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An Assessment of Wetland Loss in Lagos Metropolis, Nigeria

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Abstract
Wetlands are a very important subsystem of the general ecosystem as they play vital roles in the sustenance of both the surface and groundwater resources of the earth. However, much of the world's wetlands have been lost due to series of human activities which gradually cause the degradation of this distinct element of ecosystem. The foundation of this problem is based on public perception of wetlands as unproductive, unhealthy lands, full of disease carrying insects and reptiles such as snakes and crocodiles. Therefore, this study assessed the loss of wetlands in Lagos metropolis. Questionnaires were administered on 75 Estate Surveyors and Valuers located within the study area and 76% were successfully retrieved. Also, 20 questionnaires were administered on conservation officials while 50% were retrieved. Data collected was collated and anlysed using descriptive statistics and relative importance index (RII). The study revealed that wetlands in Lagos Metropolis are habitats for fishes, source of water supply, help in sustaining the food chain of various wetland animals and are inevitably useful in maintaining the integrity of the Lagos coastline. The study further revealed urbanisation as a major factor responsible for the loss and degradation of wetlands in Lagos. Construction activities such as sand-filling, converting and reclaiming wetlands for the purpose of housing construction and infrastructural development contribute to wetland loss in Lagos metropolis. The study therefore concluded that efforts should be geared towards giving this natural ecosystem its due consideration when taking economic decision that will impact on it.
Keywords: Environment, Lagos Metropolis, Wetland Loss, Wetland Valuation, Nigeria

1.0 Introduction

Wetlands are a very important subsystem of the general ecosystem as they play vital roles in the sustenance of both the surface and groundwater resources of the earth. There are several definitions of wetlands as there are shades of opinions of the concept. Turner and Cahoon (1987) acknowledging this difficulty in their study of the causes of the loss of wetlands in the gulf of Mexico, had to resort to simply defining wetlands as any area covered by emergent vegetation.

According to Ramsar convention (1971), wetlands are areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt-water, including areas of marine within the depth no more than six (6) meters at low tide. Other authors include Corwardin, Carter, Golet and La'Roe; (1979) define wetlands as lands that are transitioned between terrestrial and aquatic systems where the water table is usually at, or near the water table and the land is covered by shallow water and have one or more of the under listed attributes:

(i) The land support a hydrophytes growth, at least periodically
(ii) The substrate is predominantly hydric soil
(iii) The substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year.

Mitsch and Gosselink (1993) define wetlands are ecosystems characterized by the presence of those plants (hydrophytes) that are adapted to the life in the soils that form under flooded or saturated conditions, that is, hydric soils. The United States Environmental Protection Agency (USEPA, 2009) define wetlands as land areas covered with water or where water is present at or near the soil surface all year or varying periods of the year. To McCarteny, Rebelo, SenaratnaSellamuttu and de Silva, (2010) wetlands are sinks into which surface waters or groundwater flows from a surrounding catchment. Within landscapes, they are "natural harvesters" of rainwater and, by definition; they are sites where water occurs at or close to the ground surface. On the other hand, Kadziya and Chikosha (2013) in their study of the relationship between wetlands and urban growth in Bindura, Zimbabwe define wetlands as lands where saturation with water is the dominant factor determining the nature of the soil development, types of soil development and the types of plant and animal community living in the soil and on its surface, and generally includes swamps, marshes, bogs and similar areas.

However, most of the world's wetlands have been lost due to series of human activities which gradually cause the degradation of this distinct element of ecosystem. The foundation of this problem is found to be basically psychological. Historically, wetlands have been regarded by most members of the public as unproductive, unhealthy lands, full of disease carrying insects and reptiles such as snakes and crocodiles. The view that wetlands are wastelands, and the ignorant perception that they are worthless, mosquito-infested swamps, has led to over half of the world wetlands being either drained for agricultural use or as building sites. For instance, New Zealand has lost up to 90 per cent of her marshy terrain, while more than 70 per cent of the wetlands in Europe have disappeared as of now. Even more, the immense peat bogs of England and Ireland

which were once thought to be an inexhaustible source of fuel are now about 90 per cent depleted. The reduction in the mass and eventual disappearance (loss) of these wetlands the world over are as a result of several human motivated factors such as hydrologic alteration, urbanisation, use of marinas/boats, agriculture, lumbering, mining, atmospheric deposition, Industry and industrial development. It is in the light of this that this study focused on assessing wetland loss in Lagos Metropolis by indentifying the various factors responsible for this.

