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The cost of poor land use practices in Lake Nakivale Wetland in Isingiro District, Uganda

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The land use practices around Lake Nakivale Wetland have over the last five decades changed from dominantly cattle keeping to crop farming, human settlement and urbanisation. This change, has increased food production and security, it has come at a cost to the natural environment in form of land degradation, wetland encroachment, loss of wildlife habitats and crucial wetland resources. Based on a research conducted in Lake Nakivale Wetland in Isingiro District in Uganda, this paper assessed the cost residents incur as wetland resources experience external disturbances from poor land use practices. Collection of data involved a household survey, interviews, focused group discussions and wetland resource ranking. The impact analysis approach was used to estimate the value of the affected wetland resources. This was based on the market price and the concept of willingness to either pay or accept compensation for wetland resources. The findings indicate that cost of poor land use practices on vital wetland resources is enormous, estimated to be worth US \$ 2,943,960.3 per annum and is expected to continue to increase in the future, putting the livelihoods of residents in dilemma. Sustainable land use management based on sound land use planning and restoration program is proposed to minimise the negative effects of land use on the wetland.

Key words: Land use practices, wetland resources, livelihoods, sustainable land use management, land use planning, wetland resource value.

INTRODUCTION

Lake Nakivale Wetland (referred to as Lake Nakivali Wetland in the list of Ramsar Sites) is part of the larger Lake Mburo- Lake Nakivale Wetland System (26,834 ha). It was designated as a Wetland of International Importance by the Conference of Parties to the Convention on Wetlands (Ramsar Convention) on 15th September 2006 because it supports globally threatened species of birds, two of the endangered cichlid fish species (*Astatoreochromis* and *Astatotilapia* sp.) and is the only area in Uganda where the Impala (*Aepyceros melampus*) is found (WMD and NU, 2008). The wetland system falls within geographic coordinates of 30°49' -

31°04' East and 00°33' - 00°47' South. Lake Nakivale is 14 km long, 6 km wide and has a maximum depth of 3.5 m at high water level (NAFIRRI, 2010). Lake Nakivale Wetland intertwines with Lake Kachera and Lake Kijjanibarola Wetlands through River Rwizi Wetland which feeds into Lake Victoria.

The wetland system is not only a site of international importance but plays a great social-economic role at local level as a source of water for domestic use, livestock and wildlife, pasture for the local herds of cattle during droughts, fish and materials for handcrafts and thatching houses. Like any other wetland in Uganda it contributes

directly and indirectly to national economy. The wetlands' contribution to the Gross Domestic Product is estimated to be Uganda Shillings 6.5 to 7.0 billion (GOU, 2002). In addition, they provide direct income opportunities to rural communities and indirect benefits in form of environmental goods and services such as purification of water, control of floods and water storage that improves the livelihoods of rural population (Mugisha, 2011; Opio, 2008).

However, in Uganda, conversion of wetlands to other land uses is widespread and increasingly affecting the wetland dependent communities in both urban and rural areas. Poor land use practices around the Wetlands have stimulated human induced environmental problems which have negatively affected the availability and socio-economic value of wetland resources that are crucial to the livelihoods of neighbouring local communities. The lost wetland resources and their socio-economic value indirectly reflect the conservation cost the rural people incur as they search for either scarce wetland resources or substitutes. Consequently, residents walk long distances, and spend more time looking for scarce resources. Before 1994, Lake Nakivale Wetland was well protected and the main human activities that used to take place were cattle keeping, fishing and harvesting of wetland materials for domestic use. However, with time, the land use and farming practices within the landscape systematically changed from cattle keeping to crop farming. The nationals and refugees shifted away from livestock husbandry to crop cultivation. As a result of this shift in land use practice, the wetland started to experience a lot of human pressure in the form of conversion to create more areas for food production, human settlement and urbanisation.

Consequently, crop farming activities and other forms of poor land use practices have had a spill over effects on the wetland. The wetland forests have been converted into crop gardens, leading to soil erosion and subsequently, the siltation of Lake Nakivale. Human settlement on the edge of the wetland coupled with poor human waste disposal has affected the quality of water. Overgrazing of livestock has degraded the shallow parts of the wetland, flood plain and steep slopes of hills around Lake Nakivale Wetland, leading to soil erosion and subsequently, the siltation of water bodies in the area. In addition, the clearance of vegetation cover and conversion of some sections of Lake Nakivale wetland to crop farming has contributed to the scarcity of useful plants that rural people have for centuries depended on as source of medicine and food. By and large, the residents now incur costs in terms of time spent searching for the scarce wetland resources. In practical terms, these costs indirectly represent the socio-economic values of the lost wetland resources.

