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Assessing Wetland Degradation in a Growing Urban Area: Case of Nsooba in Kampala, Uganda

Ali Warsame, Suzan Luyiga & Oluwole Akiyode

Biological and Environmental Sciences Department,
School of Natural and Applied Sciences
Kampala International University,
Kampala, Uganda

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Abstract
Increasing population and urbanization of most of the cities with their continuous socio-economic development and experiences put pressure on the components of the environment that are essential for their sustainable development. This includes urban wetlands which are parts of the veritable resources for the sustenance of societal ecosystems. This study assesses the process of wetland degradation in Nsooba, Kampala through the identification of the current anthropological activities that encourage the wetland degradation and also examined the levels of the water quality in its pools during the dry and wet seasons. This was done through questionnaire administration and physicochemical analysis. The study identifies the prevalence of constructions activities in the wetland area which crippled the flow of its stream. The results of the physicochemical analysis of the water quality of the pools/channels depicted that the pH values of both the wet and dry seasons were within acceptable limits while the Biochemical Oxygen Demand (BOD_5) was above the acceptable limits during the wet seasons signifying moderate organic pollution. In the end, the study advocates the need for the Kampala Capital City Authority (KCCA) to develop a framework that will encourage the sustainability of the city wetlands. This includes enforcement procedures that will control and stop the destructive anthropogenic activities that pervade the wetlands in the city

1.0 Introduction

The sustainability of most areas has been affected by humans and their societal developmental processes (Akiyode, 2010, 2013; Ayeni, 2017; Soyinka & Siu, 2018). Consequently, the increasing population and urbanization the cities with their continuous socio-economic development and experiences put pressure on the components of the environment that are essential for their sustainable development. This includes urban wetlands which are parts of the veritable resources for the sustenance of societal ecosystems. The urban wetlands are known to be indispensable in encouraging human livelihoods opportunities as well as supporting well-being (CBD, 2015; EPA, 2018).

Thus, the importance of wetlands in urban society cannot be overemphasised as a dynamic natural resource that provides socio-economic, socio-cultural, ecological, recreational, and scientific services to society (Gideon & Bernard, 2018). They are exceptional productive ecosystems where aquatic and terrestrial habitats encounter themselves with a role of maintaining many natural cycles that support an extensive range of biodiversity apart from serving as a natural sponge against drought and flooding (CBD, 2015). Thus, they support plant and animal life, thereby encouraging the provision of food. They help in sediment transport and also controls erosion (EPA, 2018; Yoon, 2009). They influence water security through purification and treatment systems that boost clean water for society (Agboola et al., 2016). They also act as a sink to carbon thereby regulating the climate (Hesslerová et al., 2019).

However, there has been a continuous loss and, degradation of wetlands globally in the present day which limits most of the society from fully partaking of their invaluable benefits. Hence, the foremost indirect drivers of wetland loss and degradation in different parts of the world are primarily the continuous growth of population and the increasing socio-economic development while the direct drivers include infrastructure development, land conversion, water withdrawal, eutrophication and pollution, overharvesting, and overexploitation (MEA, 2005). Though, in most growing cities in developing economy countries, urbanisation that is accompanied by land-use and land cover changes, reclamation, and pollution is the chief primary cause of increasing wetland degradation which stimulates urban ecological insecurity through its adverse effects on human and societal health, regional climate, and biodiversity (Bai et al., 2013; Sithole & Goredema, 2013).

Uganda is currently transiting from a predominantly rural setting to a fast-urbanising country in the East African region (Stewart-wilson et al., 2017). Hence, the level of urbanisation of Uganda is around 18%, but Kampala the capital city contributes about 40% to the country's urban population (GOU, 2017). Kampala's rate of urbanisation is between 5.2 and 16% (Bidandi & Williams, 2017). There has been a continuous increase in the population of Kampala city because of its administrative and socio-economic influence on every part of the country. Records from the main report of the Uganda Bureau of Statistics *"National Population and Housing Census 2014"* shows that there was an increment of 53% in the number of people residing in Kampala between 1999 and 2002 and 21.1% increment between 2002 and 2014 (Akiyode, Tumushabe, & Abdu, 2017; UBOS, 2016). Hence, the city population grew from 24,000 people in 1948 to 1.65 million in 2019 and its present yearly population growth rate is 4.03% (KCCA, 2019; Mukiibi, 2012).

