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RELEVANCE OF WETLAND ECONOMIC VALUATION IN UGANDA A CASE STUDY OF THE KIYANJA–KAKU WETLAND IN LWENGO, CENTRAL UGANDA

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ABSTRACT

This study examined the relevance of economic valuation of wetlands in Uganda. A case study was done on the Kiyanja-Kaku wetland in the Lwengo District in Central Uganda using a semi-structured survey. Three objectives were examined, i.e.: (i) To identify wetland ecosystem services in Uganda, (ii) To identify the economic valuation methods appropriate for wetlands in Uganda, and (iii) To value the clean water obtained from the Kiyanja-Kaku wetland. The wetland ecosystem services were identified as provisioning and regulating habitat, cultural and amenities services. The community had knowledge about 17 out of the 22 services as given by TEEB (2010). The economic valuation methods identified were market price, efficiency price, travel cost, contingent valuation, hedonic pricing, and production function and benefit transfer methods. These were appropriate for valuation of wetlands in Uganda, but only three methods, i.e. market price, contingent valuation and productivity methods, have been applied by researchers in Uganda so far. The economic value of clean water from the Kiyanja-Kaku wetland to the nearby community was established by using the market price of clean water the National Water and Sewerage Corporation charges for the water in Uganda to obtain the low value and the

market price of water from the survey was used to obtain the high value. The estimated economic value of clean water service for a household ranges from UGX 612174 to 4054733 (US$ 168.0-1095.0). The estimated economic value of clean water service from Kiyanja-Kaku wetland to the entire community ranges from UGX 2,732,133,000.0 to 18,096,274,000.0 (US$ 775,228.0-4,885,994.0).

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1. INTRODUCTION

Wetlands are one of the vital natural resources in the world on which the rural economy depends. The global cover of wetlands is 11% of the total area and their economic value is estimated to be in the range of US $3,418-10,898 ha^{-1}/y^{-1} (Woodward et al. 2001). Wetlands provide a range of services that are important to local communities as well as to the entire world. They sustain biodiversity and provide goods and services (Kakuru et al. 2013).

Wetlands have proved to be very important in the sustaining of food security through provision of food, e.g. fish, wetland edge gardened crops, fruits and others. They are also important in provision of incomes through sale of raw materials such as papyrus which is used for making mats, thatching houses and many other things. They also provide water for the different uses such as domestic use and irrigation of crops and play an important role in climate modification (Kakuru et al. 2013). The ecological and economic wealth of Uganda is reflected in its wetlands. which occupy 15% (31,400 km^2) of its land area. Wetlands are found in almost every district. Wetlands have a variety of values and services that contribute to the national economy (Ministry of Water and Environment 2009).

In Uganda over 70% of wetlands are used for three purposes simultaneously, i.e. 1) rearing of livestock, 2) water supply, and 3) harvesting of natural trees. Furthermore, wetlands filter pollutants and regulate the water flow, which is important in influencing the charging of ground water (Ministry of Water and Environment 2009).

In Uganda wetlands services are public goods meaning that one person's consumption of a service provided by a wetland does not deprive another person of the opportunity to use the same service. Examples of wetland services include flood control, water purification, and climate modification (Wamunga 2014). The economic theory calls for government intervention for provision of public goods and services as the private sector cannot provide such as there are no profits to act as a point of attraction. Hence the government has been involved in providing goods and services by ensuring dissemination of information and effectiveness of environmental awareness programs (Wamunga 2014).

Some experts in ecosystem management have argued that one of the solutions to curb the deterioration of ecosystem services is to engage the society as a whole in the acknowledgement of the monetary value of this natural capital (Lui et al. 2010). Laurans (2014) argues that valuation of ecosystems in monetary terms potentially enhances the collective choices of the community as regards the ecosystem services. Valuation has the potential to unveil the hidden values of ecosystems that policy and decision makers may put into consideration. Therefore, there is need to understand the wetland ecosystem services and identify the appropriate methods for valuation of the wetland ecosystem services in Uganda.

1.1 A case study on the valuation of wetland ecosystem services in Uganda

Kakuru et al. (2003) carried out a study on the total economic value of wetland products and services to determine (i) the economic value of the wetland resources, and (ii) the quantity of the economic benefits.

This was done for selected key wetland goods and services and the value was determined in monetary terms in order to demonstrate to wetland stakeholders the value of wetlands as resources. This would provide a guide to decision makers in regards to making difficult decisions when conflicts over natural resources arise. The survey took place in various wetland systems situated in areas which are representative of three of the five agro-ecological sites in Uganda, as shown in Table 1. These wetlands provide various benefits to local communities and to the entire world.

Table 1. Location of wetlands in the different ecological zones in Uganda

District	Wetland	Ecological zone
Wakiso	Nangabo, Mabamba, Mende	Lake Victoria crescent
Mbarara, Isingiro	Rucece, Lake Nakivale	South-western farmlands
Pallisa, Kibuku	Limoto, Gogonyo	Kyoga plains

In this valuation, the methods used to value wetland goods and services were three, i.e. the productivity method, contingent valuation and market price methods. The valuation of direct use values was obtained by applying the market price method to derive the economic value for resources in wetlands such as products from papyrus, fish, etc. The valuation of water usage was done by applying the productivity method. The contingent valuation was applied for the non-use values, e.g. water recharging, supply, breeding, habitat, etc. (Kakuru et al. 2013).

Lumbert (2003) defined ecosystem economic valuation as "the attempt to assign quantitative and monetary values to goods and services provided by environmental resources or systems, whether or not market prices are available to assist us" (p.1).