What is of great concern is that although Lake Nakivale Wetland is serving a multi-ethnic community with people originating from different countries and is of great value to

the people of South - Western Uganda due to its ecological, economic and social values, little efforts have been made to study the impact of poor land use practices on the wetland. The few studies with regards to land use which have been carried out (Lambrecht, 1964; Breyer et al., 1997; Place and Otsuka, 1997; Tukahirwa, 2000; Makalle et al., 2008) focus on soil erosion, land use cover, livelihoods and population pressure but not necessarily the wetland resource values lost. Another challenge is that while most of the benefits of wetlands go to the general public, the costs of conservation often fall on the landholders (Musamba et al., 2011). On this basis, wetlands cannot be managed in isolation without taking into account the neighbouring land use (Houlahan et al., 2006). Poor land use practices around Lake Nakivale have resulted into land degradation and other human induced environmental problems such as soil erosion, wetland encroachment, wildlife habitat loss as well as deforestation leading to the scarcity of crucial wetland resources which rural people depend on for survival. Ramsar Convention Secretariat (2007) confirms that degradation of wetlands by poor land use practices have resulted in among others; vegetation destruction and sedimentation. Fennessy and Craft (2011) also attribute the loss of wetland ecosystem services such as the ability to regulate water movement and biogeochemical cycles to the conversion of wetlands into agricultural land.

This paper is a result of a study that was conceived on the realisation that there is urgent need to address threats to the conservation of Lake Nakivale Wetland which emanate from poor land use practices such as poor farming methods, wetland reclamation, human settlement and urbanisation on the fringes of the wetland. Otherwise, this important ecosystem is likely to be lost in the near future. It recognises the fact that although conversion of wetlands to other land uses such as crop production seems to be the cheapest way for local people to meet their basic needs (Musamba et al., 2011), its impact on the wetland resource values is a cost the same people must bear.

Nevertheless, the spill over impacts of conversion of the wetland and surrounding land cover may also be felt at a much larger spatial scale (Marshall and Shortle, 2005). In other words, the cost of poor land use practices are losses in wetland values arising from damages to the wetland resources. Barbier et al. (1997) noted that such damages would amount to the losses in net production benefits and the total cost of this impact in terms of damage to the wetland, are the foregone benefits.

In this regard, however, the affected communities appear not to have fully internalised and appreciated the causes and magnitude of the damage on wetland resources emanating from land use related externalities. The same applies to the decision makers who seem to be constrained by insufficient understanding of the socio-economic values of wetlands as noted by Schuijt (2002). Based on the findings, sustainable land use management

Table 1. Estimated cost of poor land use practice in Lake Nakivale Wetland as perceived by the respondents.

Cost per month (million Ug. Shs)	No. of respondents	Percentage	Cumulative percentage
Less than 1	29	9.2	9.2
1 - 10	201	63.8	73.0
11 - 20	33	10.5	83.5
More than 21	52	16.5	100
Total	315	100	

Table 2. Value of wetland pasture utilized by livestock.

Type of domestic animal	Estimated number	Daily intake of fodder per animal (kg)	Quantity of fodder required (kg)		Value of fodder based on market price (Ug. Shs) '000'	
			Daily	Annual	Daily	Annual
Cows	675	12.5	8,437.5	1,139,062.5	13,500,000	1,822,500
Goats	756	8.0	6048.0	816,480	9,676,800	1,306,368
Total			14,485.5	1,955,542.5	23,176,800	3,128,868

Daily pasture intake rate was adapted from Babu (2002) and value of fodder is based on surrogate market price of livestock feeds in Mbarara Municipality.

Table 3. Value for papyrus reeds.

Use of papyrus	No. of bundles per unit/ house or user	Estimated total bundles	Price of unit/ bundle excluding the cost of harvesting (Ug. Shs.)	Total cost Ug. Shs)
Thatching	65	1,050	2,250	2,262,500
Supporting walls	7	3,500	2,250	7,875,000
Handcraft	4	640	2,250	1,440,000
Total		5,190		11,577,500

The price of bundle of papyrus is based on local market price.

which is hinged on sound land use planning and restoration of already lost important portions of the wetland ecosystem is recommended.

