Global Journal of Applied, Management and Social Sciences (GOJAMSS); Vol.20, September 2020; P.216 – 225 (ISSN: 2276 – 9013)

A STUDY OF WETLAND ENCROACHMENT IN OJO LOCAL GOVERNMENT AREA OF LAGOS, NIGERIA

SOLADOYE, OLAYEMI
Department of Geography and Planning,
Lagos State University, Ojo, Lagos-Nigeria
email: soladoyeo@yahoo.com
Phone: +2348028309354

&

ADEPOJU, OLUSEGUN
Department of Geography and Planning,
University of Lagos, Akoka, Lagos, Nigeria
email:gbemiroemmanuel@gmail.com
Phone: +2348025936148

&

EMEFIENEM, CHIOMA ANGELA
Department of Geography and Planning,
Lagos State University, Ojo, Lagos-Nigeria
email: angelemefienem@gmail.com
Phone: +2348107390873

ABSTRACT
It has been observed in the literature that the conversion of wetlands to other uses has grave consequences on the natural ecosystem in general and on water resources in particular. Despite detrimental impacts observed globally, the encroachment trend has not been abated neither are there deliberate measures in place to control it. This study was carried out to assess the changes that have occurred in the wetlands of Ojo LGA from 1986 to 2016. The area was selected for study because of the rapid rate of urbanization witnessed in the area in the past two decades. Data was obtained using topographical maps and satellite imageries in mapping the extent of encroachment on the wetland area. The Area Analysis method was used to show the trend and rate of land use changes over the period. The results show that there is a marked decline in the areal extent of wetlands. Urban development is however increasing rapidly. The need for further research is also evident.

Keywords: wetland, urban development, water resources, encroachment, land use

1. INTRODUCTION

Freshwater is a precious and finite resource central to sustainable development, economic growth, social stability, and poverty alleviation. Freshwater quality, quantity, and security have grown to become a major international issue in recent years. Global environmental changes induced by natural variability and human activities influence both water quantity and quality at regional and local scales as well as at the global scale (Chang, 2004). It is for this reason that man has striven to protect and develop this scarce resource which is a basic necessity for the sustenance of life. Water, in its natural state, is free from pollution but when man tampers with the water body, it loses its natural conditions. The quality and available quantity of a water resource depend on the natural characteristics of the catchment area.

An important component of water reservoirs in the earth's water cycle is the wetland. Wetlands have been described by RCS (2007) as areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed 6meters. Corwardin et al., (1979) gave a comprehensive definition of 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. Furthermore, the land must support the growth of hygrophytes; the substrate should be predominantly hydric soil and be saturated with water or covered by shallow water at some time of the year.
Wetland is comprised of some physical, biological and chemical components which include soils, water, plants and animal species and nutrients. The totality of the components forms the wetland ecosystem structure which is of benefit to humans. It serves as major source of water and maintains the wellbeing of biodiversity. Agriculture has been a major driver in wetland areas because they have rich and moist soils that can provide excellent conditions for crop growth. However, the unique state of their soil composition makes them unfit to accommodate urban human settlements without artificial moderation like sand-filling.

According to Turner(1990), wetland ecosystems account for about 6% of the global land area and are considered to be among the most threatened of all environmental resources. Although land-use occur at the local level, it has the potential to cause ecological impact across local, regional and global scales (Zhao et. al., 2006). Perhaps the most important effect is the impact of such urban developments on water resources. The relationship between land use and hydrology is of interest worldwide. This is because water resource is one of the major components of environmental resources that are under threat by human activities on the earth's surface (Efe, 2001). Also, urbanization is an increasing threat to ecological communities and has become a leading cause of population and species extinction (McKinney 2006).

Urban populations and wetlands are said to have been engaged in a turbulent somewhat symbiotic marriage since the dawn of civilization. The hypothesis that urbanization can have direct and indirect impacts on the environment and that wetlands are particularly susceptible to negative change has long been proven (Darnell, 1976; Maltby, 1986). A wide range of human activities have altered wetlands around the world and caused their degradation (O'Connell 2003). But since the existing pressures on wetlands have both economic or financial roots, many of the existing benefits derived from the activities that negatively affect the status of the wetlands seemed to have overshadowed the economic benefits of the protection of wetlands (Schuyt and Brander,2004). Therefore, the march of urbanization continues to degrade and destroy natural capital.

