INFLUENCE OF ANTHROPOGENIC ACTIVITIES ON WETLAND AS A HABITAT FOR SHOEBILL (BALAENICEPS REX) IN UGANDA. CASE STUDY LUTEMBE BAY WETLAND SYSTEM, WAKISO DISTRICT

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Introduction

Wetland ecosystems around the world make up approximately 6% of the world's land area (Turner, 1990). About 13% or 30,000 km2 of Uganda's total areas are covered by wetlands with areas of, swamp forest, grassland (seasonally flooded), grass swamps and papyrus (permanently flooded), and highland bog (NEMA, 2001). In Uganda wetlands are essential natural resources, offering a range of ecological functions, socio-economic, scientific, and recreational services (Wasswa et al., 2018). Economically, wetlands are a direct source of food products, water, and fuel to the well-being. From an ecological point of view, the wetland functions include habitats for wildlife such as shoebill bird (Balaeniceps rex) classified as vulnerable species by BirdLife International and listed under Appendix II of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Despite these benefits mentioned above, wetlands in Uganda are not continuously managed as natural capital worth of protection and investment (UNDP, 2009). Instead, they are degraded for agricultural farming, settlement, and industrial development, a move that is likely to cause irreversible environmental outcomes, harmful to wildlife and human welfare. Up to the year 2000 approximately 2376 km2 of wetland area in Uganda; have been converted into agricultural land, infrastructure, and industrial activities (NEMA, 2001). Specifically, in the Wakiso District, numerous wetlands have been reclaimed for alternative land uses, particularly for settlements and agricultural land. Land use of this kind has encroached on wetlands like Lutembe Wetland System and other wetlands in the Wakiso district.

Such incursions into wetlands are caused by insufficient knowledge of wetland values and the increasing population growth rate in Uganda, which is exacerbated by high levels of poverty (UNDP, 2009). The rapid growth of the settlement and industrial establishments has given rise to the violation of wetlands in the Wakiso district and its edges.

Methods and Materials

Data Collection: A series of orthorectified and cloud-free multi-temporal Landsat 4-5 Thematic Mapper (TM) images, downloaded on 20 February 1995, containing seven spectral bands of 30 m spatial resolution were used for bands 1, 2, 3, 4, 5 and 7. A series of Landsat 8 Optical Land Imager (OLI) scenes were used, and the downloaded images were acquired on February 9, 2020. Landsat 8 covers 10 spectral bands, of which bands 3 (green), 4 (red), and 5 (near infrared) are used. The year 1995 was used as the standard for the analysis because at that time Uganda's wetlands had not yet been trespassed. In this study, anthropogenic activities were limited to settlement (industrial and residential) and agricultural activities, as they contributed to wetland degradation.

Image classification: To separate the wetland land-use/cover class for each year was computed using the QGIS 3.16 Hannover software and EnMAP-Box plugin. Training data for wetland use/cover classification was collected by visual interpretation of high resolution, freely available satellite imagery for each subset of the 1995 and 2020 time periods. Random forest classification and accuracy assessment were performed for each period. Both classification results were subjected to a post-classification, where both results were calculated against each other.

Accuracy Assessment: Obviously, for errors originating from interpretation, the accuracy assessment based on the confusion matrix is considered to be between known classes of the collected reference points (over 200 points) rather than between classes of the categorical raster dataset. For each classified raster, a confusion matrix was generated from which values for overall accuracy, Kappa, errors of omission, and errors of the commission were calculated.

Year	Landsat sensors	Spatial resolution (m)	Band combination
20th.Feb.1995	Landsat 4-5 TM	30	2,3,4,5,7
09th.Feb.2020	Landsat 8 OLI	30	2,3,4,5,6,7

Results

In 1995, vegetation (papyrus) was the predominant type of wetland cover over 7.2 km2 (45%) of the Lutembe Bay wetland system. However, in 2020 there was a more significant change in the use/cover type of the Lutembe wetland, 4.0 km2 (25.72%). These changes are mainly reflected in the significant reduction of vegetated land due to subsistence agriculture (bare soil), which increased by 4.8 km2 (30.04%) in 2020. Between 1995 and 2020, there was a huge difference of about -3.0 km2 (-19.43%) in the total sample area of the Lutembe Bay wetland system (15.8 km2), mainly due to the continued loss of vegetation (papyrus).