MATERIALS AND METHODS

To assess the cost of poor land use practices on Lake Nakivale Wetland, the impact analysis approach (Barbier et al., 1997; De Groot et al., 2006) was used. This study considers poor land use practices to be external disturbance on the wetland ecosystem that leads to the degradation of resource values. The cost of land use practices is not only reflected in losses of wetland values arising from damage to the wetland system and its resources but time spent by wetland dependent local people while searching scarce resources. Using participatory rural appraisal tools (Conroy, 2002; Abdullah et al., 2012), the most affected wetland resources were identified, prioritized and quantified based on average annual harvest and the local people's preference. The monetary value of affected wetland resources was established based on either market price or indirect substitutes. The wetland resource values were grouped into three categories of direct use values for those

resources that local people derive values from direct use, indirect use values which cover the indirect support and protection and option or existence values (Barbier et al., 1997; Barton, 2002; Millennium Ecosystem Assessment, 2005). The valuation of affected resources took into consideration, the economic concept of willingness to pay (Babu et al., 2002; Ramchandra and Rajinikanth, 2003; Turpie et al., 2010) to attach monetary value on wetland resources that have readily available market price. Where wetland resources or services that do not have market prices such as pasture for livestock were encountered, techniques such as indirect substitute (opportunity cost of using a substitute for the wetland resources or service) and surrogate market prices (the price of related goods and services) were applied. Contingent valuation method (CVM) which involves the asking of individuals how much they are willing to pay to ensure that wetland is preserved was integrated into the survey questionnaire to assess their willingness to pay or accept compensation (Leschine et al., 1997; Subade, 2005) for a change in availability of Lake Nakivale Wetland.

In total, 315 questionnaires were administered to household heads in three randomly selected parishes bordering the wetland. Three out of ten parishes bordering Lake Nakivale Wetland were randomly selected for household survey. The parishes which were selected are Kamuri, Kankingi and Kyabishaho with a total of 1,750

Table 4. Value of water.

Use water	Unit quantity per household/animal (litre)	Total daily quantity (litre)	Total annual quantity (litre)	Value of daily water consumed excluding costs of fetching (Ug. Shillings)	Value of annual water consumption excluding costs of fetching (Ug. Shs)
Domestic use	40	70,000	25,620,000	3,500,000	1,281,000,000
Cows	20	13,500	4,941,000	675,000	247,050,000
Goats	1	756	276,696	37,800	13,834,800
Total		84,256	30,837,696	4,212,800	1,541,884,800

The daily water intake of cows and goats was estimated based on Duguma et al. (2012).

Table 5. Value of fuel wood.

Use of fuel wood	Quantity for a month (bundles)	Annual quantity (bundles)	Monthly value of fuel wood excluding costs of collection (Ug. Shs)	Annual value of fuel wood excluding costs of collection (Ug. Shs)
Cooking and other domestic use	21,000	252,000	63,000,000	756,000,000
Drying fish	864	10,368	4,320,000	51,840,000
Burning of bricks	12,000	144,000	60,000,000	720,000,000
Total	33,864	406,368	127,320,000	1,527,840,000

The value of fuel wood is based on local market price.

Table 6. Summary of the cost of poor land use practices on wetland resources.

Nature of resource	Category	Estimated annual value (Shs)
Fish	Direct use	1,000,771,720
Pasture	Direct use	3,128,868,000
Papyrus reeds/building materials	Direct use	11,577,500
Water	Direct use	1,541,884,000
Firewood	Direct use	1,527,840,000
Herbal medicine	Direct use	38,112,000
Recreation (historical and cultural sites)	Indirect use	6,650,000
		7,359,900,720

households with estimated human population of 10,745 people. The reliability (confidence level) of 95% and the acceptable margin of error of 5% was used to come up with the sample size (number of sampled households). The unit of observation in this study was a household and the unit of analysis was the household head. The questionnaire was supplemented by face to face interviews and focused group discussions in order to minimise biases inherent in CVM. In total, four groups discussion were held as follows: Rukinga Fishing village (n = 10), Kikutsi Fishing Village (n = 6), Rubondo village (n = 8) and Kabazana village (n = 10). For wetland resources, the net monetary value of benefits derived by the wetland neighbouring communities was calculated.

