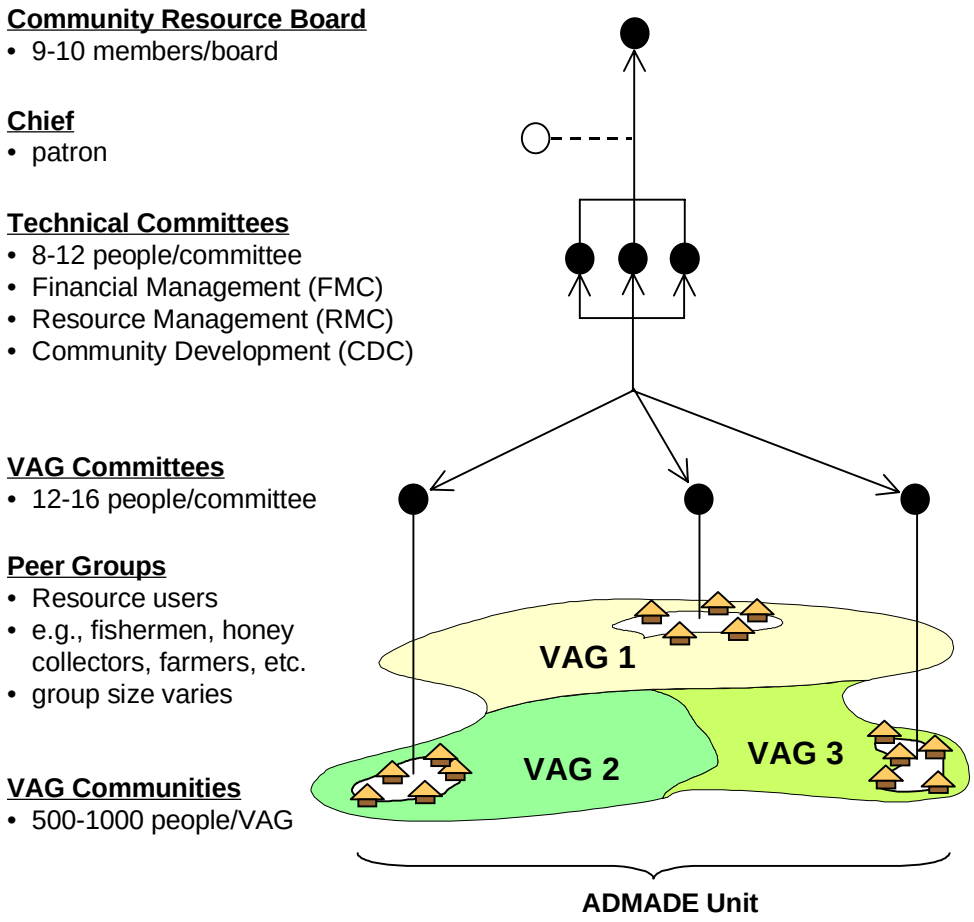

Figure 5 – ADMADE organizational structure for a single game management area

Document Review

A considerable amount of literature has been written about ADMADE. Nyamaluma Institute has a substantial collection of manuals, workshop proceedings, trip reports, monitoring summaries, policy papers, and newsletters. USAID/Zambia, ADMADE's primary donor for its first ten years, contracted a number of evaluations and studies and has a large collection of reports. Wildlife and conservation issues in Zambia have been the topic of numerous articles from academic journals, many of which address approaches to CBNRM and ADMADE. A list of the various reports and articles reviewed for this study can be found in Appendix C.

Meetings and Workshop Participation

I participated in the following meetings and workshops:

- Wildlife Conservation Society Africa Program meeting, Nyamaluma, 7/98
- USAID/Zambia Performance Monitoring meetings (6), Lusaka, 7/98 - 8/98
- Wildlife Donor Coordinating meeting, Lusaka, 7/98

- Four community quota-setting meetings, Luangwa Valley, 10/98
- Financial Management Committee workshop, Nyamaluma, 12/98
- CBNRM District Team meeting, Environmental Support Programme, Mumbwa, 3/99

Interviews

I conducted semi-structured interviews with key stakeholders of ADMADE's monitoring program. Interviewees were select to represent three levels of interest in monitoring: upper-level managers (9), mid-level technicians (9), and field staff (14). The purpose of these interviews was to ascertain information needs, familiarity with ADMADE's monitoring activities, perceptions of monitoring, and levels of input into the monitoring system. In the case of village scouts and unit leaders, additional questions focused on data collection and data management issues. See Appendix B for sample interview guides.

Upper-Level Managers

- Deputy Director, NPWS
- Chief Wildlife Research Officer, NPWS
- Technical Advisor, Nyamaluma
- Principal, Nyamaluma
- Agricultural Development Officer, USAID/Zambia
- ADMADE Project Manager, USAID/Zambia
- Project Manager, Kafue Anti Poaching Organization (KANTIPO)
- Director CBNRM, Environmental Support Program (ESP), Ministry of Environment and Natural Resources (MENR)
- Director of National Environmental Monitoring and Information Network, MENR

Mid-Level Technicians

- GIS/database analysts, Nyamaluma
- Research Officer, Nyamaluma
- Agroforestry Officer, Nyamaluma
- Systems Analyst, NPWS
- Wildlife Biologist, Kafue Command
- Technical Advisor, Wildlife Resources Monitoring Unit, Environmental Council of Zambia
- Research Officer, South Luangwa Area Management Unit

Field Staff

- Unit Leaders: Chifunda (1), Mumbwa (1), Lunga-Luswishi Busgana (1)
- Deputy Unit Leaders: Kasonso Busanga (1), Lunga-Luswishi Busanga (1), Mumbwa (1), Munyamadzi (1)
- Village scouts (7)

Table 1 – Research methods

Framework Element	Document review	Meetings	Interviews	Database analysis	Monitoring workshop	Field visits
Conducive Environment						
natural resource with economic value	●			●		
legal and policy framework	●		●			
leadership	●		●		●	●
community organizations	●	●	●			●
Design						
analysis of stakeholder information needs	●	●	●		●	●
identification of monitoring goals	●	●	●		●	
inclusive participation	●	●	●		●	●
indicator selection	●		●	●	●	
temporal and spatial scales	●			●		
sampling	●		●	●	●	
feasibility	●		●			
incentives	●		●		●	
Implementation						
identification of data collectors	●		●			●
training	●		●		●	
observations	●		●	●	●	●
supervision	●		●			●
information flow	●		●			●
data processing system	●		●	●		
timeliness	●	●	●			
data quality evaluation	●	●	●	●	●	

Table 1 – Continued

Framework Element	Document review	Meetings	Interviews	Database analysis	Monitoring workshop	Field visits
Applications						
adaptive management practices	●	●	●		●	●
feedback for monitoring implementation	●		●		●	●
dissemination routes	●	●	●		●	●
presentation of results	●	●	●	●	●	●
Sustainability						
perceived value in information	●		●		●	●
participant willingness to reinvest in monitoring	●		●		●	
validations of project conceptual model	●		●			
sustainable management of resource	●			●		

Database Analysis

All monitoring activities in ADMADE at the project level are designed and coordinated at Nyamaluma Institute. Nyamaluma also manages the primary repository of monitoring data, with some datasets going back as far as 1992. Nyamaluma's facilities include a modern GIS lab, which is used for data processing, analysis and generating outputs.

While at Nyamaluma, I was graciously given free access to the monitoring database and GIS data. Datasets reviewed for the study include field patrol observations, safari hunting results, crop damage, household demography, quota setting worksheets, field staff records, scout camp facilities, hunting quotas, poacher case records, and population trends surveys. These datasets were examined for factors affecting data quality, such as missing data, spatial and temporal bias, sample sizes, and dispersion.

In the course of analyzing the database, I helped upgrade their information system to a more flexible relational database management system. This exercise involved extensive consultations with Nyamaluma's research staff to understand their needs and mode of operation. Upgrading the database required compiling and normalizing all existing data to a new relational data structure, and merging multiple GIS layers into national covers for use in the new application.

I was physically present at Nyamaluma for approximately five months of the research period. However I also worked on the database while in transit to field sites. At Nyamaluma I observed day-to-day research and training activities, and spent a substantial amount of time observing and interacting with research staff. Nyamaluma's research officers also serve as extension and training staff, and I benefited immensely from their wealth of field experience dealing with communities and monitoring issues.

Organizing a Monitoring Workshop

In May of 1999, I assisted the staff of Nyamaluma in planning and conducting a one-week Advanced Scout Workshop for 44 village scouts and deputy unit leaders. I helped develop the workshop objectives and outline, and created lesson plans for several of the sessions. I also led sessions on applications of monitoring data, conducting snare transects, waterhole and fish camp reconnaissance, and lesson planning for civic education. I also prepared participant notes for each session in the workshop, which were compiled into an end-of-workshop handout.

I also administered entry and exit questionnaires to the participants which were designed to ascertain their knowledge of applications of monitoring data, workshop expectations, level of cooperation with resource management committees, and opinions of the workshop. In preparation for this workshop, as well as other courses at Nyamaluma, I developed an educational framework for data analysis training, and drafted a quota setting manual for communities. During this workshop, I also interviewed village scouts from GMAs which I was not able to visit. The village scouts who attended the workshop were very experienced in monitoring, and were good sources of information on monitoring issues at the field level.

Field Visits

For most of this study, I was based at Nyamaluma Institute, however I was able to visit several ADMADE areas while accompanying Nyamaluma inspection teams. During these trips, I interviewed scouts, unit leaders, and deputy unit leaders. I also observed data management practices at the unit headquarters, sat in on quota-setting exercises, and observed Nyamaluma staff conduct other monitoring activities such as reviewing data forms.

The list below shows the amount of time spent in each area, while the map in Figure 6 shows the locations of the GMAs I visited.

- Lower Lumimba, Upper Lumimba, Munyamadzi, Chifunda - 2 weeks, Oct. 1998
- Kasonso Busanga, Lunga Luswishi Busanga - 10 days, March 1999
- Mumbwa - 5 days, March 1999

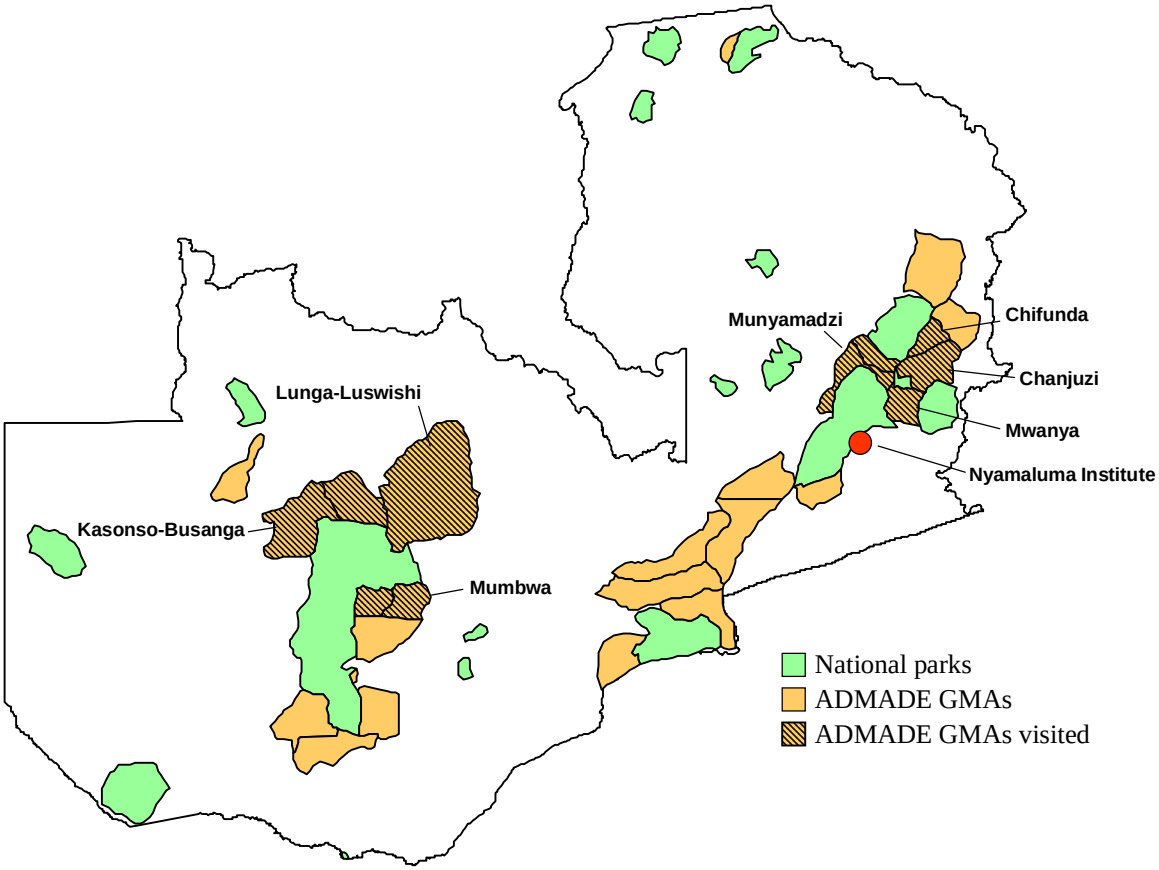

Figure 6 – ADMADE units visited for this research

CHAPTER 3
RESULTS

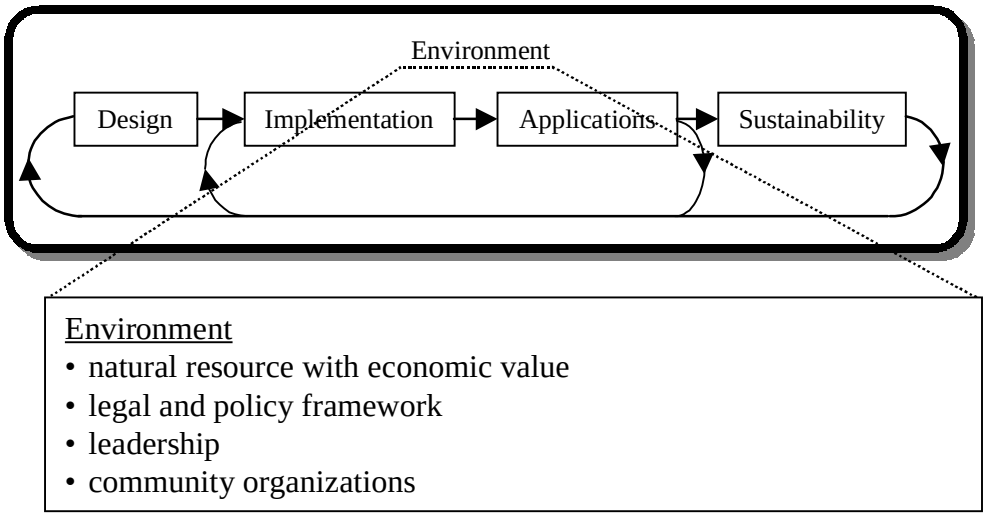

Figure 7 – Environment

Environment

Although it was beyond the scope of this study to conduct a full-blown evaluation of ADMADE as the broader context of the monitoring system, other authors have conducted more thorough evaluations and concluded that although imperfect ADMADE is functioning fairly well in a number of regards (Alpert & DeGeorges, 1992; Clarke, 2000; Mano Consultancy Services, 1998; National Parks & Wildlife Services, 1998). Alpert and DeGeorges (1992) reported that although ADMADE has not yet succeeded in establishing self-sustaining wildlife management practices or influenced national policy, it had demonstrated that wildlife could be a profitable form of land use. A second mid-term evaluation found that policy and lack of will power were still hampering progress, particularly the flow of revenue back to the communities, and that the monitoring systems were not yet strong enough to demonstrate success (ULG Consultants Ltd, 1994). Rosenthal and Sowers (1995) produced the first evaluation to suggest that sustainability of ADMADE was possible. They reported that the concept of community based management had taken root within the parks department, and that sport hunting has positive economic benefits that can be passed on to rural communities. The community development side of the project was still weak, however village scouts were functioning well under trying conditions. By the final USAID evaluation in 2000, Clarke (2000) reports that a strong wildlife legislation had been adopted by the government and new democratic community institutions were helping to improve the conversion of safari revenue into benefits for the producer community.

ADMADE has many of the required elements for a successful CBNRM project, including a highly lucrative natural resource (large game animals); direct linkages between conservation behavior and economic benefits; a legal framework which does not grant ownership yet empowers rural communities with access and management rights; committed and competent leadership at the project level and many of the communities; and community organizations which are gradually becoming more effective and representative. Thus while not perfect, the design and implementation of ADMADE in many GMAs functions well enough to serve as a conducive environment for participatory resource monitoring.

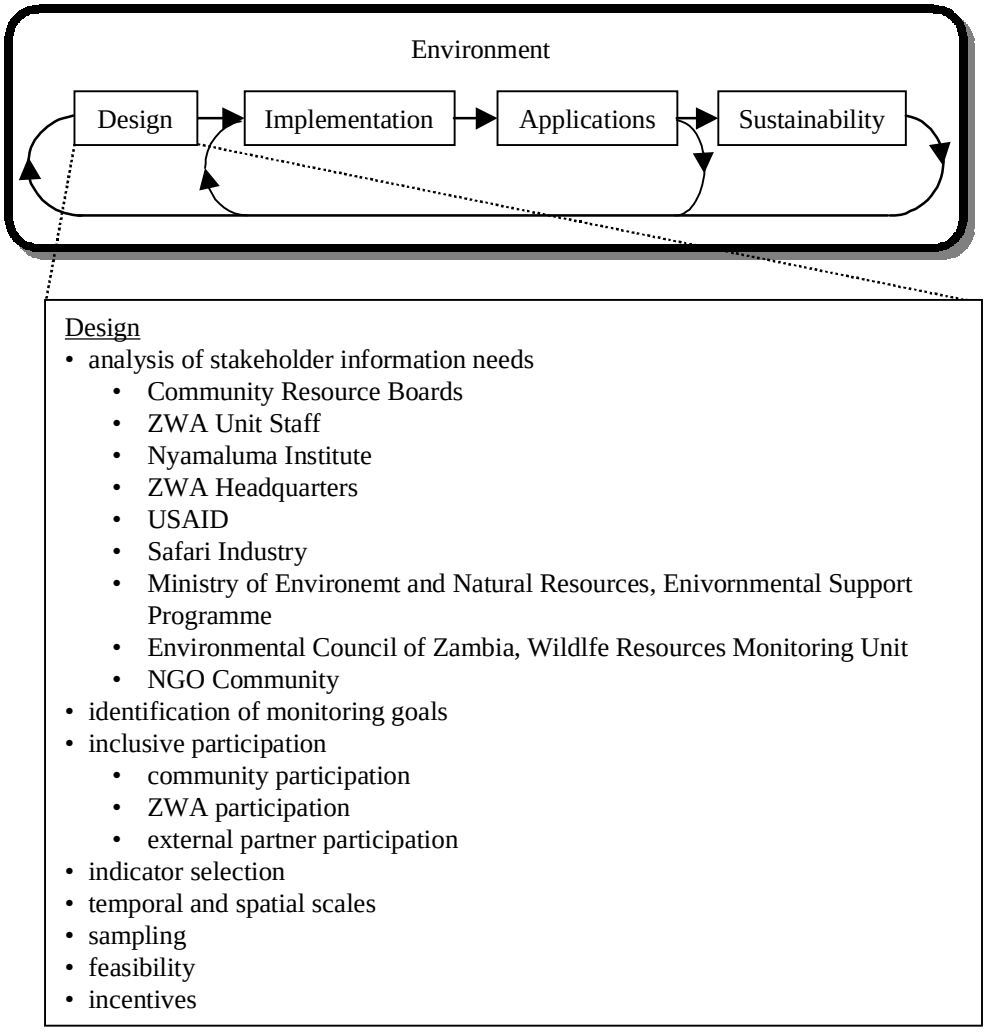

Figure 8 – Design

Design

Analysis of Stakeholder Information Needs

Community resource boards

Residents living in or near ADMADE GMAs have probably the most to gain or lose from wildlife management in Zambia. Whereas other wildlife stakeholders are affected by wildlife indirectly, such as by lost recreation opportunities, reduced revenue, conflicts with esthetic and moral values, and critical performance reviews, the wildlife-related issues faced by rural residents are very immediate and personal. These include property damage, fear for personal safety, loss of vital food stocks, possible loss of life, and risk of arrest or imprisonment. Conversely, rural residents also have much to benefit from wildlife management, such as increased opportunities to satisfy livelihood needs, improved health and education services, employment, community income, and better food security. Hence it is appropriate that rural communities have been finally recognized as perhaps the most important stakeholder in CBNRM programs such as ADMADE.

Rural communities are far from homogenous entities, and this diversity is mirrored in a variety of information needs and interests. Community resource boards, which are the elected representatives of the community at large, and the technical management committees need data for management activities, such as selecting quota recommendations, planning anti-poaching operations, and ensuring that all hunting and fiscal regulations are adhered to. In the early years of ADMADE, many of these chores fell almost exclusively upon the unit leader and his staff, with assistance from NPWS headquarters and Nyamaluma Institute. However under the new ADMADE structures, more and more of these responsibilities will fall with the various elected community management committees. Information available for management activities includes indicators of wildlife population trends (e.g., hunting statistics, observations on field patrols), field patrol results, poacher case records, and Wildlife Conservation Revolving Fund (WCRF) statements.

Planning and implementing community development projects is at least complex, if not more so, than managing wildlife. To prioritize development needs, CRBs need information about human demographics, household level food security, livelihood strategies, human population growth and distribution, income flows, health and education services, wealth distribution, markets, and intra-community dynamics. To meet these needs ADMADE's monitoring system can provide information on human demographics and to some extent income flows, however is less well equipped to provide other socioeconomic data, particularly household level variables.

Catching and preventing mismanagement of funds and other project resources is another important need of rural communities. Whether it is ammunition or food rations taken on field patrols, or income received from the Wildlife Conservation Revolving Fund, transparent accountability of resources is critical for the program to maintain the confidence of the local people. To ensure accountability, CRBs need information on field patrol supplies, license sales, hunting results, expenditures from community development projects, and bank statements. If mismanagement should occur, CRBs need a monitoring system that is sensitive enough to catch the problem at an early stage so that corrective

measures can be taken. Catching mismanagement also requires that a broad spectrum of stakeholders have access to data on financial resources.

Under the 1998 Wildlife Act, CRBs will also be required to develop comprehensive resource co-management agreements between themselves, government agencies, and private industry. Negotiating a co-management agreement is an information-intensive activity, requiring baseline resource inventories, resource use patterns, management capability, and market demand for safari products. In addition to helping negotiate co-management agreements, resource monitoring will itself be an important component of all co-management plans.

CRBs will face other information needs when reviewing and renegotiating safari hunting concessions with safari operators. One of the major determinants of success of ADMADE in a GMA is the performance and integrity of the safari operator and his professional hunters (National Parks & Wildlife Services, 1999d). Monitoring data can be used to evaluate the past performance of a safari operator, assess the economic potential of a hunting block, and negotiate new concession fees.

Local land-use plans have been developed for most of the ADMADE units in the Luangwa Valley, and will be developed for the remaining areas in the near future. Land-use plans are developed in participatory workshops, and are broad-spectrum, comprehensive sets of proposed actions designed to resolve and prevent land-use conflicts. Resolutions from a land-use plan may include shifting human activities away from wildlife areas, implementing a new project such as an electric fence or road rehabilitation to address community needs, or clarification on the roles of the various stakeholders. Developing a land-use plan is a complex, iterative, participatory exercise, which requires monitoring data such as wildlife habitat needs, safari hunting trends, unit demography, community development priorities, and revenue flows.

ZWA unit staff

The information needs of Zambia Wildlife Authority field staff, which includes unit leaders, deputy unit leaders, village scouts, and civil servant scouts, parallel the information needs of local communities with whom they are partners in management. As the field representatives of ZWA, these officers have the responsibility and authority to enforce wildlife regulations, conduct anti-poaching operations, arrest poachers, and recommend scientifically based hunting quotas. On the 'softer' side of their job, some unit staff are active participants in formulating local policy, such as land use plans, resolving conflicts, and public education. Each of these different types of activities requires monitoring information to plan, execute, and evaluate.

In addition to using data to plan and review management operations, unit staff have an interest in ADMADE's monitoring system in a way that not many other stakeholders have: they are the source of most of the data. Village and regular scouts, under the leadership of the unit leader and his deputies, collect all of the safari hunting, field patrol, and poacher arrest data, and are recorders for other types of data, such as crop damage and snaring pressure. The scouts and their supervisors need to know not only the results of their monitoring work, but also feedback on their methodology of data collection. One of the on-going efforts by extension staff from Nyamaluma has been to

increase the capacity of units to collect, store, and analyze the various forms of monitoring data.

Interviews conducted for this study revealed that providing evidence for judicial proceedings is another use of field patrol. Poacher case records and field patrol dataforms may be important pieces of evidence when poachers are brought to court. In addition to the prosecution of cases, dataforms may be used in the defense of scouts who are accused of offenses such as improperly confiscating property, or injuring or killing a poacher.

At a slightly higher organizational level, wardens, who are responsible for an entire command,[3] have their own information needs. Wardens are in charge of all personnel matters, allocation of human and material resources, and monitoring wildlife populations in their command. Commands also get a percentage of safari hunting revenues for their operations, so they have a vested interest in ensuring that safari hunting is being managed profitably and sustainably. Some commands have biologists on staff, who are responsible for monitoring wildlife populations in the command. Commands typically have few resources to work with, so a biologist may rely heavily on data from ADMADE scouts, or collaborate with unit staff in analyzing data or organizing ground transects.

Nyamaluma Institute

Nyamaluma Institute is ADMADE's center for training, research, and extension services. Although officially a government facility, in many regards Nyamaluma functions as a semi-autonomous NGO, providing a variety of services to ADMADE units. Nyamaluma also serves as a liaison between ADMADE units and other stakeholders, such as the Zambia Wildlife Authority headquarters in Chilanga, the safari industry, and the international conservation and donor community.

Nyamaluma's information needs are as diverse as the roles it plays. To fulfil its function as a training institute, Nyamaluma requires information about unit staff, elected community members, retention rates, educational backgrounds, and training needs. In its role as a source of extension and facilitation services, Nyamaluma needs all the same information as communities and unit staff. Likewise, as the liaison between communities and ZWA headquarters, international donors, and the safari industry, Nyamaluma requires the same type of information as these other stakeholders.

Nyamaluma is able to fulfill so many roles partly because it functions as the central nervous system of ADMADE's monitoring program. There are very few monitoring activities in ADMADE that were not designed, initiated, and continuously supported by the staff and technical resources at Nyamaluma. Nyamaluma staff also conduct special studies periodically on specific topics, such as village expansion, agricultural yields, or community awareness and attitudes towards ADMADE.

Zambia Wildlife Authority headquarters

The Zambia Wildlife Authority office in Chilanga is the department headquarters. This is the base for all the senior officers in ZWA, including the Director, Deputy Director, Chief Warden, Landuse Planning Officer, and Chief Wildlife Research Officer. The headquarters office is responsible for all policy issues and national decisions affecting wildlife in Zambia, including approving final hunting quotas in game management areas,

[3] Zambia is divided into nine commands

budgeting and staffing, program planning, research and education, developing and enforcing policies and regulations, collection of fees and permits, and coordination with other agencies both domestic and foreign. ZWA is the government's legal steward of wildlife, and they are answerable to parliament and state house concerning the state of Zambia's wildlife estate. ZWA headquarters also has vested interest in ADMADE because ADMADE is the department's official management policy in most non-depleted GMAs. Safari hunting in ADMADE GMAs also provides a significant amount of revenue both for ZWA and GRZ. Senior ZWA officers also represent Zambia in many international wildlife fora, such as the annual CITES convention and regional conservation conferences.

As far as ADMADE is concerned, senior officers in ZWA want to know how successfully wildlife is being conserved in the project area, and how communities are benefiting from the program. On a more immediate level, they need information on staffing issues and supplies for field operations. At the policy and strategic planning levels, they need to know how government policy and private industry affect the success of safari hunting and ADMADE, and how those policies might be altered or supplemented with new initiatives. The decision to adopt and support ADMADE as the official government wildlife management policy for GMAs was based in part on monitoring results from the pilot Lupande Development Project as well as ADMADE. Projecting into the future, the evolution of wildlife management in game management areas of Zambia will be based in part on the experiences of ADMADE as expressed through monitoring.

In 1999 an ADMADE coordinating office was opened at ZWA headquarters Chilanga. This office allows ADMADE to develop a presence in the day-to-day activities of the department. The coordinating office also provides field support to the ADMADE units surrounding Kafue National Park, and liases with other government departments and the donor/NGO community in Lusaka. The information needs of the coordinating office parallel those of Nyamaluma, and there is close coordination between the two branches. The coordinating office does not presently play a role in data processing and analysis, but once its future is stabilized, monitoring may become a larger component of its operations.

USAID

As the primary donor for the first ten years of ADMADE’s existence, USAID has its own information priorities. At a very basic level, they want to determine whether the goals and objectives described in project documents are being achieved, and whether the program is sustainable. In the big picture, one of USAID's interests in funding ADMADE has been to evaluate whether CBNRM is an effective strategy for wildlife management, and if so whether this approach can be replicated in other areas or other sectors. Thus it needs a variety of information that will show not only whether ADMADE is achieving its goals, but also through which strategies and under what conditions.

One of the challenges all projects with long-term donor support must face are shifts in the donor's information needs and priorities. In the mid and late 1980s, when ADMADE's funding agreement was developed and approved, USAID's reporting and evaluation frameworks were generally oriented to measuring the impact of individual projects, and biodiversity conservation was a goal in itself. In the mid 1990's, USAID became more 'results oriented' agency wide, reflecting a larger movement in the US federal government to improve accountability and effectiveness. Oversea missions were instructed

to develop strategic plans for the country, and streamline their project portfolios to be more coherent and integrated around a hierarchical framework of goals and objectives.

As a result of this shift, USAID funding for ADMADE in 1998-1999 fell under Strategic Objective One: *To increase the rural income of selected groups.* Under this strategic objective, and its three intermediate results, a variety of performance indicators are listed for which ADMADE must provide data in its quarterly and annual reports. These indicators include the net income of rural households, access to finance, value of commodities marketed, improved land and labor productivity, and the number of clients of support institutions (USAID/Zambia, 1997). ADMADE, which has always had a strong programmatic emphasis on wildlife conservation, does not fit neatly into this new branch of USAID's strategic objectives framework, and has had to strengthen its data collection in several areas. To measure performance towards USAID's strategic objectives, ADMADE needs to report the number of people benefiting from community development projects, the nature of those benefits, the effectiveness and efficiency of management activities, and variables which impact the long-term sustainability of the program. This translates into improving data collection on revenue flows, community awareness and support for the program, impact of community development projects, management capacity at the local level, wildlife population trends, and performance of the safari hunting industry.

Because donors are not involved in day to day management, USAID for the most part only requires aggregated summaries of monitoring data, not all the details. Furthermore, because ADMADE's impact monitoring data are combined with data from other USAID supported projects to measure the impact of the entire SO1 project portfolio, USAID prefers quantitative over qualitative data, in universal units such as dollars, and in absolute values instead of simply relative measures or trends. They also require data which is representative of the project as a whole, instead of just selected areas, to ensure that the results are a valid measure of ADMADE's overall performance.

Safari industry

The safari hunting industry is the private sector partner with the largest role in ADMADE. Within the safari industry, the people that have the most immediate interest in ADMADE's monitoring system are individual safari hunters, safari operators, and professional hunters. Safari operators are generally private individuals who have won a concession agreement from the government to conduct safari hunting in a specific GMA. They represent the political and business side of safari hunting. Professional hunters, on the other hand, are highly-experienced hunters who are licensed by the government to guide safari hunters and have been contracted by a safari operator to construct and operate a safari hunting camp in the hunting block.

