# Influence of Anthropogenic Activities on Nyangongo Wetland Ecosystem in Nyaribari Chache Sub-County, Kisii County, Kenya

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**Abstract**

*Wetlands are among the most productive ecosystems in the world as they perform diverse functions including; flood attenuation, recharge of underground aquifers, climate regulation, erosion control; water provision for human use as well as acting as habitat for wildlife. Nyangongo Wetland in Kisii County in Kenya covering an area of 825 hectares of land is a key life support system to communities in Lake Victoria Basin. The study was informed by the theory of tragedy of commons on free access to environmental resources .The main objective of the study was to assess the effects of human activities on Nyangongo wetland over the last 30 years. The study adopted a mixed-method consisting of Remote Sensing and GIS-based analysis, to determine Land Use and Land Cover dynamics and associated human-induced alterations in the wetland. 251 respondents were randomly selected for interviews in order to gather data on their overall perception of the wetland, which were corroborated by six Key Informant interviews conducted. The respondents observed that the wetland has been adversely affected by the high demand for agricultural products and pollution of water sources leading to limited access to clean water. Based on image analysis, we established that the areal extent of the wetland in the year 1984 was 72.85ha which had since shrunk to 17.37ha by 2017 demonstrating a drastic reduction of 76%. On the other hand, the area under vegetation reduced from 609.07ha (73.8%) to 148.86ha (18%) by 2017, while Farmland area increased from135.65ha (16.4%) to 473.85ha (57.4%). Built-up area which used to be 7.65ha (0.9%) in 1984 expanded to 185.14ha (22.4%) by 2017 due to population pressure. Loss of biodiversity was identified as the most significant negative environmental effect of Nyangongo wetland as it lost more than 460.21ha of vegetation due to agriculture expansion and for settlement. It is recommended that the County and National governments should intervene by declaring the wetland an Environmental Sensitive area and implement interventions to regulate restoration and relocate land uses that are injurious to the wetland and promote appropriate use of the wetland for posterity.*

***Keywords:*** *Restoration, Spatio-Temporal, Wetland*

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## Introduction

Wetlands are vital natural ecosystems which contribute significantly to the natural and human environments through the history of mankind (Tego, 2010). They are most diverse and productive ecosystems and were defined as areas of marsh, fen, fringes of lakes, rivers, flood basins, estuarine deltas, ponds, river fields and marine water areas either permanent or periodic inundation, whether natural or artificial, with water that is static or flowing, fresh, brackish or salt the depth of which at low tide does not exceed 6 meters (Ramsar Convention in 1971).According to Ramsar Convention, there are more than 1900 designated wetlands around the world covering 186 million hectares. Ramsar mission entails conservation and appropriate use of all wetlands through local, regional, national and international cooperation to achieve sustainable development globally (Ramsar, 2007).

Despite their importance in providing ecological services and supporting livelihoods of local communities, wetlands are currently threatened by degradation. The estimated inland wetland loss in some parts of the world is placed at more than 50% as a consequence of human activities leading to loss of wetland flora and with resultant wetland species loss and negative impact on the livelihoods of local communities (*EANHS, 2018;* Springate-Baginski *et al., 2009*; Millennium Ecosystem Assessment, 2005; Otieno *et al., 2001).* This is because many developing countries depend heavily on exploitation of wetland biological resources to support life among very poor rural communities whose livelihoods depends solely on the exploitation of these resources (IUCN, 1996). Lack of appreciation of the value of wetlands and their subsequent low priority in decision-making process has led to perpetual destruction or modification of wetlands causing an uncalculated social cost. The existence of wetlands is under threat due to alarming human infringement and it is estimated that more than 50% of the world's inland wetlands have been lost mostly due to agricultural activities. In a profound sense, it is estimated that the loss of 56-65% of existing wetlands in Europe and North America, 27% in Asia, 6% in South America and 2% in Africa is due to agricultural activities (O'connel *2013*).Wetlands are considered sustainable when they have the ability to cope with and recover from stresses and shocks which allows them to maintain or improve their capabilities in future.