Earlier on, UNEP (2007) alerted that globally, wetlands have been reduced by 50%. In Nigeria, human activities continue to adversely affect wetland ecosystems (Orimoogunje,2008). The alarming rate at which the country's wetlands are disappearing has some direct consequences. In particular, wetlands destruction is affecting water supply and water resources management in various parts of the country (Orimoogunje,2008). Uluocha and Okeke (2004) expressed the view that a major factor aggravating the problem of water management in the country is the fact that wetlands, which naturally recharge and protect both the surface and groundwater resources, are being unscrupulously degraded at a rather alarming rate. Odunuga and Oyebande (2007) noted that the conversion of large tracts of wetlands into built-up areas results in increased impervious surfaces which can lead to flooding and altered aquifer recharge

Tijani et al. (2011) in their study of Eleyele wetland in Ibadan revealed a reduction in the riparian wetland forest of 1.25km² as at 1984 to 0.70km² by 2004 with a projected decline of 0.42km² by 2014. Balkare et al.(2011) in a study of wetland ecology in Ijebu-Ode, Nigeria showed a wetland loss of 1.04km ² between 1985 and 2007 with a perimeter of 11.56km² and the wetland covered area was 1.38km². This indicates that about 0.34km of the wetland areas has been lost to different uses such as construction between the year 1985 and 2007. A further analysis indicated that over a period of 12 years, wetland reduced in Ijebu-Ode at 0.02km annually. Orimoogunje et al., (2009) in their study of wetlands in Ilesha, Osun state observed that between 1986 and 1991, the total land area for wetland decreased from 258 hectares to 148 hectares, there was further decrease of wetland areas as at 2002 to 89 hectares while other land uses such as agricultural activities and settlement within this period increased.

The aim of this research work is to study the encroachment of wetlands in Ojo area of Lagos, Nigeria. The specific objectives are to:

i. map the spatial distribution of wetlands in the study area.
ii. study the changes in the pattern of wetlands over time in the study area.
iii. evaluate the impact of wetland loss on the pattern of vegetation cover in the area of study
iv. examine projected patterns of land use/land cover changes area

2. STUDY AREA

Lagos State lies approximately between longitude 2˚34' and 3˚42'E and latitude 6˚24' and 6˚42'N. It is bounded in the South by Atlantic Ocean, in the West by Benin Republic and in the North and East by Ogun State. The state remains the smallest state with a total landmass of 3,577 km² and numerous water bodies covered an area of about 256.26 km². The population density as a result of urbanization is about 1,300 persons/km², which is about 15 times the country's average (Oyebande et al., 2004). Lagos state remains the most urbanized state in Nigeria with 60,839 hectares of landmass or 17% of the total area occupied by lagoons and waterways. The state has a low-lying terrain about 3 –5 m above sea level and is drained by Rivers Ogun, Osun, Yewa, Ona and others. The area is covered with clay-sandy soil along the coastal axis in the south and clay-loamy soil at the interior part. The vegetation of the region is that of coastal swamp and marsh forest and is mostly of mangrove vegetation

It has been reported severally that nowhere in West Africa is the rate of urbanization in the last few years as unprecedented as the city of Lagos (Braimoh et. al., 2007; Neuwirth, 2007; Agbola, 2007). This implies that the city has a persistent rate of growth with a resultant effect on the carrying capacity and ecological footprint of the city.

To facilitate city development, rapid and unplanned land reclamation has been achieved by infilling coastal swamps and floodplains (Adelekan 2009). Not only has this impacted directly on wetland biodiversity, but the destruction of mangroves and wetland has also reduced the flood storage capacity of the land. It is apparent that undisturbed forest has virtually disappeared in most of the Local Government Areas. Also, it is evident that urbanization has claimed land from agriculture and freshwater swamp and that freshwater swamp has been aggressively used for agricultural purposes. Large hectares of mangrove swamps and other exotic vegetation has been lost to city development (Lagos State Ministry of Economic Planning and Budget, 2004).