Safari operators and professional hunters in the safari business are frequently motivated as much from a passion for wildlife and hunting as the financial rewards. They have an interest in ensuring that hunting in Zambia is managed profitably and sustainably, and by extension are interested in all data that are used to guide management of wildlife. More specifically, they are interested in any information that can be used for setting hunting quotas, to ensure maximum profit without jeopardizing the success of future hunting seasons. Nor do they want to be in the position of selling promises for wildlife trophies that do not exist, which can quickly ruin one's reputation in a market where the

main information source for prospective clients is word of mouth. When competing for concessions, safari operators need data upon which to base their bid for the hunting block. This includes measures of wildlife abundance, past hunting success, management capacity, and characteristics of the local communities.

Both safari operators and professional hunters must recruit foreign hunters to hunt in their area. Much of this marketing takes place during the annual Safari Club International convention in Las Vegas. To market their hunting block to wealthy, sophisticated, and demanding clientele, safari operators need to present evidence of the status of wildlife and hunting success in their area. To a lesser, but growing extent, safari hunters are also interested in the conservation benefits of hunting, and desire information about the sustainability and ethics of hunting in a certain area. ADMADE's 'Green Bullet' certification program is one of the newer elements of its monitoring program which provides prospective hunters with this type of information. Green Bullet certification for a hunting area is an indication that there is an effective partnership between the safari operator and the local community according to ADMADE guidelines (see Appendix A).

Ministry of Environment and Natural Resources, Environmental Support Programme

Within the Ministry of Environment and Natural Resources (MENR), the Environmental Support Programme (ESP) is a multi-faceted project aimed at increasing environmental management capacity in Zambia. The sub-programs under ESP, each of which is supported by a separate donor but share common goals and strategies, include the Environmental Information Network and Monitoring System (EINMS), the Community Environmental Management Programme (CEMP), the Project Environmental Fund (PEF), and Institutional and Legal Framework (ILA). At least two of these component projects, the EINMS and CEMP, have very concrete interests in the monitoring activities of ADMADE.

The EINMS has the mandate of compiling a directory of all environmental data in the country and developing institutional partnerships to facilitate exchange and enable cross-sectorial analyses (Mukumbuta & Mbumwae, 1997). Wildlife is one of the key resources identified by the ESP to be of national significance and at risk, along with forest resources, fisheries, and clean air and water. ADMADE has one of the most complete datasets on wildlife in the country, particularly outside national parks in the GMAs which hosts much of Zambia's wildlife estate. Furthermore, from a methodological standpoint, the EINMS and its institutional partners have a lot to learn from ADMADE's ten year experience of using community residents in natural resource data collection, and conducting analyses with GIS enabled RDBMS applications.

The CEMP program is similar to ADMADE in that it strives to involve communities in the management of natural resources (Zulu, 1999). Two of the four CEMP pilot areas actually overlap ADMADE units. However CEMP differs slightly from ADMADE in that it focuses on a larger suite of resources, including forest products, fisheries, and mining, and is being implemented through district level government. Despite the differences in implementation strategy, CEMP stakeholders at the national, district, and community levels could benefit from ADMADE's monitoring system, in both content and methodology. Because CEMP is slated for expansion into a national program, ADMADE areas may potentially gain as well, in developing strategies for managing non-

wildlife resources appropriate for the Zambian context, diversifying the resource base for community development, and working more closely with local government.

Environmental Council of Zambia, Wildlife Resources Monitoring Unit

The Environmental Council of Zambia (ECZ) is a semi-autonomous government unit that performs a variety of roles, including developing and enforcing policies and regulations for the control of pollutants. ECZ also implements or provides support to many environmental projects within different government ministries, including several of the sub-programmes under ESP. Recently, a new unit within ECZ, the Wildlife Resources Monitoring Unit (WRMU), was created with the mission to compile a database on wildlife populations, support ZWA in monitoring activities, and serve as a third party source of wildlife data. There is a natural opportunity for developing partnership and dialogue between ADMADE and WRMU, as they support complimentary datasets and methodologies.

NGO community

The Wildlife Conservation Society (WCS) of New York is ADMADE's longest standing supporter from the international conservation community, and has many of the same types of information needs as a donor, but with a stronger emphasis on the status of wildlife. Unlike USAID, which sees wildlife conservation as a means to improve rural livelihoods, WCS sees rural development as a means to conserve wildlife. They would like detailed feedback on wildlife issues, including quantifiable data on habitat and species conserved. WCS has conservation interests and objectives at the regional and continental level as well, and would like data that can be aggregated with others to shed light on conservation issues at larger scales. Furthermore, because WCS and other international conservation NGOs support and plan conservation projects in many other countries, they also want feedback on ADMADE's success as a methodology, including lessons learned and the context for success/failure.

There are numerous wildlife NGOs, both domestic and international, working in Zambia. WWF has activities in two of Zambia's prized wetlands, the Kafue Flats and Bangwelu, which also support safari hunting. The Zambia IUCN office supports biodiversity inventories and coordinates environmental research for a variety of government units and donors. At the regional and continental level, IUCN's different specialist groups monitor the status of threatened wildlife, of which Zambia hosts some of the most important remaining populations. The Wildlife Conservation Society of Zambia (unrelated to WCS New York) supports the Chongolola program, which are wildlife clubs in schools throughout Zambia. The South Luangwa Area Management Unit (SLAMU), formerly known as the Luangwa Integrated Rural Development Program (LIRDP) is a program similar to ADMADE but operates in only two GMAs, Upper and Lower Lupande. SLAMU has recently adopted selected elements of ADMADE's safari monitoring program for its own operations. The Kafue Anti-Poaching Organization (KANTIPO) is a young NGO comprised mostly of lodge owners supporting anti-poaching and community development activities in and around Kafue National Park. These are just a few of the many wildlife related NGOs and activities in Zambia, all of which have or would like to share wildlife data and methodologies for community based monitoring.

Identification of Monitoring Goals

ADMADE's monitoring system, like the program itself, has evolved and adapted since its inception in 1987, and even now is best characterized as a work in progress. However monitoring has always been recognized as an integral component of community based management, and has consistently received relatively substantial resources in terms of training, internal and external technical support, personnel, and finances. Although there is no single master plan for monitoring that describes all the goals and workings of ADMADE's monitoring system, Nyamaluma Institute's research unit has produced several internal documents describing various aspects of monitoring (National Parks & Wildlife Services, 1990; National Parks & Wildlife Services, 1993a; National Parks & Wildlife Services, 1993b; National Parks & Wildlife Services, 1995). These documents suggest the following goals of the monitoring system:

- to build capacity at the local level to make informed management decisions
- to provide quantitative data to measure the effect of local participation in natural resource management
- to meet the legal responsibility of NPWS to provide a national monitoring service of Zambia's wildlife estate
- to make pertinent information on local resource needs more available to resident management authorities
- to collect the information necessary to conduct participatory land use planning workshops
- to develop monitoring methodologies within the scope of skills of locally recruited personnel and under the supervision of officers resident in the GMA
- to provide data for the senior NPWS staff to manage personnel and field operations

Inclusive Participation

The Effective Monitoring Framework highlights the importance of inclusive participation from all stakeholders in all aspects of the monitoring system, including design, implementation, and analysis. The issue of participation can be perhaps best explored by examining the role of the three main groups of stakeholders (communities, NPWS/ZWA, and external partners) in the various stages of monitoring.

Community participation

In the early stage of ADMADE,[4] participation in monitoring from the community was limited to the use of village scouts in data collection. Village scouts constitute the foot soldiers for ADMADE's resource monitoring program, and while their job may at times put them at odds with fellow residents of the area, they appear to remain well integrated into community social structures,[5] at least more so than civil servant scouts. While there has not been an experiment to see whether community members place more

[4] "Early" in this sense refers to the level of implementation, and is relative to a given area. Hence some GMAs which may have joined the ADMADE program in 1987 could still be considered in the "early" stages of the program because they have made limited progress in establishing the various structures and activities outlined in the program design.

[5] Although some authors have questioned this, e.g., Marks 1994; Gibson and Marks 1995.

confidence and trust in monitoring data if it is collected by a local village scout versus a civil servant scout, this is an assumption made by ADMADE's monitoring model.

Community participation in data collection is extended into the realm of ownership and control of data. Local ownership of data has always been one of the paramount principles in ADMADE's monitoring design. This principle is translated into practice by making sure that all data forms and summaries are returned to the unit headquarters after processing and analysis at Nyamaluma. Once data forms are returned to the units, however, the collective ownership principle slips somewhat as evidence suggests that few people in the community know what data are available, how it can be used, and that they have a right to ask to see it.

Although village scouts have always been heavily involved in data collection, community residents in GMAs did not play a significant role in the design of ADMADE's monitoring system. This was due partly to a lack of resources and staff experience in participatory monitoring design methods, and a need for project-wide standardization of biological indicators and data collection methodologies. There was also limited time and training opportunities to conduct the training and participatory exercises that would have been necessary for true community based monitoring.[6] However community information needs and capability were assessed during ADMADE's early years and its precursor, the Lupande Development Project. The designers of ADMADE's monitoring program have always made an expressed objective to ensure monitoring methods and results are relevant to the community and within their technical capabilities (National Parks & Wildlife Services, 1993b).

Strengthening community participation in the data analysis phase has also always featured in the monitoring design, even if accomplishments are more modest. One of the early monitoring plans called for the establishment of regional data processing centers headed by NPWS staff biologists, who would assist unit leaders in analyzing their monitoring data and interpreting results to communities (Lewis, 1993). This strategy aimed to lessen the dependence of unit staff and communities on the technical backstopping from Nyamaluma, but was difficult to implement. However in mid-2000, a similar network of support centers, called ADMADE Outposts, was established in four areas. These outposts are staffed by extension staff from Nyamaluma and provide facilitation and technical services to ADMADE communities, including assistance with data processing and analysis.

Community participation in data analysis and interpretation also features in exercises such as quota setting and land use planning. These activities have become established in about half of the ADAMDE GMAs, and represent a significant step forward in information-based decision making at the community level. Much of the monitoring system has been tailored around the needs of these two specific activities, which in turn impart an awareness and appreciation of monitoring data in local land management.

To strengthen community participation in analysis, Nyamaluma is currently focusing on providing training to members of the three technical committees (resource management committee, community development committee, and financial management

[6] In comparison, the CARE/Zambia Livingstone Food Security Project used PRA exercises to initially identify community information needs and select indicators for the community self-monitoring system. See Lyons, 1998.

committee) to appreciate, understand, and use monitoring data in decision making. This move represents an effort to broaden the number of people involved in analyzing and using monitoring data, which until recently centered around the unit leader. Assuming the functions and capabilities of these management committees continue to increase as expected, their involvement in monitoring will increase and they may one day collaborate in monitoring functions currently performed only by unit staff and Nyamaluma.

NPWS/ZWA participation

For the purposes of analyzing participation in monitoring, NPWS/ZWA can be divided into three sub-groups: Nyamaluma staff, senior officers, and field staff. The staff of Nyamaluma have been heavily involved in all phases of the monitoring program: design, implementation, and analysis. They conduct virtually all of the planning, training, data processing, and assist unit staff with analysis and interpretation.

The senior NPWS officers, namely the Director, Deputy Director, Chief Wildlife Research Officer, Chief Warden, and Land Use Planning Officer, and Wardens are less involved with the operation of ADMADE's monitoring system, however their information needs have been incorporated in the design of the monitoring program. The primary role for this group is at the level of data analysis and interpretation. In practice, this audience has not been as well served by ADMADE's monitoring program as possible. Because of the distance between the NPWS/ZWA headquarters, Nyamaluma, and the GMAs, senior officers do not have many opportunities to become familiar with the datasets and their analyses. For years, Nyamaluma sent hard copy printouts of the raw data and summaries to the Chief Wildlife Research Officer, however this was not a format conducive to further analysis or dissemination. Nyamaluma has made an objective to improve the data flow and feedback between the senior NPWS/ZWA HQ, Nyamaluma, and the units. One of the interventions of this research, a major upgrade of Nyamaluma's information system, may help in this effort by reducing the technical barriers to data sharing.

External partner participation

ADMADE's external partners include the primary donor USAID; other government units such as the Environmental Support Programme (ESP) in the Ministry of Environment and Natural Resources, and the Environmental Council of Zambia; national NGOs such as the Kafue Antipoaching Organization (KANTIPO) and South Luangwa Area Management Unit (SLAMU); and international NGOs including Wildlife Conservation Society (WCS) and World Wide Fund for Nature (WWF).

USAID has always played an active role in the development of ADMADE's monitoring program, as they are one of the most influential stakeholders and have specific information requirements. The recent emphasis on strengthening the monitoring of socioeconomic benefits has been driven in part by the information needs of USAID. USAID also supported computerization of the Wildlife Conservation Revolving Fund in the early 1990s, which today is one of the most important datasets in ADMADE's database. WCS and WWF also played a role in designing and refining ADMADE's monitoring program, through the provision of technical assistance. ADMADE's long-term technical advisor, who more than anyone is responsible for the design of the monitoring program, is a staff member of WCS, as well as an officer of NPWS.

Other external partners have come onto the scene more recently, are less connected with ADMADE's mission and activities, and played a negligible role in ADMADE's monitoring program. Over time, if more linkages for sharing information and technical resources are developed, these other partners may play a greater contribution in supplementing or expanding the scope of natural resource monitoring in Zambia.

Appropriate Indicator Selection

From the onset of the program, ADMADE's monitoring design called for the systematic collection of a core group of indicators, focusing primarily on wildlife populations and management efforts. While there have been some changes over the years, the basic content and analysis of these core datasets has not changed significantly. Recently, a few new indicators have been added, addressing more of the social aspects of the program, such as demography and levels of resource use. In time, as an archive of data is gradually built up, the combination of resource monitoring data and social variables will paint a clearer picture of the achievements of the program.

Below are descriptions of the main datasets collected in all ADMADE areas. The datasets are categorized based on the source of the data. Except where noted, all of the following datasets have been incorporated into the master database at Nyamaluma. See Appendix A for sample dataforms.

1. Field patrol data (FLDPAT1 dataform)

The field patrol dataform records patrol dates, number and classification of scouts in the patrol, supplies taken and returned, number and location of poachers encountered, names and origin of any poachers arrested, objects confiscated (e.g., weapons, snares, ivory, etc.), carcasses (species, number, and cause of death), snares, fishing camps, waterholes, poacher camps, fires, live animal sightings (each unit picks up to six key species to monitor), and the number of hours spent in each grid (added 1999).

All field patrol observations are geo-referenced using a 5 km^2 grid system. In the early years of ADMADE, field patrol observations were recorded in an open-ended 'Comments' section. However this format frequently resulted in irrelevant details and was impossible to analyze quantitatively or process in a computer. In 1995/96, the dataform was redesigned for entering observations in a preset tabular format. However it was not until 1999, when the Nyamaluma computer system was upgraded through this research, that field patrol observations were input into the master database.

2. Safari hunting (SAFLICE, TROPHY, SAFHUNT, CLIENT dataforms)

The safari hunting dataforms record includes starting and ending dates of a hunt, license numbers, fees paid, species desired by the client before the hunt, species actually killed, wounded animals, locations and dates of animals killed, evidence of snare wounds on animals (added 1999), trophy sizes (following SCI measurement conventions), sex, number of baits (for baited species such as lion), non-hunted trophy animals seen, disturbances to the hunt, poaching activity, client opinions of their hunt and Zambia.

The safari hunting dataset is one of the most robust datasets for two reasons. Safari hunting datasets are generally complete, because there are typically only 10-25 hunts per season and safari hunters are legally required to be accompanied by a scout when hunting. More importantly, the small numbers of hunters enables an assessment of

when dataforms are missing, an important aspect of data quality. Secondly, the hunting measurements (e.g., date of the kill, trophy size, species) are not difficult for to scouts to take, increasing confidence in the data. For these reasons, safari hunting statistics serve as one of the more important indicators used to assess wildlife population trends. The other main use of safari hunting data is to ensure that all hunting and fiscal regulations are complied with.

3. Crop damage (CROPDAM, FIELD CROPDAM, GRANARY CROPDAM dataforms)

The crop damage dataforms record the name of the crop, date damage occurred, owners name, location (village and grid number), number of plants affected (reported in kg or buckets), size of the garden, species that caused the damage, action taken (e.g., shots fired), and result (animal frightened off, wounded, or killed).

Damage to crops is one of the biggest wildlife related problems facing rural farmers in ADMADE areas. This dataset represents an effort to measure the scope of this damage, and look for patterns in attacks. Unfortunately, it is not known what percentage of crop damage is actually reported to wildlife scouts and recorded on paper, however a review of the data and interview results suggest in many areas the amount of damage reported is only a small fraction of the total crop damage. Hence this dataset can not be used to make an accurate estimate of the total amount of damage caused by wildlife, however it can be used for other purposes such as examining trends in crop selection and the relative impact of different species. None of the areas I encountered had compensation programs for wildlife damage, which would likely increase the size of the dataset.

Prior to 1998, the Crop Damage dataform was not entered into the database at Nyamaluma. However, all existing dataforms from previous years were saved and entered for analysis in 1998. In 1999, the Crop Damage dataform was divided into two new dataforms - Granary Crop Damage and Field Crop Damage. This division was in response to a notable shift in attack strategies by elephants, who have learned to improve their foraging efficiency by breaking into granaries (food storage bins areas within the village perimeter). Increased attacks on granaries are a concern in ADMADE, and require slightly different monitoring and preventative strategies.

4. Poacher case records (CASEREC)

The Poacher Case Record dataform records information about arrested poachers, including occupation, origin, weapons, number and species of carcasses, and offenses. There are also spaces for the trial date and results of the trial, however none of the dataforms examined for this study has these areas filled in.

5. Household demography (DEMOG)

The household demography dataform records the number of people per household, broken down by gender and age group. This is the only community-generated dataset that is not collected by wildlife scouts. In 1998-99, Nyamaluma contracted private individuals, mostly community health workers, from each area to conduct a door-to-door survey for the census. This exercise was undertaken primarily to demarcate boundaries for the new Village Area Groups, subdivision of each GMA introduced to improve equitable representation in decision making. In addition to VAG demarcation, demography data can be used for other purposes such as planning community development projects and

evaluating the per-capita benefits of the program. Only the GMAs in the Luangwa valley area were surveyed in 1998, the remaining areas expected to be surveyed in 1999 or 2000.

6. Quota setting worksheets

Starting around 1996/7, units were encouraged to organizing workshops at the end of each hunting season to discuss the hunting quota for the following season. In practice these exercises have occurred only when extension staff from Nyamaluma were available to facilitate the meetings, however in the future it is expected that communities will be able to conduct these meetings on their own. The methods for assessing population trends in the area include a mix of quantitative (e.g., hunting statistics) and qualitative (e.g., scout opinions, feedback from the tracker) indicators. The population trend suggested by each indicator (i.e., upward, no change, downward) is written on a flip chart for each species, and a new recommended quota arrived at by consensus. The flip charts are then copied onto the Quota Setting Worksheet, which is brought to Nyamaluma and entered into the database.

7. Staff

When monitoring teams from Nyamaluma visit a GMA, they collect information about staff in the unit, including both civil servant and local staff. Information collected includes date of birth, education level, position, status (e.g., in camp, retired), and family size. This data is used for analyses on staff efficiency, financial support, personnel needs, budget reviews, training needs, and retention rates.

8. ADMADE projects

Updated on an annual basis, the dataset for community development projects includes information on all projects financed with safari hunting revenue. Projects include both community development projects such as clinic building as well as resource projects such as scout quarters. Information recorded includes the type of project, when it was started, when it was completed, the amount of money spent, and the current status. This dataset does not include the number of beneficiaries of the project, or a measure of the economic value of the project. Once a project is complete it is no longer monitored except for special studies. The projects dataset had not been converted into the new database as of May 1999.

9. Camps, assets, firearms

These datasets are also collected by teams from Nyamaluma on an annual basis, and are used for planning support to areas and measuring changes in the operational capacity of a unit. Fields include number of scouts at the camp, type and serial number of firearms, camp water source, and scout ages and family size.

10. Official quotas, license prices, and daily license sales

Once a year, a committee at NPWS headquarters in Chilanga approves a final hunting quota for each hunting block. Quotas are based on community recommendations if available and any other relevant information such as license sales. NPWS also sets the

price for hunting licenses, and sells all hunting licenses at headquarters[7]. The office which sells hunting licenses has been computerized since 1994, and all of those records have been imported into Nyamaluma's new database. This information is useful for analyses on topics such as the economic impacts of safari hunting at the local and national levels, timing and distribution of revenue flows, and long-term trends in safari hunting in Zambia.

11. Green Bullet certification

The Green Bullet is a certification rating which suggests that safari hunting is being conducted in a ecologically and socially sustainable manner. The certification is bestowed to individual GMAs, and so requires minimum performance measures from both the local safari company as well as community organizations. Criteria for Green Bullet certification include the practice of distributing excess meat to community residents, adherence to hunting policies and procedures, and effective communication between the Professional Hunter and members of the ADAMDE community organizations. See Appendix A for the Green Bullet dataform.

12. Discontinued dataforms

Some dataforms introduced early in the program but no longer widely used include the Budget Cost Form, Employment Records, Skills Bank Record Form, Patrol Effort/Yield Summary Sheet, Culling Product Processing, Culling Product Marketing, Wildlife Inventory Report, Transect Dataform, Community Attitude Survey, Village Scout Attitude Survey, Socioeconomic Survey, and Annual Data Summary Sheet (National Parks & Wildlife Services, 1990). Many of these dataforms were basically worksheets or administrative templates for which alternatives were found, and hence not vital elements of the monitoring program. However others, such as the attitude and socioeconomic surveys, could have potentially made an important contribution to ADMADE's monitoring program but did not take root.

13. New dataforms

In 1999, Nyamaluma introduced several new dataforms, including the Village Area Group (VAG) Committee Establishment dataform, VAG Meeting Attendance dataform, VAG Committee meeting report. VAG Development Needs Implementation dataform, Social Service Provider Form, VAG Development Needs and Priorities dataform, CDC Community Development Monitoring dataform, Self-Appraisal Monthly Work Form for village scouts, Snare Survey dataform, and Population Trends dataform (National Parks & Wildlife Services, 1999b). Some of these dataforms are primarily designed to assist the new management committees, and are not designed to be analyzed project wide.

14. Other data collected

In addition to the above datasets, which are collected on a regular basis in most ADMADE units, other data have been collected by Nyamaluma staff over the years for focused studies. These special studies have included surveys of ADMADE awareness,

[7] In 1999 a decentralized licensing system was pilot-tested in several GMAs, which may change the way hunting licenses are sold and recorded.

garden productivity, ground transects, infrastructure surveys, snaring pressure, behavioral ecology of species in decline, and others.

Temporal and Spatial Scales

According to the Effective Monitoring Framework, monitoring must take place at a spatial and temporal scale which concurs with use of the information. Short-term management decisions require information measured at fine scales, while long-term impact assessment requires data taken over long periods of time and larger geographic areas. Table 2 below summarizes the temporal and spatial scales of the primary datasets collected in ADMADE areas.

Table 2 – Spatial and temporal scales

Data Set	**Temporal Scale**	**Spatial Scale**
Field patrol data	whenever field patrols are conducted, weekly/monthly	only patrolled areas 5 km accuracy
Safari hunts	throughout the hunting season (March-Nov)	only areas hunted 5 km accuracy
Crop damage	as often as it is reported, monthly	areas close scout camps
Household demography	once every five years (anticipated)	entire GMA
Population trends survey	annual	patrolled areas of GMA
Staff	annual	entire GMA
Camp conditions	annual	entire GMA

Sampling

The Effective Monitoring Framework also highlights the importance of using a sampling method which allows inference to the population as a whole, and that enough measurements are made to make inferences about the entire population.

Table 3 below summarizes the sampling method and sample size of the primary monitoring datasets.

Feasibility

The Effective Monitoring Framework requires that the design of a monitoring system concur with the available resources in terms of manpower, training, equipment, financial resources, and leadership. ADMADE's monitoring program is ambitious, evident from the quantity of datasets monitored, the size and location of areas in the program, diversity of end users, methods used to allow quantitative measurements and analysis, and centralized processing model. Factors which challenge the feasibility of such an ambitious monitoring design include the state of the transportation and communication infrastructure in ADMADE areas, the educational level of scouts and unit staff, and funding. However the

amount of data successfully collected and analyzed over the last several years suggests that the monitoring design is feasible for many areas.

Table 3 – Sampling

Data Set	Sampling Method	Percentage of Population Sampled	
		Design	Actual (est.)
Field patrol data	complete	100%	unknown
Safari hunts	complete	100%	near 100%
Crop damage	complete	100%	unknown but probably small
Household demography	complete	100%	100%
Population trends survey	complete	as many as possible	unknown (just started)
Staff	complete	100%	near 100%
Camps	complete	100%	near 100%

However this achievement is not uniform in all GMAs, and has come at a cost. Nyamaluma has devoted a considerable amount of its resources, in terms of manpower, equipment, training, and field support, to developing and supporting unit monitoring systems. The importance of this support is clearly evident when comparing the monitoring achievements of units which receive more field support in monitoring to those units which receive little. Even in areas which are well served by support staff and have established monitoring programs, it took an average of two to three years before good information was generated on a regular basis. In addition, not all datasets have been equally successful. Some dataforms, such as the scout and community attitude questionnaires, never became well established, nor generated a lot of useful information.

Both successful and unsuccessful efforts at monitoring have provided useful feedback for understanding issues which affect feasibility of a monitoring design. This improved understanding has helped and will continue to help adapt monitoring strategies to increase the effectiveness and benefits of community level participation in data collection and analysis.

Incentives

In an effort to minimize data fabrication or falsification, ADMADE's monitoring design does not call for direct incentives for village scouts to record data (National Parks & Wildlife Services, 1993b). Instead, it is hoped that scouts will take an interest in monitoring based on an appreciation of the importance of monitoring in resource management, and because it is part of their job. In 1996 Nyamaluma sponsored a monitoring competition and offered a small prize to recognize the best village scout involved in monitoring in all of ADMADE, judged on the fewest number of mistakes on data sheets. However this competition was dropped after one year because it was cumbersome to administer and more appropriate to implement at the unit level. Unit leaders have always been encouraged to reward scouts who demonstrate high interest and ability in data recording with additional training opportunities and other forms of recognition. There is also a certain incentive for monitoring safari hunts, because there is

the possibility of receiving a tip from the client. However several scouts interviewed stated this positive incentive was overshadowed by poor accommodations at the safari camp for scouts, and unpleasant or dishonest professional hunters.

There are few negative incentives for not participating in monitoring. Scouts who choose not to record data on field patrols or not accompany safari clients are not penalized financially or otherwise. Some unit leaders may verbally scold their scouts if monitoring activities are not being carried out effectively, however the mix of positive and negative incentives will depend on the leadership skills and style of the unit leader. Negative incentives are more likely to be applied to more serious deficiencies in job performance, such as drunkenness or failure to participate in anti-poaching operations. Due to the multitude of factors that may disinterest a scout from monitoring (e.g., lack of education, lack of appreciation, extra work involved), a unit leader is more likely to concentrate on identifying and encouraging those scouts that have some interest and aptitude in monitoring rather than apply pressure to those who are not involved.

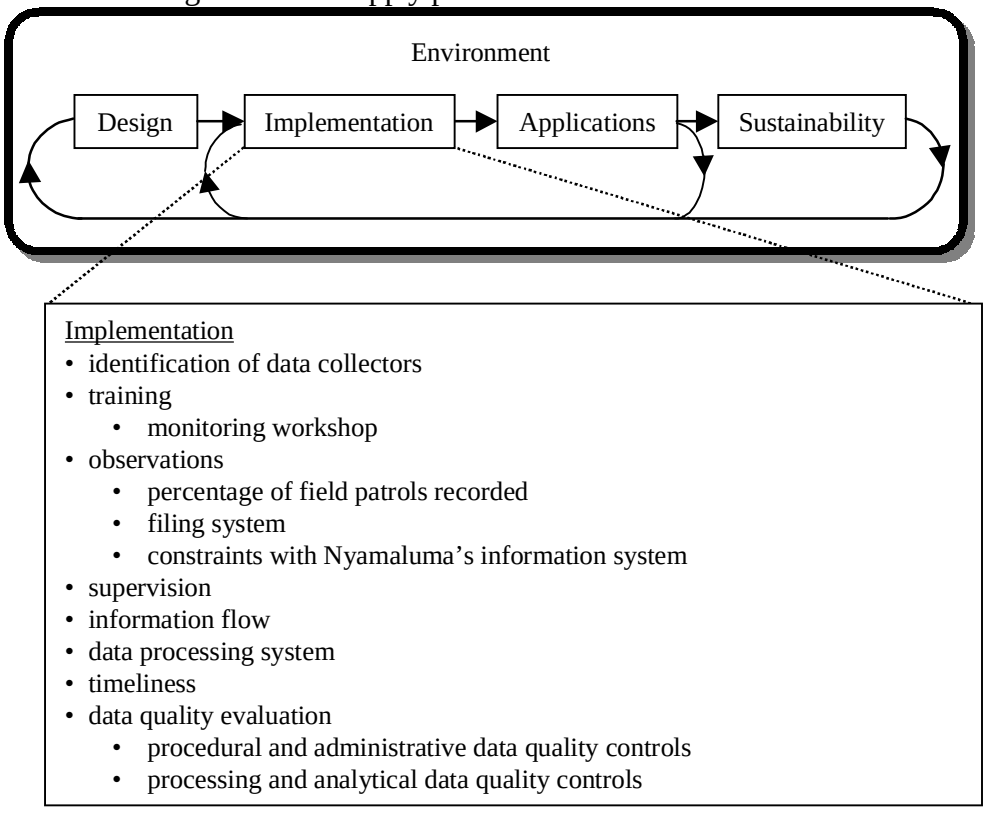

Figure 9 – Implementation

Implementation

Identification of Data Collectors

An important element of an effective monitoring system is the appropriate selection of data collectors. Data collectors should be in a position to and capable of making observations and recording data properly. Most of the monitoring data in ADMADE is collected by village scouts. This seems an appropriate choice because village scouts are likely to spend large amounts of time in the bush in the normal course of their

duties, are employees of the community, fall under the command structure of the NPWS field officers, and are required to go through training courses. Scouts have also proven that they can be competent data collectors given sufficient training and supervision. All village scouts receive instruction in data collection during their basic training, however only those scouts who show competence on practical trials during the course and do not make many mistakes on dataforms become regular recorders on field patrols and safari hunts. It is up to the unit leaders or their designated deputy to decide which scouts are qualified recorders.

The only real alternative choice for resource monitoring data collectors are the civil servant scouts. Civil servant scouts serve side by side with village scouts, but are government employees and paid by NPWS, instead of safari revenue. They typically have more formal education than village scouts, however do not go through basic training at Nyamaluma and are not trained in the use of dataforms. Civil servant scouts are also less attractive as data collectors because they are not local residents, which has both symbolic connotations for trustworthiness, as well as practical implications in terms of being less familiar with an area. According to interviews, in practice some civil servant scouts do serve as monitors on both field patrols and safari hunts, having learned how to fill out the dataforms from their fellow scouts. This arrangement seems to be generally satisfactory among the scouts where it occurs. An exception may be the assignment as a safari hunting monitor, which also carries the possibility of receiving a tip from the hunting client. In two out of seven interviews, scouts complained that the unit leader was favoring civil servant scouts for safari hunting monitoring, despite the fact that the civil servant scouts had not received the same training as village scouts.

