Need for Emergency response to Wetlands Loss in Southwestern Nigeria: A Review

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Abstract

Southwestern Nigeria's wetlands are assaulted, degraded, and lost, especially to agricultural development and urban expansions, while the rural wetlands losses are due to agriculture but temporal in nature, loss to urban developments are permanent. To examine the extent, influence, and potential of the degradation, the review covered the six states of the region, revealing losses due to wetlands destruction in the region between 1965 and 2019. Wetlands in Lagos reduced from 708.96ha (52.68%) in 1965 to 7.10ha (0.53%) in 2005, Eleyele Wetland in Oyo State, (Riparian), reduced consistently from (1.25 km^2) in 1984 to (0.98 km^2) 1994, (0.70 km^2) 2004 and finally (0.42 km^2) in 2014. Eriti forested wetlands of Ogun State lost about 45.32% between 1972 and 2015; in Ondo State, Akure South Local Government Area Wetlands decreased from 98.90 km^2 (30.13%) in 1999 to 90.33 km^2 in 2009 (27.52%); Ilesa wetlands, in Osun State decreased from 258 hectares to 89 hectares between 1986 and 2002. The above scenarios in the region imply that in a short while, the wetlands would be completely lost, most importantly to the uncontrolled urban developments. Therefore, there is an urgent need for all hands to be on deck to protect wetlands by considering them as endangered ecosystems.

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Introduction

Wetlands are among the Earths most productive and threatened ecosystems combined (Ducks Unlimited Canada, 2008); accounting for only 6.2-7.6% of the Earth's land surface (Lehner and D€oll 2004; Cassidy, 2019). Wetlands are important component of the human environment, as they perform key functions in the stability of ecosystems. Such roles include the supply of water to minimize the effects of inadequate rainfall; home to diverse species of plants and animals; thus, serving as a diversity bank among other roles (Uluocha et al., 2004; Bikangaga, 2007; Federal Ministry of Environment, 2009; Mitsch, 2009; Di Liu et al., 2017). Importantly, wetlands are cultivated to ensure cultivation and food production in the time of water scarcity in uplands, most especially at the peak of the dry seasons. However, in recent decades, there has been an increase in the agricultural use of wetlands, especially in developing countries (McCartney et al., 2010; Commonwealth of Australia, 2016). This singular function of wetlands in ameliorating the water supply for continuous crops' cultivation seems to be the major factor responsible for its loss all over the world.

The sustained use of wetlands for agricultural purposes, according to Guthrie (1985), was due to their great potential for a sustainable increase in food production. Possessing inherent high fertility status and locations in flat or near-flat landscapes where soil erosion is not a major constraint to crop production. However, there exists staggering statistics of wetlands degradation and loss capable of undermining their capacity to provide ecological services the world over and have triggered number of research among scholars (Modaret et al., 2010). Much of the research are geared towards unravelling the economic values of wetlands; some considered the fertility status of the wetlands vis-à-vis its loss to crop cultivation and extensions. Accordingly, an agricultural incursion into wetlands is the chief destroyer and modifier of wetlands, after which is the issue of

urbanization (Orimoogunje, et al., 2009). Conversion of wetlands to agricultural lands may cause the altercation of soil physicochemical properties, which in turn may influence the soil fertility status of a given area (Kassahun et al., 2014). Although the influence of climate changes induced by a reduction in rainfall events and prolonged heat spells cannot be overemphasized in this regard, the anthropogenic factor was decisive (Hategekimana and Twarabamenye, 2007).

Wetlands are found all over the world, most African countries inclusive; of which the largest in the continent include the Okavango Delta, the Sudd in the Upper Nile, Lake Victoria basin and Lake Chad basin, and the floodplains and deltas of the Congo, Niger, and Zambezi rivers (UNEP, 2000). Nigeria is richly endowed, both with coastal and inland wetlands resources, but anthropogenic and bio-geophysical factors are currently threatening them; such as increased population pressure, rapid urbanization, mining, and pollution among others (Orimoogunje et al., 2009; RAMSAR, 2009). Even Nigeria's most important wetlands, the Hadejia-Nguru Wetlands in Jigawa and Yobe states respectively, have shrunk by as much as two-thirds in the past 30-40 years because of diversions from dams, irrigation developments and drought (Tijani et al., 2011). This had seriously influenced; fisheries, farming, and wildlife due to changed hydrological morphology of the area (Idris, 2008), and by extension, the livelihood sustenance of the local communities that depend on them. Moreover, uncontrolled oil exploration activities, spillage, and pollution have rendered Niger Delta, Nigeria's largest wetlands (third largest RAMSAR designated site in the world), waste and unproductive (Nigerian Environmental Study, 1991). In the Southwestern part of the country, there are many wetlands' area that dots the six states which constitute the region. These are; the Eleyele wetland area in Oyo State, Eriti watershed in Ogun State; Lagos Wetlands in Lagos State; Akure Wetlands of Ondo State; Ilesa in Osun State, Wetlands of Ekiti State Ado-Ekiti among others in the region.

