

Research Paper

Economic Implications of Wetland Conversion to Local People's Livelihoods: The Case of Kampala- Mukono Corridor (KMC) Wetlands in Uganda

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ABSTRACT

Uganda's wetlands are an important stock of natural capital producing goods and services that have economic value. Despite the need to conserve them, their loss to unsustainable resource utilization activities has continued because they are considered to have little or no economic value. This study aimed at highlighting the economic importance of three wetlands within the Kampala-Mukono Corridor (KMC) and the economic implications of their degradation to the Local Administration and people's livelihoods. Emerton et al. (1998)'s Total Economic Valuation Approach (TEV) was used to quantify selected use values of wetland benefits, drawing on the market price, replacement cost and the contingent valuation techniques. The results revealed that the KMC wetlands yield a flow of economic benefits at a minimum approximated value of US\$ 3,418 M/Ha/per Year. Degradation of these wetlands would imply serious economic costs to the government and local communities reflected in high expenditures to duplicate wetland services, foregone incomes, livelihood support and alternative employment. The study recommends several strategic interventions including the use of economic incentives and disincentives, intensification of economic valuation on threatened wetland ecosystems, promotion of efficient harvesting technologies, ensuring independency of Environmental Monitoring and Regulatory Institutions, community participation in planning and enforcement of regulations.

¹H. Wasswa, ²*F. Mugagga ¹V. Kakembo

¹Department of Geosciences, Nelson Mandela Metropolitan University, P. O Box 77000, Port Elizabeth, 6031 South Africa.

²Department of Geography, Geo-Informatics and Climatic Sciences, Makerere University, P. O Box 7062, Kampala, Uganda.

*Corresponding author. E-mail: fmugagga@gmail.com; Tel: +256 772 968421

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INTRODUCTION

Uganda is endowed with wetlands, covering approximately 13% of the land surface (NEMA, 2006; UNDP, 2009) representing one of the most vital ecological and economic resources (Amaniga et al., 2010; Bakama, 2010). They are associated with important functions that provide goods and services which have economic value and therefore satisfy human wants, directly /or indirectly (Kirsten, 2005; Brander et al., 2006). Directly, wetlands are sources of water supply and other products such as fish and plant resources, clay, papyrus, sand and they are also centres of

recreation whilst indirectly, they perform environmental functions vital in the maintenance and protection of human systems through services like the preservation of water quality, flood attenuation, nutrient retention, ground water recharge and climatic regulation (Barbier, 1993; Gayatri, 2000; Oglethorpe et al., 2000). Because of their socio-economic importance, wetlands have attracted significant portions of human populations who survive by exploiting their resources, through different resource utilization activities, often driven by economic and financial motives

(Kirsten, 2005). This has resulted in the degradation and modification of these valuable stocks of natural capital.

This situation arises out of the fact that wetlands are perceived to have little or no economic value (Kirsten, 2005), coupled with the fact that no formal markets exist for their services to humanity (Jodi, 2005). Consequently, this makes wetland conservation not to be seen as a serious alternative compared to other uses that seem to yield more tangible and immediate economic benefits. As a result inadequate resources are fed into their management which breeds environmental degradation through inappropriate commercial exploitation of wetlands (Oglethorpe et al., 2000). The Kampala-Mukono Corridor (KMC) presents an area where conservation benefits have been hampered by human desire for economic gains. This challenge is, consequently, making decision makers, particularly at the local level, to opt for the conversion of wetland resources to other uses like agriculture, clay extraction and brick making. This trend is likely to result in grave and irreversible environmental consequences that potentially affect human welfare.

The present study is therefore aimed at carrying out an economic valuation with a view of quantifying the actual and potential economic benefits accruing from conserving wetlands in the KMC so as to facilitate optimal and informed decisions about wetland management for a sustainable future.

The specific objectives of this study were:

1. To estimate the direct and indirect wetland economic benefits accruing from the KMC wetlands.
2. To establish the significance of wetland values to people's welfare and the environmental costs of converting them.

STUDY AREA

The study was conducted within the Kampala-Mukono Corridor- (KMC) of Uganda. Located between 00° 18' 49" N 34° 52' E to 00° 20' N 32° 45' E, this area lies along the Northern shores of Lake Victoria, in the central and eastern parts of the country, transcending the two Districts of Kampala and Mukono. A specific area comprising Lwajjali, Nakiyanja and Namanve wetlands that represent zones with diverse resource utilization activities was selected for the study. This study area is located in the broad uniform valley slopes, which descend into extensive papyrus wetlands, punctuated by flat, topped hills that rise to an average height of about 1300 m a s l. (NEMA, 1996) Figure 1.