Training

Training is a key element in the implementation of a monitoring program, a lesson borne out by the experiences of ADMADE. The leadership of ADMADE recognized the importance of training from the onset, and were fortunate to have a residential training facility, Nyamaluma Institute, available to host courses and workshops. Nyamaluma has conducted dozens of training programs since the first village scout course in 1988, and currently claims to offer more than 15 different courses to over 500 ADMADE participants annually (National Parks & Wildlife Services, 1998). Courses with significant monitoring content include

- Village Scout Basic Training
- Village Scout Advanced Training
- Unit Leader Basic Training
- Skills Training in Resource Management
- Wildlife Biologist Internships (National Parks & Wildlife Services, 1999f)

In addition to centralized training programs held at Nyamaluma, informal training is provided during field visits for unit leaders, deputy unit leaders, and village scouts. Feedback on dataforms and office management is a standard part of nearly every visit to units, and since 1996-7 Nyamaluma has been sending staff to select GMAs at the end of the hunting season to help analyze safari monitoring data and facilitate quota setting exercises. During this study, I was not made aware of any units which had organized their

own workshops or refresher courses on monitoring. However informally unit leaders or their deputies continually provide feedback to village scouts on their performance in collecting data, and scouts provide feedback to each other on the proper use of dataforms.

Monitoring workshop

During this research, I assisted Nyamaluma staff in planning and conducting an advanced course for village scouts and deputy unit leaders. About three-quarters of the content this course focused on topics related to monitoring. This one-week workshop was held in May 1999, and was attended by 44 scouts from all ADMADE areas. The workshop objectives related to monitoring included to:

- review monitoring as one of the roles of village scouts
- discuss different uses of monitoring information
- review common mistakes on dataforms
- review techniques for measuring hunting trophies
- introduce a new technique for conducting snare transects
- explain how "data collection" patrols around fish camps and waterholes differ from standard anti-poaching operations
- explain how to maintain running summaries of monitoring data using base maps
- discuss setting targets and developing work plans for monitoring and other activities

Other sessions during the workshop addressed:

- the ADMADE vision
- developing lesson plans for school groups
- new dataforms for a pilot community based licensing system
- individual participant interviews to update Nyamaluma's database on unit staff, roads, etc.

Most of the workshop sessions were held in the classroom, but were participatory in nature. There were two outside practical sessions, one on conducting snare transect and another on trophy measurement. To pass the course and receive their certificates, students were required to make presentations on the last day of the workshop, reviewing the topics they had learned during the course.

Pre- and post-workshops questionnaires were administered to gauge scout expectations of the course and knowledge of the role of monitoring in management. Pre-workshop questionnaires revealed a general lack of understanding of the different ways monitoring information can be used. Exit evaluations were strongly positive, but focused mainly on satisfaction with the workshop.

In addition to this short-term intensive workshop on monitoring issues, monitoring was covered in other courses during 1999. A workshop for unit leaders held in June addressed monitoring supervision, and various workshops for the newly elected community resource boards also touched on monitoring. ADMADE will need to continue to provide training, both at Nyamaluma and in the field, to enable unit staff and communities to collect and analyze their own monitoring data for exercises such as quota setting, setting work targets, and resolving land use conflicts.

Observations

Table 4 shows the number of GMAs which have monitoring data entered in the master monitoring database at Nyamaluma, broken down by year and dataset. Although this table is not a totally complete picture of the amount of monitoring data in ADMADE, because some units may not have submitted their dataforms to Nyamaluma, it does accurately represent historical trends and highlights those datasets which have been most successfully collected for the greatest number of areas.

Table 4 – Datasets in Nyamaluma database, May 1999

Data Set	Source	Number of GMAs With Data				
		1994	1995	1996	1997	1998
Field patrol data	community	11 (50%)	16 (72%)	13 (62%)	8 (40%)	11 (58%)
Field patrol observations	community	0	0	3 (14%)	3 (15%)	10 (53%)
Safari hunts	community	0	15 (68%)	12 (57%)	11 (55%)	8 (42%)
Crop damage	community	0	2 (9%)	1 (5%)	3 (15%)	1 (5%)
Household demography	community	0	0	0	0	6 (32%)
Quota setting worksheets	community	0	0	0	8 (40%)	6 (32%)
Staff	Nyamaluma	11 (50%)	17 (77%)	12 (57%)	16 (80%)	18 (95%)
Camps	Nyamaluma	16 (72%)	20 (91%)	12 (57%)	13 (65%)	11 (58%)
NPWS Quotas	NPWS	22 (100%)	22 (100%)	21 (100%)	20 (100%)	19 (100%)

Percentage of Field Patrols Recorded

One of the important, but largely unknown, variables about ADMADE's monitoring program is the percentage of field patrols that are actually recorded on the field patrol dataform. This unknown ratio has implications not only for calculating estimates of total law enforcement effort, but also evaluating the validity of any monitoring data collected on field patrols.

In interviews for this study, scouts unanimously stated that 100% of all field patrols are recorded on dataforms. However after reviewing the field patrols summaries it seems unlikely that all field patrol data actually make it through the information chain to Nyamaluma. Not only do analyses suggest low patrolling effort of 20-40 days per year per scout (National Parks & Wildlife Services, 1999f),[8] but some units also have lengthy gaps

[8] Although this estimate is probably low, it may not be far off. In the similar LIRDP project, which keeps more detailed records of patrolling effort, Jachmann (1998) reports that effective scout-days varied from 52.5 - 121.7 days per year between 1988-1996. This estimate includes time spent investigating poaching activities in settlements but excludes time spent getting to the patrol area. The main factors identified

where no patrolling is recorded. Hence it is suspected that either the percentage of patrols recorded is less than 100% to begin with, or that dataforms get lost en route to Nyamaluma.

My visit to Mumbwa GMA afforded an opportunity for the first time to empirically study the percentage of field patrols recorded on dataforms. The Mumbwa unit headquarters at Nalusanga keeps a field operations record book, an independent ledger for all field operations that originate from Nalusanga camp. Although the ledger book records just a subset of the fields of information on the ADMADE field patrol data forms, it does record the starting and ending dates of each patrol and the number of scouts.

I compared the field patrol records in the field operations record book with ADMADE field patrol dataforms for 1997 and 1998. For 1997, there were 17 field patrols from Nalusanga recorded in Nyamaluma's database, and 16 original dataforms in the filing cabinet at the unit headquarters. This implies that dataforms were not lost en route to Nyamaluma. However the field operations ledger recorded 44 field operations during 1997, excluding operations such as escorts and checkpoints. Thus for 1997 only 39% of the field operations were recorded on dataforms that were returned to the unit headquarters and eventually Nyamaluma.

Reviewing the field patrol dataforms from 1997 reveals that all recorded patrols were between July and December of that year. Hence the most likely explanation for only 39% of field patrols recorded is that during the first six months of the year data was either never collected, or the dataforms were lost. However neither the unit staff nor staff at Nyamaluma had any memory of what may have caused this gap, and the missing data still results in a substantial underestimate of patrolling and monitoring effort.

It should also be noted that Nalusanga camp lies on the border of Mumbwa GMA and Kafue National Park, and that scouts from Naluanga patrol in both areas. Kafue National Park is not an ADMADE area, and there is no base map for it. Scouts are supposed to record patrols made in either area, however it may not be entirely surprising that not all patrols in the park, particularly day patrols, are recorded.

For 1998, there were 39 field patrols from Nalusanga recorded in the Nyamaluma database, spread almost evenly throughout the year. However the Nalusanga Field Operations ledger recorded 115 field operations, again excluding investigations, official escorts, funeral drills, etc. Thus only 32% of field operations were actually recorded for that year. The missing dataforms represent an unrecorded 122 patrols-days and 421 man-days of patrolling effort. Thus for 1998, the number of patrols from Nalusanga recorded in the database was only 32% of the actual, representing 56% of actual patrol-days and 67% of total man-days.

Of the non-recorded field patrols, 69 were in Kafue National Park and nine were in Mumbwa GMA. This pattern suggests the probable cause of the underreporting--scouts apparently do not fill in dataforms for all patrols in Kafue, even though they do submit dataforms for *some* of the patrols there. However other omissions were from patrols in the GMA. The nine patrols in the GMA not recorded on dataforms represent 163 man-days of patrolling and monitoring effort.

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affecting the number of effective scout days included the availability of carriers to assist with supplies and scout salaries.

Filing System

Developing an organized filing system is an essential requirement for the implementation of a community based monitoring program, however this has proven to be a challenge for many ADMADE units. Obstacles encountered include lack of filing equipment (Figure 10), failure to see the need to organize records, lack of understanding how to categorize records, and failure to anticipate the volume of dataforms that will need storage. Building capacity in managing a filing system is a basic prerequisite for community based monitoring. Poorly organized filing has many times caused misplaced or incomplete data sheets, resulting in lost opportunities for data analysis and management feedback.

Figure 10 – Files at Lunga-Luswishi GMA

Nyamaluma's extension staff have tried to address the technical aspects of managing dataforms in workshops and field visits. Staff from all units attend the same courses at Nyamaluma, however units which receive more frequent field visits from Nyamaluma's extension staff tend to develop functional filing systems in a shorter period of time. The audience for data management training includes office staff in each unit, and more importantly the unit leaders whose interest in and supervision of filing is critical for all subsequent steps of the monitoring process.

Supervision

Supervision is an important element of the Effective Monitoring Framework, and in the case of ADMADE exists at two levels. At the GMA level, unit leaders or their designated deputies are supposed to supervise the data collection activities of scouts. This includes ensuring that data forms are available and filled out on field operations, and when completed reviewed for errors and properly filed. Research staff at Nyamaluma provided numerous examples where months of data were lost and/or unusable because of poor

supervision within the unit. For example Munyamadzi unit staff lost all of their dataforms for 1997. At the project level, staff from Nyamaluma must supervise the monitoring work of the units. Communication and transportation constraints make this level of supervision difficult for areas distant from Nyamaluma, reducing the ability of the project to catch monitoring problems in the early stages before large amounts of data are lost or collected improperly.

Information Flow

When discussing information flow, it is useful to categorize datasets based on their origin. ADMADE's core datasets can be grouped as follows:

Community-collected data	Nyamaluma-collected datasets	Other
Field patrols	Staff	Hunting quotas
Safari hunting results	Camps	Hunting license sales
Poacher case records	Unit assets	
Crop damage	Training records	
Household demography	Special studies data	

According to scout interviews, most field patrol monitoring data is initially written on blank sheets of paper, and then transferred to dataforms after the patrol is over. Scouts interviewed stated this practice is primarily intended to avoid messing up a dataform while on patrol. Once recorded, the dataforms are then given to the unit leader or his designated deputy. If the scouts are based at the unit headquarters, then the dataforms will be turned in to the office within a day or two. If the scouts are based at a distant camp, they will wait until someone travels to the unit headquarters for salaries or supplies, or a special request is made for the dataforms. It is not uncommon for weeks or months to pass before field patrol and crop damage dataforms are turned in at the unit headquarters. Communication and travel between scout camps and the unit headquarters has proven to be one of the most challenging links in ADMADE's information flow and other aspects of management. Long distances between camps can result in inadequate supervision of monitoring activities, failure to maintain an adequate supply of blank dataforms, and loss of dataforms. Providing feedback on dataforms soon after the patrol or safari hunt has ended is an important mechanism for data quality control, a lesson also learned by other monitoring programs (Jachmann, 1998).

At the unit headquarters, dataforms are supposed to be inspected for errors when they are submitted, and then filed chronologically. Dataforms are then sent to Nyamaluma with workshop participants, or collected by teams from Nyamaluma on field visits. There is no mail service to Nyamaluma nor most of the units.

At Nyamaluma dataforms are entered into the computer, and summaries and presentation maps prepared. The original dataforms, summaries, and presentation maps are then sent back to the unit, again either with a returning workshop participant or field team. Depending on the workload at Nyamaluma and the status of the computer system, some dataforms may remain there for months and in a few cases years. Long processing delays mostly affect lower priority datasets such as poacher case records, and crop

damage. With the new information system the turn around time at Nyamaluma is likely to decrease.

In addition to producing monitoring summaries for the units, Nyamaluma is also responsible for disseminating monitoring results to external stakeholders, including senior NPWS officers, USAID, and WCS. Monitoring results are usually presented as aggregated summaries, through quarterly reports, preset tabular or graphic summaries, or technical papers.

Monitoring datasets collected by Nyamaluma staff are usually updated annually during field visits. Occasionally questionnaires or interviews will be administered during workshops at Nyamaluma to update specific datasets.

Data Processing System

A common challenge faced by monitoring programs is handling the large amounts of data that can quickly accumulate (Macdonald & Smart, 1993). Hence the Effective Monitoring Framework emphasizes the need to develop some kind of system which can process and analyze monitoring data. For small datasets or very qualitative data, paper and pencil methods are often adequate. Paper and pencil methods have the advantages that they can often be more readily understood by rural people, and do not require large amounts of outside technical support.

However, paper-based data systems are constrained in the amount of information they can effectively store, and are not well equipped for analyzing quantitative data. Due to the large number of datasets and GMAs participating in the program, as well as the need to aggregate data at the project level, the designer's of ADMADE's monitoring program elected early on to integrate computerization into data processing and analysis (Lewis, 1995). Developed at Nyamaluma in the early days of the project, ADMADE's database has enabled thousands of dataforms to be entered and analyzed, and tabular and graphical summaries generated for community use and applied research. Nyamaluma pioneered the use of GIS software for community based conservation, and digitized dozens of Survey Department maps for the production of flipchart-sized summary maps of monitoring data.

As pioneering as Nyamaluma's information system was, it was constrained by the software and hardware of the early 1990s, and its performance was severely limited in a number of regards. These are summarized below.

Difficult to operate. The old system was based on a combination of Lotus 123, dBase IV for DOS, and ArcView GIS. Most of the tabular data was entered through Lotus, a process which was semi-automated with macros, and summaries were produced using Lotus and dBase. Maps and graphical summaries were designed manually in ArcView, using imported summaries that were created in Lotus and dBase. Due to the number of software packages involved and the number of steps in creating summaries, only a very small number of staff could operate the system, and only the technical advisor could make any significant changes to the design or structure of the data. Operating the database was also time intensive, as only a small part of the data processing was automated.

Restricted to single-area, single-year summaries. In the original system, the files for each unit were saved in separate directories, and additional sub-directories created for

each year. For the tabular data, each year was saved on a separate worksheet and each dataset was saved in a separate workbook. The spatial data were also divided into separate coverages for each unit. While this file structure was useful in keeping data organized, it made conducting analyses across years or across multiple GMAs tedious almost to the point of almost being impossible. While this was not a major constraint in providing data summaries for individual units, it made seeing the 'big picture' rather difficult.

Little error checking. Due to the limitations of spreadsheets, error checking depended heavily on the skills and experience of the data entry clerk. Problems such as inconsistent units of measurement, inconsistent spelling of names, incorrect dates, and occasional outliers limited the reliability of certain types of analyses. For example, it was difficult to get an accurate count of all staff who worked in a unit over time because some names appeared twice under different spellings, while others were just copied over from the previous year without checks to confirm they were still in the unit.

Unwieldy file system. Maintaining the files in the old information system was an administrator's nightmare. The hundreds of directories, sub-directories, and files made copying or backing up the database challenging. A more severe constraint of the file structure was the challenge of synchronizing files. Nyamaluma uses multiple computers for entering data, making it incumbent upon the technicians to keep track of which files on which data on which computers were the most up to date. Updating files on other machines always carried the risk that recent data could be overwritten with older data.

Expansion difficulties. Adding new datasets into the information system was challenging, because new files had to be integrated into both the directory system, data structure, and multiple software formats. Creating new summaries of data was equally difficult, because summaries had to be either done manually or by programming new Lotus macros. This constraint on the system's expansion and flexibility not only affected staff time, but also the number of datasets that could be entered and analyzed. Very important datasets, including all field patrol observations, observations from safari hunts, were not entered into the old information system at all because of the limitations of the software. Other datasets, such as poacher case records, and crop damage, were entered but not tied to other tables and could not be analyzed against other variables.

Tedious map production. As described previously, one of the most important outputs of Nyamaluma's information system are the flipchart-sized maps of monitoring data that are returned to communities. Creating these maps in ArcView, although flexible, involves a complicated series of steps that requires a significant amount of training and many hours of staff time.

Data never left Nyamaluma. Because it was difficult to extract data except in the small number of preset formats, and the clunky file and software system made it impossible to share data electronically, Nyamaluma's research unit struggled to meet the information needs of its many external stakeholders in Zambia and abroad. Among the donors and wildlife sector, Nyamaluma developed a reputation of being miserly with data, failing to share results with even its closest institutional partners.

Timeliness

Timeliness is an important variable in the implementation of an effective monitoring system, as many management decisions such as quota setting or targeting field patrol effort require summaries of recent data. ADMADE must contend with built in delays in the information flow as well as time required for data processing analysis. Due largely to poorly developed transportation networks in rural areas, the time to process monitoring data and return results to units has proven challenging, particularly for GMAs outside the Luangwa Valley. This delay is compounded when scout camps are some distance from unit headquarters, making it difficult for scouts to submit their dataforms in a reasonable amount of time. However recent efforts to increase the capacity of units to analyze their own data, and the possibility of using the new database system to process data in the field with laptops, may decrease the amount of time it takes for summarizing data. Timeliness is less of a problem with safari hunting data, which provides important indicators for quota setting, because the dataset is fairly small, data are collected from one location only, and indicators can be calculated in the field using pencil and paper in only a couple of hours.

Data Quality Evaluation

Mechanisms for measuring and controlling data quality is an important element in the implementation of a monitoring system. ADMADE has relied primarily on procedural and human controls to ensure the quality of its data. With the new information system described above, quantitative tools are also now available for the assessment of data quality. Although no data quality assurance system is foolproof, these controls provide reasonable precautions against most of the common errors that can infect data.

Procedural and Administrative Data Quality Controls

Monitoring certification for village scouts. Instruction in data recording is an integral component of the 4-6 month basic training course all village scouts attend. Scouts are taught the basic concepts of monitoring and use of the dataforms. While the skills for recording data do not require a high level of education, not all village scouts demonstrate an aptitude or interest to be monitors. At the end of their basic training, scouts are evaluated on their ability to use dataforms, and only those who pass are 'certified' to be monitors. Nyamaluma also holds shorter advanced scout classes from time to time, which cover monitoring topics in more detail.

Only certified scouts are supposed to be selected for safari monitoring or appointed as the data recorder on field patrols or crop damage. In reality, some non-certified scouts, including civil servant scouts, may also record data on field patrols or safari hunts. The unit leader or his designated deputy have the responsibility to weed out those scouts who do not show competence in monitoring, and over time, only those scouts who have the ability and interest to record data continue as recorders.

No direct incentives. To reduce the likelihood that dataforms will be falsified, village scouts are given no material incentives for recording data. Instead it is hoped that scouts will be motivated from an understanding and appreciation of the benefits of collecting data. Although the policy of not providing incentives for the extra work is unpopular among scouts, and may have other consequences, it has most likely achieved its

objective of minimizing falsified data and there have been no known cases were dataforms were purposefully fabricated.

Dataform certification. The first line of defense against bad data comes at the field level. Each dataform is supposed to be reviewed and certified by the unit leader or his appointed deputy soon after the data are collected. Certifying data forms in the field can catch omitted responses on forms, as well as detect certain irregularities and outliers.[9] In practice, the degree to which dataforms are certified depends in large part on the individual unit leader or deputy assigned to monitoring, and frequency of contact with scouts.

Spot checking during data entry. The data entry staff at Nyamaluma have a lot of experience entering and analyzing data, and have a good feel for what is and what is not a reasonable measurement. Many mistakes can be caught during the data entry process, including problems with inconsistent units and outliers. For example, a hippo allegedly shot in the hills far from water bodies would be flagged as a probable error. Data which are suspect are not entered into the database, and common dataform mistakes are mentally noted in preparation for the next training on monitoring.

Interpreting analyses. Previewing the results of an analysis can also highlight errors in data. Most of the extension staff from Nyamaluma who spend a good bit of time in the field have a pretty good intuitive feel for the major problems and accomplishments in different areas. When summaries or graphs depict results that seem counter-intuitive, the discrepancy may be traced either to an incorrect analysis, error in data processing, or bad data.

Processing and Analytical Data Quality Controls

Enforced referential integrity. The new database system has a number of built-in features that help to ensure good data. Enforced referential integrity helps to prevent incomplete records from being entered, and makes certain that all fields containing a lookup value (such as the id number of a species) have valid values. This prevents many errors that formerly resulted from inconsistent spellings or impartially entered data.

Field and table validation rules. In addition to enforcing the integrity of linkages between related tables, the new database also has the ability to validate all data being entered against preset validation rules. For example, the date a hunt ended can not come before the date it started (an error which in fact was encountered in the old system because the spreadsheet was not formatted to display the year of a given date). Similarly, table definitions specify which fields must have data, and which fields are optional. Table validation rules also prevent duplicate records, for example there can not be two field patrol observations entered for the same phenomenon in the same grid on the same day. Other validation checks are done programmatically during the data entry process, such as the check for valid trophy measurements based on the species hunted.

Statistical measures of data quality. Once data have passed through field certification, data entry, and finally stored in the database, they can still be evaluated for data quality. One of the advantages of using a well-designed database is that quantitative

[9] Other CBNRM projects such as LIRDP have also recognized the importance of reviewing datasheets in the field soon after the data is collected, so that mistakes can be corrected and questions clarified while the operation is still fresh (Jachmann 1998).

summaries and graphs can be easily and quickly produced. The following are examples of charts, maps, and tables of monitoring data that are built-in to the new ADMADE database and can be used to highlight data quality concerns.

Sample size. An important and easily measured component of data quality is sample size. Summaries which are based on only a small number of observations are less likely to accurately reflect the population than those with a larger size. Very few observations in ADMADE's monitoring system are based on a random sample, so sufficient sample size becomes all the more important to minimize the bias introduced by opportunistic sampling.

Fortunately sample size is easy to present to the user in tabular and graphical summaries. Figure 11 is one of the interactive charts in the new database and depicts the hunting success for hartebeest in all GMAs from 1994 to 1998. The diamond markers represent the hunting success (calculated as the percentage of hunters who shot a hartebeest out of those who stated they desired one at the start of their hunt), and should be read using the scale on the left. The square markers represent sample size (the number of hunters seeking an animal) and should be read using the scale on the right.

In this graph, we see that the sample size is between 30 and 35 hunters each year, which is probably enough to reduce the effect of any outliers (we could also plot 95% confidence limits for each year if we wanted even more feedback on dispersion). Hence for the country as a whole, we can say with a fairly high degree of confidence that hunting success for hartebeest increased between 1994 and 1998. If, on the other hand, the sample size had only been 5-10 hunters per year seeking hartebeest, as it is for some species, then this indicator would be a lot less significant when evaluating the sustainability of safari hunting quotas for hartebeest.

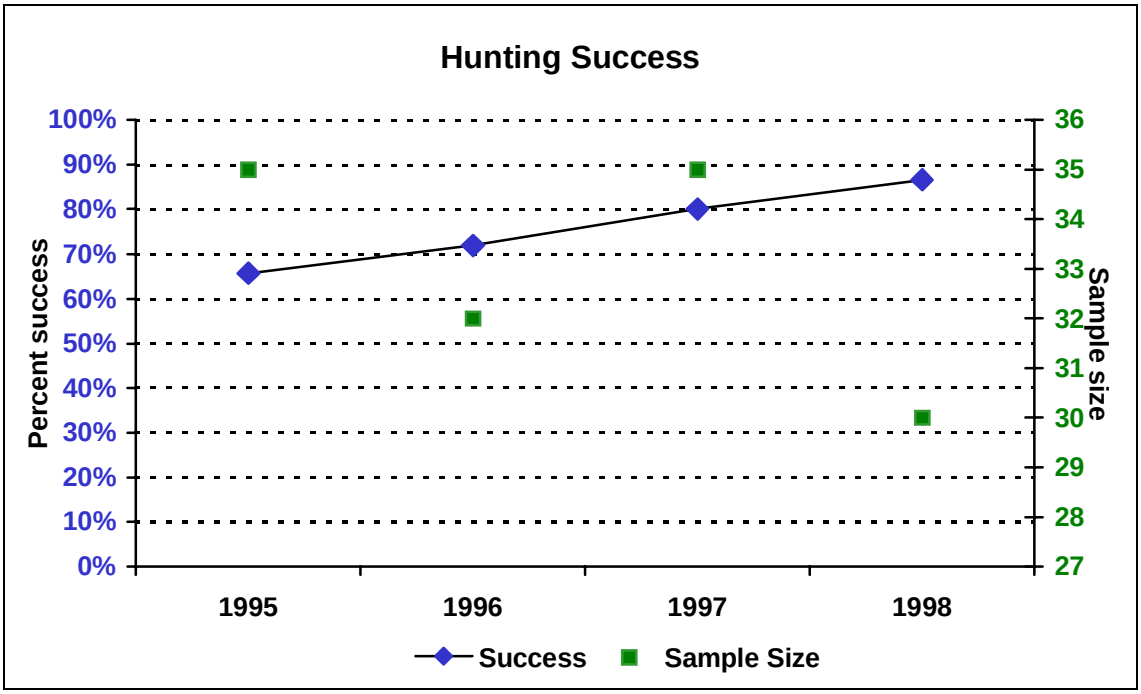

Figure 11 – Hunting success of hartebeest 1994-98

Dispersion. The amount of dispersion in a set of measurements can suggest whether the data have been collected properly. Histograms can quickly present the distribution curve of the sample data, which are expected to fit certain norms.

Figure 12 shows a histogram of trophy measurements for Cape Buffalo for all hunting blocks and all years combined. This fairly normal distribution is what we would probably expect from a natural population of trophy specimens, and suggests that scouts are probably making measurements properly and that individuals are probably being selected from the population in a consistent manner.

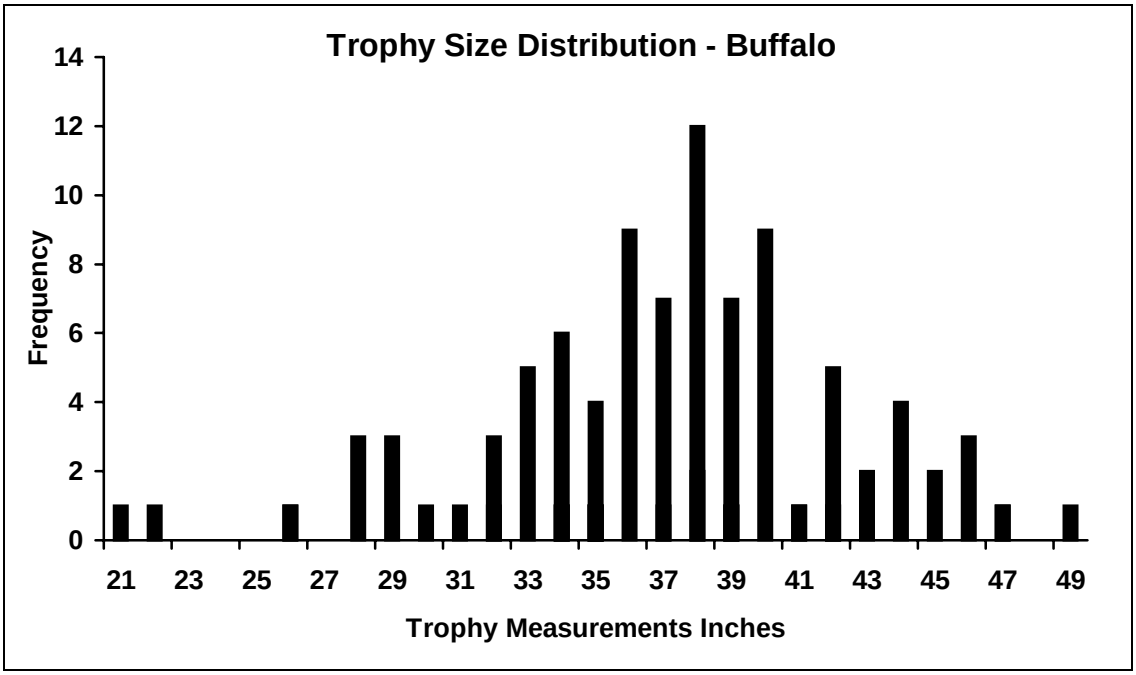

Figure 12 – Histogram of trophy size measurements

Temporal bias. Another factor which can affect data quality is the timing of observations. Bias can be introduced when the sampling is not consistent or representative of the time frame of interest. Graphs and numeric summaries can be used to help detect bias that might be introduced by irregular temporal sampling.

Figure 13 below shows the number of day on patrol for two camps in the Chifunda Unit for 1998. A few patterns are immediately apparent from this graph. First of all, Kanusha camp did almost no patrolling during the months of February to May--the rainy season. Hence any data from the scouts in that camp on poaching levels, animal abundance, or other phenomenon are likely to be biased by the lack of patrolling during this period. Secondly, there are no patrols recorded for the months of November and December. This can only be attributed to (1) there were no patrols during those months, (2) not all data have been entered into the database. Assuming the later, we also note that any summary of patrolling effort for this unit for the year will likely under-represent the actual number of days patrolled.

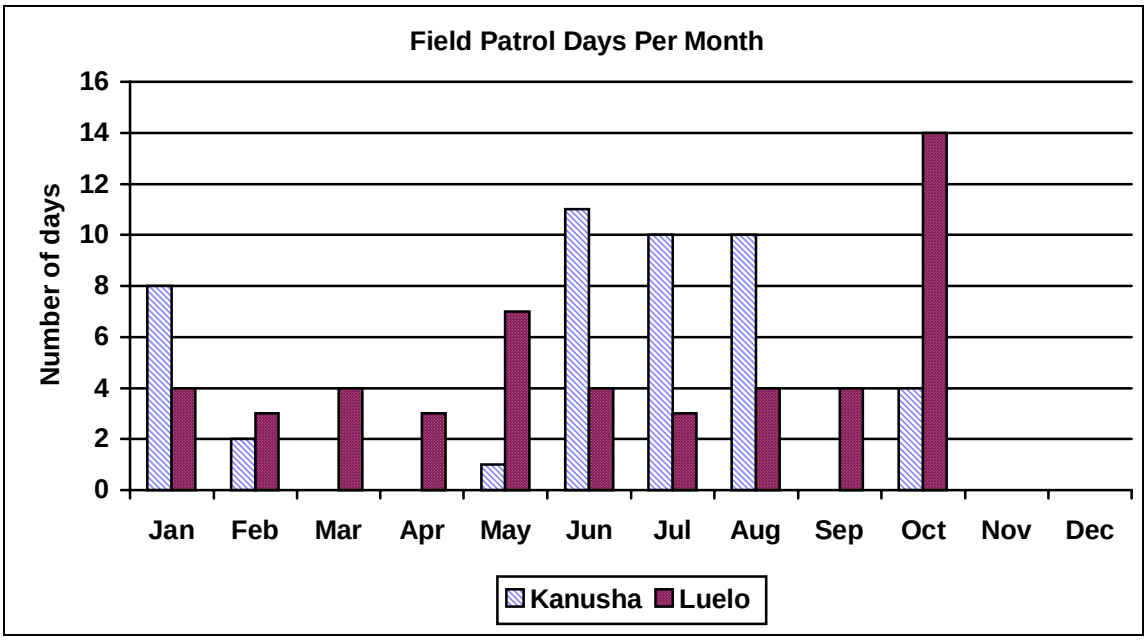

Figure 13 – Number of days on patrol for Kanusha and Luelo camps, 1998

The next graph shows a timeline of hunts in Chanjuzi Hunting block, 1998. This graph reveals that (1) there are no large gaps in the hunting or monitoring, and (2) there was no hunting after September 22nd. This implies that either the professional hunter closed the camp before the normal end of the hunting season, or the data are incomplete. Since hunting statistics provide one of the important indicators for assessing population trends, we would want to resolve this question before using this data to look for trends in wildlife populations. An important requirement for the methodology of summarizing hunting statistics for trend analysis is to get an entire season's worth of data so that intra-seasonal variations in hunting effort and hunting success will average out. Also apparent from the graph is that the PH frequently has more than one client at once (or else there were two PHs in the area), and more than half of the clients were on mini-safaris (seven days or less) which generate less revenue than classical safaris.