2.0 Importance of Wetlands

Wetlands are one of the world's most important resources because of the many environmental and socio-economic benefits they provide. However, the paradox is that they are still being degraded at a rapid rate worldwide despite their relative importance to the general ecosystem.

Jansen and Schuyt (1998) carried out a research in order to assess the economic values of the Yala swamp in Kenya and the resultant effect of the increasing population trends on wetland's sustainability. The researchers however discovered that although population pressures resulted in unsuitable use of many of the wetland resources, it was the Kenyan government and not the local people who initiated the wetland reclamation for agricultural purposes. The study was therefore able to show that while the economic loss of wetlands is majorly a localized problem, the government as well contributes to the loss of these ecosystems which under normal circumstances are meant to be preserved by government. Results of this research showed that reclamation in general did not benefit the local residents as most of the crops grown on the converted swamps were for the purpose of exports. Ultimately meaning that the cost of the conversion of the wetlands was borne by the people as the goods and services they initially derived from the wetland diminished. In terms of the economic values of the Yala swamp, it was clear that the wetland provided numerous goods and services to the local population. Also, the wetland served as a habitat for both plants and animals (aquatic and birdlife) which were evicted by the alteration of Lake Victoria.

In a latter study of the economic consequences of wetland degradation for local populations in Africa, Schuyt (2005), acknowledge the importance of wetlands for the sustenance of rural dwellers in Africa. The study focused on the Yala swamp wetland in Kenya to quantify the dependence of human population on wetlands. According to the researcher, wetlands in Africa serve as important source of water and nutrients necessary for biological productivity and often sheer survival of people, thereby making the sustainable management of these ecosystems critical to the long term health, welfare and safety of many African communities.

Following the loss of the Mutubuki wetland in Chigombe (rural) community of Gutu district, Masvingo, Zimbabwe Hardlife, David, Godfrey, Somandla and Proud (2014) conducted a study on the implication of the loss and degradation of wetland ecosystems on sustainable rural livelihoods of the people in Chigombe community, Zimbabwe. In order to achieve the objective of the study, a total of 26 household heads and 6 key informants were directly involved as questionnaire respondents and subjects directly observed. They state that wetlands are areas where water is at near or above the surface of the ground, often enough for hydric soils to form and/or for wetland plants to grow. They equally opine that wetlands are a critical part of our natural habitat (environment) and provide important range of ecological and socio-economic goods and services which are vital for environmental integrity and human wellbeing. They went further to state that wetlands are the most productive ecosystems on the planet as they provide numerous products, services, functions and multiple benefits such as water purification, water storage, nutrient cycling.

In Nigeria, Ojekunle (2011) reviewed the ecology of Nigerian wetlands in order to determine the factors influencing their utilization in sustainable food production and likewise presented a design alternative for food and water re-use production. The author (Ojekunle, 2011) posits that by adopting the use of water-recycling systems, specifically waste water treatment plant and reclaimed water reservoirs; sustainable use of water could be achieved.

Examining the ways the Nigerian communities can salvage wetland ecosystem to ensure sustainable fish production, Dauda (2014) also identify wetlands as one of the high valued resources which has been exposed to indiscriminate use. In the study, Dauda (2014) reviewed the term wetland, its functions and values, the importance of wetlands to and/or of fish production in Nigeria and the threat to wetlands' sustainability in Nigeria. According to the study, wetlands contribute to the national and local economics by producing resources in terms of fish, fibre and water, while enabling recreational activities and providing other benefits such as climate regulation, water purification, pollution control and flood protection. Additionally, wetlands serve as sites for scientific research and discovery, education and commercial fishing, habitats and site of nutrient cycle for mammals, plants, amphibians, reptiles, birds and fishes.