Whereas for this review, one wetland research journal pertaining to each state was selected for the region, so that the outcome of the review would adequately represents the zone. Like every other region of the world, wetlands in the study area, have suffered tremendous degradations, conversion, modification, and loss in areal coverage. Although some past conversions, according to Turner et al. (2000) might have been in the society best interests, nonetheless, wetlands have frequently been lost to activities resulting in limited benefits or costs to society (Murdiyarso et al., 2012). Loss and degradation of wetlands not only affect the existence and health of an individual wetland, but also affects the ecosystems as a whole and can contribute to regional and even global environmental problems (Gannaway, 1995). While some modifications such as farming/ earth ponds for fishing are temporal. Modifications for human settlements, constructions of bridges, embankments and drainages are permanent in nature with serious consequences both in the immediate and in the future. In the immediate, it may include the distortion of natural direction of water flows and incidence of floods; and in the future distortion in the water feeding the wetlands. This may result in the loss of wetness and inability of the wetlands to perform the natural roles of flood abatements and supply of wetlands goods and services. In-ability to perform these roles may constitute a great loss in economic terms to the surrounding populace who depend solely on the wetlands for their survival and severe consequences on the natural pools (Idris, 2008; Rebelo et al., 2010). The effects on the natural pools included loss of natural nursery ground and breeding sphere for many plant and animal species, and survival ground during acute water shortage.

When wetlands are lost, significant amounts of greenhouse gases are released and the landscape ability to store carbon is reduced. The ecological goods and services that are critical to our health and economic well-being are continually being deteriorated (Ducks unlimited Canada, 2008). However, with all the importance attributed to wetlands; they are modified, converted, and drained

for other uses, not minding the consequences; though most of the users do not know the effects on the environment, as the economic prospects drive them. On the other hand, the governments that know the implications of the wetlands loss do not come up with enforceable policy statements that will curb the indiscriminate conversion and modification of these important ecosystems. If only the policymakers could apply the same zeal deployed for the protection of forests ecosystems in protecting this endangered land use, much would have been achieved in wetlands protection.

Materials and methods

Data and methodology

This review was based on data obtained from existing studies in various selected wetlands in the six states across the Southwestern region of Nigeria. Studies pertaining to wetlands dynamics, changes or uses in the region were downloaded from the internet, while ensuring that each state was duly represented by at least one published research paper on wetlands utilizations. Although several research papers were downloaded, but for this review findings from one paper each were used to analyze and cross-examine the loss due to wetlands across the entire region of Southwestern Nigeria. The Wetlands were selected in Lagos, Ogun Oyo, Ondo, Osun and Ekiti State the six states of the region. The wetlands selected were Lagos Lagoon; Eriti in Ogun; Eleyele in Oyo; Ilesha in Osun State and Akure in Ondo state respectively. Lagos was included based on the extensive wetlands surface area in the state. Eriti Wetland was included because of its use for agricultural purposes and its consequent involvement in FADAMA programmes. Eleyele Wetland is a major source of potable water distribution for household use upon treatment in Ibadan and its environs. Akure too was included due to its fast urbanization status and rapid increase in population, like wise for other locations.

The study area: Wetlands in the Southwestern Nigeria

The study area is Southwestern Nigeria (also referred to as the southwest geopolitical zone/region) (Figure 1). The zone is made up of six States (Ekiti, Lagos, Ogun, Ondo, Osun, and Oyo) extending over a surface area of about 76,851 km2, with an estimated population of about 27,581,993 and population density of 359 people/km2 (Macmillan, 2007). The choice of southwestern region for this review was because of the serious dynamics of its land uses, rapid urbanization and population growth, rapid socio-economic development, and diversity of agricultural practices. Whereas various sites were purposively selected among the states for the review, as they are still being modified and converted to both temporal and permanent uses at alarming rates. The modifications, most of the time, are economic in nature due to lack of jobs among the teaming youth population and available markets for wetland products such as vegetables. All the sites are known to have been sources of enormous economic benefits to the various states over the years (Okali and Onyeachusim, 1991), because of their fertile soils, all-year wetness, log-gable woods, and non-wood resources such as leaves and barks for medicinal purposes, wild fruits, and their wild animal biodiversity store.

