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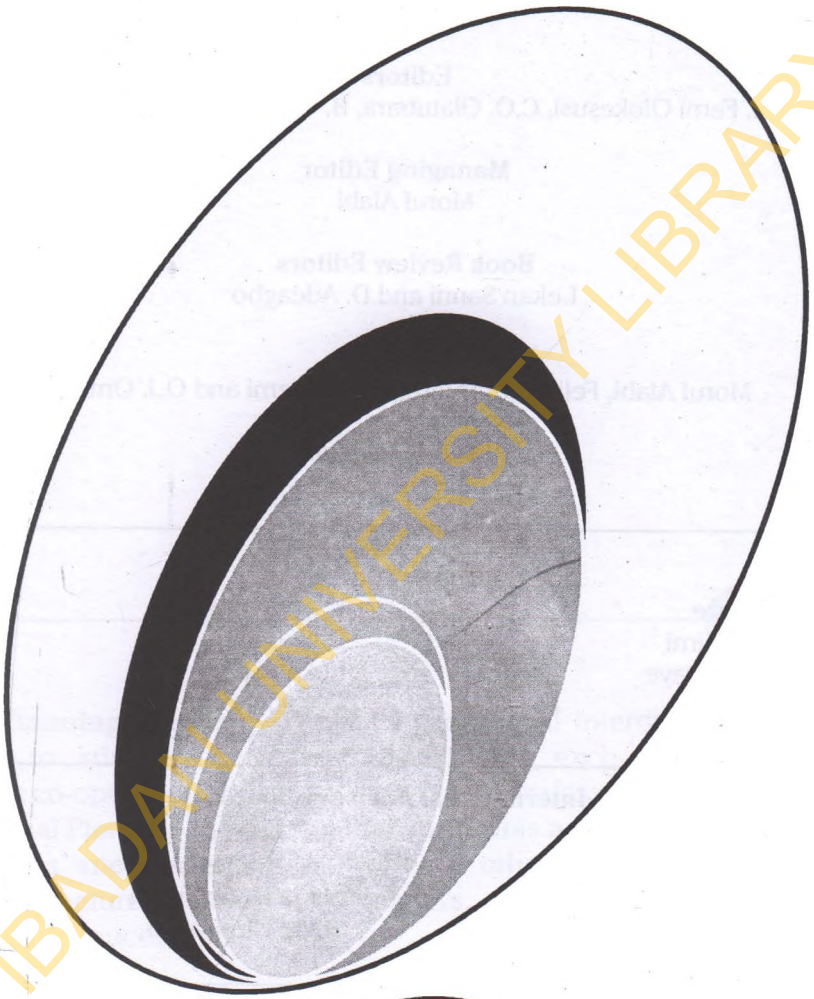

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Are Wetland Threats Synonymous With Environmental Problems? Analysis of Threats to Coastal and Inland Wetlands Environment in Nigeria

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Abstract

Wetlands are a component of the environment and threats facing wetlands might just be a miniature of the larger environmental problems in their immediate vicinity. This paper posited that there is a strong linkage between the major environmental problems in the immediate vicinity of wetlands and threats faced by wetlands. Two questions addressed are (a) are threats faced by coastal wetland substantially different from those faced by inland wetlands, and (b) are wetlands threats synonymous with environmental problems in their immediate vicinity? Questionnaire focusing on the identification of threats to coastal and inland wetlands as well as the environmental problem in their immediate vicinity were administered to wetland users. Results show that the identified threats in both coastal and inland wetlands are almost similar, and that there is no difference between the identified threats to wetlands and environmental problems recognised by the people. Hence, threats to wetlands might be an extension of the general environmental problems in their immediate vicinity. The results of this study provide basic information that is required for developing measures toward a sustainable management and conservation of the inland and coastal wetlands, and addressing environmental problems in the immediate vicinity of wetlands may further assist in resolving some of the threats faced by wetlands.

Keywords: Environmental problems, Coastal and Inland Wetlands threats, Anthropogenic factors, Natural Factors, Sustainability.

Introduction

Environment refers to the totality of conditions that affects humans and the interaction between them could be either positive or negative. Positively beneficial interaction results in positive environmental outcomes, while unsustainable outcomes are regarded as environmental problems or

externalities. Environmental problems are a sequence of interdependent and interlinked procedures and processes which consume one or more resources to convert inputs into outputs that have negative effects on the sustainability of the environmental quality necessary for the wellbeing of the society (Businessdictionary.com). The increasing population of humans, rapid economic and technological development, and intensification of agricultural production represent interactions with the natural environment that have resulted in large-scale environmental damages or negative externalities. Environmental externalities often arise when consumption of natural resources by humans results in social cost that is far greater than the private cost, or when activities of one or more agents have consequences on the wellbeing of other agents, without any exchange or transaction occurring between them (Papandreou, 1994). Some of the threats arising from these interaction include; deforestation, coastal erosion, droughts, flooding, pollution, desertification, and oil spillage etc. Wetland is one of the ecosystems that despite its numerous benefits have suffered large scale degradation and loss consequence on the interaction between it and humans. Agricultural expansion, dam construction, road construction, poor waste management, bush burning, grazing and poverty arising from increasing urbanization and population explosion have contributed to wetland loss and degradation (Groffman et al. 2003). These threats directly and indirectly affect wetlands physical, social, economic and spatial functionalities (Uluocha and Okeke, 2004).

Wetlands are among the world's most valuable resources which are least understood and most abused perhaps because of its public good nature (Maltby, 1990). Cowardin et al. (1979) defined wetlands "as lands transition between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water". Lyon and McCarthy (1993) observed that wetlands contain "a mix of characteristics from terrestrial or upland area and the characteristics of aquatic or water environments". The US Army Corp of Engineers (1987) in its wetlands delineation manual stated that wetlands are "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support and that under normal circumstances do support, the prevalence of vegetation typically adapted for life in saturated soil conditions". Based on these definitions, it is evident that there are several beneficial resources provided by wetland ecosystems that humans have exploited and continue to exploit for their beneficial purposes. The exploitation of wetlands has resulted in loss and degradation of this valuable resource and it has affected its physical, social, economic and spatial functionalities (Uluocha and Okeke, 2004).