1.2 Problem statement

The use of ecosystem economic valuation of wetlands (from now on: EEV of Wetlands) is insignificant or non-existent in Uganda. This fact, along with other factors such as poverty, food insecurity, industrialization and population pressure are contributing to the rampant degradation of wetlands in Uganda.

The wetlands have been put under extreme pressure both in rural and urban areas despite the obvious value obtained from their presence. Wetlands are being encroached on to provide land for agriculture, settlement in towns, brick making and planting of exotic tree species, all leading to the conversion of wetlands. This has led to the reduction of the ecosystem services performed by wetlands. The wetlands are fertile and have water throughout the year and hence attract people to carry out agriculture for the continued production of food throughout the year (Kampala City Council 1997).

Kampala, the capital city of Uganda, is a case in point where wetland degradation has been identified as a big problem. Wetlands have the capacity to control floods but since they have been destroyed the water runoff cannot be controlled. This has led to frequent water logging in parts of Kampala such as Jinja-road, Nsambya, the clock–tower area, Bugolobi, and Nakawa. The water logging has highly interfered with movement within the city area (Kampala City Council 1997).

EEV of wetlands occupies a role in today's restoration, discussions, and conservation debates. It is therefore important to understand how EEV of wetlands is undertaken and how it can be used in the decision making system. EEV of wetlands can contribute to conservation of these fragile ecosystems by providing information for the decision making process regarding the value of wetland services. This information can be useful when it comes to making difficult choices in situations such as financial resources allocations (Wamunga 2014).

Therefore, the importance of this study is to engage the community in appreciating sustainable wetland management by attaching monetary value to the wetland resources and services, focusing on clean water service obtained from the wetland.

1.3 Overall goal

To set an economic value on wetland ecosystem services from the Kiyanja-Kaku wetland focusing on clean water service to households in the nearby community in Lwengo District-Central, Uganda.

1.4 Specific research objectives

(i) To identify wetland ecosystem services in Uganda.
(ii) To identify the economic valuation methods appropriate for wetlands in Uganda.
(iii) To value clean water service obtained from the Kiyanja-Kaku wetland by the nearby community in Lwengo District.

1.5 Research questions

(i) What ecosystem services are provided by the wetlands in Uganda?
(ii) What are the economic valuation methods appropriate for wetlands in Uganda?
(iii) What is the economic value of water supplied to the nearby communities of Kiyanja-Kaku wetland?

1.6 Significance of the study

A successful completion of the study would make available information on methods appropriate for economic valuation of wetlands in Uganda. The results would also be useful to environment managers to raise awareness on wetland restoration and influence the drafting of ordinances and byelaws on wetland conservation in the District.

The study would provide up-to-date references to academics that could carry out research on related topic. The study would have the potential to guide policy makers and decision makers when it comes to the conflicts over natural capital such as wetlands. The results of the study would be presented to the Lwengo District Council for discussion and approval of the wetland ordinance formulation.

2. METHODS

For objectives (i) and (ii) results were obtained by reviewing the available literature.
For objective (i) data on ecosystem services in the Kiyanja-Kaku wetland were also collected, which supplemented the available literature.

In reviewing the available literature, ecosystem services were identified and categorized as provisioning, regulating, and cultural and amenities and habitat services, as in the study by TEEB (2010) on the economics of ecosystems and biodiversity.

For objective (iii) questionnaires were administered randomly to 30 households (villagers) within and near the wetland to find out the different uses of water from the Kiyanja-Kaku wetland system, and water quantities used by households were obtained in 20 litre jerrycans. The respondents were residents from Kanyogoga, Kyandazima, and the Kyazanga Town Council. The market price method (Tietenberg 2012) was used to attach monetary value to water used for the different household activities. A value range was estimated by using: 1) a value obtained from the water tariffs charged by the National Water and Sewage Corporation representing the lower bound of the value range and 2) the market value obtained from a survey in Lwengo District, representing the upper bound of the range.

2.2 Data collection

A random survey was carried out from the 22nd to 23rd of June, 2015, in communities near the Kiyanja-Kaku wetland. The villages where the data were collected were: Kyandazima, Kanyogoga in Kyazanga Sub-County and the Kyazanga Town Council, as shown in Figure 1. Data on the quantity of water used for domestic activities, agriculture, livestock and brick making were obtained, as these were the major uses of water from the wetland by the households.

2.3 Data analysis

The results were compiled and analysed to determine the economic value of clean water service as an example of the multiple values that the wetland readily provides.