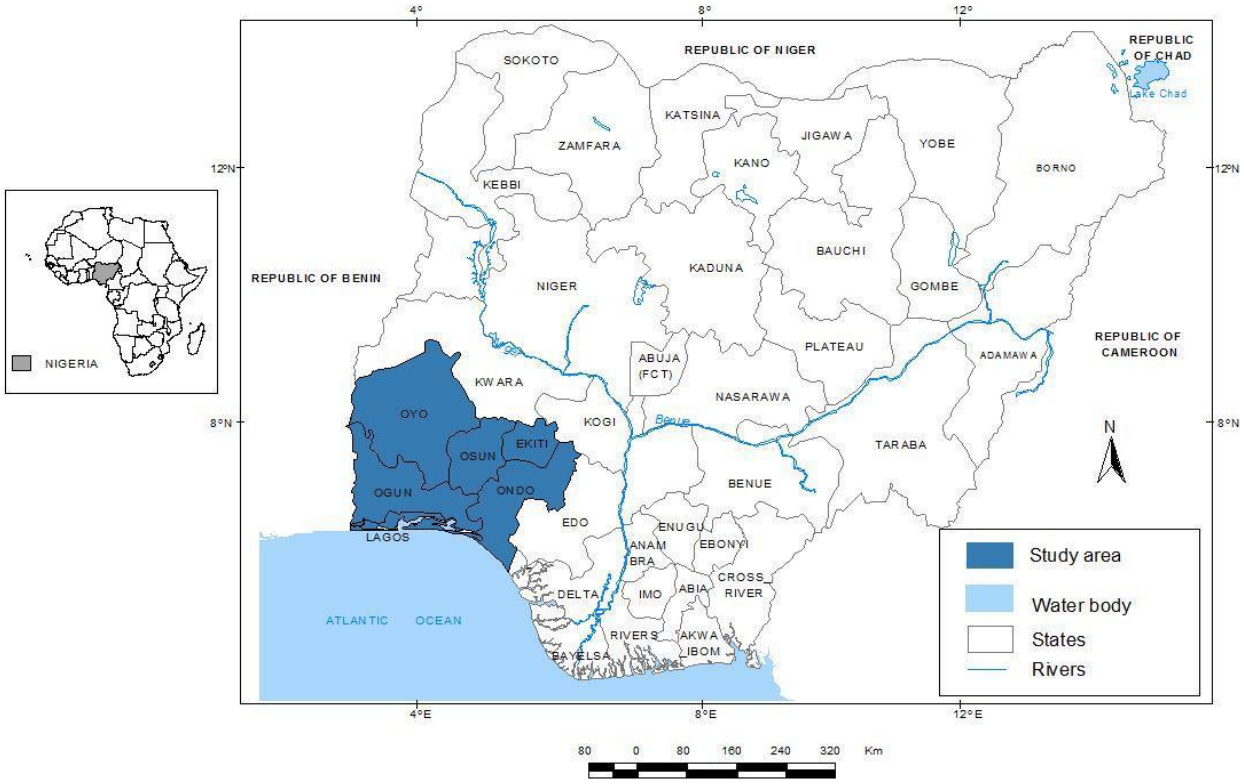

Figure 1 Map of Nigeria showing the Southwestern region, Adapted from Oyinloye and Oloukoi 2013

Eleyele Wetland Oyo state

Eleyele Wetland is in north-eastern part of Ibadan, southwestern Nigeria within Longitudes 3°50′ E and 3°53′ and Latitudes 7°25′ N and 7°27′ N. The study site is surrounded by Eleyele neighbourhood in the south, Apete in the east and Awotan in the north. Eleyele wetland is a modified natural riverine wetland type with area of about 100 km2 including the catchment area. The elevation is relatively low, ranging between 100-150 m above sea level and surrounded by quartz-ridge hills toward the downstream section where the Eleyele dam barrage is located. Several stream channels serve as feeding / recharge streams to the Eleyele wetland basin. In 1942, the quest to create a modern water supply system to meet the challenge of water scarcity for the emerging

Ibadan metropolis led to the construction of the Eleyele Dam on the main River Ona with a reservoir storage capacity of 29.5 million litres.