3.0 Causes of Wetland Loss

Differentiating wetland loss and wetland degradation, Moser, Prentice and Frazier (1998) explain wetland loss as the loss of wetland areas due to the conversion of wetland areas to areas of non-wetland due to human activity, while wetland degradation is the impairment of wetland functions as a result of human activity. Wetland loss

could also mean the change or transformation from vegetated wetland to either uplands or drained areas or submerged habitats which initially supported wetland dependent organisms. In other words, a wetland is considered to be lost if it has been degraded or developed to the extent that it has lost a considerable amount of its natural functional values, as would occur if it was severely eroded or drained and planted to pastures.

Examining the reasons for wetland loss in China, Yin and Ming-xiang (2001) focused on the Sanjiang plain marshes, lakes in the middle reaches of Chanjiang (Yangtze) river, coastal rivers and mangroves. The study identified the anthropogenic causes of wetland loss, and equally blamed the general public perception and the lack of the comprehensive understanding of wetlands as reasons for the blind exploitation of wetlands in China, ultimately causing their depletion and eventual loss. Yan and Ming-xiang (2001) state in their study that human activities such as land reclamation, over-exploitation of bio-resources, pollution, exploitation of water resources and hydro-engineering, siltation, coastal erosion, urban development and tourism are major threats to the largest wetland body in China. According to them, coastal wetlands have been the most affected of all wetlands mainly due to reclamation for urban, industrial or agricultural purposes.

Desta, Lemma and Fetene (2012), carried out a review on the aspects of climate change and its associated impact on wetlands functions and pointed out that wetlands are among the ecosystems most vulnerable to anthropogenic activities being aggravated by climate change. According to the authors, change in climate has the potential to alter the features of wetlands such as water temperature, flow, runoff rate as well as the physical characteristics of these special ecosystems. Such disturbances and alterations would have effects on the proper functioning of wetlands and then lead to changes in the critical goods and services of wetlands upon which human societies depend (Desta et al. 2012).

In a study conducted on the geospatial mapping of wetland potential in Ilesa, Osun State, Nigeria, Orimoogunje, Oyinloye and Soumah (2009) identify urbanisation and agricultural activities as constituting major threats to wetlands in study area. According to them, urbanisation and agro-economic activities put pressure on wetland resources in the area of study. Urbanisation, over-cultivation and encroachment of wetland resources due to increased population pressure and the suitability of the areas for the production of arable crops increased the stress on wetland resources in area. As a result of these factors, areas that were initially regarded as wetlands have now been converted to agricultural sites and settlements. Findings from the study showed that the area coverage of wetlands has drastically reduced from 148ha in 1991 to 89ha in 2002. On the other hand, agricultural activity in the town enjoyed a tremendous increase in land cover within the same period as it increased from 9,017 ha to 14,435 while land use for human settlement more than doubled its initial figure of 4,541 ha by 1991 to a total of 10,012 ha in 2002.

Examining the impact of urbanisation on wetland degradation in Eleyele, Ibadan, South West Nigeria, Tijani, Olaleye and Olubanjo (2011) highlight the environmental impacts of urbanisation and land-use and the role both factors played in the degradation of Eleyele wetland in Ibadan. The authors concluded that Nigeria is richly blessed with both coastal and inland wetlands, many of which are threatened by anthropogenic drivers and human motivated factors such as land use activities, urbanisation and agricultural activities in addition to the emerging threats of climate change.

Similarly, Ajibola, Adewale and Ijasan (2012) examine the effects of urbanisation on Lagos wetlands and were able to establish that the primary causes of wetland loss in Lagos metropolis are majorly human motivated. Such human activities listed by the researchers include incessant sand-filling and conversion of wetlands environment for economic uses, high rural-urban migration and increased dredging of wetland sites within Lagos State. Also, the study identified that perennial flooding which is a common occurrence in Lagos environ has a part in the depletion and loss of the ecosystems. The authors were able to identify several effects of economic activities on wetlands in Lagos and the impacts that urbanisation had on wetlands located within the region. Direct habitat loss, suspended solid additions, hydrologic changes, altered water quality, increase runoff volumes, diminished infiltration, reduced stream based flows and groundwater supply, and lengthy dry periods according to this study are the resultant effects of urbanisation in Lagos.