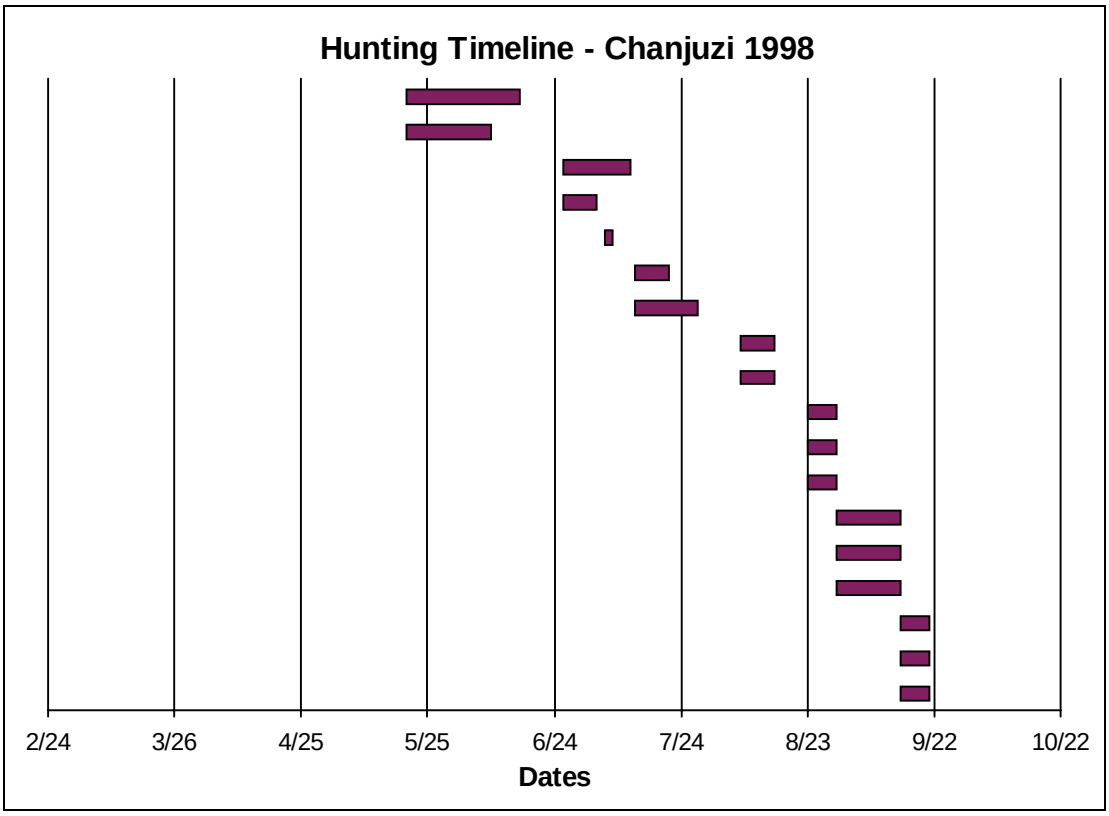

Figure 14 – Timeline of safari hunting in Chanjuzi hunting block, 1998

Spatial bias. Figure 15 is copied from one of interactive maps in the new database, and shows the 5 km^2 grids where scouts went on field patrols in Mumbwa GMA during 1997. The color represents the number of times a grid has been patrolled, with red indicating the greatest number of visits.

We observe from this map that not surprisingly scouts patrol more heavily around their base camps. While that pattern may have implications on its own, it must also be considered when interpreting other results from field patrol monitoring. For example, all of the safari hunting in Mumbwa GMA is done on the western side of the GMA, so at least for the year shown it would probably not be appropriate to use field patrol observations to measure the competition between safari hunters and poachers for the same animals. This spatial sampling bias also suggests that scouts may be impacting poaching near local settlements on the eastern side of the GMA, but are not patrolling areas closer to the park, where organized commercial poachers may be attracted.

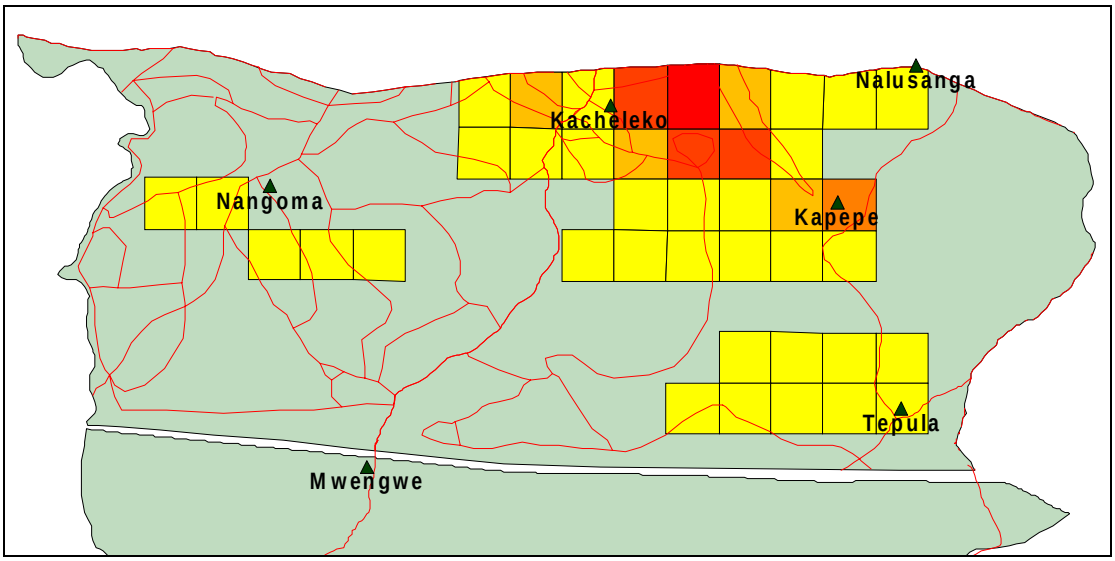

Figure 15 – Map showing location of field patrols in Mumbwa Unit, 1997

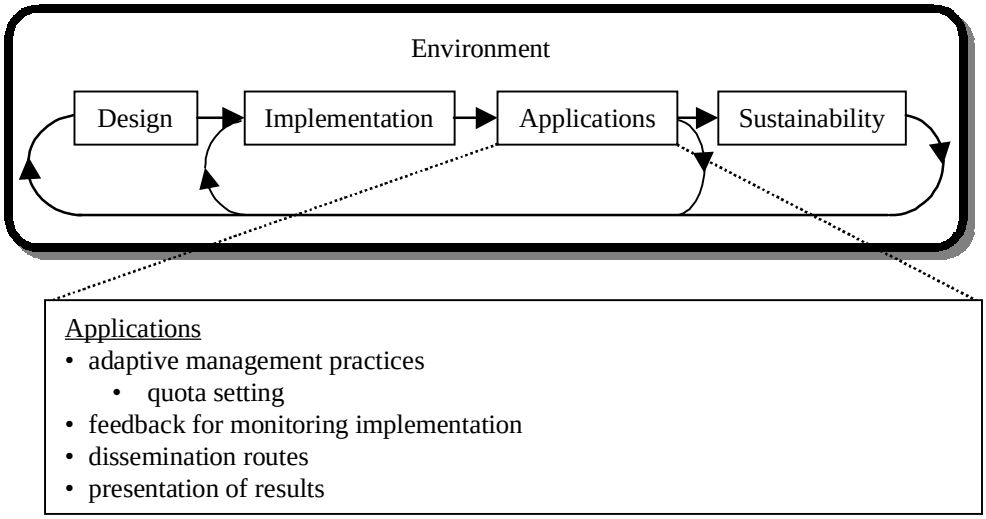

Figure 16 – Applications

Applications

Adaptive Management Practices

Applications of monitoring data include any analysis or synthesis of monitoring data which is used to inform management, policy, planning, or evaluation. Applications can also include education campaigns or participatory processes which incorporate lessons learned through monitoring data. Without such structures woven into the program, data may sit unused and its value diminished.

Although it would be futile to try to list every application of monitoring data for the many stakeholders in ADMADE, perhaps the single most important management decision is the annual exercise of setting hunting quotas. Hunting quotas are the mechanism used to control hunting, and represent the critical and delicate balance between

financial revenue and ecological sustainability. Community quota setting is also a fascinating process in itself as it encapsulates much of the complexity of CBNRM:

- multiple stakeholders with varying interests are involved
- quotas are developed in a larger context of complex ecological and socioeconomic systems
- roles and power levels of stakeholders reflect larger institutional and policy structures

In Zambia, there are five types of hunting quotas. The safari quota is the number of animals which can be sold to international safari clients. This is the type of hunting that generates the vast majority of the revenue for ADMADE communities. The non-resident quota is the number of animals which can be hunted by Zambian nationals who live outside the hunting block, while the resident quota is the number of animals which can be legally hunted by local residents. Finally there are quotas for culling, which is mostly used to thin populations and provide a cheap source of meat for people in the area, and ceremonial purposes, such as traditional celebrations at the chief's compound.

There are two general strategies for setting quotas: *percent off-take* and *adapt and assess*. These strategies can be mixed and matched, but in any particular quota setting exercise one approach is likely to dominate the other. In the percent off-take method, information about the reproductive biology of a species is combined with a population model to calculate a maximum percent of the population that can be sustainably harvested each year. The percentage off-take estimate is then combined with an estimate of the total population to calculate the total number of animals that can be harvested. In the *adapt and assess* method, (1) an estimate is made for a reasonable quota, (2) the population is rigorously monitored to detect an upward or downward trend, and (3) the quota is continuously updated to reflect new population information as it becomes available.

In practice there is actually a third model of quota setting, which becomes the default when there is no monitoring data to support either of the other two approaches. In this method, the interests of different stakeholders are reviewed and a quota is negotiated based on the power relationships of the various parties. Unfortunately this method rarely produces a sustainable quota, yet becomes the norm when there is no monitoring program in place. This is largely the system that was used in hunting blocks before ADMADE was established by the government.

The selection of the most appropriate quota setting strategy is largely determined by the type of population data available. Calculating the percent off-take requires information about recruitment and mortality rates as well as a fairly accurate estimate of the total population. Accurate population estimates may be feasible on fenced game ranches, but tend to be less precise for open populations. To illustrate, Table 5 below shows the results of a series of aerial surveys in Munyamadzi GMA between 1994 and 1998.

Table 5 – Upper and lower bounds of 95% confidence intervals of population estimates in Munyamadzi GMA from aerial surveys

Species	**Total Population - 95% Confidence Interval**		
	1994 (4.2%†)	**1996** (5.1%†)	**1998** (12.3%†)
Buffalo	0 - 8,170	0 - 22,066	0 - 14,140
Eland		not seen	0 - 67
Elephant	101 – 817	0 – 337	0 - 612
Hartebeest	86 - 2,086	0 – 410	not seen
Reedbuck	25 – 329		not seen
Roan	31 – 347	0 - 1,260	not seen
Waterbuck	0 – 677	not seen	0 - 412
Wildebeest	817 - 3,571	0 - 353	0 - 1,080
Zebra	142 – 538	16 - 1,342	not seen

† percent of GMA sampled. (Jachmann, 1994; Jachmann, 1996; Jachman 1998)

What is interesting about these figures are the wide confidence intervals for the total population estimates. These wide intervals, which are not uncommon in aerial survey counts, permit coarse estimate for the total population, as well as detection of statistically significant populations trends. However census data tend to less useful for setting hunting quotas based on a percent off-take of the population estimates.

In ADMADE hunting areas, which usually lack population estimates even as coarse as the ones above, the only real alternative strategy for setting quotas is the *adapt and assess* method. With this method, population monitoring is used not to calculate the total sustainable offtake, but to identify population trends on a regular basis and adjust the quota in response to population fluctuations. In ADMADE, this review takes place at the end of each hunting season. The indicators that are used to monitor the wildlife populations include the following.

Hunting statistics

Trophy size. Each time a safari client hunts a horned animal, the village scout accompanying the client measures and records the size of the trophy. Measurements follow the widely used standards by Safari Club International (SCI) and are of interest to the safari client as well. Trophy size is a fairly reliable measurement, because horns can be measured without much difficulty or time pressure. For lion and leopards, skull width and length are the measurements used by SCI for trophy size. However this measurement can not be taken by scouts in the field, because it requires removing and cleaning the skull. Hence there is relatively little trophy size data for the big cats.

Assuming that animals grow larger with age, and safari hunters are generally selecting trophy animals in the same way from year to year,[10] trophy size is a fairly direct and valid index of the age of the oldest males in the population. This is reason enough to use trophy size as an important indicator, as the success of safari hunting is dependent on trophy specimens. In addition, changes in age structure can reflect changes in abundance in the population as a whole.

Hunting success. Hunting success is the percentage of safari hunters seeking a particular species that successfully found and shot an animal. Before each hunt begins, the village scout accompanying the client is supposed to ask which animals will be sought. At the end of the hunt, the animals actually taken are compared with what was desired to calculate hunting success.

Hunting success intuitively seems like a good index for the population, because a small population would probably result in reduced hunting success and vice-versa. However hunting success can also be biased by several factors. First, the probability of successfully finding and shooting an animal is dependent on the skill of the hunter and the amount of time searching for the animal. The amount of time available will also vary between mini-safaris (seven days or less) and classical safaris (more then seven days). A low hunting success from ten classical safaris would be much more worrying than low hunting success from ten mini safaris. Currently ADMADE does not weight or breakdown hunting success data according to length of the hunt, however the assumption is that the variations between hunters and classical/mini safaris will be similar from year to year so that cross-year comparisons will be valid.

Like other indicators, the validity of hunting success as a measure of population change is also very dependent on sample size. A hunting success of 33% would be interpreted much differently if it was a result of one out of three hunters finding the animal than if it resulted from eight out of 24 hunters taking an animal.

Hunting effort. Hunting effort is defined as the number of days it takes a safari client to find and shoot an animal. When hunting effort increases, it implies that animals are more difficult to find, presumably because there are fewer of them. Hence hunting effort is therefore also intuitively a good indicator of population change. However like the other indicators, the validity of hunting effort as a proxy for population change requires controlling for or at least averaging out other factors which may affect hunting effort.

One factor which affects hunting effort include the time of the season, because it takes longer to find animals during the beginning of the hunting season when grasses are high. The time it takes to find and shoot an animal may also vary depending on whether the hunter is on a classical safari, where he has more time to be selective, or a mini-safari, where all hunting must end after seven days. Finally, hunting effort can vary greatly according to the style of the professional hunter, and other species on the hunt which may necessitate hunting animals in a particular order.

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[10] In practice, the selection strategy of safari hunters is not consistent. Some hunters look for animals that will get them in the SCI record book, while others are more like stamp collectors who just want a variety of trophies to display in their showroom. Other factors, such as fatigue, running out of time, or advice from the professional hunter, may also influence which animal a hunter selects to shoot. However as long as the general mix of hunters is similar from year to year, these differences in selection should average out.

With so many confounding factors, hunting effort is one of the weaker indicators of population change. In theory, the effect of confounding factors should cancel out with a sufficiently large sample size. When taken in concert with other indicators, hunting effort can help detect changes in population.

Number of animals hunted. The total number of animals which have been legally hunted is an indication of the offtake from hunting. By itself, the number of animals successfully hunted may not be very meaningful, as it depends on a variety of factors (such as the number of hunters who wanted an animal). However when evaluated with other indicators, the trend is more likely to be valid. The number of animals hunted is also important because it represents the sample size for hunting effort and trophy size, and helps determine the magnitude of any changes in the quota.

Key Informants

Interviewing individuals who spend lots of time in the bush, such as scouts, professional hunters, trackers, ex-poachers, etc., can yield important insights into population dynamics not captured by hunting statistics or quantitative monitoring. These individuals have knowledge not only of whether populations are increasing or decreasing, but where animals can be found and perhaps why the population is changing.

However like any other indicator, using key informants (a term borrowed from cultural anthropology) can result in bias or error. There are many possible confounding variables with observational recall data, well described in social science research texts (Bernard, 1994). Some of the most relevant validity problems for key informant surveys in ADMADE include bias from peer-pressure, spatial or temporal patrolling patterns, recall error, mistaken observations, and hidden agendas.

The basic strategy for making informant data more valid is the same as making any kind of data valid: measurement should be as objective as possible, and confounding variables controlled for. Collecting data from informants (i.e., interviewing them or administering a questionnaire) can itself introduce bias due to factors in the interview environment. In the past, ADMADE did not use a systematic or controlled method for interviewing informants; their opinions on wildlife were solicited during group meetings, such as quota setting exercises. This generally resulted in forming an opinion by group consensus, with one or two scouts speaking for the others and perhaps suppressing dissenting views. In 1999, Nyamaluma introduced a more objective way of interviewing informants, by using a "Population Trend Survey" questionnaire which is designed to be administered individually and under controlled circumstances. These results are entered into the database and analyzed for agreement. This approach offers promising possibilities, because it should now be possible to quantify inter-scout agreement as well as intra-scout consistency over time.

Informants involved during the quota setting process include

Scouts. Village and civil servant scouts form the backbone of ADMADE's law enforcement and monitoring programs in the field. On both field patrols and safari monitoring their primary mission is to go where wildlife and poachers are likely to be found. Hence they can offer some of the most well-informed observations about populations. The amount of time scouts spend in the bush is not well known, however it likely varies widely. A 1998 ADMADE report estimated that scouts patrol an average of

20-40 days per year (National Parks & Wildlife Services, 1998). This is probably an underestimate, but to what extent is not known. One pattern revealed in the data is that most patrols are restricted to the areas around the camps, which may bias scout opinions when population trends in the GMA as a whole. Scouts also do very little patrolling in the rainy season (December-April) which is also the hungry season and therefore a time of increased poaching. Many wildlife species also tend to disburse away from water sources during the rainy season, so a lack of patrolling may bias scouts' opinions of species distribution and habitat use.

Professional hunter and tracker. The primary job of a professional hunter is to guide safari clients to wildlife. Professional hunters have good vehicles to move around the area and often many years of experience in an area. Hence they are usually a good source of information on wildlife population dynamics. Most professional hunters also employ a Zambian with extensive bush experience to be a tracker, providing another good source of information. However both professional hunters and their trackers operate mostly during the dry season and only in the best wildlife areas, so their opinions may be biased towards these times and places. An unscrupulous professional hunter may also intentionally over or under-estimate wildlife populations in the hopes of changing the hunting quota to better meet his business goals.

Unit leader. Due to the requirements of the job, the unit leader does not go out on patrol as much as his scouts. Nevertheless he is a valuable source of information on wildlife. The unit leader is in frequent contact with his scouts, and serves as a focal point for all other wildlife issues, such as reports of poaching activity, crop damage, legal hunting by Zambians, and disturbances to habitat. A good unit leader has a grasp on the main wildlife patterns and issues in his area, and when combined with other informants can provide valuable insight into population trends.

Others (ex-poachers, honey gatherers, etc.). Other informants who have extensive knowledge of the bush include local residents who earn part of their livelihood from bush products, such as former poachers, honey gatherers, and firewood gatherers. Their background, bush experience, biases, and other agendas may be less well understood than scouts or professional hunters, however they can provide corroborating evidence for population trends and offer important insights into resource use patterns. Their opinions and knowledge are collected primarily during group exercises such as community quota setting or land use planning.

Field patrol data

Observational data from field patrols are a potentially rich source of information for quota setting. In 1996, field patrol dataforms were revised to prompt scouts to quantify patrols observations including live sightings of animals. As yet no area has accumulated enough field patrol data to use for detecting trends in animal sightings because observational data was only analyzed starting in 1998. However, once a unit has three or more years worth of field patrol data, they will be able to provide additional indicators, such as number of animals observed per hour of field patrol time, as well as locations of animal sightings. Other field patrol observations which may prove useful for quota setting include observations of carcasses, poaching activity, and recent bush fires.

Quota setting meetings

At the end of the hunting season around October, each ADMADE area is supposed to hold a meeting to review the most recent indicator data and recommend a hunting quota for the next season. Quota setting meetings are supposed to involve the full spectrum of stakeholders, including the professional hunter, tracker, community resource board, unit staff, scouts, and NPWS biologist for the area. Facilitators use a participatory approach during the meeting, soliciting feedback from all parties with knowledge of or interest in wildlife.

Quota setting meetings usually can be completed in one day, although sometimes a second day is required if the area contains more than one hunting block or the meeting gets off to a slow start. These quota setting meetings were introduced program wide in 1997 and most meetings have been facilitated by staff from Nyamaluma. It is hoped that in the future the unit staff and community leadership will play a larger role in conducting these meetings.

The basic strategy for wildlife assessment during quota setting is to compile data from as many sources as possible and look for agreement between indicators. Before the meeting begins, the facilitators and unit staff prepare all the hunting statistics for the current season, and look for trends from previous years. A trend is defined as three or more year's worth of data suggesting a definite change in the population. The results of each indicator are summarized on a flipchart with the following symbols: + positive trend, - negative trend, 0 no discernable trend. Next to these are additional columns for the opinions of scouts, tracker, and professional hunter, which are filled in during the meeting. Table 6 below shows an example of a quota setting worksheet filled out.

Table 6 – Quota setting indicator worksheet for Mwanya GMA, 1998

Species	Effort	Success	Trophy	PH	Scouts	Tracker
Buffalo	0	+	0	+	+	+
Bushbuck	-	0	-	+	+	+
Crocodile					+	+
Eland				+		
Hartebeest				-	-	-
Hippo	+	0			+	+
Hyena	0	-			+	+
Impala	0	+	0		+	+
Kudu	0	-			-	-
Leopard	0	-		0	+	+
Lion		+		+	+	+
Oribi					+	
Puku	0	0	0			+
Roan		0		-	-	-
Warthog	0	0			+	+
Waterbuck C	-	0	-		-	-
Wildebeest C	--	--			-	-
Zebra	0	+			+	+

Interpreting indicators is based on scientific principles, but also involves a qualitative and dynamic discussion. In most cases, the statistical indicators and the opinions of the scouts and Professional hunter are in agreement, and there is little debate. In some cases, the hunting statistics are contradictory, inconclusive, or unavailable, and more discussion is required between the 'human indicators.' In rare cases, the quantitative indicators contradict the observations of scouts and hunters. In general, the opinions of people outweigh the statistical measures. From my observations of four quota setting exercises in 1998, the relative weight of indicators during group discussions are in descending order of importance:

1. opinion of the professional hunter
2. opinions of the tracker and the scouts
3. opinions of others at the meeting (e.g., ex-poachers)
4. hunting statistics

Once consensus has been reached on whether the population of a species is changing, the next step is to review the hunting quota. If there is unanimous agreement that a species is increasing, the hunting quota may be raised. Crocodile, monkeys, puku, impala, and hippo are examples of species which have been doing generally well in recent years. In some cases, the professional hunter will request that the quota not be raised even if the data indicates a rising population, because he doubts his ability to successfully market the additional animals to clients and does not want to be penalized for failing to sell the entire quota. In these cases, a raise in the quota may be allocated for culling, ceremonies, or non-resident hunting. In some areas the Professional Hunter will assist with the culling operation to insure that only non-trophy specimens are removed.

When indicators suggest that a population is in a period of decline, the hunting quota will likely be reduced, sometimes drastically. In some instances this occurred because the community's previous quota recommendation was ignored or raised by the final quota setting committee at ZWA headquarters.

Conservatism is part of ADMADE's overall design strategy in quota setting. When data are missing or inconclusive, the quota should remain about the same. Even when data indicates that a population is increasing, quotas are more often than not adjusted slowly. My observations were that although there was usually someone at the meeting who wanted to drastically increase the number of animals on quota, the final consensus was much more conservative. This dampening effect of individual voices is another important benefit of broad participation in community meetings. Reproductive rates and home range requirements are sometimes taken into account when adjusting hunting quotas. Even if all indicators are positive, quotas for species such as leopard that reproduce slowly and are thinly spread are likely to be incremented by only one or possibly two animals. Some species, such as lion, have a separate quota for males and females.

Once the quota setting meeting is complete, the results of the discussion are copied from the flipcharts and onto the Quota Setting Worksheet (Appendix A), which is then signed by the chief and all those present at the meeting. This form is then sent to NPWS headquarters for the annual review meeting of the NPWS quota setting committee.

The facilitation role of Nyamaluma's extension staff is an important element in community quota setting exercises. In addition to the technical knowledge they bring,

summaries of previous monitoring data and logistical support such as a vehicle and flipchart materials, they also represent an outside third party which is perceived to be neutral and objective. Nyamaluma staff narrated examples where their facilitation role helped bridge differences between stakeholders. Whether ADMADE units will be able and willing to conduct quota setting exercises with the same level of professionalism without support from Nyamaluma remains to be seen.

Indicator Agreement

As can be seen in Table 6 above, there are numerous blanks in the quota setting worksheet, indicating no data was available, however there are at least a couple of indicators for nearly every species. Table 7 below summarizes the amount of population indicator data that were available in 11 hunting blocks during the first two years of ADMADE's experiment with community quota setting exercises. The table indicates that there is at least some data for the large majority of species on quota. It also indicates that

Table 7 – Indicator data available for community quota setting

Hunting block	Year	Species with indicator data		Average number of indicators per species	Coefficient of agreement	Coefficient of agreement without 0's
		Number	% of all species on quota			
Chanjuzi	1997	26	100%	4.8	0.49	0.73
Chanjuzi	1998	23	100%	3.7	0.38	0.64
Chifunda	1997	22	100%	4.9	0.45	0.65
Chifunda	1998	20	100%	3.6	0.55	0.66
Chikwa	1997	22	100%	5.7	0.53	0.81
Chikwa	1998	23	100%	4.6	0.46	0.57
Luawata	1997	20	100%	4.7	0.69	1.00
Luawata	1998	16	100%	2.8	0.43	0.73
Mulobezi	1997	20	100%	5.0	0.48	0.72
Mumbwa East	1997	17	89%	4.0	0.54	0.71
Mumbwa West	1997	21	100%	5.0	0.42	0.71
Mwanya	1997	22	96%	4.0	0.53	0.79
Mwanya	1998	18	82%	3.9	0.61	0.89
Nyampala	1997	21	90%	4.9	0.47	0.80
Nyampala	1998	20	100%	3.8	0.50	0.87
Sandwe	1998	11	65%	2.4	0.33	0.48
West Petauke	1997	20	100%	5.0	0.48	0.78
Average		19.1	95%	4.25	0.48	0.72

the average number of indicators per species is 4.25. While there is no magical number for the minimum number of indicators, in general "more is better" and the minimum that would allow any amount of meaningful cross-checking is three.

The coefficient of agreement is the percentage of all possible pairs of indicators that are in agreement. Higher values indicate that indicators tended to agree with each other, while lower values indicate there was disagreement between the indicators. When the 0's (non-conclusive indicators) are removed from the analysis, the coefficient of agreement increases substantially, as seen in the last column. This implies that there rarely are pairs of indicators in complete opposition (e.g., one indicating a negative trend and another indicating a positive trend). Indicator agreement suggests that the indicators are valid measures of the same underlying phenomenon (i.e., population change).

Feedback for Monitoring Implementation

The Effective Monitoring Framework stresses the need for developing mechanisms to use feedback from monitoring data to adapt not only program and management activities, but also the monitoring system itself. ADMADE has integrated the principles of adaptation to virtually every aspect of the program, including monitoring. In the case of monitoring, adaptation is facilitated by the practice of reviewing data on a continual basis, so problems and opportunities in design and implementation do not take long to surface.

Examples of monitoring adaptation based on analysis of monitoring data and feedback from stakeholders include

- The section of the field patrol dataform for recording observations was converted from an open-ended comments box to a tabular matrix, after the need to quantify field observations to measure trends became apparent. The most common observations to include on the matrix were identified from the collection of open-ended comments.
- The crop damage dataform was divided into two, one for damage in fields and one for damage to grainaries, in response to a pattern of elephants altering their raiding strategies and the need for different techniques for measuring damage.
- The geo-reference grid was reduced from 10 km^2 to 5 km^2 in response to feedback from scouts who stated they felt confident locating themselves on a map within 5 km.
- A column was added to the field patrol dataform for 'day light hours in grid' in response to the need to control for search effort to make analyses of field patrol observations more robust.
- New dataforms and survey methods were introduced to strengthen monitoring of snaring activity and disturbances around fish camps and waterholes, in response to feedback that these are some of the most significant threats to wildlife and safari hunting.
- The formula for calculating hunting effort was altered to exclude those hunters who failed to find the animal. Previously, the total length of time hunted was used as the effort for hunters who failed to find a trophy.

Appropriate Dissemination Routes

An effective monitoring system requires that methods of dissemination and presentation be appropriate for the different applications of data. Transferring information in ADMADE, be it the collection of raw data or disseminating summaries, is challenged by the logistics of distance and poor transportation infrastructure in the rural areas of Zambia. In the case of ADMADE the challenge is compounded by a relatively small number of project vehicles and financial resources for travel. Although NPWS has a country-wide

radio system which is a fairly reliable means to communicate with units, the volume of monitoring data requires the movement of paper dataforms. ADMADE has coped with the logistical dissemination challenges by using every possible opportunity to transfer monitoring data between the units and Nyamaluma, including field visits of any kind, participants travelling for workshop, and other sometimes complicated relays of exchange.

I was not able to explore in much detail how monitoring information is disseminated within GMAs, however the most likely opportunities for sharing monitoring results with local residents is at meetings and public forums. Most scouts interviewed stated they did not get summaries or feedback from their own monitoring results, although the scouts in Mumbwa GMA did state that their unit leader would meet with them from time to time to review field operations based on monitoring data. None of the scouts interviewed attend community meetings, although many unit leaders and deputy unit leaders interact with the local community.

The World Wide Web is a medium ADMADE has begun to explore for sharing monitoring results. An activity of this research project was development of ADMADE's premier web site. The web is an appropriate medium for ADMADE for several reasons. Using the web resolves one of the biggest hurdles ADMADE has faced in disseminating information: the difficulty and expense in producing and distributing sufficient hard copies of data. Printing costs are high in Zambia, and Nyamaluma Institute, where the vast majority of monitoring and publicity materials are produced, has only one small reliable photocopy machine. Transporting hardcopy documents is also expensive and logistically complicated.

The web removes many of the technical barriers to disseminating information. Although many of the stakeholders of ADMADE's monitoring program do not have access to the internet, in particular local communities, many of the national and international stakeholders are online. Zambia is fortunate to be relatively well 'wired' into the internet, with at least one national ISP and dial-in services in many parts of the country. ADMADE can all but eliminate the distribution costs and technical barriers to sharing information to online stakeholders.

ADMADE is also particularly well placed to share data electronically because most of the programmatic and monitoring materials are already prepared in electronic format. Nyamaluma pioneered the use of database and GIS technology for resource monitoring, and has been using word processing, digital photography, and desktop publishing tools for years in the preparation of educational materials, newsletters, and reports. Converting these materials to a format suitable for the web is technically simple with commonly available software tools. Nyamaluma's recently upgraded monitoring database could also be put online with a little additional work, either statically or interactively, partially or in full, and with restricted or unrestricted access.

To develop the ADMADE web site, a list of the potential audiences was first developed. These included members of the wildlife sector in Zambia, international conservation organizations, tourists, safari hunters, academics, donors, and the general public. Secondly, a list of desired thematic sections was developed, including introductory materials about ADMADE, wildlife conservation, community development, safari hunting, Nyamaluma, monitoring and GIS, publications, bibliography, and related links. Finally

pages were designed for each of the sections, largely borrowing from existing documents and images.

ADMADE's web page made its debut in January 1999. Although no monitoring summaries are online as of yet, the structure is in place and can be quickly and economically updated to share results.

Presentation of Results

An effective monitoring system must present information in a format appropriate for the various stakeholders and data applications. Presentation formats can include oral presentations, small format tabular or graphic summaries, large format summaries, technical reports, or dramatizations.