The geology of the area is dominated by Precambrian – Paleozoic sedimentary cover sequence, punctuated with segments of crystalline Precambrian basement. It is the warping associated with these geological periods that is

responsible for the formation of alluvium and lacustrine deposits that were colonized by numerous wetlands including lacustrine and riverine swamps/flood plains (NEMA, 2002).

The area receives bimodal rainfall with the wettest period being March to May and September to November, while the very dry periods are experienced in December to February, and June to August. The mean annual rainfall often exceeds 2100 mm /83 inches, with sunny intervals most of the year, characterized by temperatures that rarely rise above 29°C (NEMA, 2002).

The vegetation in the KMC follows the existing rainfall and relief patterns. The National Biomass Study (NBS) categorized Kampala's wetlands into woodland trees, shrubs, bush thickets, scrubs, built up vegetation, and wetlands (NEMA, 2002). Whereas in Mukono district, vegetation cover is majorly comprised of the forest/savannah mosaic characterized by patches of dense forests, scattered trees in shrubs, grasslands and wetland vegetation (NEMA, 2002). Collectively, KMC is estimated to have a total of 40,700 ha of wetland area that is 15 km² for Kampala District (NBS, 2003) and 392 km² in Mukono district (Marylyn, 2006). The major threats to these wetlands include reclamation for industrial expansion, urban and residential expansion, agricultural development, brick- making, sand extraction and papyrus harvesting in Kampala and Mukono Districts.

This study area is relatively developed, with Kampala being more developed than Mukono in terms of infrastructure, urbanization, industry, commerce and trade. However, Mukono District is already showing indicators of economic growth and development through the contribution to national income in terms of the expanding agricultural and agro-based industries, improved infrastructures and growing urbanization (NEMA, 2002). The move for economic growth and development means that this area experiences greater environmental stresses including habitat destruction, pollution, deforestation and wetland degradation, hence the need to bring development and environmental resource utilization at an ecologically sound footing.

MATERIALS AND METHODS

Research design

Economic valuation is one tool that aims at investigating public preferences for change in the state of wetlands and natural resources it contributes in monetary terms (Sathigile, et al., 2011). In the present study, a cross-section survey research design was used in which information relating to the economic valuation of wetland goods and services was collected from a cross section of the population