Ojo is a Local Government Area in Lagos State, Nigeria located between latitude 6˚28'N and longitude 3˚11'E with a land area of about 182km^2 with about 30% of it being water. Ojo local government shares boundaries with Oto-Awori on its Southwest. It is bounded in the East by the Oriade Local government, in the North by Iba local council development area and in the South by the Lagoon. It is located in the Trans-West African Coastal Highway, about 37km west of Lagos.

Geologically, the whole of Ojo local government to the coast and lagoon gives it some peculiar geophysical characteristics quite typical of riverine settlement. Water is one of the most significant topographic features in Ojo. The geology of Ojo is mainly sedimentary of tertiary and quaternary sediment. Ojo LGA naturally within the most humid tropical climate region is characterized by high temperature, high humidity and heavy rainfall with a double peak during July and September. The annual rainfall average is 1800mm and the average yearly temperature is 26.7˚C with a small annual range of less than 40˚C. The relative humidity of the air is high, rarely falling below 80% except in afternoons.

Ojo town has undergone lots of changes during the last decades. The city has grown and is fast extending its boundaries into hitherto undisturbed landscapes. Like many cities in Nigeria, Ojo has recorded rapid growth in population of 215,837 by 1991 it grew to 941,523 by 2006 and by 2015 it grew to 1,250,100 persons.

3. METHODS AND MATERIALS

This research involves the integration of remote sensing techniques using a Geographic Information System (GIS) to get information on the study area using a PC-based image processing and analysis using ArcGIS10.4 software.

The data was obtained from both topographical maps and satellite imageries that was useful in mapping the extent of encroachment and urbanization on the Ojo wetlands.

Table 1: The Land-use Classification Scheme used in the study

S/No	CLASS	DESCRIPTION
1	Built-up Areas	Parcels of land developed for dwelling purposes (residential), commercial ,markets, schools ,banks, roads, railroads, etc. And other urban arears with human activities.
2	Cultivations	The act of growing something on land surfaces. E.g.; Farms, etc
3	Grasses	Any of a large group of green plants with jointed stems, long slender leaves and stalks of clustered flowers; Land (as a Lawn) covered with growing grass.
4	Water Bodies	Streams, Rivers and inland waters.
5	Scattered development	The building of new residences, either separately or in a sub-division, at some distance from existing built-up areas.
6	Fringe Vegetation	Grasslands, Shrubs, Solitary trees and groves.
7	Mixed forests	Agricultural lands, forests and other vegetation classes.

3.1 Spatio-temporal change detection Analysis

The change detection method used in this study is the 'area Analysis method'. This involves the analysis which shows the trend and rate of different land use (LU) changes over the period under assessment. There are three (3) levels embarked on in computing the change detection for each LU by area statistics which involves;

i) The first stage involves the calculation of the magnitude of change and this is done by subtracting observed change of each period of the years from earlier periods of the years.
ii) The next step is the calculation of the percentage change of each of the land use (trend), this was achieved by subtracting the percentage change of the previous land use from the recent land-use, divided by the previous land-use and multiplied by 100. Consequently thus will help assess at a glance, the spatial extent of LU gained or loss.
iii) Finally, the last step involves the calculation of the annual rate of change by dividing the percentage change by 100 and multiplied by the number of the study years, which is 55 years in this case (i.e. 1964-2019). This will however show the rate at which different LU is either gaining or losing in terms of area extent.

There are numerous satellites data for this nature of analysis but the particular one used is the Landsat imageries with spatial resolution of 30m which was acquired by NASA. These products were obtained for years 1986, 2000, 2016 and 2019 in combination with topographic data to establish a baseline mapping for a sequential tracking of changes.