ADMADE is confronted with a group of stakeholders more diverse than many environmental monitoring programs. Monitoring summaries are needed by everyone from development bureaucrats, to wildlife ecologists, to illiterate rural people. Customizing the presentation formats of monitoring summaries for each group requires creativity, resources, and time. Hence ADMADE has had to make compromises in developing formats for presenting data.

Data summary formats targeted for unit staff and rural communities have received the greatest focus and greatest amount of success. These materials include tabular summaries of patrol effort broken down by month, including days patrolled, costs, and results in terms of arrests and confiscations. Tabular safari hunting summaries present all the hunting statistics listed above and are also standard outputs of Nyamaluma's information system.

ADMADE has also pioneered the use of large format maps for use in community decision making. The maps and summaries produced by Nyamaluma have proven to be an effective means of conveying monitoring feedback to community members and catalyzing dialogue around key resource issues (Lewis, 1993). Maps are an integral component of annual reviews of field operations and land use planning workshops. Figure 17 below illustrates a typical map designed for land use planning.

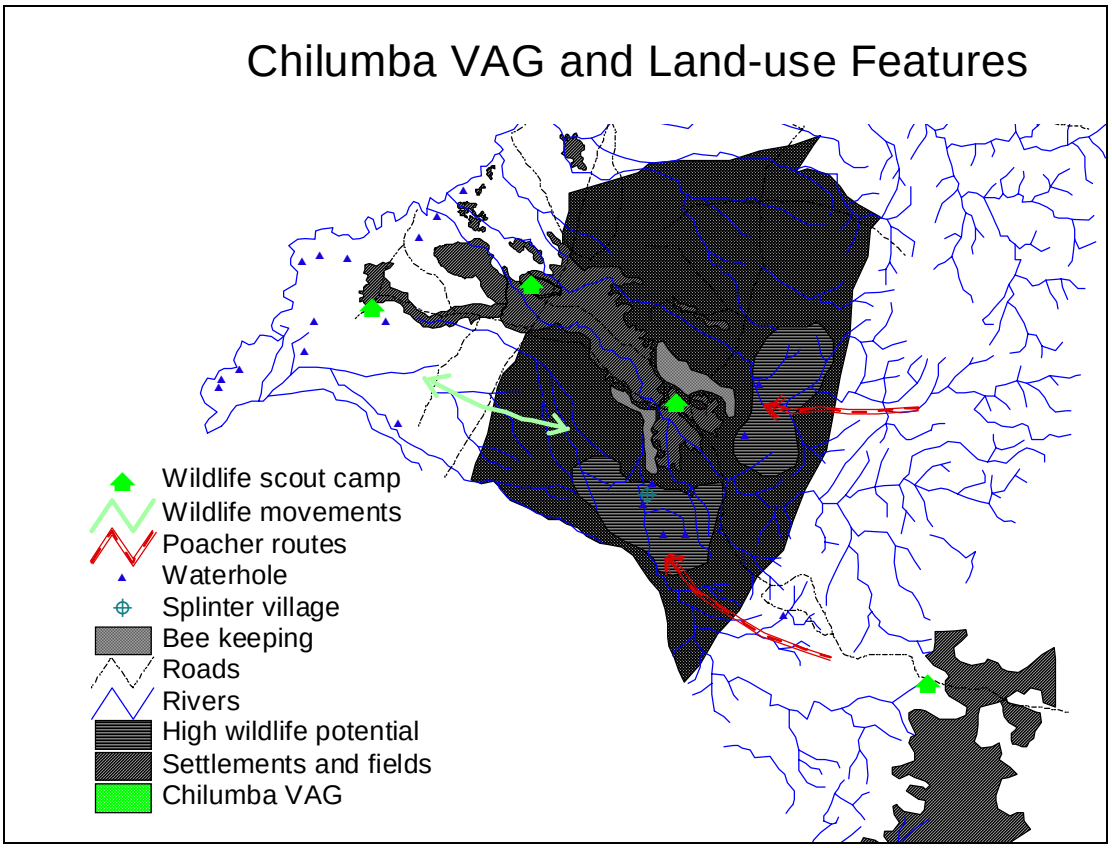


Figure 17 – Land use planning map developed from monitoring data

ADMADE has been less successful in developing presentation formats suitable for its national and international partners. These stakeholders have very specific information needs, require guidance in interpreting data, and prefer neatly packaged materials. Producing such materials requires the expertise of middle and upper level analysts which ADMADE has found difficult to develop and retain.

To help meet the information needs of both communities and external partners, Nyamaluma has published a newsletter in various forms throughout the history of ADMADE. The current form, "The ADMADE News and Review," comes out several times a year. Although monitoring results are occasionally discussed in the newsletter, the majority of the articles focus on recent happenings, profiles of specific GMAs, or essays promoting the vision of ADMADE. For at least a year ADMADE submitted the newsletter to USAID in lieu of quarterly reports, however this publication did not really meet the exacting information needs of USAID or other national partners.

In 1999, ADMADE, with the support of WCS, produced a series of technical reports aimed at national stakeholders which summarized the main results of its monitoring program (National Parks & Wildlife Services, 1998; National Parks & Wildlife Services, 1999a; National Parks & Wildlife Services, 1999d; National Parks & Wildlife Services & Wildlife Conservation Society, 1999).

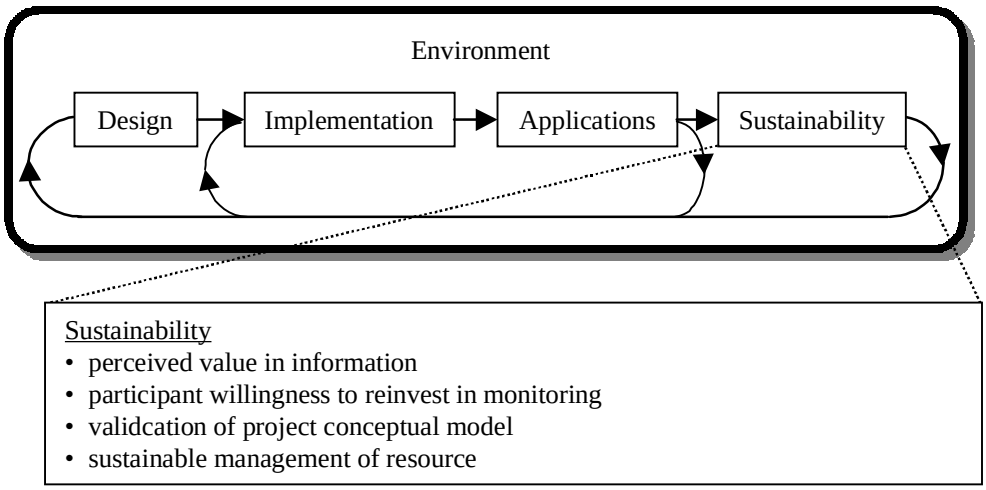


Figure 18 – Sustainability

Sustainability

Perceived Value in Information

One sign of a sustainable monitoring system is an increase in the perceived value of information among the participants. Although I did not conduct a widespread survey of community attitudes towards monitoring information, the interviews with seven village scouts reflected a diversity of attitudes towards monitoring. At one end of the spectrum, a scout stated, "We already know where the animals and poachers are. We do not need the dataforms to tell us, but we fill them in anyway because its part of the job." At the other end, a scout mentioned several ways that monitoring has helped the management of his unit, including quota setting, financial planning, guiding clients to the best areas, enforcing the quota, and determining population trends. Overall, the scouts interviewed demonstrated limited understanding of the role of monitoring or enthusiasm for monitoring activities other than being a requirement of their job. However as a greater number of community members become involved in management activities, and GMAs compile enough data to base decisions upon, there should be an increase in the recognition of the importance of monitoring. Likewise if ADMADE continues to strengthen its socioeconomic monitoring, which may be seen as more relevant to community interests, the perceived value of monitoring also may increase.

Participant Willingness to Reinvest in Monitoring

Communities, as represented by the sub-authorities, have already made some investment in resource monitoring by supporting the salaries of village scouts with community revenue. ADMADE communities have also invested in monitoring by sharing some of the costs of training. This demonstration of support was particularly evident in 1997 when there was a break in the USAID funding to Nyamaluma, requiring increased contributions from the units to support training programs. Many individual scouts have also made extreme personal sacrifices to attend training courses at Nyamaluma, including walking for several days to get to Nyamaluma or travelling a week or more on public transport from distant parts of the country. While these demonstrations of support are not

exclusively directed at monitoring, monitoring is seen as one of the returns from investments in village scouts and training.

Validation of Project Conceptual Model

A project's conceptual model is a framework of all the factors and their linkages that influence a target condition, which in the case of ADMADE is the status of wildlife populations and community standards of living (Figure 19). A sustainable monitoring system is one which can provide information to test and update the conceptual model, because long-term survival is very unlikely without an accurate understanding of all the factors which affect the outcome.

ADMADE's monitoring program is very much management oriented, and measures only a fraction of the total variables in its overall conceptual framework. Some of the important *unmonitored* variables in ADMADE's complex conceptual framework include rainfall patterns, cross-boundary wildlife movements, micro-economics, trends and stability in the safari hunting industry, political support or interference, and social dynamics at the community level.

Nevertheless, ADMADE has been able to use its monitoring data, together with data collected from special studies and other sources, to produce a series of analytical papers examining factors which contribute to or detract from its success. The most relevant paper was a 1999 study which identified bio-geophysical, demographic, private sector, policy, and donor factors which affect ADMADE's success (National Parks & Wildlife Services, 1999d). Other technical papers include a study of problems and opportunities in the safari hunting industry (National Parks & Wildlife Services, 1999e), a study of the economic impact of safari hunting at the local and national levels (National Parks & Wildlife Services, 1998), and a study of land use and management issues (National Parks & Wildlife Services & Wildlife Conservation Society, 1999). Collectively these studies shed light on many of the factors in ADMADE's overall conceptual framework and explain much of the variation in implementation at the GMA level.

Sustainable Management of Resource

Ultimately, the aim of an effective resource monitoring system to is to make a contribution to the sustainable management of natural resources and human development. The contribution may be in the form of a tool for management and planning, a mechanism for developing local human resources, or improving a conceptual framework. "Sustainability" is in itself a broad term and the focus of a large body of literature in conservation and development. Many of the special studies listed above explore in more detail various issues related to the sustainability of ADMADE.

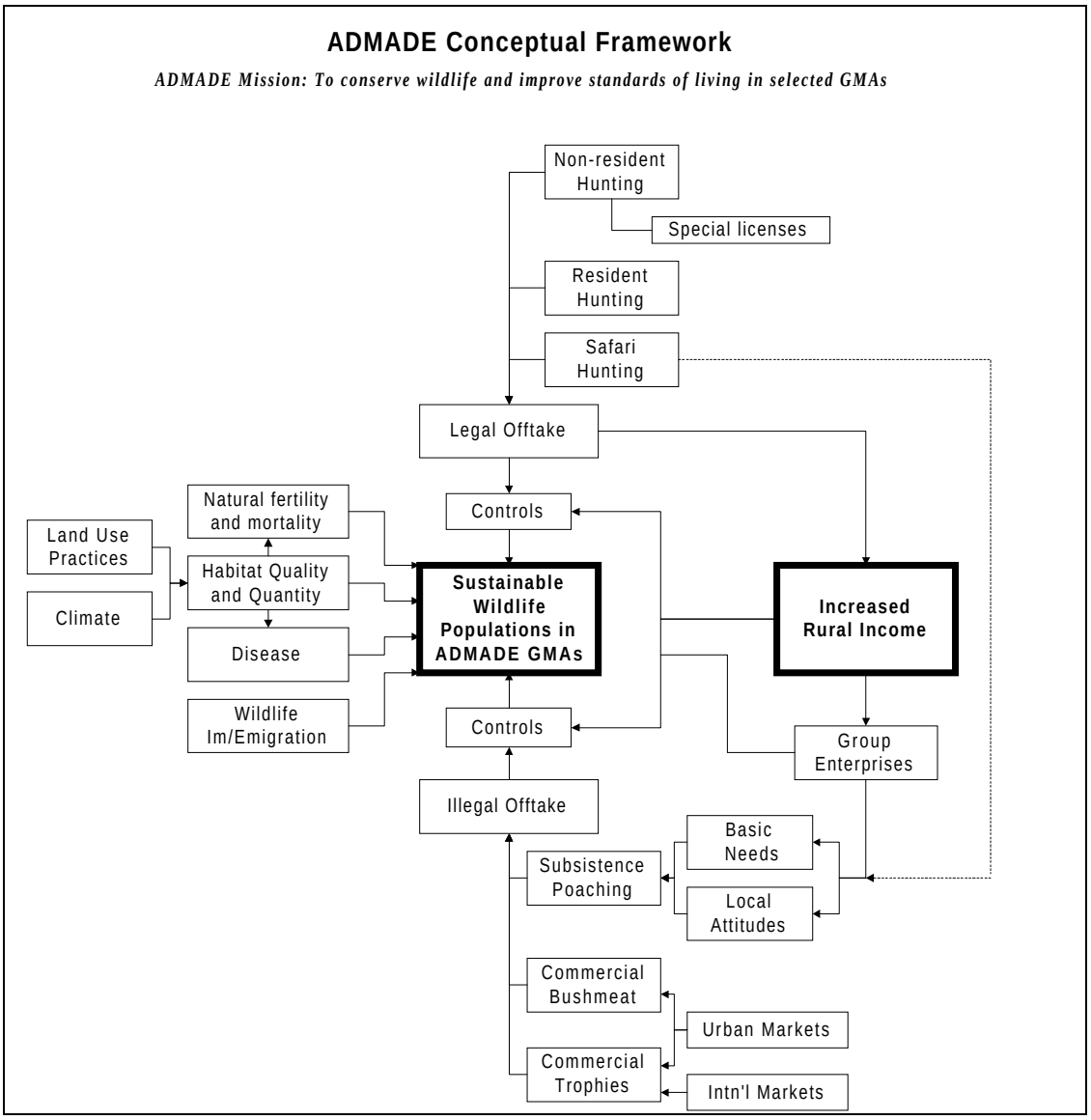


Figure 19 – ADMADE conceptual framework

Figure 20 presents a single indicator, safari hunting revenue, which I present as an indirect measure of both resource conservation and community development. Hunting revenue is an indirect indicator of wildlife conservation in the sense that hunting is dependent upon the presence of trophy quality animals, which in turn suggests potentially healthy populations of the large game species which also serve as umbrella species for habitat and smaller animals. Hunting revenue is also an indirect measure of community development because community development is dependent on funding, and 35% of the revenue retained by the WCRF is earmarked for community development activities. Although there are certainly many other factors which affect on-the-ground conservation and community development, the stable trend in total hunting revenue depicted below suggests that ADMADE has done a reasonably good job to date in demonstrating that its approach is working at least at the macro level.

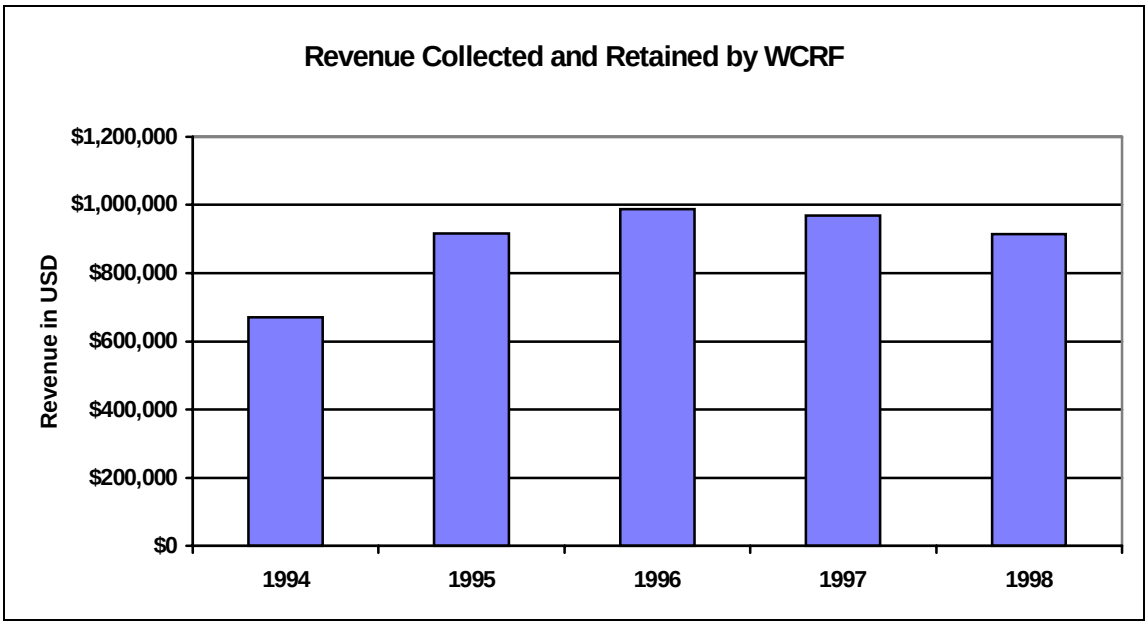


Figure 20 – Safari hunting revenue collected and retained by the Wildlife Conservation Revolving Fund in ADMADE Areas

CHAPTER 4
DISCUSSION

Environment

ADMADE has made some impressive accomplishments during its first 13 years of existence, and there is a solid foundation for continuing to develop and strengthen the program. However there also remain several threats to the program which could erode the conducive environment upon which monitoring built. Some threats are short-term, while others are more likely to manifest themselves after several years. Some threaten the entire program, while others are more likely to affect individual GMAs.

In 1999/2000, NPWS is going through a top-to-bottom restructuring process to become the semi-autonomous Zambia Wildlife Authority. Whether and how the new organization is going to affect the policies and activities of ADMADE, and in particular the employment status of village scouts, remains to be seen. Village scout salaries, which have been set by the sub-authorities, are unreasonably low in almost all areas, and are not adequately incremented for Zambia's 20-30% annual inflation. The issue of salaries is a universal bone of contention among scouts, and a sensitive issue which could eventually deteriorate into chaos, at least in specific areas, if no remedy is made by local or national officials.

Concurrent with the restructuring of NPWS at the national level, ADMADE communities are undergoing a significant restructuring in how the program is implemented at the GMA level. The sub-authorities are being replaced with democratically elected community resource boards, and the traditional chiefs are being converted from influential chairmen to honorary patrons. While virtually all participants recognize the importance of this restructuring, if the chiefs object or try to obstruct the work of the community resource boards, or if the community resource boards fail to be effective administrative bodies or mobilize action as effectively as chiefs, then management activities, including monitoring, could suffer.

Another big transformation can be seen in the status of Nyamaluma. Nyamaluma, which serves as the nucleus of ADMADE's monitoring system, lost a major portion of its annual operating budget when USAID funding for ADMADE ended in December 1999. Whether the institute will be able to replace this funding or maintain its training programs and field support with a smaller budget may have a very big impact on monitoring activities. Nyamaluma's long-term plan is to become a financially self-supporting semi-autonomous trust, however for the foreseeable future external funding will continue to be needed.

Committed and competent leadership at all levels will always be an important element of the conducive environment of CBNRM. When one GMA went through a financial scandal which led to the suicide of the unit leader, all aspects of the program

were severely affected, including monitoring. ADMADE also remains highly dependent on its long-term expatriate technical advisor. Although the technical advisor's position seems secure for the foreseeable future and efforts are continually being made to train upper level management, such dependency on any single irreplaceable person is never a comfortable situation.

Design

Identification of Monitoring Goals

The goals of ADMADE's monitoring system seem to be well developed conceptually. This is not a monitoring program that collects data for the sake of collecting data or for answering questions that have yet to be identified. ADMADE's data collection was developed for very specific purposes, focusing on wildlife management. However what seems less developed, outside the research unit at Nyamaluma, is an awareness of those goals. When asked the purpose of recording data on field patrols and safari hunts, village scouts, who should be among the most knowledgeable of any group, most commonly expressed that having data was an end in itself. The second most common type of answer was to ensure that clients had paid for their hunting and that the unit would receive all the money due to it from the WCRF. These two categories of answers reflect two predominant constraints of ADMADE implementation: data for the most part are not analyzed within the unit unless outside support and encouragement is provided, and there is a common perception in GMAs that the collection and redistribution system of safari revenue is not entirely transparent and trustworthy.

It would appear that ADMADE has a never-ending challenge to increase the awareness of its mission and activities, particularly with regards to monitoring. This need is especially keen now that a greater cross-section of the rural communities is becoming involved in program management through the resource management committees and community resource boards. These members need to become oriented to the goals and methods of monitoring, and to recognize that monitoring is primarily a means to improved management and planning, and not an end in itself. This theme was a recurring message during the May 1999 Advanced Village Scout course, and will be continue to be reinforced if village scouts and community members become more involved with planning management activities such as quota setting, budgeting, and land use planning.

Inclusive Participation

ADMADE's monitoring system is similar to many other participatory monitoring programs in the respect that there is strong community participation in the data collection phase, but little in the data analysis and design phases (Estrella & Gaventa, 1998). The tradeoff between integrating input of diverse communities during design, and meeting the preset information needs of the project and influential stakeholders, such as donors, is a common dilemma for conservation and development projects. Another Zambian project, the CARE Livingstone Food Security Project, conducted a series of participatory rural appraisal exercises to identify which indicators should be recorded in the community self-monitoring ledgers. But during those exercises, the facilitators also had to exert some influence over the process so that each community agreed to monitor at least a core set of

pre-identified household level indicators that could be aggregated at the project level (Lyons, 1998). With a legal mandate to monitor wildlife resources across all project areas, ADMADE has even more stringent requirements for monitoring design that all but precluded wide-scale community input during the design phase.

The top-down approach to designing and implementing monitoring, while efficient in many respects, can falter during implementation. Because village scouts and their unit supervisors have basically followed instructions they were given during workshops at Nyamaluma and by inspection teams, they may not immediately appreciate the rationale of the monitoring program, nor understand the techniques used for data analysis. Consequently they may not initially see much benefit from monitoring, other than appeasing those higher in the chain of command. Many monitoring problems experienced in ADMADE units, such as poor data management, poor supervision, and neglect, are probably caused by a fundamental lack of appreciation of the importance of monitoring and understanding of its role in management. Conversely, as scouts and unit leaders become more experienced in data collection and using information for decision making, these data management issues tend to become less of a problem.

This pattern suggests that an important strategy to strengthen monitoring is to raise the level of appreciation and understanding of monitoring at the field level by involving officers not only in data collection, but also analysis, interpretation, and whenever possible, design. Devolving these functions, which are currently dependent on Nyamaluma support, to the community level would likely result in improved data collection and management. The alternative hypothesis is that unit staff actually have very little use for monitoring data, in which case strengthening the command and control structure would be a more appropriate strategy for solving monitoring problems.

Although ADMADE has not had many resources or models to follow for devolving data analysis, it has taken some steps to increase the capacity of community members to analyze and interpret monitoring data. Monitoring is a frequent topic of many workshops and training programs, and unit staff are frequently involved in data interpretation during inspection visits. Perhaps most importantly, participatory exercises such as quota setting and land-use planning demonstrate the application of monitoring data, which beforehand may have seemed abstract. As these efforts continue, and as Nyamaluma tries to gradually reduce support to advanced GMAs to strengthen and maybe even introduce the program in other areas, more units should become increasingly self-sufficient in monitoring.

ADMADE may have new opportunities in the near future to solicit community input in the design of socioeconomic monitoring. The interest in and need for socioeconomic monitoring is likely to increase as a broader spectrum of GMA residents become involved in decision making through peer groups, village area groups, community development committees, and financial management committees. Issues such as food security, settlement and agricultural patterns, household assets, access to development projects, immigration and emigration, educational needs, seasonal patterns in resource use, and other social variables are common topics of planning meetings. ADMADE does not currently have at the project level an established methodology for monitoring these types of variables, but a wonderful opportunity to pool the ideas and resources of the people to identify which indicators are most important to measure and with which methods. Such

exercises could lead to experimental pilot monitoring activities and streamline the trial and error process for a new group of datasets.

Indicator Selection

Use of indices

ADMADE's strategy of using indirect indicators to measure wildlife population trends has proven to be extremely cost-effective and adequate for most management tasks. The use of indirect indicators, as opposed to direct counting methods, for assessing wildlife populations is almost cost-free, because monitoring has simply been added to standard field operations. Wildlife scouts would still conduct anti-poaching operations and accompany safari clients even if they were not recording data. The minor additional investment to add data collection to these operations includes a portion of training costs, printing dataforms, some computers at Nyamaluma, and the salaries for 2-3 research staff. The cost is also shared with communities who pay the salaries of village scouts with their portion of safari revenue. Based on my interviews with village scouts, monitoring also does not seem to impinge upon the ability of scouts to perform the primary functions of their field operations.

A second benefit of using indices, which may be even more significant than financial cost-effectiveness, is that monitoring wildlife with indices is within the technical capacity of ZWA field staff and community organizations themselves.[11] Direct methods of censusing wildlife, such as ground and aerial transects, provide important data as well, but are unlikely to be within the capacity of unit staff anytime soon due to the cost and technical expertise required. Developing monitoring methods that can function at least partially without dependence on support from donors or outside government assistance should be an objective of all CBNRM programs. Particularly in the case of ADMADE, where external donor and government support is small and erratic, low-cost monitoring methods are very attractive.

However, monitoring with indirect indices also has disadvantages. Indices can not answer many important questions about populations, such as absolute population estimates or densities, or the conservation impact on broader taxa. Indices are also vulnerable to error when extrapolating results, because observations rarely are randomly selected. All of the statistical indices used by ADMADE to measure population trends also have numerous confounding factors, such as the skill level of the hunters and time of year. ADMADE's monitoring design assumes that the effect of these many confounding variables will be consistent from year to year, and so will average out in the final analysis. However this assumption has not been tested.

Table 8 summarizes the comparative advantage and disadvantages of different monitoring methods.

Although assessing wildlife with indirect measures is far from perfect, when observations are made in a consistent manner, multiple indicators are used, and a conservative approach is made to setting quotas, then sustainable management of the

[11] Although there are no ADMADE Units that are completely self-sufficient in processing and analyzing their own data without support from Nyamaluma extension staff, several areas are close and the trend is certainly in that direction.

population appears to be possible. The fact that several ADMADE areas have been able to recommend safari hunting quotas that are nearly completely used for two or three consecutive years is good preliminary evidence that this strategy of wildlife monitoring can work.

One way ADMADE's monitoring data can be made more robust for management decisions, as well as illuminate some of the more scientific questions, is to use more precise measures of sampling effort in trend analyses. The research unit at Nyamaluma is moving in this direction, for example introducing in 1999 a column for 'day light hours in grid' on the field patrol dataform. The new information system also allows for the first time allows entry of all observational data from safari hunts, including the 'daylight hours spent hunting' and number of baits used for large cats. These new pieces of information will allow more precise measurements of hunting effort, and generate more precise indices of population trends by controlling for confounding variables related to search effort.

ADMADE's experience with monitoring also highlights that monitoring indicators should encompass both the status of the resource as well as other important aspects of the program, such as public awareness, knowledge, food security, distribution of benefits, market changes, operator performance, law enforcement results, revenue allocation, public expenditures, and attitudes. Each of these variables represents a link in the long and tenuous chain of effective CBNRM, and each is important to hold all the parts of the program together. Conserving wildlife is one of the final goals of CBNRM, and needs to be monitored, however achievement of conservation in and of itself does not guarantee that program success will be sustainable. A monitoring system needs to encompass of all of the pieces of the puzzle to predict problem areas before they arise and maximize effectiveness.

To illustrate the domino effect in CBNRM, one of the units in the Luangwa Valley was doing well for several years. Hunting revenue had been steadily increasing, and community initiatives, such as a new theater group and participation in public meetings, were on the rise. In 1998, a financial scandal was unearthed, eventually leading to the suicide of the unit leader. As a result of this blow, staff morale plummeted, confidence in the program fell, patrolling decreased, poaching skyrocketed, and a number of serious land use disturbances threatened to erode the quality of safari hunting. A strong unit leader, good financial management, and community support for the program are important links in the chain of success, links which did not hold up in this case. If monitoring of finances and development activities had been as sensitive as safari hunting monitoring and caught the problem earlier, it is possible that the damage from this tragic chain of events could have been averted or lessened.

Table 8 – Comparison of wildlife counting methods in Zambia GMAs

Method	Est. cost per km^2	Species	Suitability for woodlands	Can calculate abundance	Confidence limits	Expertise required	Logistic require-ments	Temporal sensitivity	Community Participation
Aerial census	$1[†]	large only	poor	yes	wide	high	low	high	poor
Ground transect foot	$3[†]	all	good	yes	wide	high	high	high	fair
Ground transect road	unknown	most	poor	yes	wide	high	medium	high	fair
Hunting statistics	negligible	hunted species	good	no	none	medium	medium	low	good
Interviewing key informants	unknown	all	good	no	none	medium	low	low	good

[†] Cost estimates based on data from LIRDP in Lupande GMA using civil servant scouts (personal communication, Jachmann 1998).

Dataform expansion

ADMADE experienced a year of explosive dataform growth in 1999. New dataforms introduced in 1999 include the village area group (VAG) committee establishment dataform, VAG meeting attendance dataform, and the VAG committee meeting report. The VAG development needs implementation dataform, social service provider form, and VAG development needs and priorities dataform are designed to help communities plan and execute projects. There is a similar set of dataforms for the community development committee, in addition to the CDC community development monitoring dataform which is designed to help the CDC committee oversee projects. Other new dataforms include a self-appraisal monthly work form for village scouts, the new snare survey dataform, and population trends dataform.

Not all dataforms that have been introduced by Nyamaluma in the past have "taken root" in the units, so time will tell which of these new forms will be used at the community and/or project level. Although many of these new dataforms are designed to serve primarily as an administrative template and be used only within a unit, if past history is to be a guide, only those dataforms which are requested and supplied by inspection teams from Nyamaluma are likely to become permanent additions to ADMADE's monitoring program at either the unit or project levels. Nyamaluma is also near or above its capacity at processing dataforms, so priorities will have to be set before large new datasets are integrated into the monitoring database.

Appropriate scales of observation

The architects of ADMADE's monitoring program appreciated from the very beginning the importance of incorporating a spatial reference in all datasets at an appropriate scale. Initially base maps were prepared for each unit with an overlaid 10 km x 10 km grid system. Each grid was given a unique number that is written on dataforms. As this system was field tested, it became apparent that scouts could locate themselves more precisely within a grid, so the base maps were redesigned with 5 km^2 grids. This scale sacrifices precision for the sake of accuracy, however it seems adequate for the management-oriented uses of the data. More importantly, scouts feel comfortable that they can locate themselves on a map at this scale with a high degree of confidence.

A constraint of ADMADE's sampling program is the lack of measurements in the areas adjacent to most GMAs. Wildlife moves frequently across borders, however safari hunting and field patrols must remain within the GMA. Most GMAs are adjacent to National Parks, however there is no monitoring and little patrolling inside the parks despite the role of parks as reservoirs for the GMAs. Units also do not have easy access to the monitoring data of adjacent units, although this would be useful for exercises such as quota setting and land use planning.

Temporally, ADMADE's monitoring design calls for the collection of field patrol data throughout the year and safari hunting monitoring throughout the dry season. Continuous collection of data is advantageous because it reduces the effect of outliers that are connected with seasonal events. Assuming that scouts continue to collect data throughout the year, abnormal observations such as a large flux of animals during a brief migration period will be averaged with other observations. ADMADE's design also calls

for the collection of data over a several year period, so units are beginning to amass continuous multi-year archives of data which allow for analyses of trends and impact.

