

Community-based natural resource use and management of Bigodi Wetland Sanctuary, Uganda, for livelihood benefits

A. Gosling · Charlie M. Shackleton  · J. Gambiza

Received: 5 May 2016 / Accepted: 1 April 2017 / Published online: 6 April 2017
© Springer Science+Business Media Dordrecht 2017

Abstract Conservation and sustainable management of wetlands requires participation of local stakeholders, including communities. The Bigodi Wetland is unusual because it is situated in a common property landscape but the local community has been running a successful community-based natural resource management programme (CBNRM) for the wetland for over a decade. Whilst external visitors to the wetland provide ecotourism revenues we sought to quantify community benefits through the use of wetland goods such as firewood, plant fibres, and the like, and costs associated with wild animals damaging farming activities. We interviewed 68 households living close to the wetland and valued their cash and non-cash incomes from farming and collection of non-timber forest products (NTFPs) and water. The majority of households collected a wide variety of plant and fish resources and water from the wetland for household use and livestock. Overall, 53% of total household cash and non-cash income was from collected products, mostly the wetland, 28% from arable agriculture, 12% from livestock and 7% from employment and cash transfers. Female-headed households had lower incomes than male-headed ones, and with a greater reliance on NTFPs. Annual losses due to wildlife damage were estimated at 4.2%

of total gross income. Most respondents felt that the wetland was important for their livelihoods, with more than 80% identifying health, education, craft materials and firewood as key benefits. Ninety-five percent felt that the wetland was in a good condition and that most residents observed the agreed CBNRM rules regarding use of the wetland. This study confirms the success of the locally run CBNRM processes underlying the significant role that the wetland plays in local livelihoods.

Keywords Benefits · Costs · Gender · Income · Land-based · Local management · Non-timber forest products

Introduction

Being a mix of both aquatic and terrestrial components, wetlands are complex ecosystems with multiple ecological, social and economic values (Schuijt 2002; Brander et al. 2006). Since 1900 more than half of the world's wetlands have disappeared (Stuip et al. 2002), largely as a consequence of intensive drainage and cultivation because wetlands are particularly attractive due to their usually fertile soils and abundant water (Dixon 2002). The degradation of wetlands results in a loss of productive land, habitat, resources and ecosystem functions. It is often the poorest, land-dependent

A. Gosling · C. M. Shackleton (✉) · J. Gambiza
Department of Environmental Science, Rhodes
University, Grahamstown 6140, South Africa
e-mail: c.shackleton@ru.ac.za

communities that are the most directly dependent on wetland resources and functions (Silvius et al. 2000; Maclean et al. 2011), and thus are frequently the most affected by their degradation (Maclean et al. 2011). Despite their obvious values, wetlands in Africa continue to be modified by human activities largely as a result of many decision-makers being uninformed of the various ecosystem goods and services that wetlands provide to the local people and broader society (Schuijt 2002; Adekola et al. 2012). Consequently, they encourage wetland development and cultivation as a productive activity that they believe can better benefit local communities and economies.

The economic valuation of wetland ecosystems is an important tool in illustrating the benefits obtained from a wetland and the subsequent loss if such systems were degraded through overexploitation or transformation (Gawler 2002; Brander et al. 2006). Yet the global meta-analysis of Brander et al. (2006) revealed that only a handful of wetlands in Africa had one or more valuation studies. Such a lack of empirical studies, especially on small wetlands, indicates insufficient knowledge to inform authorities of the value of sustainable use of wetlands, which, from the review of Maclean et al. (2011), was always higher than transformation to subsistence agriculture. The future of African wetlands thus lies in a stronger awareness building and consequent political will to protect them based on sound policies and encouragement for community participation in their management (Ramsar 2011).

Uganda is well endowed with wetlands as they cover approximately 15% of its surface area (World Resources Institute and Ministry of Water, Lands and Environment 2009). The wetlands contribute significantly to the national economy and rural livelihoods (Kakuru et al. 2013) and are particularly important in local food security (Turyahabwe et al. 2013). The value of wetland use to local households was estimated over a decade ago at USD 11.4 billion/annum (Moyini et al. 2002). Yet, despite their considerable value, wetlands are under increasing threat from population growth, agricultural expansion and economic and development activities (Maclean et al. 2011). Consequently, the national government has taken various steps to help conserve wetlands (Hartter and Ryan 2010) such that it has 11 sites designated as Wetlands of International Importance and has a Wetlands Division within the Ministry of Environmental Resources. However, the

majority of Uganda's wetlands lie outside of protected areas, on customary lands with local councils as the responsible management agency (World Resources Institute and Ministry of Water, Lands and Environment 2009; Hartter and Ryan 2010), where they are subjected to a variety of anthropogenic pressures.

At the local level the need for sustainable resource use in common property areas elsewhere on the continent has frequently resulted in some sort of community mobilisation and involvement as a means of balancing livelihood needs and resource conservation, i.e., a community-based natural resources management (CBNRM) arrangement. CBNRM seeks to promote better resource management outcomes with the full participation or control of communities and resource users in decision-making activities, and the incorporation of local institutions, customary practices, and knowledge systems in management, regulatory, and enforcement processes (Armitage et al. 2007). Yet, despite their title, many CBNRM programmes are designed or imposed by external agencies who retain much of the decision-making power, making their claims to being community-based rather frail (Shackleton et al. 2010; De Beer 2013).

The benefits gained through CBNRM are primarily meant to compensate the local people for the costs of natural resource management and perhaps some restrictions on harvesting of some local resources (Rozemeijer 2009; Suich 2014). For a CBNRM project to be accepted by local communities and consequently be successful, the benefits must significantly outweigh the opportunity costs that may arise (Magome and Fabricius 2004; Turner 2004). However, in most cases the direct financial benefits from formal CBNRM in Africa are negligible (Arntzen et al. 2007; Child 2009), with limited improvements in household wealth other than for the few who get direct employment (Suich 2014; Pailler et al. 2015; Riehl et al. 2015). For example, in the much vaunted CAMPFIRE programme in Zimbabwe, the cash from selling or consuming a single 'illegally' hunted impala was double the average annual payment to households from the programme (Magome and Fabricius 2004). Some employment opportunities might result from CBNRM programmes, but often they are quite limited. However, even limited employment and tourist income can be meaningful in small and remote communities where employment opportunities are relatively scarce (Arntzen et al. 2007).