RESULTS

The study results showed that most crucial wetland resources that were being affected by poor land use

practices are fish, pasture for domestic animals, papyrus reeds for construction, water for livestock and domestic use, firewood, medicinal plants as well as cultural sites.

Contingent value of Lake Nakivale Wetland resources

The assessment of the residents' willingness to accept somebody from outside their society to buy and own Lake Nakivale Wetland indicated that 94.3% of the respondents (n= 297) would not accept. Only 5.7% of the respondents (n = 18) were willing to accept the idea of selling off the wetland but only at exorbitant price. For instance, nine respondents (2.9%) suggested a price of more than Ug. Shs 20 million (more than US \$ 10,000) per acre. Similarly, 2.2% of the respondents proposed a

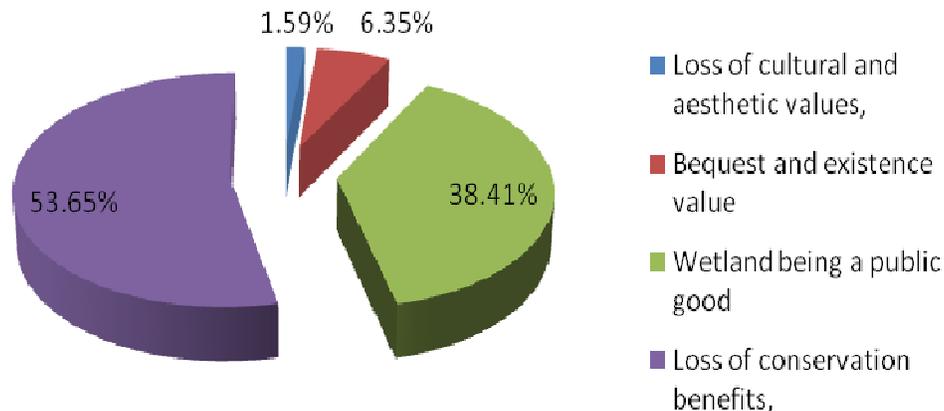


Figure 1. Reasons for not selling Lake Nakivale Wetland.

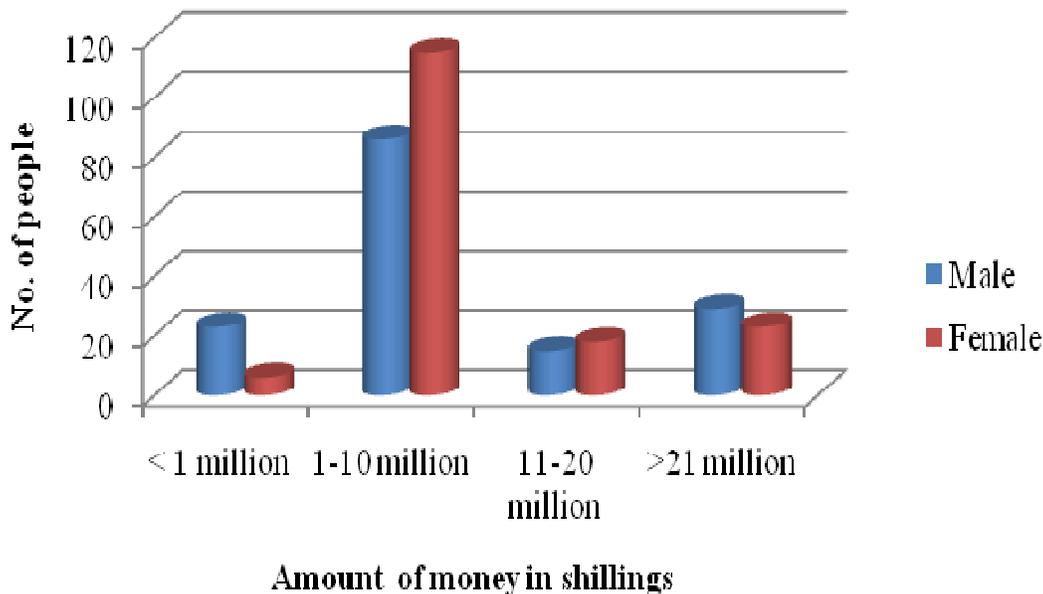


Figure 2. Estimated cost of wetland resources per month according to gender

price ranging from Ug. Shs 2 to 10 million (US \$ 500 to 5000) per acre. Only two respondents (0.6%) were willing to accept a price within a range of Ug. Shs 11 to 20 million (US\$5500-10,000) per acre.