Kenya has a rich heritage of wetland ecosystems accounting for 3-4% or 14,000km$^2$ of the total land area coverage (*Raburu et al 2012; GoK 2013)*. This rich heritage is due to her diverse climatic and topographical conditions. The country hosts six wetland types; riverine; lacustrine; palustrine; estuarine; marine; and a few constructed wetlands. The area covered by Inland wetlands in Kenya is 2,641,690 ha, far outstripping that covered by marine and

coastal wetlands which occupy 96,100 ha. However due to increased rates of wetland and catchment degradation, the total percentage of wetland area is estimated to have gone below 2% (GOK, 2008).

Kenyan wetlands were the first ecosystems to receive international attention through the Ramsar Convention which was ratified in 1990. Lakes Nakuru, Naivasha, Bogoria, and Baringo which cover a combined area of 1,045km$^2$ have since been designated as wetlands of International importance. In addition Lake Elementaita and Nakuru were added to the UNESCO World Heritage List during its 35$^{th}$ session (2011) in Paris, France. The government of Kenya (2013) through a ministerial statement acknowledged that, Wetlands are key to socio-economic development of Kenya.

Though perceived as 'wastelands', wetlands are crucial in provision of goods and services that are of ecological or socio-economic in nature to rural communities surrounding them. The perception has encouraged their continued degradation and loss through conversions to farmlands, settlement areas, waste disposal areas, development of industries and overexploitation of its biodiversity. The dependency by riparian rural communities who are faced with poverty, food insecurity and poor living standard and the existence of small-wetlands such as Nyangongo in communal lands have further encouraged their degradation hindering their sustainable management (Raburu *et al.,* 2012). The impacts are expected to increase with increased population reducing the areal extent of wetlands' ecosystem. The impacts may result in an ecosystem disruption destroying the wetland beyond repair. This study aimed at examining some of the anthropogenic activities and their environment impacts on Nyangono wetland ecosystem and establish their importance to local community and determine appropriate land use practices applicable to Nyangongo wetland.

**Literature Review**

In Kenya, many wetlands have been threatened by emanating natural events and anthropogenic activities since 80% of the wetlands occur on lands which are privately or communally owned and without any serious conservation measures (Ndungu, 2013). The main threats to wetlands are unsustainable human practices such as extensive agriculture, overgrazing, fires, industrial use and infrastructure development which could result in drying-up, siltation and pollution of wetlands. However natural factors which are inevitable like drought and aridity may also affect wetlands (Chipps *et al*., 2006).

*Drivers of Wetland Loss and Degradation*

Planning Policies and decisions in most cases do not take into account the many services that wetland provide hence the rapid degradation and loss of wetlands globally (Grabl *et al.*, 2012). This rapid worldwide wetlands loss and degradation has been the basis of Ramsar Convention and initiatives.

The increasing human population, coupled with the growing need for increased food production for subsistence and commercial purposes to meet the high demand, have put tremendous pressure on wetlands around the world (O'Connell, 2003). Globally, human activities pose the greatest threat to the well-being of wetlands, resulting in either their loss or degradation (Bierstadt, 2011). Wetland loss is defined as "the loss of wetland area due to conversion of wetlands to non-wetland areas as a result of human activity". Degradation refers to impairment of wetland functions as a result of human activities (Moser *et al.*, 1996). Degradation leads to loss in wetland area leading to change in quantity of wetland resources around a baseline. This is usually manifested by loss of biodiversity, change in wetland water quality/ flow patterns, scarcity of wetland resources, loss of aesthetic, cultural and spiritual values of wetlands and the appearance of new species (Schuijt, 2002).

Some of the drivers include agricultural activities, infrastructural development, growing of alien tree species such as eucalyptus, pollution and urbanization. Although cultivation is taken as a remedy to cushion the poor and landless to secure their food security to sustain their livelihood needs in a short-term, it leads to direct loss of wetland due to drainage and conversion to agricultural land; indirect loss as a result of water abstraction from rivers and streams for irrigation; salinization, sediment deposition, eutrophication and pollution from pesticides and chemical residues. Poor agricultural practices in the upland areas may also lead to soil erosion and sedimentation or runoff of agricultural waste, both of which can affect wetlands. The subsequent pressures may lead to degradation of that wetland (Houlahan *et al.*, 2006; Makalle *et al.,* 2008).