The benefits do not have to be financial; it is common for revenue generated to be put towards community projects and infrastructure (e.g., schools, clinics, sanitation) or local organisational development and capacity building in business skills and marketing rather than to individual households (van der Jagt et al. 2000; Campbell 2006; Arntzen et al. 2007). These initiatives thereby complement government spending and poverty alleviation projects (Arntzen et al. 2007). Additionally, cultural identity and social cohesion is often strengthened via CBNRM processes (van der Jagt et al. 2000).

The benefits of CBNRM are rarely without costs, which are frequently overlooked in much CBNRM literature (Arntzen et al. 2007). There are a number of potential costs. The first is the unavailability for other purposes of the land that is reserved for conservation or ecotourism. The second is restricted off-take of a range of wild resources such as firewood, plant fibres, bushmeat, medicines and the like. Third is that 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). For example, in the Okavango Delta (Botswana) the San villagers at Xaxaba no longer grow crops due to the unrelenting damage caused by elephants (Magome and Fabricius 2004), whilst in Torra, Namibia, lions killed livestock owned by the neighbouring local farmers (Nott and Jacobsohn 2004). 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., also all take time (Suich 2013). Taken together these costs can outweigh the financial or infrastructure benefits from CBNRM projects (Arntzen et al. 2007; Suich 2013). Thus, the livelihoods of participating households and other households in the geographic community may become more vulnerable due to CBNRM initiatives.

The Bigodi Wetland Sanctuary (BWS) does not fit the typical CBNRM model in two respects. Firstly, it is purported to have been strongly community-based in design and management right from the outset rather than externally imposed (Lepp 2007). However, there

has been limited examination of the BWS as a model for CBNRM. Secondly, there is limited knowledge and experience with CBNRM in wetland systems (Williams 2002; Lamsal et al. 2015) which pose a different suite of conditions and operational needs than wholly terrestrial sites due to their dynamic nature and links to catchment processes up and downstream. This dilutes some of the core characteristics required for CBNRM, where definition and recognition of boundaries are key (Fabricius 2004). The Bigodi community's setting aside the wetland to be conserved for local benefit whilst generating income as a tourist attraction is unusual. The main body of the wetland is approximately 8 km long by 0.30 km wide, covering an area of 240 ha (Hartter 2007). It is managed by a community-based organisation called the Kibale Association for Environmental Development (KAFRED) which was founded in 1992. Although the idea for the wetland sanctuary was first mooted by an external facilitator, the formalisation of the BWS was by KAFRED which is a registered community-based organisation (Lepp 2007). 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". Tourism initiatives include guided walks through the BWS, home-stays with local households and visits to the houses of crafters, healers, elders and the like (Lepp 2007; Gosling 2011). The presence of tourists also promotes the sale of crafts, beadwork, paintings, and foodstuffs. As of 2008 there were approximately 3500 tourist visitors annually to the BWS (and growing), over 80% of which took a guided walk through BWS (Gosling 2011).

With our focus on the role of BWS in local livelihoods the sustainable livelihoods framework (SLF; Ellis 2000; Farrington et al. 2004) was useful in guiding conception of the study and the attributes recorded. The SLF was designed to explicitly promote understanding of the assets available to households and the manner in which they are combined in often complex and dynamic ways to provide diverse livelihood strategies and outcomes (Scoones 2009). However, since BWS operates as a CBNRM initiative, the links between the SLF and the principles of CBNRM (Fabricius 2004) were useful, as previously examined by Turner (2004). Thus, we were particularly interested in the natural capital, provisioning services

provided by the BWS relative to other livelihood strategies, and the governance system that promoted or hindered the access to and use of such natural capital, which together determine the vulnerability status of households at specific times.

Given this context, the objectives of this study were to ascertain the level of community involvement in and respect for the BWS processes and the benefits it contributes to local livelihoods. We considered three key questions, namely (1) What are the costs and benefits of BWS to neighbouring households? (2) What is the proportional contribution of BWS to local household income? (3) What are the general attitudes of the community towards the wetland sanctuary, management processes and harvesting restrictions?

Study area

Bigodi Village is located in the Kamwenge district of western Uganda (00°24.364' N, 030°24.527' E), 39 km south from Fort Portal on the Kamwenge Road. It is situated in the forested highlands of the Albertine Rift valley. The rift valley has fertile soils and a high mean annual rainfall (1719 mm), which together promote high biodiversity and support dense human populations (Lepp 2004). Bigodi borders the southeast edge of Kibale National Park (KNP). The area surrounding KNP, encompassing Bigodi, is a patchwork of agricultural lands (Hartter 2007).

The village comprises between 230 and 250 households (Lepp 2004), with an estimated population density in 2006 of 335 individuals/km² (Hartter 2007). There are more men than women, presumed to be a result of an influx of young men looking for tourism-related employment in the region, especially at KNP. Between 15 and 30% of the population of the district lives below the poverty line (Kamwenge District State of Environment Report 2004). Lepp (2004) reported that 60% of the people had an education level lower than primary school grade seven, which is typical in Uganda where 43% of adult females and 22% of adult males are illiterate (Ngaka 2007).

The principal economic activity in Bigodi was described by Hartter (2007) as subsistence agriculture, largely for home consumption, but with any surplus sold in local markets. A wide variety of crops are grown, such as sorghum, maize, millet, cassava, bananas, groundnuts, sunflower, sweet potato, Irish

potato, beans, tea, coffee, tobacco, cotton, tomatoes, cabbage, onions, and pineapples (Lepp 2004). Livestock husbandry is common, based on cattle, goats, chickens, sheep and pigs.