The process of urbanisation in the country as a whole has not been appropriately guided and planned, so it tends towards organic development of unplanned urban societies that are characterised by land-use disorder and growth of urban sprawl with inadequate integrated planning that increases their environmental insecurity (GOU, 2017). Therefore, the continuous loss and degradation of laudable environmental resources like wetlands in Kampala city may be attributed to continuous urban development (Kasimbazi, 2018). This may also be encouraged by inadequate development of wetlands inclusive and sustainable policies by stakeholders alongside a failure to enforce laudable urban developmental planning laws in the growing cities (Turyahabwe et al., 2017). Thereby, there has not been adequate control of human activities on wetlands in the city. Consequently, wetlands in Kampala city which include Nsooba the case study has been subjected to human encroachment with impacts on their invaluable ecosystems. Hence, this study assesses the process of wetland degradation in Nsooba, Kampala through identification of the current anthropological activities that encourage the wetland degradation and assessed the levels of its water quality during the dry and wet seasons.

2.0 Materials and Methodology

Study Area

Nsooba is situated at an elevation of 1169 meters above sea level in Kampala city with coordinates of 0° 21' 1.8"N and 32° 34' 3" E in the north of Mulago and Bwaise. The catchment area is represented in Fig. 1

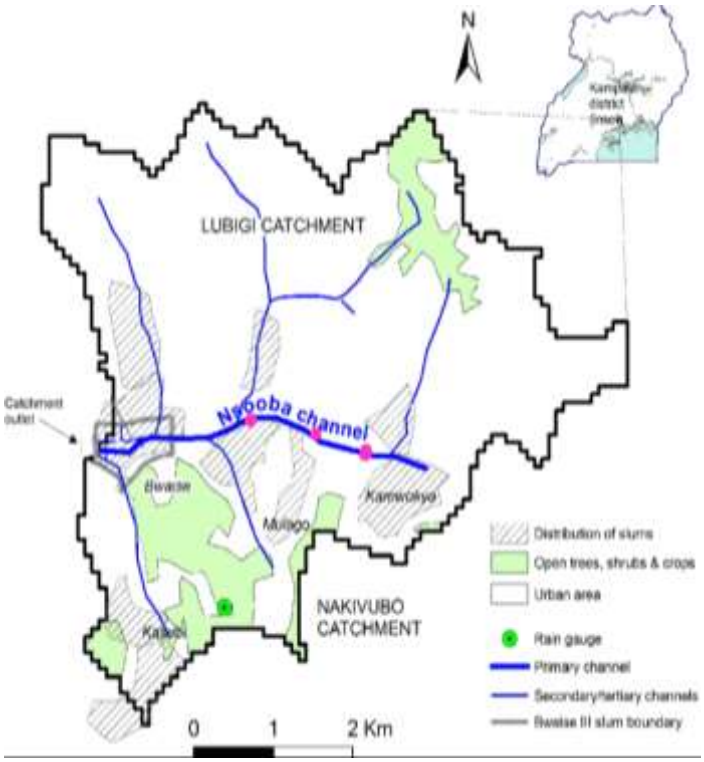

Fig. 1 Map of Nsooba Wetland alongside its Catchment Area Showing the Sampled Area (the pink dots show the sampling points)

3.0 Data Collection

The study utilized a mixed research method using both qualitative and quantitative techniques. It administered 103 questionnaires to randomly chosen adult member of households in the study area with the view of analysing their socio-economic characteristics anthropogenic activities that supports degradation of wetland. Also, face-to-face interviews were conducted on purposively chosen stakeholders. This included local council representatives, community leaders, and government officials to elicit information on the past and present stages of the wetland. Samples of water were collected during dry and wet seasons for physicochemical analysis from three pools in the wetlands that were in proximity to a marketplace, an **abattoir**, and a garage to assess their levels of pollution between July 2019 and December 2019. Data gathered from the questionnaires were subjected to analysis using the IBM SPSS (Statistical Package for Social Science) while the face-to-face interviews of stakeholders were reviewed for emerging issues.