Eriti wetland

Eriti wetland is located in Obafemi Owode Local Government Area of Ogun state, Southwest of Nigeria. It is located on Longitudes 3°18′ E and 3°39′ and Latitudes 6°50′ N and 7°50′ N. It has an average temperature of 24° C during the dry season and 30° C during the rainy season (Olarewaju et al., 2014). Eriti vegetation is mainly Guinea and derived savannah. Eriti is mainly a farming community, and it is popularly known as the home of vegetables as the farmers cultivate more of leafy and fruit vegetables.

Akure Wetlands of Ondo State

Wetlands are scattered across Akure along rivers Ala and Elegbin, the two major rivers passing through the city. Akure being the administrative city and the seat for many government organizations and industries in Ondo state is fast becoming urbanized and has experienced rapid increase in its population from 71,106 in 1963 to 360, 268 in 2006 (1963 and 2006 Population Census Reports of the National Population Commission, (NPC). This increasing population puts tremendous pressure on land availability as well as food and other social amenities in the city with priority given to developers for buildings rather than for conservation or for agriculture, thereby, leading to encroachment of the wetlands and consequently degradation.

Ilesa study area, Osun state

The study area lies within latitude 7° 30′ and 7° 35′ N and longitude 4° 30′ and 4° 34′ E. Ilesa urban area is made up of two local government areas, namely Ilesa West and Ilesa East. Both

Council areas are bounded in the North, West, and South by Obokun, Atakunmosa and Oriade Local Government areas respectively. The town covers a total area of about 73.6 square kilometres. It is about 32 Kilometres Northeast of Ile-Ife and about 30 kilometres Southwest of Osogbo, the Osun State Capital. The population of Ilesa has been put at 210,141 in 2006 (NPC 2006). The climate is humid tropical type with a mean annual temperature of about 28° C and a mean annual rainfall of over 1600 mm. the underlying geology is mainly fine-grained biotite gneiss and schists, although quartzite and quartz-schist rocks are common especially on slopes and ridges. The soils are mainly the well-drained Egbeda series known as alfisols, which has been classified as one of the most fertile soils in the Nigeria cocoa belt (Smyth and Montgomery, 1962). The whole area is drained by tributaries of Osun, Sasa and Oora Rivers, which flow southward and southwest direction. The natural vegetation is the Tropical Rain Forest, which could only be found in patches all over the district but mainly on hills.

Wetlands of Ekiti State Ado- Ekiti

Ekiti State lies entirely within the tropics between latitude 7° 15′ to 8° 5′ north of the equator and longitude 4° 45′ to 5° 45′ east of the Greenwich Meridian. It enjoys a typical tropical climate with two distinct seasons, the rainy season, which last roughly from April to October, and the dry season, which prevails for the remaining months. The State is endowed with abundant water resources, and some of its major rivers are Ero, Osun, Ose, Ogbese, Oni and Egbe. Most of the washed areas of these rivers and many other small streams in the state are areas where wetland farming is practiced.

Results and Discussion

Major threats to wetlands

The world has lost more than half of its wetlands since 1900 (Barbier, 1993). As reported by FAO (2000), about 25% of the world's wetlands have already been lost, largely due to conversion to agriculture or diversion of water for agriculture and aquaculture. Most of these disappearances have occurred during the twentieth and early twenty-first century (Davidson, 2014). The wetland losses are generally due to the public nature of many wetlands products and services; user externalities imposed on other stakeholders and policy intervention failures due to a lack of consistency by governments (Turner et al., 2000). Literatures are a-washed with staggering statistics of losses due to wetlands all over the world: In the United States, it is estimated that 54% of its original wetlands have been lost, of which 87% are to agricultural development and 8% to urban development (Maltby, 1986, in: Barbier, 1993). In France, 67% of its wetlands have been lost between the years 1900 and 1993; estimates on wetlands losses indicate that up to 70% of wetlands have been lost or degraded in settled areas of Canada (Ducks unlimited Canada, 2008). While the Netherlands has lost 55% of its wetlands in only 35 years between 1950 and 1985; In China, more than half of the wetlands have declined over the past 50 years; and between 1990 and 2000, nearly 30% of Chinas natural wetlands have disappeared (Ren et al., 2007; Cyranoski, 2009). Regarding the status of tropical wetlands, though such data are lacking, it is expected that the patterns of wetlands conversion are similar to that of the United States (54%) (Schuijt, 2002).