4.0 Extent or Wetland Loss in Lagos Metropolis

Various studies had shown continuous and consistent loss of wetlands in Nigeria in general and Lagos Metropolis in particular. In the study carried out by Odunuga, Omojola and Oyebande (2011), Lagos wetland, due to conversion to other economic uses, was reduced from 708.96ha (52.68) in 1965 to 7.10ha (0.53%). This is evident in Table 1

Table 1: Static Land Use/Land Cover distribution, 1965, 1975, 1987 and 2005

	1965		1975		1987		2005	
Landuse	**Area (ha)**	**% of total**	**Area (ha)**	**% of total**	**Area (ha)**	**% of total**	**Area (ha)**	**% of total**
Agriculture	38.09	2.83	18.57	1.38	10.90	0.81	3.86	0.29
Built up Area	166.88	12.40	1045.54	77.69	1195.99	88.87	1231.00	91.46
Open Surfaces			23.15	1.72	14.94	1.11	6.03	0.46
Transportation			40.78	3.03	55.04	4.09	66.70	4.96
Vegetation	396.60	29.47	60.02	4.46	33.24	2.47	24.93	1.85
Water Body	35.26	2.62	25.84	1.92	6.86	0.51	6.16	0.46
Wetland	708.96	52.68	131.89	9.80	28.80	2.14	7.10	0.53
Total	1345.78	100.00	1345.78	100.00	1345.78	100.00	1345.77	100.00

Source: Odunuga, Omojola and Oyebande (2011)

In the same vein, Adegun, Odunuga and Appia (2015) conducted another study on the implications of urban land uses on hydrological processes and ecological services in Lagos. The authors used the drainage channel that traverses Agidingbi, Obafemi Awolowo Way, Oregun Link Road and Ogudu Bridge. The land use analyses focused on the extent of built-up and wetland areas. While the analysis showed a consistent increase in the built-up areas since 1965 (321.06ha, 7.57%), 2008, the extent of imperviousness had increased to 3346.20ha (79%) and finally in 2014 it has increased to 3405.23ha (80.39%). On the other hand, the extent of inland wetlands and coastal wetlands was decreasing 1840.41ha (43.45%) and 2074.22ha (48.97%) respectively in 1965, by the turn of 2008, the extent of inland and coastal wetlands had reduced to 222.37ha (5.25%) and 667.12ha (15.75%). By 2014, it was as low as 203.9ha (4.82%) and 626.56 (14.79%). The increase in the extent of imperviousness is indicative of the conversion of wetlands in the study area to other uses.

Table 2: Land Use Analysis for System I in Lagos

	Static Land Use 1965		**Static Land Use 2008**		**Static Land Use 2014**	
Land Use Type	**Area (ha)**	**% Total**	**Area (ha)**	**% Total**	**Area (ha)**	**% Total**
Built-Up	331.06	7.58	3356.20	79	3405.23	80.39
Inland Wetland	1840.41	43.45	222.37	5.25	203.9	4.82
Coastal Wetland	2074.22	48.97	667.12	15.75	626.56	14.79
Total	**4235.7**	**100**	**4245.7**	**100**	**4235.7**	**100**

Source: Adegun, Odunuga and Appia (2015)

5.0 Research Methods

For the purpose of this study, survey research design was adopted. The research instrument used was questionnaire administered on 75 Registered Estate Surveyors and Valuers in the firms located in Lagos Island and Victoria Island and 20 on conservation officials. Out of the 75 questionnaire administered on Estate Surveyors and Valuers, 57 were retrieved while only 10 were retrieved from the conservation officials (representing 76% and 50% respectively).

For the purpose of this research, the data retrieved was presented and analyzed using descriptive and inferential analytical tools such as frequency distribution tables and relative important index (RII). Frequency distribution was used because it allows the researcher to have a glance at the entire data conveniently that is, it shows whether the observations are high or low and also whether they are concentrated in one area or spread out across the entire scale. It equally helps to organise the data into a meaningful form after the completion of data collection so that a trend, if any, emerging out of the data can be seen easily.

