A case study of Bigodi Wetland Sanctuary as a community driven Community-Based Natural Resource Management initiative: maintaining livelihoods and wetland health

A thesis submitted in fulfilment of the requirement for the degree of

MASTER OF SCIENCE

at

RHODES UNIVERSITY

By

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September 2011

Abstract

Community-Based Natural Resource Management (CBNRM) is considered a win-win approach to reconcile conservation with natural resource use. CBNRM aims to accomplish conservation whilst prioritising development and contributing to poverty alleviation. This study analysed the different components of a CBNRM initiative, Bigodi Wetland Sanctuary (BWS), located in western Uganda. The study was carried out by interviewing the managing committee members (n= 8) as well as local households (n= 68) regarding the manner in which the project works, and the associated benefits and constraints. The main management issues recognised were a lack of monitoring and committee cohesiveness. The information gathered through the household survey enabled the calculation of the value of local livelihood options. This was done on the premise that conservation is better accepted when land users realise the economic value of natural resources. The average annual value of local household livelihoods was represented by 30 % crop production, 57 % natural resource use, and 13 % livestock. Lastly, wetland assessments were performed using the WET-Health and WET-EcoServices methodologies from the Wetland Management Series. These assessments indicated that the impacts of local livelihoods on the wetland were currently low but potential issues could arise with the increasing human population density. Ultimately, BWS presents both environmental and social costs and benefits. With a detailed and interdisciplinary method specific recommendations of improvement can be made to reduce such costs and further reconcile the conservation of Bigodi Wetland with local natural resource use.

Keywords: CBNRM; management; rural livelihood strategies; wetland health; wetland ecosystem services; costs and benefits.

Acknowledgements

Firstly, I would like to thank Tinka John Amooti and the KAFRED committee for permitting this research to take place. A special mention must be made of Tinka and his wife Betty who welcomed me so warmly into their family and looked after me for the duration of my stay in Bigodi. To the Bigodi community, thank you for your hospitality and for your participation, time and patience, without which this research would not have been possible. I also acknowledge my interpreters Ben Twinomugisha and Vallencia Turyatunga for their help and patience.

To my supervisors James Gambiza and Charlie Shackleton, thank you for the incredible research opportunity as well as your guidance and support throughout this thesis. To Fred Ellery thank you for your advice and help in making the wetland assessment possible. Another special mention must be made of Juliana Keirungi and her family for receiving me in Entebbe, thank you for your hospitality and kindness. Lastly, I would like to thank my family and friends for all their support.

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Glossary

AGM	Annual General Meeting
BW	Bigodi Wetland
BWS	Bigodi Wetland Sanctuary
CAMPFIRE	Community Areas Management Programme for Indigenous Resources
CBNRM	Community-Based Natural Resource Management
GDP	Gross Domestic Product
HGM	Hydrogeomorphic Unit
KAFRED	Kibale Association for Environmental Development
KNP	Kibale National Park
MAP	Mean Annual Precipitation
MUBFS	Makerere University Biological Field Station
NGO	Non-Governmental Organisation
NTFP	Non-Timber Forest Product
PET	Potential Evapotranspiration
SES	Social-Ecological System
UCOTA	Uganda Community Tourism Association
UNITE	Uganda and North Carolina International Teaching for the Environment
UNWP	Uganda National Wetland Policy
UWA	Uganda Wildlife Authority

Chapter One

Introduction

1.1 The Importance of Sustainable Natural Resource Use

One in five of the world's population (approximately 1.4 billion people) lives in extreme poverty, with 75 % of these people residing in rural areas (IFAD, 2006; UN, 2011). Poverty can be defined as: "a denial of choices and opportunities, a violation of human dignity. It means lack of basic capacity to participate effectively in society. It means not having enough to feed and clothe a family, not having a school or clinic to go to; not having the land on which to grow one's food or a job to earn one's living, not having access to credit. It means insecurity, powerlessness and exclusion of individuals, households and communities. It means susceptibility to violence, and it often implies living on marginal or fragile environments, without access to clean water or sanitation" (UN, 1998).

Poverty alleviation is an international goal as exemplified in the Millennium Development Goals (2000). Africa has a large rural population which accounts for the majority of the continent's poorest people. In eastern and southern Africa, 63 % of the population is rural with an average population growth of 1.8 % annually (US Census Bureau, 2006). These rural communities tend to be underdeveloped in terms of infrastructure, government services, markets and jobs (Shackleton *et al.*, 2007). These areas are thus characterised by high levels of poverty and few livelihood opportunities. For this reason a number of post-colonial governments aim to address rural poverty by initiating frameworks for improving rural livelihoods (Kepe, 2007).

Natural resources contribute substantially to the well-being and in certain cases the survival of poor rural communities (Shackleton *et al.*, 2007). In Africa, the increasing population pressure in poor and remote rural areas is likely to result in natural resource exploitation and degradation. This is due to a combination of factors such as restricted access to markets and improvements in agricultural technology due to poor infrastructure; a lack of investment by government in rural areas; and a generally low availability of financial resources to invest in agricultural intensification means such as fertiliser (Marquette, 1997; Murton, 1999; de Groot and Romero, 2009). This increased dependence on natural resources for food and income jeopardises livelihoods and so it is crucial to determine the best means of managing the

environment to promote sustainable use. Governments are therefore faced with a combined developmental and ecological challenge.

The value of natural resources to rural communities can be categorised into: direct-use value, indirect-use value and non-use value. Direct-use pertains to resources that are consumed directly or marketed, such as non-timber forest products (NTFPs) (Moyini *et al.*, 2002; Turner, 2004). An NTFP is any natural resource, of plant or animal origin, which is harvested by rural communities for domestic consumption or small-scale trade with little or no capital input (Shackleton *et al.*, 2007). Over 90 % of poor rural households in southern Africa are known to depend on NTFPs gathered from communal areas (Mazur and Stakhanov, 2008). The people are dependent on these resources for the provision of food, medicine, fuelwood and craft and construction material.

Indirect-use concerns the environmental services provided by a natural resource system, for example a wetland provides water flow and water quality regulating services. Passive or non-use values are those that are intrinsic or socially determined without an economic use such as cultural, religious and aesthetic values (Moyini *et al.*, 2002; Turner, 2004). The non-use values are often more important in guiding local decision making than they are accredited for.

Paying to view nature for its aesthetic, cultural or sacred value gives rise to non-consumptive tourism. This indirect-use value minus the consumption creates significant economic benefit streams that can be sustained indefinitely under effective management (Turner, 2004). Ecotourism has the potential to aid poverty alleviation through job creation. Those employed in tourism, although generally only a small proportion of the rural households, typically earn greater than the households that are not employed in the industry and only partake in subsistence agriculture (Shackleton *et al.*, 2007).

The direct use of natural resources contributes to rural livelihoods by providing three benefits: the supply of basic needs, the saving of cash resources and lastly, by acting as a safety-net in times of misfortune (e.g. death, illness, HIV/AIDS, retrenchment, drought, floods, low crop yields, and livestock disease) (Shackleton *et al*., 2007). The households most dependent on natural resources are those found in isolated communities and those that are headed by women (Shackleton *et al*., 2007). Wealthier households can harvest greater amounts of natural resources as they have better means to, for example, having access to pick-up vehicles (Dovie *et al.*, 2005). Although wealthier households may use greater amounts of forest products than

the poorer ones, it tends to represent a smaller proportion of their total income (Shackleton *et al*., 2007).

The characteristics of a household, its composition and social networks influence the livelihood strategies adopted (Dovie *et al.*, 2005). For example, there is gender segregation in everyday activities in sub-Saharan Africa. The men are more likely to be formally employed, are concerned with the collection of building material and hence construction activities, as well as tend to the livestock (Dovie *et al.*, 2005). Alternatively, the women cook, make crafts, look after the children, cultivate the fields and collect natural resources. The ability to diversify livelihood strategies contributes towards a sustainable livelihood as it allows for alternative options in times of stress (Dovie *et al.*, 2005). Sustainable resource use should satisfy the livelihood needs of the present generation whilst considering the needs of future generations (Baker, 2008).

The use of NTFPs is significant yet largely underestimated, which has resulted in a lack of monetisation of the consumption of many of these resources, a lack of formal markets and a subsequent exclusion from national level accounting (Chamberlain *et al*., 2004; Dovie *et al.*, 2004). NTFPs contribute to national GDP (Gross Domestic Product) by providing social security as building material, fuel, food, medicine and income (Chamberlain *et al*., 2004). The use of NTFPs rarely leads to poverty alleviation but it may prevent the intensification of poverty (Shackleton *et al*., 2007). By harvesting natural resources to meet daily household needs scarce cash resources can be saved for other uses such as school fees and agricultural tools (Shackleton *et al*., 2007). It must be realised that the use of natural resources as a means of saving cash has a national effect too. The needs met by natural resource harvesting save the government having to provide such services to rural areas. It is therefore in the government's interest to ensure that natural resources are utilised sustainably (Shackleton *et al*., 2007).

A number of studies have examined the contribution of natural resources to total income streams of rural households (Campbell *et al*., 2002; Dovie *et al*., 2002; Crookes, 2003; Shackleton *et al.*, 2007). This can be calculated by determining the gross direct-use values (the product of the amount of a resource used and the local price). Where prices are not available locally, prices at the closest point to the target community or replacement values can be used (Shackleton and Shackleton, 2004). By comparing the relative contribution of crop production, livestock and natural resource harvesting to rural livelihoods it is hoped that central government as well as the rural communities themselves will appreciate the value of

the resources and participate in sustainable use practices. This often helps rural communities understand the costs they will endure should they lose their natural resource base through overuse.

To enable sustainable harvesting it is important to look at who uses which resources and the quantities that they use, the environment in which the resources are found and their accessibility to users (Kepe, 2007). One also needs to know the institutional dynamics affecting the availability and control of the harvesting of the resource. To be able to produce and implement an effective management and monitoring programme it may be necessary to carry out training programmes, community development programmes, provide job opportunities and to allow controlled access to natural resources in protected areas.

1.2 Wetland Ecosystems and Natural Resource Harvesting

Since 1900 more than half of the world's wetlands have disappeared (Stuip *et al.*, 2002). The term 'wetland' encompasses a wide variety of habitats such as marshes, peatlands, floodplains, rivers and lakes and coastal areas such as saltmarshes, mangroves, and seagrass beds, also coral reefs and other marine areas no deeper than six metres at low tide, as well as human-made wetlands such as waste-water treatment ponds and reservoirs (Ramsar, 2011). Wetlands are complex ecosystems with multiple ecological, socio-esthetical, intrinsic, and economic values (Schuijt, 2002).

Although the large scale conversion and destruction of wetlands in developed countries has been mostly avoided in developing countries, the wetlands are currently threatened by overexploitation and unsustainable use due to population pressure, socio-economic changes, and insensitive government policies (Dixon, 2002). Wetland resources that are commonly overexploited include the water, soils, plants and animals which provide goods that can be used to generate subsistence, income and employment (Emerton *et al.*, 1998). Such resource degradation negatively affects wetland service provisioning. Wetland services are the hydrological and ecological functions of wetlands, which support and maintain economic activities and human settlement because they act as a sink for wastes and residues and protect human and natural production systems (Emerton *et al.*, 1998). The degradation of wetlands also causes a loss in habitat important to many different plant and animal species, which are often endangered and or migrant species (Silvius *et al.*, 2000). For example, the Pantanal wetlands of Brazil provide habitat to the endangered hyacinth macaw (*Anodorhynchus*

hyacinthinus), giant otter (*Pteronura brasiliensis)*, and marsh deer (*Blastocerus dichotomus)* (Ramsar, 2010).

It is often the poorest members of a community that are the most dependent on wetland resources and functions (Silvius *et al.*, 2000). For example, the rapid economic development in Thailand in the past three decades has led to environmental degradation and the marginalisation of rural communities (Erftemeijer and Bualuang, 1998). Fifty per cent of the country's mangrove forests have been lost since 1970. This is largely as a result of commercial logging for charcoal, the conversion of land for shrimp aqua-culture, and industrial and urban development. This has had negative impacts on the rural poor as fish catches have declined along with the availability of other food resources and timber that was traditionally harvested from the wetlands (Erftemeijer and Bualuang, 1998).

A large part of the population in developing countries consists of communities that are dependent on livelihood strategies that combine subsistence farming with wetland resource use (Silvius *et al.*, 2000). The large scale conversion of wetlands for agricultural purposes is still common as a result of the need for more land and greater productivity. This has led to the intensive drainage and cultivation of wetlands which are particularly attractive due to their fertile soils and abundant water supply (Dixon, 2002). This inevitably results in a loss of biodiversity and hydrological functions which in turn has implications on local food security. Such wetland use options tend to be unavoidable for many rural populations (Dixon, 2002). In Illubabor, Ethiopia, the local people were aware of the impact their agricultural practices had on the condition of the wetland (Dixon, 2002). They therefore developed ways to reduce such impacts, for example disallowing irrigation and crop production in the rainfall season to enable the regeneration of the wetland water table.

Despite their obvious values, wetlands in Africa are being modified by human activity largely as a result of decision-makers being ignorant of the various values of wetland goods and services to the local people (Schuijt, 2005). They allow wetland development, such as drainage for agricultural purposes, as they perceive the benefits from such use outweigh the opportunity cost of wetland conservation. The economic evaluation of wetland ecosystems is an important tool in measuring the benefits obtained from a wetland and the subsequent cost if such systems were degraded through overexploitation (Gawler, 1998). Such knowledge would better inform decision-making authorities of the importance of sustainable wetland use. The future of African wetlands thus lies in a stronger political will to protect them based on

sound wetland policies and encouragement for community participation in their management (Ramsar, 2011).

As wetland resources are depleted, degradation occurs, poverty levels increase and water supply is compromised (van der Duim and Henkens, 2007). Therefore, wetland conservation needs to occur simultaneously with poverty alleviation through sustainable utilisation. Sustainable wetland utilisation is the human use of a wetland in such a way that it yields continuous benefits to present generations while maintaining its potential to meet the needs and aspirations of future generations (van der Duim and Henkens, 2007). The involvement of local communities in the management of wetlands is crucial as without it the long-term sustainability of the wetland could be jeopardised as well as the livelihoods of the people (van der Duim and Henkens, 2007). Local community members, relevant government officials, local authorities, and other stakeholders need to be represented in the management plan; they should have information and appropriate opportunity to be involved in the planning and management of wetland use (Kairu, 2001). As sustainable wetland management usually requires some restriction of resource utilisation activities it should also provide a number of benefits, alternative income options, and employment, to compensate for opportunity costs in order to maintain local support (Emerton *et al.*, 1998).

1.3 Community-Based Natural Resource Management (CBNRM)

In the 1970s a movement towards social justice and a fairer international economic order led to conservation initiatives incorporating participatory engagement, indigenous knowledge and community needs (Dressler *et al.*, 2010). It was realised by external managers that local people already utilised, relied on and managed natural resources making them suitable to administer local conservation. This realisation led to the new grass-root approaches called: integrated conservation and development projects (ICDPs), community-based conservation (CBC) and community-based natural resource management (CBNRM) (Dressler *et al.*, 2010).

CBNRM has become an umbrella term for many different approaches and models for natural resource management, from joint or co-management initiatives with government on either state land or communal land, to private sector-community partnerships (with or without the state intervention), and finally to true common property arrangements on community-owned land (Jones and Mosimane, 2000). In this study, a true CBNRM initiative is one that achieves positive outcomes in both the social and ecological dimensions with power devolved to the community (resource-user) level (Shackleton *et al.*, 2010). In this light, CBNRM is the

"management of natural resources under a detailed plan developed and agreed to by all concerned stakeholders. The approach is community based in that the communities managing the resources have the legal rights, the local institutions, and the economic incentives to take substantial responsibility for sustained use of these resources." (USAID, 2010)

The International Union for the Conservation of Nature (IUCN, 2003) promotes CBNRM for the following reasons:

- Prior top-down approaches to conservation brought about high incidences of poaching and local resentment.
- Conservation of natural resources in rural areas is crucial to sustain the livelihoods of the communities that depend on them.
- Incentives better ensure that the local people utilise natural resources in a sustainable manner.
- Common property management needs to be updated and improved in order to be viable.
- Bottom-up approaches to rural development have proved to be more efficient.
- Conservation with community empowerment redresses the issue of previous forced removals.

Ultimately CBNRM is considered a win-win approach to reconcile conservation with natural resource use (Reid and Turner, 2004). It aims to accomplish conservation whilst prioritising development and the political liberation of the poor. The local communities involved in CBNRM need to receive benefits that exceed the cost of conservation (Magome and Fabricius, 2004). If the reward for conservation is in proportion to the effort required, communities are more likely to participate. The benefits do not always have to be financial, other intangible benefits include: the development of skills; restoration of land and resource rights; increased access rights; restoration of pride in the community; the attainment of greater levels of decision making powers over the use and management of natural resources; and the development of greater cohesion within the community (Johnson, 2004). CBNRM should therefore empower the community socially, economically, politically and psychologically.

Once the rural people are re-empowered their use of natural resources is likely to become sustainable. This is, however, more difficult than it seems as CBNRM processes and

initiatives are embedded in a complex socio-ecological system (SES) and so need to accommodate economic, political and organisational principles within a strongly devolutionary rights-based approach (Child, 2009; Ostrom, 2009). SESs are complicated as they consist of interacting attributes such as non-linearity, uncertainty, and scale that tend to be overlooked as a result of oversimplification (Berkes, 2003).

Due to the complexity of SESs, feedback processes between the different interconnected components and dimensions lead to relationships that vary in a dynamic, non-linear and unpredictable manner (Ramalingam *et al*., 2008). In such complex systems non-linearity is the direct result of the mutual interdependence between dimensions. Clear, causal relationships cannot be identified because of the multiple influences involved (Ramalingam *et al*., 2008). The SESs are unpredictable as they are dependent on factors that fluctuate beyond their control. Such factors include climate (e.g. natural disasters and global climate change); politics (e.g. change of government or war); economic state (e.g. global recessions or booms) and institutional change (e.g. international agreements, protocols and conventions) (Fabricius *et al.*, 2004).

Another common error made in conservation management is the issue of scale. For example, centralised management of natural resources neither fits the level of central government nor that of the community (Berkes, 2004). Cross-scale conservation requires linking institutions horizontally (across space) and vertically (across levels of organisation) (Berkes, 2004). It is also important to consider temporal scale as CBNRM initiatives are slow to establish and so require a long-term approach. Patience is required and donor agencies need to be aware of the lengthy process involved (Child, 2009).

A SES system typically involves the following subsystems: resource units, resource users and governance systems (Ostrom, 2009). These subsystems interact and produce outcomes which in turn feed back into the system or into other interconnected systems. To determine what factors promote sustainability of SESs one needs to identify the processes and interactions within the system and analyse the relationships at different temporal and spatial scales. Ostrom (2009) produced a framework for organising knowledge of SES systems which can be adapted to analyses of CBNRM initiatives (Fig. 1.1).

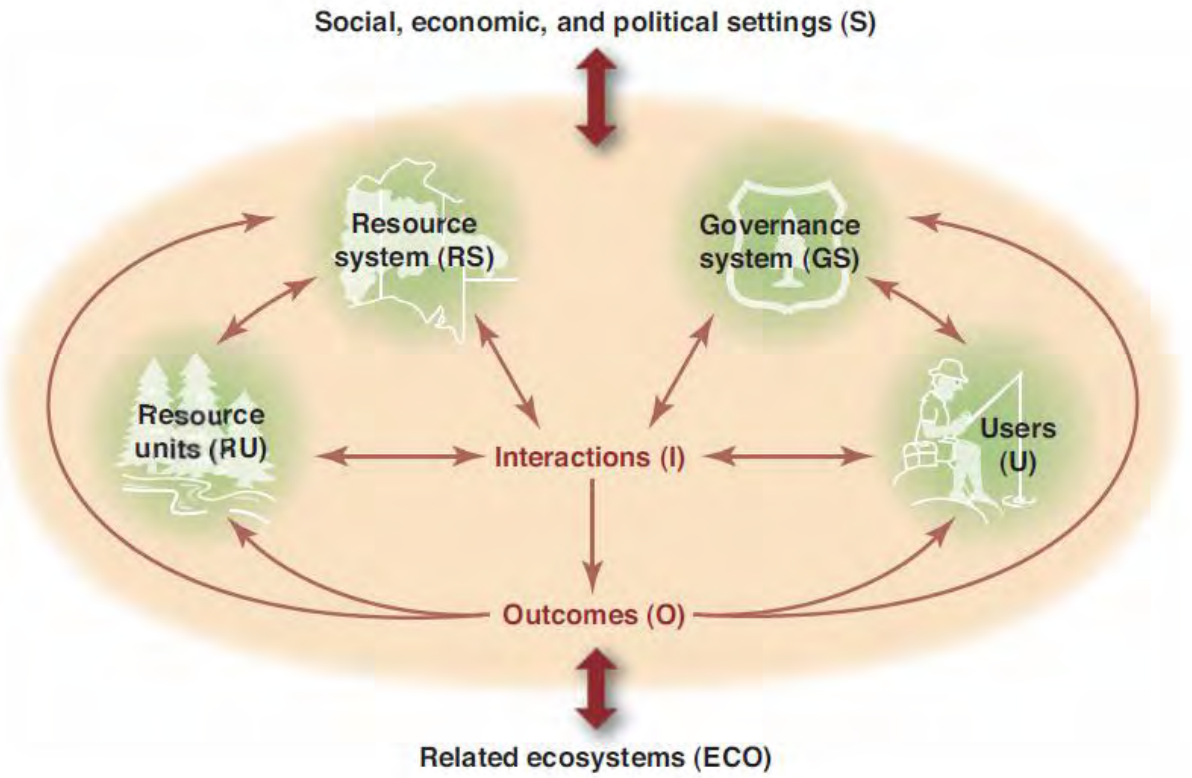

Figure 1.1: The core subsystems in a framework for analysing socio-ecological systems (Ostrom, 2009).

In contrast, the approach of Fabricius *et al*. (2004) identifies the basic components of CBNRM as ecosystems and people. The inputs that are required for the CBNRM process include: institutions, skills and tools and equipment. The processes involved are external events (e.g. floods, drought and political change), external interventions (e.g. policies, donations, negotiations and law enforcement) and local management activities (e.g. people's actions associated with the natural resource base) (Fabricius *et al*., 2004). The outputs generated by a CBNRM project are controlled by the facilitators, local people and policy makers (Fig. 1.2).

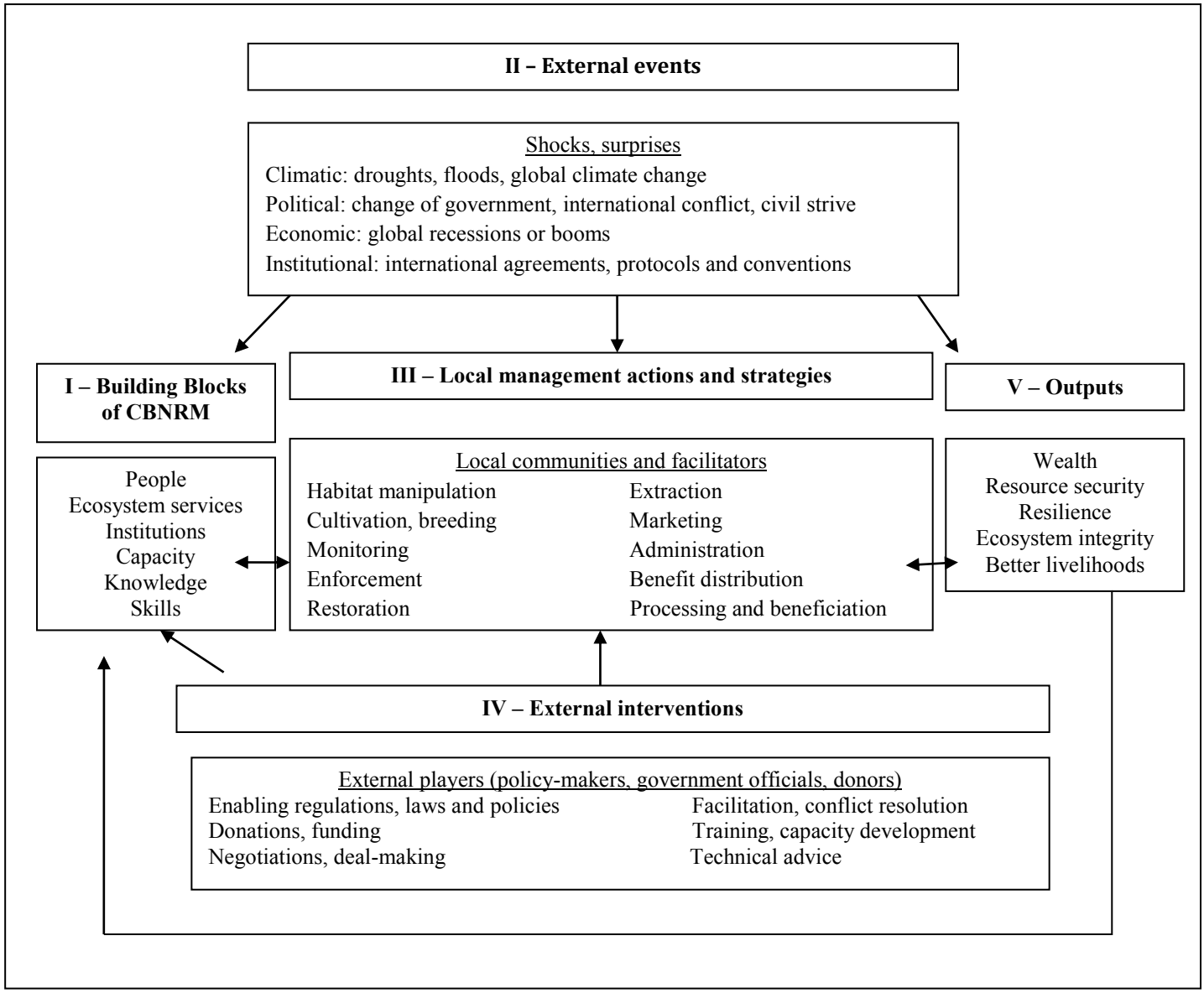

Figure 1.2: A community-based natural resource management systems model

(Fabricius et al*., 2004).*

Both models simplify the CBNRM variables, flows and processes to enable a more holistic understanding. One needs to analyse all the inputs, processes and outputs of a CBNRM project from a combination of social, ecological and economic stances to produce a balanced and full assessment. The above two models were merged to produce a hybrid framework that could be used to analyse CBNRM case studies (Fig. 1.3).

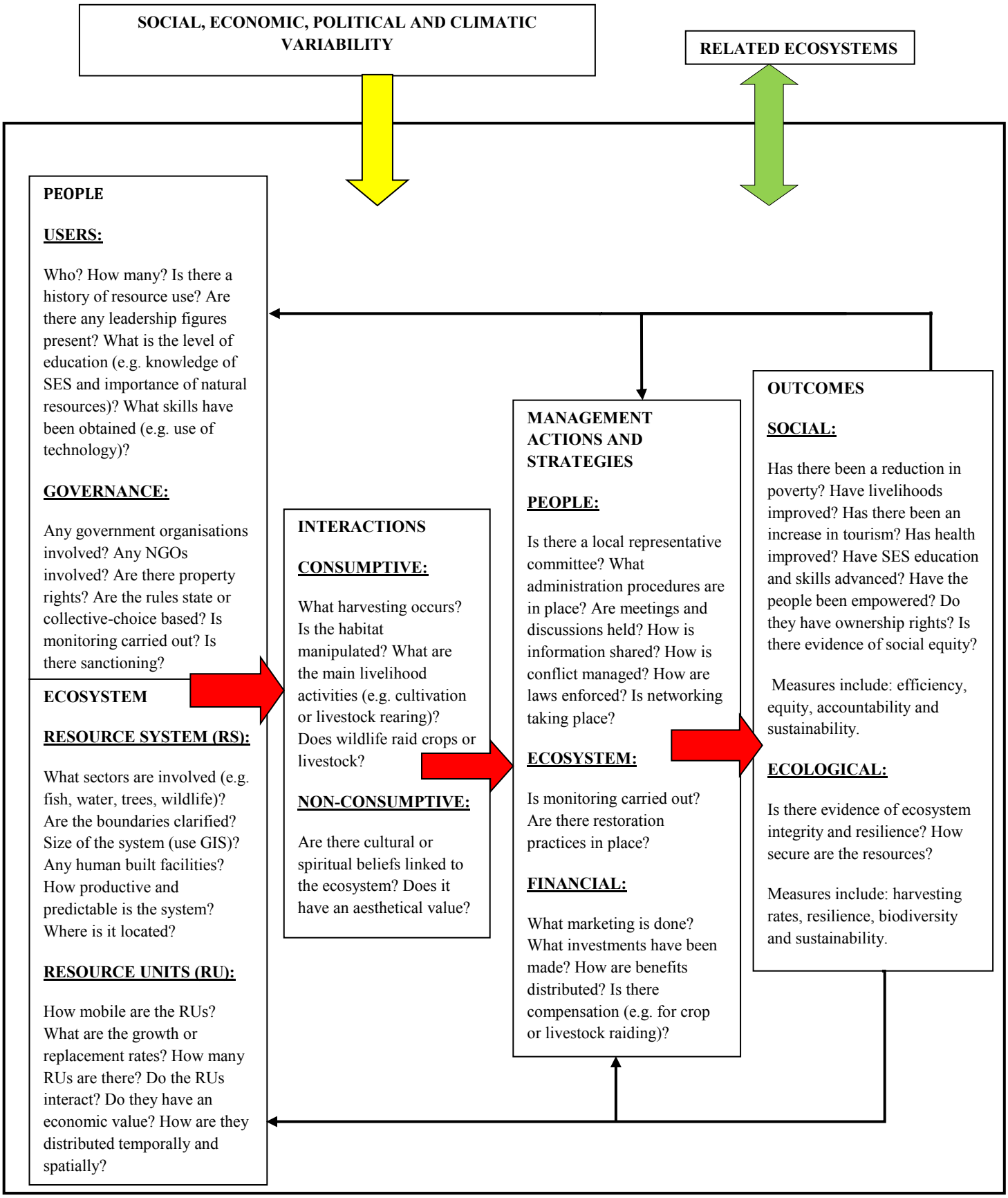

Figure 1.3: A CBNRM systems model adapted from Fabricius et al. *(2004) and Ostrom (2009).*

An analytical framework can enhance understanding of complex systems that are characterised by non-linearity, unpredictability, cross-scale issues and interactions of multiple factors (Ostrom, 2009). Figure 1.3 illustrates the complexity of SESs and suggests potential relationships between people and an ecosystem, how they interact and the possible outcomes. Social, economic, political and climatic variability are external factors that can influence the effectiveness of a CBNRM initiative. The utilisation and management of an ecosystem may impact the functioning of other ecosystems and vice versa. The black arrows illustrate the importance of feedback mechanisms to enable management to adapt and evolve to suit change or disturbances. All aspects of the SES need to be monitored to ensure that the project is progressing towards the desired goals.

CBNRM is a widely accepted form of conservation as it can: enhance participation in decision making, encourage community representation and empowerment, promote equity as a result of retention and sharing of benefits, improve public sector accountability and thus effectiveness, and lastly people are less likely to degrade their resource base if there is a sense of ownership in decision making, and in seeing positive returns from careful resource use (Campbell, 2006). To achieve these positive outcomes CBNRM approaches have been experimented with, adapted and have evolved over the past two decades. This has resulted in the creation of seven basic principles which act as guidelines for successful CBNRM implementation. These include (Fabricius *et al*., 2004):

1. Livelihood options need to be diverse and flexible. The poor are more vulnerable to environmental stochasticity, whether it is ecological, political or economic; it is therefore important not to put all one's eggs in one basket.
2. The condition of the resource base must be maintained or preferably improved. Good management is required to improve the production capacity of the natural resource base.
3. The institutions for local governance and land and resource management are in place and are effective. The local rules and management need to be implemented and taken seriously whilst working closely with the community members.
4. Incentives must be provided to encourage people to use the resources sustainably. People must be rewarded for their conservation efforts and the distribution of revenue by the committee should be transparent.

5. Laws and policies should be implemented with the authority devolved to the lowest capable level. The local people are given the right and responsibility to make their own decisions.
6. Facilitation from outside should be sensitive and responsible. The experts should share their knowledge and encourage the community to contribute its experiences to guide management.
7. Local-level power relations are favourable for CBNRM and are understood. Work closely with the respected traditional leaders and elderly men as they can greatly influence a community's decisions and tend to strive for community prosperity.

The above seven principles are steps towards 'successful' CBNRM but how is this overall success determined? Fabricius (2004) argues that both success and failure are likely to occur because of the multiple objectives of CBNRM. Blueprint approaches do not work when managing natural resources under conditions of uncertainty and change; case-by-case management is required (Fortmann, 2001; Gunderson and Holling, 2002). The seven principles are mere guidelines as each CBNRM initiative differs in terms of: ecosystem properties, ecosystem management beliefs and the decision systems used to understand and predict ecosystem functioning, the modes of learning and how success and failure is measured (Fortmann, 2001). The following summaries from a number of case studies in Africa briefly mention some of the many different problems faced by CBNRM initiatives worldwide.

Zimbabwe

The CAMPFIRE initiative in Zimbabwe played a key role in pioneering CBNRM in southern Africa by demonstrating that financial and responsibility devolution can result in improved rural democratisation, governance and ultimately natural resource management (Taylor, 2009). Although CAMPFIRE has been one of the most successful innovations in rural Zimbabwe since independence it has been constrained by a number of factors. In particular, the national-political arena in the last decade or so has been largely unstable. Government policies have not worked well in the rural areas and the taxes are punishing (Taylor, 2009). This is an example of the impacts of uncertainty and negative external policy intervention on CBNRM efficiency.

In the Nyaminyami ward CAMPFIRE has succeeded in adopting some of the Tonga people's beliefs about hunting season and the prohibition of hunting female wildlife. The management plan unfortunately overlooked the local people's spiritual hunting needs that are required to heal the mentally ill (Sibanda, 2004). This resulted in conflict and distrust. Also, only 50 % of the Nyaminyami ward households were receiving an income for their conservation efforts as opposed to the richer areas of Masoka and Mahenye where all the households received financial incentives (Sibanda, 2004).

Zambia

In the Luangwa Valley, revenue distribution was a problem as a result of the local chief's authority (Child, 2004). He 'encouraged' the community to spend their income gained from the Lupande programme on a new vehicle for him. After five years of conflict the chief's power to access the finances was decreased (Child, 2004). This is in contradiction to the aforementioned principle seven for the success of CBNRM.

Uganda

Bwindi Impenetrable Forest aims to achieve conservation through collaborative management and benefit-sharing agreements (Mazur and Stakhanov, 2008). The communities are unable to gain legal control over the natural resources as there are no enabling policy frameworks or guidelines for collaborative management agreements. The Uganda Wildlife Authority (UWA) maintains control over protected areas and has the right to issue or refuse natural resource harvesting permits (Mazur and Stakhanov, 2008). This means that local communities can never truly secure ownership over managed resources.

Namibia

CBNRM has been well supported by the local people of Namibia so far; however benefits and ownership rights will have to strengthen with time to maintain this enthusiasm (Jones and Weaver, 2009). The financial reward received by the households from conservation is low, the ownership rights are weak and the expense of living with wildlife is high. Land tenure is a constraining issue for CBNRM initiatives. If outsiders are free to utilise the land that the local community wishes to set aside for conservation then the incentive to do so is low (Jones and Weaver, 2009). This also means that communities struggle to raise funds as their land cannot be used as security. The benefits of conservation need to outweigh the costs in order for it to become a viable livelihood option.

Tanzania

Since the late 1980s, the value of Tanzanian wildlife has increased with the expansion of the tourist hunting industry (Nelson and Agrawal, 2008). The industry is dependent on community land to provide habitat for the wildlife. Foreign donor and conservation organisations have invested millions of dollars in the country's wildlife sector rationalised by the economic and environmental logic of CBNRM (Nelson and Agrawal, 2008). The wildlife authorities have reaped the benefits of the funding whilst the rural communities are marginalised and at most have played a small role in policy formation or in setting the wildlife reform agenda. Foreign donors have had little leverage in enforcing lasting institutional changes (Nelson and Agrawal, 2008). This case study highlights the importance of public transparency and the problems faced due to corruption.