As to why the majority of respondents (94.3%) were not willing to allow an outsider buy and privately own the wetland, several reasons were given. Most of them (53.7% of the respondents) feared they would lose ecological and economic goods and services the wetland provides. Other 41% of the respondents (n = 121) indicated that Lake Nakivale Wetland was a public good which every member of the society had a right to access and utilise. They considered the wetland to be a public asset that should not be owned by an individual but the whole society. There were 1.6% of the respondents (n =

5) who indicated that selling of the wetland was likely to lead to the loss of cultural values of Lake Nakivale Wetland. Only 6.3% of the respondents (n = 20) attached bequest and existence values to the wetland (Figure 1). They were not sure that a private owner would guarantee the long term existence of the wetland and its future benefits.

As to how much neighbouring communities were likely to lose if the current poor land use practices were not checked, 63.8% of the respondents (n = 201) estimated the loss to be between 1 and 10 million shillings per month (Figure 2). While 10.5% of the respondents (n = 33) indicated that it was in the range of Ug. Shs 11 to 20 million per month, only 9.2% of the respondents (n = 29) suggested a monetary value that was less than one

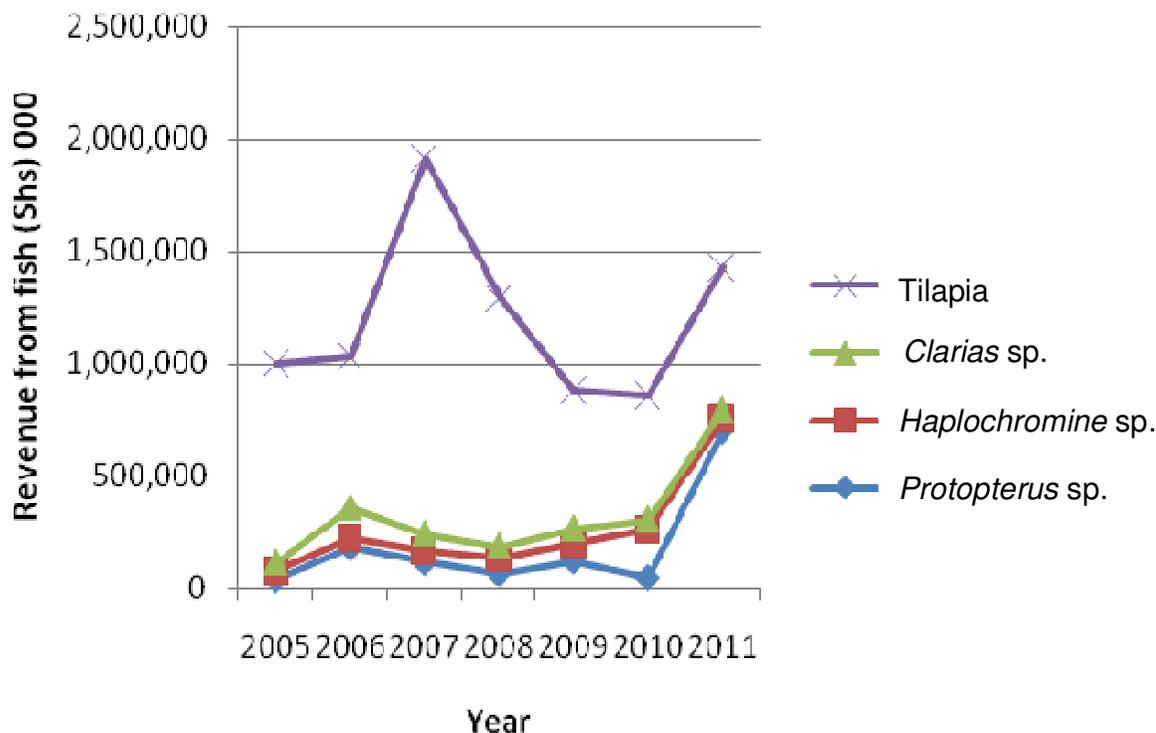


Figure 3. Revenue from fish harvested in Lake Mburo (part of Lake Mburo-Nakivale wetland system) from 2005 to 2011 (Source: Lake Mburo National Park Annual Reports 2005-2011).

million Uganda shillings per month. Using mode as a measure of central tendency of clusters of estimated costs of poor land use practices on the wetland, it was evident that cluster of 1 to 10 million was mentioned most frequently (202 respondents/63.8%)(Figure 2).