Under relative important index measure, variables are to be rated against a scale to assist in assessing the significance of each factor. The scale was then transformed into an index otherwise known as Relative Important Index (RII) for each factor to determine the ranks of the different factors. The analysis for this study employs the relative important index or RII formula which is evaluated as:

$$RII = \frac{\sum a_i n_i}{\sum x_j} \quad (1)$$

Where: i = response category index

x_j = the sum of j factors 1,2,3……N

a_i = constant expressing the weight given to the ith response

n_i = the variable expressing the frequency of the ithA

6.0 Results and Discussions

The data used in this study to draw conclusions was obtained from both Estate Surveyors and Valuers (working

in Estate Surveying and Valuation firms) and Conservation Officials (working in Nigeria Conservation Foundation) located within the area of study. In order to source adequate data, questionnaires were administered on 75 Estate Surveyors and Valuers located within the area of study of which 76% of them were successfully retrieved. A total of 20 questionnaires were similarly administered on conservation officials while 50% of them were retrieved. The analysis of the data collected is as contained in Tables 3 – 6.

Table 3: Working Experience

Years of Experience	Estate Surveyors and Valuers	Conservationists
1 – 5 years	9 (15.8%)	8 (80%)
6 – 10 years	18 (31.6%)	1 (10%)
11 – 15 years	24 (42.1%)	0 (0%)
16 years and above	6 (10.5%)	1 (10%)
Total	**57 (100%)**	**10 (100%)**

The data in Table 3 shows the level of experience acquired by the respondents. The Table reveals that while 15.8% of the respondent Estate Surveyors and Valuers had worked for between 1 – 5 years, 80% of Conservationists are in the same category of experience. The proportion of Estate Surveyors and Valuers that had worked 6 – 10 years is 31.6% while that of the Conservationists in the same category is 10%. While 42.1% of respondent Estate Surveyors and Valuers had worked for between 11 and 15 years. Only 10.5% Estate Surveyors and Valuers had worked for over 16 years, 10% of respondent Conservationists had worked for a period of more than 16 years. It is evident from the table that about 84.2% Estate Surveyors and Valuers had worked for not less than 6 years hence their opinion could be relied upon.

Table 4: Educational Qualification

Educational Qualification	Estate Surveyors and Valuers	Conservationists
HND	18 (31.6%)	0 (0%)
B. Sc.	33 (57.9%)	2 (20%)
M. Sc.	6 (10.5%)	7 (70%)
Ph. D	0	1(10%)
Total	**57 (100%)**	**10 (100%)**

Respondents' level of education is as displayed in Table 4. The Table reveals that while the minimum level of education for Estate Surveyors and Valuers is HND (31.6%) and the highest level is M. Sc. (10.5%), the minimum educational level for Conservationists is B. Sc. and the maximum is Ph. D. The reason for this disparity could result from the fact that one does not require having a higher degree to be registered as Estate Surveyor and Valuer. However, Nigerian Conservation Foundation is an affiliate of international organistaion where premium is usually placed on having high level of education to qualify for employment. It could therefore be deduced that both set of respondents possessed good educational qualification for them to attend to the study requirements.

Table 5: Knowledge on Wetlands

Knowledge on Wetlands	Estate Surveyors and Valuers	Conservationists
> 10 Years	0 (0%)	2 (20%)
6 – 10 Years	0 (0%)	4 (40%)
3 – 5 Years	1 (1.75%)	4 (40%)
< 3 Years	2 (3.51%)	0 (0%)
None	54 (94.74%)	0 (0%)
Total	**57 (100%)**	**10 (100%)**

Knowledge is a vital factor in whatever one does in life. Table 5 contains the analysis of respondents' knowledge about wetland. While Conservationists have appreciable knowledge (more than 10 years) on wetlands, Estate Surveyors and Valuers' knowledge are merely considerable. About 94% of the respondent Estate Surveyors and Valuers had no knowledge of wetland ecosystems. The reason may be due to the differences in work environment. A Conservation Officer, by virtue of his work requirements has the tendency of having deeper knowledge of wetland ecosystem than an Estate Surveyor and Valuer whose major contact is usually with developed aspect of the environment.