Botswana

In the Okavango, the benefits received by households from the conservation and tourism projects were not reaching those most dependent on the resources i.e. the traditional hunters, women, elderly and the very poor (Rozemeijer, 2009). Another problem was that not all voices were being heard at community meetings. This is a common issue in CBNRM where village elites, for example literate men, tend to dominate meetings and the women that are directly involved with the natural resources are suppressed (Rozemeijer, 2009).

In Xaxaba, local people perceived the CBNRM project negatively (Madzwamuse and Fabricius, 2004). It had replaced their subsistence hunting lifestyle with uncertainty as tourism in the area fluctuated beyond their control due to conflict in neighbouring Zimbabwe and competition from South Africa and Namibia. As hunting and gathering was of symbolic importance to the people it became an 'underground' activity and therefore uncontrollable (Madzwamuse and Fabricius, 2004).

Despite the numerous and rich examples of CBNRM in many sub-Saharan African countries, in an editorial review by Shackleton *et al*. (2010), it was questioned how many were real examples of CBNRM. Without debating varying definitions of CBNRM, Shackleton *et al*. (2010) argued that CBNRM projects needed to display elements of true community control and benefits, as well improvements in or conservation of the natural resource base. Yet, many examples could not show attainment of both these primary objectives, usually demonstrating only one or the other. Additionally, they argued that many CBNRM interventions were not

demonstratively community based as most had external catalysts, facilitators, and often funding. When these external support mechanisms were removed, many of the projects collapsed. There seemed to be a dearth of case studies internationally of autonomous CBNRM, in which the community was the instigator of the project and in which they had the primary management responsibility. At face value, the Bigodi Wetland Sanctuary in Uganda seems to be a rare example of such, and is the case study examined further in this thesis.

1.4 Management and Monitoring Requirements for CBNRM

To enable sustainable natural resource harvesting, management and monitoring programmes need to be established. It is important that a reasonable portion of the profit made by a CBNRM project is put towards maintaining management and monitoring practices (Fabricius *et al*., 2004).

1.4.1 Management

As mentioned previously, Fabricius *et al*. (2004) identify the basic components of CBNRM as ecosystems and people. The people involved in CBNRM need to develop effective management institutions. Biological systems are adaptable and resilient to change if they are healthy and if anthropogenic disturbances are minor (Lyon, 2000). The management plan should be locally developed and the community organisational units should be small enough to meet regularly and face-to-face. All stakeholder voices should be heard to inform the management protocol (Rozemeijer, 2009). The ability of a project to adapt is dependent on the quality of feedback loops and information and long-term personal relationships and experience (Child, 2009).

Although there are different management models, they follow the same basic procedure of: setting a desired future state, defining objectives and goals, planning and implementing management actions, and monitoring of indicators so as to audit goal achievement and enable an informed evaluation of the management process. It is crucial that any rules made at the community level are monitored and enforced and are supported by higher government policies (Child, 2009; Ostrom, 2009). Local institutional structures involved in management must be legally recognised in order to be handed ownership and management responsibilities (Lyon, 2000).

Collaborative management or co-management is based on the concept that rights and responsibilities should be shared among those with a claim to the natural resource or

environment (Plummer, 2009). Previously, co-management focused on power sharing solely between government and local resource users (Plummer, 2009). This evolved with time to include a broader spectrum of stakeholders and thus co-management became a continuous problem-solving process (Plummer, 2009). As CBNRM approaches are now regarded as multi-scalar and dynamic they enter the realm of adaptive co-management (Hill *et al.*, 2010). By combining adaptive management with co-management a governance system is produced that involves heterogeneous actors and cross-scale interactions (Plummer, 2009). Adaptive co-management can be defined as a long-term management structure that enables stakeholders to share management responsibility and to learn from their actions (Berkes, 2003). Consequently, it has been proposed as one of the best practices for managing natural resources under conditions of uncertainty and change that characterise complex SESs (Armitage *et al.*, 2007; Cundill and Fabricius, 2010). Adaptive co-management is effective as it facilitates learning through feedback, highlights social processes that encourage flexibility and builds capacity for adaptation (Plummer, 2009). Armitage *et al*. (2007) state the following as characteristics of adaptive co-management:

- A shared vision, goal and problem definition to provide a common focus among actors and interests.
- A high degree of dialogue, interaction and collaboration among multi-scaled actors.
- Distributed or joint control across multiple levels, with shared responsibility for action and decision making.
- A degree of autonomy for different actors at multiple levels.
- Commitment to the pluralistic generation and sharing of knowledge.
- A flexible and negotiated learning orientation with an inherent recognition of uncertainty.

Olsson *et al*. (2004) outlined four key requirements for successful adaptive management of ecosystems under uncertainty. First, there is a need to build knowledge and understanding of resource and ecosystem dynamics. Second, there is need to develop practices that interpret and respond to ecological feedback. Third, institutions and organisations and adaptive management processes need to be flexible. And fourth, the generation of knowledge of ecosystems should be integrated with management practice and evolve with the institutional and organisational aspects of management. These requirements should be incorporated into

CBNRM programmes to maximise their potential to achieve the win-win situation of sustainable natural resource harvesting.

1.4.2 Monitoring

Monitoring of all aspects throughout the duration of a CBNRM project is essential yet often overlooked (Boggs, 2004; Fabricius *et al.*, 2004). Adaptive monitoring has been proposed as a new paradigm for long-term research and monitoring of natural resources that addresses shortcomings of current monitoring programmes (Lindenmayer and Likens, 2009). Monitoring can be defined as "the systematic measurement of variables and processes over time…it assumes that there is a specific reason for the collection of data, such as ensuring that standards are being met" (Danielsen *et al.*, 2009). An 'adaptive' monitoring programme is one that evolves and develops in response to new information or new questions.

Monitoring needs to be set at the start of a CBNRM initiative and must be used for both the development of the rural community and the management of resources (Boggs, 2004). It is essential in guiding the process of adaptive management and in ensuring that the project at hand is progressing towards planned outcomes. Monitoring is important in assessing the impact on society and the associated ecological system when new policies are implemented; it also ensures accountability (Lyons, 2000). If there is no means to assess a programme then how do the various actors know if it is on the right trajectory for the agreed objectives?

Monitoring natural resource use is important in determining the impact of consumptive use to avoid overexploitation and population extinctions. To achieve this, the level of natural resource use as well as the associated biological characteristics of interest (e.g. population size, reproductive success, age and sex structures, migration patterns and feeding ecology), need to be monitored simultaneously (Lyon, 2000). To assess ecological health a selection of indicators should be chosen to monitor; these should align with the management objectives and ideally meet five criteria (Margolius and Salafsky, 1998), namely, they should be: measurable, precise, consistent, sensitive, and simple.

Despite the participation of local people in natural resource management, their active involvement in natural resource monitoring is a recent development (Danielsen *et al*., 2005). Locally-based approaches to monitoring are thought to be cheaper and likely to survive longer than professional monitoring by scientists. Five generic methods are used for locally based

monitoring: patrol records, transects, species lists, simple photography, and village group discussions (Danielsen *et al*., 2005). The advantage of these methods is the ease of application even by people with little formal education; although this has led some to question the validity of the data collected (Danielsen *et al.,* 2009).

A CBRNM project requires that the: effectiveness of expenditure, performance of CBRNM according to local individuals and the governance of CBRNM as well as the involvement of and accountability to individual members of the community are monitored (Child, 2009). The approach should involve all stakeholders and the outcomes must be used to adapt management accordingly. When analysing a CBNRM case study one needs to ensure that all interests are represented in decision making. The outcome of current decision making needs to be monitored to direct future adaptive management plans. Lastly, the performance of those who make the decisions needs to be reviewed by those who are affected by the decisions (Agrawal and Gibson, 1999).

1.5 Ugandan Context

1.5.1 Natural Resource Use

In Uganda, the 1970s and 1980s were times of social turmoil and political uncertainty which resulted in the loss of 600 000 lives (Hamilton *et al.*, 2000; Moyini *et al.*, 2002). Due to this national unrest, Uganda's economy struggled. Land degradation, low and declining agricultural productivity, poverty and food insecurity are some of the interconnected problems faced by the Ugandan people (Pender *et al.*, 2004). With 35 % of the country's population living below the national poverty level, an average life expectancy of 42 years, and a national population growth of 3.4 % per annum, it is unsurprising that most of the people (90 %) are directly dependent on natural resources (Uganda Ministry of Water, Lands and Environment, 2002; World Bank, 2003; US Census Bureau, 2006).

Ugandan livelihoods are intimately tied to the environment both as a source of subsistence household requirements such as food and fuel and as a basis for production (Moyini *et al.*, 2002). Approximately 4.9 million ha of Uganda's land surface is forest or woodland; of which 60 % is unprotected and vulnerable to overexploitation and conversion to agriculture (Hartter, 2007). It is estimated that the rate of forest loss ranges from 0.8 % to 3 % annually (Hartter, 2007). Fuelwood and charcoal provide 95 % of Uganda's energy needs, with two-thirds of this amount utilised at the household level (Hartter, 2007).

Despite these values, natural resources are not included in national economic measures such as the GDP and National Income (NI). National accounts only capture the goods and services that are traded in formal markets, those that are not traded and have no formal monetary value are excluded (Moyini *et al.*, 2002). This means that the contribution of the natural environment to economic development is taken for granted. Environmental degradation is therefore not viewed as a cost to the economy and policies are formulated that indirectly promote environmental exploitation. As a result inadequate funds are invested in conservation and sustainable natural resource use practices. As the natural resource base is undervalued it makes it difficult to justify conservation when other competing investments are perceived to yield greater and more immediate returns, but which may be unsustainable in the long-term (Moyini *et al.*, 2002).

As a result of the expansion of agricultural practices in Uganda, conflict between rural communities and conservation projects has become a common occurrence over the past 30 years. Over 80 % of Uganda's land is used for small-scale farming (Uganda Bureau of Statistics, 2005; Stampone *et al.*, 2011). The high dependency of Ugandans on the natural resource base has also resulted in clashes with National Park authorities as the areas people relied on for harvesting are now inaccessible. For example, the establishment of Bwindi Impenetrable Forest restricted the supply of natural resources to the local people and simultaneously increased the likelihood of crop raiding by wild animals (Hamilton *et al*., 2000). The people became bitter and sentiments were expressed such as 'when you mention the national park we want to vomit' and 'gorillas should be put in cages and taken to zoos'. In the dry season following the establishment of the park 16 fires were lit that burnt five per cent of the forest and threats were often made against the gorillas (Hamilton *et al*., 2000).

As wetland and forest resources decline the local households lose their ability to secure resources and sustain their livelihoods (Hartter, 2007). As resource shortages arise the local communities have to either purchase the resources or a substitute; or else travel greater distances to collect them.

1.5.2 Wetland Conservation

Approximately 15 % of Uganda's land surface area is wetland (World Resources Institute and Ministry of Water, Lands and Environment, 2009). The wetlands contribute significantly to the national economy and rural livelihoods. The value of wetland use to local households has been estimated at USD 11.4 billion per annum (2001 exchange rate where USD 1: USh 1 650)

(Moyini *et al.*, 2002). Yet, despite their value, wetlands are under increasing threat from population growth, economic reform, the desire for increase in *per capita* income, and development activities (Maclean *et al.*, 2003).

In 1986, the Ugandan government issued administrative guidelines to prevent the further destruction of wetlands. The wetland policy bans the drainage of wetlands; promotes sustainable use of the wetlands; encourages environmentally sound management; allows for equitable distribution of wetland benefits; and the application of Environmental Impact Assessments (EIAs) on all wetland activities to ensure that wetland development is well planned and managed (UNWP, 1995). Uganda is recognised for leading the effort in Africa to conserve wetlands that are regionally and globally important for migratory bird species and biodiversity. It has eleven sites designated as Wetlands of International Importance. However, other than these eleven, the majority lie outside protected areas (World Resources Institute and Ministry of Water, Lands and Environment, 2009).

Wetlands in Uganda have traditionally been used as sources for construction and craft materials, fresh water, medicinal plants, hunting and fishing areas. Seasonal wetlands and the peripheries of permanent wetlands are used for grazing cattle, growing crops and providing fresh water for domestic uses (UNWP, 1995). The wetlands also contribute to biodiversity, aesthetic beauty and cultural heritage whilst providing important ecological services such as flood prevention, water purification and groundwater recharge (Hartter, 2007). Unfortunately, Ugandan wetlands have been treated as wastelands and many have been degraded (UNWP, 1995). As wetlands are degraded the micro-climate can change e.g. solar radiation, humidity and wind patterns that are important for the survival of many organisms. Other biological attributes that are affected include: predator-prey relationships, habitat quality, migration corridors, and the associated species survival probabilities. Such habitat destruction may not only cause local extinctions but may have more long-term effects on populations through changes in pollination, predation, and food availability (Hartter, 2007).

A positive feedback loop is created whereby the overexploitation of natural resources and land transformation results in greater degradation of the natural environment which in turn reduces the ability of it to provide the required resources and services. Despite this knowledge the degradation continues to the detriment of local livelihoods. The poorest sector of society is the most dependent on harvesting wetland resources and so such degradation enhances poverty (Maclean *et al.*, 2003).

1.6 Objectives and Key Questions

Drawing on the previous discussion, this project hoped to examine the governance dynamics and livelihood and conservation benefits of a CBNRM project or process that was community initiated and managed with relatively little or no external support. The Bigodi Wetland Sanctuary was identified as a possible case study, which forms the basis of this thesis. Although the idea for the sanctuary was first posed by an external facilitator, the formalisation of the Bigodi Wetland Sanctuary in 1992 was by KAFRED which is a registered community-based organisation. KAFRED aims to "conserve the wetland through the wise use of natural resources and simultaneously use tourism as a tool to develop the local community and eradicate poverty". As each CBNRM project varies considerably, this study would not provide a blueprint for success but rather a better understanding of the potential of CBNRM and to act as an example and a guide for improvement for other CBNRM attempts worldwide in the absence of significant external support. The key questions covered in this study include:

- What are the goals of Bigodi Wetland Sanctuary (BWS) and are they being achieved?
- What monitoring occurs of costs, benefits and outcomes? How can this be strengthened?
- What are the costs and benefits of the project to the local community?
- How do the local people perceive the Wetland Sanctuary?
- How are the management of BWS and the activities of the local community affecting the wetland? How can this be improved?

This case study was divided into three main sections: an assessment of the KAFRED management and monitoring practices and procedures in place (Chapter 2), an investigation into the relative value of local livelihood strategies (Chapter 3), and lastly, a wetland health and ecosystem services assessment (Chapter 4).

1.7 Study Area

1.7.1 Location

Bigodi village is situated in the Kamwenge district of western Uganda (00°24.364'N, 030°24.527'E) (Fig. 1.4). The district occupies an area of about 2 439 km^2, with an altitude ranging between 1 300 m and 3 800 m above sea level. Bigodi is 39 km south from Fort

Portal on the Kamwenge Road, and is situated in the forested highlands of the Albertine Rift. The rift valley has fertile soils and receives high rainfall; therefore, the area is rich in biodiversity and has a dense human population (Lepp, 2004). The area is surrounded by large water bodies as it lies approximately 190 km west of Lake Victoria and between Lake Albert to the north and Lakes Edward and George to the south (Stampone *et al.*, 2011). Bigodi borders the southeast edge of Kibale National Park (KNP). The park is 767 km^2 of forest and is renowned for its great diversity of primates, including the largest chimpanzee population in the world (Lepp, 2004). The area surrounding KNP, encompassing Bigodi, is a patchwork of agricultural lands interspersed with natural areas (Hartter, 2007) (Fig. 1.5). The forest fragments and wetlands are important resource bases for humans and wildlife.

About 50 % and 20 % of the land in Kamwenge district is crop land and grazing land, respectively (Kamwenge District State of Environment Report, 2004). The principal economic activity in Bigodi is subsistence agriculture. The following crops are commonly grown: sorghum, maize, millet, cassava, bananas, peas, groundnuts, sunflower, sweet potato, Irish potato, beans, tea, coffee, tobacco, cotton, tomatoes, cabbage, onions, and pineapples (Amooti, pers. comm., 2010). Livestock owned in Bigodi are predominantly cattle, goats, chickens, sheep and pigs. Livestock are used for income generation, prestige in society and cultural norms such as paying dowry and other traditional customs such as offering them as sacrifices to appease the spirits (Kamwenge District State of Environment Report, 2004).

Kamwenge District is developing economically. However, it is occurring at the cost of the natural environment through land degradation, poor sanitation, poor health, pollution, waste and garbage accumulation, destruction of wetlands and fish stock depletion (Kamwenge District State of Environment Report, 2004).

Figure 1.4: Kamwenge District, Uganda (LACOR, 2011).

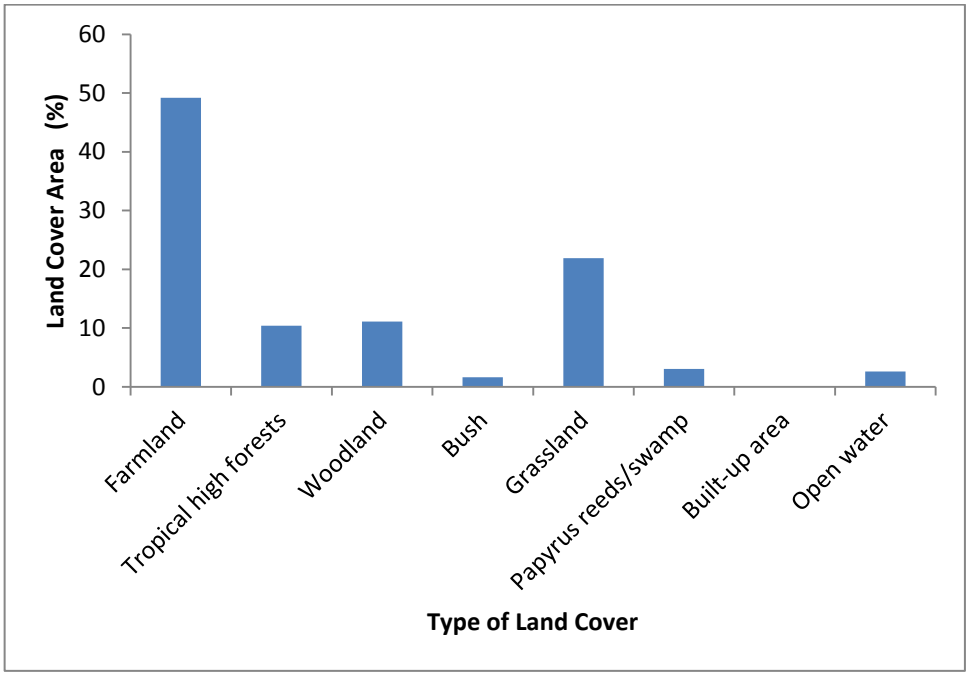

Figure 1.5: Land cover, Kamwenge District

(Kamwenge District State of Environment Report, 2004).

1.7.2 Climate

The amount of rainfall and the length of the season vary according to the biannual migration of the ITCZ (Inter-Tropical Convergence Zone) (Stampone *et al.*, 2011). The average annual rainfall for the region is 1 543 mm (average 1903-1999) and 1 719 mm (1990-2006) (Hartter, 2007). The rainfall is bi-modal with a long season (late February to early May) and a short season (late August to early December) (Hartter, 2007; Stampone *et al.*, 2011). These wet seasons are interspersed with two dry periods: first dry and second dry (Stampone *et al.*, 2011). The average annual temperature range is 15 – 23°C (Stampone *et al.*, 2011).

1.7.3 Vegetation

The area represents a diverse landscape of variable topography with disparate and discontinuous land cover types. The district has tropical high forests (254.5 km^2) found in protected areas (10 %) as well as in the public land (2 %), the forests are scattered unevenly and are mostly found in riverine valleys (Kamwenge District State of Environment Report, 2004). Savanna woodland occupies around 11 % of the district cover (271.2 km^2). The woodland is rapidly being degraded due to land transformation and population expansion (Kamwenge District State of Environment Report, 2004). In a study by Hartter (2007) it was found that there has been a decrease in papyrus and elephant grass cover and a corresponding increase in the area of land under cultivation around KNP.

1.7.4 Geology

Crystalline Basement Complex rocks of pre-Cambrian age underlie over 90 % of Uganda (Uganda National Water Development Report, 2005). These consist of predominantly granites, granitoid gneisses and gneisses, which are sometimes magmatised. These rocks are overlain by the so-called Buganda series and Karagwe–Ankolean series (Uganda National Water Development Report, 2005). The western part of the country is bounded by the rift valley, which is underlain by sediments made up of a mixture of sand, silt and clay.

1.7.5 People

According to the Ugandan Census of 2002, the population density of the Kamwenge District was 133 people/km^2 which was slightly above the national average of 126 people/km^2. The annual population growth rate of the district was calculated at 3.3 % and so by 2010 it was estimated that the population of the district would be approximately 380 000 (Kamwenge

District State of Environment Report, 2004). In the Kamwenge District, 15 to 30 % of the population lives below the poverty line. The highest levels of poverty were found in northern Uganda whereas the southwest and central areas of the country have the lowest poverty levels (World Resources Institute and Wetlands Management Department, Ministry of Water and Environment, 2009).

The Bigodi Local Councillor's tax roll and voter register indicated, using a low estimate of four children per household, that there were slightly more than a thousand people in the village (Lepp, 2004). Bigodi has experienced rapid population growth and subsequently has a high population density estimated in 2006 to be 335 people/km^2 (Hartter, 2007). The community was found to consist of more men than women; this is believed to be as a result of an influx of young men looking for employment in tourism. The majority of the people of Bigodi are subsistence farmers and so are largely dependent on natural resources to sustain their livelihoods. This has resulted in a history of conflict with the KNP authorities (Lepp, 2004; Hartter, 2007).

The principal ethnic group in the district is the Batoro. However, there are also a large number of Bakiga who migrated to the area (Amooti, 2007). The languages spoken include: Rutooro, Rukiga and Rutagwenda. The Bakiga, in general, are poorer than the Batoro, they have less land and so farm more intensively (Hartter, 2007).

1.7.6 Wetlands

Kamwenge District is endowed with numerous wetlands covering a total area of 75.2 km^2 (Kamwenge District State of Environment Report, 2004). In 1955 to 2000 it was found that the wetlands surrounding KNP had decreased by 19 % whilst smallholder agriculture had increased by approximately 137 % (Hartter, 2007). There are two types of wetlands found in this area: seasonal and permanent. The most common types of wetland vegetation include Phoenix palm, papyrus, phragmites and sedges (Kamwenge District State of Environment Report, 2004).

Bigodi is a unique community in that it has set aside a wetland to be conserved as a tourist attraction. The main body of the wetland is approximately 8 km long by 0.30 km wide, covering an area of 420 ha (Hartter, 2007; Amooti pers. comm., 2010). It is a permanent unchannelled valley bottom wetland with papyrus being the dominant vegetation. The

wetland stretches through the Bigodi community and meets the KNP boundary at both ends (Lepp, 2004) (Fig. 1.6). It is managed by a community-based organisation called the Kibale Association for Environmental Development (KAFRED) which was founded in 1992.

Figure 1.6: Location of Bigodi Wetland and KAFRED Centre in relation to Kibale National Park (Google Earth, 2011).

1.8 Approach

The CBNRM systems model (Fig. 1.3) was used to formulate the questions to be administered in the management and household surveys. This was done to ensure that all the necessary inputs and outputs, as well as the inter-relationships between the various system components were assessed. It enabled the case study to be viewed with a 'bigger picture' perspective.

The first phase aimed to analyse the management and monitoring practices performed by KAFRED's executive committee. Structured questionnaires were drafted (Appendix 1). The programme manager as well as each of the seven committee members received identical questionnaires to complete. Prior to them receiving the form the aim of the research was clarified and then each of the questions was explained. The questionnaires were completed anonymously to encourage free expression. As the meeting was held at 16:00 on a Monday

the committee members said they were tired and so were given the questionnaires to complete individually and were asked to hand them in by Friday 17:00. Additional information was gathered through personal communication with the programme manager (Tinka John Amooti), from the booklet he has produced on Bigodi and from the written constitution.

The second component involved carrying out household surveys to assess local livelihoods and the contribution of the wetland to these (Appendix 3). Of the estimated 160 households buffering the wetland, 68 were randomly selected and interviewed. Two translators were used and alternated according to availability. The questionnaires administered were identical and fully-structured. The interview was only conducted if there was an adult present to question. The nature and purpose of the interview was explained after which informed consent was sought.

Questions were based upon the following:

- The nature, amount, frequency of collection and value of the natural resources harvested from the wetland, and by whom.
- The costs endured as a result of the prohibition of utilisation of certain natural resources.
- The effect the wetland sanctuary has had on cultural or spiritual beliefs, spaces and practices.
- The cost of damage by wildlife to subsistence farmers.
- Potential alternative land use options.
- Involvement of the community in management practices, monitoring and decision making.
- The general perceptions and attitudes of the community towards the wetland sanctuary.

Any valuable information gained from informal conversation was recorded in field notes. Photographs were taken to document significant observations.

The third section of this study was an assessment of the wetland's health. This involved mapping the wetland perimeter with a GPS, slope readings were taken with an abney level, and land-use at each GPS point was noted. Photographs and field notes were taken to record all observations deemed significant. The WET-Health (Macfarlane *et al.*, 2007) and WET-

EcoServices (Kotze *et al.*, 2007) methodologies from the Wetland Management Series were used to assess Bigodi wetland. The assessments were based on the characteristics of and activities in the wetland and in the wetland catchment area. The methods rely on scoring sheets using variables that are estimated to fall within certain ranges by the assessor.

For both the WET-Health and WET-EcoServices sections a level 2 (field based) assessment was carried out based on personal observations of the wetland, information received from the KAFRED executive committee and household interviews, and from a topographical map (1:50 000) and satellite images (1996) obtained from the Department of Cartography in Entebbe. A Google Earth (2011) satellite image was used to compare with the images obtained from Entebbe. Two soil samples were collected to determine the organic material content.

Chapter Two

An Assessment of the Governance, Management and Monitoring Strategies of Bigodi Wetland Sanctuary

2.1 Governance

Governance refers to the interactions among structures, processes, rules, and traditions that determine how people in societies make decisions and share power, exercise responsibility, and ensure accountability, and how stakeholders have a say in the management of natural resources (Cundill and Fabricius, 2010). The following are critical requirements for effective governance according to Andrew and Shava (2010):

- An enabling legislation and policy framework.
- Adequate financial, physical, human and social capacity.
- Meaningful community participation in all processes and outcomes of governance.
- Effective collaborative monitoring of implementation and compliance.
- Flexible and adaptive local institutions.
- Supportive national and global governance institutions.

Ostrom (2009) produced a socio-ecological framework which emphasises that governance needs to be aligned with the resource users, the resource system and the resource units. To enable this, the management plan should be locally developed. For local governance to be effective it needs to be able to adapt to and monitor change (Ostrom, 2009).

2.2 Adaptive Co-management and the Importance of Decentralisation

The two fundamental building blocks of CBNRM are people and the natural resource base that they interact with (Fabricius *et al.,* 2004). As our world is human-dominated the people need to be viewed as a part of the environment rather than just drivers of change. Their interaction with the natural environment needs to be managed. Adaptive co-management is more and more being seen as the governance approach to managing these complex socio-ecological systems (Cundill and Fabricius, 2010). Adaptive co-management combines adaptive management and collaborative management to produce a potential innovation in natural resource governance under conditions of uncertainty, change and complexity (Plummer and Armitage, 2007).

When managing natural resources it is crucial that any rules made at the community level are supported by higher government policies (Campbell, 2006). These policies should be aligned with sustainable resource management to guide CBNRM and monitor public adherence. Institutional structures and resource tenure must be legally recognised to devolve ownership and management responsibilities (Lyon, 2000; Campbell, 2006). Decentralisation has been shown to promote equity and enhance social development through receiving and sharing benefits at the local level (Campbell, 2006). It is assumed that if resources are managed at a local level they will be used more efficiently and so improve opportunities for sustainable livelihoods. The local people are less likely to destroy the natural resource base if they own it and experience the benefits of sustainable use (Campbell, 2006). Community level organisational units need to be small enough to meet regularly and face-to-face. All stakeholder voices should be heard to inform the management protocol (Rozemeijer, 2009). Collaboration, transparency and accountability are required to foster a learning environment where practice can build on experience (Berkes, 2003). The ability of a project to adapt and achieve goals is dependent on the quality of feedback loops and information and long-term personal relationships and experience (Child, 2009).

It is apparent that when dealing with co-management the sharing of responsibility and power is tricky (Berkes, 2003). This is due to the involvement of multiple partners such as:

- There are often three levels of organisation: community/local, regional/national and international.
- A selection of different groups at the community level.
- A number of government agencies.
- A number of NGOs.
- One or more international groups.

As knowledge and trust develops between the partners the management process can adapt and evolve. This unfortunately is a timely process.

It is crucial that reliable information is gathered based on resource use patterns and the production potential of the ecosystem to create effective and adaptive natural resource management and monitoring programmes. It needs to be determined which species are used and what for, who uses them, how much they use, and how frequently. A reasonable amount of the profit made by the project must be put towards maintaining management and monitoring practices (Fabricius *et al*., 2004).

2.3 The Process of Adaptive Monitoring with Local Stakeholder Involvement

Monitoring is "the systematic measurement of variables and processes over time" and "assumes that there is a specific reason for that collection of data, such as ensuring that standards are being met" (Danielsen *et al.*, 2009). Monitoring needs to be set at the start of a CBNRM initiative and must be used for both the development of the rural community and the management of resources (Boggs, 2004). It is essential in guiding the process of adaptive management and in ensuring that the project at hand is progressing towards planned outcomes. Monitoring is important in assessing the impact on society and the associated ecological system when new policies or actions are undertaken; it also ensures accountability (Lyon, 2000). A good monitoring programme needs well defined questions that are stipulated prior to the commencement of monitoring, it should be strengthened with an appropriate statistical design, it needs to be based on a conceptual ecological model and lastly the programme should be as a result of an inherent need to understand the ecosystem as it should assist in improving natural resource management (Lindenmayer and Likens, 2009).

Adaptive monitoring provides a framework for incorporating new questions into a monitoring approach for long-term research whilst maintaining the integrity of the core measures (Lindenmayer and Likens, 2009). The initial key steps are to develop critical questions and a robust statistical design (Fig. 2.1).

If there are no means to assess an initiative then how do the various actors know if it is on the right trajectory to achieve the agreed goals? Despite the importance of monitoring it is often side-tracked as it is difficult and expensive to coordinate (Danielsen *et al.*, 2009). This is such the case in southern Africa where a number of strong monitoring systems have been developed but are not always implemented (Child, 2009).

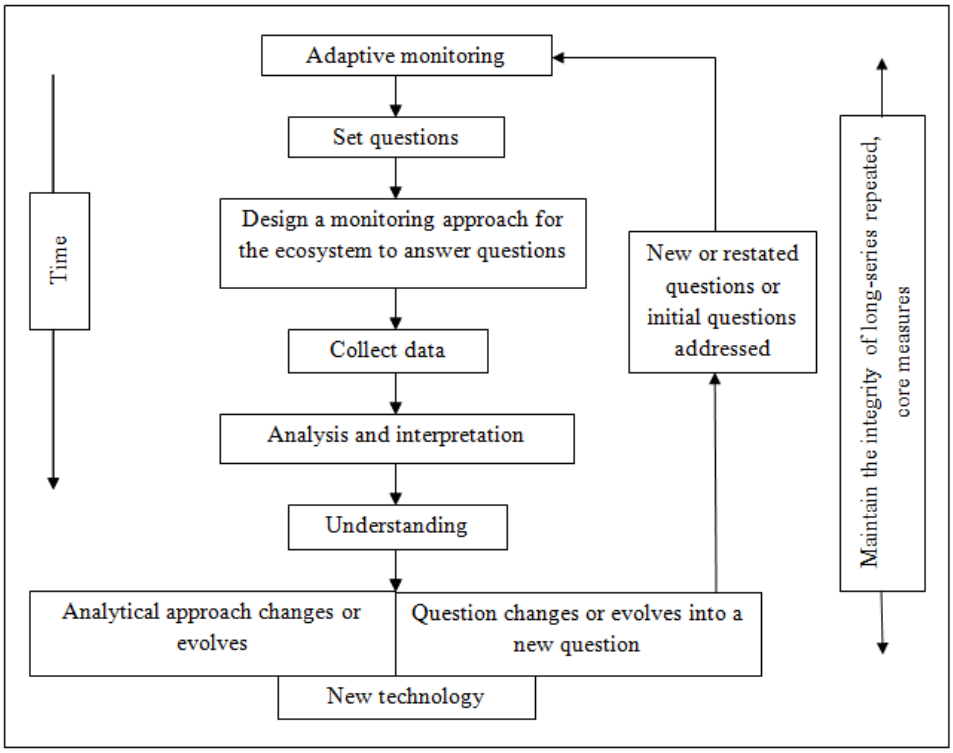

Figure 2.1: Adaptive Monitoring Framework (Lindenmayer and Likens, 2009).

Attempting to secure an adequate monitoring approach is a daunting task as funds are often limited in developing countries. Danielsen *et al.* (2009) describe monitoring schemes that can be classified into five categories according to the level of involvement of local stakeholders and external professionals (Fig. 2.2). Each of the five schemes has associated characteristics such as expense, expertise requirements, and accuracy and precision which are extremely important to consider prior to delving into a monitoring approach.

1. Externally driven and professionally executed	Increasing Local Stakeholder Involvement
2. Externally driven with local data collectors	
3. Collaborative monitoring with external data interpretation	
4. Collaborative monitoring with local data interpretation	
5. Autonomous local monitoring	

Figure 2.2: Categories of natural resource monitoring schemes and relative local stakeholder involvement as given by Danielsen et al. *(2009).*

A CBRNM project requires that the: effectiveness of expenditure, performance of CBRNM according to local individuals, the governance of CBRNM, as well as the involvement of and accountability to individual members of the community are monitored (Child, 2009). The approach should involve all stakeholders and the outcomes must be used to adapt management accordingly.

CBNRM initiatives also need to monitor natural resource use to determine the impact of consumptive use, and to avoid overexploitation and population extinctions. To achieve this the level of natural resource use as well as the associated biological characteristics of interest (e.g. population size, reproductive success, age and sex structures, migration patterns and feeding ecology) need to be monitored simultaneously (Lyon, 2000).

Essentially, monitoring a socio-ecological system is vital in determining whether something has gone wrong and must result in corrective action through feedback loops. The monitoring programme therefore needs to be isolated from problems affecting the main CBNRM programme, i.e. it should not be affected by a lack of funds, weak leadership or management inadequacies (Child, 2009).

These theories behind CBNRM governance, adaptive co-management and adaptive monitoring were used to analyse the case study of BWS. This resulted in the formulation of the following key questions: How is Bigodi Wetland Sanctuary managed? What are the goals of the initiative and are they being achieved? What monitoring occurs of costs, benefits and outcomes and how can this be strengthened? To what extent is the local community involved in management and monitoring? These questions aim to ascertain the strengths and weaknesses of the management system in place.

2.4 Methods

Structured questionnaires were used to determine how KAFRED's executive committee manages and monitors Bigodi Wetland Sanctuary (Appendix 1). The programme manager as well as each of the seven committee members received a questionnaire to complete. One of the seven committee members was a woman. Prior to them receiving the form the aim of the research was clarified and then each of the questions was explained. The questionnaires were completed anonymously to encourage free expression. As the meeting was held at 16:00 on a Monday the committee members said they were tired and so were given the questionnaires to complete individually and were asked to hand them in by Friday 17:00. Additional

information and insight was gathered through personal communication with the programme manager (Tinka John Amooti), from the booklet he has produced on Bigodi and from the written constitution.