Rapid population growth compels the landless to encroach on fragile ecosystems like wetlands. Population projections predict that the population of developing countries will increase to about eight billion by 2025 and nine billion by 2050, (UNEP report, 2015).
Eucalyptus plantation has high impact on the storage function of wetlands because a lot of water is lost through transpiration. The water uptake is high compared to other trees such as polar trees which shade their leaves in winter and support vigorous growth of indigenous plants resulting in habitat loss (MEA, 2005; Hein *et al.*, 2006; Gonzales, 2009)

**Theoretical Framework**

This study adopted theoretical approach of Garret Hardin 1968 tragedy of the commons depicting a scenario where a group of pastoralists grazed their animals on common fields without restrictions on how grazing land should be utilized. In this open access regime, individuals sought to maximize private gains from the common property where every herder increased his stock to foster individual wealth, social prestige and a status symbol. Such actions result in overexploitation of the grazing land and eventual degradation of resources. Arguably, if he did not increase his stock, the other grazers would and would hence be wealthier than him. In this competitive, all herders tended to add as many animals as they could to the common grazing lands. The land carrying capacity was exceeded resulting in collapse of the pastoral economy and impairment of productive ecosystems.

Based on this theory, residents in the study area have resorted to encroachment of Nyangongo wetland as it is a common resource open for easy access for settlement, crop farming and other land use activities without restriction by relevant authorities. However, these activities have resulted to overexploitation and to impairment pf ecosystem resilience. Inadequate funding and lack of cooperation by the local government to facilitate conservation of this resource has led to accelerated environmental degradation. Figure1 presents the detailed situation in the study area.