4. RESULTS AND FINDINGS

Figures 1- 4 show maps of wetland conditions in the study area in 1964, 1986, 2000 and 2016 respectively. The information contained in the maps can be categorized into two principal classes namely: wetland complex and other landuse/lancover including the mixed forests. The wetland is made up of combination of palm forest, short forest and undifferentiated cover type, thus the wetland complex.

4.1 Wetland condition in the study area in 1964

Figure 1 shows the wetland situation in 1964. From the map, it is clear that wetlands were widely spread across the study area. Urban development is not dominant (0.46%). The land use/land cover is summarized in Table 2.

Table 2: Land use/Land cover in 1964

Class,1964	Sum_AreaSq	Percent
Beach	1.92	0.95
Built_Up	0.92	0.46
Grasses	3.21	1.58
Mixed Forests	76.95	37.97
Scatttered Dev.	0.43	0.21
The Ocean	13.53	6.68
Water Body	24.13	11.91
Wetland Complex	81.55	40.24
Total	202.6469051	

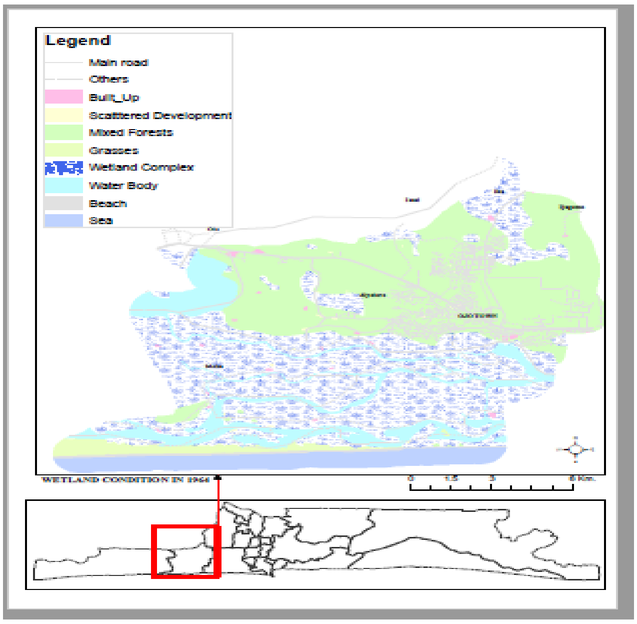

Figure 1: Wetland condition in 1964

4.2 Wetland condition in the study area in 1986

Table 3 revealed the process of gradual reduction in the size of the wetland complex in the study area. By 1986, wetland has decreased by about 6% from 40% to about 34%. The actual size by this 1986 is about 68.7square kilometers.

Table 3: Land use/Land cover in 1986

Class,1986	Sum_AreaSq	Percent
Beach/S. Surfaces	0.31	0.15
Built-Up Area	5.07	2.50
Grasses	3.55	1.75
Mixed Forest	48.98	24.20
Scattered Dev.	38.85	19.19
Sea/Ocean	9.07	4.48
Water Bodies	27.94	13.80
Wetland Complex	68.68	33.92
Total	202.44	