Contemporary research focuses on the wise use and sustainable extraction of resources from wetlands because of the various ecological benefits and services individuals, communities and societies derived from them. Wetlands provide ecosystem services such as water purification, flood control, biodiversity conservation, climate regulation, act as sinks for carbon in climate regulation, and are essential for wellbeing and survival of human population especially after a major disaster (Millennium Ecosystem Assessment, 2005; Day et al, 2007; Mitsch et al, 2013). However,

despite the multitude of benefits from wetlands, they have been intensively threatened by increasing urbanization, agricultural expansion, pollution dam construction, unsustainable government policies and poverty (Ehrenfeld, 2004; Meyer et al, 2005; Ehrenfeld, 2008). Limited awareness of the importance of wetlands, hydrological alteration, poverty, absence of wetland inventory, market failure, climate change, urbanization and the associated population explosion have been identified as the causes of wetland loss and degradation (McComb and Lake, 1988; Maltby, 1990; Finlayson and Rea, 1999; Adekola and Mitchell, 2011; Mamolos et al., 2011; Anderson, 2012; Mitsch and Hernandez, 2013). In order to provide a comprehensive understanding of the causes of wetland loss and degradations, scholars have differentiated between direct and indirect cause of wetland loss and degradation. Hollis (1992) observed that population pressure, general lack of awareness of wetland values, lack of political will for wetland conservation and restoration, over-centralized planning, financial irregularities, land use and tenure, deficiencies in the application of environmental impacts and cost-benefit analysis methodologies, and lack of enforcement are some of the underlying cause of wetland loss and degradation. Wetland reclamation and modification, ground water extraction, water diversion from wetlands, wetlands inundation for water storage, regulation of rivers through channel construction, banks walling, surface mining, use of wetlands as evaporation basin, weed invasion, application of chemicals for insect control are some of the direct causes of wetland loss and degradation (McComb and Lake, 1988). Focusing only on the ecological factors at the expense of non-ecological factors accounting for loss of wetlands would hardly produce the expected result and there is a great need to understand the contributions of these non-ecological factors to the pattern of wetland loss (Turner, 1991; Finlayson and Rea, 1999; Mitsch and Hernandez, 2013). This shift in focus should be accomplished through a proper contextualization and holistic rather than independent assessment of the threats facing wetlands.

Putting wetland management within the context of environment of which it is a microcosm would provide a better opportunity for managing threats facing wetlands. Since wetlands are not isolated system, but rather a major component of the larger environment, it thus follows that larger percentage of the threats facing wetlands might be a miniature of environmental threats in the immediate vicinity of wetlands. In addition, despite the connection that exists between wetland ecosystems and its immediate surroundings, resources managers and researchers often treat wetlands as separate entities, compartmentalized by artificial geographic or political boundaries (Barnard et al., 2013). McComb and Lake, (1988) observed that one of the factors that limit wetlands sustainability is the lack of recognition of wetland as linked interdependent systems. The natural and anthropogenic processes causing or contributing to wetland loss and degradation are however complex and varied (Ehrenfeld, 2008), hence research efforts continue to explore the causes and consequences of wetland loss and degradation at different spatial scale because there is no all encompassing lists of wetland threats as well as solutions to the threats (Bedford and

Preston,1988). Today, there are considerable social and scientific debates focusing on the identification of the most important factors responsible for wetland loss and degradation. However, with a better understanding of the relationship between the prevailing environmental problems and major threats to wetlands, a clearer consensus on how best to reduce and mitigate wetland loss and degradation can be achieved. The identification of the prevailing environmental problems together with their linkages with wetland loss and degradation would help in the formulation of policies aimed at protecting wetlands while at the same time guarantying its sustainability (Taylor et al., 1995; Dungan, 1990; Wilen and Bates, 1995). Thus this study focused on the comparative analysis of the wetlands threats in coastal and inland wetlands and also attempts to establish an association (not necessarily a causal relationship) between prevailing environmental problems and threats to wetlands in Nigeria.

Study Area

Nigeria has an estimated area extent of 923,768km^2 and a breakdown of this figure shows that water account for 13,000km^2. Irrigated land is about 2,330km^2 while land

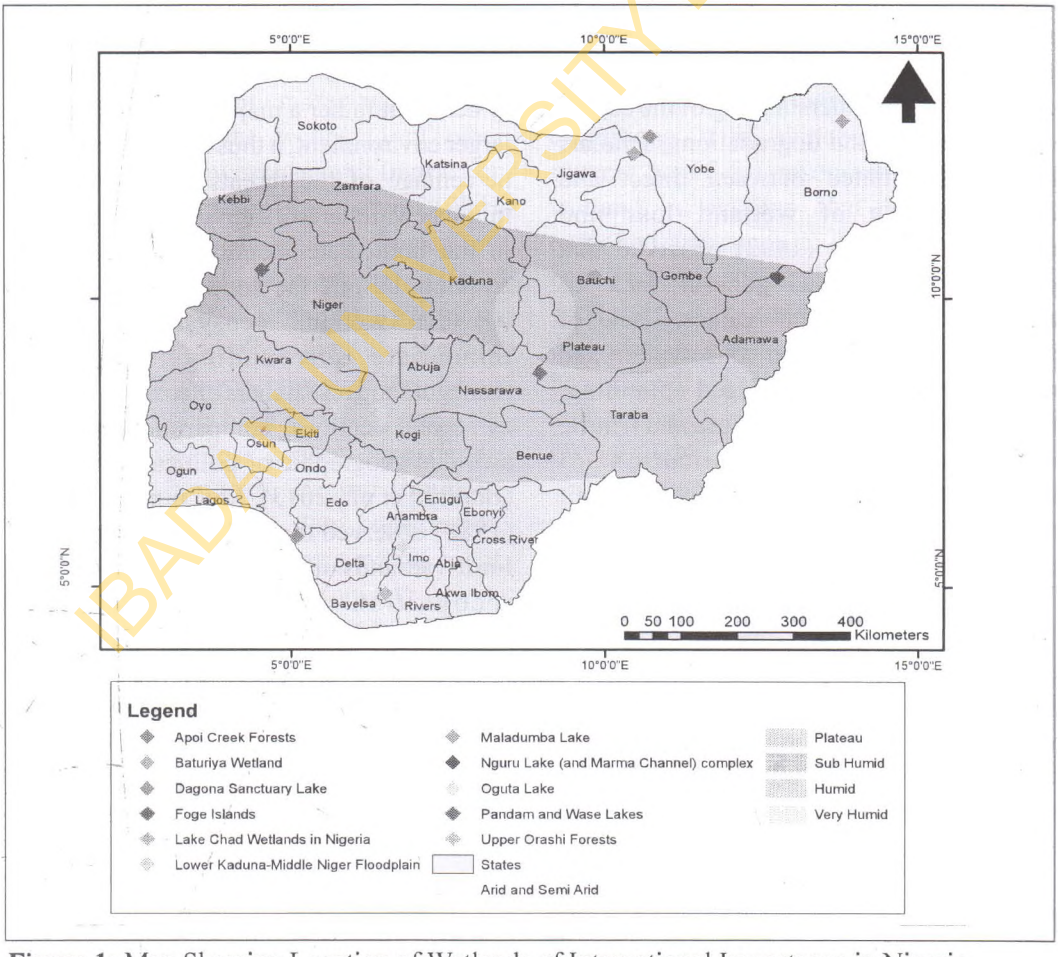

Figure 1: Map Showing Location of Wetlands of International Importance in Nigeria