The Bigodi Wetland is a permanent, unchannelled, valley bottom wetland with papyrus being the dominant vegetation, fringed with riparian trees. The wetland stretches through the Bigodi community and meets the KNP boundary at both ends (Lepp 2004). The local people use the wetland for water, wild foods, medicines, fuelwood, and construction and craft materials but such activities are regulated as a part of the CBNRM programme. 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 a school, a library, a clinic, roads, pathways, sanitation and training courses. The remaining 20–25% of the income is used to pay the committee members', secretary's and guides' salaries as well as the running costs of the project (Amooti pers. comm., 2010). KAFRED have also catalysed the formation of a women's group and small income generating projects. KAFRED started a revolving fund in 2005 to be used by families that border the wetland that experience damage from wild animals.

Methodology

A local-language, structured, household survey was conducted with 68 randomly selected households (from aerial photographs of the site) living within 700 m of the wetland. This represents a 43% sample intensity of the estimated 160 households that border the wetland (Amooti pers. comm., 2010). The head of household was interviewed, but in many instances other adult members of the household also contributed (e.g., the head's spouse). The time period covered by the interview was the preceding 12 months, noting seasonal differences. No indication was provided that there was anything climatically or economically atypical during the previous 12 months. Core elements of the interview covered (1) the nature, amount, frequency of collection and value of the natural resources harvested from the sanctuary and by whom; (2) the nature, yields and value of crops produced by the household in the last 12 months; (3) the nature and value of livestock benefits received in the last

12 months; (4) the costs endured as a result of the prohibition of utilisation of certain natural resources; (5) the effect the BWS has had on cultural or spiritual beliefs, spaces and practices; (6) the cost of damage by wildlife protected in the BWS to farming activities and incomes; (7) potential alternative land use options; (8) involvement of the community in management practices, monitoring and decision making and (9) the general perceptions and attitudes of the community towards the wetland sanctuary. Local ('farm gate') prices for different wild resource, crop and livestock products were recorded as reported by households selling or buying them.

Data analysis

The mean gross value per household of each livelihood activity for the preceding 12 months 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 = US\$ 2250. Gross direct-use values were calculated based on the product of the quantity of the natural resource or crop used and the local price. Labour time was not accounted for. Basic descriptive statistics were used to summarise the data using Microsoft Office Excel. More detailed statistical analyses were carried out in STATISTICA 10 (StatSoft, Inc., 2011) after testing for normality using Kolmogorov–Smirnov and Lilliefors tests, which indicated non-normal distributions ($p < 0.05$) and hence non-parametric tests were used; specifically, Mann–Whitney U test to compare incomes between female- and male-headed households. The relative distribution across income sources was examined via means of a χ^2 test. For all tests, significance was taken at the 5% level. A principal component analysis (PCA) was performed to explore the associations between measured household attributes and the relative contribution of the various livelihood strategies to annual income. Associations suggested in the PCA were then tested via linear regression (for continuous variables) or Mann–Whitney U test (for discrete variables). The value for medicinal plant use had to be extrapolated from a South African study (Dovie et al. 2002) as the nature of harvesting by the Bigodi households was largely on an 'as needed' basis and so recall-based quantities were impossible to quantify and information on

Ugandan rural medicinal plant use values was non-existent.

Results

Among the 68 households, 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 interviewees was 49 years (± 19.5), and most had limited formal education (3 ± 3.2 years). Moreover, education levels differed between male and female household heads ($Z = 6.3$; $p < 0.01$), with the average for males being 5.3 ± 3.1 years of schooling, and for the latter 3.1 ± 3.4 years. Only 6% of the respondents were formally employed. There were, on average, 7 ± 3.3 people per household of which five were children, with three under the age of 15 years (± 2.7). The average number of people per household of working age (16–65) was 3 ± 2.8 . The average distance of the households from the wetland was 371 ± 566 m.

Livelihood strategies and income sources

Local households made use of a wide range of species and resources collected largely from the BWS as part of their daily needs (Table 1). Some of the wild foods were weedy species also collected from their arable fields, and approximately half of the water was drawn from a borehole. Collection frequencies were variable among resources, from daily for firewood and water, to weekly for wild foods, and monthly for plant fibres and seasonally for construction materials. Medicinal plants were collected on demand for cultural and medicinal needs.

The distance or time travelled to collect wild resources depended on the location of the household and the need for a specific or a more general resource. Almost all (92%) of the households collected dead fuelwood only, whilst the remaining 8% said that they collected both dead and live wood opportunistically. The average time taken to collect fuelwood was an 1 h and 50 min (± 28). Similarly, all households collected water daily from the local borehole (50%), the wetland (44%), streams (3%), or a combination of these (3%). The average amount of water collected per household was $63.5 \text{ l} (\pm 23.8)$ /day. All plant fibres for crafts were

Table 1 The proportion of sampled households using selected natural resources collected largely from the BWS, and the number of species used

Natural resources	Proportion of households using	No. of species used
Firewood	100	Many
Plant fibres	94	5
Wild foods	94	23
Medicinal plants	92.5	18
Construction timber	95.5	10
Water	100	n/a
Sand	100	n/a

Sample size was 68 households

collected from the BWS. The most common crafts made were mats (88%), baskets (77%), carpets (41%) and winnowing trays (11%). Other items included pots, beads and mortar and pestle (from timber). Approximately half (51%) of the households sold some of the crafts that they made, within the village and to tourists visiting BWS.

The average area of land owned per household was 2.26 ha (± 1.96), of which approximately 72% (± 27.6) was cultivated. Female-headed households owned slightly more land (2.66 ha ± 1.83) than the male-headed households (2.15 ha ± 1.99). Every household grew at least one crop. The most widely grown crops were maize (94%), bananas (81%), beans (60%), sweet potatoes (53%), cassava (47%), Irish potatoes (32%) and groundnuts (31%). Other crops grown by 20% or fewer households included coffee, yams, sorghum, tobacco, pawpaw, millet, pumpkins, avocados, millet, cabbage, eggplant, pineapples and sugarcane. Most households (94%) sold some agricultural produce in local markets, other than coffee and tobacco which were marketed externally. The highest earning crops were coffee and tobacco. However, they were not cultivated by many households (21 and 10%, respectively) because of insufficient land and the greater need to grow food crops for household use which left insufficient land for cash crops.