**Conceptual Framework**

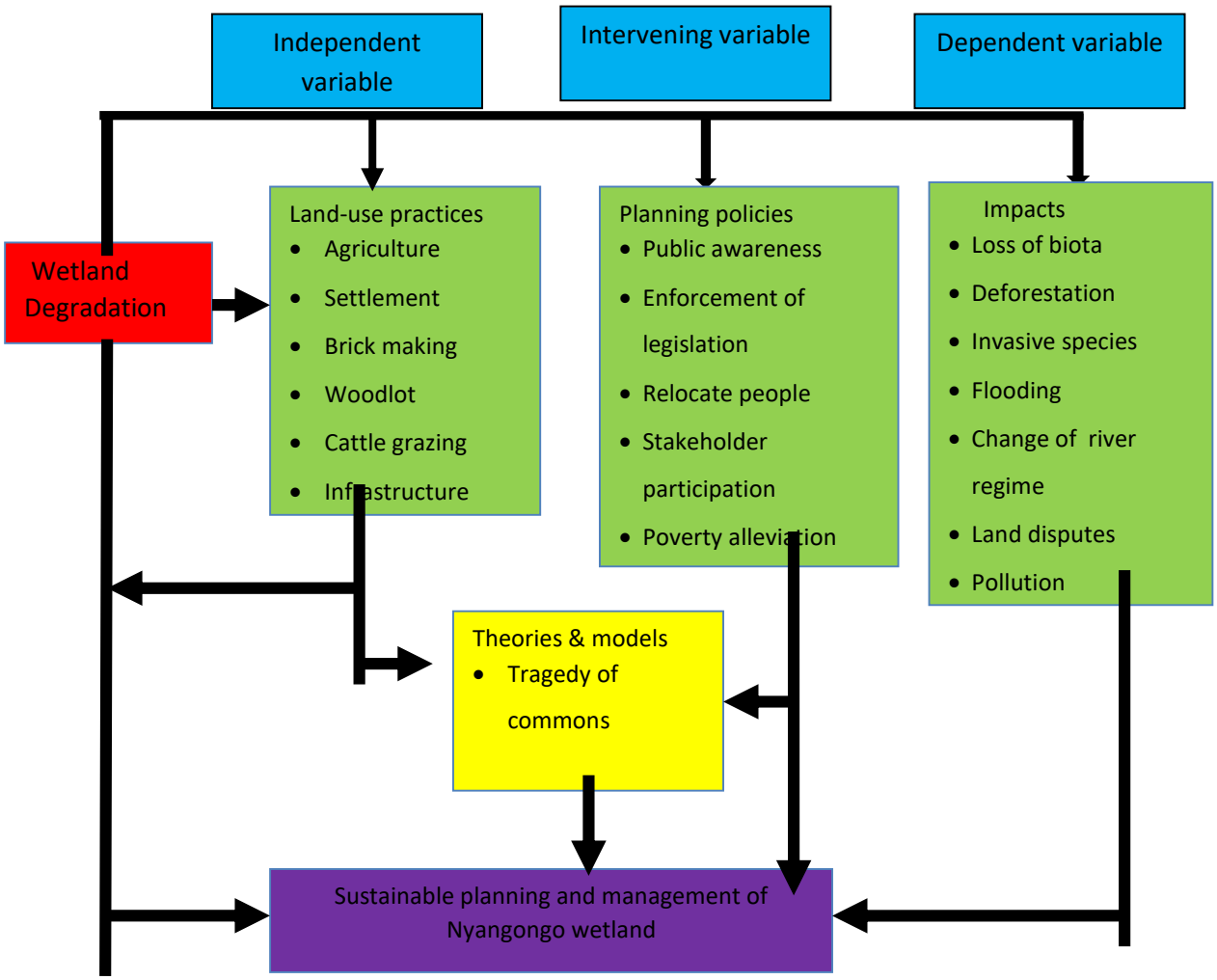


**Figure 1: Conceptual Framework**

The conceptual framework, depicts that the wetland is a key resource for poverty alleviation. Poverty on the other hand is a state of reduced or limited livelihood opportunities and leads to increased environmental degradation, either because people have no other variable options other than overexploiting natural resources. To contribute towards the realization of the MDG7, Kenya raised a poverty reduction strategy paper (2001-2004) that outlined key areas and measures necessary for poverty reduction and economic growth underscoring critical need for sustainable management of natural resources such as wetlands. Promotion

and attainment of food security is recognized as the first step towards poverty reduction. Hence for the local community to sustain themselves they engage on exploitation of natural resource and since access to the same is not restricted by relevant authorities, overexploitation of the scare resources is inevitable. The community has moved into the wetland to engage in land use activities such as brick making, crop farming and livestock keeping, planting of eucalyptus trees and infrastructural development which enormously diminishes. For the locals to continue enjoying accruing benefits from the wetland, conservation should be key and this underscores the need for the implementation of policies that emphasize on resource management, monitoring and conservation by all interested parties. Therefore, there should be a concerted effort to educate the locals on the values of the wetland conservation and management to provide secure environmental services such as clean water and air for human use and provide insurance against risks of crop failure, market failure and natural disasters (Dechaineux (2015).

## Materials and Methods

### *Study area*

Nyangongo wetland (*Figure 2*) is situated about 10 km south of Keumbu market in Kisii County. The wetland covers an area of 825ha of land with a population density of 919.2 persons per square kilometer (Kisii CIDP, 2018). It is located at GPS coordinates 704,513.91m E, 9910989.53m S. A number of streams and rivers drain through the wetland with the main one being Rigathi river.

### *Climatic Conditions and Soils*

The area exhibits a highland equatorial climate resulting into a bimodal rainfall pattern. Long rains are experienced between March and May and short rains between October and December with figures ranging between 1500mm to 2200mm with months of January and July being relatively dry. The mean annual temperature ranges between 16deg to 22deg. The high and reliable rainfall coupled with moderate temperatures are suitable for growing crops like tea, coffee, pyrethrum, maize, beans, and bananas as well as dairy farming. The area has red volcanic soils (nitisols), red loam soils, sandy soils and clay soils which have poor drainage (phaezems). In the valley bottoms, there exists black cotton soils (vertisols) and organic peat soils (phanosols).