area account for 910,768km^2 with a coastline that stretches over a distance of 853km. The climate varies from equatorial in the south to tropical in the middle belt while an arid climate predominates in the north (Figure 1). Based on the 2006 national population census, the country has an estimated total population of 140,003,542 and this population would have increased to about 160 million by 2012 (CIA Fact book, 2009). The ecological environment in Nigeria has been broadly classified into three and these are (a) broad coastal belt of mangroves, freshwater swamps, coastal thicket sand lowlands tropical forest (b) a much more extensive hinterland of savannas with a variety of physiognomic types and pocket of upland grassland (c) semi arid scrub lands of the Shaelian region around Lake Chad (Areola, 1998). The major environmental problems in Nigeria stem from either a lack of or an improper appreciation of the dynamic relationship between environmental factors and man's land management practices (Areola, 1998). The mangrove and freshwater swamps in the Niger Delta area as well as the Hadejia-Nguru wetland in the North central part of Nigeria are some of the most prominent wetlands in Nigeria.

Materials and Methods

Understanding the relationship between environmental problems and wetland threats was explored using standardised questionnaire. The use of questionnaire allowed the assessment of the prevailing wetland threats as well as the local environment problems where wetlands are situated. Typically, literature on wetland loss and degradation seem to have dissociated wetlands from the larger environmental context within which it exists. Consequently, isolated rather than holistic management solutions are often proffered. This limitation may largely be responsible for the limited success so far achieved in wetland loss and degradation management both locally and internationally. Questionnaire administration took place on six randomly selected wetland communities in Nigeria. There are eleven (11) notable wetlands of international recognition in Nigeria (Table 3 and Figure 1). The coordinate of these wetlands were plotted in a Geographic Information System (GIS) software. Subsequently, the location of communities derived from the national Gazetteer of communities was overlaid on the wetland map with a view to identifying communities within the 200meter corridors of wetlands. Three communities were selected from the inland wetlands, while additional three were selected from the coastal wetlands. Ikorodu (Lagos state), Brass (Bayelsa State) and Buguma (Rivers State) were surveyed for the coastal wetlands, while Kadera (Jigawa State), Wanko Danko (Niger State) and Oguta (Imo State) were surveyed for the inland wetlands (Table 1). The differentiation into inland and coastal wetlands was based on the anticipated variations in threats and challenges between the inland and coastal wetlands due to the process that brought about their formation and variation in their location within the hydrological continuum. While coastal wetlands are mainly confined to the coastal areas, inland wetlands are found further inlands and thus variation in environmental and wetland threats were anticipated. Nigeria is a country endowed with both coastal and inland wetlands; hence, it is expedient that threats to both coastal and inland wetland types should be studied as well as their associated environmental

problems (Uluocha and Okeke, 2004; NEST, 1991). Emphasis was placed on the identification and analysis of the various physical and human challenges plaguing these wetlands as well as the identification of the prevailing environmental problems in the immediate vicinity of the chosen wetlands.

Six hundred questionnaires were administered in these communities, and respondents include fisher folks, farmers, herdsmen, and wetland dwellers etc. Only residents living and or interacting with wetlands were interviewed. The questionnaire was divided into three sections: the first section addressed socio-demographic characteristics of wetland users, the second section focused on the identification and ranking of threats to wetlands, while the third section focused on the environmental and human challenges facing the people in the vicinity of wetlands.

Essentially, the questionnaire addressed the issue of direct and indirect drivers of wetland change. The primary indirect drivers of wetland loss in the inland wetlands include population growth and increasing economic development, while the direct drivers, typically referred to as pressure, include infrastructure development, land conversion to agriculture, water withdrawal, pollution, dam construction, sand mining, overexploitation of plants, land and fish, and the introduction of alien species (Millennium Ecosystem Assessment, 2005). For coastal wetlands, such as saltwater marshes, mangroves and freshwater swamp forests, population growth and economic development are the known key indirect drivers of change, while conversion to other land uses, the diversion of freshwater flows, overharvesting and siltation are the direct drivers (Ehrenfeld, 2008; Anderson, 2012; Adekola and Mitchell, 2011). The questionnaire was administered randomly to respondents within the ages of 25 and 75 years in the selected communities. The preference for these age range was predicated on the need to obtain information on the past and present threats to wetlands ecosystem. While conducting interviews, direct observations were made on land use and land cover around the wetlands. Additional information on wetland inventory and threats to wetlands in the country were obtained from existing publications both at the local and international level. Simple percentages, cross-tabulation, chi-square and Analysis of Variance (ANOVA) statistics were used to explore the differences in the identified threats to inland and coastal wetlands in addition to association between prevailing environmental problems and the various threats to wetlands.

Results and Discussions

General Overview of Wetland Distribution in Nigeria

Overtime, there have been conflicting reports about the extent of wetlands in Nigeria. Researchers, NGOs and government agencies have come up with different figures

Table 1: Communities Surveyed in the Coastal and Inland Wetlands

Coastal Wetlands				Inland Wetlands			
Wetland Name	State	Geopolitical Zone	Community Surveyed	Wetland Name	State	Geopolitical Zone	Community Surveyed
Lagos	Lagos	South West	Ikorodu	Baturiya Wetland	Jigawa	North Central	Kadera
Bayelsa	Bayelsa	South South	Brass	Lower Kaduna	Niger	North West	Wanko Danko
Rivers	Rivers	South- South	Buguma	Oguta Lake	Imo	South South	Oguta

on the extent and number of wetlands in Nigeria. There are fourteen notable wetlands in the country and these include Sokoto-Rima, Komadugu Yobe, Lake Chad, Upper Niger and Kainji Lake, Middle Niger – Lokoja - Jebba – Lower Kaduna, Lower Benue – Makurdi, Cross River, Lower Niger, Niger Delta, Benin – Owena and Okomu, Lagos Lagoon and Lekki Peninsula, Lower Ogun River, Ologe Lagoon, Badagry and Yewa Creeks and the trans-boundary wetlands of the Upper Benue (Oyebande et al, 2003; Asibor, 2009; Nwankwoala, 2012). The Ramsar Convention organization identified eleven wetlands of internal recorgnition, while NEST (1991) identified twelve wetlands (Table 2). The inability to clearly demarcate wetland boundaries and define what constitute wetlands and non-wetland may have been responsible for this discrepancy. Apart from these isolated assessments, there has not been a comprehensive national inventory of all wetlands and thus, limited information on the extent and loss of wetlands exist. Basic information on the national wetland inventories such as the physical, chemical and ecological features, land tenure, uses, threats, disturbances, monitoring and restoration are not readily available in Nigeria. This may be an indication of priority and limited awareness of the role of wetland in ecological functioning and in sustaining livelihood of wetland communities by the various levels of government. Thus, information on areal extent, threats as well as on physical, chemical and biological composition is almost absent. The near absolute lack of information on wetlands has greatly hinder efforts aimed at managing wetlands in the country. Detailed wetland inventory would have provided the basis for awareness creation, conservation and restoration as well as the development of viable policies that will ensure sustainability of this critical ecosystem. In addition, it would have provided policy makers and government with the resources and tools needed to address specific threats confronting wetlands within their jurisdiction. Wetland inventory is indeed a fundamental requirement for all countries that are signatories to the Ramsar Convention (Dungan, 1990). Lack of national wetland policy and weak legal and institutional frameworks have contributed towards unfavourable environment for wetland conservation and sustainable use (Adekola and Mitchell, 2011).