4.0 Results and Discussions

(i) Socio-economic Characteristics

80 questionnaires were retrieved back from the respondents and 45 respondents (56.25%) were male while 35 were female (43.75%). The age classification depicts that the majority of the respondents (88.75%) were between 18 and 42 years while 9 respondents (11.25%) were above 42 years of age. This age of the respondents is represented in table 1.

Table 1 Age Classification of Respondents (n=80)

Age in Years	Number of Respondents	Percentage
18-23	7	8.75
24-28	14	17.50
29-32	15	18.75
33-37	17	21.25
38-42	18	22.50
43 above	9	11.25
	80	100

78 respondents (85%) were having more than primary education. This implies that majority were literate in the English language used in the questionnaires. Also, the study analysed the period of tenancy of the respondents to assess their ability to give relevant information about the wetland. It was discovered that about 87.5% of the respondents had resided in the community above 1 year, while 72.5% of the respondents had resided in the community for above 3 years. Therefore, the majority of the respondents may have adequate information on the wetland. Table 2 represents the period of tenancy of the respondents in Nsooba.

Table 2 Respondents Period of tenancy in Nsooba (n=80)

Years	Number of Respondents	Percentage of Respondents
Less than a year	10	12.50
1-3	12	15.00
3-5	20	25.00
5 years and above	38	47.50
	80	100.00

The study analysed the commonest socioeconomic activities that were carried in and around Nsooba wetland. 37.5% of the respondents indicated construction business, 28.75% stated small business (i.e., restaurants/ chapatti vendors), 11.25% specified subsistence farming and 22.5% stated small industries

and garages. Likewise, the occupation of the respondents was analysed. It was discovered that 28.75% of the respondents were builders (i.e., into construction), while 25% were involved in businesses, 20% were civil servants and 15% were farmers while 11.25% were virtually not employed. Thus, close to three-tenths of the respondents were builders or construction workers while about four-tenths of the socio-economic activities were affirmed to be commonest in the community. This suggests that construction activities is prevalent in the wetland.

The study also assessed the perception of the respondents on the importance of the wetlands. 60 respondents (75%) acknowledged the indispensability of the wetland while 20 respondents (25%) were in denial. Since about three-quarters of the respondents affirmed the indispensability of the wetland, it suggests that there may be acceptance and support of the majority of the community to the laudable programmes by relevant authorities for the sustainability of the wetland.

The study identified the anthropogenic activities that were engaged in the community leading to the destruction and degradation of the wetlands. Thus, 78.75% of the respondent identified the construction of houses as a wetland destructive anthropogenic activity in their community, 40% indicated farming, 38,75 stated landfilling, 32.50% specified bricklaying industries, and 18.75% fingered domestic solid waste.

(ii) Physicochemical Characteristics

The levels of the water quality of the Nsooba wetland were assessed and characterised during the dry and wet seasons and compared to the standard specified by the Ugandan National Environmental Management Authority (NEMA). Water samples were collected from 3 pools S1 (upstream), S2, and S3(downstream) as indicated in figure 1 for physicochemical analysis**. The** three pools were in proximity to a marketplace, an **abattoir**, and a garage. The flow of the stream has been cut short due to interference from construction sites. The results of the physicochemical analysis are presented below in table 3

Generally, the analysis of the water from the pools shows that pollution was more in the dry season than in the wet season. However, the quality of water in the selected points in the wet season may be subjected to dilution by rainwater since the channels were cut off from flowing by constructions and landfilling processes on its path. Hence, the turbidity, electrical conductivity, and colour were within acceptable limits in the wet season. The pH values of both the wet and dry seasons were within acceptable limits while the Biochemical Oxygen Demand (BOD_5) was above the acceptable limits during the wet seasons signifying moderate organic pollution. Thereby, the result suggests that the pools/channels were polluted from the point sources.