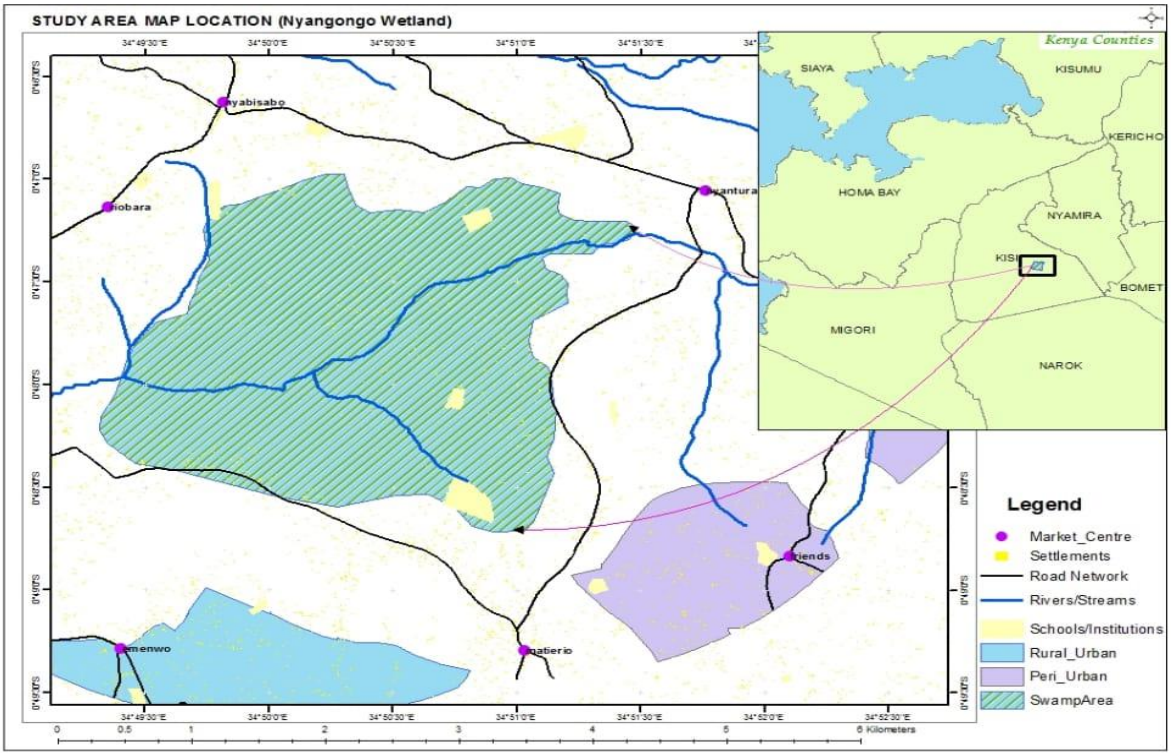


**Figure 2: Map Showing Location of Study Area**

***Research Design***

The study adopted action research design to interrogate the human activities in this setup and determine how they have impacted on the social and physical environment of this area. Action research can be defined as a reflective process of progressive problem identification and solving by individuals or groups to improve an issue in a community setup**.**

Data on human activities taking place on the wetland was collected and analyzed though their economic returns are high and short term and does not reflect sustainable utilization of this wetland.

***Sample size and Sampling procedure***

The research involved household interviews comprising of 251 respondents, key informant interviews, Focused Group Discussions, checklist, direct observation coupled with photographing to collect data.

***Key Informant***

The key informants were drawn from forestry department, agriculture, NEMA officers, WARM, County environment officers, who were purposefully selected to provide the desired information for the study. Key informants interview were carried out to corroborate

the information obtained from household surveys to help gain a comprehensive understanding of nature and types of human activities, impacts, their relationship with land use and land cover in the wetland and the measures applied to promote conservation of the wetland.

**Focus Group Discussions**

Focus group discussions (FGD) were conducted as a follow-up to content analysis and individual interactions in interviews. Two focus group discussions were conducted with participants ranging from 8-12 both male and female. One group comprised of local farmers and brick makers and the other group comprised of members of administrative officers and elderly persons from the area.

***Photography***

Photography was used to corroborate the perception of results from other data collection sources to show the physical environment and land use practices as portrayed on the ground.

***Sampling procedure***

The main sampling procedures used included; Purposive sampling and Systematic Random sampling. Purposive sampling procedure was used in selecting key informants based on their knowledge of the study area. Systematic random sampling technique was used to select household respondents.

***Research instruments***

Primary data was collected using interview, to gain historical background of the wetland and data on wetland size and its users. Structured questionnaires were administered to individual household head/representatives. A total of 251 questionnaires from both wetland areas and its catchment area were duly filled and subsequently used for data analysis. The study focused on the communities living inside the wetland and within a range of 4km from the wetland boundary. The buffer zones were restricted to a distance of 4km because the propensity to use wetland resources is inversely related to travel distance (Odhengo et al.., 2018a; Abila, 2003). The questionnaires were complimented with photographs and data analyzed quantitatively using descriptive statistics.

***Data Analysis***

Data was analysed using descriptive and inferential statistics using SPSS Version 22. Descriptive statistics was used to assess the values the locals derive from the wetland to form a basis to develop a framework to enhance resource conservation. Data collected from key

informant's interview and Focus Group Discussions (FGD) were analyzed and summarized as pertaining to wetland use, impending issues on its conservation, drivers of encroachment and emerging issues impacting on wetland loss and degradation. (Hsieh and Shannon, 2005).