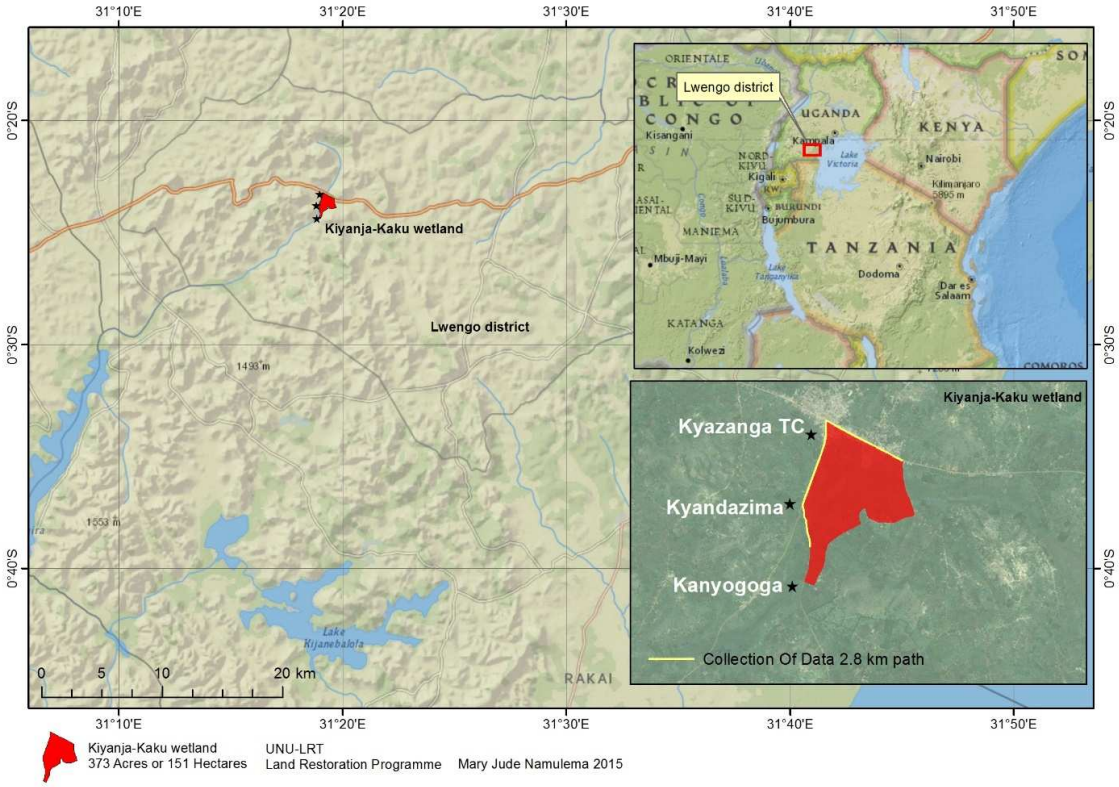

Figure 1. Map of Kiyanja-Kaku wetland where data collection took place in Lwengo in Uganda

The economic value of clean water service obtained from the Kiyanja-Kaku wetland by the nearby communities was established by multiplying the water quantity with the market price of a 20 litre jerrycan of water from the water company (National Water and Sewerage Corporation). For domestic use UGX 53 (US$ 0.01) was used for computation while for agriculture and livestock water use UGX 65 (US $ 0.02) was used to obtain the low value and UGX 400 (US $ 0.11) obtained from the survey was used for the high value. The total economic value for each category (domestic, agriculture and livestock) of water was obtained. There were 365 days for domestic and livestock water usage and 317 days for agriculture. The annual economic value of water for the sample population was computed by multiplying the economic values for each water quantity category by the number of days in a year. The mean annual economic value of water by households was obtained by dividing the annual economic value of water by the sample population 30. The mean annual economic value of water for a household was multiplied by the number of households (4463) within the affected community to get the total economic value of water for the entire community, which was given in a range with a low and high value as shown in Tables 2 and 3.

Lwengo District is a water stressed area where the water prices sometimes rise up to UGX 1000 (US $ 0.27) per jerrycan during prolonged droughts (Red pepper, 9th September 2015).

Table 2. Values used for the estimation of the economic value of clean water service to households from the Kiyanja-Kaku wetland in Uganda Currency in UGX**.**

No. of jerry cans	**Market** price	**Total price**	**Days per month**	**Econ.value** (month)	**Year (days)**	**Econ.value** (annual)	**Total** Econ.value	**Sample size**	**Household**	**No.of households**	**Economic value**
Domestic 320	53	16,960	30	508,800	365	6,190,400	18,365,225.0	30	612,174.0	4463	**2,732,133,000.0**
Agric. 455	65	29,575	26	768,950	317	9,375,275					
Livestock 118	65	7,670	30	230,100	365	2,799,550					
Total						**18,365,225.0**					

Table 3. Values used for the estimation of the economic value of water to households from the Kiyanja-Kaku wetland in Ugandan currency, UGX.

No. of jerry cans	**Market price**	**Total price**	**Days per month**	**Econ.value** (month)	**Year (days)**	**Econ.value** (annual)	**Total econ.value**	**Sample size**	**Household**	**Total households**	**Economic value**
Domestic 320	400	128,000	30	3,840,000	365	46,720,000	121,642,000.0	30	4,054,733.0	4,463	**18,096,274,000.0**
Agric. 455	400	182,000	26	4,732,000	317	57,694,000					
Livestock 118	400	47,200	30	1,416,000	365	17,228,000					
Total						**121,642,000.0**					

2.4 Study area

Location and description

The Kiyanja-Kaku wetland is located in Lwengo District between longitudes $31^0$10'E and $31^0$50'E and latitudes $0^0$20'S and $0^0$40'S. It occupies the following sub-counties: Lwengo, Malongo, Kyazanga and Ndagwe. The nearby trading centres are Kyazanga and Kyawaggonya. Its nearby villages are Kyazanga, Kyandazima, Kanyogoga and Kirumba. It is located along the Masaka-Mbarara road. The Kiyanja-Kaku wetland system has both permanent and seasonal wetlands with a swamp forest with an emerging lake which has attracted fishing in the area and it is the only source of water for the Kyazanga town council with a population of 15,531 people (Uganda Bureau of Statistics 2014).

It has grassland of spear grass (*Imperata* species), papyrus (*Cyperus papyrus*) and other Cyprus group and Typhus species. It has Sitatunga (*Tragelaphus spekii)* and ducks. It is internationally known as a breeding site for the crested cranes (*Balearica regulorum)* (Muheebwa 2012).