2.5 Kibale Association for Rural and Environmental Development (KAFRED)

Background

KAFRED is a registered community based organisation that was established in 1992 with advice from an American Peace Corps volunteer, Mark Noonan (Amooti, 2007). The realisation of the tourism potential of the wetland resulted in guided wetland walks starting the following year. The reasons for the establishment of Bigodi Wetland Sanctuary (BWS), according to the executive committee, could be condensed to the following: 'to conserve the wetland through the wise use of natural resources and simultaneously use tourism as a tool to develop the local community and eradicate poverty'.

The objectives of KAFRED as stated in their constitution are as follows:

- The conservation of natural and cultural resources for the benefit of both present and future generations.
- Development of the rural communities adjacent to the wetland by establishing or supporting community development programmes such as education, health and sanitation, roads and bridges, agriculture and eco-businesses.
- Create awareness among the local people about the importance of the natural environment, their interconnection with it and attitude and ways to live in harmony with nature.
- Encourage and promote tourism activities that will benefit the local community by encouraging the establishment of tourism services and activities.
- Seek technical training for tourism staff and other players, for the smooth running of tourism businesses and the conservation of natural resources.
- Assist local farmers in the development of improved methods that work in harmony with wildlife and the environment.
- Carry out research on problems that affect the local community including research that seeks to solve the issues of crop raiding, soil erosion and crop and animal husbandry.

Also conduct research on animal behaviour and tourism impacts on both the community and the natural environment.

- Monitor the impacts of tourism on the local community and the environment, and the development trends both positive and negative.
- Support to poor and disadvantaged groups, such as women, youths, elderly, disabled, orphans, children, widows, people living with HIV/AIDS, and any other groups as may be identified by the executive committee.
- The objectives of the association are charitable and shall not be profit oriented.

In 1995, the IUCN NGO Program Office and the National Wetlands Program provided training to KAFRED members in tourism and business management. The KAFRED executive committee consists of seven members who are elected every two years (KAFRED executive committee, 2007). The committee consists of a chairperson, a vice chairperson, a secretary, the treasurer and three other committee members. Additionally there is a KAFRED programme manager who oversees the initiative. The term of an executive committee member is two years with possible re-election; the chairperson however, may only serve for two years. The election process is not open to the general public, only to KAFRED voting members.

According to the constitution, KAFRED membership is open to any Ugandan citizen who supports the cause of conservation and utilisation of natural and cultural resources for the purpose of rural development. There is a non-refundable membership fee of USD 22 (Amooti pers. comm., 2010). The heads of the families bordering the wetland are automatically classified as non-voting members. They may become voting-members if they pay half of the standard membership fee (KAFRED executive committee, 2007). In 2010 there were 113 KAFRED members in total. People are encouraged to become members through the messages of dance and drama groups, newspaper advertisements and verbal promotion.

Monthly executive committee meetings and annual general meetings (AGM) are held (Amooti, 2007). The monthly executive committee meetings are carried out to ensure that tourism activities are running smoothly and that the conservation and community development objectives are being reached (Amooti, 2007).

KAFRED members are notified about the AGM through radio announcements and invitation letters; it is generally well attended as lunch is provided (Amooti pers. comm., 2010). At the AGM the executive committee runs through the agenda as described in the constitution. If a KAFRED member would like to add an issue to the agenda they have two weeks to approach

an executive committee member, a vote takes place and with sufficient support the issue will be incorporated. The committee presents reports and draft plans for the year to come, which are then discussed with the KAFRED members for approval (Amooti, 2007). A copy of the financial report is given to the members.

The KAFRED members are free to inspect AGM minutes, annual reports and financial statements at any time. As declared in the constitution, these members are permitted to make key decisions based on the association's aims and objectives and may dismiss an executive on the basis of poor performance.

Support

There are no long-term investors in BWS (KAFRED executive committee pers. comm., 2010). The external organisations involved with BWS include the Kibale Community Fuelwood Project, Makerere University, Uganda Wildlife Authority (UWA) and UNITE (Amooti pers. comm., 2010). The Kibale Community Fuelwood Project was initiated as a result of the growing pressure on wood and charcoal as a fuel source in and around Kibale National Park. Nurseries have been established consisting of *Sesbania sesban* and *Marcamia* seeds which are collected locally and germinated in recycled plastic bags. These seedlings can then be grown to provide wood or as fencing (Kibale Fuelwood Project, 2009).

UNITE (Uganda and North Carolina International Teaching for the Environment) is a conservation education and teacher training programme that is committed to conserving wild areas in and around KNP. It promotes environmentally sound attitudes, knowledge and skills to the local people. UNITE works with the schools and national parks to develop environmental curricula (North Carolina Zoo, 2009).

Makerere University Biological Field Station (MUBFS), located at the edge of KNP, carries out diverse ecological research. It was involved in the establishment of KAFRED in 1992 (Makerere University, 2010).

Uganda Wildlife Authority (UWA) is a government institution whose aim is to manage wildlife and protected areas in partnership with neighbouring communities and stakeholders (uwa.or.ug, 2010). UWA is associated with BWS and helps with marketing the sanctuary to tourists.

Leadership figures from the local community that are involved in BWS include: a traditional healer, chiefs, teachers and local council members. The traditional healer has been a part of the Community Walk for three years; he explains the local traditions and culture to tourists. The chiefs, teachers and council members offer their advice, guidance and support to KAFRED. The chiefs have been a part of the initiative since it was established in 1992, they are important in policing the use of the wetland.

Income Generation

Income is derived from tourism in a number of ways. There is a guided wetland walk which allows wildlife tourists to view eight different primate species, as well as a variety of plant, insect and bird species. Another popular tourism activity is the community walk whereby visitors pay to speak to local influential members of the community for example the traditional healer and elders about their lifestyle, traditions and culture (Amooti, 2007).

Homestead stays are on offer to enable visitors to experience the rural way of life, culture and organic cuisine. With the demand for accommodation and western food, new vegetables such as tomatoes, cabbages, broccoli, beetroot and carrots are now grown by the local farmers (Amooti, 2007). It is claimed that these vegetables have improved the nutrition and health of the local people.

Income is also generated by the sale of locally made crafts and peanut butter produced by community development initiatives (the Women's Group and Peanut Butter Project described later). In this way the benefits of tourism are spread to the wider community by including and empowering the women and subsistence farmers.

The government supports KAFRED by providing additional funding for specific initiatives, such as in the case of Bigodi Secondary School (mentioned later). KAFRED also receives technical support and donations from NGOs and occasional volunteers (KAFRED executive committee pers. comm., 2010).

Community Development Projects

KAFRED ensures that the Bigodi community reaps benefits from the wetland sanctuary by investing 75-80 % of the tourism generated funds into village infrastructure and projects such as education, health, roads and sanitation. Infrastructural developments to date include: the construction of bridges, boardwalks, roads, schools and permanent brick buildings with iron

sheet roofing (KAFRED executive committee pers. comm., 2010). The remaining 20-25 % of the income is utilised to pay the committee members', secretary's and guides' salaries, as well as the running costs of the project (Amooti pers. comm., 2010).

In 1992 a community meeting was held to determine what development was needed in Bigodi (Amooti, 2007). Most people requested a secondary school, as the previous one (Bigodi High School) had collapsed as a result of religious differences. In 1993 the school was built on government land but KAFRED gained exclusive land user rights to develop and run the school. It was funded by membership fees, tourist activity fees and a loan which was later repaid (Amooti, 2007).

A community library was also opened in the Bigodi Trading Centre to improve education standards; the books were either donated or borrowed from the public library in Fort Portal (Amooti, 2007). KAFRED employed a librarian and the service was free to the community. The donated books did not interest the local people and so were moved to the secondary school.

The Bigodi Women's Group (WG) was initiated in 1993 with the advice of Noonan to enable the local women to gain from the tourism business (Amooti, 2007). The ladies produce crafts to sell to the tourists such as mats, baskets, hats and jewellery. Ninety per cent of the sale price goes to the producer, with the remaining ten per cent donated to the group fund (Amooti, 2007). The group uses environmentally sustainable techniques to produce the crafts such as using agricultural residue (millet straw), natural dyes and growing their own plants. The beads used to make necklaces and bracelets are made from recycled paper.

Another initiative taking place in Bigodi is the Peanut Butter Project which was also started by Noonan. Groundnuts grown by approximately 100 local farmers are processed with a generator-powered motorised grinding machine (Amooti, 2007). The group sells around 200 kilograms of peanut butter per month which has increased the daily income of the members by 150 % (Amooti, 2007). The peanut butter product is marketed locally and nationally in shops and hotels.

There is no compensation for crop damage and livestock loss associated with animals from the wetland or KNP. KAFRED started a revolving fund in 2005 of USh 100 000 to be used by around 35 families that border the wetland. They have one year to utilise the money and pay it

back interest free. KAFRED does not monitor the use of the money, the families are to manage it at their own discretion (Amooti pers. comm., 2010).

Development of Rules

A participatory planning workshop was held in 1996, involving KAFRED members, heads of the households bordering the wetland, local council members, women leaders and district officials. The facilitators were from the National Wetlands Programme (NWP) and the Kibale and Semliki Conservation and Development Project (KSCDP), with financial and logistical support from the IUCN NGO Support Program (Amooti, 2007). The facilitators introduced the national wetlands policy to the participants as a basis for discussion. A 'do's and don'ts' list was developed (Table 2.1). This participatory workshop was important for future conservation and tourism development as there was a significant change in attitude towards the wetland (Amooti, 2007).

Table 2.1: The 'do's and don'ts' list (Amooti, 2007).

Do's	Don'ts
Collect: -water	-no individual ownership
-fuelwood (dead)	-no irrigation canals
-medicinal plants	-no burning
-mushrooms	-no cultivation
-craft materials	-no cutting down trees
-thatch material	-no clearing of papyrus on a large
-fruit	scale (e.g. for thatch)
-graze on wetland periphery	-no building
-fish (small scale)	-no burning charcoal
-keep bees	-no garbage disposal
	-no unnecessary noise

The executive committee, local council members and the District Environmental Officer are responsible for enforcing the rules (KAFRED executive committee pers. comm, 2010). Offenders are sensitised and warned, repeat offenders are either taken to the police, to the respective chief or to the District Environmental Officer. The legislation is available to the

community, it was handed out a long time ago, however it is believed that not many people have read it (KAFRED executive committee pers. comm, 2010).

The Ugandan National Wetland Policy (UNWP) states that wetlands cannot be owned individually or destroyed. There is no formal document written up for BWS, but KAFRED is managing the use and conservation of the wetland for government (KAFRED executive committee pers. comm, 2010). There is no boundary marking the buffer zone, it is an imaginery line stipulated by the government according to the category of the wetland.

2.6 Data Analysis

When the questionnaires were returned it was found that some of the committee members (n=7) had not completed all of the sections, hence 'n'or 'number' varies in the results. The programme manager completed the entire questionnaire as it was administered personally. The answers received from the programme manager were combined with those from the committee members. Thus, where answers were received from all committee members and the programme manager 'n' is equal to eight. Due to the small sample size, basic descriptive statistics were used to summarise the data in Microsoft Excel. All mean or average values calculated were displayed with the standard deviation in brackets.

2.7 Results

2.7.1 Governance Approach

Goals

Table 2.2 demonstrates that conservation was the goal most frequently mentioned by the KAFRED committee members (7), which was followed by community development (5) and ecotourism (3). The other six goals were all mentioned by less than one-third of committee members. The following goals: conservation, ecotourism, improved education and environmental education were all rated the highest, with regards to achievement, as being 'mostly met' (4). Community development, improve standard of living and job creation were rated the next highest as being 'partially met' (3). The lowest score was received by poverty eradication as only being 'slightly met' (2).

Table 2.2: The goals mentioned and scored by the executive committee (n=8).

Goals	Frequency	Average Attainment Score
Conservation	7	4 (± 0.5)
Community development	5	3 (± 0.9)
Ecotourism	3	4 (± 0.6)
Improve standard of living	2	3 (± 1.4)
Job creation	2	3 (± 0.0)
Improve education	2	4 (± 0.0)
Environmental education	1	4 (± 0.0)
Income generation	1	*no value given
Poverty eradication	1	2 (± 0.0)

Support

When looking at the perceived involvement of external organisations in making BWS management decisions it was found that three of the committee members believed that the involvement in decision making was high, two members said that there was no involvement, one said that there was moderate involvement and one other said that there was only slight involvement.

Participation

All of the executive committee members (8) said that the local people are willing to engage and exchange knowledge at the AGM. Only one of the committee members said that they felt that women were unable to speak freely at the AGM.

Five of the executive committee members said that they thought trust existed between them and the local people. One person said that there was no trust between them and another said that there was some trust.

The range in KAFRED's perception of community adult attendance to the AGM was extreme with the lowest at only 2 % and the highest at full attendence or 100 %. The median proportion of local adults believed to attend the AGM was 63 %. It was found that the variation in KAFRED's perception of men:women AGM attendance was also great. The median ratio of men:woman thought to attend was 60:40. The proportion of men relative to

women believed to attend the AGM ranged from 33 % to 85 %. The range for women attendance was also great at 15 % to 67 %.

Rules and Regulations

The information received from the interviews with regards to livestock restrictions was contradictory:

- Two members said that there were no livestock restrictions as there are only a few animals and most of them are goats, so the impact is low.
- Animals are not allowed to graze in the wetland but can be taken there to drink.
- Two members said that there were no restrictions and that the animals are free to graze and drink.
- Yes, there are restrictions as water sources are contaminated by livestock and they also contribute to erosion.
- Cattle and goats are only allowed to drink from the wetland in the dry season.
- Any person found grazing their animals on the wetland is subjected to time in prison worth the damage done.

Other than the one committee member who stated that livestock was only allowed to drink from the wetland in the dry season, the other members said that the restrictions were not based on season.

When asked whether KAFRED's rules were state or collective choice based, mixed answers were received. Two members said that the rules were collective choice, one said that they were state and two said that they were both state and collective choice based.

Rule Enforcement

Two committee members said that the local people adhered to KAFRED's rules fully (score of 5), one member said that most (score of 4) of them did and the other two members said that only some (score of 3) people respected the restrictions. The median score given to adherence was 3.5 indicating that most of the local people were believed to abide by the rules.

One member said that there had been three issues of conflict in the past year, two members said that there had been only two problems. These breaches included growing eucalyptus trees and moving the wetland trail to increase land area for cultivation.

Finances

Those mentioned as responsible for marketing BWS were the: programme manager, all KAFRED members, the guides, the community, the executive committee and the Uganda Community Tourism Association (UCOTA).

It can be noted in Figure 2.3 that with the exception of years 1999 to 2001, there has been a relatively steady increase in the number of visitors to BWS. The mean annual increase in visitors between 2002 and 2008 is approximately an additional 268 people per year.

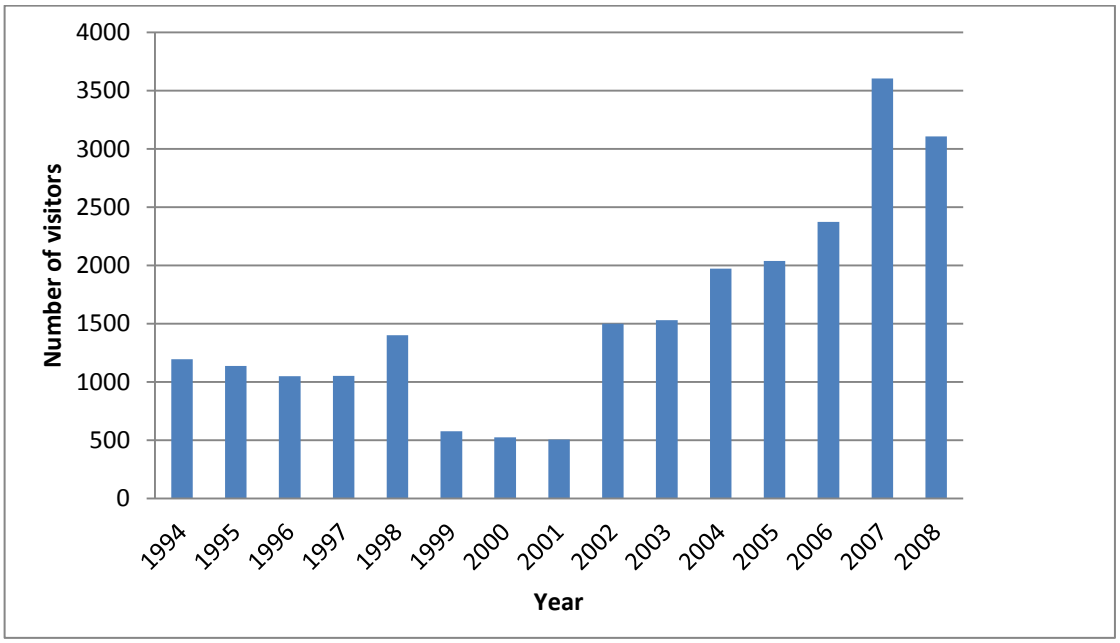

Figure 2.3: Annual number of tourists who visited BWS (KAFRED records, 2010).

The majority (69 %) of BWS income is generated by the guided swamp walk, the next highest contribution is 15 % from the village walk. KAFRED membership fees make up 8 % of the annual income, followed by 5.5 % from donations. Small sales only contribute to 2 % and training guides generates the remaining 0.5 % (KAFRED charges a small fee for providing training).

2.7.2 Bigodi Wetland Natural Resource Use

System Health

Half of the committee members believed that the wetland condition was good and a quarter said that it was average. One said that it was very good and one member said that it was poor. All of the executive committee members said that the wetland condition had improved since

the establishment of the sanctuary. This is deemed to be the result of sensitisation enabling people to realise the importance of conservation.

Hippos, the blue monkey and sitatunga were mentioned as no longer being found in the wetland. This knowledge was based purely on observation. The loss of the animals is thought to be as a result of habitat loss and poaching. Three committee members said that there has been an increase in the total number of animals since the establishment of BWS, one member said there had been no increase and one said that there had only been an increase in monkey numbers. There are no records kept of animal numbers. Primate counts were only started in June 2010.

The invasive species mentioned were *Eucalyptus spp.* which are currently being cut down and an unidentified parasitic vine. They cover an estimated 0.1- 1 % of the wetland.

Water Abstraction

According to the executive committee no irrigation is carried out. Animals are allowed to drink the wetland water and people can collect it for household use. An estimate of water extraction was given at 100 to 200 litres per family daily. With a total of around 160 households in the community this can be extrapolated to between 16 000 and 32 000 litres a day (assuming that all the households collect water from the wetland).

2.7.3 Monitoring of Bigodi Wetland Sanctuary

Three members said that the monitoring started with KAFRED in 1992, two members said that it started in 2009. Four of the seven committee members said that they had access to relevant and recent monitoring information. Four members said that BWS was monitored, one said that it was not, one member said that certain aspects of it were, the last member said that monkey counts and a tree phenology study were being carried out.

The monitoring was said to be carried out for the following reasons:

- To determine plant succession rates as certain tree species displace papyrus.
- To see if utilisation is affecting the wetland.
- To sensitise the people on the importance of the wetland.
- To determine if progress is being made.
- To ensure the survival of tree species that provide food for the monkeys and birds.

When asked what was monitored the committee said: “animal poaching and littering”, “trees”, “flora and fauna”, “damage” and lastly, “trees and primates”. When asked why these were monitored the following were said: “we would like to fulfil conservation goals”, “they are dominant” and lastly, “trees are easy to monitor as it does not require skill or time, the monkeys are also easy to count and are important for the tourists, the next aspect to be monitored will be birds”.

It was found that half of the responses suggested that the indicators were easy to monitor and half were neutral (n= 6). The animal poaching and littering monitoring is done weekly, the tree phenology and monkey counts take place every six months. Four members said that the monitoring in place was effective, another member said that it was just providing baseline data and still needed to be processed.

Two members mentioned that a problem encountered was that the tree labels were being removed, another member said that there was a lack of funds, the other member said that there were no problems.

The guides are responsible for monitoring the trees and primates, they are paid as it is part of their job. General litter and damage monitoring is done by the committee. The programme manager is to process the monitoring results. Low level monitoring training was done by volunteers. Three members said that the guides are supervised when monitoring. There are no feedback loops from monitoring to management as it is still in its infancy. The monitoring results have not yet been processed. There is only a sketch map drawn by a volunteer of the tourist section of the wetland.

2.7.4 Perceived Impacts of Bigodi Wetland Sanctuary on Local Livelihoods

Incentives

“The people realise that BWS generates income through tourism which is then put towards developing Bigodi” and “they know that they benefit from it” were answers given by the committee pertaining to reasons for the local people to accept the sanctuary. Five members said that those who contribute more to BWS receive greater rewards than those who do not. Two members said that this was not the case. It was unanimous that the standard of living of the people of Bigodi had improved since the establishment of BWS.

Human Well-being

All of the executive committee members said that education had improved in the area as a result of BWS. Three quarters of the committee members said that there had been an increase in income. Five of the eight committee members said that there had been an improvement in health and half of the committee members said that skills had improved too.

It can be deduced from Figure 2.4 that fuelwood, food and construction material needs were the most affected (ranked as partially affected) by BWS rules. This was then followed by the aesthetical and recreational value of the wetland which was scored as slightly affected. The need for clean water, craft materials, cultural and spiritual provisions and medicines were rated as not affected at all.

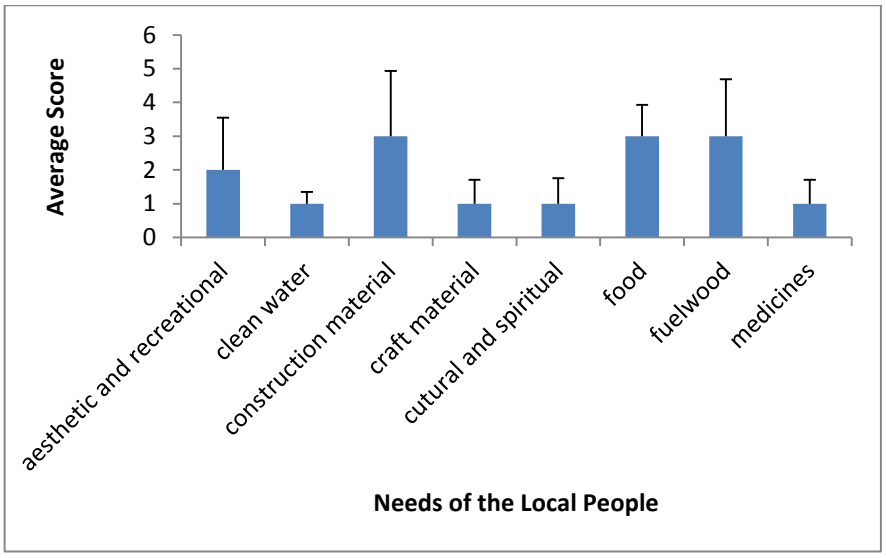

Figure 2.4: Average scores (on a scale of 1-5) to demonstrate the effect of BWS restrictions on the needs of the local people.

The negative impacts of BWS, according to the executive committee, are that it harbours vermin which raid crops, some agricultural land has been taken, no hunting is allowed and there are restrictions on natural resource harvesting. Despite the negative impacts, seven out of the eight committee members believe that the people are happy with BWS in general, one member said that they are neutral towards it.

2.8 Discussion

2.8.1 Governance Approach

Goals

Fixed goals are useful for project managers to set criteria and monitor progress. However, there must be an emphasis on adaptive and cyclical patterns of management, and on learning from experience (Koch, 2004). It would therefore be beneficial for KAFRED to monitor indicators to ensure that their goals are achieved and to enable the evaluation and adaptation of the management process to suit sudden change.

CBNRM initiatives are strategies aimed at addressing both environmental and socio-economic goals enabling an accepted compromise between the exploitation and conservation of valued ecosystem components (Armitage, 2005, Shackleton *et al*., 2010). The aim of KAFRED: 'to conserve the wetland through the wise use of natural resources and simultaneously use tourism as a tool to develop the local community and eradicate poverty' covers both conservation and social responsibilities. The executive committee's perception of goal attainment was that conservation was being 'mostly met', and community development and improved standard of living was 'partially met'. Through the conservation of the wetland and the associated increasing number of tourists one can assume that local livelihoods will continue to improve with time, provided KAFRED remains a fair and transparent institution.

The goal of 'local poverty alleviation' was described as being only 'slightly met'. The poorest members of a community tend to be ill-equipped to capture the benefits associated with CBNRM initiatives (Turner, 2004). Another problem faced by the poor is that they are more dependent on the natural resources that CBNRM typically restricts access to. It is therefore crucial that they are involved in management decisions and that any benefits generated are suited to their needs too. KAFRED should ensure that the poorest members of the community are not marginalised as a result of the membership fee. The involvement of the poor in management decisions is necessary to achieve KAFRED's poverty alleviation objective.

Whatever the aims of a CBNRM initiative, in order to avoid conflict and potential programme collapse, it is important that the goals contribute to a vision common to all stakeholders. For example, in Sankuyo, Botswana, the community and commercial operator had different expectations. The community anticipated a development programme expecting training, financial benefit and social upliftment (Boggs, 2004). On the other hand, the commercial

operator expected the community to act as a business partner willing to take responsibility and risks. This highlights the benefits of 'collaboration' in co-management. KAFRED should continue to work closely with the District Environmental Officer and the local community.

Support

Government institutions often play a major role in CBNRM and can ultimately determine the successes and failures of an initiative. In the case of BWS, the Ugandan government has been supportive by formulating a national wetlands policy and by accepting and hosting a Ramsar Convention. Government has trained extension staff at the district level (e.g. the District Environmental Officer) to provide them with the skills needed to facilitate their supervisory role (UNWP, 1995).

To enable CBNRM programmes, government needs to respect local-level control (Ostrom, 1990; Fabricius, 2004). This has proved problematic in Tanzania where the battle for land tenure between central authorities and villagers has resulted in conflict among different private investors, reduced incentives for wildlife conservation at the village level, and loss of revenue to rural villages (Nelson, 2005). The Ugandan National Wetland Policy states that wetlands are recognised as a public resource to be managed by government on behalf of the people, thereby rendering Bigodi wetland as common property. Although government supports KAFRED's involvement in the conservation of the wetland land tenure still needs to be devolved to the people of Bigodi. This would encourage them to use natural resources sustainably, to feel responsible for the state of the wetland and want to be involved in management decisions, as well as to instil a sense of pride and ownership.

Fabricius *et al.* (2004) state that local-level power relations need to be supportive of CBNRM as they greatly influence community decisions. If traditional leaders are not included the progress and ultimate success of the initiative may be jeopardised. KAFRED has involved influential and respected members of the community in management and procedures of BWS. The traditional healer is a part of the village walk, local chiefs, teachers and council members offer their guidance and support. The chiefs in particular, are important in policing the use of the wetland. On the contrary, it must be warned that traditional leadership figures do not always represent their people equitably (Child, 2004). For example in the case of the Mafungautsi State Forest, Zimbabwe, where the Mrembwe village was largely controlled by the kraalhead's family and wife who was deemed to be a witch. The people feared to disagree with her as it was believed that they would fall ill, die or suffer from bad luck (Sithole, 2004).

The family was repeatedly elected onto the resource management committee by a democratic process involving three villages.

One of the seven principles for successful CBNRM according to Fabricius *et al.* (2004) is that facilitation from outside should be sensitive and responsible. The involvement of NGOs in funding operational costs can result in committees being accountable upwards rather than downwards to their members (Jones and Weaver, 2009). It is often the case that when an external organisation or funder pulls out of a CBNRM initiative it collapses, due to the fostering of a dependent relationship (Campbell, 2006). BWS has no long-term investors. The relationship of KAFRED with organisations such as the Fuelwood Project, UNITE and Makerere University is not one of reliance as they do not provide funds but rather services and skills.

On a broader scale it must be noted that a nation's economy can restrict the chances of CBNRM success. For example, the Malawian economy brought about an increased dependence on Lake Malombe fisheries by diminishing alternative income options. This resulted in the local people being reluctant to accept the restrictions in catches (Turner, 2004).

On a similar note, a potential problem faced by KAFRED and the Bigodi community is a dependence on tourism as this is essentially the driving force behind the conservation of Bigodi wetland and income generation. In a study by Lepp (2008) it was determined that although tourism has achieved infrastructural development, improved education and increased income in Bigodi it has not fostered self-reliance. The people of Bigodi demonstrate an external locus of control in their conceptualisation of tourism believing that the locally improving economic conditions are a direct result of the good will of outsiders (Lepp, 2008).

Tourism in Bigodi is subject to greater influences beyond the control of the community. Political and economic stability within Uganda as well as its neighbouring countries can affect tourist numbers. For example the number of visitors to BWS dropped between 1999 and 2001. This was as a result of eight tourists being murdered in Bwindi Impenetrable Forest in April 1999 (Amooti pers. comm., 2010). Parallel issues have been experienced in Zimbabwe and Botswana. In Zimbabwe, as a result of macro-level policy changes; both foreign and domestic tourism declined in addition to the cessation of USAID in 2003 (Taylor, 2009). In Botswana, the Xaxaba elders said that CBNRM replaced their traditional lifestyle of subsistence hunting (Madzwamuse and Fabricius, 2004). They argue that they are now dependent on the government for hand-outs, pensions and employment; and are at the mercy

of events which are beyond their control such as: the deterrent of political instability in neighbouring Zimbabwe, competing markets in Namibia and South Africa, as well as the price of fuel (Madzwamuse and Fabricius, 2004).

The fluctuation in BWS tourist numbers is a typical example of the unpredictable nature of a SES and emphasises the requirement for an adaptive form of management. To deal with the uncertainty of tourism the community also needs to ensure that they have established safety-nets in the form of diverse livelihood activities. Ultimately, the people and organisations involved in the initiative need to be adaptable and prepared for change (Cundill and Fabricius, 2010).

Management Procedures

Prior to the commencement of a CBNRM initiative there is a need to pre-organise community land tenure or else secure and legally recognise user rights (Fabricius, 2004). If local communities cannot prevent other people from using the land that they wish to conserve then there remains little incentive to do so (Jones and Weaver, 2009). As mentioned previously, the UNWP (1995), states that wetlands are a public resource to be controlled by government on behalf of the people. They will not be leased out to any individual or organisation. So, although there is no formal document written up KAFRED is managing the use and conservation of the wetland for government and the local people (Amooti pers. comm., 2010). This should be amended; land tenure needs to be devolved to the people of Bigodi.

If local common resource use rules are aligned with conservation objectives then management becomes an easier task (Berkes, 2003). Through the participatory planning workshop held in 1996 KAFRED aligned conservation goals with the local harvesting ways. Both parties compromised and in doing so developed the ‘do’s and don’ts’ list.

Participation

Formal communication channels should be established at the outset of a CBNRM initiative with room for additional informal contacts (Fabricius *et al.*, 2004). The executive committee meets once a month but only interacts formally with the KAFRED members at the AGM. However, the KAFRED members are free to visit the KAFRED centre to inspect financial statements, AGM minutes and annual reports at any time. Such frequent face-to-face meetings are important as they foster trust, transparency and the sharing of knowledge (Gruber, 2010).

The majority of the committee members said that trust existed between them and the local people.

Hosting an AGM provides the opportunity for participatory visioning, planning, designing, problem solving and decision making. It is important that knowledge is accessible to those whose lives are being affected (Gruber, 2010). The executive committee members all agreed that the local people are willing to engage and share knowledge at the AGM. This satisfies 'meaningful community participation in all processes and outcomes of governance' as previously stated by Andrew and Shava (2010) as a requirement for successful governance. Exchanging ideas and communicating problems at the AGM allows for people to feel that conservation is something done *by* them, not *to* them.

A common belief of donors and project managers is that by grouping people together time can be saved as it is deemed simpler to work with fewer groups. However, communities are often not homogenous, cohesive or sedentary, and so cannot be expected to speak as one (Fabricius, 2004; Johnson, 2004; Rozemeijer, 2009). Participation at public meetings needs to represent the thoughts of all sectors of the community. As a result of culture the women in Uganda are largely subservient in the presence of men. Yet, only one of the KAFRED committee members said that they felt that women were not free to express themselves at the AGM. KAFRED has ensured that there is a woman on the executive committee to link management with the local women. Women are largely responsible for harvesting natural resources and so need to be involved in management decisions (Shackleton and Shackleton, 2004; Turner, 2004). The local knowledge of men on wild food is declining as a result of formal schooling and emigration, while women not only retain a high and widely shared level of general knowledge about wild foods, crafts and medicinal plants, but also acquire new-men's roles as duties change (Kajembe *et al*., 2000).

Traditional knowledge is a concoction of knowledge, practice and belief that is developed through experience (Cundill and Fabricius, 2010). Men and women living in rural areas are traditionally assigned different tasks e.g. craft making, construction, fishing, cultivation and cooking and so acquire slightly different knowledge based on their respective daily activities. In the case of Duru-Haitemba, Tanzania, the government officials found that although they were better educated and worldlier than the local people, these attributes were insignificant in comparison with the villagers' more intimate knowledge of their environment (Kajembe and

Monela, 2000). The use of this knowledge is crucial for management decisions and should be shared at the AGM.

Finances

Tourism associated with CBNRM initiatives is considered an important poverty alleviation strategy. For example, seven villages in the Loliondo District of Tanzania earn over USD 100 000 annually from ecotourism ventures carried out on their land. The income has increased from virtually nothing five years ago (Akunaay *et al*., 2003). However, the distribution of revenue by the committee needs to be transparent to evade conflict (Fabricius, 2004). Equity is key, people who contribute more to the initiative need to be rewarded and those whose livelihoods are hindered should be compensated (Cundill and Fabricius, 2010; Gruber, 2010). KAFRED devotes 75 % to 80 % of its income to Bigodi village (Amooti pers. comm., 2010). Financial reports are given at the AGM and are available to the members throughout the year. This ensures that all income and expenditure is transparent. The people of Bigodi are rewarded for conservation with infrastructural development as well as the potential income they can make from the visiting tourists by selling crafts, peanut butter and providing food and accommodation. The job opportunities offered by KAFRED provide income to the local families and training increases social capacity. The families living adjacent to the wetland are subjected to persistent crop and animal raiding by wildlife. They are compensated through free KAFRED non-voting membership and are also the recipients of a revolving fund.

Spending revenue on community development should be a decision based on the will of the local people. In the case of the Mafungautsi State Forest, the forest officials pushed for livelihood activities such as beekeeping and gum tree planting when the local people really wanted a school (Sithole, 2004). Honey was not a part of the peoples' staple diet and growing trees next to a forest where they were abundant did not make sense to the community. The person responsible for the revenue allocated to the community needs to ensure that a fair representation of gender, wealth status and age is consulted prior to its spending.

In the case of Bigodi Secondary School, KAFRED organised a meeting with the local people to discuss what development was most needed and the resulting project was successful. On the other hand, the establishment of the public library provides a valuable lesson of a lack of communication. The local people were not interested in the library resulting in it being moved to the secondary school. KAFRED should hold discussions on potential infrastructural

development at the AGM, and as in the case of the Lupande project, Zambia (Child, 2004), only accept a decision if at least 60 % of the members are present.

KAFRED do not give cash hand-outs. This has positive implications as providing cash benefits to the local community for cooperating with CBNRM initiatives can be counter-productive. This is because finances may not be distributed equally as those with authority retain most of the income for themselves. This was evident in the case of the Lupande project, Zambia (Child, 2004), mentioned in Chapter 1. On the other hand, many community managers are afraid to use the public funds as they realise that every spending decision usually causes disagreements. As they manage the finances they are automatically open to challenges of embezzlement and fraud (Turner, 2004).

However, the Bigodi community should still have the option to choose their preferred means of benefit distribution. In the successful Torra Conservancy in Namibia, local residents requested receiving benefits in the form of community projects. Due to the high population in the conservancy the alternative, household dividends, would be very low (Jones and Mosimane, 2000). This is likely to be the case in Bigodi too.