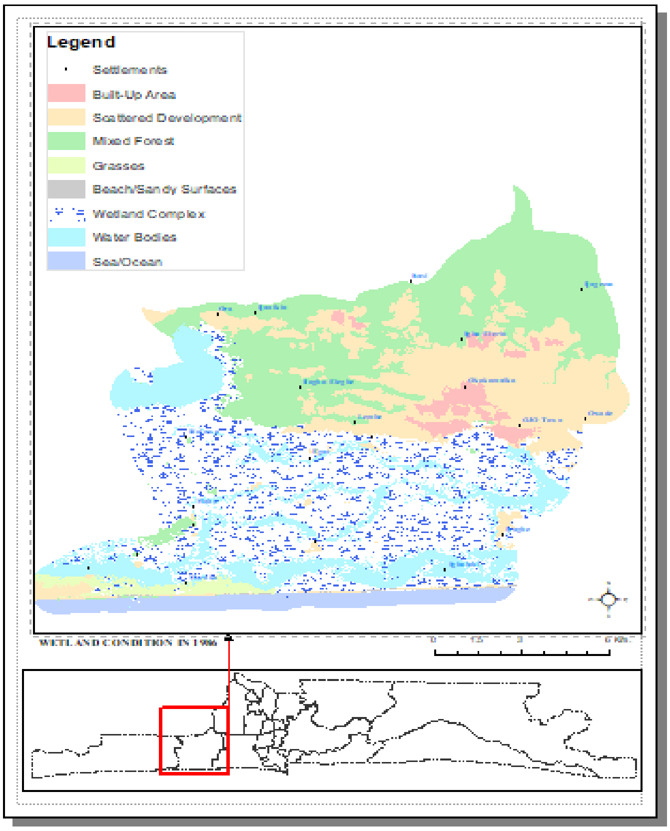

Figure 2: Wetland condition in 1986

4.3 Wetland condition in the study area in Year 2000

The wetland complex cover continued the downward trend with a further >10% reduction in the size from about 34% in 1986 to about 23% in 2000. As will be seen later, some of the components of changes can be seen as evidenced in the scattered developments, and grassy areas coming up.

Table 4: Land use/Land cover in 2000

Class_2000	Sum_Area_SqKm	Percent
'Mixed-Forests	5.76	2.84
Beach/S. Surface	2.23	1.10
Built-Up Area	10.40	5.14
Cultivation	9.92	4.90
Fringe Vegetation	16.04	7.92
Grasses	22.95	11.34
Scattered Dev.	52.56	25.96
Sea	14.63	7.23
Water Bodies	22.26	11.00
Wetland Complex	45.69	22.57
Total	202.44	

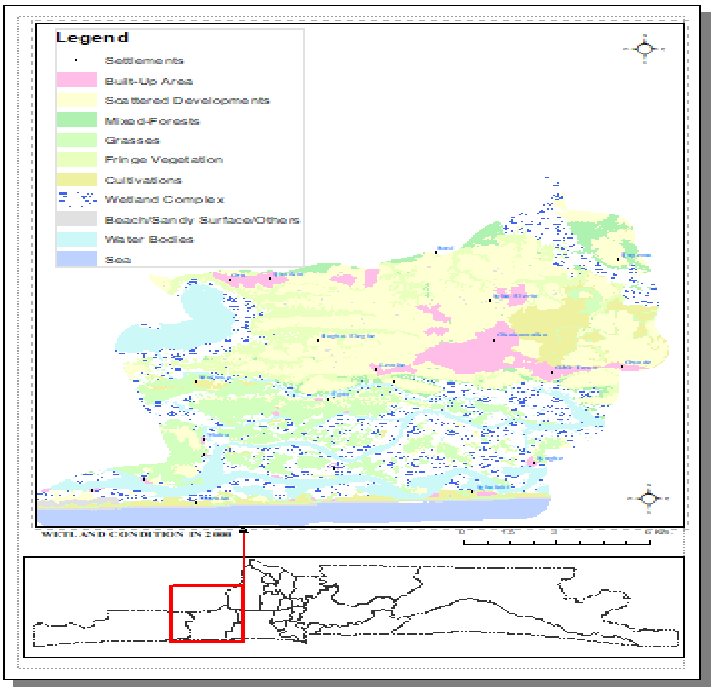

Figure 3: Wetland condition in 2000

4.4 Wetland condition in the study area in 2016

In this period, built-up area has increased to 40.68km^2 making up 20.09% of the entire land area. Built-up area component was only 5.42% in 2000.

Table 5: Land use/ Land cover in 2016

Class_2016	Sum_Area-S,Km	Percent
Beach/S. Surfaces	2.04	1.01
Built_Up	40.68	20.09
Cultivations	10.42	5.15
Fringe Vegetation	11.23	5.55
Grasses	20.17	9.96
Mixed Forest	1.47	0.72
Scattered Dev.	26.40	13.04
Sea	14.84	7.33
Water Bodies	21.33	10.54
Wetland Complex	53.88	26.61
Total	202.44	