The majority of households (91%) owned one or more types of livestock, the most common being chickens (87%), goats (76%), cattle (23%) and pigs (13%). Other types, held by less than 10% of households, included sheep, ducks and rabbits. Chickens were the most numerous with an average of 6 ± 3.8 per household, followed by goats (5 ± 4.2), cows (4 ± 2.4), sheep (4 ± 3.5) and pigs (3 ± 1.7). Of the households that owned livestock 32% did not sell any animals or animal products (milk, skins or eggs) and 68% did.

Relative contributions of different livelihood sources

The respondents described their primary livelihoods as agrarian and that was how they made a living and earned cash. The respondents believed that most of their cash and non-cash income was derived mainly from crop production and livestock (>75%), supplemented by cash from retail activities, remittances, government grants and craft sales. None considered the value of natural resources collected from BWS and surrounds as income. Yet, in summing all income sources, the contribution of natural resources (52.9%) was bigger than all other sources combined (Table 2). The contribution of wild plant resources (38%) dwarfed that of the other sectors even after excluding water from the natural resource component. Crop production was the second highest contributor, with livestock and cash sources contributing 12 and 7%, respectively.

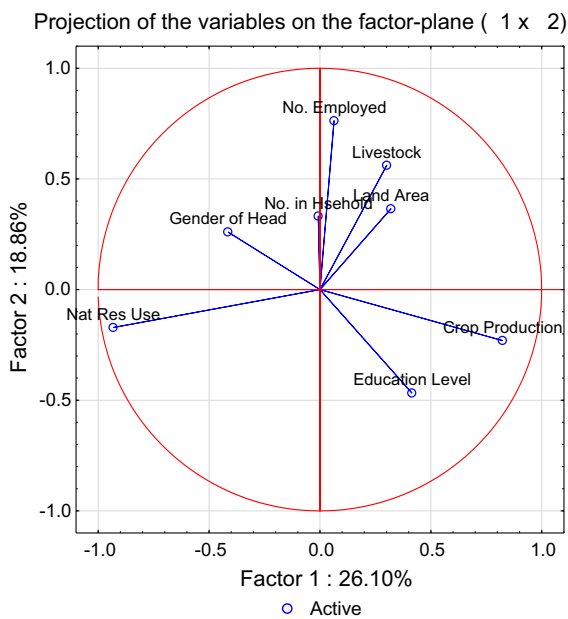
The PCA indicated that income from livestock husbandry was weakly ($r^2 = 0.32$; $p > 0.05$) associated with the area of land owned and the number of people employed in the household (Fig. 1). The income derived from crop production was inversely associated with the gender of the household head, with female-headed households having less (Table 3). There was a weak inverse association between natural resource use, livestock and land area. Thus, households with larger lands and herds made less use of wild natural resources ($r^2 = 0.15$; $p = 0.09$). The variance accounted by the PCA was 26% on the primary axis and 19% on the second axis.

Given the differences in education and income from crop production between genders, we examined the land-based income contributions in more detail. The proportional distribution of the average annual land-based income of female-headed households was

Table 2 Mean gross income per household from land-based livelihood options

Income sources	Mean annual income (USh)	Standard deviation	Percent of total income
Natural resource use			
Wetland water	346,161	125,954	14.7
Construction materials	40,726	15,744	1.7
Fuelwood	523,804	173,729	22.3
Crafts	116,700	129,931	5.0
Food (fish and spinach)	126,100	31,729	5.4
Medicinal plants (based on Dovie et al. 2002)	91,980	–	3.9
Total	1,245,471	–	52.9
Crop production			
Total	659,675	687,468	28.0
Livestock husbandry			
Total	287,906	702,761	12.2
Cash income			
Retail	52,436	162,321	2.2
Family remittances	44,945	39,457	1.9
Government grants	29,963	35,588	1.3
Other	33,709	62,194	1.4
Total	161,053	–	6.8
Total	2,354,105		100

1 USD = USh 2250 at the time of data collection

**Fig. 1** The relationships between livelihood strategies, household dynamics and land size

natural resources (71%), crop production (19%) and livestock rearing (10%, Table 3). This was significantly different ($\chi^2 = 10.4$; $p < 0.01$) to male-headed households who obtained 55% of their income from natural resource use, 31% from crop production, and 14% from livestock rearing. The households with male heads therefore used natural resources to a lesser extent than the female-headed households. The magnitude of absolute income differed significantly between genders for cropping, livestock and total income, but not for natural resources (Table 3).

The costs of crop and livestock raiding

Despite the benefits from the WBS, a large proportion of households (88%) stated that they were affected by raiding by wild animals from the wetland and national park. Fifty-nine per cent of the complainants said that they lost both livestock and crops to the wild animals, 10% said that they lost only livestock and 31% said that they only lost crops. Animals said to be pests included (frequency mentioned): monkeys (50),

Table 3 The effect of gender of household head on the mean annual values of household livelihood options

Income sources	Female-headed			Male-headed			Statistics
	Mean annual value (US\$)	Standard deviation	Percent of total value	Mean annual value (US\$)	Standard deviation	Percent of total value	
Natural resource use							
Wetland water	306,600	48,970	19.0	353,769	135,206	15.0	
Household construction	31,646	17,775	2.0	42,769	14,730	1.5	
Fuelwood	501,875	106,557	30.0	528,964	186,507	22.0	
Crafts	109,532	106,616	7.0	118,791	136,919	8.0	
Food (fish and spinach)	126,100	31,729	8.0	126,100	31,729	5.0	
Medicinal plants	91,980	–	5.0	91,980	–	3.5	
Total	1,167,733	–	71.0	1,262,373	–	55.0	Z = 1.49 p > 0.05
Livestock rearing							
Total	160,429	181,307	10.0	323,165	786,770	14.0	Z = 2.60 p < 0.05
Crop production							
Total	308,706	209,628	19.0	740,669	733,939	31.0	Z = 2.42 p < 0.05
Total	1,636,868	–	100	2,326,207	–	100	Z = 3.73 p < 0.001

1 USD = US\$ 2250 at the time of data collection

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 households an average of US\$ 98,780 ($\pm 114,140$, USD 44)/annum. This value represents 10.4% of the mean annual income derived from crop production and animal husbandry, or 4.2% of total gross income.