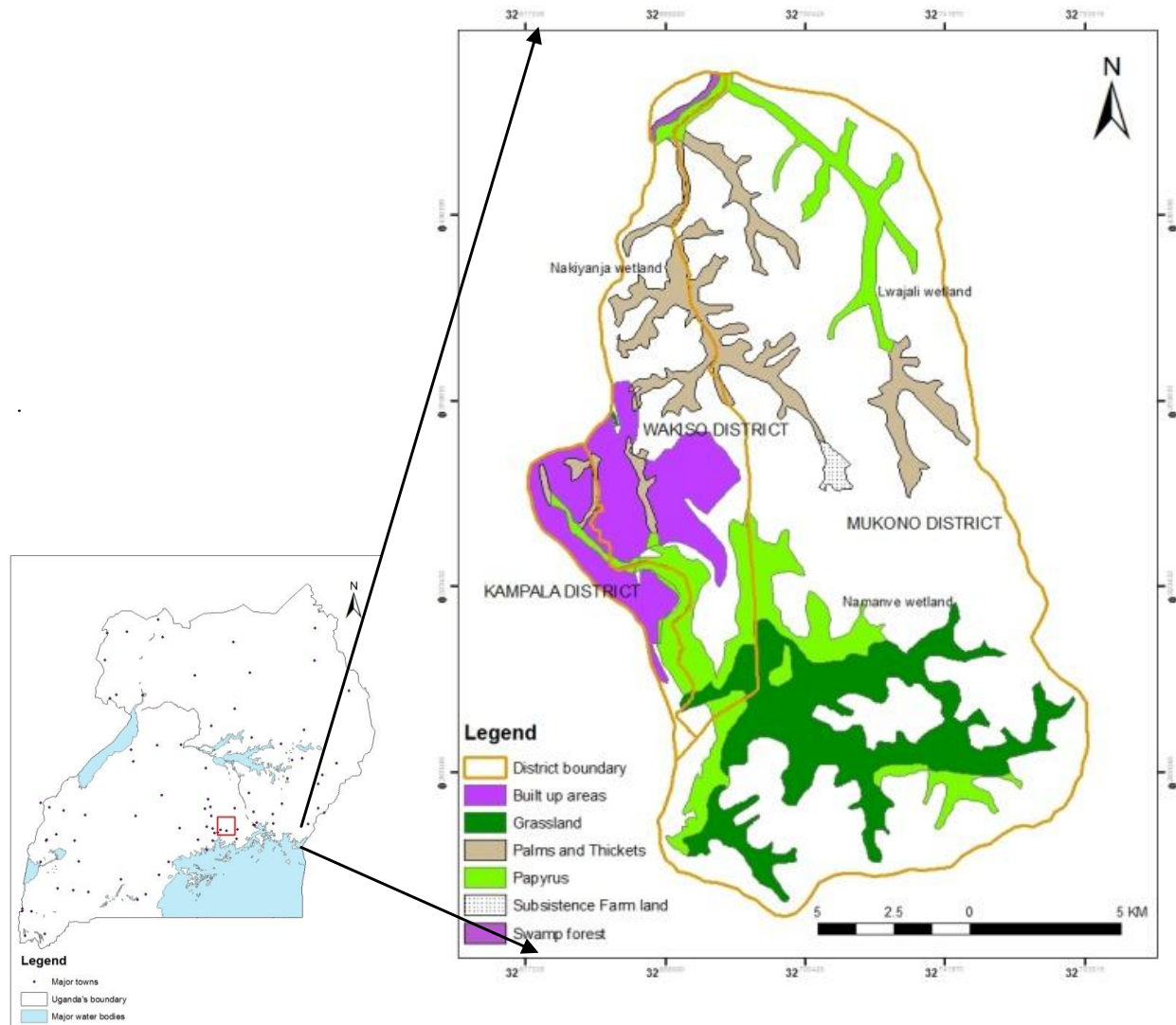


Figure 1. Map of Uganda showing location of the sampled wetlands in the KMC.

involved in the different resource utilization activities. This research design was considered because it permits the collection of various wetland value attributes at a given point in time.

Sampling procedure

Purposive sampling was applied throughout the study. Three wetlands with significant resource utilization activities were selected including Lwajjali, Nakiyanja and Namanve wetlands. For each of the selected wetlands, a proportionate sample of villages was considered from which a representative sample of respondents were selected to provide information pertaining to the selected

wetlands. Local Chairpersons in the selected villages were contacted during the reconnaissance survey to provide basic information about the number of primary harvesters and traders of wetland goods. The sample sizes were determined using Morgan and Krejcie's (1970) Table of Sample Size Determination.

Valuation approach

Owing to its versatility and applicability in related **assessments** (including Karanja et al., 2001; MEA, 2001; Kirsten, 2005), Emerton et al. (1998)'s Total Economic Valuation Framework (Table 2) in valuing the selected wetland ecosystems was adopted for the study. This

Table 1. Selected economic value indicators and their expression.

Economic indicator	Expression
Gross value	Units harvested, used, produced, or sold X price per unit.
Net value	Gross value – cost of inputs.
Gross cash income	Units sold X price per unit.
Net cash income	Gross cash income – cost of inputs.
Subsistence consumption value	Gross value - gross cash income or units used at home X price per unit.
Gross /net / cash returns to land	Value ÷ hectares of land from which goods harvested/produced / sold.
Gross /net/cash returns to labour	Value ÷ no. of days required to harvest, use, produce or sell goods.
Total net economic value	Net economic value of wetland goods + Net economic value of wetland services

framework outlines six major stages in wetland economic valuation as presented below:

Identifying wetlands economic benefits: The first step in the valuation process involved the identification of wetland goods and services that the wetlands in the study area yielded. This was done through the use of the Total Economic Value concept which categorizes wetland economic values according to the direct, indirect, option, and existence values. Emphasis was put on the use values, that is the direct and indirect benefits accruing from the use of wetland goods and services, because they are relatively straight forward to estimate (Kirsten, 2005).

Choosing which wetland goods and services to value: A prioritization of major wetlands goods and services that formed a basis of the study was made. This was mainly done because it would be realistically impossible to value all goods and services that the wetlands yielded, owing to limited resources, time constraints, and the fact that all the selected wetland goods and services were not significant in the sampled wetlands. In essence, the study concentrated on four direct use values of wetland goods including crop production (mainly sweet potatoes, and yams), thatch, clay, and water supply, in addition to two indirect use values namely water purification and flood attenuation.

Choosing valuation techniques: Having identified the wetlands benefits that formed the basis of this study, the following valuation techniques were selected.

(a) The market price method was used to value wetland benefits/goods traded in the open market with direct use value. These goods included crops particularly yams and sweet potatoes, grass thatch, clay and water.

(b) The replacement cost method was considered for wetland services with indirect use value, but with evidence of artificial facilities that could be used in calculating their replacement cost to the people benefiting from same services freely or at a lower cost in the selected wetlands. Due to inadequate resources and time, this method was used to value only the Water purification service.

(c) The contingent valuation method was considered to value wetland services for which people had some knowledge about and therefore could estimate their value in a hypothetical market if asked to do so. Flood Control service was valued by this method.