Wetland loss and degradation are manifesting in virtually all wetlands throughout the world, particularly in the last 20 years (Junk, 2002). These losses however occurred at different spatial and temporal magnitude and some wetland environments have been more affected than others. Similarly, there has also been a massive surge in wetland conversion in most developing countries following their independence. Prior to independence, wetlands remain untapped resources because of their vastness, inaccessibility, limited understanding of their economic importance, and because of limited rural-urban drift (Turner, 1991). In Nigeria, the last fifty years have witnessed massive conversion of wetlands to non-wetland uses. The economic boom brought about by the discovery of petroleum led to massive migration cities. It also brought about massive construction of roads and buildings for residential, industrial and commercial purposes and some of these developments led to reclamation, draining and hydrological modification of rivers (Uluocha and Okeke, 2004; Mofat and Linden, 1995). Furthermore, the massive construction of dams in the

northern part of the country especially on the Shiroro dam and Niger, and Kaduna River may have altered wetland boundaries downstream of these rivers (Uluocha and Okeke, 2004). Specifically, the construction of Kanji dam for generating electricity may have affected wetland composition downstream. However, there has not been comprehensive assessment of the implications of dam construction on the wetland status in the country.

Available local inventories on wetlands were conducted by Non-Governmental Organizations (NGOs) such as the Nigeria Environmental Study Team (NEST) and international donor agencies such as Food and Agricultural Organization (FAO) and in some cases, state governments. International NGOs and various donor agencies have been active in researching the role of wetlands in the livelihoods of the local populations and this has contributed to the substantial knowledge of certain of the larger and more prominent systems. They have therefore provided an invaluable information and data on wetland situation in Nigeria. The connection between wetland resources and livelihood characteristics of wetland dependent communities has also been examined, especially in the Hadejia-Nguru wetlands. One of the earliest and most comprehensive howbeit-generalised assessments of wetlands in Nigeria was conducted by NEST (1991). The analysis was based on river system and they observed that the Niger and Cross river systems account for about 83 percent of the coastal wetlands, while the estuaries of Imo and Qua Iboe rivers account for 4.2%, and the remaining 12.8% was accounted for by other rivers. In terms of the distribution of the freshwater wetlands, the Niger Delta basin account for about 55% while the Ogun/Osun river basin which comprises of the larger parts of Lagos, Ogun and Osun states account for about 17.84% making it the second largest freshwater wetlands in the country (Table 2). Other river systems in the southern part of the country accounted for the remaining percentage. The southern part of the country comprises almost 99 percent of all the coastal wetlands, while the freshwater wetlands are found both in the northern and southern parts. The different species of mangroves and nypa palms characterise the coastal wetlands, while different species of freshwater forest dominate the inland wetlands.

Table 2: Distribution and Extent of Nigerian Wetlands by River Systems

Coastal Saline Wetlands			Freshwater Wetlands (Floodplains)		
Name	**Extent (ha)**	**%**	**Name**	**Extent (ha)**	**%**
Niger River	617,000	71.91	Niger Delta	1,177,000	55.26
Cross River Estuary	95,000	11.90	Niger River	8,150	0.38
Imo River and Qua Iboe River Estuary	36,000	4.2	Benue River	242,000	11.38
Others	110,000	12.8	Cross River	250,000	11.44
			Imo River	26,000	1.2
			Lake Chad	55,000	2.5
			Ogun/Osun	380,000	17.84
Total	759,000	100		2,130,000	100

Source: NEST (1991)

The Ramsar Convention provided another important contribution to the understanding of wetland diversity in Nigeria through the identification of eleven wetland sites of international recognition (Table 3). Ramsar's vision is to develop and maintain an international network of wetlands, which are important for the conservation of global biological diversity, and for sustaining human life through the ecological and hydrological functions. Obviously, all the wetlands on the list are inland wetlands and none of the coastal wetlands was included. The none inclusion of the coastal wetlands according to Junk (2002) may be the result of policy deficiencies, deficient planning concepts, limited information and awareness, and institutional weakness which may further exacerbate the issue of wetland change in the future. These wetlands measures about 1,076,728 hectares and eight out of the eleven sites are located in the northern and middle belt of Nigeria (Savannah belt), while the remaining three are located in the southern part of the country (Mangrove and freshwater swamp forest). The Baturiya wetland is the largest while Dagona Sanctuary Lake is the smallest. There are indeed more wetlands in Nigeria than what is presently listed and wetlands listed are components of the drainage basin identified in Table 2.

Gwary (1995) also provided a regional analysis of wetland extents in the Northern part of Nigeria, where he estimated the amount of wetlands in each of the eleven states surveyed. The analysis shows that four states namely Adamawa, Borno and Yobe, and Sokoto accounted for the largest wetlands share (61.9%), while the remaining eight states have less than 10% each (Table 4). The analysis of the relationships between size of wetlands and population size, area of states and population density shows that there are no significant relationships between them. The correlation coefficient between total available wetlands and population distribution was (-0.319) as well as population density (-0.332) showed a negative relationship which was also not significant ($P>0.05$). Other population based independent variables such as urbanization, occupation and other ecologically based factors may however be responsible for the observed size of wetlands in these states. An isolated assessment of the spatiotemporal size

Table 3: Eleven Wetlands of International Recognition in Nigeria

S/No	Wetland Site Name	Area/Ha	Coordinate
1.	Apoi Creek Forests	29213ha	05°47'N 004°42'E
2.	Baturiya Wetland	101095ha	12°31'N 010°29'E
3.	Dagona Sanctuary Lake	344ha	12°48'N 010°44'E
4.	Foge Islands	4229ha	10°30'N 004°33'E
5.	Lake Chad Wetlands in Nigeria	607354ha	13°04'N 013°48'E
6.	Lower Kaduna-Middle Niger Floodplain	229054ha	08°51'N 005°45'E
7.	Maladumba Lake	1860ha	10°24'N 009°51'E
8.	Nguru Lake (and Marma Channel) complex	58100ha	10°22'N 012°46'E
9.	Oguta Lake	572ha	05°42'N 006°47'E
10.	Pandam and Wase Lakes	19742ha	08°42'N 008°58'E
11.	Upper Orashi Forests	25165ha	04°53'N 006°30'E

Source: *http://www.ramsar.org/cda/en/ramsar-pubs-annolist-annotated-ramsar-16114/main / ramsar/1-30-168%5E16114_4000_0__*

of wetlands and level of urbanization might possibly reveals the role of urbanization and urban primacy in accounting for available wetland extent across the states. A good example here is the case of Kaduna state, which was the former regional, headquarters of the northern region and which host more than 65% of all industries in the north, account for only 2.6% of the wetlands (Gwary, 1995).