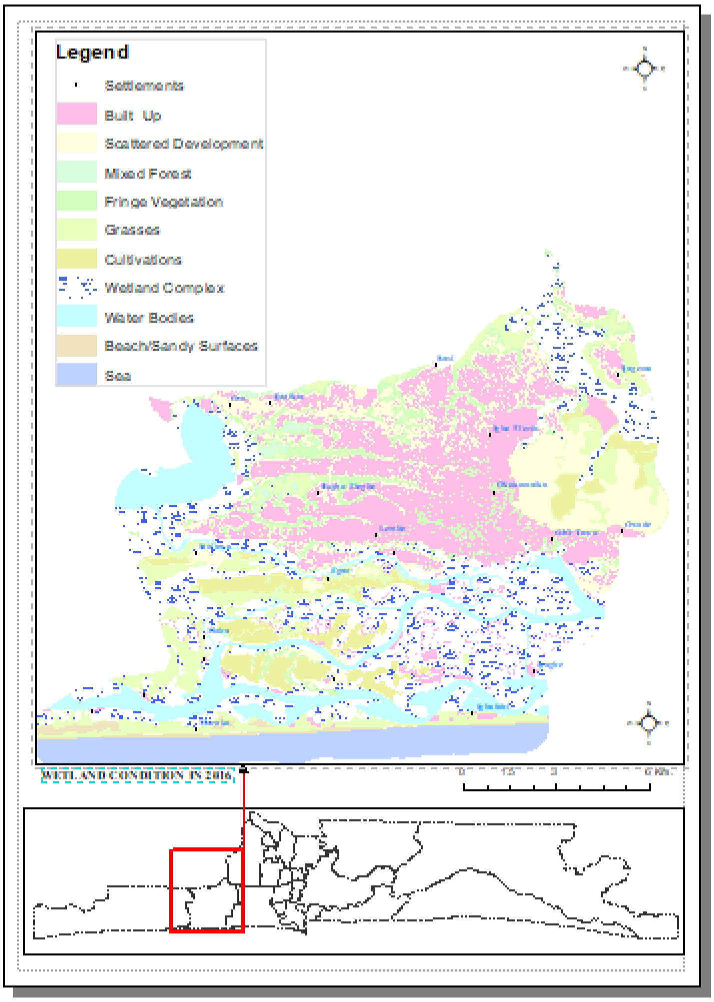

Figure 4: Wetland condition in the study area in 2016

5. CONCLUSIONS

From the results displayed in Tables 1 – 4 and Figures 1 – 4, it is evident that wetlands in the study area are being encroached on. There is a marked decline in the extent of land covered by wetlands within each time frame studied. If this trend is not checked, urban development may overtake other land cover types in the study area. This study therefore recommends that the natural landscape of the study area be preserved for the proper functioning of the ecosystem and groundwater recharging processes.

REFERENCES

Adelekan, I.O. (2009). Vulnerability of Poor urban coastal communities to climate change in Lagos, Nigeria. Paper presented at the Fifth Urban Research Symposium, Marseille, France, and June 28-30, 2009.

Agboola, T. and Agunbiade, E. M., (2007). Urbanization, Slum Development and Security Of Tenure: The Challenges of Meeting Millennium Development Goals (MDG) 7 In Metropolitan Lagos, Nigeria, Paper presented to the PRIPODE workshop on Urban Population, Development and Environment Dynamics in Developing Countries, Nairobi, 11-13 June 2007.

Bakare. H.O.; Oke M.O.; Bankole, M.O. and Komolafe, B.O. (2011):"Spatio-Temporal Analysis of Wetland Ecology of Ijebu-Ode, South West Nigeria". Proceedings of Environmental Management Conference, Federal University of Agriculture Abeokuta, Nigeria.

Braimoh, A. and Onishi, T. (2007). Spatial Determinants of Urban Land Use Change in Lagos, Nigeria, Land Use Policy, 24: 502-515

Chang, H. (2004). Water Quality Impacts of Climate and Land Use Changes in Southeastern Pennsylvania. The Professional Geographer, 56(2): 240-257.

Cowardin, L.M., Carter, Virginia, Golet, F.C., and LaRoe, E.T., (1979). Classification of wetlands and deepwater habitats of the United States: U.S. Fish and Wildlife Service Report FWS/OBS-79/31, 131 p.