When Pearson Chi-square (X^2) for the respondents who considered the magnitude of expected cost/loss of the wetland resources in monetary terms per months in relation to sex was applied, the observed significant level of 0.002 was obtained. This implies that hypothesis that residents' perception on the cost of poor land use practices and gender is independent is rejected. In other words, women were less willing to accept compensation and idea of selling the wetland than men.

Use of market price to establish the cost of losing wetland resources

Fish

The assessment of fish harvest from Lake Mburo which shares the same wetland system with Lake Nakivale shows that neighbouring communities earn a living from fisheries resources. If the current human induced siltation of Lake Nakivale is not checked, residents are likely to lose fisheries resources worth above Ug. Shs 1 billion (US \$ 400,000) per annum (Figure 3).

Pasture

The study established that residents were grazing their livestock especially goats and cows in Lake Nakivale Wetland and associated floodplains for a period ranging from 3 to 6 months depending on the intensity of dry seasons and proximity of their homesteads to the wetland. A total of 82 (26%) respondents owned livestock and other domestic animals. Approximately 14.3% of the respondents ($n = 45$) had cows with average heads of cattle of 15 while 11.4% of the respondents ($n = 36$) had goats (on average each had 21 goats). Although, all domestic animal owners were found to be relying on Lake Nakivale and associated wetland for watering their animals throughout the year, grazing was seasonal. The mean grazing period \bar{X} was 4.5 months (135 days). Based on the average market price of animal feeds of Shs 1,600 per kilo, residents were likely to lose Ug. Shs 3,128,868,000 (US \$ 1,251,547) per annum if the current poor land use practices were not checked and the remaining grazing area converted to crop fields.

Papyrus reeds

Local people living close to Lake Nakivale Wetland depended on papyrus reeds for house thatches (Figure 4), make handcrafts and as a source of energy (alternative to fuel wood). On average, 50 to 80 bundles of papyrus were needed to thatch a single house depending



Figure 4. A mud and wattle house thatched with papyrus reeds.

on its size and strength. Even small houses that were thatched with strong polythene covers needed six to eight bundles of papyrus reeds to support mudding of the walls. The market price of each bundle was in the range of Ug Shs 2,000 to 2,500 depending on the proximity of the wetland to the site of the house.

In total, 1050 houses had their roofs thatched with papyrus reeds, 3500 housing units had their walls supported by either papyrus reeds or palm stalks and 40 residents, all of them women, were using on average 160 bundles of papyrus reeds on quarterly basis to make handcrafts such as mats. A total of 5,190 bundles of papyrus reeds valued at Shs11,577,500 (US \$4,631) per annum are utilized by the residents in the sampled parishes as building and handcraft materials. This excludes some isolated cases whereby papyrus reeds were being used for house ceiling; fence around homes and makeshift bathrooms.

Water

On average, 30,837,696 L of water from Lake Nakivale

Wetland system worth Shs 1,541,884,800 (US \$ 616,754) was estimated to be utilized annually for domestic use and watering animals.

Fuel wood

Residents depended on fuel wood harvested from Lake Nakivale Wetland as a source of energy for domestic use, fish drying and brick making. A bundle of fuel wood for cooking was being sold at Ug Shs. 3000, while the one for drying fish and burning bricks was being sold at Shs 5,000. Unlike the bundle of firewood for cooking, the brick burning and fish drying fuel wood bundle was relatively bigger but with fewer stems (pieces of wood). On average, 33,864 bundles of wood worth Shs 127,320,000 (US \$ 50,928) were harvested on monthly basis.

Annually, approximately 406,368 bundles worth Shs 1,527,840,000 (US \$ 611,136) were collected from the wetland system.

This vital resource was becoming scarce due to conversion of wetland forests into crop fields.