Generally, wetlands occupy floodplains of the major rivers (Anambra, Cross River, Niger, Imo, and Itu) and their tributaries in southern part of Nigeria. Their areal extent has been estimated at 22,859Km^2 and are mainly confined to areas with topographic range of between 0-2% slope, while the remaining ones are found in upland depressions (concavities) and valley bottoms (Chukwu et al, 2009). Their distributional pattern also shows a decrease from the coast to the interior, which could be attributed to more rivers, floodplains and swamps fed by tidal effects in the coastal areas compared to the interior areas (Lekwa, 1986; Chukwu, et al. 2009). The high population density in South-

Table 4: Wetlands in the Northern Region of Nigeria

States	Total Available Wetlands (ha)	% of Total	Population Distribution 2006	Land Mass Km2	Population Density
Adamawa	995,000	31.6	3,168,101	36,917	86
Bauchi	235,000	7.5	4,676,465	64,605	72
Benue	298,000	9.5	4,219,244	34,059	124
Borno and Yobe	550,000	17.6	4,151,193	71,130	58
Kaduna	81,000	2.6	6,066,562	43,460	140
Kano	163,000	5.2	9,383,682	20,680	454
Katsina	46,000	1.2	5,792,578	26,785	216
Kwara	100,000	3.5	2,371,089	37,700	63
Niger	110,000	3.5	3,950,249	13,390	284
Plateau	166,000	5.3	3,178,712	58,030	55
Sokoto	400,000	12.7	3,696,999	25,973	142
Total	3,144,000	100			

Source: Modified after Gwary (1995)

Table 5: Distribution of Wetlands in Akwa Ibom State

Wetland Locations	Area (Km^2)	% of Total Land Area in the State
Mbiabet	62.5	0.9
Use	81.3	1.3
Ayadeghe	125.0	1.8
Nwaniba	312.0	4.4
Ebughe	193.8	2.9
Etebi	331.3	4.7
Okore Ete	350.0	5.0
Ukam	75.0	1.0
Floodplains of all Rivers and streams in the state (Except Ubuim Creek)	468.0	6.7
Nkana	87.5	1.2
Nung Obong	68.8	0.9
Ebam Ekot/Ekoi	63.0	0.8

Source: Akwa Ibom Agricultural Development Programme (1992)

eastern Nigeria coupled with the need to feed the teaming population and the endemic poverty and unemployment, are fuelling intensive use of available lands for agriculture (Adekola and Mitchell, 2011). Since wetlands are found mainly on alluvial soils derived from shale and recent alluvium materials, they are potential sites for agriculture and this account for the isolated degradation and loss of wetlands in this region (Adekola and Mitchell, 2011).

Furthermore, government agencies such as the Agricultural Development Programme (ADP) also conducted inventory of micro and macro wetlands especially within their areas of jurisdiction. This is not so surprising since the agency is in charge of flood plain agriculture (*Fadama*) in Nigeria. The Akwa Ibom State ADP provided information on wetland extents in the State (Table 5). The data helps in understanding wetland diversities at the micro level together with the various challenges confronting them. Wetlands found along small rivers account for the bulk of wetlands in the state and this shows the need to for conservation of small patches of wetlands which are very important in local people's livelihood.

The data provided by the various NGOs, government institutions and private individuals therefore provides the basis for an understanding of the available wetland resources in different part of Nigeria. However, the basis of their computation would need to be assessed before further extrapolation and policy recommendation made. In addition, most of the data cover a one-off period and this makes it difficult to analyse the changes in areal extent of wetlands over time and over space. There is however an urgent need to update the data set since almost all of them were collected in the 1990s. Hence, that there is no recent national inventory of wetlands extent but what exist are pockets of isolated studies on wetland.

Socio Economic Characteristics of Coastal and Inland Wetland Users

The perception, exploitation, conservation and management of wetland resources are often dependent on the socio-economic characteristics of wetland dwellers. These can however be influenced by the educational status, occupational/livelihood characteristics, and income level including poverty status of the wetland residents (Nonga et al., 2010). Thus, the understanding of local people's socio-economic values of wetlands and traditional methods of managing natural resources is central to their sustainability (Nonga et al., 2010).

Income is one of the socio-economic factors that affect wetland utilization (Junk, 2002; Chukwu et al., 2009; Nonga et al., 2010). Although, no absolute circularly causal relationship can be established between income and wetland loss, experienced has shown that while poverty fuelled wetland loss and degradation in rural communities; increasing income and high standard of living coupled with scarcity of land in cities have also exacerbated wetland conversion to non-wetland use in cities (Uluocha and Okeke, 2004). However, the increasing poverty and poor ecological awareness of wetland ecosystems functions placed a very strong negative pressure on wetlands (Junk, 2002; Scherr, 2000). The over exploitation of these resources in turn aggravate human health and food security, which may further exacerbate the degradation of natural resources (Cleaver and

Schreiber, 1994; Forsyth et al., 1998). Low income households may thus embark on wetland agriculture as an alternative to meeting their financial and nutritional needs, while high income urban dwellers in their bid to live close to nature embark on massive draining and sand filling of wetlands for construction purposes. Summarily, while the relatively poor continue to expand agricultural frontiers into the wetlands, the rich continue to expand construction frontiers into urban wetlands in the immediate vicinity of cities. Furthermore, as nation and cities develop, their frontiers encroach into hitherto pristine wetland ecosystem. Accordingly, the loss of wetland areas associated with urbanization and urbanization processes would affect more people from economic fronts as well as individual households (Lannas and Turpie 2009). Respondent income was used as a surrogate measure for poverty although it is a well-known fact that income alone does not measure poverty. The income distribution among the coastal wetlands dwellers is higher than those in the inland wetlands. Whereas the coastal wetlands are mostly urbanized, the inland wetlands are mostly rural agricultural communities. The rural nature of the community may thus explain why many are not using modern farming technology as well as adopting best environmental practices. Coastal wetland cities like Lagos and Port Harcourt have a large human population, and industrial establishment and wages is comparatively high. Two out of every ten coastal wetland dwellers earn below N100,000 while more than seven out of every ten earn between N100,000 and N500,000. On the other hand, nine out of every ten inland wetland dwellers earn less than N100,000 monthly (Table 6) , pointing out the disparity in income distribution between the coastal and inland wetland dwellers. The disparities can be explained in terms of the diversities of opportunities in most of the coastal cities compared to inland locations. There is a significant difference ($F= 12.6457$, $P < 0.05$) between the income of the coastal and inland wetland dwellers and this can be explained in terms of urbanization and better opportunities in coastal towns compared to inland towns.