In Africa, the Niger Republic, for example has lost more than 80% of its freshwater wetlands over the past two decades (Niger Ministry of Environment and Hydraulics, 1997, in UNEP, 2000). The pressure that threatened the existence of wetlands consists of drought, upstream and downstream water developments. While upstream dams alter the timing and size of flood flows and divert

surface or groundwater for irrigation. Downstream increasing demands for irrigated agriculture cultivations lead to diversion of water past wetlands through bypass channels (Schuijt, 2002). Threats to wetlands also include reduced flows caused by droughts and water abstractions, aquatic weed infestation, pesticides (especially DDT), infrastructure development like dams, overuse of resources due to human pressure, uncontrolled fires, pollution, and deforestation (SARDC, 2000). While the Potential threats for the future include poverty, population increase, soil erosion and siltation, destruction of breeding grounds and sanctuaries of aquatic animals through the increased use of agrochemicals, which affect aquatic environments so, also invasion by exotic plant species (Schuijt, 2002).

In addition, human-mediated activities such as mismanagement and misuse also subject wetlands to damage and degradation, particularly in regions with low or irregular precipitation, because these areas experience significant conflicts between water use and wetlands maintenance (Melendez-Pastor et al., 2010). In a study conducted on the geospatial mapping of wetlands potential in Ilesa, Osun State, Nigeria, Orimoogunje et al. (2009) identify urbanization and agricultural activities as constituting major threats to wetlands in the area. Accordingly, urbanization and agro-economic activities put pressure on wetland resources in the area. Urbanization, over-cultivation and encroachment of wetland resources due to increased population pressure and the suitability of the areas for production of arable crops increased the stress on wetland resources. Because of these factors, areas that were initially regarded as wetlands have been converted to agricultural sites and settlements. Adeleke (2019) discovered the same influence in a study entitled drivers of wetlands conversion in the tropical environment. In a similar vein Tijani et al. (2011) examining the impact of urbanization on wetlands degradation in Eleyele, Ibadan, Southwest Nigeria, highlighting the environmental impacts of urbanization and land-use

and the roles both factors played in the degradation of Eleyele wetlands in Ibadan. The authors concluded that Nigeria is richly blessed with both coastal and inland wetlands, many of which are threatened by human-motivated factors such as land use activities, urbanization and agricultural activities in addition to the emerging threats of climate change.

Similarly, Ajibola et al. (2012) examined the effects of urbanization on Lagos wetlands and established that the primary causes of wetlands loss in Lagos metropolis are mainly human-motivated. Such human activities listed by the researchers included incessant sand-filling and conversion of wetlands environment for economic uses, high rural-urban migration and increased dredging of wetland sites within Lagos State. Furthermore, the study identified perennial flooding, which common occurrences in Lagos environs have played major roles in the depletion and loss of the ecosystems. The authors identified several effects of economic activities on wetlands in Lagos and the impacts that urbanization had on wetlands located within the region. Direct habitat loss suspended solid additions, hydrologic changes, altered water quality, increase run off volumes, diminished infiltration, reduced stream-based flows and groundwater supply; lengthy dry periods according to this study are the resultant effects of urbanization in Lagos. Ajibola et al. (2016) ranked that urbanization is the first major factor causing degradation, depletion and subsequent loss of wetlands in Lagos. Sand-filling of wetlands for construction was ranked second, while conversion of wetlands for housing and infrastructural development was both ranked third. Toxic chemicals and industrial wastes emptied into wetlands ranked fourth, while the disposal of non-biodegradable wastes into wetlands is ranked fifth. Dredging of wetlands, climate change and the unsustainable conversion of wetlands were ranked sixth, seventh, and eight respectively.

It could thus, be deduced that urbanization is the major factor causing the degradation, depletion, and loss of the wetland resources in Lagos. Siltation and improper handling of solid wastes are

some other activities that cause stress to wetland resources. Over-cultivation and farming methods that do not take care of soil conservation in the respective hilly and mountainous areas have resulted into flooding during the rainfalls. The floods bring silts from the headstreams causing siltation of wetlands downstream; therefore, threaten the existence of wetland resources (Orimoogunje et al., 2009). Solid waste has also been regarded as one of the factors causing stress to the wetland resources through the blocking of water sources in streams and rivers.