Choosing indicators of economic value and specifying data needs for valuation: Different indicators of economic value were identified to provide estimates of total returns to income, subsistence value and returns to land. Focus was put on the Net Cash Income, Subsistence Consumption Value and the Gross Value as indicators of economic value for the selected goods and services. The data required in calculating the specific indicators of economic value was determined taking into consideration comparable units of time, seasonal variations of goods harvested or produced, price and other factors. Since many goods were consumed in both raw and processed forms, this data was collected at different stages particularly the harvesting, production and marketing stages. The selected economic values indicators and their expression are presented in Table 1.

Data collection

Open ended questionnaires were administered to respondents to elicit data about the production, harvesting and marketing of wetland resources. These were triangulated with in-depth Interviews and Focus Group Discussions (FGDs) with various key informants and members of the various resource user groups.

Distribution of wetland economic benefits and identification of economic measures for sustainable wetland management

A distribution of wetland values between different stakeholders was assessed. This was done in order to determine the type and level of benefits and costs accruing at different levels and with different activities, so as to determine the significance of wetlands to people's welfare,

Table 2. Stages in wetland economic valuation and analysis.

Step	Involves	Outcome
1. Identifying wetland economic benefits	Categorizing the benefits of a particular wetland according to the concept of total economic value	Full description of wetland economic benefits.
2. Choosing which wetland goods and services to value	Prioritizing wetland benefits and selecting those which will be valued	List of wetland economic benefits that will form the focus of the study
3. Choosing valuation techniques	Deciding on the economic methods and techniques that will be used to value selected wetland benefits	List of indicators of wetland economic value.
4. Choosing indicators of economic value	Deciding on the way in which economic value will be expressed for the given wetland benefits	List of indicators of wetland economic value
5. Specifying data needs for valuation	Formulating a list of the data that must be collected to enable the economic valuation of wetland benefits	List of data requirements for wetland economic valuation.
6. Collecting the data	Selecting and implementing methods to collect the information required to calculate wetland economic value of wetland benefits.	Data that can be used to calculate wetland economic benefits.
7. Assessing the distribution of wetland benefits and costs	Involves the evaluation of wetland benefits to stakeholders (land holders, private sector, government)	A listing of which stakeholders gain, and by how much, from wetland conservation, and which groups lose, and by how much, if the wetlands are degraded.
8. Identifying economic measures for sustainable wetlands management	- Identification of groups responsible for wetland management, - pinpointing groups and economic activities benefit freely or at low cost from wetlands - Identification of opportunities for raising finance for wetland management - Which groups need economic incentives or disincentives to conserve the wetlands.	A listing of economic incentives and disincentives for wetland management

Adapted from Emerton et al. (1998).

that is who gains and who loses, and by how much from the selected wetlands resources. Finally, the last stage in this economic analysis involved the identification of economic measures for sustainable wetland management. This is mainly because wetland conservation and the groups who bear its costs require funds. This stage involved pinpointing groups and economic activities that benefit freely or at low cost from wetlands. It is from these groups that opportunities for raising finance required for wetland management were identified in form of incentives and disincentives for wetland conservation (Table 2).

Emerton et al. (1998)'s step by step valuation process as used in this study is summarized below:

$$R = f(x, y, z, p, q, r)$$

Where;

r = Total Economic Value of Wetland resources

x = Wetland economic benefits which is equivalent to ($x_1 + x_2 + x_3 + x_4$), denoted as;

x_1 = Benefits with direct use values

x_2 = Benefits with indirect use values

Table 3. An inventory of benefits accruing from the KMC wetlands.

Direct uses	Indirect uses	Options values	Existence values
Fish, wood fuel, Building poles, sand, clay, thatch, water, wild fruits, herbs and rich soils for agriculture, pastures for grazing	Water quality control, water flow regulation, water storage, water purification, flood control, storm protection and nutrient retention,	Tourism, Pharmaceutical applications, leisure un known future developments of wild species and genes	Heritage values, cultural, religious and aesthetic values

Source: Based on field observations and Secondary data from Mukono District state of Environment Report (2002).

x3 = Benefits with option use values

x4 = Benefits with existence use values

y = Choice of wetland goods and services to value

z = Choice of valuation techniques

p = Choice of indicators of economic value

q = Specification of data needs

r = Data collection

RESULTS AND DISCUSSION

Wetland benefits from the KMC

Based on the inventory of wetland goods and services made during the reconnaissance survey (Table 3), various wetland benefits supporting people's livelihoods were identified and categorized according to their direct use, indirect use, option value, and non use / existence value. This categorization was done based on the Total Economic Valuation (TEV) approach. The direct production services including the harvesting of raw materials particularly clay and physical products used for production, consumption and sale of different goods like crops, clay bricks, thatch and water, were perceived as valuable to the people in wetland peripheries. This is because they provide benefits that directly satisfy human wants such as the direct use of wetland products for income generation and subsistence utilization to support human welfare. Besides they are better known to the people since they involve human interaction through a range of resource utilization activities like brick making, sand mining, fish farming, thatch extraction, and agriculture that provide the much needed employment for the local people. This observation is shared by Apunyo (Makerere University, Uganda) and Amaniga et al. (2010) who affirm that the importance of wetlands is

more associated with the direct consumptive values, while the essential life supporting processes including indirect uses are the least recognized due to their inconspicuous nature.