Table 6: Factors Responsible for Wetlands Loss in Lagos Metropolis

Factors	**Strongly Agree $a_i = 5$**	**Agree $a_i = 4$**	**Indifferent $a_i = 3$**	**Disagree $a_i = 2$**	**Strongly Disagree $a_i = 1$**	**Total**	**RII**	**Ranking**
Urbanisation	17 $a_in_i = 85$	14 $a_in_i =$ 56	4 $a_in_i =$ 12	4 $a_in_i =$ 8	18 $a_in_i =$ 18	57 179	3.14	1st
Sand-filling for construction	16 $a_in_i =$ 80	11 $a_in_i =$ 44	6 $a_in_i =$ 18	6 $a_in_i =$ 12	18 $a_in_i =$ 18	57 172	3.02	2nd
Wetland conversion/reclamation for housing or infrastructural development	10 $a_in_i =$ 50	19 $a_in_i =$ 76	8 $a_in_i =$ 24	1 $a_in_i =$ 2	19 $a_in_i =$ 19	57 171	3.00	3rd
Toxic chemicals and industrial wastes emptied into wetlands	9 $a_in_i =$ 45	16 $a_in_i =$ 64	7 $a_in_i =$ 21	8 $a_in_i =$ 16	17 $a_in_i =$ 17	57 163	2.86	4th
Disposal of non-biodegradable wastes from markets into wetlands	9 $a_in_i =$ 45	13 $a_in_i =$ 52	9 $a_in_i =$ 27	8 $a_in_i =$ 16	18 $a_in_i =$ 18	57 158	2.77	5th
Dredging of wetlands	2 $a_in_i =$ 10	12 $a_in_i =$ 48	13 $a_in_i =$ 39	15 $a_in_i =$ 30	15 $a_in_i =$ 15	57 142	2.49	6th
Climate change	1 $a_in_i =$ 5	4 $a_in_i =$ 16	14 $a_in_i =$ 42	18 $a_in_i =$ 36	20 $a_in_i =$ 20	57 119	2.09	7th
Unsustainable conversion of wetlands for agricultural production	0 $a_in_i =$ 0	3 $a_in_i =$ 12	8 $a_in_i =$ 24	6 $a_in_i =$ 12	40 $a_in_i =$ 40	57 88	1.54	8th

Results as exhibited in Table 6 reveal that urbanisation is the 1st major factor causing the degradation, depletion and subsequent loss of wetland ecosystems in Lagos. Sand-filling of wetland site for construction was ranked 2nd while conversion of wetlands for housing and infrastructural development was both ranked 3rd. Toxic chemicals and industrial wastes emptied into wetland ranked 4th while the disposal of non-biodegradable wastes into wetlands is ranked 5th. Dredging of wetlands, climate change and the unsustainable conversion of wetlands were ranked 6th, 7th and 8th respectively. It could thus be deduced that urbanisation is the major factor causing the degradation, depletion and loss of the wetland resources in Lagos.

5.0 Conclusions and Recommendations

The study revealed that wetlands in Lagos are especially important as they serve as major habitats for fishes, source of water supply, help in sustaining the food chain of various wetland animals and are inevitably useful in maintaining the integrity of the Lagos coastline.

The study further revealed urbanisation as a major factor responsible for the loss and degradation of wetlands in Lagos. Construction activities which are tied to economic development and growth in terms of sand-filling, converting and reclaiming wetlands for the purpose of housing construction and infrastructural development contribute their quota to wetland loss in Lagos. The study equally revealed that the disposal of waste material and non-degradable plastics and nylons into drains and runoff which end up in surrounding wetlands is similarly a major threat to the wetlands in Lagos.

Lagos being the economic hub of Nigeria, daily receiving influx of people which would always require increasing demand for housing and commerce, infrastructure will continue to encroach on the available wetland ecosystem. It is therefore pertinent that enlightenment programmes be carried out to sensitize the general public on the benefits of these wetlands and the consequences of their loss. Also, it is advisable that wetland restoration and preservation programmes and revitalization activities be carried out in order to restore lost wetlands and likewise revitalize degraded wetlands. In addition, the creation of artificial wetlands where they did not exist before should be encouraged.

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