Wetland dynamics: Southwestern Nigeria experience

Various studies have shown continuous and consistent loss of wetlands in Nigeria in general and southwestern part of Nigeria in particular, common to all the studies in the area from the year 1965 to 2019 was depletion of wetlands in all the states of the region as shown in the various research findings. In a study by Odunuga et al. (2011), Lagos wetlands, due to conversion to other economic uses, were reduced from 708.96ha (52.68%) in 1965 to 7.10ha (0.53%), urbanization (Built-up Area) gained tremendously taken as much as 91.46% of the total land areas in 2005 from initial 166.88% of 1965 (Table 1).

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

Landuse	1965 Area (ha)	% of total	1975 Area (ha)	% of total	1987 Area (ha)	% of total	2005 Area (ha)	% of total
Agriculture	38.09	2.83	18.57	1.38	10.9	0.81	3.86	0.29
Built up Area	166.88	12.4	1045.54	77.69	1195.99	88.87	1231	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	66.7	4.96
Vegetation	396.6	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*	*9.8*	*28.8*	*2.14*	*7.1*	*0.53*
Total	1345.78	100	1345.78	100	1345.78	100	1345.78	100

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. Around the drainage, channel that traverses Agidingbi, Obafemi Awolowo Way, Oregun Link Road and Ogudu Bridge, focusing on the extent of built-up and wetland areas. While the analysis showed a consistent increase in the built-up areas since 1965 (331.06ha, 7.57%), 2008, the extent of imperviousness had increased to 3356.20ha (79%) and finally to 3405.23ha (80.39%), in 2014. Meanwhile, inland and coastal wetlands were decreasing 1840.41ha (43.45%) and 2074.22ha (48.97%) respectively in 1965, reduced to 222.37ha (5.25%) and 667.12ha (15.75%) in 2008, and was as low as 203.9ha (4.82%) and 626.56 (14.79%) by 2014 (Table 2). The increase in the extent

of imperviousness is indicative of the conversion of wetlands in the study area to other uses, especially built ups.

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	3356.2	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	4235.7	100	4235.7	100

Source*:* Adegun, Odunuga and Appia (2015)

Table 3: GIS-based estimated and projected temporal changes in the spatial extent of land use types (in km^2) within the Catchment of Eleyele Wetland, Oyo State

Land Use Type(km^2)	1984	1994	2004	2014
Dense forest	3.38	3.2	3.01	2.52
Riparian (wetland) forest	1.25	0.98	0.7	0.42
Light forest	3.84	2.46	1.09	0.01
Waterbody (River)	1.25	1.19	1.14	1.09
Built-up Area	4.47	5.99	7.52	9.04
Total	14.19	13.82	13.46	13.08

Source: Tijani et al. (2011)

GIS-based estimated and projected temporal changes in the spatial extent of land use types (in km2) within the Catchment of Eleyele Wetland, Oyo State by Tijani et al. (2011). The experience was not different at the Eleyele Wetland in Oyo State, Riparian (wetland) forests experienced consistent loss from (1.25 km2) in 1984, to (0.98 km2) in 1994, (0.70 km2) 2004 and finally (0.42 km^2) in 2014. Whereas urbanization represented by Built-up Area kept growing consistently in the area during the period (Table 3). Specifically, study by Tijani et al. (2011) in Ibadan using satellite

data revealed that the built-up area within the catchment of Eleyele wetlands increased by almost 70% between 1984 and 2004. This has resulted in reduction or loss of forests and agricultural lands around the wetlands by more than 60%. They argued that while the increase in urbanization may not have resulted into loss or degradation of wetland soils; there are clear influences of urban catchment activities on water and bottom sediments of the feeding streams and the main wetlands lake. Consequently, in the work, degradation, and loss of wetlands and their biodiversity impose major economic and social losses and costs on the ecosystems. As shown in Table 3, the size of the built-up areas around the wetlands increased from 4.47km^2 in 1984 to 7.52km^2 in 2004. It was projected to reach 9.04km^2 in 2014. This shows a consistent increase in the size of the built-ups in over four decades. The overall implication of the study is that there is need to control the increasing urban encroachment on the wetlands to avoid removal of the vegetation and degradation of the ecosystem within buffer zones, Tijani et al. (2011). In addition, findings of Adeleke (2017), in a study of Land Use Change of Eriti Watershed in Obafemi-Owode Local Government of Ogun State between 1972 and 2015 revealed the wetland status at the end of the study epoch. Wetland's situation in Eriti study area of Ogun state was not different to every other location in the southwestern part of the country, here on Table 4, forested wetlands lost about 45.32% between 1972 and 2015. Non-forested wetlands also lost a significant portion of its lands between 1972 and 2015. Attesting to the influences of other land uses, most especially, farmlands and built up or open space on the wetlands in the area.