However, the indirect ecological functions also play a role in supporting and maintaining natural and human systems through regulation services that include flood control, water purification, storm protection, water storage, storm protection and microclimatic regulation and ecosystem services such as nutrient cycling, nitrogen fixation, carbon sequestration and soil formation. According to Barbier et al. (1997), these services are derived from the support and protection of economic activities which indirectly have measurable values. For example, through nutrient cycling, the KMC wetlands support subsistence agricultural activities that sustain livelihoods especially for the poverty stricken rural and urban population. Because these services do not involve human interaction, their importance to the society is significantly unnoticed. Besides, they are often perceived as 'free' public services making it difficult for them to be accounted for in the open market (de Groot et al., 2006). All this contributes to the undervaluation of the KMC wetland's TEV, which fuels inadequate resources into their management. As noted by Loomis et al. (2000) and Oglethorpe et al. (2000), this situation instigates poverty stricken local communities driven by financial motives to exploit wetland resources to their own advantage causing environmental degradation and affecting human welfare.

The option use values varying from tourism, pharmaceutical uses, leisure, to unknown future developments of wild species and genes. The existence of these resources pre supposes that current exploitation of a resource may be irreversible (Barbier et al., 1997). Because local communities in and outside the wetlands are not certain of the future demand or the availability of these resources, particularly wild species and genes, they place a high value of option uses to the KMC wetlands, some of which may not be currently known.

The existence values include heritage, cultural, religious aesthetic and bequest values. This category of value is

highly recognized among communities that live and spend much of their time in the wetlands (Loomis et al., 2000; Hajnalka and Petrics, 2006). Particularly it is the direct extensive users involved in the harvesting of papyrus, thatch and reeds, direct exploiters who extract mineral resources like clay, sand and other wetland resources, water abstractors and agricultural producers that value this use option. Because of their strong attachment to the wetlands, they advocate for the conservation of the wetland resources so as to see their way of life as well as seeing wetlands passed on to their future generations.

The present study revealed that the KMC wetlands yield a flow of economic benefits as categorized in the different value forms to society. Their protection and sustainable management is critical to the survival and welfare of these folks whose livelihoods are strongly aligned to the fragile wetland ecosystems.

The economic value of the KMC wetlands

Table 3 presents the economic value of the sampled wetlands in the KMC estimated at US\$ 1,543,738 per year, which is equivalent to US\$ 3,418/ha/year. The benefits from clay and flood control make up the bulk of this value, contributing 48 and 35% respectively. Water purification contributes 11% of this value, while water supply, crop cultivation and thatch contributed the least economic value (3.8, 0.26 and 0.19%, respectively). According to Emerton et al. (1998), these figures represent a minimum estimate of KMC wetland's Total Economic Value. This is because they exclude other benefits yielded by the wetlands, most importantly, option values and the non-use values attached to aesthetics, biodiversity, bequest and cultural values. Additionally, they deal with selected existing direct production services related to significant utilization activities that represent a small portion of the potential utilization opportunities (Table 4).

In this study, the valuation of wetland goods surpassed that of wetland services. The wetland goods considered included crops (yams and sweet potatoes), thatch, clay and water. Only two wetland ecosystem services (water purification and flood control) were considered. This clearly demonstrates what was (Kirsten, 2005) observed with the valuation of similar African wetlands such as; the Hadejia-Nguru wetlands in Nigeria by Barbier et al. (1991); the Nakivubo wetlands in Uganda by Emerton et al. (1998); and the Zambezi Basin wetlands in Zambia by Seyam et al. (2001) that it is still relatively difficult and time consuming to value wetland ecosystem services. Hence, even when their importance may be intuitively known by both the local and the National Planning Units, it is more probable that these non use services will continuously be ignored in wetland management decisions, which underestimates the

gross value attached to the KMC wetlands. There is still more need for capacity building in wetland valuation studies of this kind in Uganda and particularly for those regions where demographic growth amidst poverty and the current economic stress threaten the existence of wetlands.