Rules and Regulations

Local rules and means of enforcement need to be decided upon, implemented and taken seriously whilst working closely with the community members (Fabricius, 2004). Meetings have a propensity to enhance rule adherence through peer pressure (Koch, 2004). KAFRED's participatory and collaborative approach to rule development was ideal. However, the workshop took place in 1996 and so needs to be updated to suit present trends in the SES. In conjunction with more frequent rule development workshops, monitoring of harvested species should be in place to warn of any negative trends in their population dynamics. Resource management interventions should take into account all the natural resources required by local livelihoods, both for direct provisioning and income, not just for high-value species or resources (Shackleton and Shackleton, 2004). Those individuals affected by the rules must be able to participate in changing them (Ostrom, 1990 in Fabricius, 2004).

Rule Enforcement

CBNRM initiatives should develop conflict coping strategies at the outset to deal with power inequalities and differences in values, interests and perspectives (Cundill and Fabricius, 2010). KAFRED relies on a small police base, local council, chiefs and a District

Environmental Officer for rule enforcement. Using local-level power such as chiefs to discipline is suggested by CBNRM specialists (Fabricius, 2004). These leadership figures are respected and prior to colonialism would have traditionally played a dominant role in managing natural resource use. For example, in the traditional 'haymanda' system in Tanzania, anyone who harvested wood from the sacred forests was forced to offer an ox as a sacrifice (Kajembe and Monela, 2000).

The resource users and their officials should have access to low cost local mechanisms that can rapidly resolve conflict among users (Ostrom, 1990 in Fabricius, 2004). In the case of BWS most of the local people are believed to abide by the rules. Peer pressure is relied upon as an enforcement strategy where the community monitors each other's use and reports to KAFRED if the rules are violated. When conflict arises it is beneficial for punishments to be decided upon by the other resource users, by officials accountable to them or both (Ostrom, 1990 in Fabricius, 2004). BWS repeat offenders are taken to the police, respective chief or to the District Environmental Officer.

Communal lands, such as wetlands in Uganda, are held in trust by the state. Uganda has a national wetland policy that stipulates use guidelines according to the category of the wetland (UNWP, 1995). Institutions working in accordance with government can start acting as agents rather than elected community representatives (Fabricius, 2004). KAFRED needs to foremost ensure that they act as an extension of the community. Any actions that are perceived otherwise may cause distrust, a lack of cooperation and conflict.

2.8.2 Bigodi Wetland Natural Resource Use

System Health

Management decisions should be based upon a comprehensive body of knowledge including: local knowledge, ecosystem understanding, and economic evaluations of environmental assets (Gruber, 2010). Access to relevant and recent research is required to make informed decisions (Cundill and Fabricius, 2010). It would be beneficial for KAFRED to align with the guidelines stated in Uganda's National Policy for the Conservation and Management of Wetland Resources. Monitoring of the wetland would have ideally started with the establishment of BWS, as long-term data can be assessed for patterns and trends linked to changes in management.

CBNRM initiatives need to ensure that the condition of the resource base is maintained or preferably improved with time (Fabricius, 2004). The KAFRED committee members all agreed that the state of the wetland had improved since the establishment of the wetland sanctuary although there was no data to support this observation. The health of the wetland needs to be assessed and monitored to ensure that any changes, for better or worse, are recognised by management and consequently acted upon. This should be a priority for KAFRED because the wetland walk contributes to 69 % of BWS income. If the wetland condition declines the biodiversity that attracts the tourists may diminish too. This will mean the visitation of fewer tourists and subsequently less income.

Natural Resource Harvesting

Traditional institutions develop monitoring techniques and rules to control the amount and rate of natural resource use. These rules tend to be tacit rather than explicit and can be infused with religious and customary beliefs. These rules should be worked with as the local people have a propensity to resist change to traditional practices (Fabricius, 2004). KAFRED consulted the people of Bigodi to formulate the resource use rules. As the rules are developed by the local people they are better respected, owned and abided by which makes enforcement an easier task (Amooti, 2007).

The local people obtain: medicinal plants, construction material, food, craft material and fresh water from the wetland. According to KAFRED, the amount of water collected from the wetland daily was 100 to 200 litres per family. This was found in Chapter 3 to be an overestimate which indicates a lack of communication between the committee and the community. When KAFRED was asked to list the harvesting rules they contradicted each other. If the managing committee is unsure of the rules it can be assumed that the community is confused too. Amooti (2010) said that the harvesting rules are made available but not many people have read them. Action needs to be taken to ensure that the rules are revisited and clarified and that the people doing the harvesting are aware of them. This could be done regularly at the AGM.

2.8.3 Monitoring Bigodi Wetland Sanctuary

Monitoring of all aspects throughout the duration of a CBNRM project is essential yet often overlooked (Boggs, 2004; Fabricius *et al.*, 2004). Those responsible for monitoring rules and resource use should be either resource users themselves or accountable to them (Ostrom, 1990

in Fabricius, 2004). KAFRED should be assessing the effects of activity in and around the wetland on its health; the effect of the wetland restrictions and management on the local people's livelihoods; the success or failure of anti-crop raiding techniques and the management protocols of the KAFRED committee itself needs to be monitored. Feedback generated through monitoring and evaluation enables the process of learning from experience. The KAFRED executive committee needs to be accountable to the community and CBNRM outcomes (Gruber, 2010). Those who are affected by management decisions need to be able to routinely review those who make them.

To develop an effective monitoring programme according to Lindenmayer and Likens (2009) the committee needs to develop key questions. Setting monitoring questions and objectives at the outset of an initiative will help resolve issues over what is to be monitored. In order to pose good questions a conceptual model needs to be drawn up of the ecosystem targeted. A monitoring programme should be designed based on answering these questions and it should be statistically sound. The data is then collected, analysed and interpreted. The understanding gained from the process is then fed back into the system by making appropriate management changes. The key questions are adjusted accordingly and the process begins again.

From the executive committee questions it can be said that there is much confusion about monitoring: what it is, why it is needed and how to carry it out. The primate identification and counting, which was started in June 2010 may provide some valuable data with time. However, looking at the bigger picture, the monitoring practices of KAFRED are inefficient. KAFRED appears to have undergone the three main problems associated with monitoring programmes: the programmes were developed in reverse as in 'collect data now and think later'; they were not designed at the start of the project, and lastly, they were unsure of what to monitor (Lindenmayer and Likens, 2009). High quality light touch facilitation and capacity building by an external organisation is required by BWS. Collaborative monitoring with local data interpretation (Category 4, Danielsen *et al.*, 2009) is the ideal scenario in the case of BWS where there is currently an absence of monitoring expertise or knowledge. By working together with the likes of Makerere University Biological Field Station, with training, this will be achievable.

2.8.4 Perceived Impacts of Bigodi Wetland Sanctuary on Local Livelihoods

Incentives

It is assumed that the greater the income the better the natural resource base will be managed (Fabricius, 2004). However, financial benefits are not always necessary and on-going participation is usually based on the need to be involved in resource management; as it is their safety-net in times of hardship and directly affects their well-being (Fabricius, 2004). For example, in both the Kunene region of Namibia and the forest-adjacent communities of Tanzania, conservation success was achieved without administering promises of cash income as an incentive. Purely regaining control over the natural resources and wanting them for their existence value as well as gaining some responsibility proved an adequate incentive (Wily, 2000; Jones and Weaver, 2009).

As mentioned previously in the finance section, the people of Bigodi do not receive cash incentives for conservation efforts. Rather, they benefit through improved infrastructure and job opportunities. In order for this form of incentive to be successful it is important that these benefits are applicable to all members of the community. This was not the case in Nyaminyami, Zimbabwe, where the CAMPFIRE community projects (a school and a grinding mill) did not benefit the poor and elderly population. The elderly had no children to send to the school and the poor had no crops to mill. The wealthier members of the community benefit but the poor and elderly are expected to make equal sacrifices in wildlife conservation (Sibanda, 2004). Poverty in rural areas, if left unattended, can have negative consequences on the environment (Magome and Fabricius, 2004).

According to KAFRED the people of Bigodi realise that they benefit from the wetland sanctuary; they see the money generated through tourism as ‘free income’. The recognition of a relationship between conservation and financial gain is important in generating positive attitudes.

Human Well-being

CBNRM projects can provide important benefits to the local people such as jobs in tourism which contribute to livelihood diversification opportunities (Jones and Weaver, 2009). Livelihood assets and resources need to be diverse to allow the people to be flexible, to switch from one livelihood strategy to another as the need arises (Fabricius, 2004). Skills and capacity training are improved through a requirement for financial, tourism, business and

wildlife management. Empowerment of rural communities as devolved decision making, financial management, improved advocacy and access to government and institutional development are necessities for CBNRM initiatives (Jones and Weaver, 2009).

It was agreed by all executive committee members (2010), that the standard of living of the people of Bigodi had improved since the establishment of the wetland sanctuary. The following areas of the people's livelihoods have advanced: education, health, income and skills. All of the committee members agreed that education had improved with the new high school, library, scholarships and teacher training. Health has improved indirectly through the consumption of a wider variety of vegetables and KAFRED helps to fund the local hospital. Income has increased with ecotourism creating more business opportunities such as craft sales and the peanut butter project as well as creating jobs such as the trail guides. Skills have been bettered as craft making develops and through training.

According to KAFRED (2010) the costs experienced by the people of Bigodi as a result of the sanctuary are: being subjected to crop and livestock raiding, access to natural resources has been restricted to an extent and some land was taken from the subsistence farmers. The crops that are cultivated on the wetland periphery have become an easy target for vermin as people are no longer permitted to hunt. KAFRED has tried to educate the people on animal behaviour and have experimented with ways of reducing the raiding such as: planting Mauritius thorn hedges, digging elephant trenches along the KNP boundary, using scarecrows and introducing crops such as tea that the animals will not eat. The next step would be to buy the land from the farmers surrounding the wetland to increase the size of the buffer zone (Amooti pers. comm., 2010).

Crop and livestock raiding is a common CBNRM issue that can have bitter results. In the northwest and northeast of Namibia the costs of living with wildlife are increasing as a result of growing wildlife populations. Elephants damage water installations, raid crops and attack livestock (Jones and Weaver, 2009). Although such occurrences are evidence of conservation success they can sway the attitudes of the local people to be more negative.

2.9 Conclusion

The management of BWS displays both outcomes of success and failure typical to CBNRM initiatives. There are two management domains that are of particular concern: a lack of committee cohesiveness and poor monitoring activities.

Many of the responses given by KAFRED's committee members were alarmingly contradictory, particularly in reference to the harvesting section. This leads to the impression of a lack of cohesiveness potentially as a result of each committee member focusing solely on the role of their respective positions. It is important that the executive committee members have a more holistic understanding of the management procedures. In this way, they can avoid confusion and conflict as well as support each other through knowledge sharing and collaborative learning about the social system-ecosystem which will aid in problem solving and decision making.

In order to understand the system dynamics the management committee, with local participation, should be monitoring: the effect of the local people's activities on the health of the wetland (such as the population dynamics of harvested species); the activities of the management committee; the effect of the restrictions on the community (paying particular attention to the poor and elderly); and the results of the different anti- crop and animal raiding techniques. Monitoring is crucial to allow for the process of adaptive management which will better prepare BWS for times of change and uncertainty.

One of KAFRED's aims is to support the poor and disadvantaged groups. Through monitoring, it should be determined whether the poorer households are able to pay the KAFRED membership fee and ultimately be included in management decisions. If the poor are marginalised, KAFRED should adapt its management practices to enable their inclusion.

KAFRED has funded a lot of the development in Bigodi village and has allowed for employment opportunities in the tourism industry thus contributing to livelihood diversification. Consequently, the standard of living has improved and as the local people realised the value of the input from conservation, 'free income', their attitudes towards it have become more positive.

Long-term success of CBNRM initiatives is rare with a high incidence of degeneration with time. BWS has been running for eighteen years. This success can partially be attributed to government support; local community participation; the ability of the management committee to work independently of external organisations; and a lack of dependence on external funding.

Chapter Three
Local Livelihood Strategies: Natural Resource Use, Crop Production and Livestock Rearing

3.1 Costs and Benefits of CBNRM to Local Livelihoods

True CBNRM seeks to achieve positive outcomes in both social and ecological dimensions (Shackleton *et al.*, 2010). The benefits gained through CBNRM are primarily meant to compensate the costs of natural resource management to the local people (Rozemeijer, 2009). For a CBNRM project to be accepted and consequently successful the benefits must be significantly greater than the opportunity costs that may arise (Turner, 2004).

3.1.1 Benefits

The majority of African rural households are poor and dependent on agriculture and natural resource harvesting for their well-being (Arntzen *et al.*, 2007). CBNRM can generate a number of benefits which help to address the different community needs contributing to poverty alleviation. There are two types of benefits, tangible and intangible. Tangible benefits are the direct and more obvious benefits for example: access to some subsistence and commercial products, share of revenues from hunting, tourism, sales of timber and non-timber forest products (NTFPs), share of income from permit and licence fees, employment, support for alternative or diversified livelihood activities, and a more productive resource base (Campbell, 2006). The intangible benefits accrued from CBNRM are very difficult to quantify (Magome and Fabricius, 2004; Turner, 2004), for example the general well-being of the people such as the satisfaction associated with improved aesthetics and a sense of achievement, and the conservation of spiritual sites and species.

Perhaps the most obvious benefit associated with CBNRM is conservation of the natural resource base through agreed sustainable harvesting methods. As rural households in Africa are largely dependent on natural resources and agriculture for their subsistence the improvement in ecosystem productivity allows for an increase in harvesting quality and quantity (Arntzen *et al.*, 2007). The natural resources are important in providing a safety-net to rural households in case of crop failure (Magome and Fabricius, 2004; Turner, 2004). A

healthy ecosystem will also provide the people with valuable ecosystem services e.g. pollination, soil protection and clean water which are often taken for granted.

CBNRM can stimulate tourism enterprises that provide an alternative or supplementary means of income for the community (Magome and Fabricius, 2004). The creation of employment and alternative livelihood options is one of the most important strategies to alleviate poverty and to enhance social security as it mitigates the impact of droughts and crop failure (van der Jagt *et al.*, 2000; Arntzen *et al.*, 2007). Employment in CBNRM is particularly significant where the village concerned is small and so most households have a member employed by the commercial partner or conservancy (Arntzen *et al.*, 2007). Such employment opportunities are valuable to the more vulnerable members of the community such as the elderly, youth, women, ethnic minorities and general low-income groups.

The local communities involved in CBNRM should receive benefits that exceed the costs of conservation (Magome and Fabricius, 2004). If the reward for conservation is in proportion to the effort required communities are more likely to participate. However, in most cases the direct financial benefits from formal CBNRM in southern Africa are low (Magome and Fabricius, 2004; Arntzen *et al.*, 2007; Child, 2009). The benefits do not have to be financial; it is common for revenue generated to be put towards community projects and infrastructure rather than to individual households. These initiatives in effect complement government public spending and poverty alleviation attempts (Arntzen *et al.*, 2007).

Some other benefits that are less obvious but equally important to the community include:

- Infrastructure development such as: schools, clinics, community halls, road improvements, crèches, boreholes, toilets, gardens, nurseries, and community vehicles; all of which contribute to a higher living standard (Campbell, 2006; Arntzen *et al.*, 2007).

- Local organisational development and capacity building in business skills and marketing. Through exposure to commercial partners these skills can offer long-term benefits that are traditionally weak in rural communities (van der Jagt *et al.*, 2000; Campbell, 2006; Arntzen *et al.*, 2007).

- New channels of communication and an improvement in working relationships with government, NGOs, and the private sector which can open up new opportunities (van der Jagt *et al.*, 2000; Campbell, 2006; Arntzen *et al.*, 2007).

- The empowerment of local people, the election of responsible leaders, optimism for the future, enhanced self-esteem and pride, as well as a reduced dependency on government (van der Jagt *et al.*, 2000; Arntzen *et al.*, 2007).

- Cultural identity and social cohesion is strengthened (van der Jagt *et al.*, 2000).

3.1.2 Costs

When looking at costs involved with CBNRM initiatives one needs to determine how the associated activities will suit existing livelihoods: what revenue will be lost with land or resource conversion? Will access to natural resources be restricted? What are the institutional and transaction costs? The focus of CBNRM literature is predominantly on the distribution of benefits whereas the costs tend to be neglected (Arntzen *et al.*, 2007). There are a number of potential negative socioeconomic impacts associated with CBNRM.

Some direct negative impacts faced by the community as a result of CBNRM include: restricted access to fuelwood and wild foods; financial benefits are often below local expectations and may not be shared fairly; devolution policies can weaken local leadership structures and reduce public participation (Campbell, 2006). There are also costs associated with the wildlife that is being conserved; such as livestock raiding, crop damage, the destruction of water sources, and even the loss of human life (Magome and Fabricius, 2004; Arntzen *et al.*, 2007). The attitudes of rural communities and their relationship with wildlife are critical to the success of community-based schemes (Osborn and Parker, 2002). Negative impacts, such as wildlife damage to crops, are often of major importance to the local people, particularly the poor. Such destruction can be prevented but outsiders are often more focused on maximising benefits (such as income) rather than minimising costs (Ashley, 2000).

Often it is the case that rural communities incur the primary costs of living with wildlife but receive few of the benefits. For example, in the Okavango Delta the San villagers at Xaxaba no longer grow crops due to the unrelenting damage caused by elephants (Magome and Fabricius, 2004). With the hunting prohibitions the people found that the animals no longer respected humans and there was an increase in injuries. In Torra, Namibia, and the periphery of Kruger National Park, South Africa, lions killed livestock owned by the neighbouring local farmers (Magome and Fabricius, 2004; Nott and Jacobsohn, 2004).

CBNRM usually benefits from free labour and it is common to find that only executive committee members are compensated. It is assumed that the opportunity cost of input is zero (Arntzen *et al.*, 2007). For some members of the community being involved in CBNRM means they have less time available for other activities such as herding, cultivation, or looking after their family (Arntzen *et al.*, 2007). Negotiations, meeting attendance, organisation and licence applications, etc. all take time. Those attending are often not fed or compensated for their time. It is a paradox: CBNRM aims to reduce levels of unemployment which in turn increases the cost of people's time and so results in fewer participating volunteers (Magome and Fabricius, 2004).

Wildlife and NTFP quotas are often introduced which reduces access to previously available resources (Arntzen *et al.*, 2007). The cost of being prohibited from hunting may come at a price too. For example, CAMPFIRE incomes per household were approximately USD 4.50 in 1996 whereas a single impala hunted illegally could have fetched as much as USD 9.63 (Magome and Fabricius, 2004), thus for CBNRM to be accepted by a community there have to be other incentives on offer.

CBNRM may instil a dependence on tourism. This was the case with the Xaxaba in Botswana who now feel that they are reliant on hand-outs, pensions and employment received via the government's drought relief programme (Madzwamuse and Fabricius, 2004). Their new found dependence on tourism means that they have no control over their livelihoods; they are at the mercy of decisions made by government, joint venture partners, as well as market fluctuations. The ecotourism industry in Botswana is affected by the political events in neighbouring Zimbabwe as well as the opening of new markets in Namibia and South Africa.

It is important that land designated for CBNRM yields higher total returns than those of other uses such as crop production or livestock (Arntzen *et al.*, 2007). The cost of CBNRM to communities living in high rainfall areas can be significant with regards to alternative land use options. In areas where the mean annual rainfall is greater than 600 mm, profits potentially gained through agriculture out-compete conservation efforts economically (Magome and Fabricius, 2004). Only in dry areas, or those rich in high-value wildlife, has CBNRM sufficient income-generating potential to offset agriculture; such places tend to be located adjacent to protected areas (Arntzen *et al.*, 2007). The livelihood options offered through CBNRM tend to be an additional source of livelihood that usually does not replace agriculture.

3.2 Rural Livelihoods in Uganda

In rural Uganda, livelihoods are directly linked to ecological systems both as a source of subsistence household requirements such as food and fuel and as a basis for production (Moyini *et al.*, 2002; Hartter, 2007). This high dependence on natural resources is a result of the limited and insecure nature of rural livelihoods and the absence of alternative sources of income and subsistence, poverty and land pressure (Shah and Muramira, 2001). The three main livelihood activities carried out by the rural people of Uganda include: crop production, livestock rearing and natural resource harvesting.

In this study the natural resource use associated with wetlands is of particular interest. Uganda has a variety of wetland types which provide services and products worth hundreds of millions of dollars each year and thus pays an important contribution to the national economy (Wetlands Management Department, Ministry of Water and Environment, Uganda, 2009). Wetlands supply the people with ecological services (climate modification, water purification, waste water treatment, flood control and water storage) and products such as water provisioning for domestic purposes, livestock watering, fuel, source of fish, medicinal plants and animals, and various materials (e.g. for crafts and construction) (Wetlands Management Department, Ministry of Water and Environment, Uganda, 2009).

Nearly 80 % of Uganda's 27 million people have rural-based livelihoods and more than 80 % of the land is used for small-scale farming (Pender *et al.*, 2004; Hartter, 2007). It can therefore be said that the most common land-use is agriculture. Land is cultivated for the production of cereals, other storable annual food crops, coffee, bananas and root crops. Cotton production, non-farm activities, cattle production and horticultural crop production are the primary activities in only a few communities (Pender *et al.*, 2004).

Livestock are raised, often in conjunction with crop production, for a mix of subsistence (milk, eggs, meat and skins) and market needs (cash income) (Hesse and MacGregor, 2006). Livestock are not only used for income generation, they determine status in society and are of cultural value such as for paying dowry or offering as sacrifices to appease the spirits (Kamwenge District State of Environment Report, 2004). The animals (particularly cattle) define social identity and provide financial security (Hesse and MacGregor, 2006).

The harvesting of natural resources is the least obvious and most overlooked economic activity in rural areas; and yet it is often essential in sustaining the well-being of the rural poor

(Turner, 2004). On valuing, and ultimately comparing, the relative contribution of each livelihood activity to a rural household's annual income it can be determined which livelihood activities are the most significant contributors to the people's well-being. Values can be calculated based on the product, of the quantity of the resource used, and the local price. Where prices are not available locally, prices at the closest point to the target community or replacement values can be used (Shackleton and Shackleton, 2004).

The aim of this chapter was to determine the relative annual contribution of each livelihood activity to the Bigodi households. The following key questions were addressed:

- What are the costs and benefits of BWS to the local people?
- What are the average annual values and relative contribution of local crop production, livestock rearing and natural resource harvesting to the households?
- What are the general perceptions and attitudes of the community towards the wetland sanctuary?

3.3 Study Area

Bigodi village is found in the Kamwenge district of western Uganda (00°24.364'N, 030°24.527'E). It is located 39 km south from Fort Portal on the Kamwenge Road, and is situated in the forested highlands of the Albertine Rift. The rift valley has fertile soils and receives high mean annual rainfall (1 719 mm) therefore the area is rich in biodiversity and has a dense human population (Lepp, 2004). Bigodi borders the southeast edge of Kibale National Park (KNP). The area surrounding KNP, encompassing Bigodi, is a patchwork of agricultural lands interspersed with natural areas (Hartter, 2007).

The principal economic activity in Bigodi is subsistence agriculture. The following crops are commonly grown: sorghum, maize, millet, cassava, bananas, peas, groundnuts, sunflower, sweet potato, Irish potato, beans, tea, coffee, tobacco, cotton, tomatoes, cabbage, onions, and pineapples (Amooti, pers. comm., 2010). Livestock owned in Bigodi are predominantly cattle, goats, chickens, sheep and pigs.

Bigodi is a unique community in that it has set aside a wetland to be conserved as a tourist attraction. It is a permanent unchannelled valley bottom wetland with papyrus being the dominant vegetation. The wetland stretches through the Bigodi community and meets the

KNP boundary at both ends (Lepp, 2004). The local people are highly dependent on the wetland for water provisioning, wild foods, medicines, fuelwood, and construction and craft materials.

The Bigodi Local Councillor's tax roll and voter registry indicated, using a low estimate of four children per household, that there were slightly more than a thousand people in the village (the national average fertility rate is six children per female) (Lepp, 2004). Bigodi has experienced rapid population growth and subsequently has a high population density which was estimated in 2006 to be 335 individuals/ km^2 (Hartter, 2007). The registry also indicated that the community consisted of more men (205) than women (143); which was believed to be as a result of an influx of young men looking for employment in tourism. It should also be noted that fifteen to thirty per cent of the population of the Kamwenge District lives below the poverty line (Kamwenge District State of Environment Report, 2004).

Lepp (2004) found that 60 % of the people he interviewed in Bigodi (n= 48) had an education level lower than primary school grade seven. This is typical of Uganda where 43 % of adult females are illiterate and 22 % of adult males are illiterate (Uganda Ministry of Water, Lands and Environment, 2002; World Bank, 2003).

3.4 Methods

A household survey was conducted in Bigodi in the months of June to July, 2010. A total of 68 households were randomly selected and interviewed. The interviews were fully structured and identical (Appendix 3). The interviews were carried out personally with the aid of two trainee guides from the wetland sanctuary who acted as translators. Households near to the wetland boundary were randomly selected to interview (Fig. 3.1). The interview was only conducted if there was an adult present to question. The nature and purpose of the interview was explained after which informed consent was sought.

Questions were based upon the following:

- The nature, amount, frequency of collection and value of the natural resources harvested from the sanctuary, and by whom.
- The costs endured as a result of the prohibition of utilisation of certain natural resources.

- The effect the wetland sanctuary has had on cultural or spiritual beliefs, spaces and practices.
- The cost of damage by wildlife to subsistence farmers.
- Potential alternative land use options.
- Involvement of the community in management practices, monitoring and decision making.
- The general perceptions and attitudes of the community towards the wetland sanctuary.

Any valuable information gained from informal conversation was recorded in field notes. Photographs were taken to document significant observations.

Figure 3.1: The locations of the households interviewed (n=68) in relation to Bigodi Wetland, the KAFRED Centre and Kibale National Park (Google Earth, 2011).

3.5 Data Analysis

The mean annual gross value of each livelihood activity was calculated to determine relative livelihood contribution. This incorporated both the value of sales and direct consumption. The exchange rate at the time was USD 1= USh 2 250 and ZAR 1= USh 350 (July, 2010). Gross direct-use values were calculated based on the product of the quantity of the natural resource used and the local price. Labour time was not accounted for as deducing these costs in such environments of low earning skills and negligible labour opportunities can be misleading (Shackleton *et al*., 2002). Basic descriptive statistics were used to summarise the data using Microsoft Office Excel. All mean or average values calculated were displayed with the standard deviation in brackets.

More detailed statistical analyses were carried out in STATISTICA 10 (StatsSoft Inc., 2011). A factor analysis was performed to explore the associations between measured household attributes and the relative contribution of the various livelihood strategies to annual income. Any patterns observed were then further explored by performing either a multiple regression analysis, a two-sample t-test with independent variables or a non-parametric Mann-Whitney U test. The data were tested for normality using the Kolmogorov-Smirnov and Lillefors tests.

The value for medicinal plant use had to be extrapolated from a South African study (Dovie *et al*., 2005) as the nature of harvesting by the Bigodi households was largely on an 'as needed' basis and so the amounts used were difficult to quantify and may have produced inaccurate results. Information on Ugandan rural medicinal plant use values was very limited.

Values for wild spinach and fish were obtained from the households to represent the wild food consumption. The wild fruits, however, were more difficult to value as again they tended to be consumed in an opportunistic fashion.

3.6 Results

3.6.1 Household Demographics

Of the 68 households interviewed, 21 % were headed by women and 79 % by men. The death of a husband was responsible for 73 % of the female headed households with the remaining 27 % due to divorce. The average age of the people interviewed was 49 years (± 19.5). The average education of the interviewees was primary school grade three (± 3.2). The average education level reached by the women interviewed was primary school grade three (± 3.4),

and for the men it was primary school grade five (± 3.1). It was found that only 6 % of the people interviewed were employed, 90 % were unemployed or subsistence farmers and 4 % were part of the Women's Group.

The average number of people living in a household was seven (± 3.3), of which five were children, with three under the age of 15 years (± 2.7). The average number of people per household of the age fit to work was three (± 2.8) with another adult (± 0.8) over the age of 60 years.

The average number of people employed in a female headed household was one (± 0.7). The male headed households also had an average of one person employed (± 1.3). The average number of dependents supported by a female head was four (± 2.3). The male headed households also supported an average of four (± 2.7) people.

3.6.2 Natural Resource Use

Almost all (92 %) of the households collected dead fuelwood only, the remaining 8 % said that they collected both dead and live opportunistically (n= 68). The average time taken to collect fuelwood was an hour and fifty minutes (± 2.89).

The average amount of water collected per household from the wetland daily was 63.5 l (± 23.8). The main source of water was boreholes used by 50 % of the households, followed by the wetland (44 %), streams (3 %), borehole or wetland (1.5 %) and borehole or stream (1.5 %).

It was found that 94 % (64) of the households harvested materials to make crafts. The most popular crafts made were mats (88 %), followed by baskets (77 %) and carpets (41 %) (Fig. 3.2). Nearly half of the households (49 %) did not sell crafts.

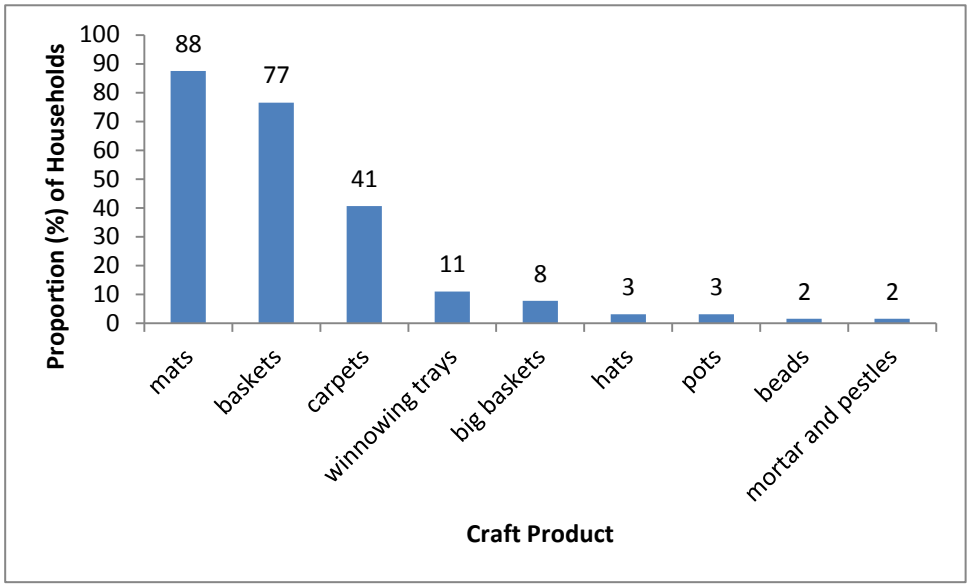

Figure 3.2: Craft products made from natural resources (n=64).

Ninety-four percent of the households collected one or more natural resources for food. The people used 21 different wild plant species to supplement their diet, as well as harvesting mushrooms and mudfish (Appendix 4).

It was found that 92.5 % of the households harvested medicinal plants. Eighteen different plant species were commonly harvested for their medicinal properties (Appendix 5).

Of the households interviewed, 95.5 % harvested natural resources for construction purposes. Refer to Appendix 6 for the different types of construction material derived from natural resources. The average distance walked to harvest from the wetland was 565 m (± 371), within a range of 10 m to 2 000 m.

Table 3.1 shows the average unit prices of each of the natural resources harvested and the finished craft products. Hats and pots were the most expensive craft products at USh 5 250 (± 1 061 and ± 1 768, respectively), followed by necklaces at USh 5 000. The cheapest craft product was a carpet at USh 3 042 (± 1 389). The value for a heap of sand (USh 60 000) was considerably higher than those of the other natural resources required for household construction.

Table 3.1: The average unit prices of the different natural resources harvested and craft products.

	Resource/ Resource Product	Quantity	Average Price (USh)	Standard Deviation
Water	Water	20 l	300	0
Fuelwood	Fuelwood	one bundle	1 500	0
Wild Foods	Fish	10	1 500	0
	Wild spinach	one bundle	200	0
Crafts	Basket	1	4 205	3 030
	Beads (necklace)	1	5 000	0
	Carpet	1	3 042	1 389
	Hat	1	5 250	1 061
	Mat	1	4 870	2 642
	Pot	1	5 250	1 768
	Winnowing tray	1	2 500	0
Construction material	Thatching grass	one bundle	500	0
	Papyrus heads (thatch)	one bundle	500	0
	Sand	one heap	60 000	0
	Vines for tying	one bundle	4 000	0
	Poles	10	7 000	0

When asked of the impact of KAFRED's harvesting restrictions, 50 % of the households said that their harvesting was positively affected by the restrictions, 44 % said that they were neutral and 6 % said that they were negatively affected (n= 68). Of the households interviewed 94 % said that they knew the restrictions, 4 % said that they did not know them and 2 % knew that there were restrictions but they did not know what they were (n= 68). The most recognised restriction was that of the wetland boundary (19), followed by 'no overharvesting' (14), 'no burning' (12), 'no cutting' and 'no hunting' (10) (Table 3.2).

Table 3.2: Harvesting restrictions mentioned by the households (n= 68).

Restriction	No. of Households	Restriction	No. of Households
respect the boundary	19	do not wash bicycle in wetland	1
no overharvesting	14	harvest only mature plants	1
no burning in wetland	12	no burning charcoal in wetland	1
no cutting	10	no clearing	1
no hunting	10	no cultivation	1
no cutting papyrus	4	no grazing in wetland	1
harvest young not old plants	3	no tree cutting	1
no harvesting deep in wetland	3	only harvest from wetland arms	1
no harvesting live wood	3	plant trees	1
collect from wetland edges	1		

Approximately half (51.5 %) of the households believed that most people abide by the restrictions, 47 % said that some of the people abide and 1.5 % said that nobody abides by them. Forty-six per cent of the people said that the punishment for breaking the rules was imprisonment, 21 % said that there was no punishment, 11 % said that they did not know if there were punishments, 10 % said that one would be sent to the police and the remaining 12 % said that one would get fined or caned by the police or KAFRED would warn you. The sentiments towards the restrictions were as follows: 43 % said that the rules should remain the same, 32 % said that the rules should be made stricter, and the remaining 25 % said that the rules need to be made more lenient.

3.6.3 Crop Production

The average area of land owned per household was 2.26 ha (± 1.96), of which approximately 72 % (± 27.6) was cultivated. The female headed households owned slightly more land (2.66 ha ± 1.83) than the male headed households (2.15 ha ± 1.99). The average distance of the households from the wetland was 371 m (± 566). Every household (n= 68) grew at least one crop. The most popular crop was maize grown by 94 % of the households (n= 68) (Fig. 3.3), followed by bananas (81 %), beans (60 %) and sweet potato (53 %). Most of the households (94.1 %) sold some agricultural produce.

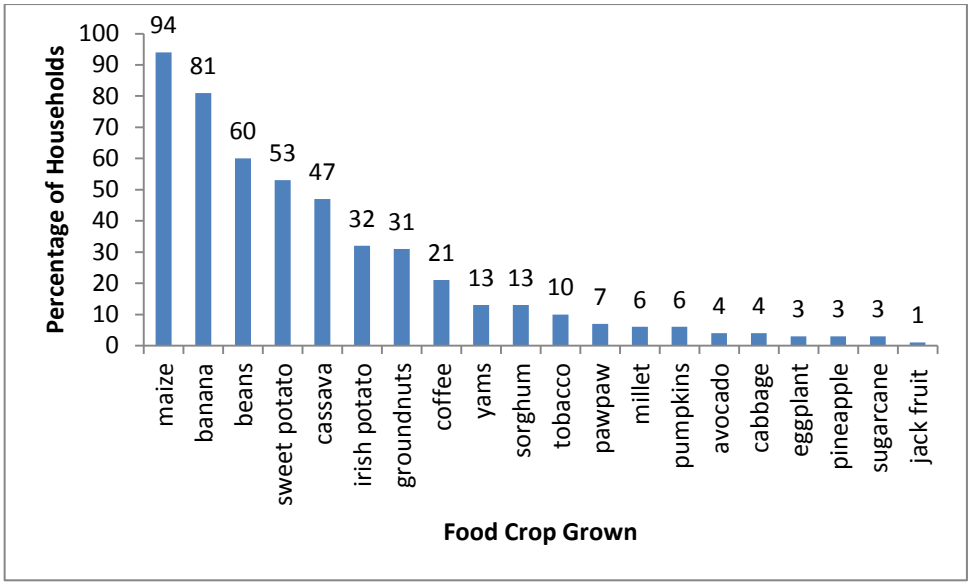

Figure 3.3: Crops grown by the local households (n= 68).