Table 4: Land Use Change of Eriti Watershed Obafemi-Owode Local Government of Ogun State between 1972 and 2015

LULC	Change between 1972 and 1984		Change between 1984 and 2000		Change between 2000 and 2015		Change between 1972 and 2015	
	Acre	%	Acre	%	Acre	%	Acre	%
Farmland	2905.92	46.46	1170.36	19.77	42.12	0.90	1693.44	56.21
Water body	1092.24	67.42	99.72	18,89	19.80	4.63	1211.76	74.80
Built up/open space	463.32	149.48	336.96	43.58	242.64	21.85	1042.92	336.47
Fallow land	1474.56	73.33	1226.64	228.68	625.20	35.46	377.28	18.76
Forested Wetlands	3180.60	80.06	1641.96	207.22	262.08	10.77	1800.72	45.32
Non Forested Wetlands	2378.16	114.17	1936.08	43.40	543.24	21.51	101.16	4.86

Source: Adeleke 2017

Table 5**:** Spatial Changes in Wetland Configuration of Akure South Local Government Area of Ondo State, 1986 to 2019.

LULC	1986		1999		2009		2019	
	Area (Km^2)	%	Area (Km^2)	%	Area (Km^2)	%	Area (Km^2)	%
Built up	14.06	4.28	27.01	8.23	36.78	11.2	63.28	19.28
vegetation	196.4	59.83	153.33	46.71	186.07	56.7	147.4	44.9
wetlands	98.9	30.13	120.32	36.65	90.33	27.5	106.16	32.34
Rock outcrop	18.91	5.76	27.61	8.41	15.09	4.59	11.43	3.48
Total	328.27	100	328.27	100	328.27	100	328.27	100

Source: Omodehin, Basorun and Oyinloye, (2021).

The study by Omodehin et al. (2021), Spatial Changes in Wetland Configuration of Akure South Local Government Area of Ondo State, 1986 to 2019. Wetlands in the study area had a land area of 98.90 km2 representing 30.13% of the total land areas, in 1999, wetlands configuration increased to 120.32 km^2 (36.65%) and decreased to 90.33 km^2 in 2009 (27.52%); in 2019, there

was an increase to 106.16 km^2 representing 32.34% (Table 5). The sustained increases in the wetlands' area as shown in the study is suspicious and could only be attributed to the seasonal changes of the multispectral satellite imageries used for the analyses (Kojima et al., 2005). Most importantly, satellite imageries taken during the wet season tend to have seemingly more wetlands (temporary wetlands) than those taken during the dry season of the year. As wetlands are expected to reduce in status from one period to another due to growth in agricultural and urban usages, as the review of studies conducted in different parts of Southwestern Nigeria, have shown. For instance, Orimoogunje et al. (2009) revealed that between 1986 and 1991, the total land area of wetlands decreased from 258 hectares to 148 hectares in Osun State. They further showed that there was further decrease in wetland as of 2002 to 89 hectares, while other land uses such as agricultural activities and settlement within this period increased (Table 6). In the same Osun State, Adeoye and Dami (2012) observed human modification in terms of the reduction in the size of the original wetlands in Ile Ife. Similar findings were made by Abiodun and Akinola (2019), who investigated land use area and percentage of land use area in Osun State between 1986 and 2016. Wetlands also experienced loss of ground from 1986 the base year to 2016 covered by the study. Although there was slight increase in the areal coverage of wetlands in 2006, which could only be due to seasonal variation of the satellite imageries used, according to Kojima et al., (2005). As wetlands are expected to diminish in areal extents from one period to another; due to continuous loss to agricultural and urban lands expansion, coupled with unregulated growth in population responsible for their sustained losses.

Table 6 Geospatial Mapping of Wetlands Potential in Ilesa, Southwestern Nigeria

Land use types	Areal extent (ha) 1986	%	Areal extent (ha) 1991	%	Areal extent (ha) 2002	%
Bare soil/land	1401	6.49	1969	9.12	2902	10.09
Dense/Riparian vegetation	8791	40.72	5915	27.4	1328	4.62
Agricultural activities	7047	32.64	9017	41.76	14435	50.18
Settlement	4093	18.96	4541	21.03	10012	34.8
Wetlands	258	1.19	148	0.69	89	0.31
Total	21590	100	21590	100	21590	100

(Orimoogunje et al., 2009)

Table 7: Land use area and percentage of land use area in Osun State between 1986 and 2016

Land use Classes	Land use area (km2)			Percentage land area		
Year	1986	2006	2016	1986	2006	2016
Waterbody	226	223	224	2.44	2.41	2.42
Vegetation	3317	2883	2206	35.82	31.14	23.83
Wetland	1853	1854	1852	20.01	20.03	20.01
Built up	1900	2843	3190	20.52	30.71	34.45
Bare land	1963	1455	1787	21.2	15.72	19.3

Abiodun and Akinola (2019).