The unit value of US\$ 3,418/ha per year is relatively higher compared to similar African case studies, whose value varies between US\$ 45 - 90/ha/ year (de Groot et al., 2006). This should not discredit these results, since this area is a peri-urban outskirt of Kampala city with diverse resource utilization activities that command higher returns. Besides, it is quite plausible that the value of wetlands is enhanced with proximity to the cities (Stuip et al., 2002). Considering the unit estimate of US\$ 3,418 / Ha/Year, the TEV accruing to the entire KMC with 40,700 ha, that is 15 km² for Kampala District (NBS, 2003) and 392 km² for Mukono district (Kamanyire, 2006) would amount to approximately US\$ 139,097,020. This economic value reflects the potential losses to the people if the wetlands are totally degraded. In tandem with Emerton et al. (1998); Karanja (2001) and Kirsten (2005), these losses should be integrated in wetland management decisions, and weighted against the benefits of wetland conservation.

According to Balmford et al. (2002), the Total Economic Value of intact wetlands far exceeds that of converted wetlands. Consequently, this value would certainly be higher if the KMC wetlands were still intact. However, since they are being converted, their value is significantly lowered, a situation that has over time created long term 'national capital debts, which are being paid at a high cost through expenditures on programs that aim towards wetland restoration, management and sensitization. In the face of this, immediate conservation and sustainable utilization of these natural stocks of capital is critical to the survival of the present and future generations.

Distribution analysis of wetland benefits among stake holders

The distribution analysis arising from this study implies that a great deal of wetland economic benefits (over US \$ 1.3 Million) accrue at the local level, particularly the subsistence level. Although this may not be feasible to the District Planning Units, it ought to be taken as a substantial amount (Emerton et al., 1998; Karanja et al., 2001), whose loss through unsustainable wetland utilization would make local communities adjacent the KMC wetlands poorer (Table 5).

At an estimated population of 2.45 Million, that is with Mukono district having 795,393 persons (Muyomba, 2011) and Kampala 1.66 Million (GoU, 2011), and also realizing that a great deal of the economic value estimated in this study accrues at the local level, wiping out the current

Table 4. Summary of the estimated economic value of the KMC Wetland benefits.

Description	Estimated economic value
A. Wetlands Goods (With direct use value)	Total Value in USD per year (Buying at UGX 2,500)
1. Yams	
1.1 Estimated Annual subsistence consumption value accruing to the yam producers in the wetlands	1,983
1.2 Estimated value added through the sell of yams accruing to yam traders	13
Estimated total economic value of yams in the selected wetlands of the Kampala Mukono corridor per year	1,996
2. Sweet Potatoes	
2.1 Estimated Annual subsistence consumption value accruing to the yam producers in the wetlands	2,088
2.2 Estimated value added through the sell of yams accruing to yam traders	USD 4
Estimated total economic value of yams in the selected wetlands of the Kampala Mukono corridor per year	2,126
2. Thatch	
Estimated Net Annual value accruing to the number of thatch harvesters in the selected wetlands	3,007
3. Clay	
4.1 Estimated Annual Net value accruing to the number of clay extractors in the selected wetlands	184,959
4.2 Estimated Annual Net value accruing to the number of clay brick makers in the selected wetlands	552,287
4.3 Estimated Annual Net value accruing to the number of clay pot makers in the selected wetlands	7,853
4.4 Estimated Annual Net value accruing to the number of clay charcoal stove makers in the selected wetlands	1,299
Total economic value clay in the selected wetlands	74,798
4. Water	
Estimated annual net subsistence consumption value of water in the selected wetlands	59,002
B. Wetland Services (With indirect use value)	
5. Flood Control	
6.1 Estimated annual economic value of protecting upstream gardens accruing to the 52 farmers / households in the selected wetlands	805
6.2 Estimated annual economic value of protecting 1,132 motorized road linear distances with 50m in the selected wetlands from floods	28,379
6.3 Estimated economic value of protecting dwellings from floods	269,236
Total Wetlands Economic Value of Flood Control	553,832
6. Water purification	
Estimated Total annual replacement cost of water purification and treatment for 8,437.3 Users of un safe water in the KMC	177,378
Minimum Economic Value of selected wetland services in the KMC	1,543,738
Estimated Total wetland area in the study area (hectares) based on GIS measurements	
Estimated Minimum Economic Value KMC wetlands (/ Ha / Year)	3,417.6

Table 5. Distribution of wetland economic benefits.