The average unit price for crop produce are indicated in Table 3.3. For the produce sold in sacks, tobacco was of the highest value per kilogram (USh 2 508 ± 524), followed by groundnuts (USh 2 104 ± 644), coffee (USh 867 ± 123), sorghum (USh 775 ± 206) and beans (USh 662 ± 180). Maize was relatively cheap at USh 150 (± 0.0) per kilogram.

Table 3.3: The average monetary value of local crop produce.

Crop Cultivated	Quantity	Average Price (USh)	Standard Deviation
Avocado	1	100	0
Banana	1 bunch	3 063	1 031
Beans	100kg	66 207	18 010
Cabbage	1	250	0
Cassava	1 basin	7 500	3 500
Coffee	100kg	86 670	12 344
Groundnuts	100kg	210 385	64 435
Irish potato	1 basin	7 063	2 306
Maize	100kg	15 000	0
Millet	1 basin	5 750	6 010
Pineapple	1	550	71
Sorghum	100kg	77 500	20 615
Sugarcane	20 sticks	100	0
Sweet potato	1 basin	3 000	1 000
Tobacco	100kg	250 833	52 385
Yams	1 basin	1 250	0

3.6.4 Livestock Rearing

Livestock was owned by 91 % of the households interviewed (n= 68). Of the households that owned livestock 32 % did not sell any animals or by-products (milk, skins or eggs). The average amount of water given to livestock to drink daily was 21.02 l (± 29.98). Figure 3.4 shows that chickens (87 %) and goats (76 %) were the most common animals owned by the households. Chickens were found to be the most abundant animal with an average of six per household (± 3.8), this was followed by an average of five goats (± 4.2), four cows (± 2.4), four sheep (± 3.5), three pigs (± 1.7), two ducks (± 0.0) and two rabbits (± 0.0).

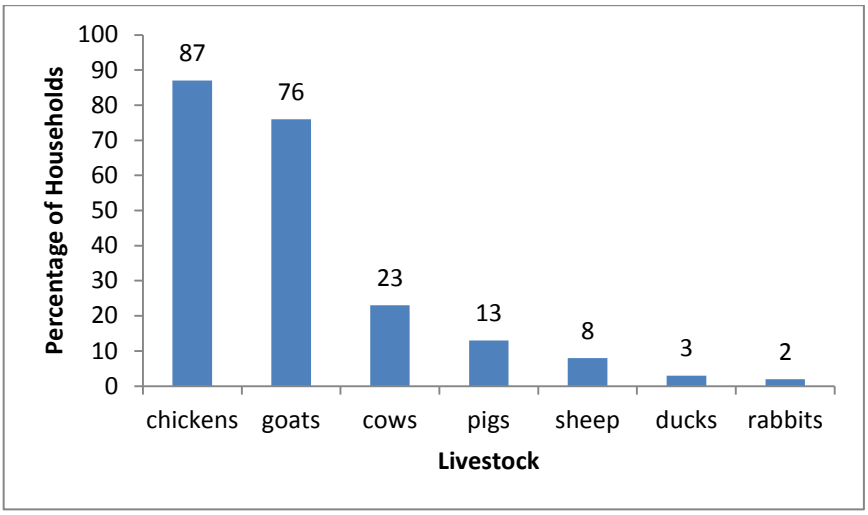

Figure 3.4: Different animals owned by households.

Of the livestock reared in the area, cattle were the most expensive at USh 325 000 (± 125 499) an animal, followed by goats (USh 41 600 ± 13 186), sheep (USh 31 250 ± 2 500) and pigs (USh 23 750 ± 13 769). The cheapest animal was the chicken at USh 8 100 (± 2 496) (Table 3.4).

Table 3.4: The average unit prices of different animals and animal products.

Animal/ Animal Product	Quantity	Average Price (USh)	Standard Deviation
Cow	1	325 000	125 499
Goat	1	41 600	13 186
Sheep	1	31 250	2 500
Pig	1	23 750	13 769
Chicken	1	8 100	2 496
Eggs	1	176	32
Milk	1 l	375	177

3.6.5 Relative Contributions of Natural Resource Use, Crop Production and Livestock Rearing to Local Livelihoods

The households believed that their total annual income was derived mainly from crop production and livestock (75.5 %). This was followed by retail (7 %), extended family (6 %), government grants (4 %) and other (4.5 %), and crafts (3 %). The perceived total average annual income per household was USh 749 082 (USD 332).

The average annual value of natural resource use per household was USh 1 245 471 ((standard deviation could not be calculated due to the medicinal plant value extrapolated from Dovie *et al*. (2005)) (USD 554) this included: water, construction material (for one house every ten years), fuelwood, crafts, wild foods (fish and spinach), and medicinal plants (Table 3.5). The mean annual value of livestock rearing was valued at USh 287 906 (± 702 761) (USD 128), and crop production was USh 659 675 (± 687 468) (USD 293). Thus, as can be seen in Table 3.5, natural resource use contributed the most to local livelihoods accounting for 57 % of the total mean annual value per household. This was then followed by crop production which was 30 % of the total value, and subsequently livestock rearing at 13 %. Table 3.5 shows that fuelwood and water were important contributors to the overall value of natural resource use. The value of crop production was high and livestock relatively low. The high standard deviation for crop production can be attributed to the growth of tobacco and coffee by some of the farmers which generated a significantly higher sale value than the local subsistence crops. The high standard deviation for livestock rearing was due to some households owning a number of cattle which were of a considerably higher value than other animals (Table 3.5).

Table 3.5: Mean annual gross direct-use values of household land-based livelihood options.

	Livelihood Option	Mean Annual Direct-use Value (USh)	Standard Deviation	% of Total Value
Natural Resource Use	Wetland water	346 161	125 954	16
	Construction	40 726	15 744	2
	Fuelwood	523 804	173 729	24
	Crafts	116 700	129 931	5
	Food (fish and spinach)	126 100	31 729	6
	Medicinal plants* value from Dovie *et al.*, (2005)	91 980	-	4
	TOTAL	1 245 471	-	57
Livestock Rearing	TOTAL	287 906	702 761	13
Crop Production	TOTAL	659 675	687 468	30
	TOTAL	**2 193 052**	**-**	**100**

The factor analysis (Fig. 3.5) indicated that income from livestock rearing was positively associated with the area of land owned and the number of people employed in the household. The income derived from crop production was inversely associated with the gender of the household head, with female headed households receiving less. There was also a weak inverse association between natural resource use, livestock and land area. Thus, households with larger lands were less reliant on collection of wild natural resources. The variance accounted for was 26 % on the primary axis and 19 % on the secondary axis. None of the above associations were found to be significant at $p<0.05$ (Appendix 7), other than the gender of household head and crop production (described later).

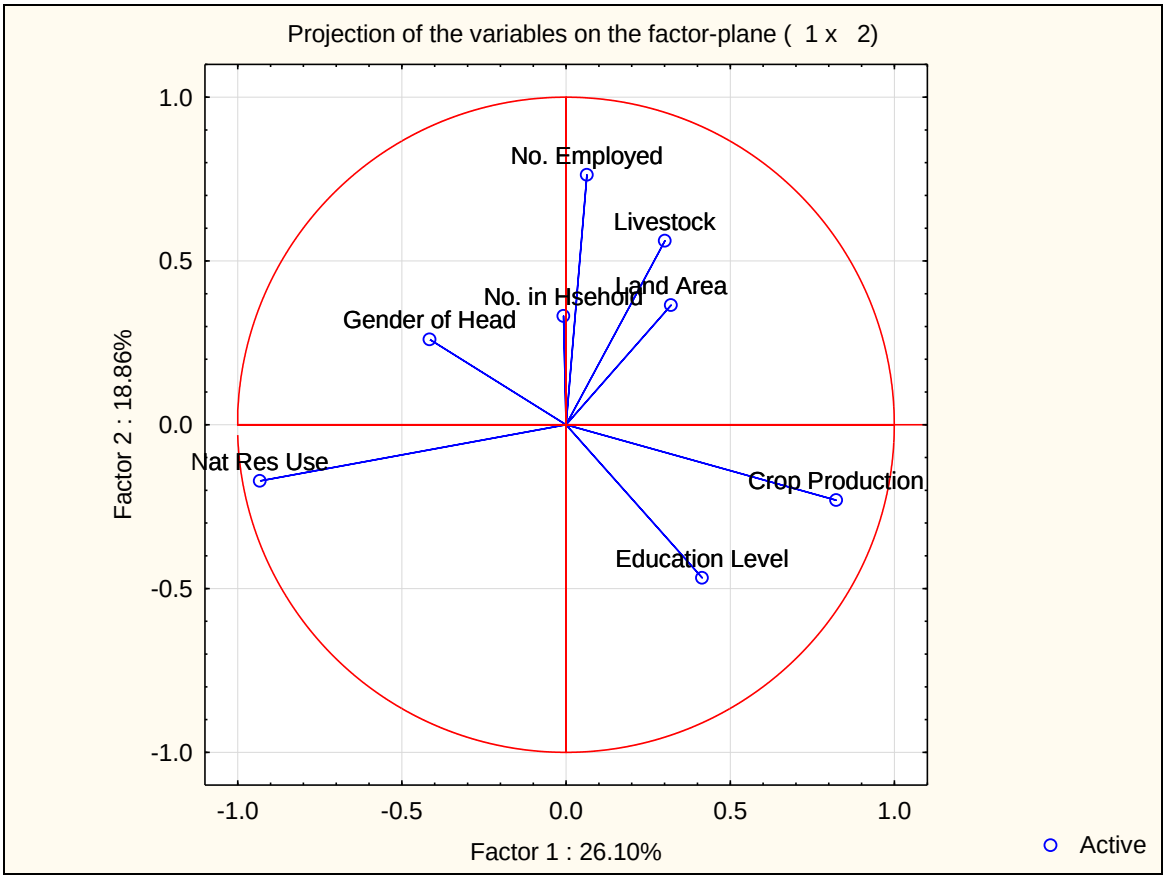

Figure 3.5: The relationships between livelihood strategies, household dynamics and land size.

Table 3.6 illustrates the difference in livelihood values in relation to the gender of the head of the household. The average annual livelihood value of female headed households was derived predominantly from natural resource use (71 %), followed by crop production at 19 %, and lastly, livestock rearing at 10 %. The relative contribution to livelihood value for the male headed households was 55 % from natural resource use, 31 % from crop production, and 14 % from livestock rearing. The households with male heads therefore utilised natural resources to a lesser extent than the female headed households.

*Table 3.6: The effect of gender of household head on the mean annual values of household livelihood options. (**Value is significantly different for male versus female headed households.)*

		Female Head			Male Head		
	Livelihood Option	**Mean Annual Value (USh)**	**Standard Deviation**	**% of Total Value**	**Mean Annual Value (USh)**	**Standard Deviation**	**% of Total Value**
Natural Resource Use	Wetland water	306 600	48 970	19	353 769	135 206	15
	Household construction	31 646	17 775	2	42 769	14 730	1.5
	Fuelwood	501 875	106 557	30	528 964	186 507	22
	Crafts	109 532	106 616	7	118 791	136 919	8
	Food (fish and spinach)	126 100	31 729	8	126 100	31 729	5
	Medicinal plants* value from Dovie *et al.*, (2005)	91 980	-	5	91 980	-	3.5
	TOTAL	1 167 733	-	71	1 262 373	-	55
Livestock Rearing	TOTAL	160 429	181 307	10	323 165	786 770	14
Crop Production **	TOTAL	308 706	209 628	19	740 669	733 939	31
	TOTAL **	**1 636 868**	**-**	**100**	**2 326 207**	**-**	**100**

None of the data (fuelwood, construction material, wetland water, crafts, livestock or crop production) were normally distributed. Only the value of crop production ($Z= -2.42$, $p= 0.02$) varied significantly between male and female headed households (Appendix 8). There was no significant difference between male and female headed households with regards to total natural resource use value ($t= -1.49$, $p= 0.14$). There was a significant difference between male and female headed households with regards to total annual income ($Z= -3.33$, $p= 0.001$).

3.6.6 The Costs of Crop and Livestock Raiding

It was found that 88.2 % of the households were affected by crop or livestock raiding by animals from the wetland and national park. Fifty-nine per cent of the complainants said that they lost both livestock and crops to the animals, 10 % said that they lost solely livestock and 31 % said that they only lost crops. Animals said to be pests included (frequency mentioned): monkeys (50), mongooses (40), baboons (30), elephant (7), leopard (4), chimpanzee (4),

civets (1), kites (1), quail (1) and crested crane (1). It was calculated that the pests cost the households an average of USh 49 390 (± 57 070) (USD 22) per season (two growing seasons per annum as a result of bimodal rainfall pattern). This value represents 10.5 % of the mean annual income derived from crop production and animal husbandry, and 4.5 % of total gross income.

3.6.7 Household Involvement in Management and Associated Sentiments

Most of the households (60 %) interviewed were satisfied with the performance of KAFRED, 29 % were neutral, 7 % were unsatisfied, 2 % were very unsatisfied, and the last 2 % had not heard of KAFRED. It was found that 63 % of the households interviewed did not attend the KAFRED Annual General Meeting (AGM) (n= 68). Of the people that attended the AGM (n= 25), 9 % said that they did not feel that their voices were heard. Only 4 % said that they did not want to meet more frequently with the executive committee (n= 25). It was found that 57 % of the people felt that they were included in BWS decision making (n= 25).

Fifty-nine per cent of those interviewed did not receive any form of income (salary or revolving fund loan) from KAFRED, 38 % (n= 26) said that they did and the remaining 3 % did not know if their spouse received an income from KAFRED (n= 68). Half of the households that did receive an income from KAFRED said that they were satisfied with it (n= 26). Fifty-seven per cent knew of how KAFRED distributed the profits it made (n= 26).

The majority of the households (73 %) monitored the wetland ((n= 67 (one household refused to comment)). By ‘monitoring’ 59 % said that they report offenders to KAFRED, 35 % said that they warn offenders, 2 % educate offenders, another 2 % actually stop the offenders, and the last 2 % observe the condition of the wetland.

The majority of the people interviewed (88 %) said that they felt that the condition of the wetland was good, 5 % said that it was bad and 7 % said that it was very good. Animals thought to no longer be found in the wetland included (frequency mentioned): hippopotamus (34), buffalo (12), elephant (9), chimpanzee (5), bush pig (5), bushbuck (3), lions (1), squirrels (1) and crocodiles (1).

3.6.8 Household Perceptions on the Positive Contributions of BWS; and Alternative Land Use Options

Of the people interviewed, 60 % said that they felt that BWS contributed positively to their livelihoods, 7 % said that they were negatively affected and 33 % remained neutral ((n= 67 (one household refused to comment)). Of the positive attributes contributed by KAFRED, the most frequently mentioned by the respondents was health (100 %), followed by education (93 %) and skills development (78 %). Culture was the least mentioned at only 6 % (Fig. 3.6).

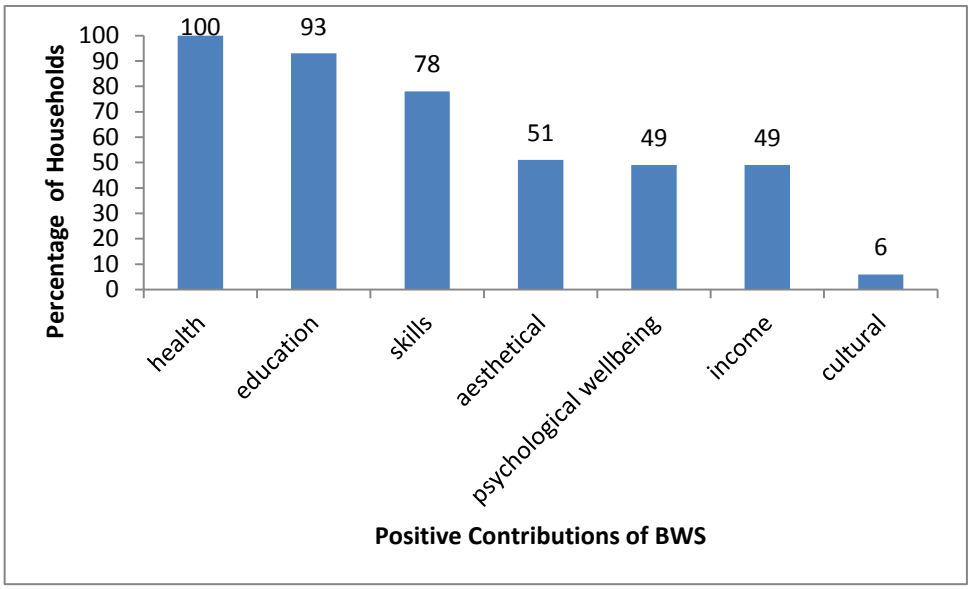

Figure 3.6: Positive contributions to livelihoods by BWS, as acknowledged by the local people.

When asked what they would use the wetland for if the sanctuary was not established the majority of the households said cultivation (93 %), followed by livestock grazing (10 %), 3 % said conservation, 2 % said beehives, and 2 % said hunting.

3.7 Discussion

3.7.1 The Effects of Household Demographics on Natural Resource Use

Household demographics can affect local environmental outcomes and resource dependence (de Sherbinin, 2006). Equally, changes in natural resource quality and quantity can impact population dynamics. It is therefore essential to understand household demographics in order to reflect on the motivations and perceived costs and benefits of certain population behaviour (de Sherbinin, 2006). The degree of dependency on natural resource use tends to vary

according to the gender of the household head, wealth, ethnicity, level of education, and distance from the source (Hartter, 2007).

Bigodi consisted mainly of households headed by men (79 %), as is the case in most African countries. These results are similar to those found in the Rakai district (south western Uganda near the border of Tanzania) where 81.5 % of the rural households were headed by men (Nalugoda *et al.*, 1997). The overall level of education in Bigodi was low, particularly for the women interviewed, although this is likely to improve with time due to the recent establishment of Bigodi Secondary School. This is typical of Uganda where 43 % of adult females are illiterate and 22 % of adult males are illiterate (Uganda Ministry of Water, Lands and Environment, 2002; World Bank, 2003).

The men in Uganda stay at school for longer than the women; they therefore have more opportunities for socialising and obtaining work off the farm (Hartter, 2007). Employment opportunities for women in rural Africa are rare (Shackleton and Shackleton, 2004). It is common for the women to stay at home and raise the children, tend to the crops, and do most of the natural resource harvesting. In southwest Bengal it was also found that women gather most of the NTFPs such as fuelwood and food (Miah, 2007). As the women stay at home they tend to receive a limited cash income and so are amongst the most vulnerable members of a rural community. The poorer households such as those headed by women tend to be more dependent on natural resources than the wealthier households or those run by men (Shackleton and Shackleton, 2004).

KAFRED has liaised with North Carolina Zoo (USA) to provide an environmental education programme for the local schools. There is also a dance and drama group that travels the local area teaching the importance of conservation. This seems to have improved environmental awareness in the area as people realise the importance of the wetland and associated income derived from the tourism.

The number of people found residing in the households was high by developed world standards (de Sherbinin, 2006). This can be attributed to culture as rural African households include grandparents, sons and their spouses, children and other relatives all living together (de Sherbinin, 2006). The total fertility rate for rural areas in Uganda is high at seven children per woman (Uganda Bureau of Statistics, 2006). In Bigodi it was found that there were an average number of five children per household. Population growth is a threat to the health of the wetland as with a lack of means to intensify agricultural production to meet increased food

demands the likelihood of land clearing and the dependency on natural resources increases potentially leading to overexploitation. Although harvesting seems sustainable at the moment (refer to Chapter 4), if the population density increases further, these same activities may not be sustainable and could result in conflict (Koch, 2004).

Rural household revenue sources can be categorised into two major and two minor contributors. The major contributors include: firstly livestock, crop production and natural resource harvesting and secondly urban and migrant income. It was obvious from the interviews that crop production and livestock activities were deemed by respondents to be the greatest contributors to household income. The households in Bigodi only mentioned crafts as an income derived from natural resources and cash received from family members was typically low and sporadic. Other minor contributors to rural households' incomes typically includes small scale activities such as brewing beer, making clothing and petty trading; and state pensions (Turner, 2004). In Bigodi, none of the households received money from government for pensions; the only income from government was that to pay teachers' salaries.

3.7.2 Natural Resource Use

In Bigodi the use of natural resources was not a sole source of livelihood but rather was used in conjunction with crop production and livestock rearing, as was found in a South African study by Shackleton *et al*. (2007). Fuelwood, freshwater, wild foods, medicinal plants, and construction and craft material were harvested on a regular basis by many households in Bigodi.

The study shows that the local community significantly underestimated their annual household incomes, mainly because of a lack of appreciation of the value of natural resources. Their own estimates of annual income was USh 749 082 per year, of which almost 76 % came from livestock and agriculture, and 3 % from natural resources in the form of crafts. In comparison, the valuation study of the land-based livelihood activities shows that natural resources are the most significant sector, contributing more than livestock and agriculture combined. Previous studies in southern Africa have shown the same (Shackleton *et al*., 2001; Campbell *et al*., 2002; Dovie *et al*., 2002). This needs to be widely communicated and internalised by KAFRED and the local community. The high value of natural resource contribution to local livelihoods indicates that any significant reduction in the supply of natural resources would result in local households having to find other sources of cash income

to purchase substitutes for the diminished resources or suffer a marked decline in their level of well-being.

As the poorer households, such as those headed by women, are the most dependent on natural resource use it is important that harvesting restrictions are adhered to. For example, in Bathurst and Grahamstown, in the Eastern Cape, South Africa, the poorer households with large families and low education levels were found to be the most dependent on the commonage land (Davenport *et al*., 2011). Any degradation of the wetland in Bigodi would therefore exacerbate poverty levels.

Fuelwood Harvesting

In developing countries 79 % of the total traditional energy consumed is fuelwood (Dovie *et al.,* 2004). Fuelwood is the most significant source of energy in Uganda and consumption is estimated to be growing at 2.5 % per annum (Tabuti *et al*., 2003). This can be attributed to population expansion, industrial growth, urbanisation and higher household incomes (Tabuti *et al*., 2003). The heavy dependence of the people on fuelwood as a low cost energy source is likely to present a threat to future economic welfare and growth. A similar issue is faced in South Africa where 80 % of rural households are dependent on fuelwood for energy supply (Dovie *et al.*, 2004).

In rural Africa, women and young girls tend to collect the fuelwood as it is largely used for cooking (Tabuti *et al*., 2003; Dovie *et al.*, 2004). As fuelwood sources become scarce more time is required to harvest it as the women are forced to walk further and further (Madubangi and Shackleton, 2006). Currently the average time required to collect fuelwood in Bigodi is one hour and fifty minutes this is comparable to the findings of Tabuti *et al*., (2003) in that the people of the Bulamogi County (Uganda) required less than two hours. This presents another issue already evident in Bigodi whereby 8 % of the households said that they would collect either dead or live wood opportunistically. As dead wood becomes scarcer it is likely that live wood harvesting will increase despite it being prohibited by KAFRED. The harvesting of live wood could ultimately affect tree reproduction and population dynamics thereby reducing fuelwood availability. Therefore, the overexploitation of fuelwood is not just a threat to the natural environment but also to the very people who are harvesting it and dependent upon it.

In a study carried out in the Limpopo Province, South Africa, it was found that the mean annual consumption of fuelwood was valued at USD 311 ± 24 per household (Dovie *et al.*,

2004). Alternatively, in a study by Baker (2008) in Sango Bay (Uganda), the annual income value of fuelwood and charcoal burning per household was found to be USD 200. Therefore, the mean annual household value for fuelwood in Bigodi, equivalent to USD 233 ± 77, is comparable. With the growing population in Bigodi more and more stress is going to be placed on the natural fuelwood source; and as this happens the value of it is likely to steadily increase, as scarcity will increase local prices.

Wetland Water Abstraction

A report from the Kamwenge Water Department (2006) showed that 63 % of the population has access to safe water. However, in Bigodi, only 50 % of the households collected water for domestic use solely from boreholes and 44 % still used the wetland as a source. Unclean water can result in water-related diseases causing illnesses and sometimes death, with diarrhoeal diseases particularly dangerous to infants and young children (World Resources Institute and Wetlands Management Department, Ministry of Water and Environment, Uganda, 2009). Pit latrines are common in Bigodi and so it is likely that the wetland water is, or will become polluted with *E. coli* bacteria. This requires the construction of elevated pit latrines to prevent sewage from directly entering the wetland. At 1999 prices, the cost of constructing a single elevated pit latrine was USh 625 000 (Emerton *et al.*, 1998). Thus, it would likely be more cost effective to educate people on the potential health hazard and encourage them to utilise the borehole water for domestic purposes.

The average amount of water used daily by a household in Bigodi was 63.5 l; with an average of seven people residing in a household. According to Gleick (1998) the basic amount of water required daily for one person, in a moderate environment with average activity levels and excluding water to grow food, is 50 l. This encompasses the water required for drinking, sanitation services, bathing and food preparation. WHO and UNICEF state that 20 l per person daily is adequate for domestic hygiene purposes (Chenoweth, 2008). The amount of water used by the people of Bigodi is thus considerably lower than the mentioned standards and as assessed in Chapter 4 has a negligible impact on the wetland environment.

Crafts Production from Natural Resources

Worldwide, plant fibres are used to make crafts of cultural and functional importance (Pereira *et al.*, 2006). The craft products are often sold within the community or to tourists. Such sales have been viewed as a development option for poor rural communities (Pereira *et al.*, 2006).

The production and sale of crafts is important for women empowerment as it provides them with an alternative cash income such as in the case of the Bigodi Women's Group.

Most of the households in Bigodi (94 %) made crafts yet only 51 % sold them. The most popular crafts produced were mats, baskets and carpets which are made of papyrus (*Cyperus papyrus*) and palm (*Phoenix reclinata*) leaves. Relatively little papyrus and palm is required to manufacture crafts (Maclean *et al.,* 2003). Therefore, the sustainability of harvesting depends on the quantity of crafts produced and the demand for them.

The Xaxaba women of Botswana sell baskets to tourists for USD 25 to USD 42 each and consequently 73 % of the households counted basket making as a livelihood option (Madzwamuse and Fabricius, 2004). In Sango Bay, the annual value per household of selling papyrus crafts was found to be USD 233 (Baker, 2008). The annual value for craft production in Bigodi was relatively low (USD 52 ± 58). This could be due to the fact that the market is flooded by the Women's Group and that most of the tourists visiting the wetland come from Kibale National Park which also sells local crafts.

Wild Food Consumption

Wild foods are important in supplementing the diets of rural households particularly in the case of drought or crop failure (Magome and Fabricius, 2004). They provide the rural poor with essential vitamins, minerals, carbohydrates and proteins; as well as add variety, spice and taste to meals (Dovie *et al*., 2004). In South Africa the most common wild foods harvested are spinach and fruit (Shackleton *et al*., 2007). Wild spinaches are eaten by the people of Bigodi but not too frequently as there is a lack of knowledge of their nutritional value (Amooti pers. comm., 2010). The consumption of wild fruits in South Africa and Tanzania tends to be largely opportunistic, and predominantly by children (Kajembe *et al*., 2000; Shackleton and Shackleton, 2004). Wild fruit harvested in Bigodi was also largely opportunistic and included predominantly guavas, cape gooseberries, and passion fruits.

It is important to consider that a seemingly low impact use, such as harvesting of fruits, may have a high long-term effect on populations, either because of the effect on seedling recruitment or because fruit collection involves tree felling (Chamberlain *et al*., 2004). Often little is known about the basic taxonomy, geographic distribution, reproductive biology, and sustainable yields (Chamberlain *et al*., 2004).

Bush meat is a valuable source of protein to rural communities in Africa (Magome and Fabricius, 2004). In Botswana it was found that 46 % of households ate an average of 18.2 kg of bush meat per month as it was the only affordable animal protein available (Magome and Fabricius, 2004). In Tanzania, birds, insects, rodents and other larger animals are consumed; in some cases this game is the sole provider of animal protein to the rural peoples' diets (Kajembe *et al.*, 2000). Hunting is prohibited in the wetland and so the people of Bigodi have to rely on beans, fish and livestock for protein (unless they hunt illegally). None of the Bigodi households admitted to hunting or consuming bush meat.

Wild food harvesting was valued for mudfish (USD 36) and spinach consumption (USD 20) and was calculated at USD 56 ± 14 per household per annum. The value obtained was low as the households that consumed the spinach and mudfish did so in a supplementary fashion. This was unlike the popular consumption of wild spinach in rural communities in South Africa. The mean value for the consumption of wild spinaches alone in Bushbuckridge South Africa was valued at R 517 ± 492 (USD 82) more than four times the value of Bigodi's use (High and Shackleton, 2000). In Uganda, as increasing numbers of resource-poor farmers (especially women) are being marginalised by ecological, social and demographic forces, the value of traditional vegetables should be emphasised and their cultivation for home consumption encouraged (Rubaihayo, 1997).

Harvesting Natural Resources for Medicinal and Cultural Purposes

Certain natural resources may be irreplaceable due to their cultural value such as harvesting medicinal herbs for rituals, burials, initiation ceremonies and healing rites (Shackleton and Shackleton, 2004). It is believed that the use of medicinal plants is increasing in Africa due to the AIDS pandemic and growing poverty levels (Magome and Fabricius, 2004). In Uganda, the roots, shoots, leaves and bark of many plants as well as animal products are used for healing and protective purposes (Ssegawa and Kasenene, 2007). Plant derived medication is used for the self-treatment of coughs, headaches and stomach pain. If the ailment is considered more serious the person will seek the help of a traditional healer (Ssegawa and Kasenene, 2007). The use of medicinal plants was found to be common in Bigodi (92.5 % of households) and covered a wide variety (18) of plant types. The plant most frequently harvested, by 71 % of the households, was *Vernonia amygdalina* which is used to relieve the symptoms of malaria. Although this was the case, none of the households admitted to using medicinal plants for cultural purposes due to religious restrictions. This correlates with the

findings of Kibwage *et al.* (2008) where the people of the Sondu-Miriu wetland of Kenya are encouraged to go to hospital rather than resort to traditional medicines. This was also the case in a study carried out in Thorndale, South Africa, by Dovie *et al.* (2004), where it was found that the religion of the household determined whether medicinal plants were harvested or not.

As the annual household use value for medicinal plant use was not obtained for Bigodi, the result (USD 41) from a study by Dovie *et al.* (2005) was used. This was done to ensure that all natural resource use was represented in the total value.

Household Construction Using Natural Resources

Traditional households in Uganda are composed predominantly of wood which is collected from nearby forests and bushes (Kakudidi, 2007). The walls are constructed with vertical and horizontal poles that are interwoven and tied together with vines (Fig. 3.7). They are then packed with mud and later plastered with sand or wood ash and cow dung. The roof is constructed with narrow wooden poles and then thatched with either grass or papyrus. Grass-thatched houses last between seven and thirty years, papyrus between ten and thirty years, and lastly if galvanized iron roofing (relatively expensive so not common) is used the house could last between ten and fifty years (Kakudidi, 2007). Additional construction occurs for cultural reasons as when a boy reaches the age of eleven or twelve he must build his own small hut and move out of the main family house (Amooti pers. comm., 2010).

Figure 3.7: A small, non-plastered house in Bigodi.

In the area encompassing Bigodi many tree species preferred for building were said to not be available anymore due to overexploitation and so people have had to buy materials from woodlots or grow their own trees (Kakudidi, 2007). As a result of reduced construction material availability it may take up to three years to construct a traditional house (Kakudidi, 2007). It was found in a study in the Yala Swamp of Kenya by Shuijt (2002) that the people cannot afford to substitute traditional building materials for modern bricks and iron sheeting. Iron sheeting was found to be six fold the price of papyrus thatch and the use of bricks would be fourteen times the cost of traditional wood and mud walls. This is likely to be a problem to Bigodi in the near future when construction material is limited and people are not wealthy enough to afford substitute materials.

The value of an average thatched and plastered Bigodi house, taking all the resources into account was calculated to be USh 372 125 ± 172 403 (USD 165) (including the price of labour for plastering). Sixty-one per cent of the price was attributed to mud for the walls and the sand required for plastering. This is because the harvesting and translocation of sand and mud is a difficult and time consuming activity unless a vehicle is hired (Amooti, pers. comm., 2010). The average annual value of construction material obtained from natural resources per household was USD 18 ± 7. In the study by Kakudidi *et al*. (2007) which encompassed Bigodi, it was found that the materials required for building a traditional thatched three-bedroomed household cost USh 90 000 (USD 40).

3.7.3 Crop Production

Uganda's major economic activity is small-scale, semi-subsistence agriculture (Nalukenge *et al.*, 2009). This is characterised by growing a mixture of crops and rearing livestock on small landholdings (Nalukenge *et al.*, 2009). Over 80 % of Uganda's population is rural and agricultural (Southworth *et al.*, 2010). The principal economic activity in Bigodi is subsistence crop production. The majority of agricultural produce is consumed at the household level with the surplus sold in local community markets (Hartter, 2007). The majority of households (94 %) in Bigodi did sell some agricultural produce. The highest earning crops were found to be coffee and tobacco although their cultivation by households was rare (21 % and 10 %, respectively). This is likely due to the fact that land areas are typically small (2.26 ha ± 1.96) and the families need to grow food to be consumed at the household level too. However, with the improvement in transport networks tobacco and coffee cultivation may become a more viable option.

In Uganda the men and women have different roles to play in crop production. Men tend to focus on the production of cash crops e.g. coffee, cotton and tobacco; whereas the women grow crops for consumption purposes whilst providing labour for the cash crops too (Ellis *et al.*, 2006). This explains the significant difference ($Z= -2.31$, $p= 0.02$) found in the crop production values of the households according to gender of the head.

The input cost for subsistence agriculture in the area is low. The level of employment in the area is low, irrigation schemes are not required due to the high rainfall, and the land is rarely fertilised. The reasons for the low use of fertilisers include high costs of the input, lack of knowledge to apply fertiliser in terms of quantities and timing, unavailability of the input, fear of health hazards associated with the chemicals, and the belief that the soils are adequately fertile (Kamwenge District State of Environment Report, 2004).

Baker (2008) calculated that crop production in Sango Bay generated USD 240 per annum. In Bigodi the mean annual income value for a household was calculated at USD 293 ± 306. In a study by Kipkemboi *et al*. (2007) at Lake Victoria in Kenya, it was found that terrestrial crops generated an average of USD 164 (for a household of average total income). Dovie *et al.* (2007) calculated the annual value of crop production in the Limpopo Province to be USD 443 per household. The value for Bigodi was therefore in a similar range.

In India, it was found that the contribution of natural resources to cash income was higher in areas where crop production was low (Mahapatra *et al.*, 2005). Thus the focus on crop production in Bigodi may be taking some of the harvesting pressure off the natural environment.

3.7.4 Livestock Rearing

Most of the households (91 %) in Bigodi owned livestock. The animals reared consisted predominantly of cattle, goats, chickens, sheep and pigs. Chickens were the most commonly owned animal (87 %). Only 23 % of the households in Bigodi owned cattle. This is comparable with other African rural communities where cattle are generally owned by less than 30 % of households (Shackleton *et al*., 2001). Goats are more commonly owned in Bigodi (76 % of households) which again correlates with the rural communities elsewhere (60 % of households) (Shackleton *et al*., 2001). This is likely due to the fact that the first animal bought is usually a chicken (as it is the cheapest animal) and money is saved from selling eggs and chicks. When enough money has been saved a goat is bought and eventually a cow

(Schuijt, 2002). Cattle are mostly bought for food but also as a form of banking such as a source of cash income to pay for school fees (Schuijt, 2002). This is also the case in Kenya where livestock are primarily considered a household investment to generate savings for large expenditures such as school and medical fees (Kipkemboi *et al.*, 2007).