The current land use is hunting, settlement, grazing, harvesting vegetation and subsistence cultivation. Its physical and hydrological values are flood storage, moderation and trapping of sediments (Ministry of water and Environment 2002).

It is a source of raw-materials for crafts, domestic water, provision of water for livestock, source of mulch, fish and genetic materials, and it is a habitat for the grey-crowned crested cranes [*Balearica regulorum gibbericeps*] (Ministry of Water and Environment 2012).

3. FINDINGS OF OBJECTIVES (I) AND (II)

3.1 Review of wetland ecosystem services in Uganda

All of the wetland ecosystem services exist in Uganda, including provisioning, regulating, cultural and amenities and habitat services, as in the economics of ecosystems and biodiversity study by (TEEB 2010) and as shown in Table 4.

The provisioning services were: food, medicine, raw materials, genetic materials, ornamental uses and water. The regulating services were: air quality, climate modification, drought regulation, water purification, maintenance of soil fertility and control of soil erosion. The cultural services were: aesthetic, spiritual and recreational. The habitat services were: harbouring migratory species and maintenance of genes for both fauna and flora (TEEB 2010).

3.2 Review of economic valuation methods appropriate for wetlands in Uganda

Market price method

This method is used in the valuation of wetland resources that are directly obtained from the wetland ecosystem. Therefore, it is based on the exchange value the wetland ecosystem services

have in commercial trade, both in the local and the markets abroad. The exchange value is used to attach monetary value to the wetland goods and services. This method has been applied by Kakuru et al. (2013) to establish the economic value of wetland goods and services in Uganda. The market price method was used to attach value to goods directly obtained from wetlands such as fish, pastures, and papyrus.

Table 4. Main wetland ecosystem services in Uganda.

PROVISIONING ECOSYSTEM SERVICE	REGULATING ECOSYSTEM SERVICE	CULTURAL AND AMENITIES	HABITAT ECOSYSTEM SERVICES
Products obtained from the ecosystem: Fish, sand, clay, poles, water, medicinal herbs, gravel, thatching grass, wild fruits, transport, recreation.	Benefits obtained from the ecosystem processes: Water quality, water flow, water purification, water storage, flood control, water recharge, storm protection, micro-climate regulation, biodiversity conservation, shore stabilization	Non-material benefits obtained from the ecosystem of intrinsic significance: Cultural value, aesthetic value, heritage value, bequest value, existence value spiritual and inspirational value.	Maintenance of life cycles of migratory species such as the grey-crowned crested crane. Maintenance of the genetic diversity especially the gene pool protection.

Efficiency price method

In this method the use of market prices is put into consideration. The adjustments for the market failure and guiding principle distortions may be done where artificial prices may be obtained for goods that are not traded in the market. This method gives the true economic value to the entire society but the challenge is that the artificial prices may be rejected by the decision makers (Ramachandra & Rajinikanth (n.d.).

Travel cost method

This method is widely used during the estimation of the economic importance of recreational sites in terms of money. The method is applicable to national parks and wildlife in countries that are already developed. This technique determines the price the public is willing to pay for environmental benefits such as eco-tourism and recreation. The method requires having data on the funds and time spent by the users to visit the place. This method was applied in the valuing of the recreational uses of Pakistan's wetlands (Dehlavi & Adil 2011).

Contingent valuation method

This valuation method directly requires the community's willingness to purchase a service that is valuable to the community or the community is intending to recoup for withstanding a loss.

This method requires personal valuation to increase or reduce the amount of certain goods based on the predictable market. This aims at eliciting costs that are closely related to what would be seen if the real market was in existence.

This technique was applied to obtain the monetary value of the non-use values of the wetland such as flood attenuation and water recharge during the study of the total wetland economic value of wetland goods and services in Uganda (Kakuru et al. 2013).

Hedonic pricing method

This method portrays the ability to value some wetland services such as protection against storms and shore stabilization in relation to their impacts on the value of land with the assumption that the wetland services are reflected in the prices of the land. The method captures what people are willing to pay for the ecosystem benefit. Examples are clean air, an aesthetic view and water availability that can increase the value of the surrounding estates. This method was applied during the valuing in an urban wetlands study to establish the value of the water resources selected such as lakes and reservoirs on nearby property (Manhan et al. 2000).

Production function method

This method estimates the value as the inputs incurred during production. The method assumes that wetland resources are being used in production either directly or indirectly as inputs in protecting or supporting economic activity such as agriculture, fisheries and hunting.
This technique was applied by Kakuru et al. (2013) during the study of the total economic value of goods and services from the wetlands to value the water usage.

Benefit transfer method

The method estimates the economic value of the wetland ecosystem by transfer of information available from the wetland where a similar study was carried out on a wetland of interest. The method assumes that features in the two areas have no difference in terms of species diversity. An example is the value of a scene that includes a lake for a particular area that can have the estimates based on data from the study that are already in existence but of similar features in a place different from that where the previous study was done. However, it may be difficult to get relevant studies since many of the studies have not been published. This method was applied to wetlands in Saginaw Bay in Michigan in the U.S.A during the consideration of protection and restoration plans of wetlands located along the southern shore of Saginaw Bay (Ecosystem Valuation n.d.).

4. RESULTS OF THE SURVEY FOR OBJECTIVE (III)

4.1 Background information of respondents

The survey's respondents were 57% males and 43% women. The majority of respondents were from the age range of 26-32 years with the fewest 47 years and older, as shown in Figure 2. Of the respondents 46% were single, 47% married and 7% divorced. A majority of the respondents were farmers and business people, as shown in Figure 3.