Beneficiary groups	Nature of benefits	Value of benefits US\$ /yr
1. Local level communities (Direct extensive users)	1. Subsistence and livelihood	
	(a.) Goods	
	- Crops	- 4,070
	- Water supply	- 59,001
	-	
	(b). Services	
	<u>Flood control</u>	- 269,236.5
	- Attention to: Household dwellings	- 805
	- Attenuation to gardens	- 283,790
	- Attenuation to roads	- 177,378
	- Water purification	
		-
	Subtotal subsistence and livelihood benefits	794,281
	2. Estimated incomes accruing to local level communities :	
	- Net annual revenue from sale of crops.	- 52 per year
	- Net revenue from brick making/yr.	- 552,287 Per year
	- Net revenue from pot making/yr.	- 7,853 Per year
	- Net revenue from the sale of Charcoal stoves.	- 1,299 Per year
	- Income earnings from thatch harvesting.	- 3,007 Per year
	-	
	Total incomes accruing to the local level	564,498 per year
Total Economic Value accruing at the local level		1,358,779
Beneficiary group		
2. local Government level	Expenditure saved on the provision of goods and services	- On the minimum calculated at 139m for the entire KMC

Note: Sum of components does not equal to total wetland value since the distribution analysis is made between two stake holders who benefit from the same wetlands.

wetlands (estimated at a minimum value of over US\$139 Million) would imply that the Local Government Administrations in these two Districts have to meet the costs of providing the socio-economic needs of the population that were initially provided by the wetlands freely or at a lower cost. These are reflected in terms of all foregone subsistence livelihood products, incomes (estimated at US\$ 794,281 and US\$ 564,498 respectively), and employment losses, in favor of unsustainable wetland utilization activities or development projects which only offer short term solutions to important social economic problems (Gumm, 2011). The Local Government Administrations in Kampala and Mukono Districts should embark on developing a Land Use Plan that will ensure that the KMC wetlands are not degraded at the expense of

poverty driven unsustainable utilization activities or development projects that encroach on their lands as they search for strategic locations to enjoy economies of scale. According to Dale (2001); Randolph (2003) and Perlman (2005), such land use planning should be tailored in line with ecological principles that embrace collaborative environmental management, ecosystem and watershed management and environmental design.

The District Administrations in the two Districts making up the KMC mainly benefit from the wetlands through the taxes charged against wetland resource utilization from the production to the marketing stages. Besides, these wetlands are saving or subsidizing public expenditures through providing goods and services which the government would have had to provide. On the minimum this calculates to

US\$139 Million. Owing to the fact that the KMC wetlands provide substantial benefits to local level communities and the public sector, these stakeholders should be sensitized about the huge benefits that they acquire from the KMC wetlands, particularly the indirect use and non use values that do not involve human interaction. Hence local communities should be made to understand that the sustainable attainment of the same benefits will only be guaranteed if wetlands are conserved than when their lands are degraded through unsustainable wetland utilization activities.

Economic measures for sustainable wetland management

The location of the KMC wetlands adjacent a heavily populated and developing Uganda's Capital City (Kampala) means that land in strategic urban and neighboring rural locations is used up, making wetland resources vulnerable to encroachment, modification and conversions. One way of ensuring that the remaining wetlands are managed sustainably would be through carrying out regional awareness campaigns of the KMC wetland economic values as one way of demonstrating their contribution to the local and national economy. Such sensitization will empower local communities with knowledge and awareness particularly on the ecological roles of wetlands so as to influence a positive shift of attitudes toward these ecosystems (Apunyo, Makerere University, Uganda). Other scholars such as Macharia et al. (2010); Crafter (1992) and Mathoko (2009) noted that such awareness and educational campaigns made profound impacts that changed attitudes and perceptions of local communities in two highland wetlands of Central Kenya; as a result communities organized themselves, revived a dormant community group, and later created an ecotourism venture which has helped to address many wetland threats.

A further observation in the present study is that the KMC wetlands are principally threatened by human induced activities and government driven reclamation activities. The former applies to extractive resource utilization activities like agriculture, clay mining, thatch extraction and water utilization which are driven by poverty, demographic factors and economic anxiety, while the latter takes the form of large industrial expansion allocations and infrastructural development. The first category of stakeholders includes those within the wetlands, whose actions are dictated by poverty,¹ economic stress and demographic factors. For these groups to overcome such economic drivers, they have to carry out

unsustainable wetland utilization activities which are contributing to the continuous wetland loss. The second category comprises those who perceive the economic benefits of wetland conversion to be higher than the economic benefits of wetland conservation. This perception is a function of information failures about the potential economic benefits of wetland conservation. As recommended by Kirsten (2005), the first category of actors in the wetlands should be approached by dealing with the principal causes of unsustainable utilization while the second category of actors may be addressed through economic valuation studies of this kind, that highlight these benefits.

As wetlands become degraded, livelihood and communities welfare become progressively weakened (Andrew, 2012), yet local communities in the wetlands are unlikely to conserve them in the course of their production activities. Economic incentives present a valuable tool for both nature conservation and sustainable livelihood development (Emerton, 2000; Robert, 2002). Incentive-based regulations should be adopted by developing countries, owing to their cost effectiveness than the traditional forms of command and control approach which only rely on enforcement of regulations. Such approaches should include the use of direct economic incentives that include property rights (in form of leases, or concessions) that enable the formation of conditions under which communities will benefit from the wetlands and therefore have a stake in their conservation, performance bonds or subsidies upon environmentally friendly activities.