Perceptions on the value 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% were neutral. Of the positive attributes most respondents immediately identified the development projects resulting from tourism incomes, and thus the most frequently mentioned benefits were health (100%), education (93%) and skills development (78%). The natural resources were usually only listed second, albeit by a majority of respondents. Non-consumptive

benefits such as beauty and contributions to sense of wellbeing were also identified by approximately half of the respondents. Culture was the least mentioned at only 6% (Fig. 2). 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%), conservation (3%), beehives (2%) and hunting (2%).

Involvement in wetland management and observance of rules

Most of the households (60%) interviewed were satisfied with the performance of KAFRED in overseeing the BWS and the use of tourist income in community projects and skills training, 29% were neutral, 7% were unsatisfied, 2% were very unsatisfied, and the last 2% had not heard of KAFRED. The unsatisfied households tended to be those that were highly affected by crop or livestock raiding or did not receive any direct benefits from the KAFRED

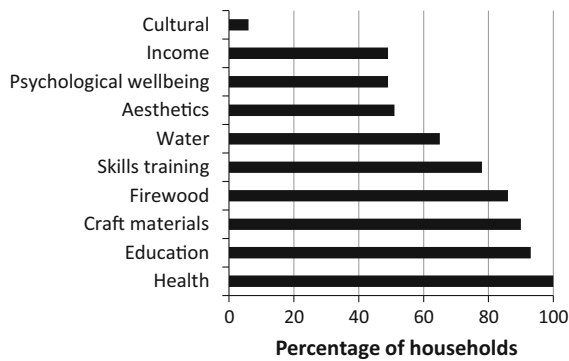


Fig. 2 Respondents free listing of the positive contributions to livelihoods of the Bigodi Wetland Sanctuary

Committee. However, only a minority (37%) usually attended the KAFRED Annual General Meeting, whilst the remainder attended rarely or never. Of the people that attended the AGM the considerable majority (91%) felt that their voices were heard and more than half (57%) felt that they were actively involved in decision making around BWS. However, most (96%) felt that once per year was not sufficient and they would like to meet more regularly. Fifty-seven per cent knew of how KAFRED distributed the profits, whilst 43% felt that they did not know.

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

The majority of the people interviewed (95%) said that they felt that the condition of the wetland was very good or good, whilst 5% said that it was bad. The majority of the households (73%) stated that they monitored the wetland by observing how others use it or any problems with the wetland. If they observed misdemeanours 59% said that they report offenders to KAFRED, 35% said that they warn offenders, 2% educate offenders, and 2% stated that they stop the offenders.

Half of the respondents felt that KAFRED's harvesting restrictions were important and beneficial, 44% felt neutral about them and 6% said that they negatively affected them. Most (94%) claimed that they knew of 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. 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 4).

Approximately half (52%) of the respondents believed that most people abide by the restrictions, 47% said that some of the people abide but not all and 2% 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 that KAFRED would warn you. Summary sentiments towards the restrictions were that 43% said that the rules should remain the same, 32% said that the rules should be made stricter for the benefit of the wetland and the remaining 25% said that the rules need to be made more lenient.

Discussion

Contributions of BWS to local livelihoods

This study indicated that most residents of Bigodi participate in a variety of activities to support their livelihoods. This echoes understandings from many other rural areas in sub-Saharan Africa, where livelihood diversification is common in response to the need to increase cash and non-cash income, spread risk and to decrease vulnerability (Little et al. 2001; Shackleton et al. 2001; Campbell et al. 2002). Whilst it is clear that the considerable majority of the income is derived from land-based activities, nearly all households engaged the full range of these, i.e., cropping, livestock husbandry and wild collection, both for household provisioning as well as the sale of surpluses on local markets. It is noteworthy however, when respondents were asked about their primary livelihood activities as well as the sources and magnitude of their cash and non-cash income, the contribution of wild collection was not mentioned other than the sale of craft products. Thus, they view themselves as a farming community which derives the bulk of their cash and non-cash income from farming. In sharp contrast, the results reveal that more than half of their

Table 4 Harvesting restrictions mentioned by the households

Restriction	No. of responses
Respect the boundary	19
No overharvesting	14
No burning in wetland	12
No cutting	10
No hunting	10
No cutting papyrus	4
Harvest young not old plants	3
No harvesting deep in wetland	3
No harvesting live wood	3
Do not do any of the following in the wetland: collect birds eggs, cut trees, burn charcoal, clear land, plant crops or trees, graze livestock, wash bicycles	One respondent each

Sample size was 68

income is derived from gathering of water and non-timber forests products (NTFPs) from the local environment, especially the wetland. In other words, the value of NTFPs is more than equivalent to the value of cropping and livestock combined, echoing the findings of Shackleton et al. (2001), Campbell et al. (2002) and Dovie et al. (2002) for drier sites in southern Africa. This emphasises the importance of the wetland to local livelihoods yet it is a “hidden harvest” (Scoones et al. 1992). It is also a key message for CBNRM projects that frequently focus on perceived high value resources sought after by foreign tourists or hunters (such as game viewing or hunting) and neglect the resources needed in everyday livelihoods of the local people (Shackleton and Shackleton 2004).