The general perception is that communal livestock off-take is low as well as being less productive than commercial systems. Such an evaluation often ignores the value of other benefits (often cultural) associated with rural livestock such as dowry payments, draught power, the sale of by-products (meat, milk or eggs), dung for compost and plastering households, prestige in society, and sacrificial offerings (Shackleton *et al*., 2001; Kamwenge District State of Environment Report, 2004).

Livestock rearing has a range of impacts on the resource base and numerous social and institutional implications (Turner, 2004). In Kamwenge the 2002 to 2004 livestock census showed increasing levels of livestock production across the district. The number of cattle, and sheep and goat, respectively, trended upwards from 83 233 and 55 274 in 2002 to 85 665 and 59 780 in 2004, an indicator of priority attached to livestock in the communities (Kamwenge District State of Environment Report, 2004). As livestock numbers increase so will the pressure on natural resources as the animals require grazing and water.

Livestock at Sango Bay was valued at USD 270 per annum, by Baker (2008), and at USD 148 by Kipkemboi *et al.* (2008). The annual value for livestock in Bigodi was USD 128 ± 312 which was marginally lower.

3.7.5 Total Values and Relative Contributions of Natural Resource Use, Crop Production and Livestock Rearing to Local Livelihoods

The total annual value of land based activities (agriculture, natural resource harvesting and livestock rearing) per household in communal areas of South Africa was found to be approximately R 5 535 per year (which in 2000 equated to USD 809) (Adams *et al.*, 2000 in Shackleton *et al*., 2001). Twenty-eight per cent of this value was from crop production, 22 % from livestock, and the remaining 50 % natural resource harvesting. The total value for crop production, natural resource use and livestock rearing per household for Bigodi was calculated at USD 975. The relative contribution to annual household livelihood value was represented by 30 % crop production, 57 % natural resource use, and 13 % livestock for

Bigodi. It was apparent in both studies that the value of natural resource use was considerably higher than that of crop production and livestock.

The average total livelihood value for female headed households was significantly lower than those of male headed households ($Z= -3.33$, $p= 0.001$). This was likely due to the considerably higher value of crop production in male headed households which was 2.4 times that of female headed households. This may also relate to the fact that the men are typically involved with the production of cash crops whereas the women focus on growing crops for household level consumption.

3.7.6 The Costs of Crop and Livestock Raiding

A typical economic question that arises in conjunction with CBNRM initiatives is: will the people be able to sustain costs, such as crop and livestock raiding, associated with the wildlife that is meant to be delivering livelihood benefits to them (Turner, 2004). Although the amount of damage varies in the areas surrounding KNP the farmers must constantly create coping strategies to deal with crop-raiding (Hartter, 2007).

Mongooses, olive baboons (*Papio anubis*), redtail monkeys (*Cercopithecus ascanius*) and vervet monkeys (*Cercopithecus aethiops*) were the most common culprits of crop raiding in Bigodi, with elephant (*Loxodonta africana*) and leopard (*Panthera pardus*) also problematic closer to the KNP boundary. Some of the households living near the KNP boundary no longer grow cassava due to the damage caused by elephants. Mongooses take chicks on a daily basis and are impossible to control. In a study by Hartter (2007) it was found in the areas surrounding KNP that the vervet, redtail and l'hoesti (*Cercopithecus lhoesti*) monkeys and olive baboons raided fields over half a kilometre from the forest and wetland. Elephants were found to raid fields at distances less than 400 m from the natural areas (Hartter, 2007). The small monkeys were found almost daily in the fields around the two harvesting periods. Elephants were found to be infrequent visitors but the damage done would be extensive.

KAFRED has tried to alleviate the damage done by the animals by encouraging the farmers to plant crops that are unpalatable to monkeys, such as tobacco and coffee, closest to the wetland border. This proved problematic for two reasons. Firstly, the average area of land owned is less than three hectares (2.26 ha ± 1.96) and so the poorer households have limited options of what to grow. Secondly, crops such as tea and coffee provide pathways for the animals to move through (Hartter, 2007). Guarding the crops, although arguably the most effective

means of inhibiting raiding has significant social impacts such as: labour and time investment and lost opportunities (Hartter, 2007).

KNP has tried a number of anti-crop-raiding strategies, such as digging a trench along a portion of the boundary and reinforcing it with Mauritius thorn (*Caesalpinia decapetala*) (Hartter, 2007). Electric fencing has been used in Zimbabwe, Mozambique and Kenya to inhibit crop raids by elephant but it is impractical for the scale of KNP and unaffordable to the local people (Johnson, 2004; Hartter, 2007).

Under the Uganda Wildlife Statute 1996, compensation to individual farmers for loss due to crop or livestock raiding is not permitted (Hartter, 2007). The Ugandan government mandated in 1996 that 20 % of the gate receipts from national parks were to be shared with local communities (Hartter, 2007). KAFRED introduced the 'revolving fund' (USh 100 000 or USD 44) in 2005 for farmers on the wetland boundary as an indirect means of compensation. They have a year to utilise the money and pay it back interest free. This revolving fund is equivalent to the average value (USD 44) per household of livestock and crop produce lost to raiding by wild animals in one year.

Although such high incidences of crop raiding are evidence of conservation success they can sway the attitudes of the local people to be more negative. It is therefore crucial that the damage caused by crop and livestock raiding be mitigated where possible.

3.7.7 Household Involvement in Management and Associated Sentiments

Communal land would have been managed in the past by traditional leaders with the local chiefs known as the custodians (Shackleton and Shackleton, 2004). In the Duru-Haitemba woodlands of Tanzania, prior to colonial rule, the local communities lived in balanced harmony with their natural environment. Either population levels were so low that the environment was little disturbed, or community institutions including ritual ones such as 'haymanda' served to regulate resource use so that society and environment remained in equilibrium (Kajembe and Monela, 2000). These management systems are unfortunately not as effective as they once were due to population growth, increasing commercialisation, and the loss of authority of hereditary leaders (Shackleton and Shackleton, 2004). In Bigodi, most of the households interviewed (60 %) were satisfied with the managerial performance of KAFRED's executive committee. A total of only nine per cent of respondents were unsatisfied or very unsatisfied. The unsatisfied households tended to be those that were highly

affected by crop or livestock raiding and/or were non-members and did not receive any direct benefits from the KAFRED committee. If the people feel that they are not receiving a fair share of the benefits they may withdraw from the management process, refuse responsibility for the consequences of non-involvement and even sabotage resource use management efforts (Johnson, 2004).

It was apparent that there was much confusion about the harvesting restrictions. Originally KAFRED did outline the rules and sent pamphlets around the community (Amooti, pers. comm., 2010). It would be beneficial to revise and reiterate the rules, and make them readily available to the community.

It is important that KAFRED's executive committee ensures that it represents the community. In the case of the Mafungautsi State Forest the people believed that the committee became an extension of forest authority and so were untrustworthy. The presence of forest poaching monitors, who came from different areas around Zimbabwe, caused tension as it was believed that they selected whom they persecuted (Sithole, 2004). There was evidence of this in Bigodi where some households referred to the KAFRED committee and government interchangeably.

Natural resource harvesting restrictions should take into account the poorest members of the community and where possible alternative options should be encouraged such as planting one's own trees for fuelwood. Any restrictions on natural resource use are likely to produce conflict and so the people should be involved in the development of the rules, as was the case in Bigodi. In Bwindi Impenetrable Forest, Uganda, the prohibition of resource harvesting meant that the local people did not have access to bark from the medicinal tree '*nyakibazi*' (*Rytigynia*). This tree was used to treat internal parasites. It was important to the people as 89 % of them were infected with whipworm and 34 % with *Ascaris*. However, the collection of the bark would result in a fine or imprisonment (Hamilton *et al.*, 2000). Such a situation is likely to result in negative attitudes towards management.

3.7.8 Household Perceptions on the Positive Contributions of BWS

The regeneration of pride in the community, empowerment and the recognition of capacity to manage one's own affairs are important outcomes of CBNRM (Johnson, 2004). It needs to be made clear to the community that any benefits received are as a result of their conservation efforts, for example in Bigodi this was demonstrated by the recognition (93 % of households) of an improvement in education due to the 'Swamp School' (Bigodi Secondary School). This

ultimately improves attitudes towards the natural environment as well as encourages future conservation activity.

3.8 Conclusion

The large contribution (57 %) of natural resource use to the value of livelihoods of the Bigodi people demonstrates the benefits acquired from sustainable utilisation. It is important that the people know this value and the potential issues faced by the community if the resources are exploited and depleted. In this light, there needs to be more awareness on the likely negative effects of population growth resulting from the associated increase in competition for land and natural resources.

Uncertainty is inevitable for communities who rely directly upon natural resources for their livelihoods. It is therefore imperative that a diverse and flexible range of livelihood strategies are maintained. BWS provides an additional cash income to the households through the sales of crafts and employment in the tourism industry. These alternative livelihood options acts as safety-nets as well as alleviate pressure from natural resource use and land development.

The issue of crop and livestock raiding is perhaps the biggest negative impact associated with BWS. Both KAFRED and KNP management committees have attempted to alleviate the issue but unfortunately with limited success. The average loss is 10.5 % of the average total household value for crop production and livestock which is likely to have a large impact on the poorer households.

The benefits obtained through CBNRM must be significant enough to accept the costs and warrant the continuation of the programme. BWS provides a number of benefits to the community, of which arguably the most important benefits are livelihood diversification and the conservation of natural resources. Once the people realise the value of their natural resource use they are more likely to understand the importance of sustainable harvesting in securing a better future for themselves and future generations to come.

Chapter Four

Impacts of Human Activity on the Health and Ecosystem Service Delivery of Bigodi Wetland

4.1 Wetland Values, Utilisation, and Resource Management

Since 1900 more than half of the world's wetlands have disappeared (Stuip *et al.*, 2002). The term 'wetland' encompasses a wide variety of habitats such as marshes, peatlands, floodplains, rivers and lakes and coastal areas such as saltmarshes, mangroves, and seagrass beds, also coral reefs and other marine areas no deeper than six metres at low tide, as well as human-made wetlands such as waste-water treatment ponds and reservoirs (Ramsar, 2011). Wetlands are complex ecosystems with multiple ecological, socio-aesthetical, intrinsic, and economic values (Schuijt, 2002). As most of Africa lies within semiarid and arid climates, wetlands are a key source of water and nutrients for biological productivity as well as the survival of people in these dry regions (Schuijt, 2005). Wetland resources and services provide food security and a safety-net in difficult times (Maclean *et al.*, 2003; van der Duim and Henkens, 2007). Wetland resources include the water, land, soils, plants and animals contained within wetlands, all of which provide goods which can be used to generate subsistence, income and employment (Emerton *et al.*, 1998). Wetland services are the hydrological and ecological functions of wetlands, which support and maintain economic activities and human settlement because they act as a sink for wastes and residues and protect human and natural production systems (Table 4.1) (Emerton *et al.*, 1998).

Despite their obvious value, wetlands in Africa are being modified by human activity largely as a result of decision-makers being ignorant of the various values of wetland goods and services to the local people (Schuijt, 2005). They allow wetland development, such as drainage for agricultural purposes, as they perceive the benefits from such use outweigh the opportunity cost of wetland conservation. Consequently, wetlands are threatened by overexploitation arising from demographic growth, poverty and economic stress, which are often magnified by drought (Schuijt, 2005). As wetland resources are depleted, degradation occurs, poverty levels increase and water supply is compromised (van der Duim and Henkens, 2007). The future of these wetlands lies in a stronger political will to protect them based on sound wetland policies and encouragement for community participation in their management (Ramsar, 2011). Wetland conservation therefore needs to occur simultaneously with poverty

alleviation through sustainable utilisation. Sustainable wetland utilisation is the human use of a wetland in such a way that it yields continuous benefits to present generations while maintaining its potential to meet the needs and aspirations of future generations (van der Duim and Henkens, 2007).

Table 4.1: Wetland services, resources and attributes (adapted from Dixon and Wood, 2003).

Services	Resources	Attributes
Water storage	Medicines	Biological diversity
Groundwater recharge	Game meat	Uniqueness to culture
Groundwater discharge	Fish	
Flood control	Wild fruits and vegetables	
Sediment retention	Water supply	
Nutrient retention	Craft materials	
Micro-climate stabilisation	Clay and sand	
Water transport	Construction material	
Recreation/tourism	Fertile soils (crop production)	
Cultural/spiritual	Cultural/spiritual	

In the past, indigenous management practices controlled wetland resource use. This required effective and credible local authority such as traditional leaders who derived their power from their ancestors (Rebelo *et al.*, 2010). With the socio-political transformation that has taken place in Africa, authority over natural resource use is now largely vested in formal government structures (Rebelo *et al.*, 2010). However, in many instances formal government agencies lack knowledge and understanding of local needs and beliefs, and in many countries also lack resources and expertise. Consequently, it has been found that the involvement of local communities in the management of wetlands is crucial as without it the long-term sustainability of the wetland could be jeopardised as well as the livelihoods of the people (van der Duim and Henkens, 2007). Local community members, relevant government officials, local authorities, and other stakeholders need to be represented in the management plan; they should have information and appropriate opportunity to be involved in the planning and management of wetland use (Kairu, 2001). As sustainable wetland management usually

requires some restriction of resource utilisation activities it should also provide a number of benefits, alternative income options, and employment, to compensate for opportunity costs in order to maintain local support (Emerton *et al.*, 1998). A typical objective would be that the cultural and spiritual values associated with the wetland should be preserved; there should be equitable access to wetland resources; an increase in local capacity and empowerment; reduced conflicts amongst stakeholders; and the maintenance of ecosystem services (van der Duim and Henkens, 2007). Government agencies would also benefit as a result of: improved ecosystem viability; reduced management costs; assistance with monitoring and surveillance; fewer infringements; and enhanced social sustainability and quality of life for communities dependent on wetlands (van der Duim and Henkens, 2007).

4.2 Ugandan Context

Throughout eastern Africa wetlands are being degraded as a result of overexploitation of resources, land transformation for alternative uses, and from upstream developments that alter flow (Emerton *et al.*, 1998). Wetlands in Uganda occupy 31 406 km^2, approximately 15 % of the total land area (World Resources Institute and Wetlands Management Department, Ministry of Water and Environment, Uganda, 2009). They are widely dispersed and are found in almost every district. Typical factors driving wetland degradation in Uganda are: population growth (rate of 3.3 % per annum), economic reform, development, and the desire for an increase in per capita income (Maclean *et al.*, 2003; Apunyo, 2006).

Wetlands are one of the most vital resources that Uganda is bestowed with as they supply the people with ecological services (climate modification, water purification, waste water treatment, flood control and water storage and distribution in time and space) and products such as water, fuel, fish, medicinal plants, game meat, and craft and construction materials (World Resources Institute and Wetlands Management Department, Ministry of Water and Environment, Uganda, 2009). They also have vital attributes such as the support of rich biodiversity and cultural and aesthetic values (Apunyo, 2006). Examples of such biodiversity include the globally endangered Shoebill (*Balaeniceps rex*), Fox's weaver (*Ploceus spekeoides*), and fish species of the Cichlidae family (World Resources Institute and Wetlands Management Department, Ministry of Water and Environment, Uganda, 2009).

The rural poor of Uganda rely heavily on wetland goods and services for subsistence and income generating activities because of a lack of affordable alternatives and limited formal employment opportunities (Emerton *et al.*, 1998). With an increase in human population size

and high levels of poverty and unemployment, these rural poor often settle in fragile wetland areas in search of a new means of livelihood (Baker, 2008). Common activities that encourage wetland degradation in Uganda include: clearing and drainage for agricultural purposes, dumping of sewerage and industrial waste, sand mining and extraction of clay for bricks, deforestation, overgrazing, and nutrient enrichment by fertiliser leachate from surrounding agricultural land (Kibwage *et al.*, 2008). Such activities may have varying degrees of impact on the condition of the wetland concerned (Table 4.2). It was found by Maclean *et al.* (2003) that with an improvement in Uganda's transport network the market for wetland goods and crops has expanded and actual levels of resource use and habitat conversion far exceed sustainable levels.

Wetland utilisation activities are particularly important for the marginal groups such as the elderly, unemployed and women (Emerton *et al.*, 1998). The high dependence of the poorest households on the ecosystem services provided by the wetlands as well as their low capabilities, lack of assets and alternatives make them the most vulnerable to wetland degradation. This means that the way in which a wetland is managed can have disproportionate impacts on the members of the adjacent community and can contribute significantly to poverty levels (Hartter, 2007). Wetland residents need to be able to cope with environmental stresses and shocks. The local community needs to be able to partake in activities that generate an adequate standard of living as well as be able to utilise the wetland resources as a safety-net in difficult times. A secured livelihood is one where the people have reliable income and assets, food and nutrition, education, participation, water and sanitation, health and the ability to respond to and cope with external shocks (Kibwage *et al.*, 2008). Unfortunately, households in Uganda tend to ignore what will not directly and immediately benefit their short-term gains, even if it does decrease the long-term standard of living or sustainability of resources and livelihoods (Hartter, 2007; World Resources Institute and Wetlands Management Department, Ministry of Water and Environment, Uganda, 2009). Although even if the people realise that their harvesting practices are unsustainable they often have no alternative options.

Table 4.2: The ranking of potential impacts, as a result of human activities, on the condition of a wetland (adapted from World Resources Institute and Wetlands Management Department, Ministry of Water and Environment, Uganda, 2009).

** Only refers to established human wastewater treatment plants.*

Increasing potential impacts on wetland ↓	**Human Activity**
	No use
	Tourism
	Beekeeping
	Water collection and use
	Wastewater treatment*
	Fishing
	Hunting
	Livestock grazing
	Natural herbaceous vegetation harvesting
	Natural tree harvesting
	Cultivation of food and fibre
	Plantation tree cultivation and harvesting
	Mineral excavation
	Human settlement

The Ugandan government has made attempts to counter wetland degradation through research and education, policy development, legal and institutional establishments and community-based approaches (World Resources Institute and Wetlands Management Department, Ministry of Water and Environment, Uganda, 2009). In 1986, the Ministry of Environment Protection was established and banned further wetland conversion until a National Wetlands Policy was developed (Apunyo, 2006). In 1988, the Ugandan government joined the Ramsar Convention and in 2005 hosted the 9th Ramsar Conference. The aim of the Ramsar Convention is "the conservation and wise use of wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable

development throughout the world". The importance of wetlands is now recognised in the country's constitution (1995) which commits the government to hold them in trust for the common good of all citizens.

The current law provides for sustainable use of wetlands through the stipulation of the types of activities to be regulated. The laws allow communities to undertake activities such as brick making, fish farming, recreation, drainage, and cultivation of crops in the wetlands under regulation (Nalukenge *et al.*, 2009). Other traditional activities such as medicinal plant and papyrus harvesting, hunting, and collection of water are allowed, as well as cultivation of up to 25 % of the wetland area. Any activity that was taking place in a wetland prior to 1995 when the law was passed is still allowed (Nalukenge *et al.*, 2009). As a result, the people of Uganda continue to use wetlands to meet their needs for subsistence agriculture and livestock rearing. This present set of environmental laws is not successfully achieving protection of the wetlands. The 'open-access' nature of the wetland regulations with the high population growth rate is leading to a classic 'tragedy of the commons' situation (Nalukenge *et al.*, 2009).

4.3 Bigodi Wetland

Bigodi Wetland Sanctuary (BWS) is located in the Kamwenge district of western Uganda (00°24.364'N, 030°24.527'E). The wetland is managed by KAFRED which is a registered community based organisation that was established in 1992 (Amooti, 2007). The realisation of the tourism potential of the wetland resulted in the commencement of guided wetland walks. The reasons for the establishment of BWS, according to the executive committee (2010), could be condensed to the following: "to conserve the wetland through the wise use of natural resources and simultaneously use tourism as a tool to develop the local community and eradicate poverty". Eco-tourism that emphasises environmental conservation, community empowerment and participation, as well as tourist satisfaction, is fast becoming a popular means of sustainable development (Baker, 2008).

Bigodi wetland is a large (420 ha), unchannelled valley-bottom wetland, with *Cyperus papyrus* being the dominant vegetation. It stretches through the Bigodi community and meets the Kibale National Park (KNP) boundary at both ends (Lepp, 2004). The area has fertile soils and receives high rainfall ((MAP of 1 719 mm (Hartter, 2007)) and so it is rich in biodiversity and has a dense and growing human population (Lepp, 2004). Due to the beneficial climate conditions the area surrounding the wetland and KNP is a patchwork of agricultural lands

(Mugisha, 2002; Hartter, 2007). There was an approximate 137 % increase in areas under subsistence farming between the years of 1955 to 2000 (Mugisha, 2002). The natural vegetation lost to subsistence farming consisted mainly of forest relics, savanna and wetlands (Mugisha, 2002).

The principal economic activity in Bigodi is subsistence agriculture. The following crops are commonly grown: sorghum, maize, millet, cassava, bananas, peas, groundnuts, sunflower, sweet potato, Irish potato, beans, tea, coffee, tobacco, cotton, tomatoes, cabbage, onions, and pineapples (Amooti pers. comm., 2010). Livestock owned in Bigodi are predominantly cattle, goats, chickens, sheep and pigs. The people of Bigodi are dependent on the natural resources and services provided by the wetland to sustain their livelihoods and to provide support in times of hardship (Chapter 3). The integrity of the wetland is thus not only of ecological importance as it also contributes significantly to the welfare of the local people. Therefore, the aim of this chapter was to determine the impacts of human activities on the health and provisioning services of Bigodi wetland. The future trajectory of change was estimated and threats to the wetland were identified.

4.4 Methods

The WET-Health (Macfarlane *et al.*, 2007) and WET-EcoServices (Kotze *et al.*, 2007) methodologies from the Wetland Management Series were used to assess Bigodi wetland. The assessments were based on the characteristics of and activities in the wetland and in the wetland catchment area. The methods rely on scoring sheets using variables that are estimated to fall within certain ranges by the assessor.

WET-Health was used to measure the difference between the natural and actual reference conditions for hydrology, geomorphology and vegetation. Impacts were measured based on the activity in the wetland catchment area. The assessments were calculated using the extent of the impacts (%), the intensity of impact (degree of alteration of impact, based on a scale of one to ten) and the resulting magnitude of impact:

$$\text{Magnitude} = \text{extent}/100 \times \text{intensity (scale 1-10)}$$

A low score (close to zero) indicates good health, whereas a high score (close to ten) indicates poor health. The magnitude scores were then used to calculate the overall magnitude of impact and the wetland health status. This was done using the following formula (WET-Health; Macfarlane *et al.*, 2007):

Health = ((Hydrology score × 3) + (Geomorphology score × 2) + (Vegetation score × 2)) ÷ 7

As hydrology is considered to have the greatest impact on wetland health it was weighted by a factor of three. The overall score ranges from zero (pristine) to ten (critically impacted).

The first part of the hydrological assessment was to determine the impact of changes in quantity and pattern of water *inputs* to the wetland from its upstream catchment. Activities within the catchment area were assessed to determine their impact on the water inflow quantity. The main activities considered included: irrigation, timber plantations, agriculture, woody alien plants, and the presence of dams. The second part of the hydrological assessment was to evaluate the impacts of *onsite* human activities. This involved determining how the local people have affected the distribution and retention patterns of water within the wetland.

The WET-EcoServices handbook was used to assess the provisioning of 15 potential wetland ecosystem services. Each characteristic for a given wetland service was designated a score from zero to four using the rationale and guidance provided by Kotze *et al.* (2007). The effectiveness of the wetland at supplying each service was analysed first. This was then followed by an analysis of the opportunity that the wetland had to provide each of the services. For example, the wetland may have the characteristics required to be efficient at toxicant removal, however, if there are no toxicants deposited in the wetland it will not have such an opportunity.

The overall score for each service was calculated using averages as the WET-EcoServices methodology avoids complicated weighting systems. The average scores for service provisioning effectiveness and opportunity were calculated. The average of these two scores was then compared with the rating classes provided in Table 4.3.

Table 4.3: Classes for determining the likely extent to which a benefit is being supplied based on the overall score for that benefit (Kotze et al.*, 2007).*

Score	**<0.5**	**0.5-1.2**	**1.3-2.0**	**2.1-2.8**	**>2.8**
Rating of the likely extent to which a benefit is supplied	Low	Moderately low	Intermediate	Moderately high	High

For both the WET-Health and WET-EcoServices sections a level 2 (field based) assessment was carried out based on personal observations of the wetland, information received from the KAFRED executive committee and household interviews, and from a topographical map (1:50 000) and satellite images (1996) obtained from the Department of Cartography in Entebbe. A Google Earth (2011) satellite image was used to compare with the images obtained from Entebbe. Two soil samples were collected to determine the organic material content. The wetland border was mapped out with a GPS and slope readings were taken. Field notes and photographs were used to record significant observations.

The layout of this chapter differs from the preceding ones in that the results and discussion sections are combined. This was done because each attribute of the WET-Health and WET-EcoServices approach generates only a single number.

4.5 Results and Discussion

4.5.1 Wetland Health Assessment

Bigodi wetland consists of one hydrogeomorphic unit (HGM), an unchannelled valley-bottom. A hydrogeomorphic unit is a recognisable physiographic wetland-unit based on geomorphic setting, water source and water flow patterns (Macfarlane *et al*., 2007). Such wetlands are characterised by having no clear stream channel (Fig. 4.1), a gentle gradient and alluvial sediment deposition (Macfarlane *et al*., 2007). Water input is from a channel entering the wetland as well as from the adjacent slopes.

Wetlands occur in regions where rainfall is in excess of losses such as evapotranspiration and surface runoff (Mitsch and Gosselink, 2007). The mean annual precipitation (MAP): potential evapotranspiration (PET) ratio indicates the dependence of the wetland on direct precipitation or inflow from the catchment area (Macfarlane *et al*., 2007). Due to the high MAP (1 719 mm) a high ratio was assigned to Bigodi wetland with a low vulnerability factor of 0.9. This means that the wetland receives a substantial portion of its water from rainfall and so is less vulnerable to catchment obstructions.

Figure 4.1: An eastern view of Bigodi Wetland.

Hydrology: impacts of human activity on water input

Wetlands purify water both chemically and biologically; and by intercepting run-off, they act as multi-functional natural reservoirs (Dixon and Wood, 2003). As hydrology is the defining feature of wetlands any alterations may have serious consequences to the overall wetland structure and biophysical processes (Macfarlane *et al*., 2007).

In Bigodi, only very small-scale irrigation was apparent and was carried out by hand with a bucket to water vegetable patches in the dry season. This water abstraction by hand has the lowest intensity of impact followed by hand-pumps and then motorised pumps (Macfarlane *et al*., 2007; Rebelo *et al.*, 2010).

Pine and eucalyptus trees were found to be planted in both the riparian and non-riparian areas of Bigodi wetland. Eucalyptus trees are common in Uganda as they were introduced in the 1950s to solve wood shortages (Hartter, 2007). Eucalyptus trees have also been planted at the wetland extremities to demarcate the KNP boundary. Although pine is preferred by the people, it was said the seedlings were more expensive than those of the eucalyptus. Only in the past few years has the KAFRED executive committee prohibited the growth of eucalyptus trees in the wetland and have started to cut them down (Amooti pers. comm., 2010). This is

due to the recognition of the fact that they use more water than the native tree species. Another potential means of mitigation is the Kibale Community Fuelwood Project which positively contributes to the issue by encouraging the planting of indigenous trees. Nurseries have been established consisting of *Sesbania sesban* and *Marcamia spp.*, the seeds of which are collected locally and germinated in recycled plastic bags. These seedlings can then be grown to provide wood or as fencing. This project was initiated as a result of the growing pressure on wood and charcoal as a fuel source in and around Kibale National Park (newnaturefoundation.org, 2009). Household level indigenous tree growth should be encouraged too, as in Cameroon the planting of indigenous trees by farmer groups significantly improved local livelihoods. The tree products (fruit, medicine, or wood) were not only used by the family but could be sold providing an additional income (Timmer *et al*., 2008).

From the map it was evident that there were no dams present in the wetland's catchment area. Uganda's major economic activity is small-scale, semi-subsistence agriculture (Nalukenge *et al.*, 2009). This is characterised by growing a mixture of crops and rearing livestock on small landholdings (Nalukenge *et al.*, 2009). As agriculture is the main livelihood activity in the area (carried out by all of the households interviewed) it was thus decided that any change in inflow would have been predominantly as a result of forest clearing for cultivation in the catchment area. Maize was the most commonly grown crop (94 % of the households), followed by bananas (81 %) and beans (60 %). Only three percent of the households grew sugarcane and so despite it being a high impact crop it would have a very minimal impact on water inflow quantities. Coffee and tobacco, the main cash crops, were only grown by 21 % and 10 % of the households, respectively. With the improvement in Ugandan communication and transport networks such cash crops are becoming increasingly common (Maclean *et al.*, 2003). Such infrastructural development is likely to provide opportunity for agricultural intensification. This will have mixed effects on the wetland. The improved income and food production could alleviate pressure on natural resource harvesting from the wetland. However, this may come at the cost of increased water abstraction through improved irrigation methods; increased phosphate and nitrate concentrations through fertiliser entering the system; and as profit margins increase the desire to clear more land will be stronger. From the interviews it was calculated that, if given the option, 93 % of the households would cultivate the wetland.

The KAFRED executive committee stipulated that only edge-cultivation is permitted. However, cultivation of the outer edges of a wetland can result in a decline in the size of the wetland as water levels recede (Hartter, 2007). Surface hardening occurs with vegetation clearing. The surface hardening as well as fallow land associated with cultivation enhances run-off. To minimise impacts it is important when the farmers practice edge-cultivation that they take into account the potential run-off effects. Surface roughness is important in mitigating run-off and so the farmers must plough with the land's contours and ensure that soil is bare for a minimum amount of time (Deasy *et al.*, 2010). Fortunately, Bigodi wetland has buffer vegetation (mainly *Phoenix reclinata*) which acts as a filter for excess sediment and nutrients (Fig. 4.2). Taking the above descriptions into account it was concluded that any additional flows to the wetland are approximately one third of that which occurs naturally.

Figure 4.2: Proximity of maize field to vegetated buffer zone also illustrating the common occurrence of Phoenix reclinata.

Factors that could potentially increase or decrease floodpeak magnitude and frequency were analysed next. Unchannelled valley-bottom wetlands are typically not dependent on flood events and so are not vulnerable to changes in floodpeaks (Macfarlane *et al*., 2007). As previously mentioned, there were no dams in the catchment area to reduce floodpeaks. The extent of hardened surfaces in the catchment area was low (approximately 5 to 20 %) and so increased floodpeaks were found to be unlikely.

In summary, it was calculated that the impact of the human modifications on the hydrological input of Bigodi wetland was small but identifiable. It was given an impact score of 1 (lower end of the 1-1.9 class).

Hydrology: impacts of onsite human activity

The retention of water within the wetland is crucial for the maintenance of hydric soils and hydrophytic vegetation, as well as various biological activities and functions (Mitsch and Gosselink, 2007). Drains reduce the flow of water through the wetland as well as the storage capacity of the areas (Dixon and Wood, 2003). There was only one artificial drain observed in the wetland (Fig. 4.3). It was located on the western side of the wetland near KNP and so a considerable distance (± 3 km) from the KAFRED centre. Drains are commonly dug for agricultural purposes; they reduce diffuse surface-flow and retention of water in favour of more concentrated flow (Macfarlane *et al*., 2007). The drainage of wetlands for agricultural purposes is considered the primary cause for wetland loss worldwide (Stuip *et al.*, 2002). Drains lower the water table, and combined with the effects of cultivation, result in physical and chemical changes of the wetland soils through compaction, oxidation and mineralisation (Dixon and Wood, 2003).

The depth of the drain in Bigodi wetland was in the 0.2 to 0.5 metre range and it was located so that the flow into and through the wetland was moderately well intercepted. There were no obstructions in the drain thus rendering it more efficient at transporting water. As the natural level of wetness of the wetland was high (the seasonal and permanent zones were both present and collectively represent 60 % of the total HGM unit area) the greater was the potential of the drain to 'dry-out' the area.

Population growth in Uganda has resulted in land shortages which have forced people to move into marginal areas (Dixon and Wood, 2003). This has led to the onsite cultivation of wetlands which originally were used mainly for natural resource harvesting. The attraction to wetland cultivation lies in the availability of water throughout the year (Dixon and Wood, 2003). Although such cultivation may improve food security it results in not only negative hydrological impacts through drainage but the wetland soil is affected too. Initially the soil is fertile as it is detritus-based and then through exposure it becomes oxidised which leads to the depletion of nutrients and increased acidity (Hartter, 2007). As the wetland is degraded crop yields drop and the vulnerability of the local people increases. Excluding a few minor tributaries, Bigodi wetland was found to be uncultivated as a result of KAFRED and

government regulations. According to government regulations the area cultivated must be less than 25 % of the total area of the wetland (Nalukenge *et al.*, 2009). Such limited areas of cultivation should not have a detrimental effect on the wetland, as according to Loiselle *et al.* (2006) a wetland can support subsistence agriculture without impeding the ecosystem's functions provided the total cultivated area is small.

Figure 4.3: An artificial drain in Bigodi wetland.

Impeding features such as dams, weirs and roads can slow water flow and increase water retention time within the wetland (Macfarlane *et al*., 2007). If a road is constructed across a wetland with culverts of an inadequate size or number, the through flow will be interrupted and back-flooding may occur in an upstream direction (Zeedyk, 1996; Macfarlane *et al*., 2007). Such features may also result in downstream localised desiccation. It was found that there was one main dirt road and a few minor dirt roads that passed through Bigodi wetland. The main Kamwenge Road (Fig. 4.4) is due to be tarred in the near future as it is the runway for a fleet of trucks that transport granite from a mine to the south of Bigodi. The upstream flooding impact associated with the road construction was calculated to be 10 % of the HGM unit. The downstream impact on the quantity and timing of flows was 15 % of the HGM unit. The roads were categorised as intermediately interrupting the low flows to downstream wetland areas.

Figure 4.4: Kamwenge Road passing through Bigodi wetland.

The wetland vegetation provides resistance to through flow which increases water residence time and consequently aids nutrient trapping (Turpie, 2010). There were certain areas within the wetland where papyrus harvesting was permitted for school children for their craft classes (Fig. 4.5). Small quantities of papyrus were allowed to be harvested by the local people to make crafts but were not to be collected for thatching purposes as such activity requires large quantities of the reed (Amooti pers. comm., 2010). There was also evidence of trees being harvested from the wetland and wetland buffer zone which also contributes to a loss in surface roughness (Figures 4.6a and b).

Figure 4.5: Evidence of papyrus harvesting by school children.

4.6a)

b)

Figure 4.6a and b: Harvesting of wood from the wetland.

Plant harvesting from the wetland was found to be an important livelihood activity for the people of Bigodi (Chapter 3). All of the households interviewed collected wood for fuel from the wetland (average of one bundle harvested daily), 92 % of them said that they only collected dead wood. Ninety-four per cent of the households harvested materials to make crafts. It was found that 92.5 % of the households harvested medicinal plants and 95.5 % of the households harvested resources for construction purposes. The roads, tourist boardwalks, and trails also contribute to a reduction in surface roughness due to clearing. The total extent of the HGM unit surface roughness affected was estimated at 5 % with the degree of reduction classified as low.

Direct water loss from a wetland can result in localised drying effects and reduced water availability downstream (Macfarlane *et al*., 2007). The direct abstraction of water by buckets is carried out daily to meet domestic needs. It was found that 50 % of the households collected water from local boreholes, 44 % directly from the wetland, 3 % from wetland streams and the remaining 3 % alternated between borehole and wetland or borehole and stream (Chapter 3). The average amount of water collected from the wetland daily per household use was 63.5 litres (± 23.8). Irrigation using a bucket has the lowest intensity of impact, it was carried out mainly for vegetable patches and only in the dry seasons, although

no one admitted to it in the interviews. Irrigation is uncommon in Bigodi as the area receives high rainfall.