Sampling

As can be seen in Table 3 on page 42, ADMADE has not made use of probability sampling to any large degree in the design of its monitoring program, opting instead to measure 100% of most datasets. This is due to two reasons. First, the main datasets (safari hunting statistics and field patrols) are small enough that it is feasible to collect 100% of the data. ADMADE units do not conduct direct wildlife counts or vegetation monitoring, exercises which would definitely require sampling due to the size of the areas. Second, the primary audience for these datasets are the rural communities themselves, and the validity and methodology of generalizing results from a random sub-sample to an entire population may be a difficult concept to sell to people with limited knowledge of inferential statistics.

Although there has not been a compelling need to use probability sampling in monitoring safari hunts or field operations, sampling may be a useful strategy in conducting any community based socioeconomic or attitude surveys. A sampling frame of the human population in the Luangwa GMAs already exists, as a product of a 1998 household census conducted for the purposes of demarcating the boundaries of Village Areas Groups. Using this sampling frame and standard survey methods, ADAMDE units could conduct cost-effective and representative surveys of important issues such as food security, costs of living with wildlife, awareness and attitudes towards safari hunting, livelihood strategies, rural-urban trade, economic value of project interventions, etc.

Nyamaluma has used random sampling for socioeconomic surveys in the past (e.g., Phiri, 1998), and has the capacity to teach this method for additional areas and topics. Another resource management project in Zambia, the CARE Livingstone Food Security Project, has also taken this approach in developing their Food Production Trends Survey, an annual intensive survey of food security which was based on repeated visits to 200 randomly selected households in the project area (Lyons, 1998). This type of survey data would be helpful in community exercises, such as land use planning, as well as help ADMADE and its partners adapt intervention strategies for maximum effectiveness in reducing threats to biodiversity and meeting the development aspirations of rural people.

Feasibility

One of the strategies ADMADE has used to make its monitoring system feasible is to integrate data collection with ongoing activities, as opposed to developing it as a separate activity. Low budget CBNRM programs such as ADMADE are unlikely to ever have the financial or human resources to maintain a separate network of field monitors, particularly in such a vast project area. So instead of being a separate activity, resource monitoring has been tacked onto existing operations, such as anti-poaching patrols, escorting safari clients, and problem animal control.

There are advantages and disadvantages to this approach. When monitoring is merged with other activities, the observations may be biased by non-random sampling. There may also be limited time available for observations and measurement. However these drawbacks are offset by the single most important advantage to integrating monitoring

with other activities: it is more likely to get accomplished.[12] The primary role of village scouts, both on paper and in their own perception, is law enforcement; they would conduct field patrols and accompany safari hunters whether or not they carried along dataforms. If monitoring had been developed as a completely separate task for scouts, it would be much more challenging to get scouts to use their limited supplies for monitoring operations. Only recently, in 1999, did Nyamaluma begin to train village scouts to conduct field operations exclusively for the purposes of data collection (e.g., patrols to fish camps, snare transects, waterhole reconnaissance). It will be interesting to see whether scouts will view these targeted monitoring patrols as an integral aspect of their job and conduct them as frequently as advised, or neglect them because they are seen as a much lower priority than law enforcement operations.

In addition to establishing data collection as a complementary activity, ADMADE's monitoring design also merges recording of critical data with less-critical data. Unit leaders and scouts naturally have greater interest in recording data that could potentially get them into or exonerate them from trouble, such as safari hunting license numbers or the amount of ammunition consumed on a patrol. By combining this type of information on the same dataforms as less immediately needed data, such as observations of live animals or bush fires, ADMADE has increased the likelihood that all monitoring data will be recorded properly and diligently.

However, not all of ADMADE's monitoring plans have proven feasible. Monitoring of socioeconomic and attitudinal variables has not proven to be successful. This may be because socioeconomic and attitudinal surveys were not emphasized as much during training and inspection visits, but perhaps a more likely explanation is that village scouts and NPWS officers have less interest and competence in socioeconomic measurements as compared with resource monitoring. ADMADE's vision of using village scouts as both social workers and law enforcement officers has had some notable anecdotes of success, however use of village scouts and unit staff to survey public attitudes or socioeconomic progress may be unrealistic.

Noting that many ADMADE units are able to collect a significant amount of quantitative resource and management data after several years of training and development, one may conclude that the design of ADMADE's monitoring program is generally feasible, *given that significant resources are available to* support *it*. This condition is also supported by the observation that areas which have had less field support have generally scantier and more suspect datasets. Thus while ADMADE has not exceeded its resources in implementing a sophisticated monitoring system which utilizes a centralized data processing model, it has certainly pushed its limits in some areas.

Incentives

ADMADE's monitoring system offers minimal direct incentives for individual village scouts to collect data, other than being a job requirement and appealing to scouts' sense of loyalty to help their community. However it has striven to offer an incentive to the community as a whole to support monitoring activities, by emphasizing that monitoring data belongs to the community from which it came. This basic principle of

[12] Other authors (e.g., Bodmer, 1994; McDuff, 1999) have also noted that data collection in community based projects must concur with the socioeconomic reality of the community to be sustainable.

community ownership, upon which CBNRM is based, is stressed both in principle and practice when it comes to monitoring data. Most monitoring data originates with village scouts, who are bona fide local residents even though their role may at times alienate them from certain segments of the community. After processing at Nyamaluma, dataforms and the summaries are returned to the units for permanent storage. Thus even though units staff may not feel much ownership of the design of the monitoring system, and they may be heavily dependent on outsiders to analyze and interpret their monitoring results, ownership of the data lies very much with the communities in both design and practice.

Implementation

Identification of Data Collectors

This study found that scouts are willing and competent in collecting data, even though they do not really understand why they are collecting data. My interviews with experienced village scouts revealed a high level of comfort with using field patrol, safari hunting, and crop damage dataforms. Almost unanimously scouts stated that the dataforms were clear and easy to fill out. Scouts further stated that using the dataforms did not interfere with their other primary responsibilities on field patrols and safari hunts.

Conversations with the data entry staff at Nyamaluma also confirmed that the scouts who submit dataforms only occasionally make errors, and the errors made are usually minor in nature. ADMADE's two main strategies for developing competent data collectors, training and a weeding out process, appear to have been effective in producing a network of scouts who are willing and able to record data during field operations. In 1999, Nyamaluma has also started giving certificates in monitoring to all scouts who attend an advanced monitoring workshop. If this monitoring certification becomes adopted program wide, and unit leaders require all data recorders to be certified, then this intervention will increase even further the level of competence of monitoring officers.

However, despite their apparent competence in data collection, the scouts I interviewed did not fully understand the role monitoring plays or can play at the unit or project level. Although most were familiar with the quota setting exercises, they had only a fuzzy appreciation that data could be useful in other ways and by whom. This pattern was also visible on entry questionnaires for the Advanced Scout workshop in May 1999.

Training

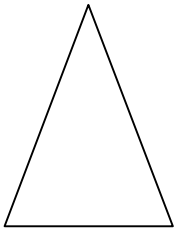
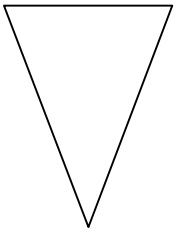
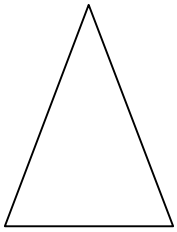
ADMADE has learned that building the capacity of field staff to collect data can be achieved relatively quickly and cheaply. However building the capacity of field staff and community leaders to analyze and disseminate monitoring data is a slower process (Table 9).

Data collection has proven to be the easiest set of skills to develop in scouts and unit staff. Data collection primarily involves recording on paper those observations which scouts are already familiar with, and does not require any understanding of data management systems or analysis. Data recording skills can usually be successfully developed through attendance at a single course at Nyamaluma, followed by periodic feedback in the field.

Data management at the unit level, which essentially consists of collecting, certifying, and filing dataforms, builds upon data collection skills and is next most difficult to develop. Data management requires developing habits and practices which previously may have been either unfamiliar or perceived to be unimportant. Data management in a unit requires attention to detail, cooperation among unit staff, office skills, and strong leadership. Although some unit leaders have quickly understood the importance and practices of managing data, most need more than just attendance at a course at Nyamaluma. Office management systems are a frequent focus of inspection teams from Nyamaluma.

Data analysis, which builds off of both proper data collection and management, is the last and most difficult skill to develop. Training in analysis and interpretation is critical for unit leaders and community members, but needs to be supplemented with on-the-job learning. This aspect of monitoring has proven the most difficult to develop, partly because it builds off of several other skills. However some areas have very capable unit leaders who have learned to analyze patterns and draw conclusions from monitoring data. If the training and outreach programs at Nyamaluma continue, these skills will likely continue to grow.

Table 9 – Capacity building in monitoring

Skill	**Time to develop**	**Number of people involved**	**Follow up support required**
data collection management and processing analysis			

Observations

Dataset gaps

As noted earlier, the strongest focus of ADMADE's monitoring program has been resource monitoring. Comparatively little data on socioeconomic indicators is collected on a regular basis. Variables such as household assets, average levels of education, the impact of community development projects, agricultural yields, community participation in the program, income generation, and public attitudes are examples of socioeconomic data which are generally lacking but would complement the natural resource monitoring to paint a more complete picture of ADMADE's accomplishments. The use of safari revenues at the community level, which has been a source of controversy for years, is also haphazardly and inadequately monitored. Another dataset that would be useful to monitor is the amount of training community residents have received and the impact of training.

Senior officers in ADMADE acknowledge these gaps in the monitoring system, and have taken steps to broaden the focus of data collection. Contracting community residents to conduct household demographic surveys was very successful and cost-

effective, and could become a model for collecting other types of socioeconomic data. As more and more local residents participate in ADMADE under the new community structures, there will be an increasing need to access socioeconomic data which can be use to plan community development and ensure transparency.

Case study of the missing data forms in Mumbwa GMA

As described in Chapter 3, this study found that only about one-third of the patrols from Nalusanga camp in Mumbwa GMA had dataforms on file. Many of the patrols not recorded in Mumbwa were day patrols, supporting a common suspicion that day patrols are widely underreported. Scouts or unit staff may not want to use their limited supply of dataforms on day patrols, as running out of data forms has been a recurring problem in many areas. Scouts may also think that only patrols which warrant filling in a data form are those where a poacher is arrested, ammunition or food rations are consumed, or something interesting is found.

It seems unlikely that the missing data forms in Mumbwa were caused by a chronic problem of dataforms getting lost or destroyed after being filled out. Nalusanga has a spacious office and one of the more organizing filing systems observed. Furthermore, the patrols originated right from the headquarters, eliminating the loss caused by bush relays. In fact, one would suspect that the percentage of field patrols recorded would be much higher in a camp such as Nalusanga, where scouts are based at the same place where dataforms are distributed, reviewed, and filed. Hence the most likely explanation is that many field patrols were never filled out in the first place due to misperceptions, a lack of dataforms, or a lapse in supervision.

These results should not be considered indicative of all ADMADE areas, because they reflect the rather special circumstances of only one camp in one unit. However they do underscore the reality that the completeness of field patrol data is difficult to assess and should not be assumed to be 100%. One intervention by Nyamaluma that may help evaluate data completeness in the future is the 1999 self-appraisal dataform. If used properly, this dataform will provide future researchers an independent record of field operations at the camp level, as well as other time allocation categories such as construction, going for salaries, education programs, rest, etc. Units have also been instructed to start numbering their dataforms, which if successful should reduce the frequency of lost forms and provide a more accurate measure of data lost caused by dataform management problems at the unit.

Supervision

The ADMADE units near Kafue National Park present an interesting natural experiment on the importance of field support to CBNRM. Four of these areas were among the nine GMAs selected by USAID for support in the early 1990s. They received the same vehicles, radios, uniforms, and training at Nyamaluma as did the remaining five areas in the Luangwa Valley. The only real difference in implementation between these areas and those in Luangwa Valley was the frequency of visits from extension staff from Nyamaluma. Visits to these areas occurred much later and less frequently than units closer to Nyamaluma. Our visit to Kasonso-Busanga and Lunga-Luswishi in early 1999 was the first time an ADMADE support team visited these areas since the program began.

Although these units received the same initial capital investment, and sent officers to the same Nyamaluma-based courses, they were clearly behind in implementation in many aspects of the program. The greatest differences could be noted in the amount and structure of community participation in ADMADE, with no theater groups, no VAG formation, no land use plans, and no community quota setting exercises. However monitoring activities in these areas were also substantially less organized. The main differences appeared to lie not in the capabilities of the scouts, but data management practices at the unit headquarters. Data management is a topic covered in many courses at Nyamaluma, but is a difficult skill to teach and has always required additional field supervision and support.

This discrepancy is not all that surprising but highlights the importance of field support for community organizations in CBNRM programs, particularly in new skill areas, such as monitoring, and partnership development between communities and government. Capital investment and foundation training are necessary, and may even be even sufficient for some aspects of CBNRM, however other skills clearly are imparted more slowly and require a longer-term presence from support staff. Discrepancies between the ADMADE GMAs in the east and west also pose some questions about ADMADE's centralized training model, and whether or not some skills would be more effectively and economically imparted through regional extension services.

Information Flow

Although it is impossible to generalize, Figure 21 on the next page illustrates the general flow of information and some of the common barriers, bottlenecks, and interventions.

All links in the information flow are critical, constriction or breakage at any point in the information flow can render all other efforts useless. It is sad to see data collection efforts wasted when there is a breakdown in the information flow. Although loss of data in ADMADE is not the norm, and does not seem to be linked to any single cause, it has happened all too frequently. Munyamadzi Unit lost all their 1997 data for both field patrols and safari hunting; possibly it was taken by a department biologist and never returned. Other areas have sent data to Nyamaluma through the regional command, only to have it lost en route. Other dataforms have been lost either at the scout camps or in unit offices, many of which are poorly equipped and organized. Even at Nyamaluma, data have occasionally been lost either because of a hardware crash, operator error, or disorganized filing (although in many cases electronic backups allow lost data to be recovered). Hence when planning or evaluating a monitoring system, all links in the information flow should be treated as equals, and assumptions that unplanned parts of the puzzle will simply work out later should be avoided.

Data Processing System

Database upgrade

By 1998, Nyamaluma had acquired newer and more powerful hardware and software than was available during the early 1990s when its first information system was developed. Consequently one of the methods in this study that was used to both analyze an important element of ADMADE's monitoring program, as well as improve the capacity

of Nyamaluma to process and analyze data, was upgrading Nyamaluma's information system to a GIS enabled relational database. The upgrade process began by studying the needs and constraints of Nyamaluma's existing information system (Chapter 3). After identifying the limitations, the research staff developed the following objectives for a new information system.

Integrate datasets. Many of the constraints of the old information system stemmed from the disjointed data and file structure. Hence a key objective of the new system was to integrate the major datasets under one relational structure. In other words, all datasets for all years and all units should be combined together and linked through a common set of lookup tables. This would enable producing summaries and analyses based on data from different years and/or GMAs.

Make user-friendly. Staff expressed a desire that any new database system should be a lot more user-friendly. This would allow a greater number of Nyamaluma staff to input data and generate outputs, and would minimize the amount of disruption in the program resulting from transitions in technical staff. A user-friendly interface would also decrease the likelihood that certain types of errors would occur, and allow the highly capable technical staff to spend less time on repetitive tasks and focus more on the analytical side of data management.

Improved error checking. Enforcing data integrity and developing built-in error checks were other desired features for the new database system. The strategy of storing the names of units, species, scouts, etc. with identification numbers instead of text strings is one example of a strategy that can reduce potential data errors. Other desired error checking features included automatic checking for numbers which should fall within a certain range (e.g., trophy sizes, dates), and ensuring that records can not be entered more than once.

Automate standard outputs and analyses. To save staff time and improve reliability, there was a need to automate many of the standard outputs of the database, including tabular summaries, maps, and charts. Automating the standard analyses also improves the consistency of the outputs produced. One of the limitations of the old system was that the manually created maps and charts often used different color schemes, column headings, layout design, etc. Although such design variations might be insignificant to people who are educated, they may disorient rural people who may be less visually literate and more comfortable with consistent output.

Facilitate future expansion. An information system which supports a program as dynamic as ADMADE needs to be able to change with the times. New datasets, new summaries, new layers of spatial data, new maps, and new users, are examples of probable changes the database will need to accommodate over its life span.

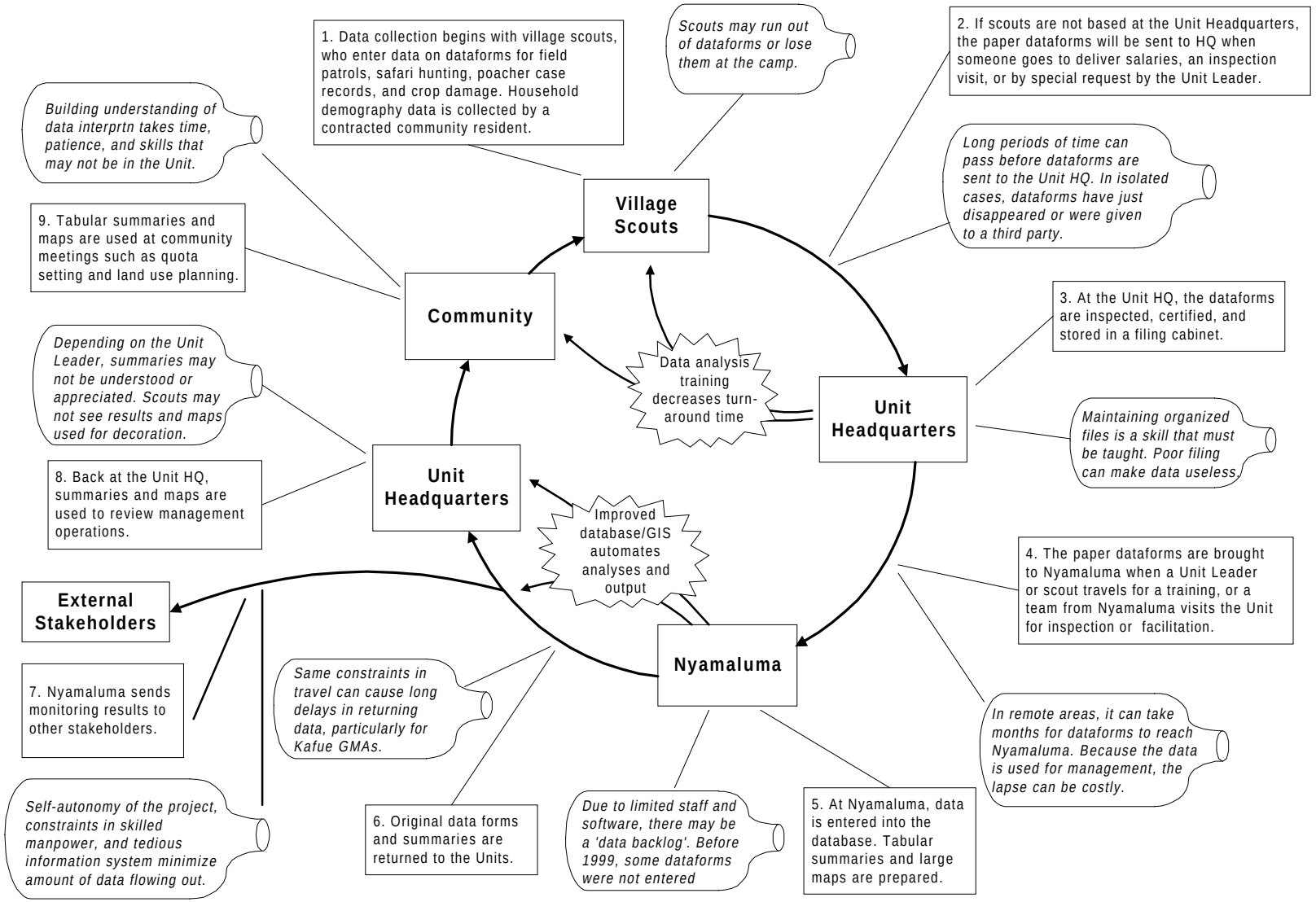


Figure 21 – Information flow, bottlenecks, and interventions in ADMADE

Provide multi-user features. More and more of the staff at Nyamaluma are using computers in their work, including some extension teams who even carry laptops with them on field visits. One of the hopes for this new database was that monitoring data could be entered in the field, and summaries provided to communities immediately, eliminating the long feedback delay caused by transport to and from Nyamaluma. Hence the new database had to provide multi-user features such as the ability to synchronize datasets across non-networked computers. One of the troubles with the old system was that there were normally multiple copies of the same files on different machines, and it was left to the computer staff to remember which was most recent.

Improve documentation. Documentation was an important element of all of the new desired features, including user-friendliness, multi-user features, and expansion. Nyamaluma's first information system was fairly well documented in a technical manual, although many of the 'tricks' were only acquired through experience, and expansion of the system was not a topic in the manual. The new database needed not just the standard printed materials, but also context sensitive online help. Furthermore, since the new database was going to have multiple architects and an order of magnitude greater number of ready-made summaries and outputs, there was a need to integrate documentation for the individual outputs. In other words, every tabular summary, map, and graph needs a mechanism to allow the user to find out what the summary is trying to capture, how it is calculated, and who created it.

Capture qualitative data. Information systems are most adept at capturing and analyzing quantitative data, however in programs as complex as CBNRM projects much of the most interesting information and almost all of the interpretation can only be expressed qualitatively (i.e., through text or pictures). In addition to the substantial use of dataforms, which are designed to capture quantitative observations, ADMADE's research unit has amassed a significant quantity of qualitative data, much of it written down in the form of field reports, correspondence, trip plans, workshop proceedings, and land use plan. This qualitative data is critical to interpreting the quantitative results of monitoring data, and also needs to be available to the user through a common interface.

Make monitoring results accessible to wider audience. Although it will be some time before rural communities will have the capacity to use computers, there are a host of other potential users who could access and benefit from monitoring data in electronic formats. These include senior officers in ZWA, USAID, and ADMADE's institutional partners within Zambia. With a cleaner, more robust information system, ADMADE for the first time would have the technical capacity to share all or some of its raw data or summaries with other institutions, either electronically or in hard copy. There are of course many non-technical factors to consider before sharing monitoring data electronically, however one of the goals of the new system was to remove some of the technical hurdles that had been hampering ADMADE's ability to disseminate monitoring results.

Results: The ADMADE Data Manager

To achieve the above objectives, a new information system was developed built around Microsoft Access and ESRI MapObjects. MS Access, which is bundled with the widely popular MS Office Professional edition, was the natural choice as the main

software tool for the database, because it is commonly available, relatively cheap, customizable, supports a fully featured powerful programming language called VBA, and has a well established tech support network. MapObjects is an ActiveX control from ESRI, the makers of ArcView and ArcInfo GIS software, which enables the integration of GIS features into development environments such as Visual Basic, Visual C++, Delphi, or Access.

The new database, dubbed the ADMADE Data Manager (ADM), is now the working information system at Nyamaluma and is also being used at the ADMADE coordinating office in Chilanga and the USAID mission in Lusaka. ADM uses a combination of built-in Access features and customized enhancements, explained below.

Built-in Access features

Relational data structure. Like most modern databases, Access supports relational data structures, which simply means that related data are divided into different tables. For example, there is a table for staff, a table for species, a table for units, and a table for field patrols. The information in all of these tables are linked together with ID numbers, which computers can process much faster than text. Using a relational data structure saves a significant amount of disk space and improves performance when querying or summarizing data.

Enforced data integrity. Access is well equipped to ensure that data saved in related tables does not violate referential integrity rules, and that all required fields are filled in. When data integrity is enforced, it becomes impossible to add the same record twice (in most cases), and impossible to enter incomplete data. For example, a user can not enter a new field patrol record unless there are valid starting and ending dates and the name of a unit where it originated from. This feature, along with the relational data structure, eliminates many of the errors that can be caused by inconsistent spellings, partial records, etc.

Replication. Replication is another built-in feature of Access that allows multiple copies of the same database to communicate with each other and synchronize the data. Replication is a real lifesaver in a facility like Nyamaluma, where two or three copies of the database are needed just for data entry workstations, and others may be needed for performing analyses and generating outputs. With replication, it is relatively simple to make certain all copies of the database are using the most up-to-date data, and each copy has the latest preset collection summaries and outputs.

Custom designed features

User-friendly menu system. A database with numerous datasets and summaries requires a menu system to navigate among the many different choices. ADM features a standard three-tiered point-and-click main menu, and a simple single document interface, which means only one window at a time is visible. Choices on the main menu can be easily expanded or modified using the menu manager. The menu system also features integrated object filtering and documentation, which are described below.

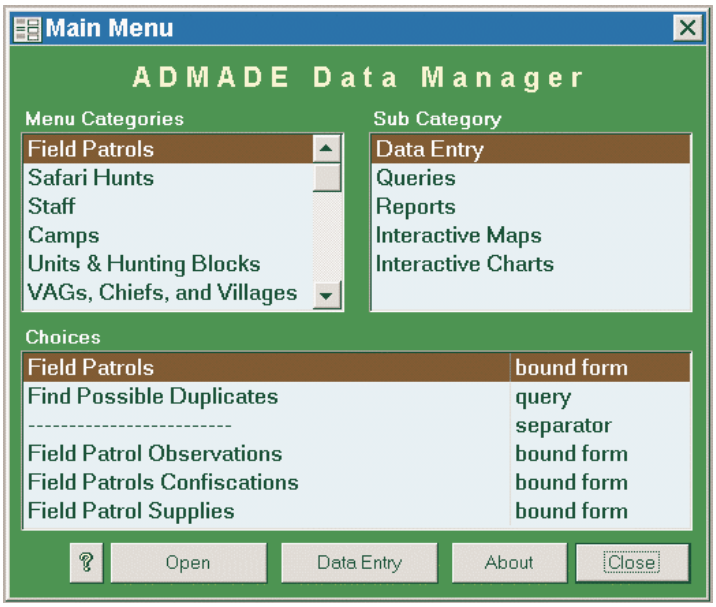


Figure 22 – The ADM main menu

Decision model menu. Decision models offer an alternative interface for opening data objects in ADM. Unlike the main menu, which organizes objects into a somewhat abstract categorical hierarchy, decision models present data objects through a graphical representation of real life questions and decision processes (Figure 23). Decision models attempt to merge in one user-friendly interface the conceptual basis of decision making with the plethora of quantitative, spatial, and qualitative data. Hence they are especially useful for analytical studies or complex management decisions based on data from a variety of sources. Each box in the decision model provides a description of the role of that factor in the decision process, as well as any relevant data objects for that factor. Decision models can be created or customized by users through a user-friendly design interface.

Object filtering. Because ADM stores monitoring data for all years and units in the same tables, a mechanism is needed to allow the user to specify which year(s), unit(s), species, village(s), etc. should be presented in the different summaries. This is achieved through a universal "filter manager," which is integrated into the menu system and pops up each time the user opens a new summary, chart, map, etc. The filter manager features an easy point-and-click interface, and offers several different ways users can select only the data they're interested in (Figure 24).

Integrated object documentation. In addition to the Users Guide, which explains how to use and expand ADM as a whole, the menu system also features documentation for individual data objects. This means that each data entry form, tabular summary, interactive graph, report, and interactive maps has plain-English description specifying who designed the object, when it was created, what it represents, and how it is calculated. This information is available from the main menu or after an object has been opened. This feature is critical to enable summaries and analyses to be reused over and over, and allows new users to become quickly oriented to the available data sources (Figure 25).

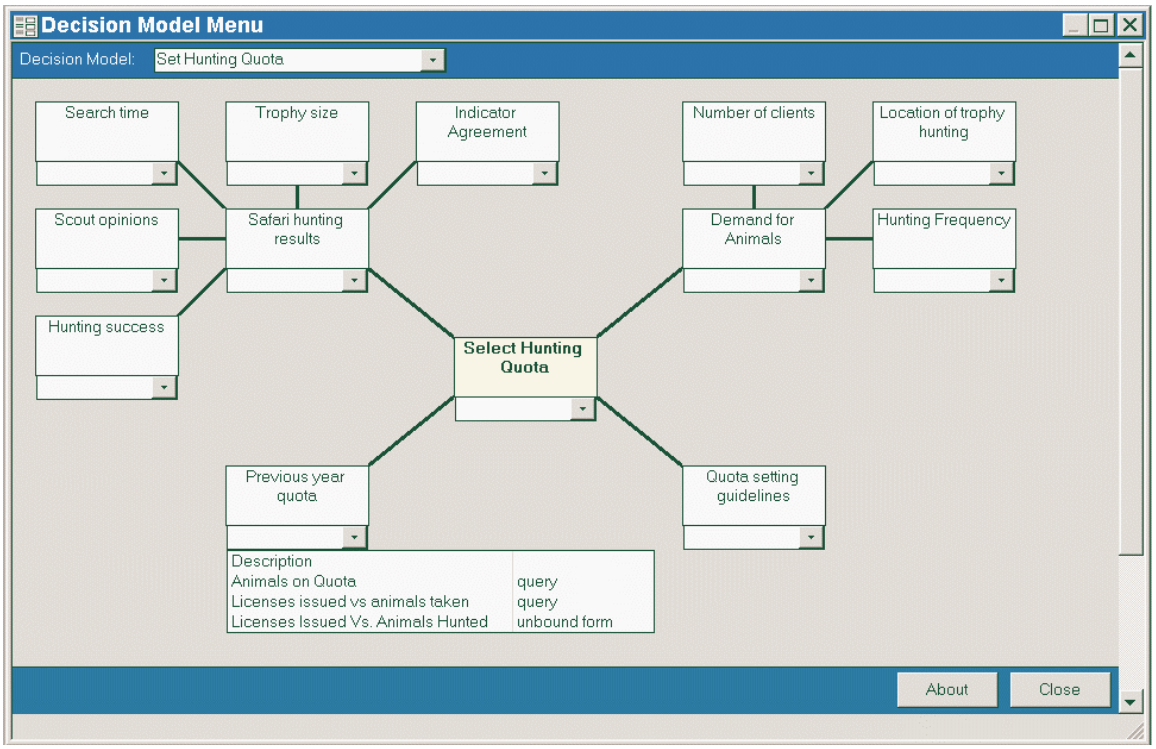


Figure 23 – Decision model interface

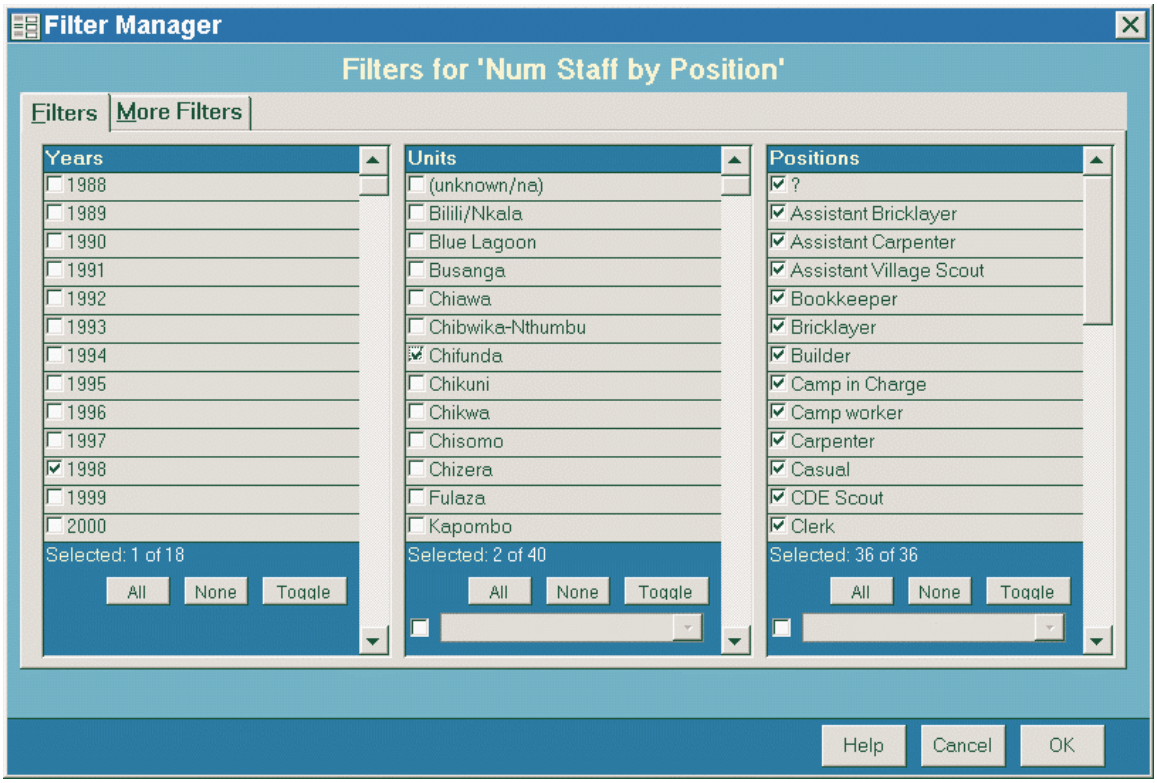


Figure 24 – The ADM filter manager

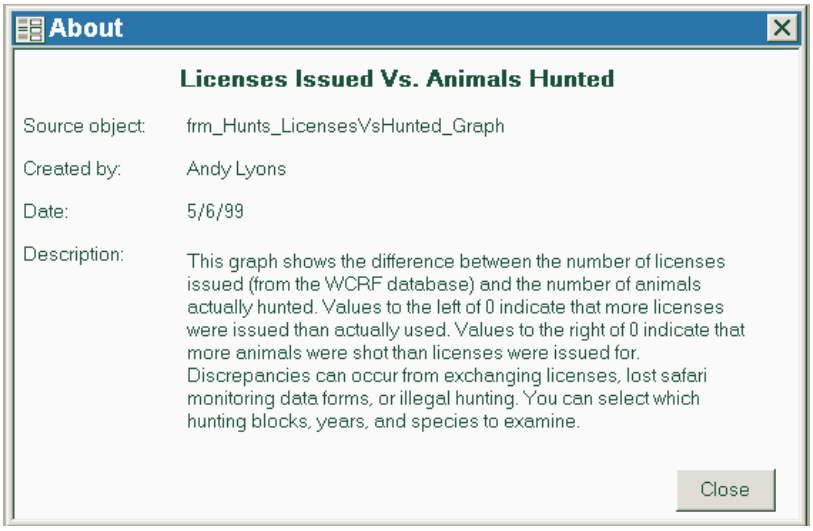


Figure 25 – The ADM about window

Data logging. ADM is a true multi-user application used by multiple data-entry technicians at Nyamaluma and possibly in the field. ADM's data logging feature keeps track of which records are being added, deleted, or changed. The log saves information about when data was altered, which table and which records were changed, and who made the change. Subsequently, if there are any problems with records being accidentally altered, deleted, duplicated, or improperly synchronized, the data log can be opened and the problem investigated. The data log is mostly a precautionary feature, but has proven useful for problem-solving on several occasions.