Each of the occupational group identified in this study can directly or indirectly affect wetland quality. The civil servants may be contributing to the pollution loadings in the wetland through vehicular emission from vehicles and generating sets especially in cities. Some of the artisans depend on the resource of the wetland for their daily living, while the absence of a strong land use control allow for indiscriminate clearing of wetlands for shops and office space especially among the informal sector operator. Farmers often indiscriminately clear large expanse of wetland for agricultural purpose and may rely on the use of fire or herbicides and this may further worsen wetland degradation and loss in the catchment. Grazing is one of the major occupations that have consequence on wetland loss and degradation. It has been recognised as one of the major disturbances to wetland ecosystem often results in the loss of vegetation diversity especially when combined with intensive agriculture (Mamolos *et al.*, 2011). The floodplain of the inland wetlands provides an important grazing area for cattle during the dry seasons, and about 60% of households, particularly from poor families graze cattle

and collect livelihoods materials from wetland (Finlayson et al, 2005; Paul et al, 2011). In Nigeria, grazing is common especially in most of the inland wetland, where cattle rearing is a major occupation and its ownership is one of the livelihood asset. Indeed, cattle rearing is a major sources of income for the Fulani ethnic group that inhabit the northern and the middle belt of Nigeria. Often times, they tend their cattle into wetlands in the southern part of the country in search of forage especially during dry seasons when forage is scarce in the northern part. This seasonal movement of cattle, together with the practice of free-range, affects wetland diversity although attempts have not been made to estimate biodiversity loss from this activity. Fishing can also contribute to wetland loss and degradation and this may arise from over fishing, construction of fishponds and use of chemicals in fishing in wetlands have been recognised in literature (Turner, 1991). Of particular importance in this regard is the oil sheen on rivers consequent of inadequate management of speedboats used in fishing in most communities. This is likely to have similar effect, although at a much smaller scale, as oil spill. Sand mining is another thriving economic activity in riverine areas in cities and rural communities of Nigeria. It provides sand for the rapidly expanding construction industry, while it enhances local income and provides job opportunities for the teaming youth population. However, it portends great danger because of its ability to alter wetland hydrology especially during the dry season (Poff et al, 2011; Foote, 2012; Ramirez and Allison, 2013).

Farmers and civil servants were the largest occupational categories of this study. While farmers accounted for 34% and 48% in coastal and inland wetlands respectively, while for the civil servants, it was 32% and 10% respectively. Other occupational groups recognized include artisans, cattle grazers, fisher folks, palm wine tappers, sand miners and water resources collector (Table 6). With the exception of civil servants, all other occupations can be categorised as primary activities which may directly or indirectly affect wetlands. Multiple occupations exist among respondents as some combined farming and fishing especially in the inland wetland areas. In addition, some civil servants indicated they farm on wetland particularly with a view to raise vegetables and increase household income. The opportunities offered by wetlands in terms of their proximity to rivers and coastline and also, their location on relatively flat and fertile soil has made wetland sites choice locations for multiple uses such as agriculture and residential development (Turner, 1991). This increases the competitiveness of wetland for the various economic activities in cities and villages. There was however, significant difference in the number of respondents in each occupational category between the coastal and inland wetlands ($F= 13.465$, $P < 0.05$). Some occupations are skewed in favour of coastal wetlands, while others are in favour of inland wetlands. Wetlands may thus be threaten by the various human occupations identified in the coastal and inland wetlands and this can be further exacerbated the increasing population of the wetland dwellers arising from the natural population growth and internal migration. Unless the wetlands are managed properly, these various occupations pose great threats to continued survival.

Inland wetlands recorded the highest

percentages of people without formal education. While 93% indicated having primary, secondary or vocational education in the coastal wetlands areas, 52% indicated same in the inland wetlands. It is evident that educational attainment among respondents in inland wetlands is low and this may have consequence on the way available resources are utilized to their advantage or disadvantage. The typical locational advantage often enjoyed by coastal towns may be one of the factors responsible for the educational disparities between the coastal and inland wetlands environment. The result shows there is a significant difference between coastal and inland wetland locations in terms of educational attainment ($F= 34.412, P \leq 0.05$). Education is a major tool in environmental management and constitutes a major factor in the attainment of the Millennium Development Goal (MDG). Appropriate education can therefore help improve income and employment status of wetland dwellers, enhancing their livelihood status and making them less dependent on wetland resources. Household income, available opportunities and infrastructure for education are all major determinants of education. Incidentally, most rural areas lack educational facilities and are thus unable to pursue programs that will ensure the sustainability of wetlands. In some of the communities, pupils travel more than 1km to the nearest educational facilities (Paul et al., 2011). Furthermore, education can help in reducing child mortality through a better awareness, improved use of family planning, and consequently reduced the population pressure on wetland resources. Education is therefore important in human-wetland relationship and it is based on its ability to shape the perception of people concerning how they relate to their environment especially those that benefit from the ecosystem services.

The length of stay within or interacting with wetlands showed that 82% and 78% of the respondents have spent between 2 and 10 years in the coastal and inland wetland respectively. Thus, the higher percentage observed is an indication that respondents have substantial knowledge of the wetland environment and should be able to provide adequate information on the threats to wetlands and also the environment in general. There is no significant difference between the length of staying in the coastal and inland wetlands ($F= 21.864, P > 0.05$) among the sampled population.

Table 6: Socio-Economic Characteristics of Respondents

Socio-Economic Characteristics	Coastal Wetlands		Inland Wetlands	
	Frequency	%	Frequency	%
Income in `000				
0 – 100,000	63	21	273	91
101,000 – 200,000	96	32	27	9
201,000 – 300,000	60	20	0	0
301,000 – 400,000	42	14	0	0
401,000 – 500,000	30	10	0	0
More than 500,000	9	3	0	0
Occupation				
Civil Servants	96	32	30	10
Artisans	36	12	39	13
Farmers	102	34	144	48
Cattle Grazers	6	2	30	10
Fisher Folks	27	9	36	12
Palm Wine Tapper	18	6	6	2
Sand Miners	12	4	6	2
Water Resources Collectors	3	1	9	3
Educational Status				
No formal Education	9	3	30	10
Quranic Education	6	2	114	38
Primary Education	96	32	75	25
Secondary Education	153	51	54	18
Vocational Education	30	10	27	9
Tertiary Education	6	2	0	0
Length of Stay				
Less than 2 Years	24	8	15	5
2- 4 Years	48	16	42	14
4 – 6 years	66	22	78	26
6 – 8 Years	90	30	60	20
8 – 10 Years	42	14	54	18
More than 10 Years	30	10	51	17