Herbal medicine

Although 62% of the respondents (n = 192) admitted to have used herbal medicine harvested from Lake Nakivale Wetland, not every user was involved in harvesting medicinal plants. There were well known traditional herbalists and healers were specialised in harvesting, processing, prescribing and administering herbal medicine. The common ailments treated by herbs harvested from Lake Mbuho Wetland plants are cough, abdomen pains and general body weakness. The market price of a handful herbal medicine after deducting the cost of transport and labour for extraction was on average Ug. Shs 8000 (US \$ 3.2). About 70% of the identified traditional herbalists were women who were earning about Shs 3,176,000 (US \$ 1,270.4) per person per month by treating the sick residents. The conversion of bush land on the fringes of the wetland system to crop fields affected the herbal plants.

Recreation value

Although only 15.6% of the respondents (n = 49) had used Lake Nakivale and associated wetland system for recreation, the wetland reclamation and deforestation had completely destroyed two important cultural and historical forests of Ishanze and Kabeigarire on the shores of Lake Nakivale. The recreation activities were now restricted in fishing villages (landing sites). Pilgrimages to the cultural and historical sites of Ishanze and Kabeigarire forests where the great Kings of former Ankole Kingdom were laid to rest stopped in early 1990s after the two forested areas were cleared and converted into crop fields

DISCUSSION

The willingness of the neighbouring community members to accept compensation or idea of selling the wetland was very low (5.7%), an indication that residents highly valued Lake Nakivale Wetland. Even those who were willing to accept the idea of selling it proposed exorbitant price per acre. This is attributed to the level of ecological, social and economic benefits the residents get from the wetland and its role in supporting their livelihoods. It also indirectly shows the magnitude of the cost the neighbouring communities were likely to incur when they lose the wetland due to poor land use practices and over exploitation which is estimated to be Ug. Shs 1-10 million (US \$ 400 - 4000) per month per person based on contingent approach. As pointed out in the findings, more women attached a higher value on the wetland than men and expressed a much less willingness to accept compensation than men ($X^2 = 0.002 \leq 0.005$). This can be attributed to gender roles as far the harvesting and utilization of the wetland resources are concerned. Women

were much more involved in collection of firewood, harvesting handcraft materials, fetching of water and dealing on selling herbal medicine. Therefore, this implies that scarcity or disappearance of wetland resources as a result of poor land practices was likely to affect more women than men. Women would be the ones to bear the cost of poor land use practices since they would be forced to move longer distance and take more time to access essential wetland resources.

The study also shows that neighbouring community's priority list of wetland resources affected by poor land use practices is composed of mainly direct use category of wetland values. This could be attributed to the role of wetland resources such as fish, pasture, water, pasture and fuel wood in sustaining the livelihoods and limited knowledge on the total economic value of wetlands at local level (Schuyt, 2004).

Increased human settlement around the wetland coupled with increased land degradation due to poor land use practices has subsequently increased demand for wetland resources and land for food production. However, other socio-economic factors for instance, low levels of household income (Turpie, 2010) and land tenure (Fraser, 2004) could also be accentuating the destruction of Lake Nakivale Wetland. The majority of the people residing in Nakivale are refugees who have a lot of hopes of returning to their country of origin and therefore perceive the idea of having a semi permanent house made up of iron sheets and bricks as waste of money. On the side of nationals, those who would afford iron sheets and bricks to construct their houses instead of wetland resources were fully aware that land belongs to the government, and they were expecting the government to evict them in future. To them, it was safer, cheaper and justified to continue depending on wetland resources as building materials.

The conversion of wetland and adjacent vegetation cover into agricultural fields has affected the availability of crucial wetland resources such as natural plants of medicinal value and fuel wood; as a result, local people are forced to walk long distances in search of scarce wetland resources. Consequently, residents were paying high price to access the essential resources in addition to environmental problems associated with wetland degradation. From management perspective, the results may therefore suggest that unless sustainable land use management (UN, 2012) that puts into consideration wetland restoration program is adopted, the cost of conservation incurred by neighbouring communities is likely to increase in future.

Conclusion

It is evident from this assessment that cost of poor land use practices on the key resource values and integrity of Lake Nakivale Wetland is so far enormous. The findings

indicate that wetland dependant local people are likely to lose vital resources valued at about Shs 7,359,900,720 (US \$ 2,943,960.3) per annum if the current situation is not rectified. The effects of poor land use practices are already exhibited in the form of receding Lake Nakivale and associated water levels and scarcity of essential wetland resources such as fish, plants of medicinal values, fire wood, pasture and building materials. The poor and marginalised members of the society, especially the women that either rely on wetland resources or their gender roles, according to the society, are the most affected by the effects of poor land use practices.

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