Integrated mapping capability. Using MapObjects as the link between the tabular and spatial data, ADM features user-friendly interactive maps for visualizing the spatial element of monitoring data. These maps present spatial summaries of data, such as reviews of grids used by safari clients, where poaching activity has been observed, which areas generate the most revenue, field patrol effort, etc. Interactive maps have many of the same toolbar options as ArcView, including the ability to add labels, change display colors or the classification scheme, make additional layers visible, create a legend, pan and zoom, etc. New maps can be easily created and added to the menu system by creating a new map definition, which specifies properties such as the layers which should be added, data the map should be linked to, etc. All interactive maps can be printed, copied to the clipboard, or sent to PowerPoint, and all make use of the standard features of the menu system, including filtering with the Filter Manager and plain-English object documentation.

ADM's interactive maps use many of the spatial layers that have been digitized at Nyamaluma, as well as a few others collected from various sources. All layers are national in scope, allowing maps to be produced of multiple GMAs. The following GIS layers are available:

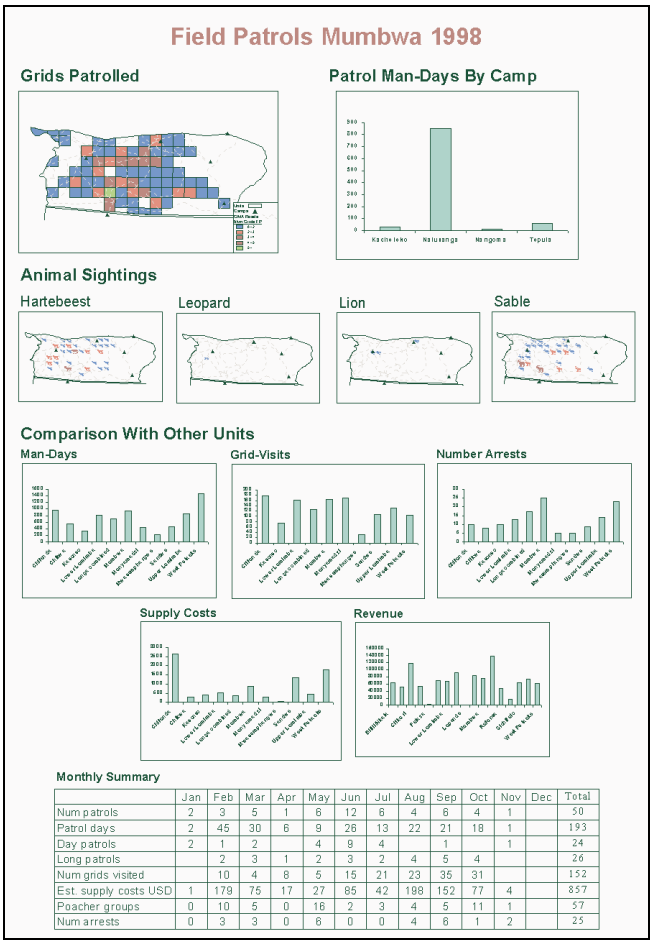
Hunting blocks*	Provincial capitals
Units*	National roads
5km2 grids*	National rivers
Scout camps*	Railroads
GMA roads*	Utility lines
GMA rivers*	Airports
National parks	Villages
Districts	Wetlands
Provinces	

*digitized at Nyamaluma

Poster-size layouts. One of the most important outputs of Nyamaluma's database are the large poster-sized layouts of monitoring data, which are used in community meetings and workshops. ADM uses a programming technique called OLE Automation to automatically create new layouts in PowerPoint using data from Access. PowerPoint is the Microsoft presentation application that also comes with Office 97, and supports VBA as well as a number of drawing tools. Layouts that are created by ADM through PowerPoint can contain any combination of maps, charts, text, or summary tables (Figure 26). New layouts can be designed by creating a "slide template" definition, which specifies the layout of different elements on the page. Slide templates can output in 3-4 minutes what previously took a trained technician a couple of hours to produce, a significant time savings when multiplied by 15-20 units several times a year. Users can use the filter manager to select which data should be summarized when creating the layout. Once created in PowerPoint, users can edit the layout, add other elements such as digital photographs or clipart, and finally print it out on a desktop printer or Nyamaluma's plotter.

Import-export object wizards. ADM is already being used at different sites within Zambia, and may one day be used at sites on different continents. The import-export menu item wizards make it possible for an ADM user at one site to design new summaries, charts, data tables, maps, slide templates, etc., export those objects to a temporary file, email that temporary file to a different user, and then seamlessly import the objects back into the ADM menu system at the destination. These wizards make it feasible to provide long-distance tech support for ADM users who may not have the technical experience or familiarity with Access, an important feature particularly if monitoring data is to become a tool for decision makers.

Documentation. A comprehensive Users Guide has been written describing how to use ADM. The Users Guide has sections both for novice users as well as technical staff who need to know how to maintain and expand the system. The Users Guide comes both in printed format as well as a context-sensitive Windows help file (National Parks & Wildlife Services, 1999c).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Num patrols	2	3	5	1	6	12	6	4	6	4	1		50
Patrol days	2	45	30	6	9	26	13	22	21	18	1		193
Day patrols	2	1	2		4	9	4		1		1		24
Long patrols		2	3	1	2	3	2	4	5	4			26
Num grids visited		10	4	8	5	15	21	23	35	31			152
Est. supply costs USD	1	179	75	17	27	85	42	198	152	77	4		857
Poacher groups	0	10	5	0	16	2	3	4	5	11	1		57
Num arrests	0	3	3	0	6	0	0	4	6	1	2		25

Figure 26 – ADM poster-sized layouts that combine maps, graphs, and tables

Data processing lessons learned

Data collection programs should be designed in consideration of information management capacity. Like many conservation and development monitoring systems, ADMADE's monitoring program has generated a lot of data, perhaps more than can be practically analyzed. At the unit level, the capacity to study and summarize data is quite limited, and most data forms remain in the filing cabinet until support staff from Nyamaluma come to help analyze them. Even at Nyamaluma, constraints on staff time and software have prevented some datasets from being fully entered, resulting in some dataforms sitting unanalyzed for months or in rare cases years. Hence an important caveat for all CBNRM programs is to not collect more data than can be feasibly processed. While everyone, in particular project managers, would like more data for their reports and assessments, collecting data that can not be used is inefficient and can lead to disillusionment when those involved in monitoring fail to see the fruits of their labor.

A well-constructed computerized database at the project level is an effective way of storing, analyzing, and disseminating information. Over the history of the ADMADE, Nyamaluma has been able to process an impressive amount of data streaming in the from the units. The main tool for this task has been the computerized database system. Nyamaluma's database allowed thousands of dataforms to be entered and summarized in a consistent manner. The database upgrade increased the capacity of Nyamaluma to enter

data, analyze it, and create summaries for a variety of stakeholders. The database has also, for the first time, largely removed the technical barriers to disseminating data electronically. Nevertheless, as the number of dataforms introduced into the program continues to grow, ADMADE will need to continue to ask itself--both at the community and project level--when does an additional investment in monitoring cease to yield proportional benefits.

Data Quality Evaluation

Table 10 summarizes the different types of data errors and the controls that steps can be used to detect or prevent bad data. Mistakes in measurement that produce outliers are relatively easy to catch, either with human checks, validation rules in the computer, or histograms. Bias that may be introduced from poor sampling (either too small or non-representative) can probably be detected using statistical summaries, but how to interpret non-representative sampling is a more challenging issue. Data which have simply been lost are also easy to detect, but it is hard to interpret how that may affect the results. Finally falsification of data is probably the most difficult type of error to deal with, so the best treatment there is simply prevention.

Table 10 – Potential errors and data quality controls

Types of Data Errors	Data Quality Controls		
	Human: Data form certification and data entry checks	Computer: Referential integrity and validation rules	Statistics: Tabular and graphic
Poor measurement or recording – incomplete records	x	x	
Poor measurement or recording – outliers	x	x	x
Small sample size			x
Biased sampling temporally			x
Biased sampling spatially			x
Missing data bias			x
Data falsification	x		

Applications

Adaptive Management Practices

The ultimate measure of success of a monitoring system is whether it can provide a basis to answer the important questions posed by its stakeholders. Table 11 summarizes a few of the very fundamental questions about ADMADE, and gives an indication of how well ADMADE's monitoring system is able to provide data relevant to the question. Each of these questions could be a significant research study unto itself, and none are so simple that they could be answered by a single graph or table of monitoring data without additional data collection and analysis. However the table tries to capture where ADMADE's data is strongest, and where additional data or species studies are needed for the questions about the "big picture."

Feedback for Monitoring Implementation

With nearly ten years experience in designing dataforms, the Nyamaluma research unit has learned, sometimes the hard way, the importance of pilot testing dataforms. Some of the common mistakes on dataforms have been traced to layout problems, confusing terminology, or ambiguous wording. Even simple design elements, such as using the # sign to stand for 'number' have been misunderstood and caused errors. Training is of course an important element in using dataforms. However, because not all scouts can attend training when changes are made to dataforms, there is no substitute for intuitive design, clear instructions, and pilot testing.

It often will take several attempts to work all the bugs out in a dataform. Reviewing the mistakes on dataforms is an ongoing exercise by the extension and research staff, providing feedback which is then used when dataforms are reprinted. Other times, design changes have been introduced even after a dataform is printed, whereby scouts are asked to pencil in the new changes. Other design changes have been implemented in the field. Aside from being confusing for scouts, having multiple versions of dataforms in circulation can cause incomplete data sets and make certain types of analyses difficult or impossible.

Nyamaluma has also learned that dataforms should be designed primarily for recording very specific data. Tabular data-entry sections which prompt the recorder for specific pieces of information tend to work better than open-ended descriptive sections.[13] Open-ended sections are prone to being overlooked by scouts and can generate incomplete or irrelevant details that can not be analyzed. Examples of comments from the first version of the field patrol dataform include irrelevant remarks such as "it was a good patrol, only too many mosquitoes," as well as ambiguous "we found some footprints." The newer dataforms still have a comments section for unusual observations or problems, but the majority of observational data are quantified under discrete columns such as "grid," "snares found," "fresh poacher camps," etc.

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[13] ADMADE's sister program, LIRDP, came to the same conclusions about dataform design (see Jachmann, 1998)

Table 11 – Key questions matrix

Question	Significance of Question	Question is important to:	Possible data source(s)	Degree to which the question can be answered	Additional data needed
Ecological impact					
Are wildlife populations stable?	Wildlife conservation is one of the main goals of the program; needed for sustainability	ZWA, GRZ, WCS, safari industry, USAID, intn'l conservation community, rural communities	hunting statistics, key informants, safari hunting revenue	good – indirect measures are generally in agreement with each other	periodic aerial census or ground counts
Is habitat being conserved?	Loss of habitat is the greatest long-term threat to wildlife; conserving habitat is a project goal in itself	ZWA, WCS, safari industry	key informants	fair – disturbance to habitat is only monitored in patrolled areas	satellite imagery; periodic vegetation surveys
Has poaching been controlled?	Poaching is the greatest short-term threat to wildlife and one of the primary stimuli to introduce ADMADE	ZWA, WCS, donor community, safari industry, rural communities	field patrol records, poacher case records, key informants	fair – generally strong consensus between patrol observations; poacher arrest data incomplete	more complete poacher case records; court records; snare surveys (begun 1999); bush meat trade
Social impact					
Are rural households benefiting from ADMADE?	One of the main goals of the program	USAID, ZWA, rural communities	selected case studies, field reports	poor – no baseline data was collected; only recently has monitoring of community development projects started to measure benefits; data largely unrepresentative	random socioeconomic household surveys, systematic monitoring of project benefits

Table 11 – Continued

Question	Significance of Question	Question is important to:	Possible data source(s)	Degree to which the question can be answered	Additional data needed
Is ADMADE understood and supported by rural communities?	Support for the program is a strong indicator that it is having a positive social impact; important for sustainability	USAID, ZWA, GRZ, rural communities	selected case studies, observations at community functions, field reports	poor – negligible monitoring has been done on community attitudes, awareness, and understanding of ADMADE	random household surveys
How has ADMADE affected food security?	A goal in itself; impact may be both negative (less access to meat) and positive (through projects); strong relationship between food security and poaching	USAID, ZWA, GRZ, rural communities	selected case studies, crop damage records	poor – crop damage dataset incomplete; case studies exist for only a couple of areas; little baseline data; food security not a focus of most community projects	more rigorous monitoring of crop damage, community based food security surveys
How democratic are ADMADE CBOs	Autocratic community leadership has been a long-term problem; democratic structures are strongly correlated with community support and equitable distribution of benefits; democratic decision making a goal in itself; precursor for sustainability	USAID, ZWA, GRZ, rural communities	field reports, observations, anecdotal evidence, demographic data	fair – local governance style has not been measured by any study, a politically sensitive topic; however many anecdotal accounts of autocratic decision making by traditional authorities	a new checklist of indicators of democratic management, population distribution in VAGs and management committees
Sustainability factors					
What is the population growth rate in ADMADE GMAs?	Prosperity and population growth can be a long-term threat to natural resources	ZWA, GRZ, USAID, rural communities	household demography, case studies	fair – baseline data first collected 1998/99, some case studies of village expansion	country census data 2000, repeated household demography surveys

Table 11 – Continued

Question	Significance of Question	Question is important to:	Possible data source(s)	Degree to which the question can be answered	Additional data needed
Is ADMADE addressing the real threats to wildlife?	The proximate threats to wildlife are well known, the deeper roots are more difficult to identify and address	ZWA, GRZ, WCS, USAID, rural communities	workshops, land use plans, case studies	good – ten years of experience and data has provided a good basis to understand the proximate and ultimate causes of wildlife degradation.	additional studies on macro-micro relationships, urban-rural linkages, long-term development, institutional capacity building, commercial bushmeat industry
Do communities have the capacity to manage their own wildlife?	The devolution of responsibilities to communities is moving forward, but the limits to what communities can be expected to accomplish have yet to be reached; the level of required external long-term support to communities is unknown	ZWA, USAID, WCS, GRZ	trip reports, case studies	fair – the experiment of developing community capacity continues, however ADMADE has done relatively little to measure the effectiveness of its training program and other capacity building measures	a study exploring community capacity building, e.g., best methods, pace of change, limits.
Are law enforcement activities effective and efficient?	Law enforcement is the backbone of resource management; strong correlation between efficiency of operations and achieving management goals	ZWA, USAID, WCS, rural communities	field patrol records, poacher case records	fair – several measures of patrol effort and patrol costs available; need better data on the number and outcomes of poacher arrests	study of court-imposed punishments, repeat offenders, time-allocation of scouts, finer measures of patrol effort
Is safari hunting a sustainable source of revenue?	ADMADE is precariously dependent on the safari industry; sport hunting is declining in many western countries	ZWA, USAID, WCS, rural communities	safari client questionnaire, personal experiences	poor – the safari industry as a whole has not been well studied; this is beyond the scope of ADAMDE	a study on the economics and demographics of safari hunters and safari hunting
Can ADMADE be replicated?	Twenty chiefs in Zambia are asking for ADMADE to be introduced; the design may be applicable to other areas or resources; donors are looking for CBNRM models	ZWA, USAID, WCS	special studies	fair – ADMADE has developed general guidelines where it works best, less well established is how it should be implemented and supported, the ADMADE approach has not been tested with non-wildlife resources	national workshop to develop guidelines for introducing ADMADE to new areas, dialogue with other CBNRM programs in non-wildlife sectors

Scouts and their field supervisors see monitoring primarily for the benefit of higher level administration. When asked why they were collecting data on field patrols, safari hunts, or investigating crop damage, the most common answer from village scouts could be paraphrased as "because it's my job." Scouts in general do not have a clear understanding of why collecting this information is important. Many thought the information was needed by higher level officers, one remarking to the effect, "we don't need to write these things down for ourselves, we already know where the poachers and animals are." Another believed that there was someone at NPWS command headquarters that was reviewing his dataforms as they were submitted.

Exercises such as land-use planning and quota setting can increase the perceived value and relevance of monitoring activities at the community level. Involving scouts in community-level exercises such as quota setting meetings and land-use planning workshops can increase their appreciation and understanding of the role of monitoring in information-based decision making. Unfortunately however not all scouts are able to attend such functions. Frequently only those scouts based at the unit headquarters, or who happen to be at the unit headquarters during a meeting, have the opportunity to see how their information is used.

Dissemination Routes

Disseminating results to stakeholders is required for adaptive management to take place, yet too frequently receives little attention. The ultimate aim of monitoring in adaptive management programs is to provide feedback to the program for improving planning and management. Performing analyses, creating summaries, printing wall maps, reports, etc. are all well and nice, but unless monitoring results are disseminated to the appropriate audience and result in a better program, monitoring will not have fulfilled its purpose. This is true both at the community and project level.

Dissemination of results is a critical prerequisite for this feedback process to occur. At the community level, people who need monitoring results include scouts, community leaders, safari operators, professional hunters, the unit leader and his staff. At the project level, the relevant stakeholders include training and research staff at Nyamaluma, senior officers at ZWA Headquarters, and ADMADE's institutional partners. These are the parties responsible for planning and implementing ADMADE at the various levels, and all need access to monitoring data if they are to make informed decisions.

ADMADE has been more successful in disseminating monitoring results to some parties than to others. The research and extension staff at Nyamaluma are of course familiar with the results of monitoring, because they are intimately involved in the analysis and interpretation. Unit leaders and their deputies are probably the second-best informed, as they have the most contact with Nyamaluma officers and are recipients of printed maps and summaries. ADMADE has relied heavily upon unit leaders and their deputies to inform the public about monitoring results, however the extension staff and scouts I interviewed did not indicate such exchanges are the norm. Information flow within the unit will most likely improve as the community management committees step up and play a bigger role.

The audience which has perhaps been most poorly reached by ADMADE's dissemination system for monitoring results are the national stakeholders, in particular

senior officers at ZWA headquarters, and the donor and NGO community. This kink in the information flow has been caused at least in part by insufficient middle-level management, and is recognized at Nyamaluma. The ADMADE newsletter, which is the one update published at Nyamaluma on a regular basis, is oriented more towards news items and promoting the "ADMADE Vision," instead of reporting results which can be used to guide policy makers. The challenge for ADMADE is to find mechanisms to keep all of its constituents informed, without compromising the level of feedback to the people who need it the most--the rural communities.

Presentation of Results

ADMADE has been very successful in getting maps to its units. Any visitor to an ADMADE unit headquarters is likely to see maps produced by Nyamaluma on the walls and in files. Often maps produced at Nyamaluma are the *only* maps available in the unit. Government maps produced by the Survey Department are not commonly available in ADMADE areas.

Developing appropriate maps for the units was a strong emphasis at Nyamaluma during the first phase of ADMADE. The research team digitized dozens of GRZ Survey Department to create smaller-format base maps for each area. Features on all base maps include the unit boundary, streams and roads, scout camps, and a 5 km^2 grid system. Most GMAs also have a GIS layers for human settlements, water holes, safari camps, and VAG boundaries (National Parks & Wildlife Services, 1993a).

Nyamaluma produces basically two types of maps from its GIS. Letter-sized base maps are designed primarily for assisting navigation during patrols, planning field operations, and geo-referencing observations for data collection. Base maps are printed in bulk, and distributed to all village scouts involved with monitoring. In 1998/99, unit staff and village scouts also received instruction in using base maps to maintain running summarizes of monitoring data. Using a simple system of hash-marks or color shading in the 5 km^2 grids, and maintaining a separate base map for each type of observation, scouts have been shown how to maintain their own spatial summaries of where they have gone and what they have seen. The intent is to increase the capacity of scouts and community management committees to summarize monitoring data, thereby reducing the amount of lag time for analysis and dependency outside support staff, and increasing the likelihood that scouts and members of the resource management committees will use monitoring data when planning activities.

Flipchart-sized presentation maps are also created to illustrate monitoring summaries and land use issues. They are used primarily during community group meetings and planning sessions. Presentation maps may illustrate any georeferenced dataset, such as trophy locations, patrolling effort, location of snares encountered, safari revenue generated by grid, areas of land-use conflict, etc. Until 1999 presentation maps were all created manually, and so the design and content were highly customized for each area. Nyamaluma's new GIS system now has the capability of automatically creating presentation maps based on standard templates, which can include tabular and chart data as well. This feature will probably be used to make the preset maps which are needed on a regular basis, such as the annual summary of field patrol results, while the manual system will be used to create customized maps for special studies or land use plans.

Although difficult to quantify, the maps distributed by Nyamaluma have undoubtedly proven valuable for planning and evaluating field operations. Because they are customized for individual areas and printed in bulk, base maps are available to scouts for monitoring every field patrol and safari hunt. The large format presentation maps make monitoring results relatively easy to understand for community residents. ADMADE's area of operation is quite large, and without an in-house capacity to produce maps, ADMADE would have found it much more difficult to visualize results and communicate trends in management and land use.

Maps have also proven extraordinarily valuable for land use and development planning. Maps help crystallize dialogue around the important issues by visualizing land use patterns, conflicts, and opportunities. Several GMAs were able to resolve one of the most difficult problems that has plagued ADMADE, inequitable distribution of benefits, by discussing a map which indicated the locations of community development projects. No contentious accusations or finger pointing was necessary, because the cluster of projects around the chief's compound was in black and white before the entire community, and dialogue quickly focused on how to better distribute projects throughout the GMA.

Maps also have subtler educational values in helping to convey concepts such as the finiteness of land and resources, and the scope of threats to an area. This is an important realization for community residents who do not travel extensively and may perceive their land and resources to be virtually limitless. One sub-authority was presented a map with a satellite photo in the background, clearly showing the areas affected by bush fires. The chief and sub-authority members were shocked to realize how much their area burns each year, and quickly developed an action plan to minimize late season burns which cause the most damage. Other innovative land use resolutions which have developed from dialogue focused around maps include resolutions to move fishing camps closer together to minimize obstructions to water access during the dry season, relocating splinter settlements that encroach into prime wildlife habitat, identifying potential areas for a second safari camp, and increasing patrolling efforts on known poacher routes.

Recommendations

1. Improve Financial Monitoring

The most pressing information gap for ADMADE, commonly acknowledged both within the program and by external reviewers, focuses on revenue flow within the project. At the national level, total revenue from safari license sales is fairly well known and accessible, thanks largely to the computerized licensing system at the Wildlife Conservation Revolving Fund[14] (WCRF). However revenue flows within the WCRF, between the WCRF and local communities, and within local communities, are far less transparent.

Lack of transparency in ADMADE's financial flows is an ongoing problem which breeds confusion and mistrust, and creates opportunities for mismanagement of resources. Both department field staff and leadership of local communities commonly suspect the

[14] In 1999, a decentralized licensing system is being pilot tested, which might make monitoring license sales more difficult

WCRF is intentionally withholding their money and delaying disbursement because it is used for other purposes. Delays in disbursement is disruptive and costs the communities money because they do not receive any interest generated from their revenue and lose purchasing power because of the 30% annual inflation rate. This has interfered with program activities at the field level on several occasions, and erodes the basic foundation of trust between government and communities upon which the program is based. More than one chief has suspended or threatened to suspend all activities in their area until the department releases their funds.

The WCRF in turn withholds payments from communities because there are strong suspicions that previous disbursements have not been used and cleared properly. In some units, revenue flows through the regional command, adding another layer to the bureaucracy and creating more doubts in the community as to whether they are receiving everything they are supposed to. In almost all units, planning field operations and community development projects is hampered by a lack of knowledge of how much money the area has earned or is projected to earn. Clearly the lack of transparent accounting and limited dissemination of financial data is causing damage at all levels.

Unlike some monitoring problems, which can be addressed satisfactorily by interventions of Nyamaluma alone, improving financial monitoring will require an integrated approach with leadership from the highest levels of ZWA. Although improved information flow is certainly part of the solution, communities also need to be trained in and responsible for accounting procedures, with closer field support and regular external audits. The WCRF needs to strengthen its reporting of revenue use and educate people about the policies and formulas used for distribution, and perhaps computerize analysis of community financial reports which would shed light on how communities are using their revenue. Most importantly, mechanisms for sharing financial data between all parties need to be strengthened to eliminate confusion and distrust.

Monetary issues are by their nature highly charged political hot issues, however failing to address and improve financial monitoring may ultimately prove to be ADMADE's Achilles tendon.

2. Monitor Project Impacts

The impact of community development projects has not been well studied. Information that has been systematically collected about projects to date is limited to the start and completion dates, amount of money spent on the project, and the status. Once a project is completed, there is no monitoring of the project except for special studies. Recording the number of beneficiaries, as well as the value and nature of the goods or services from the project, has not been institutionalized and is only collected on an ad-hoc basis.

Monitoring project impact is important not only to meet donor reporting requirements and determine whether a community has used its financial benefits efficiently, but also to assess whether community development efforts are indeed complementary to the other objectives of ADMADE. Recently there has been a growing realization that many of the most popular community development projects, such as schools and clinics, do not directly address the number one threat to wildlife in many areas - poaching driven by hunger - and may not represent the collective will of the community. This type of

finding can be used to better plan community development needs, and prioritize those projects which address food security and land use issues which are more conducive to ADMADE's long-term survival.

3. Improve Dissemination of Results

Nyamaluma, in its role as ADMADE's central nervous system for monitoring data, has recognized a need to improve communication of results to stakeholders, particularly to organizations working at the national and international levels. Sharing findings with other groups will likely play an even greater role in the future as Nyamaluma attempts to expand the portfolio of services it offers to communities, develop partnerships with other organizations, and diversify its funding base. Each type of structural change in the program is accompanied by new information needs for planning and evaluation.

In the past, ADMADE's monthly newsletter has been its primary link to the outside world, even to the point of using it as a substitute for quarterly reports to USAID. However if ADMADE wishes to maintain support within the new ZWA leadership, donor community, and domestic and international wildlife sectors, there is clearly a need for more in-depth and regular results reporting.

One of the strategies ADMADE has employed in the past, and should continue to pursue, is utilizing advances in information technology to facilitate disseminating results. ADMADE pioneered the use of GIS for CBNRM, and now has a state-of-the-art database and web site which could serve as a clearinghouse for monitoring data. The web site is currently under utilized, however and there are numerous evaluation reports, monitoring summaries, and special studies that could be posted.

Another strategy ADMADE may want to consider is to utilize the coordinating office in Chilanga as a national repository of data on ADMADE. Some of the most important audiences for monitoring results at the program level are officers within ZWA, the donor and conservation organizations in Lusaka, and the media. The coordinating office should serve as a liaison with these groups, and have at their deposal materials for talks, presentations, and program planning. Many of these audiences do not require the latest, cutting-edge analyses from the field, but simply very basic information on what-where-why-when-how of ADMADE. Misperceptions of ADMADE and its approaches are common, even with the professional conservation and development communities.

4. Coordinate with Other National Monitoring Initiatives

As described in the review of stakeholder information needs, there are several parallel projects and organizations in Zambia directly involved in wildlife monitoring. These include the National Environmental Monitoring and Information Network, and the Wildlife Resources Unit at Environmental Council of Zambia. ADMADE has yet to solidify its relationship with these other initiatives, and define whether it will be an active or passive partner with other monitoring programs. ADMADE has much to contribute to other monitoring programs, not only in terms of data, but also in methodology and experiences. Conversely, ADMADE could also benefit from other monitoring programs, through improved dissemination of ADMADE's accomplishments, complementary datasets in adjacent protected areas, validation of findings, cooperation in organizing censuses such as aerial surveys, and sharing experience with monitoring methods that ADMADE has yet to develop, such as vegetation, agricultural, and socioeconomic

monitoring. As a program of the government of Zambia, ADMADE also has a certain obligation to coordinate with and support other government monitoring programs. At a very minimum, coordination with other environmental monitoring initiatives is needed to avoid conflict and duplication of efforts.

5. Revisit Incentives for Monitoring

From the very beginning, ADMADE's policy towards incentives for data collection has been to discourage material incentives to reduce the likelihood of data falsification. The fear is that scouts will make up nonexistent field patrols to collect an additional bonus for data collection. As an alternative to material incentives, the ADMADE model predicts that scouts will be motivated to do additional work in data recording from a sense of pride emanating from the belief that their dataforms will ultimately help their community.

Units are encouraged to recognize and praise scouts who are involved in data recording in non-material ways. Nyamaluma itself at one time sponsored a national competition for the best data recorder, however it was eventually abandoned under the rationale that units should be responsible for providing awards for excellence in data collection. Invitations to attend additional training courses at Nyamaluma is also believed to be an incentive for scouts to excel in monitoring.

Not surprisingly, the lack of direct incentives for monitoring is not popular with scouts. Because some scouts are involved with monitoring and others are not, it is seen as an additional function above and beyond the primary role of law enforcement. The concern about data falsification may be warranted, however the benefits of providing scouts with incentives for monitoring need to be further explored. This issue may resurface on its own as scouts have recently been asked to conduct specialized field patrols specifically for the purpose of collecting data (e.g., snare survey, fish camp patrols, water holes patrols).