Figure 1. : Spatial temporal Lutembe wetland system extents 1995-2020

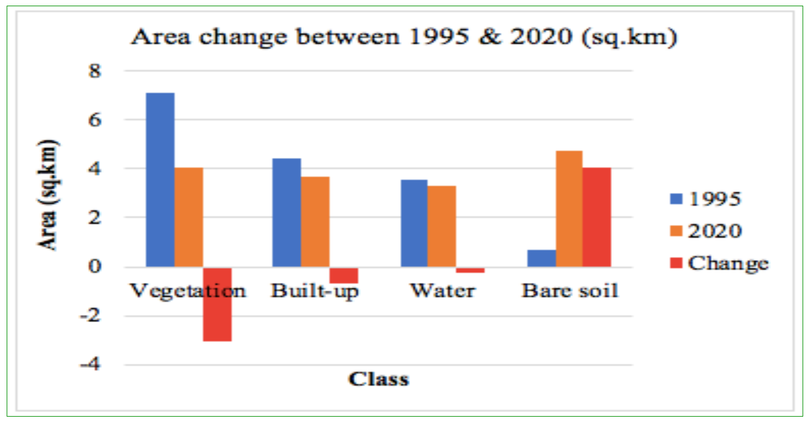
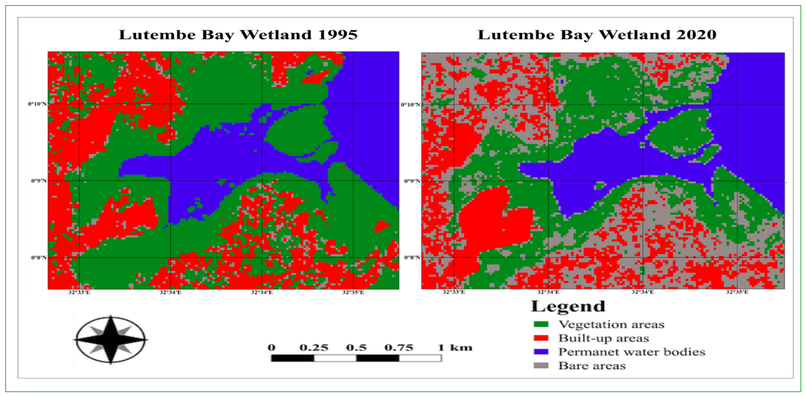


Figure 2. Classification map of Lutembe Bay Wetland Land Cover/Use for 1995 and 2020



Discussion

Infrastructural development and bare soils (settlements and farmland, respectively) can encroach on wetlands as a habitat for Shoebills and hydrologic alteration. These activities can degrade the water quality through sedimentation and turbidity increment into the wetland, which leads to change in the wetland elements causing the vegetation in the Lutembe wetland to change. Wetland vegetation, Papyrus (Cyperus papyrus) in particular, is known for creating a typical habitat for wildlife species (Byaruhanga & Ssozi, 2012). The observed losses in vegetation (papyrus) may affect the breeding patterns of shoebills, thereby leading to their migration to other wetland places. As noted by Pomeroy (2004), he stated that "the shoebill (Balaeniceps rex) has already been displaced due to the diminishing vegetation", Haberl et al. (2014) stated that conservation of these vulnerable wetlands not only enhance outdoor tourism but also revive the wetland as a habitat for wildlife.

The wetland as a habitat receives a large number of solid wastes and untreated sewage from the surrounding urban areas and industries. Noise pollution on the wetland birds and other wildlife can range from behavioral modification such as mild disturbances all these degrade the habitat and pose a great risk to the survival of shoebills inhabiting the Lutembe wetland.

Conclusions

The classification results indicated a significant growth of some land-use mainly bare soil and built-up during the study period, with a decrease in other land cover types, especially vegetation and water. It is a cause due to the rapid population growth that has triggered more urban expansion in Wakiso District.

In summary, built ups (houses, factories, and industries) and bare soil (agricultural activities/subsistence farming) on wetlands as habitats have a detrimental impact on the shoebill population. It's because industrial investors and farmers require to clear land for industries, houses, and agricultural practices; as a result of land reclamation, there is a rapid loss of land cover in particularly papyrus, vegetation needed for shoebill to survive. Therefore, there is a need to take critical measures to control the land use and conserve the environment in the Lutembe Bay Wetland System.

Figure 3. Proliferation of built-up areas (settlement) in Lutembe Bay wetland.

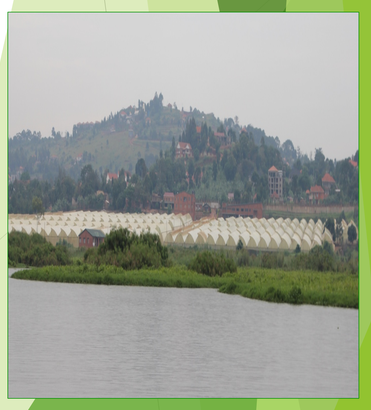


Figure 4. A flower factory site in Lutembe Bay Wetland

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References

1. Byaruhanga, A. and Ssozi, L. (2012). The impact of population growth on the ecosystems and biodiversity of Kampala: lessons for sustainable urban development. Presented at the conference for Sustainable Futures: Architecture and Urbanism in the Global South, Kampala, Uganda, 27-30 June.
2. Haberl, H., Mbow, C., Deng, X., Irwin, E.G., Kerr, S., Kuemmerle, T., Meyfroidt, P., Turner, I.I. and Billie, L. (2014). Finite land resources and land use competition. In: K.C. Seto and A. Reenberg (eds.) Rethinking Global Land Use in an Urban Era (Cambridge, MA: MIT Press), pp. 35-69
3. NEMA. (2001). State of Environment Report, Kampala-Uganda
4. Pomeroy, D. (2004). The birds of Makerere Hill, Kampala: a loss of biodiversity. Uganda Journal 48, 1-16.
5. UNDP (2009). Sustainable land management to combat desertification and land manage- ment. Extending wetland protected areas through community conservation and initiatives (COBWEB), Kampala, Uganda.