Comparative Analysis of Natural and Human Threats to the Coastal and Inland Wetlands

Natural Threats to Wetlands

Natural threats are wetland perturbations that are devoid of human interference and may include marine and coastal erosion, flooding, sea-level rise, seawater intrusion, and droughts (Turner, 1991; Wang and Zhang, 2012). Rising sea levels, reduced sediment delivery to the coast, increased storm surge frequencies, and hosts of human interference may be responsible for increasing coastal erosion (EEA, 2009; Roebeling et al, 2013). Indeed, the effect of sea level rise on wetland loss has gained prominence in literature. Klein and Nicholls (1999) identified four impacts of sea-level rise on natural systems to have included: inundation and displacement of wetlands and coastal lowlands; increased flood and storm damage; increased coastal erosion; and saltwater intrusion into surface waters and aquifers. Wetlands change arising from sea-level rise has been in response to horizontal migration and vertical elevation change (Nicholls et al. 1999). Sea-level rise will be one of the most visible consequences of climate change and this will affect wetland especially the coastal wetlands. Sea-level has been estimated to rise from 50 to 200cm over the next century (Mitsch and Hernandez; 2013). Nicholls et al, (1999) however noted that a rise in sea-level by 100cm will threaten more than 50% of Ramsar Convention designated wetland of international importance. Unless the rise in sea-level is accompanied by an equivalent vertical accretion of sediments, coastal marshes and mangroves will gradually be submerged due to inundation and erosion (Mitsch and Hernandez; 2013). It has been estimated that a rise in sea level by up to 59cm will cause most coastal states in Nigeria to be submerged by floodwater (Onyeka and Adaobi, 2008). Climate change and sea-level rise may affect coastal and inland wetlands greatly (Mitsch and Hernandez; 2013). Rising sea-levels will raise flood levels and increases the flood impacts on wetlands (Smith and Ward, 1998). In addition, the issue of sea-level rise is partially related with the issue of flooding. Flooding arising from climate change is likely to have greater consequence on wetland distribution globally. The increasing coastal erosion may also be due to the effect of various tidal processes, and this may be exacerbated by human activities such as removal of freshwater and mangroves vegetation that act as buffer for shoreline and coastline protection against storm surge. However, mangrove and salt marsh vegetation often act as natural protection for shoreline against erosion, and storm surge (Gedan et al, 2011). Respondents in the coastal and inland wetlands identified five types of natural threats and these are (a) flooding (b) coastal/riverbank erosion (c) drought (d) sea level rise and (e) siltation of channels. The ranking of the threats were however different between residents in the coastal and inland wetlands. Coastal erosion was identified by 42% as the major threat to coastal wetlands, while 49% identified drought in the inland wetlands. Drought (30%) however ranked as the second major threat to the coastal wetlands, while bank erosion (30%) was identified as the second major threat to the inland wetlands. Flooding (25% and 13% respectively) is the third major threats to both the coastal and inland wetlands (Figure 2). Only few respondents identified other threats such as sea level rise and siltation of channels and these categories of respondents are those with high level of education based on the socio-economic correlates of wetland threats.

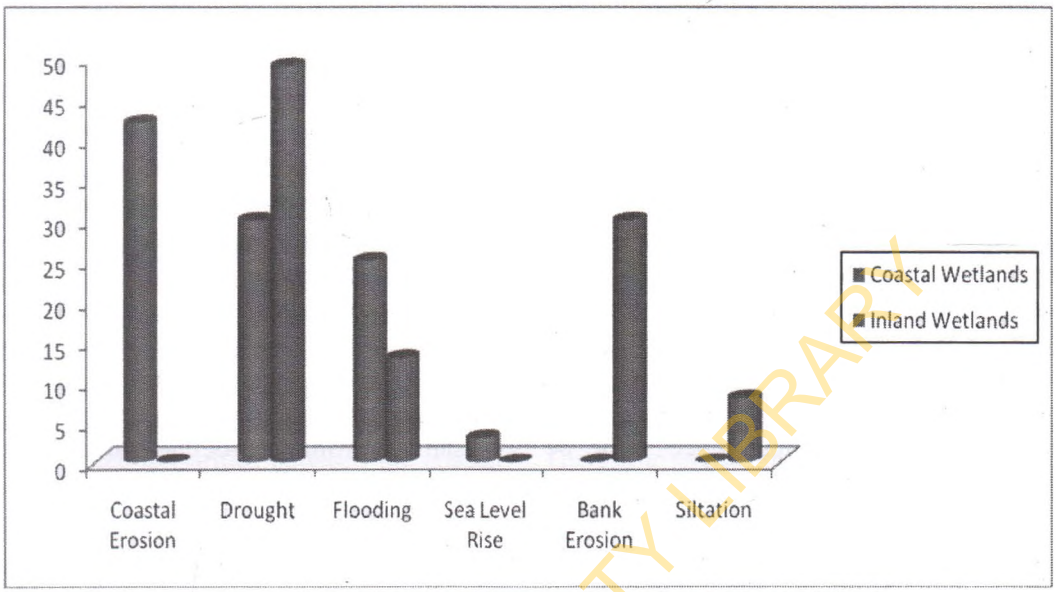

Figure 2: Comparative Analysis of Natural Threats to Coastal and Inland Wetlands

Human Threats to Wetlands

Human threats are anthropogenic factors that may or may not directly initiate wetland loss but which may sustain it over a long period. Rapid population growth, agricultural expansion, poor waste management, land reclamation and urbanization are most important in this regard both at local and global scale (Wang and Zhang, 2012). The various human engendered threats to coastal and inland wetlands have been summarised into thirteen categories. The threats are almost similar for both the coastal and inland wetlands except that respondents did not identify dam construction, sand mining, and grazing as a threat to coastal wetlands. The four leading human threats to coastal wetlands include: urban expansion (30%), agriculture (21%), poverty (11%) and oil exploration (10%). However, for the inland wetlands, the four leading human threats include: agriculture (21%), urban expansion (14%), bush burning (12%), while poverty and grazing accounted for 10% each respectively (Figure 3). Urban expansion was identified as a major threat by almost twice the percentage of people that see it as problem in the inland wetland areas. Indeed, it is the most widely recognised threat to coastal wetlands. Urban expansion is however, the second most pronounced threat in the inland wetlands. The increasing population growth and density in coastal cities resulting from in-migration from inland areas has adversely effects people's livelihoods, and has led to loss of wetlands and biodiversity (Perez et al, 1999). Agricultural expansion was identified as the second threat to coastal wetlands while it was the first identified threat in the inland wetlands. The locational advantage offered by wetland sites in terms of nearness to water bodies, low gentle topography, and fertile alluvial soils, which is a product of long years of sediment accumulation, makes it one of the most attractive sites for agriculture (Turner 1991). Poverty, which is linked to many aspects of the socio-economic and livelihood characteristics of people, was identified as the third most important threats to coastal