Village scout salaries average between $20 and $40 a month, a rate which forces many to live with their families in poverty, unable to afford to send their children to school, buy food during the hungry season when food stocks are low, purchase medicine, or live in decent housing. One could argue that village scouts are being exploited by the government and their own communities because their status does not entitle them to the same protection under the labor laws of Zambia as their civil servant counter parts who do the same work and get paid two or three times as much. Providing incentives for additional monitoring duties may help alleviate the condition of village scouts, and rather than increase the likelihood of unethical behavior, actually reduce the probability that scouts will be susceptible to bribes or poaching for their own survival.

The widespread inadequacy of village scout salaries seems to be one of the most myopic and self-defeating policies in ADMADE. The few ADMADE areas which offer scouts bonuses, provided by a safari operator or NGO, for confiscated snares, weapons, or arrests, seem to have better patrolling effort. ADMADE's sister project, LIRDP/SLAMU, has also documented a strong correlation between scout effectiveness and salaries (Jachmann, 1998). Hopefully more ADMADE areas will take note of these experiences and view scout performance bonuses as investments in their wildlife resources.

6. Prioritize Data Needs

Under the 1998 Wildlife Act, ADMADE has recently introduced several new structures at the community level: the community resource board, the village area group, peer groups, and three technical committees. Introducing these new structures comes with a set of data issues and a new layer of monitoring to ensure that the changes are having the desired effect. Community participation in meetings, community development needs, and allocation of project revenue are all examples of monitoring needs that have only recently been introduced. Additional calls for monitoring the impacts of community development projects, conducting snare surveys, fish camp and waterhole patrols, household demography, and collecting data on food security issues, are other examples of monitoring activities that have recently come aboard.

ADMADE/Nyamaluma needs to prioritize their data needs in light of their capacity to collect, process, and analyze data, else they may find themselves struggling to swim in an ocean of monitoring data. Nyamaluma has in the past introduced new dataforms or changes to dataforms that it was unable to process or analyze. Although Nyamaluma's new information system significantly removes many of the technical barriers to managing data, time and manpower are still limiting factors.

Many of the new dataforms introduced in 1999 were designed to be used primarily within the community. It remains to be seen whether communities will have the capacity and interest in using so many new dataforms. ADMADE may also wish to examine the community based monitoring methods in other rural development projects, such as the community self-monitoring ledgers in the CARE Livingstone Food Security Project, or the methodology for developing local level business plans in CLUSA Zambia's Rural Group Business Program. Although ADMADE has substantial experience in monitoring wildlife and law enforcement, other NGOs have greater experience in community mobilization and development reporting, lessons which may be of benefit to ADMADE.

7. Increase Community Capacity in Data Analysis

Nyamaluma's 1999 workshops in monitoring skills were a good step in developing the capacity of community organizations to analyze their own data. These efforts need to be continued and expanded for community organizations to be equipped with the skills to perform functions such as quota setting and running land use planning workshops. Increasing the capacity of communities to use their own data would also reduce the turn around time between data collection and production of useful results, and relieve the pressure on Nyamaluma's support service so that it can focus more on improving its training programs.

The capacity building process would probably be hastened if ADMADE supplemented its centralized training programs at Nyamaluma with a field-based network of support staff. Developing skills such as managing a filing system, summarizing data spatially and tabularly, interpreting results, and presenting findings to others are best taught 'on the job' through trial and error. Visits from Nyamaluma staff are very beneficial, however their frequency and short durations limit the amount of interaction and support possible. Decentralized extension models have been shown to be a highly effective and efficient strategy for delivering training and information services to rural areas.

8. Monitor the Monitoring

Lastly, making the monitoring system a subject of itself would provide needed feedback for improving how information is being used at all levels. Monitoring the monitoring would not necessarily require introducing a new dataform. Simple measures can be made of the amount, frequency, and spatial representation of each of the datasets. Many of these analyses can already be performed with the new database. A standard questionnaire or interview guide could also be developed to evaluate how adequately ADMADE is meeting the information needs of its primary stakeholders.

Conclusion

This study demonstrated that the Effective Monitoring Framework is a valid tool for analyzing the monitoring system of a community based natural resource management project. This framework builds upon the generic Action Research model and Biodiversity Support Program's Project Cycle model, but includes more detailed components specific to a participatory resource monitoring program. Like the models it is based upon, the Effective Monitoring Framework emphasizes the iterative nature of monitoring and the use of internal feedback loops to integrate monitoring results back into design and implementation of the monitoring system.

The ADMADE conservation program in Zambia has ten years of experience in working with members of rural communities to monitor wildlife and provides a good case study to examine the Effective Monitoring Framework. The framework provided an organized structure to comprehensively describe ADMADE's large and multi-tiered monitoring program, as well as analyze its strengths and weaknesses. Using the framework as an analytical guide, this study helped identify the major bottlenecks in ADMADE's monitoring system and design interventions to address system weaknesses, including an upgrade of the master database and community training on advanced data collection skills and analysis.

The major limitation of the Effective Monitoring Framework is its specificity to community based natural resource monitoring. Resource monitoring by a government agency or conservation organization would probably follow the same general model, but the details under each component and their relative importance would likely differ. The Effective Monitoring Framework is also designed for analyzing monitoring in the context of a sustainable use program. A monitoring program geared for ecological research or detecting trends in biological diversity would be relatively simplified in some components of the model while more detailed in others.

This study illustrated the utility of the Effective Monitoring Framework for the ADMADE program, however before this framework can be added to the toolbox of community based conservation planning tools, additional case studies and refinement are needed. Ideally future studies will test this model in analyzing the monitoring systems of other types of CBNRM programs, such as those which focus on other forms of natural resource use (e.g., forestry, fisheries, veld products, photo tourism) and under different implementation arrangements (e.g., government, NGO, consortiums). There are several other CBNRM projects in the southern African region which would be suitable for additional testing of the Effective Monitoring Framework, including the CAMPFIRE program in Zimbabwe, the LIFE program in Namibia, and the Natural Resources

Management project in Botswana. Developing a common framework which is valid for multiple CBNRM monitoring systems will also assist integrating datasets and scaling up results to get a better picture at the regional level of the effect of these programs on the conservation of Africa's spectacular natural resources.

APPENDIX A
MONITORING DATAFORMS

NPWS/ADMADE/FLDPAT1

FIELD PATROL DATA SHEET (1)

Group leader _____ Group members/Class
Which camp (or camps) do members of patrol party originate from: _____
Date departed _____ Time departed _____ Date Arrived _____ Time Arrived _____

Ration taken (kg units for m-meal, salt, beans, kapenta) _____
Ration returned _____

Ammunition taken (specify calibre) _____
Ammunition returned _____

Number of groups of poachers encountered: _____ Number of poachers arrested _____ Number of poachers escaped _____
Provide grid numbers where groups were encountered _____

Give grid numbers for grids the patrol visited _____

Name	Age	Village	District	NRC No.	Chief	Offence

Firearms confiscated _____
Ammunition confiscated _____

Ivories confiscated _____ Give weight (kg) for each tusk _____

Snares confiscated _____ Snares found on patrol

Government trophies confiscated (specify species and part of animal) _____
_____
Other items confiscated _____
_____

Certified complete by Unit Leader Date

FIELD PATROL DATA SHEET (2)

NPWS/ADMADE/FLDPA2

RECORDER .....

List what species are
being monitored 1)..... 2)..... 3)..... 4).....5)..... 6) .....

Using GRID # from base map, provide correct answers to each column item for every GRID visited during patrol. (Answers should be given as 0 when no occurrence was observed and the actual value (1, 2, 3, etc) when an occurence was observed. In other columns answers should be in a descriptive form (words) as appropriate. For "species being monitored " column, provide names in column headings for those species being monitored and give numbers sighted below.)

GRID	ANIMALS CARCASSES			# of	Fishing	Water	Fresh poacher	Poacher groups	Gun shots	Fires Sighted	For species being monitored, write species name in column headings						Day time
Number	Species	Number	Cause	Snares	camps	holes	camp	sighted	heard	Y/N	1	2	3	4	5	6	hrs in grid

Below provide any other information pertaining to the patrol of possible importance. Be sure to use GRID numbers to locate data.
(Note: Other information may include, land clearing, timber cutting, fishing activities, nocturnal sounds (lions and leopards), quality trophy for a given species of economic importance, etc.)

Under the column for CARCASS write the name of species and numbers found. In the column for CAUSE write N for NATURAL, P for POACHED and U for UNKNOWN.
Active hours spent in Grid are those hours patrol members are physically patrolling and do not include hours when group is resting or sleeping.

Green Bullet Evaluation Form

Company name: **Evaluators (not less than 2):**
Operator name:
Hunting area:
Date (not before 1 September):

Criteria for certification: ***Score:***	**Strongly agree**	**Agree**	**Disagree**	**Strongly disagree**	**Comments**
1) Excess game meat was distributed fairly and regularly to the community					
2) Public liaison officer was employed and has actively represented the operator in the community at ADMADE meetings					
3) Operator has maintained a resident PH in the area and he has played an active role in the resource management programme					
4) Operator has made a genuine effort to fulfill his pledges to the local community					
5) Operator has encouraged local employment at his safari camp					
6) Operator has facilitated the training of a Zambian PH					
7) Operator has followed all rules and regulations pertaining to hunting licenses, PH code of conduct, and services expected by clients					
8) Operator has made a personal visit to the hunting area to discuss ADMADE issues with community leaders					
9) Operator has contributed to improvements in equipment, infrastructure or operations of wildlife management					
10) Operator has contributed support toward capacity building for enhancing ADMADE's success in the area					

Signed by operator: Date:

Comments by operator:

NPWS/ADMADE/SAFLICE

SAFARI HUNTING LICENSE RECORD SHEET

Hunting Block:	Recorder:
Safari Hunter:	Client's Surname:
If primary area, record the following	If secondary area, record the following:
Classical:.....Mini.....(tick one)	Hunting rights fees paid:$
Concession Fee paid: $	Receipt No:
Receipt No:	What species are listed on receipt
What block is indicated	
	What block is indicated
Date (Client started hunt):	Date(client ended Hunt):

~~Notes~~:

Information under column heading, "species preferred by client",should be filled in prior to the start of the hunt. This information should be obtained by briefly interviewing the client. The order of preferred species will not be the same as actual species harvested, which should be listed in the order as the animals are hunted. Do not add species to the 'Species preferred' column once the hunt begins. Make sure you indicate dates for animals shot at but client misses, shot at and wounded and animals that were successfully killed. Make sure animals do not have duplicate license numbers.

ENTER BEFORE HUNT	ENTER AFTER ANIMAL IS HUNTED						
Species preferred by Client **	Actual species hunted	Provide dates for the following: Shot/missed	Shot/wounded	Shot/killed	License number	Grid location	Did animal have sign of a snare wound? (Y/N)

Note: This data form should be filled out for each licensed client or for each person who hunts with the professional hunter. This may mean that for a hunter with several clients per professional hunter, the recorder would be responsible for filling in this form

Please ask the client politely to verify the information on this form is correct after the hunt and request that he signs it below.

Certified correct by the above client: Signature _____ Date: _____

Certified correct by the recorder: Signature _____ Date: _____

NPWS/ADMADE/SAFHUNT

SAFARI HUNTING DAILY RECORD SHEET

(Note: This form should be completed by the end of each hunting day.)

I – HUNT DESCRIPTION

Unit _____ Safari operator _____
Date _____ Approx hours spend hunting _____
Recorder _____ Professional hunter _____
Total number of tourists (clients and observers) in hunting party _____
Names of clients _____
Names of observers _____
_____
Observations
1. Sightings of huntable trophies but not hunted species being monitored: Species _____ Grid _____
Species _____ Grid _____
Species _____ Grid _____
Species _____ Grid _____
2. Snares found _____ Grid locations _____
Were they collected (yes/no)
3. Poacher group encountered (yes/no) _____ If yes, grid locations _____
4. Licensed hunters encountered (yes/no) _____ If yes, grid locations _____
Were they a disturbance to client (yes/no) _____ If yes, give details _____
_____
_____
5. Provide details and grid locations to any other human caused disturbance to the safari hunt
_____
_____
_____

II – HUNTING RESULTS

License #	Person who fired gun	Species hunted	Sex	Grid location	Calibre	Successfully killed (yes/no)	Wounded (yes/no)	Hunted as trophy, bait, or both

III – OBSERVATIONS AT BLINDS (lions and leopards)

Species used for bait _____ Grid locations of baits visited _____
Observations

Grid #	# lions visited	# trophy lions seen	# leopards visited	Methods for securing bait (wire or chain)

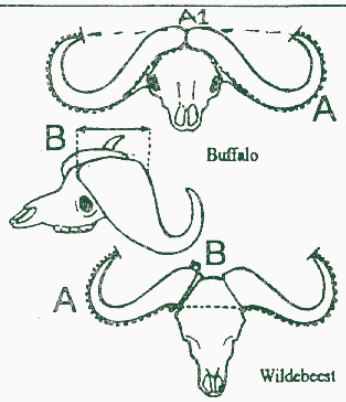
Measurement Records for Harvested Trophy Animals

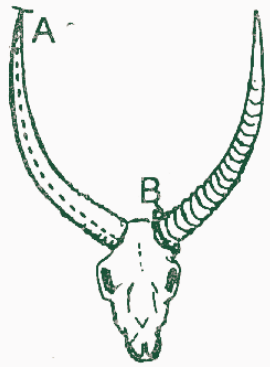
SAFHUNT2/ADMADE/NPWS

ADMADE Unit _____ Recorder _____

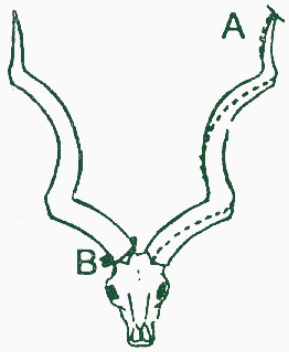
Professional Hunter _____ Client _____

Units for measuring (Check one)
inches ___
centimetres ___





Straight or curved horned trophy species



Spiral horned trophy species

Species _____ Date __/__/__

A1. Tip to Tip (Over head)_____
A. Tip to Tip (Around boss)_____
B. Width (if buffalo)
Circumference (if wildebeest)
Left boss _____
Right boss _____
Hunted for trophy quality Yes__ No__

Species _____ Date __/__/__

A1. Tip to Tip (Over head)_____
A. Tip to Tip (Around boss)_____
B. Width (if buffalo)
Circumference (if wildebeest)
Left boss _____
Right boss _____
Hunted for trophy quality Yes__ No__

Species _____ Date __/__/__

LION

Skull length:_____

Skull width:_____

Species _____ Date __/__/__

LEOPARD

Skull length:_____

Skull width:_____

Species _____ Date __/__/__

	Left	Right
A. Length of horn	___	___
B. Boss circumference	___	___

Species _____ Date __/__/__

	Left	Right
A. Length of horn	___	___
B. Boss circumference	___	___

Species _____ Date __/__/__

	Left	Right
A. Length of horn	___	___
B. Boss circumference	___	___

Species _____ Date __/__/__

	Left	Right
A. Length of horn	___	___
B. Boss circumference	___	___

Example species:
Impala, Roan, Sable, Waterbuck, Lechwe, Puku, Reedbuck, Duiker, Oribi, Grysbok

Species _____ Date __/__/__

	Left	Right
A. Length of horn	___	___
B. Boss circumference	___	___

Species _____ Date __/__/__

	Left	Right
A. Length of horn	___	___
B. Boss circumference	___	___

Species _____ Date __/__/__

	Left	Right
A. Length of horn	___	___
B. Boss circumference	___	___

Example species:
Kudu, Eland, Sitatunga, Bushbuck

POPULATION TREND SURVEY:

Please tick correct choice: Village Scout ____, Regular Scout ____, Tracker ____, Professional Hunter ____

Unit _____ Camp _____ Block _____ Date (mm/dd/yr) ___/___/___
Number of continuous years up to current year the above person has worked as a scout, tracker, professional hunter in the above unit (block) _____

If professional hunter,
1) How many years has he been licensed as a Professional Hunter (PH) in Zambia _____

2) Please provide mailing address: _____

3) Country of citizenship _____ Name of PH _____

This section seeks to know what impression the above person has on population trends for species that occur in the above area. If the person has been in the area for two years only or less, do not continue with this section. The person should be asked the following question for each of the following species. If the species does not occur, then indicate (does not occur) and move to the next species: "For the past years you have worked in this area up to the past five years, what changes in the population for this species have you noticed?" Additional instructions are: 1) The answer should be in terms of change in population size, not whether there are many or few of a given species. 2) Possible correct answers are: increase, no change, or decrease. Mark x for the correct answer. 3) If there has been a certain change in numbers for one area but another change elsewhere, provide details under comments. Likewise, for species showing a decrease, provide details as to reasons under comments.

Species	Increasing	No Change	Decreasing	Comments/Reason for decrease
Buffalo				
Bushbuck				
Crocodile				
Cheetah				
Eland				
Elephant				
Hartebeest				
Hyaena				
Impala				
Kudu				
Leopard				
Lion				
Oribi				
Puku				
Reedbuck				
Roan				
Sable				
Waterbuck				
Wildebeest				
Wild Dog				
Zebra				

For species increasing, what reasons can you suggest for reasons why? _____
_____

Recorders name _____, signed _____

Name of respondent _____

APPENDIX B
INTERVIEW GUIDES

Interview Guide for Village Scouts

Introduction

I am a graduate student from the US and as part of my program I am doing a study on how Village Scouts collect information for monitoring. This questionnaire is part of that research and will ask you questions about patrolling, how you do monitoring, the problems you have, and the training you've received. There is not payment for doing this interview, however your answers will help ADMADE and communities to improve wildlife monitoring. Everything you say will be confidential, and this information won't be used for any evaluation, promotion, or rewards. Your answers won't be shown to your Unit leader or anyone at Nyamaluma, so you should feel free to speak openly. However you don't have to answer any question you don't want to.

Personal Info (record in separate exercise book for confidentiality)

1. Name
2. Unit
3. Status (VS/RS)
4. Interview place and date
5. Interview ID Number (make one up)

Interview Answers (record in interview book)

6. Interview ID Number:
7. Interview Start Time:

Introduction

8. How long have you been an ADMADE scout?
9. Why did you become an ADMADE scout?
10. Have you always worked at this unit or have you also been posted to other units? (if so give location and dates)
11. What training(s) have you had?
    - ♦ Course(s)
    - ♦ Location(s)
    - ♦ Date(s)
    - ♦ Follow-up in the field

Perceived importance of monitoring

12. As a Village Scout, what are the types of activities you do? (e.g., anti-poaching patrolling, safari hunting patrolling, problem animal control, construction, other)

13. Based on your list, please rank each part of your job according to (1) how much time it occupies each month; (2) how much you enjoy it; (3) it's importance for wildlife management. (Bring paper cards)
14. Why do you do monitoring? Who is it for?
15. How do you think management/safari hunting/ADMADE would be different if there was no monitoring?

Anti-Poaching Patrols

16. How often do you go on patrol *(approx. times per month, in rainy season & dry season)*?
17. How many days are your patrols *(specify a range for rainy season & dry season)?*
18. How many people go on patrols *(specify a range for rainy season & dry season)?*
19. How do you decide which areas to patrol?
20. How do you decide which when to leave?
21. How do you prevent poachers from knowing when and where you go on patrol? *(e.g., how long before actually leaving is it decided when and where to patrol?)*
22. When you go on patrol, do you set up base camps in the bush or continuously move with all your katundu?
23. Do you use temporary carriers on patrols? What do they do?
24. Do scouts on patrol always stay together or do they split up?
25. When moving, do the scouts walk single file or spread out?
26. When you go on patrol, how do the scouts work together to do monitoring?

Questions for Data Recorders – Anti-Poaching Patrols

27. Do you do the recording on anti-poaching field patrols? (if no, go to next section)
28. How do you decide which scout in camp will be the data recorder?
29. Do you do monitoring on day patrols, long patrols, or both?
30. Do you ever not do monitoring on a patrol for some reason? Why would this happen?
31. What percentage of patrols would you say you are monitored?
32. Do you do the data recording yourself, or do you get help from other scouts?
33. If you are sick or can't go on patrol, who does the monitoring then?
34. Do you take dataforms with you on patrol?
35. Do you fill in dataforms as you go along, at the end of each day, or at the end of the patrol?
36. Which dataforms do you use in your work? (go through book)
37. For each item on the data form, please describe:
    - How you measure it (e.g., observation, survey, etc.)
    - How often you measure it
    - How you record it
    - Species (as appropriate)
    - Why you monitor it
    - The most important parts of the dataform.
    - The least important parts of a dataform.
    - The most difficult parts of a dataform to fill out

38. Are there times in the bush when you see something that you're supposed to record but you can't for some reason?
39. Are there other things you see on anti-poaching patrols that could be important to wildlife management, but that you don't write down?
40. *Go over summaries of field patrol monitoring data from Nyamaluma. Discuss and note level of agreement between interviewee comments and data from the summaries (e.g., number of days/month, number of scouts who go on patrol, etc.).*
41. Does monitoring on field patrols interfere in any way with the anti-poaching operations? Explain.
42. What are some of the barriers or problems with monitoring on field patrols? What can be done to solve these problems?

Questions for Data Recorders – Safari Hunting Patrols

43. Do you do the recording on safari hunting patrols? (if no, go to next section)
44. How many safari hunts did you go on last season?
45. Do you ever skip monitoring on a safari hunt? If yes, then why?
46. What percentage of safari hunts get monitored
47. Which dataforms do you use on safari hunts?
48. For each item on the data form, please describe:
    - How you measure it (e.g., observation, survey, etc.)
    - How often you measure it
    - How you record it
    - Species (as appropriate)
    - Why you monitor it
    - The most important parts of the dataform.
    - The least important parts of a dataform.
    - The most difficult parts of a dataform to fill out
49. Are there things you see on safari-hunting patrols that are important to wildlife management but that you don't write down?
50. *Go over summaries of safari hunt monitoring data from Nyamaluma. Discuss level of agreement between interviewee comments and data from the summaries (e.g., number of hunts).*
51. What are some of the barriers or problems with monitoring on safari hunts? What can be done to solve these problems?

Using Maps and Georeferencing

52. How do you know where you are in the bush? (Give examples of landmarks used)
53. What makes it difficult for you to know where you are?
54. Do you always know which grid you're in, or are you sometimes uncertain? What do you do if you are uncertain?
55. Do you take base maps with you on patrol? Do you take any other maps with you?
56. Do you ever write on your base maps? (e.g., new landmarks, observations, etc.) If yes, explain.
57. Can you think of any way the base maps could be improved? (e.g., include other geographical features, bigger, use of color, names of features on them)

58. Other than field patrols, do you ever use maps? If so, what maps and for what purposes?
59. Do you ever make your own maps? If yes, for what purpose?
60. If you could make any kind of map, what kind of maps would you make?

Data Management and Supervision

61. After you finish a dataform, where do you keep it?
62. Do you or anyone else make a duplicate copy of your dataforms?
63. How often does your unit leader come to collect data forms?
64. Does the Unit Leader or someone else check your dataforms?
65. Have you ever been told that your data forms had mistakes?
66. How often do you see your Unit Leader and under what context (e.g., meetings, day to day activities, etc.)?
67. When was the last time someone from the RMC or the community asked you about monitoring? What did you discuss?
68. What do they do with the dataforms at the Unit headquarters?
69. Have your dataforms ever gotten lost? If yes then explain.
70. Do you get any copies of summaries or maps that show monitoring information?
71. What do they do to encourage scouts to do monitoring?

Supplies and Support

72. How many data forms of each kind do you have in camp? How many base maps? (*physically count them, differentiate blank and filled ones)*
73. Other than dataforms, what supplies do you need for monitoring (eg., exercise book, clipboard, compass, watch)?
74. If you need supplies for data collection, where can you turn to?
75. In the past, what kind of supplies have you needed for monitoring?
76. Were you able to get the supplies you needed?
77. If you have questions about monitoring, who can you ask?
78. In the past, what kind of questions have you needed to ask somebody?
79. In the past, how responsive is this person to answering your questions?

Data Analysis & Usage

80. Is the monitoring information useful to you yourself? If so, how?
81. Who else sees the dataforms?
82. What (else) is the information on the dataforms used for? (Give specific examples if possible)
83. How could the monitoring system be made more useful to you and your fellow scouts?
84. Did you go to the quota setting meeting this year? If not, why not?
85. How often do you go to community meetings (e.g., RMC, VAG, CDC, etc.)?
86. When was the last time you went to a community meeting? What kind of meeting was it, why did you go, what did they discuss, and how did you participate?
87. Have there been any land use planning workshops here? If yes, did you attend? Why or why not?

Barriers to Monitoring

88. What are some of the things that make it difficult for you to do your job? (in general and specific to monitoring)
89. What types of things would make it easier to do your job well?
90. What can ADMADE/NPWS do to improve monitoring?
91. If your Unit was given 1 million Kwacha, what would be the best way to spend it?

Other Monitoring Activities

92. Do you participate in any other types of monitoring (e.g., transects, aerial surveys)? If yes, please give details
93. What do you think is the best way to know whether wildlife populations and increasing or decreasing?

Training Needs

94. What are some of the topics you learned in your training that have been most useful to you?
95. Can you think of any ways that your training could have been better?
96. Do you ever having training at the Unit?
97. Do you feel like you have enough training, or would you like more training?
98. If yes, then what topics would you like training on?

Demographics

99. What area of Zambia do you come from?
100. Are you married?
101. Do you have any children (if yes how many?)
102. What is your highest level of formal education?
103. Do you have a farm or any other activities or businesses to help support yourself and your family? (e.g., farming, fishing, trading, etc.)
104. Were you ever a poacher before you became a wildlife scout?

Perceptions of ADMADE

105. In your own words, what do you see as the objective(s) of ADMADE?

Other Comments

106. Do you have any other comments or advice for wildlife managers in other African countries who might be interested in starting or improving their monitoring system?
107. Do you have any questions for me?

End of Interview

108. Interview End Time:
109. Interviewee's English ability:
110. Translator used:
111. Other comments about the interview (e.g., *interruptions, distractions, suspected collaboration, indications of misleading, etc.)*:

Interview Guide for Unit Leaders

Introduction

I am a graduate student from the US and as part of my program I am doing a study on community based wildlife monitoring. This questionnaire is part of that research, and will also be used to help develop a workshop on data analysis at the community level. Everything you say is confidential, and will not be shared with any of the people in your Unit or NPWS. So you should feel free to speak openly. However you don't have to answer any question you don't want to.

Personal Info (record in separate exercise book)

1. Name
2. Unit
3. Interview place and date
4. ID Number

Interview Answers (record in interview book)

5. Interview ID Number
6. Interview Start Time

Introduction: General Thoughts on Monitoring

7. What do you think in general about the monitoring system in your Unit?
8. What are the main strengths and weaknesses?

Field Patrol Monitoring – General Knowledge

9. Do the scouts who go on anti-poaching patrol in your Unit do monitoring?
10. If yes, what do they monitor? (list as many indicators from the data forms as possible)
11. What trophy species do the scouts in your Unit monitor?

Safari Hunting Patrol Monitoring – General Knowledge

12. Do the scouts who accompany safari clients do monitoring?
13. If yes, what do they monitor? (list as many indicators from the data forms as possible)

Dataform Management

14. How do the dataforms get from the Unit headquarters to the scout camps?
15. How often do you re-supply dataforms to the scouts?
16. Do you ever run out of dataforms at the Unit headquarters? If so, what do you do?
17. How do the dataforms get from the scout camps to headquarters?
18. How often do you collect dataforms from the scouts?
19. How do the data forms get from the Unit to Nyamaluma?
20. How long does it take for them to get back to you?
21. Which of the dataforms do you use most? (go through dataform manual)

22. How do you manage dataforms at the Unit Headquarters? *(inspect filing system if possible)*
23. What have been the biggest problems with managing the dataforms?
24. What would be your recommendations to a new ADMADE Unit about managing dataforms?

Oversight of scouts

25. Do you find it difficult to get scouts interested in doing monitoring?
26. What incentives do scouts have to do a good job in monitoring?
27. Do you think most scouts are capable of data collection, or is it asking them to do too much?
28. Do you think monitoring interferes with scouts' role in anti-poaching operations?
29. What percentage of patrols do you think get recorded? *(differentiate day patrols and multi-day patrols)*
30. If this is less than 100%, then what do you think are some of the reasons why some patrols go unrecorded?
31. Do you think this percentage is adequate?
32. If not, what can be done to get more patrols recorded?

Accuracy Issues

33. When you receive data forms from the scouts camp, do you look them over (1) always, (2) most of the time, (3) some of the time, (4) never.
34. What kind of problems or mistakes do you see on the data forms?
35. How often do you sit down with your scouts and educate them about using the data forms?
36. Do you think the monitoring data from the scouts is complete (i.e., do they not record certain things). Why or why not?
37. Do you think the monitoring information from scouts is accurate? Why or why not?
38. Do you think the spatial aspect (i.e., grid locations) of monitoring data is accurate? Why or why not?
39. As far as the size of grids on the base map, do you think that 5 km is too big, too small, or about right? Why?
40. What can be done to improve the spatial accuracy of monitoring data?
41. What can be done to cross-check the accuracy of scout collected data?
42. What can be done to improve the accuracy of patrol data?

Analysis and Use of Data

43. Who are the primary users of this data?
44. Who from within the community sees the monitoring data?
45. Who from outside the community sees the monitoring data?
46. What kind of analyses do you do on the data?
47. Can you give any real life examples of how you used monitoring data for management? (*describe the last time you used the monitoring data for something)*
48. Can you think of other ways the data from monitoring could be used?
49. What other information would be helpful to have to do good management?

50. If you had no monitoring data, how would your management be different?

Use of Maps

51. Do you ever receive maps of your Unit from Nyamaluma? Is so when?
52. How and when do you use these?
53. Can you think of any way these maps could be better?
54. Do you have any other maps of your Unit? If so what are they?
55. Do you have or use maps of data from adjacent areas? Would these be useful, and if so how?
56. If you could make your own maps, what kind of maps would you want, and how would you use them?
57. Do you think you could make the same kinds of maps that Nyamaluma does? What would be the advantages and disadvantages of that?

Quota Setting

58. How was the quota setting exercise conducted in your Unit last year?
59. Do you think you're Unit is ready to do their own quota setting?
60. What help would be needed to do quota setting on your own?

Training Needs

61. Do you think the scouts in your area have enough training about monitoring?
62. Do you think they are capable of doing better monitoring?
63. If yes, then what kind of monitoring would you want them to do?
64. Do you yourself have enough training about monitoring?
65. If not, what would you like to learn?
66. If you were going to help plan an advanced training workshop, what topics would you cover?
67. If you were going to help plan an advanced training workshop, who would you invite?

Financial costs of monitoring

68. What are the manpower required for monitoring?
69. What are the financial expenses involved in monitoring in your area? (Cost them out individually)
70. If someone gave your Unit K5 million for management, what would you recommend be done with it? (*doesn't have to be related to monitoring)*

Other Monitoring Activities

71. Do you participate in any other types of monitoring (e.g., transects, aerial surveys)? If yes, please give details
72. What do you think is the best way to know whether wildlife populations and increasing or decreasing?

Personal Background

73. How long have you been with NPWS?

74. How long have you been in this Unit?
75. How long do you think you'll stay at this Unit?
76. List all other areas where you have worked, and give approx. number of years at each place.
77. Where are you from originally?
78. Where do you prefer to work? (GMA, Park, town)

Perceptions of ADMADE

79. In your own words, what is the objective(s) of ADMADE?

Other Comments

80. Do you have any other comments or advice for wildlife managers in other African countries who might be interested in starting or improving their monitoring system?
81. Do you have any questions for me?

End of Interview

82. Interview End Time:
83. Other comments about the interview (e.g., *interruptions, distractions, suspected collaboration, indications of misleading, etc.)*:

APPENDIX C
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