Table 3 Nsooba Wetland Water Physicochemical Analysis

Parameters	**Site 1**		**Site 2**		**Site 3**	**Standard**	
	Wet	Dry	Wet	Dry	Wet	Dry	NEMA
Turbidity	115.4±102	500	181.4±107	615	186±135	710	300
pH	7.7±0.36	8.1	7.8±0.31	7.8	7.8±0.30	8.0	6.5-8.5
EC (μScm^{-1})	621.3±74.6	1680	627±147.3	1491	622.3±140.0	1723	1200
Colour (PtCo)	174±110	700	334.7±116.6	833	234.3±75.3	897	
BOD_5 (mgl^{-1})	30±4.1	-	35±36	-	40±10	-	50
Alkalinity (mgl^{-1})	-	1250	-	941	-	1363	-

(S1-near to an abattoir S2- near a garage S3- near a market)

5.0 Conclusion and Recommendations

The study identifies that there were continuous destructive anthropogenic activities carried out in Nsooba wetland. This has been attested to by the socioeconomic activities carried out in the area. Constructions are ongoing in the Nsooba wetlands area. The flow of the stream has been crippled by construction activities. Also, the results of the physicochemical analysis of the water quality of the pools/channels depicted moderate organic pollution. This shows the laissez-faire attitude of the government and Kampala Capital City Authority towards the sustainability of the city wetlands.

The sustainable management of the urban wetland is part of the resources that are essential for the sustenance of the city's environmental integrity that is crucial for sustainable development. There is need for the Kampala Capital City Authority (KCCA) to develop a framework that will encourage the sustainability of the city wetlands. This includes enforcement procedures that will control and stop the destructive anthropogenic activities that pervade the wetlands areas in the city. This includes the implementation of city planning laws that limits construction on the wetlands area.

Though, the study discovered that about three-quarters of the respondents acknowledged the importance of the wetlands. However, the socio-economic activities in their community were counterproductive to the sustenance of the wetland. This shows that their knowledge is limited. So, there will be the need for community sensitization on the indispensability of wetlands by the joint efforts of the KCCA, NEMA, and the environmental NGOs in the city. This will increase citizenry knowledge for

wetlands preservation and sustainable usage so that the communities within the city will be able to partake of their invaluable benefits. The wetland mitigation processes should be emphasised and encouraged by the Ugandan government and KCCA through the engagement of experts for the continually degraded wetlands in the city to sustain their environmental resources.

Declaration of conflict of interest

None

References

Agboola, J. I., Ndimele, P. E., Odunuga, S., Akanni, A., Kosemani, B., & Ahove, M. A. (2016). Ecological health status of the Lagos wetland ecosystems: Implications for coastal risk reduction. *Estuarine, Coastal and Shelf Science*, *183*, 73–81. https://doi.org/10.1016/j.ecss.2016.10.019

Akiyode, O. O. (2010). Urban Environmental Security in Developing Economy Mega-city: A Case Study of Lagos, Nigeria. *Journal of Sustainable Development in Africa*, *12*(5), 294–304.

Akiyode, O. O. (2013). Implications of Urbanization on Environmental Security in Developing Economy. *Journal of Sustainable Development in Africa*, *15*(3), 102–113.

Akiyode, O. O., Tumushabe, A., & Abdu, Y. A. (2017). Urban Environmental Security in a Continuously Growing City in Sub-Saharan Africa in the Climate Change Era : A Case of Kampala, Uganda. *American Journal of Environmental Policy and Management*, *3*(4), 24–30.

Ayeni, A. O. (2017). Increasing Population, Urbanization, and Climatic Factors in Lagos State, Nigeria: The Nexus and Implications on Water Demand and Supply. *Journal of Global Initiatives: Policy, Pedagogy, Perspective*, *11*(2), 69–87.