A contribution of more than 50% of total household income in the form of NTFPs is in the upper quintile, but not the highest, in the global comparative study of Angelsen et al. (2014). In this context, water extraction from the wetland is not included as an NTFP, which are generally regarded as solely renewable, biological products (Belcher 2003; Shackleton et al. 2011). We are not aware of comparative figures for similar, small wetlands (i.e., lacking a significant fishing industry) other than Lamsal et al. (2015) who reported that a wetland in western Nepal provided 13% of gross household income, and one in northeast South Africa where it was estimated the wetland provided approximately 15% of household income (Adekola et al. 2012), both therefore being

substantially less than our study. There are studies on the value of specific wetland resources, such as plant fibres, fish and the like (e.g., Abastha et al. 2007; Mmopelwa et al. 2009; Terer et al. 2012), but not a complete inventory relative to other income sources. For non-wetland sites in sub-Saharan Africa, the mean proportional contribution to annual household income was 30.1% (Angelsen et al. 2014), ranging from less than 10 to 59%. It is conceivable that wetlands in good condition will typically offer higher values because of (i) the greater range of NTFPs provided because of both the aquatic and terrestrial components, and (ii) the usually high productivity of wetlands. The top three contributors to NTFP income in the Angelsen et al. (2014) comparative data were firewood (and charcoal), wild foods and plant fibres, which our results mirror (as water is not regarded as NTFP income).

Female-headed households had lower incomes from crops and livestock activities and a higher contribution from NTFPs than the male-headed households. This is not unusual because subsistence use of NTFPs is widely reported to be particularly important for the more vulnerable in rural communities (Angelsen et al. 2014). Female-heads are more vulnerable because they frequently have lower education, less labour available and a greater number of household responsibilities. Most male-headed households can rely on their spouse for many of the domestic duties. In this study they had marginally more land, but a lower income from cropping, which we interpret to

be a consequence of less available labour to work the fields.

Although most respondents did not initially list or identify the wetland products as sources of non-cash income, they did recognise the importance of the wetland generally and the tourist income it attracts to their community. It was well acknowledged that the BWS brought in external income and that such income had been used by KAFRED to sponsor a school, a clinic, a library and sanitation infrastructure. Thus, they perceived that local livelihoods had improved because of the BWS. Such infrastructural benefits are common outputs of CBNRM projects in southern Africa (Taylor 2009; Suich 2014). For example under the CAMPFIRE model, 55% of revenues are supposed to go to ward level committees for local development projects and household dividends (Taylor 2009).

Costs of BWS to households

Despite the widely recognised benefits, households living immediately adjacent to the wetland experienced higher levels of raiding by wild animals than households further away. Thus, they carried a disproportionate share of the costs associated with having the BWS in the community. The depredations of wildlife are a common negative outcome of CBNRM programmes in Africa, and can result in antagonistic sentiments towards CBNRM projects (Suich 2014; Khumalo and Yung 2015). Local attitudes to CBNRM are strongly influenced by the nature and magnitude of the direct benefits and costs experienced. In Bigodi the costs of wild animal raiding has been mitigated to a considerable degree by the establishment of a revolving loan fund, interest free, which victims could draw upon to replace or compensate damage by wild animals. For example, the funds could be used to buy food to replace damaged crops or lost livestock, or repair fencing. Other strategies included encouraging those farmers closest to the wetland to plant unpalatable cash crops (such as tobacco and coffee). However, most farmers do not have sufficient land for this, and such crops still provide cover for the wild animals to move through (Hartter 2007). Guarding the crops is usually an effective means of inhibiting raiding but requires labour, and may prevent children from attending school (Hartter 2007).

Community perceptions on the value of BWS and its governance

The calculated significant contribution of the wetland to local households around BWS means that it is important that it is managed appropriately to continue to deliver the goods and services required. This was starkly emphasised when most respondents said that if the wetland was not a sanctuary they would desire to use it for cultivation. Yet, crops contributed only 28% of their total income, compared to 38% from NTFPs and water an additional 15%. Thus, even though cultivation could potentially almost double the land area available to each household, it would not be sufficient to compensate for the loss of income obtained from NTFPs. The availability of NTFPs in the broader landscape is low because of the high human population densities and significant landscape transformation to agricultural land uses. Thus, whilst some NTFPs can be sourced in other spaces in the landscape, the wetland is the primary source. Consequently, sustainable management of the wetland is key to current livelihoods, whilst simultaneously offering biodiversity conservation benefits to broader society. In terms of management of the wetland, most respondents were comfortable with the current arrangements and outcomes, with the majority stating that even if they did not attend meetings, they had a voice (if they wanted) and that most residents respected and abided by the agreed rules. This was further reflected in the willingness to report transgressions of the rules if observed. Thus, the low attendance at meetings should not be interpreted as a lack of support for the BWS and the benefits it offers. Indeed, other demands on time are frequent hurdles to participatory conservation approaches, and so attendance lists should not be taken as a core measure of participation or success (Lamsal et al. 2015). Importantly, the majority felt that the wetland was in good condition, which was echoed by Gosling's (2011) empirical evaluation using the WET-Health approach.

Given the high contribution of BWS to local livelihoods it is imperative that management seeks to maintain the current flow of ecosystem goods. Currently the Management Committee focuses on marketing the BWS to attract tourists (and hence cash income), environmental education and limiting any activities that are deemed harmful to the wetland (such as cultivation in the wetland). The local perception is

that the wetland is in a good condition and well managed, which was corroborated by the WET-Health assessment of Gosling (2011). However, it is necessary that the Management Committee recognise that this system is dynamic in space and time, which will require the management vision and activities to be adaptive and dynamic. At the moment a key dynamic is the increasing human population resulting from an influx of people seeking economic opportunities associated with KNP. But simultaneously they require land. Thus, it is conceivable that the demand for provisioning resources will increase. This needs to be anticipated and catered for, whilst also protecting access for the most vulnerable. This might require a programme of resource provision or substitution away from the actual wetland, such as woodlots for firewood provision, or shallow ponds for cultivation of crafts and thatching fibres.