Pearson Correlation analysis was used to describe the degree to which one variable relates to the other.

**Results and Discussion**

The study established Human activities in Nyangongo Wetland and quantified their importance to the Local Community as shown in Figure 3

From this study it was observed that the riparian communities derive a number of wetland values to sustain their livelihoods. Most of them are Supporting services which represents the ecological process that underlie the functioning of the ecosystem (MEA, 2005; Hein *et al*., 2006; Gonzales, 2009) such as wildlife habitat, grazing pastures, fiber and fuel, genetic materials for medicinal value, sand and clay for brick making, water abstraction for domestic use and watering their livestock, farmland for crop farming to enhance food security and for commercialization. Since the area receives rains most of the time, the locals engaged in agricultural activities all year round with Agriculture accounting for 91% as compared to other uses. This is followed by wood fuel at 75%, grazing 74.1%, hunting of wildlife at 24.3% and fishing which has since declined with only 28% of the locals obtaining fish from the wetland during wet seasons since breeding sites have been destroyed due to intensification of other agricultural activities and brick making.

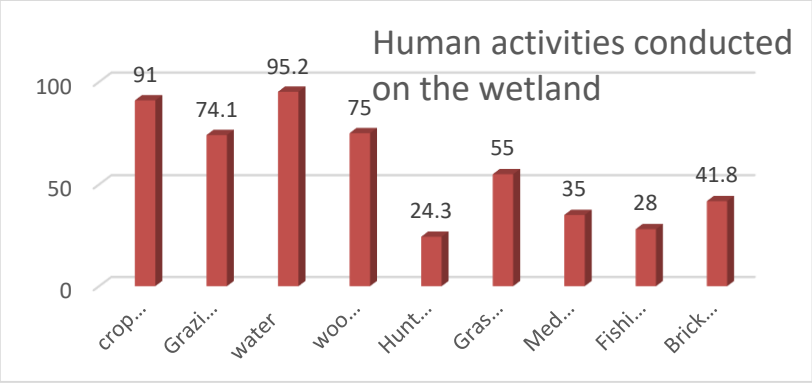


**Figure 3: Human activities conducted on Nyangongo Wetland**

**Livestock Grazing**

Grazing is one of the benefits locals derive from the wetland with 74.1% of the respondent reporting that they utilize the wetland for pasture to their livestock. Animals raised by the

inhabitants included exotic and indigenous cows, sheep, goats and donkeys. The most common cattle breed is mixed hybrid animals and some zebu breeds. It was observed that free range and tethering grazing method of cattle rearing is practiced in the wetland. The P**late 1** below shows animals grazing on the wetland.

**Plate 1: Livestock grazing on the wetland**

The study revealed that land though under trust land has been segregated into individual grazing lands. Some farmers indicated that they converted their parcels into grazing land after crop yields declined which could lead to wetland regeneration as captured on satellite images of the area. The locals also indicated that the increasing demand for productive arable land and easier to work on, on the uplands is displacing grazing land to the valley bottom wetland areas. To determine the significant of grazing activity Pearson's correlation coefficient was used and results are as presented on table 1 below

**Table 1: Model:** Relationship between Households' Socio-demographic profile and Human activities on the Wetland

| Land Use | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| Grazing | .347[a] | .120 | .026 | .49657 |
| Crop Farming | .308[a] | .095 | .073 | 1.09071 |
| Fishing | .154[a] | .024 | .000 | .16500 |
| Water | .201[a] | .040 | .016 | .60941 |
| Wood fuel | .227[a] | .052 | .021 | .07161 |

| | | | | |
|---|---|---|---|---|
| Medicinal Herbs | .257[a] | .066 | .036 | .75987 |
| Thatch grass & Fibre | .227[a] | .052 | .021 | .07161 |
| Brick Making | .175[a] | .031 | .007 | .49838 |

a. Predictors: (Constant), Gross income, Age of the respondent, respondent village, gender of the respondent, respondent marital status, educational level of the respondent, family size

Relationship between Households' Socio-demographic profile and grazing activity on the Wetland

The value of the $R^2$ =.120 (Table 1) shows that 12.0% of the independent variables was the predictors (gross income, age of the respondent, respondent village, gender of the respondent, respondent marital status, educational level of the respondent and family size as a result of grazing activities in Nyangongo wetland as explained by the model.