Of the respondents interviewed, only a minority had had any education and the rest had never had any formal education.

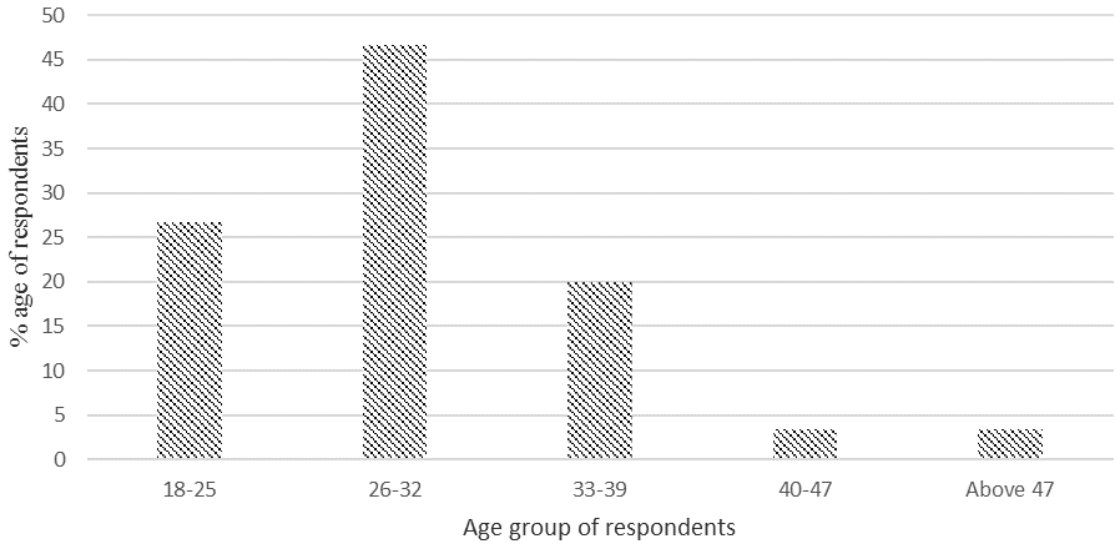

Figure 2. Respondents' age groups living within the nearby villages of Kiyanja-Kaku wetland in Lwengo District in Uganda.

In terms of household income two households earned a monthly income below UGX 50,000 (US$ 15), 14 households UGX 50,000-150,000 (US$ 15-47), 5 households UGX 160,000-300,000 (US$ 44-82), 5 households UGX 350,000-500,000 (US$ 96-137), while 4 households earned above UGX 500,000 (US $ 150), as shown in Figure 4. In terms of water consumption, 20 households collected water, 5 households collected and bought water, and 5 households only bought water from the Kiyanja-Kaku wetland, as shown in Figure 5.

Figure 3. The different occupations of the respondents within the nearby villages of Kiyanja-Kaku wetland in Lwengo District in Uganda.

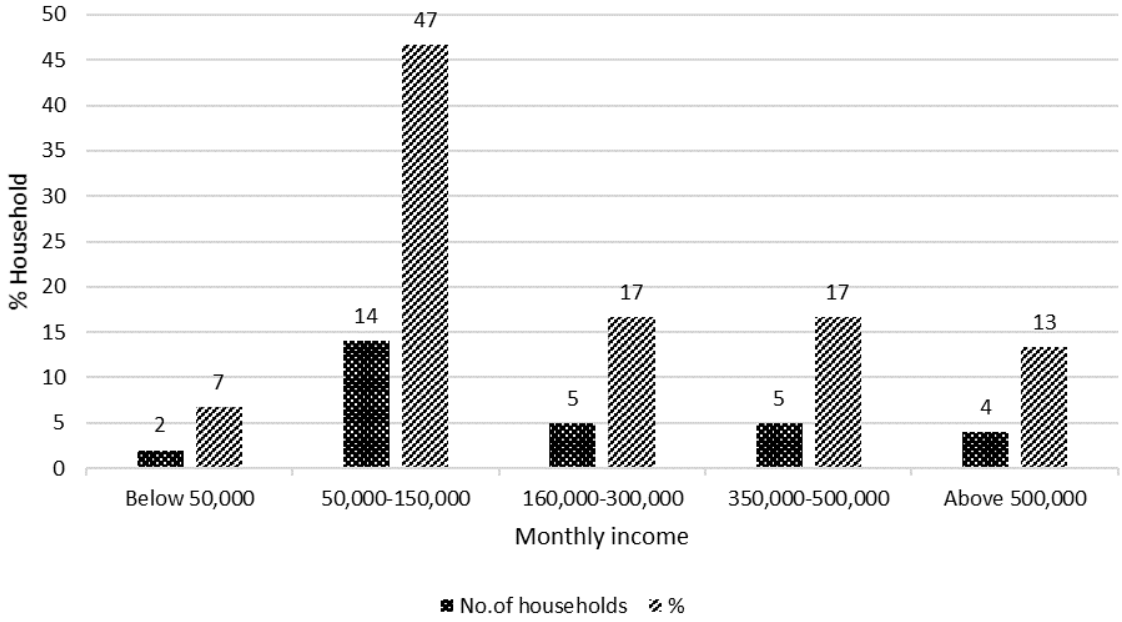

Figure 4. Respondents' monthly income in relation to the number of households in Lwengo District in Uganda.