Livestock in Uganda are often dependent on wetlands (edges) to meet their water and grazing requirements. The animals pollute wetlands by increasing turbidity and nutrient load with their dung (Hartter, 2007). Ninety-one per cent of the households interviewed in Bigodi owned livestock. Goats (76 %) and chickens (87 %) were the most common animals owned by the households, whereas cattle were relatively rare (23 %). Thus, water abstraction for livestock watering purposes was regarded to have a minimal impact on the wetland flow.

The overall impact of the activities of the local people on the hydrological health of the wetland was low and it was categorised as having an impact score of 1.6, which is described as "largely natural with few modifications; a slight change in ecosystem processes is discernable; and a small loss of natural habitats and biota may have taken place" (health category B) (Table 4.4). With the current management in place the wetland's hydrological condition can be expected to deteriorate slightly over the next five years as a result of population pressure.

High rates of in-migration and natural growth has resulted in Uganda's population growing by 240 % between 1969 and 2000 (Hartter and Ryan, 2010). These population growth rates are amongst the highest in the world and lead to ever-increasing requirements for arable land and natural resources to sustain livelihoods (Hartter and Ryan, 2010). Such population pressure in conjunction with high poverty levels has already accelerated wetland resource decline in most parts of Uganda (Kibwage *et al.*, 2008). A 'use it or lose it' mentality has been fostered as the people convert or use land because there is no security of resources for the future (Hartter and Ryan, 2010). The people believe that they do not have any alternative options.

Table 4.4: WET-Health categories used for describing the integrity of wetlands (Macfarlane et al.*, 2007).*

Description	Impact Score	Health Category
Unmodified, natural.	0- 1	A
Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place.	1.1- 2	B
Moderately modified. A large change in ecosystem processes and loss of natural habitats has taken place but the natural habitat remains predominantly intact.	2.1- 4	C
Largely modified. A large change in ecosystem processes and loss of natural habitat and biota has occurred.	4.1- 6	D
The change in ecosystem processes and loss of natural habitat and biota is great but some remaining natural habitat features are still recognisable.	6.1- 8	E
Modifications have reached a critical level and the ecosystem processes have been modified completely with an almost complete loss of natural habitat and biota.	8.1- 10	F

Impacts of Human Activity on the Geomorphology of Bigodi Wetland

The accumulation or loss of sediment affects the three-dimensional structure of the wetland surface, particularly its longitudinal and lateral slopes. These geomorphic processes can therefore control the flow of water through a wetland (Macfarlane *et al*., 2007). There were no gullies or depositional features found in Bigodi wetland. There was no peat mining and only one small wetland tributary had been burnt to clear the vegetation for cultivation despite it being against KAFRED's rules (again at the western edge of the wetland away from the KAFRED centre). A small area of the wetland (< 5 %) was affected by artificial infilling due to the construction of the Kamwenge Road. The present geomorphic state of the wetland was assigned an impact score of 0.05 and so was classified as unmodified or natural (category A)

(Table 4.5). Due to the slight slope of the wetland (0.37 %), and its large area (420 ha), Bigodi wetland was designated a score of 2 (Fig. 4.7) indicating that it is not vulnerable to erosion and so unlikely to deteriorate.

Table 4.5: The different geomorphic state categories (Macfarlane et al.*, 2007).*

Impact Score	Description	Category
0- 0.9	Unmodified, natural.	A
1- 1.9	Largely natural. A slight change in geomorphic processes is discernable but the system remains largely intact.	B
2- 3.9	Moderately modified. A moderate change in geomorphic processes has taken place but the system remains predominantly intact.	C
4- 5.9	Largely modified. A large change in geomorphic processes has occurred and the system is appreciably altered.	D
6- 7.9	Greatly modified. The change in geomorphic processes is great but some features are still recognisable.	E
8- 10	Modifications have reached a critical level as geomorphic processes have been modified completely.	F

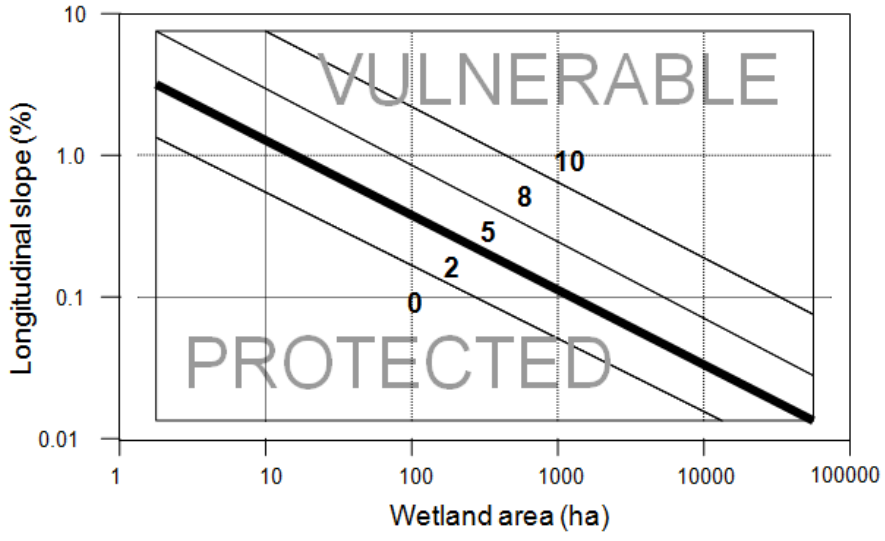

Figure 4.7: The relationship between vulnerability to erosion, wetland area, and longitudinal slope (Macfarlane et al.*, 2007).*

Impacts of Human Activity on the Vegetation of Bigodi Wetland

Wetland vegetation provides a number of important ecosystem functions: it offers a specialised habitat for a range of different animal species; the plant roots stabilise the soil surface preventing the formation of erosion channels; and it slows the velocity of through flows allowing for the sedimentation of suspended solids (Brix, 1994). The vegetation may also be used by the local people for craft material such as reeds for weaving, as well as provide services for those who live further downstream for example flood attenuation and nutrient retention (Macfarlane *et al*., 2007). The WET-Health vegetation assessment is carried out based on which plants are in the wetland that should not be there such as alien invasive species or a high abundance of ruderal species.

The Bigodi wetland vegetation had been disturbed by a number of human activities, these included: infrastructure in the form of roads and tracks, a drain, cultivation of some wetland tributaries, the small-scale clearing of papyrus, and the planting of eucalyptus and pine trees (although they were being removed). As drains result in localised desiccation they alter the conditions required by wetland plant species in favour of terrestrial ruderal species thus affecting plant composition (Zedler and Kercher, 2004; Mitsch and Gosselink, 2007). The extent of alien vegetation within the wetland was low, estimated at 2-5 % total cover. Most of the alien vegetation was found on the wetland edge and in the catchment area where disturbance was high as a result of cultivation and tree harvesting. These areas were populated by plants such as *Lantana camara*, *Caesalpinia decapetala*, *Psidium guajava*, *Acacia spp.*, *Rubus spp.*, *Sesbania spp.*, and *Solanum spp*. The most common ruderal species found was *Bidens pilosa*. It was observed that the primary vegetation (papyrus) within the HGM had not been significantly altered by human activities. Therefore, the vegetation was given an impact score of 1.5 indicating that there had been a very minor change to vegetation composition with the abundance of alien invasive and ruderal species slightly higher than would be the case naturally (Table 4.6). However, as population pressure in the area increases so will disturbance and the likelihood of deterioration in the natural wetland vegetation composition.

Table 4.6: Impact categories for assessing the intensity of vegetation integrity (Macfarlane et al.*, 2007).*

Impact Category	Description	Intensity of Impact Score
None	Vegetation composition appears entirely natural.	0.5
Small	A very minor change to vegetation composition is evident at the site (e.g. abundance of ruderal, indigenous invasives slightly higher than would be the case naturally).	1.5
Moderate	Vegetation composition has been moderately altered but introduced; alien and /or ruderal species are still less abundant than indigenous wetland species.	3
Large	Vegetation composition has been largely altered and introduced; alien and/or increased ruderal species occur in approximately equal abundance to the characteristic indigenous wetland species.	5
Serious	Vegetation composition has been substantially altered but some characteristic species remain, although the vegetation consists mainly of introduced, alien and/or ruderal species.	7
Critical	Vegetation composition has been almost totally altered, and in the worst case all indigenous vegetation has been lost (e.g.as a result of a parking lot).	9

Table 4.7 gives a summary of the scores and descriptions allocated according to the WET-Health methodology. The overall wetland health finding is that it is classified as largely natural with minor disturbances. This implies that management of the wetland is good.

Table 4.7: Summary of WET-Health Assessment of Bigodi Wetland.

	Impact Score and Health Category	**Description**	**Predicted Directory of Change**
Hydrology	1.60 (B)	Largely natural with few modifications. A slight change in ecosystem processes is discernable and a small loss of natural habitats and biota may have taken place.	Likely to deteriorate slightly over the next five years. ↓
Geomorphology	0.05 (A)	Unmodified, natural.	Unlikely to deteriorate due to slope: area ratio of wetland rendering it not vulnerable to erosion. →
Vegetation	1.50 (B)	A very minor change to the vegetation composition is evident at the site.	Likely to deteriorate slightly over the next five years. ↓
Overall Health	1.13	Most of the wetland remains in its natural state, but there are a few minor disturbances.	Likely to deteriorate slightly over the next five years as a result of increasing population pressure. ↓

4.5.2 Wetland Ecosystem Services Assessment

Wetlands deliver a wide range of services that are vital for human well-being such as flow regulation, water purification, carbon sequestration, tourism, biodiversity, and cultural attributes (Turner *et al.*, 2008). Maintaining the natural functioning of wetlands will enable them to continue to deliver these services. On the contrary, the loss and degradation of wetlands leads to a reduction in the delivery of wetland ecosystem services (Turner *et al.*, 2008). This is particularly problematic in Uganda as the demand for these services has increased simultaneously with wetland degradation owing to human population growth. The main priority when making choices about wetland management decisions should be to ensure that the ecosystem services of the wetland are maintained or restored.

The flood attenuation ability of the wetland was assessed first. It refers to the interception of storm runoff, changing the sharp runoff peaks to slower discharges over longer periods of

time thereby reducing the severity of floods downstream and potential damage (Mitsch and Gosselink, 2007). The larger the wetland relative to its catchment the greater is its potential influence on floodflow (Kotze *et al.*, 2007). Bigodi wetland occupies 2.9 % of the catchment area which was rounded up to 3 %. The speed of water flow is directly influenced by slope, the more gentle the slope the greater is the attenuating ability of the HGM unit. The slope of Bigodi wetland (HGM unit) was very slight at 0.37 %. As wetland vegetation provides resistance to through flow the greater the frictional resistance offered the more effective the wetland will be in attenuating the floods (Kotze *et al.*, 2007). The surface roughness of Bigodi wetland is high due to the dense stands of papyrus and forested areas. The sinuosity of the stream channel is intermediate and so would have a slight effect on slowing flows. The seasonal and permanent zones are both present and collectively greater than 60 % of total HGM unit area meaning that the wetland remains wet for most of the rainfall seasons due to the high MAP.

The actual opportunity that the wetland has for attenuating floods is based on: the catchment area slope (0.36 %) (catchment area encompasses the HGM unit), the run-off potential of the soils (high), the increase in run-off due to human disturbance (slight), rainfall intensity (high) and the extent of floodable infrastructure downstream (low). By combining the scores it was found that the overall effectiveness of Bigodi wetland at attenuating floods was high (score of 3.9).

The second wetland ecoservice assessed was streamflow regulation. Bigodi wetland is fed by the Magombe River, it has a high soil organic matter content of 24.5 % (according to Mitsch and Gosselink (2007), organic matter in wetland soils varies between 5 and 75 %) with moderately abundant peat, no frost to affect vegetation and thus evapotranspiration, and an underlying geology of quartzite. The wetland was allocated a score of 2.6 and so has a moderately high likelihood of contributing to streamflow regulation.

The effectiveness of the wetland at trapping sediment was analysed next. Water flow slows as it enters a wetland allowing suspended sediments to settle out of the water column (Turpie *et al.*, 2010). If the sediment concentration is high the water will be turbid. The high effectiveness of the wetland at flood attenuation, and the evidence of moderately high sediment deposition in the HGM unit, infers that the wetland is highly effective at trapping sediment. When looking at sediment trapping opportunity it was found that the catchment area contains no dams and that approximately 50 % of it is occupied by forested areas of

KNP. The remaining areas of the catchment consist predominantly of subsistence agriculture interspersed with scrub and forest patches and so can be classified as having an intermediate effect on the deliverance of sediment to the wetland due to surface runoff. When the effectiveness and opportunity scores were combined an overall score of 2.6 was reached. This means that the wetland has a moderately high likelihood of providing sediment retention services.

Wetlands are known to have a high and long-term capacity to improve water quality by reducing nutrient concentrations in through-flowing water (Verhoeven *et al*., 2006). They reduce the concentration of nitrates and phosphates in the water through sediment trapping (the compounds attach strongly to suspended matter) and plant uptake (Turpie *et al.*, 2010). The removal of nitrates, phosphates and toxicants from runoff water enhances the quality of water downstream. The Nakivubo wetland purifies water received from Kampala before it enters Inner Murchison Bay (Emerton, 1998). The waste in the water is largely organic as it is the raw sewage produced by 465 000 people (40 % of Kampala's population). The value of the water cleansing services provided by wetlands is largely unappreciated. For example, the purification services provided by the Nakivubo wetland are estimated at USh 3-5 million/ha/year (Emerton, 1998).

Due to the moderately high ability of the wetland to trap sediment, the characteristic of very diffuse flows, dense papyrus cover, and low use of fertilisers in the area, the wetland was found to be highly effective at removing phosphate. The opportunity to do so was scored as 1 (moderately low) as a result of intermediate sediment input, moderately low phosphate input, and the absence of important aquatic systems downstream. The overall score given was 2.6, with a moderately high likelihood that the wetland was providing phosphate removal services.

The effectiveness of the wetland at removing nitrates was rated as high because: the wetland is wet for most of the rainfall seasons allowing for anaerobic conditions and consequently denitrification, the low flow pattern is very diffuse, the vegetation cover is high, the contribution of sub-surface water input is moderately high (36-50 %), and lastly there is no fertiliser added directly to the wetland. With a low opportunity score of 0.5, due to only a moderately low input of nitrate and no important aquatic downstream system, the overall score was 2.2 (moderately high likelihood of ecoservice provision).

Bigodi wetland was found to be highly effective at removing toxicant water input flows. This was due to the same characteristics described above for nitrate removal. The opportunity that

the wetland has to remove toxicants was also low scoring 0.3, as a result of low toxicant input, moderately low sediment input, and no important aquatic systems downstream. This resulted in an overall score of 2.1 and a moderately high likelihood of ecoservice provision.

Erosion control within the wetland refers to prevention of the loss of soil from the HGM unit (Kotze *et al.*, 2007). The effectiveness of the wetland at controlling erosion is high (score of 4) as there was no evidence of soil erosion in the HGM unit, there is high vegetation cover due to dense papyrus stands, and a low level of current physical disturbance. The opportunity to prevent erosion was low as the slope of the wetland is slight, the run-off intensity from the catchment area is moderately low and there are no important downstream aquatic systems. On combining the scores an overall score of 2.3 was reached, indicating that the wetland has a moderately high likelihood of providing erosion control services.

Wetlands can transform nutrients such as gaseous compounds of carbon and nitrogen to different forms; as organic matter decomposition is slowed down in waterlogged conditions (Jordan *et al.*, 2003; Kotze *et al.*, 2007). Papyrus swamps have the potential to sequester large amounts of carbon (1.6 kg C/m^2/yr) (Hartter, 2007). Bigodi wetland is a permanent papyrus wetland that contains moderately abundant peat, and the onsite soil disturbance was low. This resulted in a score of 3.6 indicating that the wetland's contribution to carbon storage services was high.

Wetlands provide specialised habitats for a variety of unique flora and fauna (Mitsch and Gosselink, 2007). Although Bigodi wetland is not an uncommon type of wetland it provides habitat for charismatic, rare and endangered primate species. It accommodates nine different primate species: black and white colobus, red tail, l'hoest, baboon, red colobus, blue monkey, vervet monkey, grey cheeked mangabey, and occasionally chimpanzees (Amooti, 2007). The wetland is also popular for its diversity of bird species (>200 species) (Amooti, 2007). There is a buffer zone surrounding the wetland (although it varies in size). The wetland also plays an important role as a migratory corridor for the animals of KNP. Based on this information Bigodi wetland was given a score of 3 which indicates that there is a high likelihood that it contributes to maintaining biodiversity.

Water is commonly extracted from wetlands in Uganda for direct human use (Ministry of Water, Lands and Environment, Wetland Sector Strategic Plan, 2001). Bigodi wetland is a permanent wetland that receives high rainfall and so is a reliable source of water. The local people are largely dependent on the wetland and associated streams for the provision of their

domestic water needs as well as for the watering of their livestock. The wetland was given a score of 3, demonstrating that it is highly likely that it is providing water as an ecoservice.

Wetlands provide local communities with a variety of harvestable resources e.g. sedges for crafts, reeds and wood for construction, medicinal plants, grazing for livestock, fish, game meat, and edible plants and fruits (Kotze *et al.*, 2007). A wide variety of natural resources are collected from Bigodi wetland. The wetland is located in a rural communal area, the level of poverty in the area is high, there are a large number of households that live in the area, and due to the remoteness and poverty levels there are no alternatives to the natural resources. These characteristics resulted in a high score of 4 indicating that it is highly likely that the wetland is providing natural resources as an ecological service.

The KAFRED executive committee prohibits the cultivation of Bigodi wetland. There were however, some minor wetland tributaries that contained crops (maize in particular). The land surrounding the wetland was dominated by agriculture. So it can be said that the people are highly dependent on agriculture for food security yet the rules inhibit the use of the wetland. Due to the increasing population pressure it is crucial that the rules remain the same.

Wetlands provide culturally significant plants such as for medicine, crafts and food; they are also often considered to be places of cultural significance such as for baptisms and cleansing ceremonies to take place (Kotze *et al.*, 2007). Although cultural practices are now rare in the area due to religious reasons, there was still evidence of local taboos and beliefs in relation to the wetland. Medicinal herbs are collected from the wetland mainly to treat stomach problems. Anyone is free to collect medicinal herbs from the wetland. The wetland was thus given a score of 1.8 which indicates that it is intermediately important in the provision of cultural services. More and more people are becoming dependent on western medicine as the herbs are overexploited and disappear. Christianity also encourages the use of hospitals rather than the collection of herbs (Kibwage *et al.*, 2008).

Bigodi wetland is currently a tourist attraction due to its rich biodiversity and the scenic beauty of the forested area. There are nine different primate species, over 200 bird species, as well as butterflies and dragonflies, which are all great tourist attractions. The wetland sanctuary is in close proximity to KNP which means that it is on a tourist route. KAFRED also provides a cultural experience with the guided village walk and traditional meals and accommodation in the area. The wetland does provide tourism and recreation services.

As wetlands contain elements of both terrestrial and aquatic ecosystems they are important for education and research purposes (Kotze *et al.*, 2007). Bigodi wetland is used for both as the local schools visit the wetland to learn about the importance of conservation and the natural environment and a number of university students have carried out their research in the area.

Table 4.8: Summary of WET-Ecoservices Assessment of Bigodi Wetland.

Wetland Service	**Score**	**Likely extent to which the benefit is being supplied by the wetland**
Flood attenuation	3.9	High
Streamflow regulation	2.2	Moderately high
Sediment trapping	2.6	Moderately high
Phosphate removal	2.5	Moderately high
Nitrate removal	2.2	Moderately high
Toxicant removal	2.1	Moderately high
Erosion control	2.3	Moderately high
Carbon storage	3.6	High
Biodiversity maintenance	3.0	High
Provision of water for human use	3.0	High
Provision of natural resources	4.0	High
Provision of cultivated foods	3.2	High*
Cultural heritage	1.8	Intermediate
Tourism and recreation	3.0	High
Education and research	3.0	High

***** The wetland has the potential to contribute significantly to food security but KAFRED has prohibited cultivation in the HGM unit (the effectiveness score is high but the opportunity is low).

4.6 Recommendations

Wetlands can be described as the 'kidneys of a landscape' because they function as the downstream receivers of water and waste from both natural and human resources. They cleanse polluted water and stabilise water supplies thus mediating flood and drought damage (Mitsch and Gosselink, 2007). Bigodi wetland, like so many wetlands in rural Africa, provides a number of vital goods and services to the local community and in doing so aids in poverty alleviation. Unfortunately wetlands are fragile and transient ecosystems which are vulnerable to degradation through human and natural processes (Dixon and Wood, 2003). By degrading the wetland not only are ecological issues created but also the opportunities and livelihoods of the local people are affected.

According to the WET-Health and WET-EcoServices results Bigodi Wetland is only negligibly impacted by human activity despite the high dependence of the community on the wetland resources and services. This is largely due to the naturally resilient characteristics (high rainfall and a slight slope) of the wetland type as well as the rules enforced by KAFRED and government. Unfortunately, with Uganda's high population growth rate and the high percentage of the remote district's population living below the poverty line (15 to 30 %) the pressure on Bigodi wetland is likely to increase with time (Kamwenge District State of Environment Report, 2004). This increase in population size has already accelerated wetland resource decline in most parts of Uganda (Kibwage *et al.*, 2008). Bigodi has experienced rapid population growth and subsequently has a high population density, estimated in 2006 to be 335 people/km^2 (Hartter, 2007). It is therefore critically important that KAFRED maintains its wetland utilisation regulations particularly with regards to agriculture and drainage, eucalyptus and pine tree cultivation, and natural resource harvesting. The local Councillor's tax roll and voter registry indicated that the community consisted of more men than women which was believed to be as a result of an influx of young men looking for employment in tourism (Lepp, 2004). Therefore, a potential means of population growth mitigation would be for KAFRED to hire and train people solely from the local area.

Management of the buffer zone and the development of a monitoring programme are two areas that KAFRED could improve upon. Although Bigodi wetland has a buffer area the size of it is not clearly stipulated and is unknown to the community. If the buffer is too small it may not adequately protect the aquatic resource. On the contrary, if it is too large it may unnecessarily deny landowners the use of part of their land (Castelle *et al*., 1994). Buffers are

crucial as they improve the quality of water entering the wetland through physical and chemical filtration thereby reducing the impacts of adjacent land uses and stabilising wetland edges (Castelle *et al*., 1994; Semlitsch and Bodie, 2003). These buffer margins are also important to mammals, birds, amphibians, and reptiles for habitat in which to nest and breed (Semlitsch and Bodie, 2003).

Baseline data should be collected as it describes the natural variation in components, processes and services at each site within a given timeframe against which change can be assessed (Ramsar Handbook, 2007). Involving local members of the community in natural resource monitoring ensures that issues are identified more rapidly (Ramsar Handbook, 2007). The monitoring results need to feed back into management practices to ensure that the health and provisioning services of the wetland are maintained. Some examples of wetland attributes that should be monitored include the water quality and water levels, percentage cover of vegetation and its composition (paying particular attention to alien invasive and ruderal species) and the population dynamics of key animal species.

It is crucial to view the wetland as including the entire catchment area (Kairu, 2001). According to the WET-EcoServices assessment (Table 4.8) Bigodi wetland provides a large number of ecological services to the community which should be recognised and appreciated. In order to maintain these services KAFRED needs to manage Bigodi wetland as a whole and not just focus on the area encompassed by the tourist trail as any activity in the HGM unit or catchment area can have impacts downstream. An education programme on the hydrological dynamics and interconnectedness of wetland service provisioning should be made mandatory for KAFRED committee members.

Rural communities in Uganda view wetlands as a source of direct benefits but often fail to appreciate the ecological functions and other life supporting non-tangible benefits (Baker, 2008). The contribution of wetlands in filtering pollutants is crucial to public health as 41 % of rural households in Uganda lack adequate sanitation facilities (World Resources Institute and Wetlands Management Department, Ministry of Water and Environment, Uganda, 2009). Unclean water can result in water-related diseases causing illnesses and sometimes death. Diarrhoeal diseases are particularly dangerous to infants and young children and are responsible for the deaths of 17 % of children under the age of five in Uganda (World Resources Institute and Wetlands Management Department, Ministry of Water and Environment, Uganda, 2009). When households do not have adequate sanitation facilities

they rely on the ecosystem to clean their water. The efficiency of the wetland at cleansing drinking water depends on the size of the pollutant load, the hydrological flows, the type of wetland and the health of the wetland (World Resources Institute and Wetlands Management Department, Ministry of Water and Environment, Uganda, 2009).

With the common use of pit latrines and the ever-increasing human population, it is likely that the Bigodi wetland water is, or will become, polluted with *E. coli* bacteria. The domestic waste is likely to seep into the wetland carried in surface water or as seepage from the pit latrines. This would render the wetland as a human health hazard particularly as a source of drinking water. The large surface area to volume ratio of wetlands means that once the capacity to absorb high nutrient loads has passed, the smaller volume and so higher concentration, results in rapid deterioration (Howard-Williams and Ganf, 1981). This reinforces the requirement for monitoring, in this case, of water quality.

Another major concern is that of the tarring of Kamwenge Road, as the construction of major roads or highways through a wetland affects the hydrologic regime, sediment loading and results in direct wetland removal (Mitsch and Gosselink, 2007). The road is likely to be widened and so will need more culverts of a larger size to allow through flow. The culverts must remain decongested. Roads impact wetlands through: concentrating and accelerating sediment runoff (due to construction), the disruption of fish and wildlife movement, water level increases or decreases (inadequate culverts, water table disturbance, increased runoff), increasing sediment loading, and a reduction in surface roughness (Zeedyk, 1996). Any development in the wetland catchment area should undergo an Environmental Impact Assessment (Ramsar Handbook, 2007).

4.7 Conclusion

The Millennium Ecosystem Assessment (MA) (2005) defines the wise use of wetlands as "the maintenance of ecosystem benefits and services to ensure the long-term preservation of biodiversity as well as human-wellbeing and poverty alleviation". The use of Bigodi wetland is currently sustainable; however, the same practices may not be sustainable with an increase in human population. Species richness and diversity decrease with wetland loss which affects the ability of the wetland to provide important ecological services such as erosion and flood control (Hartter, 2007). Such a situation would exacerbate poverty in the area particularly affecting the most vulnerable e.g. the elderly, children and women.

Eco-tourism is tourism which is based on the natural environment and incorporates a desire to minimise negative social and environmental impacts whilst embracing economic, environmental, social, community and visitor benefits (Baker, 2008). In Kenya and Namibia community-based tourism development changed the livelihoods of the communities through the provision of employment and thus allowed poor households to meet their needs (Baker, 2008). By involving the local community in the wetland sanctuary and consequently distributing benefits, pressure is taken off the wetland and surrounding land as the only means of livelihood and contributes to poverty alleviation.

It can therefore be said that the combination of community-based management with eco-tourism needs to persist to ensure the conservation of Bigodi wetland and the long-term survival of the community. Particularly as the present set of environmental laws are not successfully achieving protection of the wetlands in Uganda (Nalukenge *et al.*, 2009).

Chapter Five

General Discussion and Conclusions

5.1 Bigodi Wetland Sanctuary the Bigger Picture

Blueprint approaches rarely work when managing natural resources under conditions of uncertainty and change; case-by-case management is required (Fortmann, 2001; Gunderson and Holling, 2002). This stresses the importance of detailed case studies in analysing natural resource management efforts to make site specific recommendations. To produce a balanced and full assessment of a CBNRM initiative it is important to analyse all the inputs, processes and outputs from a combination of social, ecological and economic stances. The CBNRM systems model produced in chapter one (adapted from both Fabricius *et al.* (2004) and Ostrom (2009)) was used to form an understanding of the SES encompassing BWS (Fig. 5.1). Once this was achieved it was then feasible to make more detailed enquiries into the different system components. The system's components, although highly integrated, for the purpose of analysis, were separated into management strategies (governance and management actions and strategies), local livelihood strategies (users and interactions with resource system/units), the costs and benefits of BWS to the community (social outcomes), and the impacts of human activity on the health and ecosystem service delivery of Bigodi wetland (ecological outcomes).

CBNRM initiatives are generally viewed as strategies to address both environmental and socio-economic goals (Armitage, 2005, Shackleton *et al*., 2010). Therefore, for a CBNRM initiative to be truly successful it should achieve positive outcomes in both the social and ecological dimensions. In an editorial review by Shackleton *et al.* (2010) this was found to be rare in a number of sub-Saharan African CBNRM case studies (Shackleton *et al.*, 2010). However, BWS could be the exception as it displays both social and ecological positive outcomes (Fig. 5.1) as well as demonstrates true community control in the absence of any substantial external support mechanisms and funding. BWS may therefore be a rare, true example of CBNRM that displays the desired win-win balance of social development with conservation.

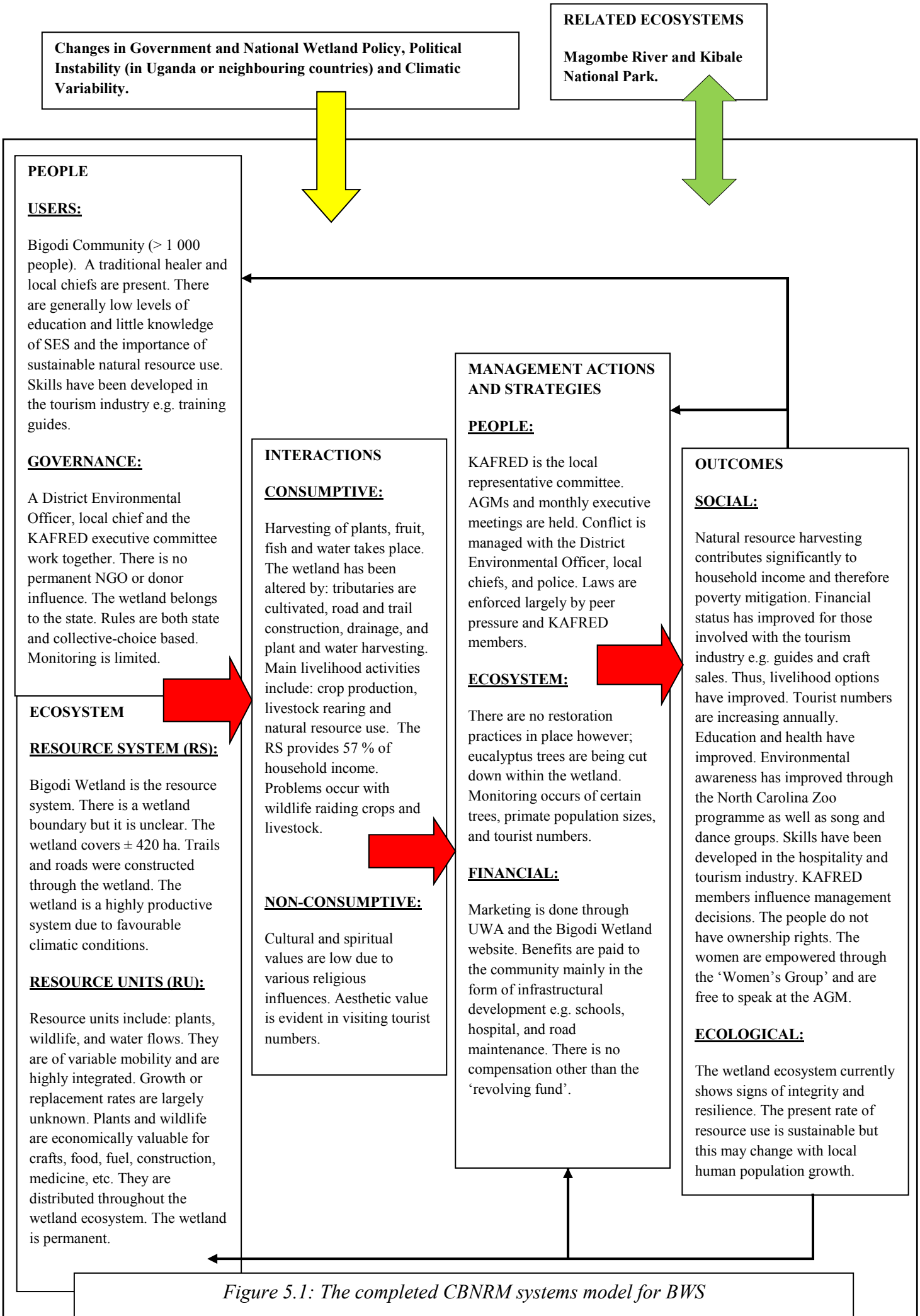

Figure 5.1: The completed CBNRM systems model for BWS (adapted from Fabricius et al. *(2004) and Ostrom (2009)).*

5.2 The Governance and Management Strategies of Bigodi Wetland

The long-term success of CBNRM initiatives is rare, with a high incidence of degeneration with time (Shackleton *et al.*, 2010). BWS has been running for eighteen years. This success can partially be attributed to government support; local community participation; the ability of the management committee to work independently of external organisations; and a lack of dependence on external funding. However, as with the case of most projects, there are certain areas that could be improved upon.

The Ugandan government realised the importance of the country's wetlands and so developed a national wetland policy (UNWP) (1995). This policy provided support for the planning and implementation of management actions proposed by KAFRED. Government has also trained extension staff at the district level (e.g. the District Environmental Officer) that are involved in rule enforcement (UNWP, 1995). However, a potential hindrance with regards to the UNWP is that wetlands are recognised as a public resource to be managed by government on behalf of the people. This means that Bigodi wetland is in fact common property. A general requirement for CBNRM is that land tenure should be devolved to the lowest level as it encourages sustainable resource use, management responsibilities and accountabilities, as well as a sense of pride (Lyon, 2000; Campbell, 2006). Public resources are susceptible to overexploitation as individual resource users reap the benefits of the communal land whilst bearing only a small portion of the cost of overuse, but with appropriate and strong local governance this need not be the case (Ostrom, 2009). The communities managing the resources need to have the legal rights, local institutions and economic incentives to take substantial responsibility for sustainable use of the resources (USAID, 2006). The local people are less likely to destroy the natural resource base if they have governance rights and experience the benefits of sustainable use (Campbell, 2006).

A good example of the importance of devolving land tenure rights was illustrated clearly in the case of the Duru-Haitemba Forest in Tanzania (Wily, 2001). The hilly miombo woodland became a National Forest Reserve in 1991. Villagers living adjacent to the forest began to exploit its resources as they felt that their communal tenure had been ignored and that they should extract as much of the resources as possible before the forest was made inaccessible to them (Wily, 2001). This resulted in the encroachment of farming activities, the natural springs dried up and dry fuelwood became very difficult to find. The communities argued with concerned foresters that should the forest be returned to them they would manage it more

effectively than government. In 1994 to 1995 the surrounding villages formed Forest Management Committees, appointed volunteer forest guards and developed access and harvesting rules. Government was impressed by the local management efforts and withdrew for a trial period. It was soon obvious that the forest was regenerating under local management and at no cost to the government (Wily, 2001). Thus, to enable CBNRM programmes, government needs to respect local-level control (Ostrom, 1990; Fabricius, 2004).

Communities are not homogenous, they consist of people of different ages, health status, income brackets, gender and ethnic origin and so have different interests in natural resource use (Rozemeijer, 2009). CBNRM initiatives are founded on the basis of equity within the community (Cassidy, 2001). KAFRED charges a non-refundable annual membership fee of USD 22, or USD 11 for households living adjacent to the wetland. The full membership fee is 2 % of the average total annual value of livelihoods in Bigodi (or 5 % of the average annual value of livestock and crop production). For female headed households, this fee is 3 % of the average total annual value of livelihoods in Bigodi (or 11 % of the average annual value of livestock and crop production). The poorer households, such as those headed by women (Cassidy, 2001), may therefore be unable to justify spending their limited cash resources on the membership. These are the most vulnerable members of society and so are likely to be the most affected by natural resource restrictions and need to be taken into account when making management decisions. KAFRED must ensure that it does not contribute to the marginalisation of the poor.