**Crop farming**

91% of respondents reported practicing agriculture hence agricultural expansion on the wetland. Other crops grown include sugarcane, bananas, tea, sorghum, finger millet, coffee, and beans, thus mixed cropping and agroforestry dominated most of the farms through the year round contributing to massive degradation of the wetland. Crops like sugarcane and bananas take a long time to mature and consume a lot of water resulting to wetland desiccation and lowering of the water table consequently impacting negatively on wetland function. Crop farming along riparian area had resulted to soil erosion and water pollution which over time will affect aquatic life and human health.

Plate 2 Agricultural Activities on the Wetland

Plate 2 above presents a sugarcane jiggery, a form of agricultural products extraction for commercialization. This has led to increased use of fertilizers to production for economic security. These agrochemicals get washed into the water resources and find their way into Lake Victoria.

**Relationship between Households' Socio-demographic profile and crop farming on the Wetland**

The relationship between Households' Socio-demographic profile and crop farming on the Wetland was analysed and results presented on table 1 above shows $R^2$ =.095, thus 9.5% of the respondents affirmed that crop farming in the wetland is significant for the local community.

**Fishing**

Fishing was also another provision services the locals benefited from the wetland though it was declining due to the loss of the wetland area. 28% of respondents indicated that they caught fish during the wet seasons when the wetland was waterlogged allowing for breeding. The Fisheries Department built fish ponds in the area to revitalize the same but the initiative stalled due to inadequate funding and poor management.

**Relationship between Households' Socio-demographic profile and fishing activity on the Wetland**

The value of the $R^2$ =.024 as indicated in the table 1 shows that 2.4% of the independent variables was the predictors (gross income, age of the respondent, gender of the respondent, respondent marital status, educational level of the respondent and family size which shows that fishing is significant for the local community as a benefit derived from the use of wetland.

**Source of Water for domestic use**

The common sources of water in the study area included; rivers, wells, protected springs and roof water harvesting. 95.2% of the respondents said they obtained water from the wetland for domestic use and to water their animals and crops including vegetables especially during the dry seasons and for making bricks. In addition, water is an important habitat for various biodiversity in the area such as mudfish which is harvested by the locals for consumption especially during rainy season when the wetland is water logged. Notably however, 5% of respondents harvested rain water and/or had sunk wells to obtain their water supply.

**Relationship between Households' Socio-demographic profile and water use on the Wetland**

A value of $R^2$ = 0.04 (table 1) shows that water obtained from the wetland is significant for the local community.

**Source of Wood Fuel**

More than 75% of the respondents interviewed indicated that they obtained fuel energy for firewood from among others *erythrina tomentosa, acacia mearnsii, croton macrostchyus* for domestic use. Wood fuel is used in processing sugarcane products from the sugarcane which is grown in the wetland and surrounding catchment areas. Satellite imagery shows that vegetation harvesting is carried out unsustainably resulting in drastic loss of habitat and biodiversity in the area. Indigenous vegetation continues to be replaced with exotic trees such as eucalyptus which brings high economic returns. However such trees impact on wetland ecology as they smother any undergrowth within the area.

**Medicinal Plants as a Wetland benefit to the Local Community**

Some of the indigenous trees in the area are useful as their roots, leaves or barks are harvested to supply medicinal herbs to cure various ailments such as mumps, typhoid, bloat, cough and sexually transmitted infections (STIs) as well as livestock diseases including foot and mouth disease, bloat and delivery problems. At least 5 plant species were associated with

medicinal values and 35% of the respondents indicating that they obtained herbal therapy from the wetland. These medicinal plants were becoming rare due to the conversion of the wetland and adjacent vegetation cover into agricultural fields.