Where incentives fail to change people's behavior in promoting sustainable wetland utilization, then disincentives should be used (Karanja et al., 2001; Andrew, 2012). These may include taxes, charges, fees, fines for unacceptable levels of degradation and tradable permits (Emerton, 2000; Robert, 2002) to local level land holders who prefer to give up their lands in wetlands to unsustainable wetland utilization activities. However, these should be refundable against proper sustainable wetland utilization.

Ironically, some progress has been made in this direction by Environmental Monitoring and Regulatory Agencies like the National Environmental Management Association (NEMA) where charges are levied at the local level for unsustainable wetland use, but these do not reflect the full level of economic costs of wetland degradation and therefore may not offer stringent penalty that would induce a positive change in people's behavior towards sustainable wetland utilization. These charges should be revised, to levels equivalent to the total estimated costs of wetland degradation highlighted in this study, so that they clearly appear as private or public expenditures that significantly affect private profits with great potential to change people's behavior about wetland utilization. Furthermore, the District

¹ Economic stress relate to macro economic problems: price inflation, volatile exchange rates, food shortages...

Planning Units should consider strengthening of community livelihood enhancement measures in order to reduce reliance on wetland resources. This may be done through the promotion of efficient harvesting technologies that will not only increase the value of raw wetland resources, but also provide the much needed employment and alternative incomes to the population engaged in wetland exploitation (Crafter, 1992; Mathoko, 2009; Macharia et al., 2010).

The future of African wetlands lies in a stronger political will to protect them, based on sound wetland policies (Kirsten, 2005). This will has been created through the development of a fairly comprehensive ²wetland legislation. Although these institutions exist, their effective functionality is hampered by inadequate funding and political interference (Sophie, 2007) Kampala, Uganda; Apunyo, Makerere University, Uganda). These institutions should be left to make independent decisions and execute their work with limited government or political interference.

Owing to the fact that the KMC wetlands are threatened by human induced activities and government driven reclamation for industrial and infrastructural development, their sustainable management requires stepping up strategies that emphasize community involvement in the planning and implementation of appropriate approaches. Ironically, this was the situation during the colonial period (before 1962), where much as wetlands belonged to the central government, the ³traditional institutions through monarchical systems played a big role in their protection, based on traditional beliefs and spiritual attachments (Apunyo, Makerere University, Uganda). However the reduction of traditional institutional powers over time is rendering communities to drop their attachments to such ecological resources. Such Community Based Participation is being revamped through the formation of Community Based Wetland Management Plans (CBWMP) though often faced with ailing funding challenges. Such community involvement in wetland conservation should be active in the planning and enforcement of conservation regulations. As earlier noted, this strategy registered formidable results in the central Kenya highland wetlands (Crafter, 1992; Mathoko, 2009; Macharia et al., 2010). However as urged

by Emerton et al. (1998), strict protection of these fragile ecosystems is rarely effective since it requires enforcement costs, bearing in mind that governments are already facing public sector deficits, with many sectors competing with wetlands for the scarce resources. Hence, there is need to establish innovative funding mechanisms for wetland conservation and management. These may come from charges, fines, bonds and deposits levied against unsustainable wetland utilization.

Conclusions

In reference to the findings of this study and the fore going discussion, the following conclusions and can be made;

Communities around the KMC wetlands benefit from direct goods and services through the utilization of wetland resources and through indirect values such as regulation and supporting services and the option values which are worth millions of dollars. This therefore implies that their protection and sustainable management is critical to the survival and welfare of the people who depend on them for their livelihoods and the reduction of Central Government and Local Administrations' expenditures and losses resulting from wetland destruction. Such losses should be incorporated into the decision making process so that they appear as private or public expenditures that significantly affect private profits with great potential to change people's behavior about wetland utilization. Protection of these wetlands could therefore be done through carrying out awareness campaigns about the KMC wetland economic values, development of land use plans that integrate economic values particularly in wetlands and riparian areas, the use of economic incentives and disincentives such fines, bonds, fees, tradable permits and taxes against unsustainable wetland utilization practices, ensuring independence of environmental institutions in decision making and the development of innovative funding mechanisms for wetland conservation and management.

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² Wetland legislation in Uganda comprises of the following; the National Wetland Policy 1995, the National Environmental Statute 1995, National Guidelines for Wetland Resource Developers 1995, and National Environment Regulations 2000

³ Traditional institutions in Uganda where subjects had strong attachments to natural resources include kingdoms particularly Buganda, Bunyoro. Attachments were in form of clans, spiritual beliefs and totems.

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