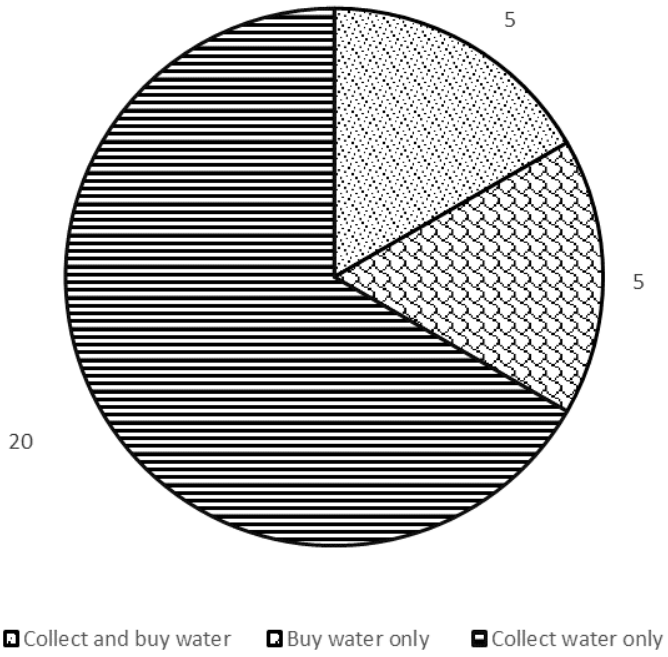

Figure 5. Households obtaining water either by buying it from salesmen or collecting from the Kiyanja wetland in Lwengo District in Uganda.

4.2 Daily average water consumption by household in relation to size

The survey showed that the average daily water consumption for household size with 1-5 members was 5 jerrycans for domestic activities, 18 jerrycans for agriculture, 3 jerrycans for watering of livestock. The average daily water consumption for household size with 6-10 members was 10 jerrycans for domestic activities, 9 jerrycans for agriculture and 6 jerrycans for watering of livestock. Household size with 11-15 members had an average daily water consumption of 17 jerrycans for domestic activities, 35 jerrycans for agriculture and 17 jerrycans for watering of livestock, as shown in Figure 6. Only one "household" had 30 people and consumed 120 jerrycans for domestic activities as it was in fact in the Kyazanga Uganda prison.

A household size of 1-5 consumes 5 jerrycans for domestic activities on average per day and household size of 6-10 consumes an average of 10 jerrycans for domestic activities, while a household size of 11-15 consumes an average of 17 jerrycans per day. This implies that water consumption increases as the household size increases, as seen in Figure 6.

4.3 The economic value of clean water service

The entire community depending on Kiyanja-Kaku wetland has 4463 households with a population of 18,210 people. This was obtained from the Uganda Bureau of Statistics 2012 for the community information system for the Lwengo District, and the population of the Kyazanga Town Council was obtained from the population census for Uganda 2014. The villages

considered were Kyandazima, Kanyogoga, Kyawaggonya, Kirumba and the Kyazanga Town Council in Lwengo District.

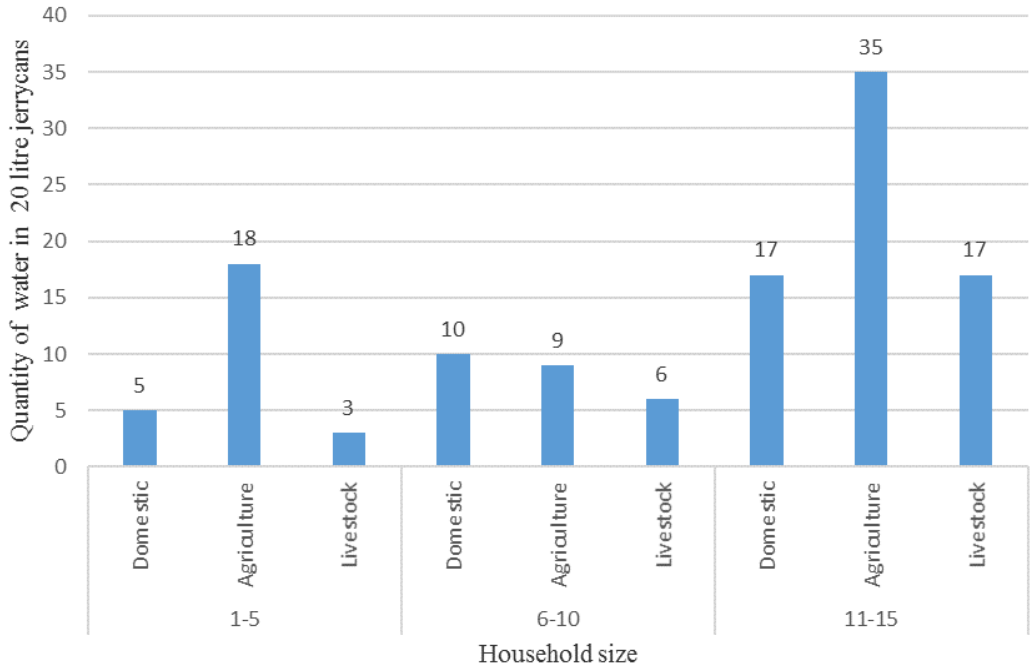

Figure 6. The average household water consumption in relation to household size in Lwengo District in Uganda.

The average economic value of clean water service for a household ranges between US$ 168.0-1095.0. The economic value of clean water service by the Kiyanja-Kaku wetland to the entire community was estimated to range from UGX 2,732,133,000.0 - 18,096,274,000.0 (US$ 775,228.0 -4,885,994.0) annually as per the exchange rates on 25/08/2015.