**Table 2: Some Indigenous and Exotic Trees Grown in the Wetland Area**

| Botanical name | Common name | Indigenous/exotic | Use |
|---|---|---|---|
| *Psidium guajava* | Guava | Exotic | Firewood, human, animal feed & timber |
| *Erythrina tomentosa* | Omotembe | Indigenous | Medicinal, firewood &wood carving |
| *Acrocarpus fraxinifolia* | Omokina bwango | Indigenous | Medicinal& firewood |
| *Sesbania sesban* | Omosabisabi | Indigenous | Water filtration |
| *Cassia didymobotrya* | Omobeno | Indigenous | Medicinal |
| *Triumfetta flavescens* | Omomiso | Indigenous | Medicinal/firewood |
| *Croton macrostachyus* | omosocho | Indigenous | Timber/firewood |

**Relationship between Households' Socio-demographic profile and medicinal harvesting activity on the Wetland**

A value of $R^2$ =.066 (Table 1) shows that medicinal herbs derived from the wetland are a significant benefit for the local community. WHO estimates that about 80% world population relies on herbal medicine for their primary health care needs. De Luca et al., (2012) asserted that more than 300,000 plant species exist globally and that only 15% have been screened for possible therapeutic potential. In light of this observation, the ministry of environment and Forests, India, documented more than 9500 plant species with pharmacological values adding value to India's healthcare system.

**Thatch Grass and Fibre**

The type of grass which is common and visible in the study areas is common cattail grass (Phragmites communis). It has numerous uses like covering fresh unroasted bricks from direct sunlight, thatch traditional houses and construction of brick sheds.

55% of respondents affirmed that they use thatch grass for various purposes and that this product was continously declining hence preference for use of other materials like iron sheets for construction. Thatch grass is also used as handcraft material for making mats and sometimes for fencing around homes and makeshift bathrooms. According to Abagusii customs, leaves from fibers were used to cover food (Ugali) prepared from wimbi during

payment of dowry. Such fibers are also used to fasten rafters when making mud houses and to fasten thatching grass in form of (reeds) to prevent it from being blown away by strong winds hence preventing roof leakages during rains.

The $R^2$ =.052 (Table 1) shows that thatch grass and fiber is a significant wetland derived benefit for the local community.

**Brick Making**

41% of respondents depended on brick making as an economic activity and that a kiln of 5, 000 bricks after baking, would yield approximately 4,000 complete bricks excluding the damaged ones. The cost of one brick at the time of the survey sold at Ksh. 10 translating to Ksh. 40,000 providing higher economic returns compared to other economic activities such as tea farming which generate less income for a similar period of time.

The relationship between Households' Socio-demographic profile and brick making had $R^2$ =.031(Table 1) demonstrating that brick making is a significant wetland derived economic activity for the local community.

Though there are laws and regulations protecting wetlands from being used indiscriminately(Swallow et al., 2003; GOK, 2014) they are continually being ignored by riparian rural populations who have no alternatives' due to socio-economic stressors leading to unsustainable use of the natural resource. Similarly, several researchers have attributed agricultural expansions in various parts of the world to depletion of land covered with natural vegetation (Bewket, 2002; Amsalu et al., 2007; Dessie & Kleman, 2007; Prakasam, 2010; Schneider & Pontius, 2001).

It is therefore clear from the findings that agricultural expansion is the major land use activity impacting more on wetland ecosystem resulting in intense vegetation clearing hence degradation and loss. Similar observations have been made in other developing countries (Rosolen et al 2014), Zsuffa et al 2014). The increase in wetland cultivation may be attributed to the integral role agriculture plays in rural livelihoods of semi-arid areas in Zimbabwe (Victoria et al, 2012).

**Conclusions and Recommendations**

Although land use activities account significantly to the sustenance of livelihoods of the riparian communities in Nyangongo wetland, land use changes and poverty coupled with rapid socio-economic dynamics of the increasing population as well as lack of elaborate

planning framework has curtailed sustainable management and development of Nyangongo Ecosystem for both present and future generations.

That agriculture is the main type of land use on the wetland ecosystem has led to increased surface runoffs, erosion, flooding, and sedimentation which has resulted in catchment degradation, water pollution, loss of biodiversity and other important socio-economic and cultural benefits.

**Recommendations**

There is need to advance policies to advise appropriate utilization of wetlands to ascertain sustainable use of such resources and limit environmental degradation to encourage rehabilitation of the wetland and restore the declining values for the benefit of the current and future generations. Communities around the wetland should be involved in sustainable wetland management strategies with the view restoring and conserving the wetland integrity. Planting of environmental friendly plants like the bamboo and other indigenous trees should be encouraged, controlled livestock grazing, apiary farming and Soil-less cultivation be encouraged to reduce the pressure on arable land to turn the wetland into a sustainable base for rural economy without altering the ecosystem characteristics.

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