Conclusion

In conclusion, this study has revealed the significant use of wild harvested resources as a primary benefit from the BWS as a CBNRM project. The contribution of these resources to household income is substantial, although not immediately recognised as such by most respondents representing the “hidden harvest” syndrome. The substantial value derived from the BWS supports the need to ensure that the wetland is maintained in a healthy condition, not only for tourism and conservation purposes, but also local household needs. The majority of respondents were in favour of such and most supported the restrictions on amounts harvested. It is possible that support for zoning and harvest restrictions would decline in the face of diminished supply or resource conflicts. At a policy level the results of this study clearly demonstrate the importance of small wetlands in local subsistence livelihoods, thereby emphasising the need for national and international policies and programmes to continue to deter wetland degradation, not just for biodiversity conservation purposes but also to support local livelihoods and thereby reducing vulnerability. Secondly, whilst the local users appreciated the benefits of resource supply from the wetland, they had not considered the high contribution it makes to their livelihoods relative to cropping or animal husbandry. This suggests an opportunity for KAFRED and

national agencies to undertake education and awareness initiatives in this regard. Thirdly, the lower incomes and labour availability to female-headed households indicates higher vulnerability. KAFRED may wish to engage with the WBS Committee to consider how such differential vulnerabilities can be reduced. Lastly, our study demonstrates that a strong community-based approach can be locally supported when the benefits are clear, widely available and the costs are compensated. This has implications for the design of CBNRM programmes elsewhere.

Acknowledgements The authors would like to thank John Tinka of KAFRED and the Community Committee for their support of and contributions to this research, as well as the villagers of Bigodi who made this work possible.

Funding This work was supported by a Rated Researchers Grant to CS from the South African National Research Foundation.

References

- Abastha K, Hussain SA, Badola R (2007) Resource dependence and attitudes of local people towards conservation of Kabartal Wetland: a case study of the Indo-Gangetic plains. *Wetl Ecol Manag* 15:287–302
- Adekola O, Morarder S, de Groot R, Grelot F (2012) Contribution of provisioning services of the Ga-Mampa Wetland, South Africa, to local livelihoods. *Int J Biodivers Sci Ecosyst Serv Manag* 8:248–264
- Amooti TJ (2010) Personal communication. KAFRED Field Officer, Bigodi
- Angelsen A, Jagger P, Babigumira R, Belcher B, Hogarth NJ, Bauch S, Börner J, Smith-Hall C, Wunder S (2014) Environmental income and rural livelihoods: a global comparative analysis. *World Dev* 64:S12–S28
- Armitage D, Berkes F, Doubleday N (2007) Introduction: moving beyond co-management. In: Armitage D, Berkes F, Doubleday N (eds) *Adaptive co-management: collaboration, learning, and multi-level governance*. UBC Press, Vancouver, pp 1–15
- Arntzen J, Sethogile T, Barnes J (2007) Rural livelihoods, poverty reduction, and food security in southern Africa: Is CBNRM the answer? IUCN—The World Conservation Union
- Belcher BM (2003) Comment: What isn’t an NTFP? *Int For Rev* 5:161–168
- Brander LM, Florax RJG, Vermaat JE (2006) The empirics of wetland valuation: a comprehensive summary and a meta-analysis of the literature. *Environ Resour Econ* 33:223–250
- Campbell T (2006) Devolved natural resource management as a means of empowering the poor: rhetoric or reality? *Trocaire Dev Rev* 2006:117–133