4.4 Degradation of the Kiyanja-Kaku wetland

During the household survey, respondents identified the existing forms of degradation of Kiyanja-Kaku wetland as: overfishing, crop cultivation, eucalyptus forest planting, spraying by use of herbicides, overgrazing, and pre-mature fishing, as seen in Figures 7, 8, 9, 10 and 11. In addition, the location of Kyazanga Uganda prison in the wetland was a main concern of the respondents as a threat to the wetland, as seen in Figure 7.

Crop cultivation, planting of eucalyptus and settlement by the prison and other individuals, and spraying of crops using herbicides were mentioned more frequently than other reasons as the major forms of degradation in the Kiyanja-Kaku wetland. A few respondents mentioned measures that the individuals and community had put in place to ensure the sustainability of the wetland. The measures were wetland edge gardening and community participation in wetland boundary demarcation in collaboration with the Lwengo District local government.

Figure 7. The settlement of Kyazanga prison, seen as a threat to the Kiyanja-Kaku wetland in Lwengo District in Uganda. (Photos: Issa Mugerwa - research assistant, June 2015). According to the survey, the respondents had not installed measures to ensure the sustainable utilization of the wetland because the community was not empowered to conserve the wetland. The Lwengo District local government could be helpful in the conservation of the wetland by ensuring frequent monitoring of the wetland, sensitization of the community to the wise use of the wetland, enforcing byelaws, and proper wetland boundary demarcations, as well as eviction of wetland encroachers.

Figure 8. Research assistants interviewing respondents in Kyandazima village in Kyazanga Sub-County in Lwengo District in Uganda.

Figure 9. Crop growing and spraying of crops with herbicides is a threat to the Kiyanja-Kaku wetland in Lwengo District in Uganda.

Figure 10. The Kiyanja-Kaku wetland is a potential source of fish for the community in Lwengo District in Uganda.

Figure 11. Eucalyptus forests as the major dangerous exotic tree species lowering the water table in wetlands in Lwengo District in Uganda.

5. DISCUSSION

Review of the available literature found that all the 22 ecosystem services provided by wetlands according to the TEEB study existed in Uganda's wetlands, as presented in Table 2. These wetland services are provisioning, regulating, habitat and cultural and amenity services. In addition to the data collected during the survey to supplement the existing information, the respondents mentioned 17 services in the Kiyanja-Kaku wetland out of the 22 services by the TEEB study, as shown in Table 5. The respondents did not mention five services probably because they were ignorant of them. It is also possible that the services that they didn't mention were not easily noticed due to lack of education. The ecosystem services which respondents had no idea about were inspiration for culture, cognitive development, art and design, biological control, pollination and soil erosion prevention.

During the review of the available methods for valuation of wetland resources it was found that all valuation methods are appropriate to wetlands in Uganda whereas only three methods have actually been used. The methods are contingent valuation, the market price method and the productivity method.

These methods have been applied by Kakuru et al. (2013) during the study of the total economic value of products and services obtained from the wetlands in Uganda. Kakuru et al. (2013) applied the contingent valuation method to value wetland non-use values, e.g. flood attenuation, water recharge and supply habitat and breeding. He further applied the productivity method to value the water usage and applied market price technique to value the wetland direct use values

by getting an estimate of the price in the commercial market for resources in wetlands such as products from papyrus, pastures and fish.

Table 5. The wetland ecosystem services provided by the Kiyanja-Kaku to the nearby community that were mentioned by households in Lwengo District in Uganda.

Provisioning services		Regulating services	
Service	No. of households	Service	No. of households
Food	25	Air quality	2
Medicine	16	Climate modification	3
Raw materials	22	Drought regulation	2
Genetic	4	Water purification	2
Ornamental	7	Soil fertility	5
Water	9	Soil erosion	1
Cultural services		Habitat services	
Services	No. of households	Services	No. of households
Aesthetic	2	Migratory species	1
Spiritual	2	Gene maintenance	3
Recreation	2		

However, the method used in this study was different from the method applied by Kakuru et al. (2013) to attach value to water from the wetland as he used the productivity method to attach value to the use of water while this study applied the market price method to attach prices to the quantity of water consumed by the sample households.

In the survey, the respondents interviewed were 43% females and 57% males and according to the gender roles the females mentioned ecosystem services such as getting fish for sauces, herbal medicine, papyrus for making crafts and many others whereas the men frequently mentioned benefits such as obtaining clay for pottery and construction, fishing and brick making.

The majority of the respondents were of the age range 26-32 and this implied a productive age group which could adopt alternative income generating activities other than overdependence on the wetland for destructive activities such as crop cultivation and planting of eucalyptus, which contribute to the drying up of water in the wetland. The majority of the respondents or 86.7% had no formal education and only 13.3% had attained an ordinary secondary level. Based on results from the survey, this implied a high level of illiteracy of the community and thus posed a threat to the wetlands as to a way for survival.

Uganda's poverty line is UGX 4,403 (US$ 1.20) per day and according to the household monthly incomes revealed in the survey, the majority of the respondents earned from UGX. 50,000-150,000 (US$ 15-47). This implied that half of the community lived below the poverty line and therefore needed the wetland for survival (New Vision, 19th March, 2013).

According to household water consumption, 20 households collected water, 5 households bought water and 5 households bought and collected water from the wetland, which implies that the community greatly relied on the wetland for its survival as the only source of water for the community.

The study only established the economic value of clean water consumed by the entire community as one of the multiple values available on which to base an economic valuation of the wetlands. This implied that if all the wetland services were assigned values, the total economic value would be substantially higher.