Darnell, R.M. (1976). Impacts of Construction Activities in Wetlands of the United States. EPA-600/3-76-045. U.S. Environmental Protection Agency, Environmental Research Laboratory, Corvallis, OR

Efe, S.T. (2001): An Appraisal of the Quality of Rain and Groundwater Resources in Nigerian Cities: The case of Warri Metropolis, A. Ph.D seminar paper presented to the Department of Geography and Regional Planning, Delta State University, Abraka.

Lagos State Ministry of Economic Planning and Budget (2004), State of Lagos Megacity and other Nigerian Cities, a Report by the Lagos State Ministry of Economic Planning and Budget in collaboration with the Lagos State Ministry of Physical Planning and Urban Development, the UN-Habitat Office in Nigeria, the State NEPAD Committee and the Lagos Economic Summit Group, Lagos Metropolitan Development and Governance Project 2006

Maltby, E. (1986). WaterloggedWealth:WhyWastetheWorld'sWetPlaces.Earthscan, London ,UK.

McKinney, M.L. (2006). Urbanization as a major cause of biotic homogenization. Biological Conservation, 127, 247– 260.

National Population Commission NPC (2006). The population of Local Government Areas (LGAs) of Lagos State (2006.

Neuwirth, R. (2007). Traffic Stalls Become Market Stalls on The World's Fastest Growing City, Azure pp. 154-159

O'Connell, M. (2003). Detecting, measuring and reversing changes to wetlands. Wetlands Ecology and Management 11, 397–401.

Odumosu, T. and Balogun, Y. (1999). Lagos State in Maps. Ibadan, REX Charles Publications and CONNEL Publications.

Odunuga, S., and Oyebande, L. (2007). Change Detection and Hydrological Implications in the Lower Ogun Flood Planning South West Nigeria. In Owe, M, and Neale, C. (Eds). Proceedings of Symposium on Remote Sensing for Environmental Change Detection. International Association of Hydrological Sciences (IAHS) publication, 316

Orimoogunje, O.O., Oyinloye, R. O. and Seumah. M. (2009): Geospatial Mapping of Wetlands Potential in Ilesha, South Western Nigeria. Surveyors key Role in Accelerated Development. FIG Working Week, 2009, Eilat Israel, 3-8 May 2009

Oyebande, L.; Obot, E.O. and Bdiliya, H.H. (2003). An inventory of Wetland in Nigeria. Report prepared for World Conservation Union-/UCN, West African Regional Office, Ouagadougou, Burkina Faso

Ramsar Convention Secretariat. (2007). Wise use of wetlands: A conceptual framework for the wise use of wetlands. Ramsar handbooks for the wise use of wetlands, 3rd edition, volume 1. Ramsar Convention Secretariat, Gland, Switzerland.

Schuyt, K., and Brander, L. (2004). The Economic Values of the World's Wetlands, Gland/Amsterdam, WWF.

Tijani, M.N., Olaleye, A. O. and Olubanjo, O. O. (2011). Impact of Urbanization onWetland Degradation: A Case Study of Eleyele Wetland, Ibadan, South West, Nigeria. Proceedings of the Environmental Management Conference, Federal University of Agriculture, Abeokuta, Nigeria.

Turner, R. E. (1990). Landscape development and coastal wetland losses in the northern Gulf of Mexico. American Zoologist 30:171–197.

Uluocha, N.O. and Okeke, I.C. (2004) Implications of Wetland Degradation for Resource Management Lesson from Nigeria. Geo Journal, 61, 151-154.

United Nations Environmental Programme (UNEP) (2007). The status of the Nigerian Coastal Zones. Retrieved online from www.unep.org/abdjanconvention/docs.

Zhao,H.Z.; Yang, H.W.; Guan, Y.T. and Jiang, Z.P. (2006).The Transformation of Aluminium Species in the Processes of Coagulation, Sedimentation and Filtration Water Science & Technology Vol 53 No 7 pp 225–233