- Campbell BM, Jeffrey S, Kozanayi W, Luckert M, Mutamba M, Zindi C (2002) Household livelihoods in semi-arid regions: options and constraints. CIFOR, Bogor
- Child B (2009) Community conservation in southern Africa: rights-based natural resource management. In: Suich H, Child B, Spenceley A (eds) *Evolution and innovation in wildlife conservation: parks and game ranches to trans-frontier conservation*. Earthscan, London, pp 187–200
- De Beer F (2013) Community-based natural resource management: living with Alice in Wonderland? *Community Dev J* 48:55–570
- Dixon AB (2002) The hydrological impacts and sustainability of wetland drainage cultivation in Illubabor, Ethiopia. *Land Degrad Dev* 13:17–31
- Dovie DB, Shackleton CM, Witkowski ET (2002) Direct-use values of woodland resources consumed and traded in a South African village. *Int J Sustain Dev World Ecol* 9:269–283
- Ellis F (2000) *Rural livelihoods and diversity in developing countries*. Oxford University Press, Oxford
- Fabricius C (2004) The fundamentals of community-based natural resource management. In: Fabricius C, Koch E, Magome H, Turner S (eds) *Rights, resources and rural development: community-based natural resources management in southern Africa*. Earthscan, London, pp 3–43
- Farrington J, Carney D, Ashley C, Turton C (2004) Sustainable livelihoods in practice: early application of concepts in rural area. In: Jones S, Carswell G (eds) *Environment development and rural livelihoods*. Earthscan, London, pp 189–202
- Gawler M (2002) What are best practices? Lessons in participatory management of inland and coastal wetlands. In: Gawler M (ed) *Strategies for wise use of wetlands: best practices in participatory management*. Wetlands International/IUCN/WWF, Wageningen
- Gosling A (2011) A case study of Bigodi Wetland Sanctuary as a community driven Community-Based Natural Resource Management Initiative: maintaining livelihoods and wetland health. Rhodes University, Grahamstown
- Hartter JN (2007) *Landscape change around Kibale National Park, Uganda: impacts on land cover, land use, and livelihoods*. PhD Thesis, University of Florida
- Hartter JN, Ryan SJ (2010) Top-down or bottom-up? Decentralisation, natural resource management, and usufruct rights in the forests and wetlands of western Uganda. *Land Use Policy* 27:815–826
- Kakuru W, Turyahabwe N, Mugisha J (2013) Total economic value of wetlands products and services in Uganda. *Sci World J*. doi:10.1155/2013/192656
- Kamwenge District Local Government (2004) *District state of environment report for Kamwenge*. National Environment Management Authority, Uganda
- Khumalo KE, Yung LA (2015) Women, human–wildlife conflict, and CBNRM: hidden impacts and vulnerabilities in Kwandu Conservancy, Namibia. *Conserv Soc* 13:232–243
- Lamsal P, Pant KP, Kumar L, Atreya K (2015) Sustainable livelihoods through conservation of wetland resources: a case of economic benefits from Ghodaghodi Lake, western Nepal. *Ecol Soc*. doi:10.5751/ES-07172-200110
- Lepp A (2004) *Tourism in a rural Ugandan village: impacts, local meaning and implications for development*. PhD Thesis, University of Florida
- Lepp A (2007) Residents' attitudes towards tourism in Bigodi Village, Uganda. *Tour Manag* 28:876–885
- Little PD, Smith K, Cellarius BA, Layne Coppock D, Barrett C (2001) Avoiding disaster: diversification and risk management among East African herders. *Dev Change* 32:401–434
- Maclean IM, Boar RR, Lugo C (2011) A review of the relative merits of conserving, using or draining Papyrus swamps. *Environ Manag* 47:218–229
- Magome H, Fabricius C (2004) Reconciling biodiversity conservation with rural development: the Holy Grail of CBNRM. In: Fabricius C, Koch E, Magome H, Turner S (eds) *Rights, resources & rural development: community-based natural resource management in southern Africa*. Earthscan, London, pp 93–109
- Mmopelwa G, Blignaut J, Hassan R (2009) Direct use values of selected vegetation resources in the Okavango Delta Wetland. *S Afr J Econ Manag Sci* 12:242–255
- Moyini Y, Muramira E, Emerton L, Shechambo F (2002) The costs of environmental degradation and loss to Uganda's economy with particular reference to poverty eradication. IUCN—The World Conservation Union, Eastern Africa Regional Office, Nairobi
- Ngaka W (2007) Illiteracy, participation and feminisation of poverty: a critique of Uganda's plan for modernisation of agriculture from a literacy perspective. *Int J Interdiscip Soc Sci* 1:131–136
- Nott C, Jacobsohn M (2004) Key issues in Namibia's communal conservancy movement. In: Fabricius C, Koch E, Magome H, Turner S (eds) *Rights, resources and rural development: community-based natural resource management in southern Africa*. Earthscan, London, pp 194–199
- Pailler S, Naidoo R, Burgess ND, Freeman OE, Fisher B (2015) Impacts of community-based natural resource management on wealth, food security and child health in Tanzania. *PLoS ONE*. doi:10.1371/journal.pone.0133252
- Ramsar Convention Secretariat (2011) *Wise use of wetlands: a conceptual framework for the wise use of wetlands*, Ramsar handbooks for the wise use of wetlands, 3rd edn, vol 1. Ramsar Convention Secretariat, Gland
- Riehl B, Zerriffi M, Naidoo R (2015) Effects of community-based natural resource management on household welfare in Namibia. *PLoS ONE*. doi:10.1371/journal.pone.0125531
- Rozemeijer N (2009) CBNRM in Botswana. In: Suich H, Child B, Spenceley A (eds) *Evolution and innovation in wildlife conservation: parks and game ranches to transfrontier conservation*. Earthscan, London, pp 243–256
- Schuijt K (2002) Land and water use of wetlands in Africa: economic values of African wetlands. International Institute for Applied Systems Analysis, Uxemburg
- Scoones I (2009) Livelihoods perspectives and rural development. *J Peasant Stud* 36:171–196
- Scoones I, Melnyk M, Pretty J (1992) *The hidden harvest: wild foods and agricultural systems—a literature review and annotated bibliography*. IIED, London
- Shackleton SE, Shackleton CM (2004) Are everyday resources valuable enough for CBNRM support? Evidence from South Africa. In: Fabricius C, Koch E, Magome H, Turner S (eds) *Rights, resources and rural development:*

- community based natural resource management in southern Africa. Earthscan, London, pp 135–146
- Shackleton CM, Shackleton SE, Cousins B (2001) The role of land-based strategies in rural livelihoods: the contribution of arable production, animal husbandry and natural resource harvesting. *Dev South Afr* 18:581–604
- Shackleton CM, Willis TV, Brown K, Polunin N (2010) Reflecting on the next generation of models for community-based natural resources management. *Environ Conserv* 37:1–4
- Shackleton CM, Delang C, Shackleton SE, Shanley P (2011) Non-timber forest products: concept and definition. In: Shackleton SE, Shackleton CM, Shanley P (eds) *Non-timber forest products in the global context*. Springer, Heidelberg, pp 3–21
- Silvius MJ, Oneka M, Verhagen A (2000) Wetlands: lifeline for people at the edge. *Phys Chem Earth B* 25:645–652
- Stuip MAM, Baker CJ, Oosterberg W (2002) Socio-economics of wetlands. Wetlands International and RIZA, The Netherlands
- Suich H (2013) The effectiveness of economic incentives for sustaining community based natural resource management. *Land Use Policy* 31:441–449
- Suich H (2014) Evaluating the household level outcomes of community based natural resource management: the Tchuma Tchato Project and Kwandu Conservancy. *Ecol Soc* 18(4):25
- Taylor R (2009) Community based natural resource management in Zimbabwe: the experience of CAMPFIRE. *Biodivers Conserv* 18:2563–2583
- Terer T, Muasya AM, Dahdouh-Guebas F, Ndiritu GG, Triest L (2012) Integrating local ecological knowledge and management practice of an isolated semi-arid papyrus swamp (Loboi, Kenya) into a wider conservation framework. *J Environ Manag* 93:71–84
- Turner S (2004) Community-based natural resource management and rural livelihoods. In: Fabricius C, Koch E, Magome H, Turner S (eds) *Rights, resources & rural development: community-based natural resource management in southern Africa*. Earthscan, London, pp 44–65
- Turyahabwe N, Kakura W, Tweheyo W, Tumusiime DM (2013) Contribution of wetland resources to household food security in Uganda. *Agric Food Secur* 2:5. doi:[10.1186/2048-7010-2-5](https://doi.org/10.1186/2048-7010-2-5)
- van der Jagt C, Gujadhur T, van Bussel F (2000) Community benefits through community-based natural resource management in Botswana. IUCN—World Conservation Union, CBNRM Support Programme, Botswana
- Williams WD (2002) Community participation in conserving and managing inland waters. *Aquat Conserv Mar Freshw Ecosyst* 12:315–326
- World Resources Institute and Wetlands Management Department, Ministry of Water and Environment, Uganda (2009) *Mapping a better future: how spatial analysis can benefit wetlands and reduce poverty in Uganda*. World Resources Institute, Washington, DC