Results showed that the Kiyanja-Kaku wetland was valued as a major source of water for the nearby community. It was noted that the wetland also provides other important ecosystem services such as provisioning of fish, mulch and papyrus, regulating ecosystem services such as water purification, flood control, maintenance of soil fertility, cultural services such as provision of spiritual values, and habitat services such as provision of a breeding site for the grey-crowned crested crane, which is the national emblem of Uganda.

The limitation to this study was that the sample size was small so if more samples could be taken from the rest of the villages it would give a more accurate value.

6. CONCLUSIONS

It is rather important for the community to understand the wetland ecosystem services for the sustainable utilization of wetlands in Uganda. Therefore, this requires collaboration of all stakeholders to ensure the sustainable use of the wetlands.

The methods that have been applied in Uganda by researchers are contingent valuation, the productivity function and the price market method. This study also found other wetland valuation methods appropriate for valuing Uganda's wetlands. However, these have not yet been applied by researchers in Uganda though they have been applied elsewhere in the world.

The average economic value of clean water service to households from the wetland ranges from UGX 612,174.0 – 4,054,733.0 (US$ 168.0 - 1095.0) where the upper bound is close to the average annual household income in Uganda of UGX 3,668,536 (US$ 1002.0) and hence shows how important the wetland is to the community. The economic value of clean water service for the affected community ranged from UGX 2,732,133,000.0-18,096,274,000.0 (US$ 775,228.0 - 4,885,994.0). Therefore, if the total economic valuation of the wetland services had been estimated the value would be higher.

Globally, the wetland ecosystems have important values, functions and uses which are beneficial to both the local society and the entire world. However, wetlands are being increasingly threatened due to the rampant degradation mainly caused by poverty, population pressure, industrialization and agricultural production, urban encroachment for settlement leading to over harvesting, and depletion as a result of over-reliance on wetland resources. Since the wetlands are public goods in Uganda, they need to be managed sustainably for the entire community to benefit from the ecosystem services. This calls for the community's involvement in attaching economic values to wetland resources to ensure sustainable wetland management.

6.1 Recommendations

- According to the information collected from the respondents, the central government should collaborate with the local governments to demarcate all the wetland boundaries together with the community's involvement to reduce the encroachment on wetlands. There is need for the local governments to conduct frequent monitoring of the wetlands to ensure compliance with the wetland policy.

- Furthermore, community sensitization should be done through various media such as newspapers, radio, television and others like public education campaigns to ensure that the community is well versed on the wetland benefits, policies, byelaws and ordinances to ensure that wetlands are sustainably managed. The community should also be well versed on the wise use of wetland for the sustainable supply of water to the community.

- Since wetland management in Uganda was decentralized to the local governments, there is a need for community empowerment in conservation of the wetlands. There is need for the government to invest in economic valuation of wetlands to assist in the policy and decision making during difficult situations such as the allocation of the resources to the sectors.

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APPENDIX 1

HOUSEHOLD QUESTIONNAIRE ON CLEAN WATER OBTAINED FROM KIYANJA-KAKU WETLAND SYSTEM BY THE NEARBY COMMUNITIES IN LWENGO DISTRICT.

I am Mary Jude Namulema. I am carrying out a research with United Nations Land Restoration Training Programme in Iceland - Europe with an objective of quantifying the use of clean water and other wetland benefits obtained from Kiyanja-Kaku wetland and with the overall goal of obtaining the market value of the clean water provisioning service to the households. Clean water provision is one of the valuable wetland ecosystem services for wetland sustainable management. Thank you

Date……..
Questionnaire number……..

(i) Please tick the appropriate box provided where applicable write your answer in spaces provided.

1.Location……Parish……sub county…….

2. **Socio-economic characteristics**

Sex of the respondent

Female ☐ Male ☐

2. Age (in years)

18-25 ☐ 26-32 33-39 40-46 ☐ >47 ☐

3. Education level

Below primary level ☐ 0 level ☐ A level ☐ Tertiary level ☐

4. Occupation of respondent
……
……

5. Marital status

Single ☐ Divorced ☐ Married ☐

6. Size of the house hold
……..

Water use in the house hold.

7. Complete the table below by filling in the relevant information (probe to get as many answers as possible)

No	Use of water	Quantity of water In Jerrycans per day (20 litres)
1		
2		
3		
4		
5		
6		

8. Apart from obtaining water from the wetland do you get other benefits such as medicinal herbs, irrigation water, clay, flowers, fish, papyrus, etc. from the wetland? Provide as many as possible as possible.
……
……
……
……
……

9. Have you noticed any form of degradation such as crop cultivation, overfishing, construction, planting eucalyptus etc. in Kiyanja-Kaku wetland? If yes what are they?
……
……
……
……

10. Have you put in any measures to ensure sustainable management of the wetland? If yes what are they?
……
……
……
……

11. Do you think community involvement is needed to conserve the wetland? If yes in what ways?.....
.....
……
……

12. According to your earnings what is your average monthly income?
a) 50,000-150,000/= b) 160,000-300,000/= c) 350,000-500,000/=

Others

Specify……

13. Do you buy water obtained from the wetland? *If no go to question no. 15.*

14. (I) if yes how much do you pay for a jerry can of water? (Please tick)

a) 100-300/= b) 400-500/= c) 500-700/= d) 800-1000/=

15. How much time (in minutes) do you take to collect water from the wetland?
……
……

16. Do you think Lwengo District local Government can be helpful in conserving the wetland? If yes in what ways?
……
……
……
……

Thank you.