Bai, J., Xiao, R., Zhang, K., Gao, H., Cui, B., & Liu, X. (2013). Soil organic carbon as affected by land use in young and old reclaimed regions of a coastal estuary wetland, China. *Soil Use and Management*, *29*, 57–64. https://doi.org/10.1111/sum.12021

Bidandi, F., & Williams, J. J. (2017). The terrain of urbanisation process and policy frameworks: A critical analysis of the Kampala experience. *Cogent Social Sciences*, *3*(1,1275949). https://doi.org/10.1080/23311886.2016.1275949

CBD. (2015). Wetlands and Ecosystem Services. Convention on Biologicla Diversity (CBD). Retrieved from www.cbd.int

EPA. (2018). Why are Wetlands Important? Retrieved June 7, 2021, from https://www.epa.gov/wetlands/why-are-wetlands-important

Gideon, O. J., & Bernard, B. (2018). Effects of Human Wetland Encroachment on the Degradation of Lubigi Wetland System, Kampala City Uganda. *Environment and Ecology*, *6*(6), 562–570. https://doi.org/10.13189/eer.2018.060606

GOU. (2017). *The Uganda National Urban Policy: Transformed and Sustainable Urban Areas*. Ministry of Lands, Housing and Urban Development, Republic of Uganda (GOU). Retrieved from mlhud.go.ug

Hesslerová, P., Pokorný, J., Huryna, H., & Harper, D. (2019). Wetlands and Forests Regulate Climate via Evapotranspiration. In S. An & J. T. . Verhoeven (Eds.), *Ecological Studies* (Vol. 238, pp. 63–93). Springer Nature Switzerland. https://doi.org/10.1007/978-3-030-14861-4_463

Kasimbazi, E. (2018). Urban Expansion in the Greater Kampala Metropolitan Area, Uganda. In *Strengthening Environmental Reviews in Urban Development* (pp. 1–60). UN-Habitat.

KCCA. (2019). Statistical Abstract for Kampala City, 2019. Kampala Capital City Authority (KCCA). Retrieved from https://www.kcca.go.ug/media/docs/Statistical-Abstract-2019.pdf

MEA. (2005). *Millenium Ecosystem Assessment (MEA). Ecosystems and Human Well-being: Wetlands*. DC: World Resources Institute.

Mukiibi, S. (2012). The Effect of Urbanisation on the Housing Conditions of the Urban Poor in Kampala, Uganda. In *Second International Conference on Advances in Engineering and Technology* (pp. 37–42). Nodia, India. Retrieved from http://mak.ac.ug/documents/Makfiles/aet2011/Mukiibi.pdf

Sithole, A., & Goredema, B. (2013). Building in Wetlands to Meet the Housing Demand and Urban Growth in Harare. *International Journal of Humanities and Social Science*, *3*(8), 193–201.

Soyinka, O., & Siu, K. W. M. (2018). Urban informality, housing insecurity, and social exclusion; concept and case study assessment for sustainable urban development. *City, Culture and Society*, (June), 1–14. https://doi.org/10.1016/j.ccs.2018.03.005

Stewart-wilson, G., Sewankambo, N., Muwanga, Nansozi, K., &

Kasimbazi, E. (2017). Owning Our Urban Future: The Case of Kampala City.

Turyahabwe, N., Tumusiime, D. M., Yikii, F., Kakury, W., & Barugahare, V. (2017). Awareness, perceptions and implementation of policy and legal provisions on wetlands in Uganda. *African Journal of Rural Development*, *2*(2), 161–174.

UBOS. (2016). National Population and Housing Census 2014-Main Report. Ugandan Bureau of Statistics.

Yoon, C. G. (2009). Wise use of paddy rice fields to partially compensate for the loss of natural wetlands. *Paddy Water Environ*, *7*, 357–366. https://doi.org/10.1007/s10333-009-0178-6