In this light, it is also essential that KAFRED encourages the women to speak freely at their AGMs. For cultural reasons in many areas African women tend to be prohibited from voicing their opinions on community matters (Ouba, 2006). Such women are thus denied the right to participate in management decisions regarding the natural resources of which they are the primary users (Ouba, 2006). As the women are directly involved with the natural resources they are aware of any arising issues and so could play a pivotal role in monitoring the resource base. For example, if the women are forced to walk further and further to collect fuelwood, it should be made public knowledge so that harvesting restrictions are introduced to allow for regeneration and sustainable use.

The BWS natural resource harvesting rules were developed by the local people in collaboration with national wetland and conservation authorities in 1996. This procedure is

aligned with Fabricius's (2004) seven principles to successful CBNRM: "laws and policies should be implemented with the authority devolved to the lowest capable level". Although these rules have been stipulated, it was found in both the executive committee and household questionnaires that there was much confusion surrounding them. It would therefore be beneficial for KAFRED to reiterate the rules and make them available to the public through local media.

The executive committee members contradicted each other when questioned about the harvesting restrictions which indicated a lack of cohesiveness. This was also evident in the fact that some of the committee members answered only certain sections of the questionnaire presumably according to their fields of expertise. Each committee member appeared to focus solely on the role of their respective positions. It is important that the executive committee members have a more holistic understanding of the management procedures. In this way, they can avoid confusion and conflict with the community; as well as support each other through knowledge sharing and collaborative learning about the SES, which will ultimately aid in problem solving and decision making (Gruber, 2010).

Long-term data are crucial in demonstrating response to stimuli variation, in providing baselines to be able to evaluate change and to be able to detect and understand change in ecosystem structure and function as a result of management intervention. The information should be trustworthy and at an appropriate scale for local-level management (Cundill and Fabricius, 2010). Monitoring of the wetland should have ideally been started with the establishment of BWS, as long-term data are required to determine patterns and trends linked to changes in management. KAFRED should be assessing the effects of activities in and around the wetland on its health and ecoservice delivery; the effect of the wetland restrictions and management on the local people's livelihoods; the success or failure of anti-crop and livestock raiding techniques and the management protocols of the KAFRED committee itself. Feedback generated through monitoring and evaluation enables the process of learning from experience. Another requirement for successful CBNRM according to Fabricius (2004) is that the resource base must be maintained or preferably improved. This can only be determined by monitoring throughout the initiative.

A lack of monitoring practices in CBNRM initiatives is common. Kremen *et al.* (1994) assessed 36 projects from around the world with 23 cases from Africa. It was found that more than half of the projects had no ecological monitoring at all whilst only two had a

comprehensive ecological modelling component. Without monitoring, the impacts of development activities such as resource exploitation cannot be evaluated (Newmark and Hough, 2000). If there is no feedback from ecological monitoring the future course of the project will be unguided.

5.3 Local Livelihood Strategies

Natural resource harvesting is the least obvious and most overlooked economic activity in rural areas (Turner, 2004). The economic evaluation of natural resource use is therefore an important tool in measuring the benefits obtained from the natural environment and the subsequent cost if such systems were degraded through overexploitation (Gawler, 1998). The use of natural resources was not regarded as a primary source of livelihood in Bigodi, but rather was viewed as supplementary to livestock and crop production. Yet, it was found to contribute more to the total annual value of the Bigodi people's livelihoods than livestock rearing and crop production combined. This finding needs to be communicated with central government as well as the local people to enable them to understand the costs they will endure should they lose their natural resource base through overuse. Conservation is better accepted when landholders realise the economic value of natural resources (including wildlife) (Ashley, 1998). The remote location of Bigodi and the high incidence of poverty restrict the potential for agricultural intensification and thus increased food production. In this light, there needs to be more awareness on the likely negative effects of population growth resulting from the associated increase in competition for land and natural resources.

The harvesting of wood for construction material and fuelwood is already of concern in Bigodi. In the area external to KNP (encompassing Bigodi) many tree species preferred for building were found to be no longer available due to overexploitation and so people have been forced to buy from woodlots or grow their own trees (Kakudidi, 2007). Although harvesting of live wood from the wetland is prohibited by KAFRED, as the required trees become scarcer people may be forced to break the rules due to a lack of affordable alternatives. KAFRED needs to create awareness about the potential wood shortage and the importance of sustainable harvesting. The local households should be encouraged to make use of the Kibale Community Fuelwood Project and grow their own trees.

It was difficult to ascertain whether the harvesting of medicinal plants and wild foods was sustainable or not as there was a distinct lack of monitoring and no quantity limits on

harvesting. Without baseline data, trends in population dynamics cannot be identified and it is likely that any unsustainable harvesting practices would be recognised too late, potentially resulting in the local extinction of certain species.

The agriculture and livestock livelihood options are threatened by BWS as a result of crop and livestock raiding by the protected animals. Although the amount of damage varies in the areas surrounding KNP and BWS, the farmers must constantly create coping strategies to deal with crop and livestock raiding (Hartter, 2007). Under the Uganda Wildlife Statute (1996), compensation to individual farmers for loss due to crop or livestock raiding is not permitted (Hartter, 2007). The high incidences of raiding by wild animals may be evidence of conservation success but it can sway the attitudes of the local people to be more negative (Jones and Weaver, 2009). Although the average value of loss is relatively low (approximately 10.5 % of the average total household value for crop production and livestock) it is likely to have a large impact on the poorest households. It is therefore crucial that the damage caused by crop and livestock raiding be mitigated by KAFRED where possible.

5.4 Costs and Benefits of Bigodi Wetland Sanctuary to the Community

The benefits gained through CBNRM are primarily meant to compensate the costs of natural resource management to the local people (Rozemeijer, 2009). For a CBNRM project to be accepted and consequently successful the benefits must be significantly greater than the opportunity costs that may arise (Turner, 2004).

5.4.1 Benefits

Perhaps the most obvious benefit to the community associated with BWS is the conservation of natural resources through enforcing harvesting restrictions. This benefit is particularly important as natural resource use was found to account for 57 % of the total annual value of local livelihoods, more than the combined value of livestock rearing (13 %) and crop production (30 %). The restrictions should result in an improvement in ecosystem productivity allowing for an increase in harvesting quality and quantity (Arntzen *et al.*, 2007). A healthy ecosystem will also provide the people with valuable services e.g. water purification. It is important that the local people realise the difficulties that they could face

should their natural resource base, on which they are so dependent, be degraded (Shackleton *et al*., 2007).

The creation of employment and alternative livelihood options is one of the most important strategies to alleviate poverty and to enhance social security as it limits the impact of droughts and crop failure (van der Jagt *et al.*, 2000; Arntzen *et al.*, 2007). Such employment opportunities are particularly valuable to the more vulnerable members of the community such as the elderly, youth, women, ethnic minorities and general low-income groups. BWS provides the opportunity for employment in the tourism industry that can offer an income to supplement that provided by agriculture and livestock rearing. It is important to have a diverse array of livelihood options as a safety-net against unpredictable and influential external events such as changes in government or policy, political instability and climatic variability.

The sacrifices made through harvesting restrictions in CBNRM initiatives can be offset by the revenue derived from tourism (Shackleton and Campbell, 2000). These funds may be allocated directly to households or accumulated for community projects. The people of Bigodi are rewarded for conservation with infrastructural development as well as the potential income they can make off the visiting tourists by selling crafts, peanut butter and providing food and accommodation. Most (75-80 %) of the funds generated by BWS are used for village infrastructure development and projects such as education, health, roads and sanitation. Infrastructural developments to date include: the construction of bridges, boardwalks, roads, schools and permanent brick buildings with iron sheet roofing (KAFRED executive committee, pers. comm., 2010). A meeting was held prior to the development of the school to determine what infrastructure was most needed. The annual finance report ensures that the use of funds is transparent and available to the KAFRED members.

Local organisational development and capacity building in business skills and marketing are other benefits that can be generated through CBNRM initiatives. Through exposure to commercial partners these skills can offer long-term benefits that are traditionally weak in rural communities (van der Jagt *et al.*, 2000; Campbell, 2006; Arntzen *et al.*, 2007). BWS provides a tourist market targeted by the Women's Group and the Bigodi Peanut Butter Project which have increased local organisational and capacity development.

The success of BWS has empowered the local people involved in KAFRED. They have a pride generated through personal achievement and a new optimism for the future. This is particularly important for the women who are empowered through the 'Women's Group'

which provides them with a personal cash income as well as their inclusion in KAFRED membership and therefore the opportunity to be involved in management decisions.

5.4.2 Costs

According to KAFRED (2010) the costs experienced by the people of Bigodi as a result of the sanctuary are: being subjected to crop and livestock raiding, access to natural resources being restricted and initially some land was lost by a few subsistence farmers on the wetland boundary to form the wetland buffer.

The cost of CBNRM to communities living in high rainfall areas such as Bigodi can be significant with regards to alternative land use options. It must be realised however, that although BWS reduces the land available for agriculture it conserves natural resources that the local people are dependent upon. It was determined in Chapter 3 that the value of natural resource use to the people's livelihoods was higher than that of agricultural produce. If the wetland was permitted for cultivation with time the crop yields would drop as the soil becomes infertile. The community would then be left with poor agricultural production, no natural resource safety-net and increased difficulty in supplying daily needs such as water, fuelwood, food and craft materials. If BWS had not been established the local people would still legally only have limited use of the wetland as restrictions are embedded in Uganda's environmental law (Nalukenge *et al.*, 2009). Although the environmental law in Uganda restricts wetland use, these restrictions are not implemented at the ground level, which with the increasing human population pressure, is resulting in a 'tragedy of the commons' situation in some areas (Nalukenge *et al.*, 2009).

On a similar note, a potential problem faced by KAFRED and the Bigodi community is a dependence on tourism as this is essentially the driving force behind the conservation of Bigodi wetland and income generation. In a study by Lepp (2008) it was determined that although tourism has achieved infrastructural development, improved education and increased income in Bigodi it has not fostered self-reliance. The people of Bigodi demonstrate an external locus of control in their conceptualisation of tourism believing that the locally improving economic conditions are a direct result of the good will of outsiders (Lepp, 2008). It is crucial that the local people do not become solely dependent on the wetland sanctuary for their income as tourist revenue is unpredictable as it is affected by exchange rate fluctuations and political instability (Newmark and Hough, 2000). Uganda and Zimbabwe are good

examples of the vulnerability of this industry to political unrest and economic recessions (Newmark and Hough, 2000).

Most of the households (60 %) interviewed were satisfied with the managerial performance of KAFRED's executive committee. A total of only nine per cent of respondents were unsatisfied or very unsatisfied. The unsatisfied households tended to be those that were highly affected by crop or livestock raiding and/or were non-members who did not receive any direct benefits from the KAFRED committee. KAFRED needs to ensure that the unsatisfied households remain in the minority otherwise the community could become divided into KAFRED members and non-members resulting in conflict. If the people feel that they are not receiving a fair share of the benefits they may withdraw from the management process, refuse responsibility for the consequences of non-involvement and even sabotage resource use management efforts (Johnson, 2004). Equity is key, people who contribute more to the initiative need to be rewarded and those whose livelihoods are hindered should be compensated (Cundill and Fabricius, 2010).

5.5 Impacts of Human Activities on Wetland Health and Ecosystem Services

It was ascertained from the WET-Health and WET-EcoServices results that Bigodi Wetland is only mildly impacted by human activity despite the high dependence of the community on the wetland resources and services. This is largely due to the naturally resilient characteristics (high rainfall and a slight slope) of the wetland type as well as the rules enforced by KAFRED and government. Unfortunately, with Uganda's high population growth rate and the high percentage of the district's population living below the poverty line (15 to 30 %) the pressure on Bigodi wetland is likely to increase with time (Kamwenge District State of Environment Report, 2004). This increase in population size has already accelerated wetland resource decline in most parts of Uganda (Kibwage *et al.*, 2008). It is therefore critically important that KAFRED maintains its wetland utilisation regulations particularly with regards to agriculture and drainage, eucalyptus and pine tree cultivation, and natural resource harvesting. Also, to restrict in-migration population growth KAFRED should make it a priority to hire and train people solely from the local area.

As mentioned previously, baseline data should be collected to describe the natural variation in components, processes and services at each site within a given timeframe against which change can be assessed (Ramsar Handbook, 2007). Involving local members of the

community in natural resource monitoring, particularly the women who are the most involved in harvesting, ensures that issues are identified more rapidly (Ramsar Handbook, 2007). The monitoring results need to feed back into management practices to ensure that the health and provisioning services of the wetland are maintained.

According to the WET-EcoServices assessment Bigodi wetland provides a large number of ecological services to the community which need to be recognised and appreciated. In order to maintain these services KAFRED should manage Bigodi wetland as a whole and not just focus on the area encompassed by the tourist trail as any activity in the HGM unit or catchment area can have impacts downstream. An education programme on the hydrological dynamics of wetland service provisioning should be made mandatory for KAFRED committee members.

A requirement of successful CBNRM as stated by Fabricius (2004) is that the condition of the resource base must be maintained or preferably improved. All of the committee members said that they believed that the condition of the wetland had improved since the establishment of BWS. Of the households interviewed the majority (93 %) said that the wetland was in good or very good condition. Such comments are, however, subjective without supporting biological data. Although KAFRED have recently initialised primate censuses and tree observation assessments it needs to start monitoring the natural resources that are affected by human activity such as: percentage vegetation cover and composition, alien invasive plant distribution, water quality, and key animal species identification and censuses.

5.6 Conclusions

Many CBNRM initiatives are biased towards either conservation or community development (Shackleton *et al*., 2010). It is uncommon to find a project that achieves in both these dimensions, yet BWS has such potential (Shackleton *et al*., 2010). The majority of responses from KAFRED and the community indicated that the condition of the wetland has improved since the establishment of the sanctuary. This however, could not be stated with confidence because there are no supporting data due to a lack of monitoring. The local people were also predominantly happy with the performance of KAFRED as BWS has contributed to local livelihood security. A secured livelihood is one where the people have improved income and assets, food and nutrition, education, participation, water and sanitation, health, and are able to absorb shocks and stresses (Kibwage *et al.*, 2008)

A lack of monitoring recurs as an issue throughout this study despite one of the aims of KAFRED being to monitor the impacts of tourism on the local community and the environment. Collaborative monitoring with local data interpretation (Category 4, Danielsen *et al.*, 2009) is the ideal scenario in the case of BWS where there is currently an absence of monitoring expertise or knowledge. By working together with the likes of Makerere University Biological Field Station or a professional organisation, with training, this should be achievable.

The success of CBNRM initiatives depends on the local people recognising the value of the natural resource base they are dependent upon (Newmark and Hough, 2000). The people of Bigodi value the wetland for its appeal to tourists and the associated income generation potential. However, they need to internalise the value of the natural resources and ecoservices that the wetland provides to them directly. By adhering to the harvesting restrictions they need to realise that they are securing a better future for themselves and future generations to come with regards to natural resource harvesting; as well as improving the condition of the wetland habitat for the birds and primate species that attract the tourists. Such a perspective will encourage long-term sustainable use. The combination of community-based management with eco-tourism needs to persist to ensure the conservation of Bigodi wetland and the long-term survival of the community. Particularly as the present set of environmental laws are not successfully achieving protection of the wetlands in Uganda (Nalukenge *et al.*, 2009).

For a CBNRM project to be accepted and consequently successful the benefits must be significantly greater than the costs that may arise (Turner, 2004). The costs and benefits of BWS to the local community are summarised in Table 5.1. An indication that the benefits of BWS are outweighing the costs is evident in the fact that (i) only nine per cent of the households interviewed claimed to be dissatisfied and (ii) 57 % of the value of local livelihoods comes from the wetland. The KAFRED executive committee is aware that there are negative sentiments, “there are people that are happy and those that are unhappy, unfortunately you cannot please everybody all of the time” (Amooti pers. comm., 2010). BWS was also assessed according to Fabricius’s ‘7 Principles for Successful CBNRM’ (mentioned in Chapter 1). The only principle not evident was the lack of ownership rights over wetland use as a result of the UNWP.

Table 5.1: Summary of the costs and benefits of BWS.

Costs	Benefits
Potential marginalisation of the poorer households.	Significant contributions to local livelihoods.
Harvesting restrictions.	A sustainable supply of key natural resources.
Crop and livestock raiding.	Women empowerment.
A dependency on tourism.	Improved wetland condition.
Community division based on KAFRED members and non-members.	Livelihood diversification through new employment opportunities.
Land lost to the wetland buffer zone.	Infrastructural development.
Opportunity cost of preferred alternative land use.	Local capacity and skills development.
	Generation of pride in the community.
	Community empowerment: BWS has put Bigodi on the map!
	Craft materials for local use and income generation.

The complexity, uncertainty, lack of control, inability to predict behaviour, inability to predetermine outcomes, and inadequate knowledge about the most appropriate ways of promoting economic and social development, in reality, make all development projects and programmes experiments (Rondilinni in Marschke and Nong, 2003). BWS displays both outcomes of success and failure typical to such CBNRM 'experiments'. Yet the fact that the sanctuary has persisted since 1992 with relatively little external support, and no external finances, implies that the successes outweigh the failures.

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Appendices

Appendix 1

KAFRED Managing Committee Questionnaire

CBNRM- Bigodi Wetland Sanctuary (BWS), Uganda 2010

KAFRED- Managing Committee Interview

QN:

Questionnaire No. ⟶

Date of Interview: Time: …… Date: ……

Section A: Governance System

1. Background

a) When was KAFRED established? .....

b) Why was KAFRED established?

.....

c) What are KAFRED's goals with regards to BWS?

.....

d) To what extent are these goals being reached on a scale of 1 to 5? (1 = not,2-few, 3-partial, 4-most,all and 5 = fully)

Goals	Score

2. Support

a) Are there any long-term investors? Yes/ No If yes, who? .....

b) Are there any other external organisations involved?

Government	NGO	Research	Other

c) What roles does the/se external organisation/s play in the management of BWS?

.....

d) To what extent do they influence BWS management decisions?

Very high	High	Moderate	Slight	None

e) Are there any leadership figures present in the community (chiefs or traditional healers) that are involved in the initiative?

Leadership figure	Involvement	Duration

3. Procedures

a) What is the tenure or ownership arrangement of the land on which BWS occurs?.....

.....

b) How were/are the committee members elected?

.....

c) How often do the committee members meet face-to-face?

Daily	Monthly	Weekly	Annually

d) How often does the committee meet with the Bigodi community face-to-face?

Daily	Monthly	Weekly	Annually

e) How is the community made aware of meetings? .....

f) What is the term of office for a committee member? .....

g) How frequently are elections or processes held to appoint committee members? .....

4. Participation

a) Are committee meetings open to the public? Yes/ No

b) Approximately what percentage of the local adults attends these meetings? .....

c) Are the people willing to engage and exchange knowledge? Yes/No

d) At these meetings what ratio of the congregation are men: women? ...../.....

e) Do you believe that all voices are heard i.e. do the women speak freely in the presence of the men? Yes/No If no, what can be/ is done about this? .....

f) Are the local people involved in all decision making? Yes/ No

g) What mechanisms are available or strategies adopted to promote local participation?

.....

h) Does trust exist between the managing committee and most, or all, community members? Yes/ No

i) Who sets the agenda for meetings? .....

j) Can any member of the community place an issue on the agenda? Yes/ No If yes, what process would they have to follow?

.....

.....

k) Are finances publically communicated? Yes/No

l) What strategies are employed to communicate the aims, goals and progress of the group other than committee meetings?

.....

5. Rules and regulations

a) Are the boundaries of the sanctuary clearly defined? Yes/ No If no, how do the local people know where the boundary is? .....

b) Do you have a map? Yes/No

c) Are there any restrictions on the harvesting? If yes, what are they and for what products?

.....

.....

d) Are there any restrictions on livestock? E.g. number, grazing access Yes/No If yes, what are they?

.....

.....

e) Are there any restrictions with regards to cultivation? E.g. proximity to wetland, irrigation Yes/No If yes, what are they?

.....

.....

f) Are these restrictions state or collective choice based? .....

g) Are the legislations readily available to the local people? Yes/No

h) Is there a written constitution that defines rights and powers? Yes/ No If yes, is it publically available? Yes/No

6. Enforcement

a) Who enforces the restrictions? .....

b) How are they enforced?

.....

c) Are these restrictions adhered to? Rate on a scale of 1 (not at all) to 5 (fully) .....

d) Are there punishments for those who ignore them? If yes, what are they?

.....

e) Do the restrictions take season into account? If yes, how?

.....

f) How do you deal with conflict?

.....

g) Approximately how many infringements of the restrictions were experienced last week, or last month, or last year? .....

7. Finances

a) Who is responsible for marketing BWS and to whom? .....

b) Who manages and distributes the finances gained by BWS? .....

c) On average, what is BWS's annual income in a good year? ..... In a bad year?.....

d) What is the source of these funds?

Source	Approx %

e) How many visitors did you have last year? .....

f) Do you have yearly records? Yes/ No

g) How are the funds generated by the BWS distributed?

Percentage of income	Recipient

h) What is the funding distribution based on?

.....

i) Is there compensation for any damage by wildlife? Yes/ No

<u>Section B: Natural Resources</u>

1. System Health

a) How healthy do you believe the wetland is?

Very good	Good	Average	Poor	Very poor

b) Has the wetland health changed since the establishment of BWS?

Improved	Unchanged	Declined

Explain: .....

c) Have any species disappeared from the wetland in the past? If yes, which species and why?

Species name	Reason for loss

d) Has there been an increase in vegetation since the sanctuary was established? Yes/No

e) Has there been an increase in the number of wild animals since the sanctuary was established? Yes/No

f) If yes, do you have data to support this in the form of maps or species censuses?

.....

g) Are there any alien invasive plant species in the wetland sanctuary? Yes/No If yes, name them:

.....

h) What percentage of the wetland sanctuary has been invaded by this/these plant species?

Species name	% cover	Species name	% cover

2. Harvesting

a) Are natural resources harvested from the wetland sanctuary area? If yes, what is harvested and what for? (cultural/spiritual, construction, fuelwood, traditional medicine, crafts, food)

Species name	Use	Species name	Use

b) Is water extracted from the wetland? Yes/ No If yes, what for and how much?

Use	Amount (litres)
Irrigation	
Livestock	
Household	

Section C: Monitoring

1. What and how?

a) Do you have access to relevant and recent research information and knowledge about natural resource monitoring? Yes/ No

b) Is the BWS project monitored? Yes/ No

c) If yes, what are the goals of the monitoring programme in place?

.....

d) When did you start monitoring?.....

e) What is monitored? .....

f) Why were these indicators chosen to monitor?

.....

g) How difficult are they to monitor?

Very difficult	Difficult	Neutral	Easy	Very easy

h) How often are measurements taken? Why? .....

i) How accurate are the measurements taken, on a scale of 1-5 (1=inaccurate and 5=accurate)?

j) How effective do you believe the monitoring programme is?

Very effective	Effective	Neutral	Ineffective	Very ineffective

k) What problems are experienced in association with monitoring the wetland sanctuary?

.....

l) Is the management plan adapted according to the outcomes of the monitoring i.e. are there feedback loops? If yes, give an example where this has occurred:

.....

2. Who?

a) Who monitors the data? .....

b) Who records the data? .....

c) Who processes the data? .....

d) Are these people trained? If yes, by whom? .....

e) What are the incentives for these people to monitor, record and process the indicators accurately and efficiently?

.....

f) Are these people supervised? Yes/ No

g) Are the monitoring results made available to the local community? Yes/No

Section D: Users

1. Incentives

a) What are the reasons for the local people to accept the wetland sanctuary over another type of land use? Explain:

.....

b) Do those who contribute more to BWS receive greater rewards? Yes/ No

c) How willing are the people to change their ways?

Very willing	Quite willing	Neutral	Resistant	Very resistant

2. Human wellbeing

a) Has there been an improvement in the standard of living since the establishment of the wetland sanctuary? Yes/No

b) If yes, what areas have improved?

Education	Skills	Health	Income

If no, why not? .....

c) Has there been an improvement in local infrastructure (e.g. roads and buildings) since the establishment of BWS? Yes/No If yes, explain: .....

d) Rate the extent to which the needs of the local people are affected by the sanctuary restrictions, on a scale of 1-5 (1-not affected at all to 5-highly affected):

Need	Score 1-5	Need	Score 1-5
Clean water		Fuelwood	
Food		Construction materials	
Natural medicines		Cultural and spiritual	
Craft materials		Aesthetical and recreational	

e) Does the sanctuary have any negative impacts on the local community? If yes, what are they?

.....

f) What are the sentiments of the people towards the wetland sanctuary in general?

Very happy	Happy	Neutral	Unhappy	Very unhappy

Appendix 2

A KAFRED Tree Monitoring Worksheet

Name of Tree/Plant:	Georeference Points:
No. of Tree/Plant:	Physical Location:

Date	Age	Size (DBH)	Height (m)	Condition	Leaves	Flowers	Fruits	Bark	Sightings/Activity	Remarks

Appendix 3

Bigodi Household Questionnaire

CBNRM- Bigodi Wetland Sanctuary (BWS), Uganda 2010

Household Interviews

QN:

Questionnaire No. ⟶

Date of Interview: Time: …… Date: ……

Coordinates of Household dwellings:

Latitude (horizontal)			Longitude (vertical)	

Section A: Natural Resource Use

a) Do you harvest materials from the wetland? If yes, what type, how much, how often, for what duration of the year and how long does it take to harvest? (i.e. medicine, food, construction, fuelwood, crafts, cultural or spiritual purposes)

Food (e.g. fish, insects, mammals, plants- berries, seeds, leaves)				
Resource type	Quantity	Frequency (days/week)	Months collected	Duration (mins/hrs)
Medicine				
Resource type	Quantity	Frequency (days/week)	Months collected	Duration (mins/hrs)
Construction (e.g. poles, thatching, mud, sand)				
Resource type	Quantity	Frequency (days/week)	Months collected	Duration (mins/hrs)

Crafts (e.g. mats, baskets, sculptures, tools)				
Resource type	Quantity	Frequency (days/week)	Months collected	Duration (mins/hrs)
Cultural and/or spiritual				
Resource type	Quantity	Frequency (days/week)	Months collected	Duration (mins/hrs)
Fuelwood (dead, alive, both or neither)				
	Quantity	Frequency (days/week)	Months collected	Duration (mins/hrs)
Water				
Use	Quantity (litres)	Frequency (times daily)	Months collected	Duration (mins/hrs)
Drink				
Bath/shower				
Laundry				
Cleaning-household, dishes etc				
Irrigation				

b) Do you sell any of the wetland materials that you harvest? If yes, what do you sell, does it require skill to make e.g. crafts products, how long does it take you to make, and how much do you sell it for?

Resource Name	Skill required	Product	Time taken/Effort	Price	Buyer

c) Do you barter with the natural resource products? Yes/ No

d) How far are you prepared to walk to collect the natural resources?

Natural Resource	<1km	<5km	<10km	>10km

e) How has the establishment of BWS affected your natural resource use?

Negatively	Neutral	Positively

Explain:.....

Natural Resource Use- Rules and Regulations

a) Are there rules that restrict your harvesting? Yes/No

b) If yes, what are

they?.....

c) Are the rules enforced? Yes/No/Some

d) If yes, who enforces them and how? .....

e) Do most people abide by the rules? Yes/No/Some

Explain why: .....

f) What are the punishments if you do not abide by the rules?

.....

g) Do you think that any of the rules need revising? Yes/No

h) If yes, which rules and why?

.....

Section B: Agriculture and livestock

1. Agriculture

a) Do you grow your own food? Yes/No If yes, what do you grow, where do you grow it and in what season?

Distance of land from wetland (km)	Area or land (m^2 or Ha)	Percentage cultivated this year	Crops/vegetables/fruit grown	Season/months cultivated

b) What do you do with the produce?

Sell it	Self use	Sell and self use

c) If you sell it: how much do you sell, how often do you sell, who to and for what price?

Crop/fruit/vegetable	Quantity	Frequency	Price	Buyer

d) How do you irrigate your crops/vegetables/fruit trees?

Plant food type	Drains/canals	Bucket	Drip	Overhead	Rainfed
Crops					
Fruit trees					
Vegetables					

e) Where does the water come from? .....

f) How many litres do you use daily? .....

g) Do you use fertilizer (man-made or manure)? Yes/No If yes, what type? .....

2. Livestock

a) Do you keep livestock and or poultry? Yes/No If yes, what animals, what do you use them for and how many do you have?

Animal	Number	Use

b) Do you sell the animals, the meat or the milk? Yes/ No If yes, what do you sell, how often do you sell it, how much, for what price and to whom?

Animal/Product	Quantity	Frequency	Price	Buyer

c) How do you water your livestock?

Bucket	Pipe in trough	Other

d) Where does the water come from and on average how many litres do you use daily?

.....

e) What do you feed your livestock? .....

3. Pests and crop raiding

a) How does BWS affect your crops/vegetables/fruit trees and your livestock? (pests)

	Positively	Neutrally	Negatively
Livestock			
Crops/vegetables/fruit trees			

Explain .....

b) Do you have problems with animals raiding your crops and livestock? Yes/ No If yes, what animals raid, what do they raid, how often do they raid and where do they come from?

Animal pest	Crop/ livestock targeted	Frequency	Origin of animal

c) Are there any measures in place to prevent crop/livestock raiding? Yes/No If yes, what is done?

.....

d) What does the damage cost?

Animal	Number lost/month	Price

Crop/Vegetable/Fruit tree	Percentage loss	Price

e) When were your fields or gardens last damaged? .....

f) Do you receive compensation for damage caused by wild animals? Yes/No. If yes, who pays?

.....

Cultivation and Livestock- Rules and Regulations

a) Are there rules that restrict cultivation? Yes/No

b) Are there rules that restrict animal husbandry? Yes/No

If yes, what are they?

.....

c) Are the rules enforced? Yes/No/Some

If yes, who enforces them and how? .....

d) Do most people abide by the rules? Yes/No/Some

Explain: .....

e) What are the punishments if you do not abide by the rules?

.....

f) Do you think that any of the rules need revising? Yes/No

g) If yes, which rules and why?

.....

Section C: Management of BWS

1. Participation

a) How satisfied are you with the performance of the managing committee?

Very satisfied	Satisfied	Neutral	Unsatisfied	Very unsatisfied

Explain: .....

b) Do you attend meetings? Yes/No If yes, how often?

Daily	Monthly	Weekly	Annually

If no, why not? .....

c) If yes, do you believe that your views are heard? Yes/No

d) Would you like to meet more frequently? Yes/No

e) Are you involved in BWS decision making e.g. rules Yes/ No

2. Finances

a) Do you receive any income from the BWS? Yes/No

b) If yes, are you satisfied with it? Yes/No

c) Do you know how the managing committee distributes the BWS profits i.e. is the process transparent? Yes/No

d) If yes, how did you find out about the distribution?

Committee member	Newsletter	AGM	Friend	Other

3. Monitoring

a) Are you involved in monitoring the wetland? Yes/No

If yes, what do you do? .....

b) Do you have access to the monitoring results?

Section D: Wetland health perceptions

a) How healthy do you believe the wetland is?

Very good	Good	Average	Poor	Very poor

b) Have any species disappeared from the wetland in the past? If yes, which species and why?

Species name	Reason for loss

c) Do you think that the vegetation cover has increased since the sanctuary was established? Yes/No

d) Do you think that there are more animals since the sanctuary was established? Yes/No

e) Is BW of cultural or spiritual value to you? Yes/No If yes, explain:

……

f) How do the sanctuary restrictions affect these beliefs and practices?

……

Section E: Sentiments

a) In general, how has BWS affected your life?

Positively	Neutral	Negatively

Explain:

……

b) Which areas (if any) of your life have been affected positively by BWS?

Education	Skills	Health	Income
Cultural	Aesthetical	Psychological wellbeing	Other

c) If the BWS was not established what would you like to use the wetland for?

Planting crops	Livestock	Irrigation	Other

Section F: Demographics

a) Household position relative to head. ……

b) Gender: Male/Female c) Age: …… (estimate if cannot be specific)

d) Marriage status:

Single	Married	Divorced	Widowed

e) What was the last grade that you completed at school? …… (yrs of education)……

f) Are you employed? Yes/No If yes, what do you do? ……

g) How many people currently live in this household excluding family members who are absent (i.e. living and working elsewhere).

Categories of Persons resident in the Household	Number
Total number of persons resident in Household	
1. Number of able bodied adults (aged 16-60 and fit to work)	
2. Number of disabled adults (aged 16-60)	
3. Number of elderly persons (above 60 yrs)	
4. Number of young children (0-10)	
5. Number of pre-teens and teenagers (11-15)	
SUM of 1-5 above	
Does it add up the total number of family members?	

h) Details of persons absent from household

	Reason for Absence	Age	Where living/working?
1			
2			
3			
4			

i) How many of the household members are employed? .....

j) Indicate in the table below which income sources provide what % of household income, how often they receive such income and the periods during the year in which they generally tend to receive them.

(Frequency of receipt of income = daily, weekly, monthly, annually, seasonally, irregularly and occasionally. Period = specify period of the year i.e. once a week, month, year, or bimonthly, six monthly, seasonally, occasionally, rarely.)

Source of Income	% of total income	Frequency of receipt	Period during year
Full time local employment on BWS Project			
Full time local employment from other sources			
Part-time local employment			
Occasional local employment (i.e. agriculture but not BWS project)			
Sale of food crops			
Sale of cash crops			
Sale of crafts			

Sale of natural resources (wood, thatch, medicines, foods, etc)			
Trader or retailer (buying and selling goods)			
Artisan (own business)			
Remittances from absent family workers			
State grants			
Other?			
TOTAL	100		

Appendix 4

Natural resources harvested by the households for food (n=63).

** plant name in local language*

Natural Resource	Frequency Harvested (% of households)
Solanum spp.	68
Afromomum spp.	56
Mudfish	43
Guava	41
Amaranthus spp.	37
Passion fruit	13
Tinospera spp.	11
Cape gooseberry	10
Mushrooms	10
Yams	8
Rubus spp.	6
Carrisa edulis	3
Hibiscus spp.	3
Solanum spp.	3
*Amotoda**	2
Aphelandra bataceae	2
*Ebisoda**	2
*Ekagwe**	2
*Emiriri**	2
*Enyonza**	2
*Eshaga**	2
Pawpaw	2
Wild rovis	2

Appendix 5

Natural resources harvested by the households for their medicinal properties (n=62).

** plant name in local language ** plant name given by guide*

Plant name	Frequency harvested (% of households)
Vernonia amygdalina	71
Warburgia ugandensis	23
Urtica massaica	19
*Engomera**	15
Spathodea campanulata	15
Tinospera spp.	15
Aloe spp.	11
*Ekisece**	8
Plectranthus spp.	6
Prunus africana	6
Vernonia spp.	6
*Ekagwe**	5
*Omushura**	5
Albizia coriaria	3
Eucalyptus spp.	3
Mangifera indica	3
*Melano discus***	3
*Orange hariopsis***	3

Appendix 6

Natural resources harvested by the households for construction (n=64).

Natural Resource	Frequency Harvested (% of households)
Cyperus papyrus stems	27
Cyperus papyrus flowers	14
Cyperus dives	3
Elephant grass	11
Elephant grass poles	2
Eucalyptus spp. poles	2
Ficus polita	8
Liana (from forest)	6
Macaranga spp. poles	9
Marantochloa leucantha	34
Palm leaves	50
Palm poles	42
Tree poles	33
Reeds	38
Sand	36

Appendix 7

Results of multiple regression analyses performed in accordance with the factor analysis.

Associations		R^2-value	p-value
Land area	Natural resource use	0.05	0.06
Land area	Livestock	0.003	0.67
No. employed	Livestock	0.04	0.09
Crop production	Education level	0.04	0.99

Appendix 8

Significance of gender of household head on value of livelihood options.

	Livelihood Option	**Z-value**	**P-value**
Natural resource use	Fuelwood	-0.25	0.70
	Wetland water	-0.72	0.45
	Construction materials	-1.77	0.08
	Crafts	-0.46	0.64
	Livestock rearing	0.04	0.97
	Crop production	-2.42	0.02