Available options at curtailing the loss of wetland

Lagos being the economic hub of Nigeria and other major cities in the southwest are daily receiving influx of people, which would always require increasing demands for housing and commerce. Therefore, infrastructures will naturally continue to encroach on the available wetland ecosystems. It is therefore, pertinent that enlightenment programmes be carried out to sensitize the public on

the benefits of these wetlands and the consequences of their loss. Furthermore, it is advisable that wetlands restoration and preservation programmes and revitalization activities are carried out to restore lost wetlands and likewise revitalize degraded ones. In addition, the creation of artificial wetlands on areas where they did not exist before should be encouraged. Nevertheless, wetlands can be sustainably exploited if the dynamics of the local institutions that influence accumulation and consumption of livelihood assets are well understood and harnessed appropriately, (Mwakubo and Obare, 2009; Gren et al., 1994). Hence, society needs to realize that the root cause of this continued loss is that agricultural producers are faced with market forces, policy signals and economic incentives to drain wetlands rather than to conserve them. Integrated wetland policies are needed now to protect and restore wetlands across the world. Wetlands need to be made a public policy issue with the objective of developing an integrated and comprehensive wetlands policy that effectively stops wetlands loss. The life support systems that are inherent within the wetland ecosystems can provide a wide range of valuable functions to society if they are used sustainably. For example, by incorporating the primary users in the management of the wetlands within the context of societal livelihoods and local institutions (Folke, 1991) as well as balancing the different use options to ensure sustainability of the resource. To achieve this, Springate-Baginski et al. (2009) opined that decentralization of management to the lowest appropriate level of all stakeholders would help achieve greater efficiency, effectiveness, and equity. However, Martin and Sutherland (2003) in reviewing several projects in Malawi observed that an understanding of the immediate Wetlands community dweller's perception of its benefits is crucial. According to them, it allows interventions to be targeted to specific groups for whom the problem is most acute. Furthermore, they opined that motivation for participation is strongly influenced by the relevance of the research focus and intervention strategy to stakeholders' priorities, roles, and

expectations of benefit. Therefore, express knowledge of the values they associate with the Wetlands will be the fundamental step upon which the correction in their values and the eventual sustainability programme hinges on. Moreover, a more explicit understanding of this relationship has the potential to encourage the greater involvement of specific groups in monitoring and evaluation (Martin and Sutherland, 2003). Between the wetlands restoration and conservation, efforts suggested by Adeleke (2019) include deliberate preservation of uncultivated forested wetlands, improvement in farming systems, such as adequate supply of farm inputs including fertilizer to prevent incursion into more uncultivated forested lands due to degradation. Suggestions also included re-forestation of already destroyed forests to bring back the natural wetland forests earlier removed.

Conclusion

The damage done to wetlands in the southwestern part of Nigeria is enormous as it is the region that is developing fastest, most especially Lagos the commercial hub of the country. There is an unchecked influx of people into the region from every other part of the country, thus stressing the available infrastructures and facilities as they are being utilized by the population more than they were meant to serve. Consequently, available spaces are shrinking, and accommodation and transportation are becoming inadequate, whereas available lands for expansion are finite. Therefore, wetlands, which were considered wastelands in the past, are feeling the brunt of land scarcity as they are now being massively converted for agricultural and settlement purposes. Various studies have shown continuous and consistent loss of wetlands in Nigeria in the general and southwestern part of Nigeria in particular, common to all the studies in the area from the year

1965 to 2019 was the depletion of wetlands in all the states of the region as shown in the various research findings. In Lagos, for example, major estate development outlays are taking advantage of oceanic wetlands by industrial dredging and sand-fillings, so are wetlands in the other major towns in the zone experiencing an onslaught. Therefore, there is need for this kind of review to bring once again to the front burner various scholastic findings as regards wetlands degradation to serve as a reminder and to encourage safe utilization of wetlands in the region. The overall implication of the study is that there is need to control the increasing urban encroachment on the wetlands to avoid removal of the vegetation and degradation of the ecosystems.

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