wetlands, while it was the fourth in inland wetlands. In developing countries, the role of poverty in natural resources degradation and loss cannot be overemphasized (Areola, 1989, Chukwu et al., 2009; Dugan, 1992). It may influence the rate and frequency of wetland loss (Agarwal, 1989). It has been posited that there is a "downward spiral" relationship between poverty and environmental resources degradation as low-income household places greater pressure on environmental resources compared to the high-income household. Undue population pressure on limited natural resources may thus involve a chain of vicious cycle in which persistent environmental resources exploitation gradually erodes the economic base of a community and this may in turn generate unemployment due to lack of resources base for industries that depend on the primary resources. People who are forced out of work would have no option but to join the already impoverished population that depend absolutely on the exploitation of environmental resources for livelihood. This scenario may likely reverse the progress made in poverty alleviation and economic development and hinder the attainment of the Millennium Development Goal (MDG) of poverty eradication. Lack of awareness, education and employment may further exacerbate the role of poverty in natural resources exploitation. Thus, poverty irrespective of how it is defined and construed is an important factor in wetland loss and degradation.

Oil exploration is the fourth identified threat facing coastal wetlands. Statistics of the per capita loss of wetland to oil related activities in Nigeria is not available, but evidence elsewhere in the world shows that sizeable quantity of wetland are lost annually to the activities of oil and gas companies that operate in deltas. Prior to the recent shift to offshore locations, oil facilities have been largely located in the inland areas in the Niger Delta region of Nigeria. Despite paying lip service to environmental conservation and management, oil companies have degraded large expanse of wetlands in the Niger delta area of Nigeria. In addition, the region has witnessed several oil spill incidents over the years and perhaps the most remarkable were the Mobil oil spill in 1999 and the 2001 Shell Petroleum Development Corporation spill in the Ogoni Land. Indeed, oil spillage has always been source of conflict between oil companies and the local communities. This is because of the effect oil spillages have had on the natural environment on which the local community depends for their livelihood especially in the Niger Delta area of Nigeria (Adekola and Mitchell, 2011).

Threats posed by the increasing number of invasive vegetation species was the fifth threats identified by coastal wetland dwellers, however, this ranked as the tenth threat to inland wetlands. Invasive species such as the *nypa palm* is currently threatening the mangrove vegetation in the coastal areas of Nigeria especially around the Bonny and Imo Rivers causing mangrove displacement. Akpakpan et al, (2012) observed that nypa palm was introduced to check the threat of coastal erosion in communities in the southerner part of Nigeria, however, it has spread eastward through the Rivers, Bayelsa and Delta State reaching the coast of Ondo State. Today it is fast replacing mangrove especially those along the coastline. James et al (2007) identified the spread of Nypa palm (Nypa Frutican) plant species among the primary causes of over 21000 hectares of wetland loss in the Niger Delta region of Nigeria. The menace posed by invasive

species may however increase with the climate change phenomenon. They may be the consequence of sea level rise, increased sea temperatures, and nutrient enrichment in coastal wetlands. Uluocha and Okeke (2004) particularly noted that the wetlands of the Sokoto–Rima Basin are seriously threatened by the invasion of Typha grass, which in some areas has taken over as much as 75% of the land. The result of this study shows that while only 6% of the respondent's recognised the invasive species as a threat in the coastal wetlands, 4% indicated that it is also a threat in the inland wetland. Pollution was another threat identified by the respondents as critical to coastal and inland wetland loss and degradation. Pollution of water and soil arising from the deposition of waste in water and rivers has its toll on wetlands. Some of the rivers in cities experience daily discharge of untreated domestic wastes, while sand quarrying is also a regular activity on these rivers and all these affect the hydrodynamics of the rivers and streams. Pollution from the activities of oil and gas companies in the Niger delta area, which host more than 40% of the wetlands in Nigeria, may affect wetlands. Uluocha and Okeke (2004) observed that over 4000 km^2 of wetlands have been lost due to oil exploitation and that between 1976 and 1998 about 2,571,113.90 barrels of oil were discharged into the wetland environment in the Niger delta region of Nigeria. James et al (2007) also identified oil exploration as the key agent in the loss of about 21,340 hectares of mangrove forest in the region. Industrial discharge into lagoon and creeks in the urban areas also affect wetland integrity, while the use of agrochemicals (herbicide and insecticides) also affects wetland functions. Thus, land use in the immediate vicinity of wetlands is the major contributor of pollutants to wetlands. Ecological integrity of wetlands therefore depends largely on the land use characteristics in the wetland corridors (Ortega et al, 2004; Sura et al, 2012). Pollution of wetlands is also enhanced in the contemporary time by the global and local climate change event. The extreme weather condition being experienced especially flooding will likely increase pollution of water and adjacent wetlands. The threat imposed by pollution on coastal wetlands was identified by 5% of the respondents while none of the respondents indicated pollution as a major threat to inland wetlands.

Increasing demand for land is also another driving force in wetland loss and degradation. The scarcity of land especially in cities is fuelling large-scale land reclamation and wetland loss. High population density, increasing migration into cities, industrial expansions etc. are catalyst for urban expansion. Obviously, due the ever-increasing population growth and intense economic activities, the demand for land in cities has increased leading to scarcity of land and in order to overcome this, individuals and government have resulted into massive wetland reclamation as seen in Lagos and Port Harcourt. Banana Island and Victoria Garden City (VGC) are all residential estates whose lands were reclaimed from the Lagos lagoon, which feeds many of the wetland in the city. Ulocha and Okeke (2004) observed that virtually all the lands, which have been or are currently being reclaimed in Lagos, are coastal wetlands. In the inland wetlands, apart from urban expansion, agricultural expansion is also important in wetlands incursion. Most importantly, the increasing promotion of urban agriculture and *fadama* farming as a

veritable tool in addressing poverty is fuelling the conversion. Mostly, urban agriculture thrives in wetlands abutting cities, while *fadama* is purely of wetland and flood plain locations. Thus, the combined effect of land reclamation and agricultural expansion into floodplain and wetlands may have resulted from scarcity of land. Industrial expansion, urbanization, agricultural expansion, construction activities, poverty and to a limited extent, lumbering are some of the major causes of wetland deforestation. In the coastal cities, wetlands are threatened by various construction activities while the combination of poverty and agriculture are principal factors in inland areas. Deforestation as a threat to wetland loss and degradation was identified by 4% of the respondents in the coastal wetland, while 2% identified it as a threat in the inland wetland areas. Similarly, bush burning was also recognised as a major threat in both coastal and inland wetland areas. While 3% noted that it is a threat in the coastal wetlands, 12% considered it a major threat in the inland wetlands. Bush burning is often used as a method of land clearing especially in the dry savannah belt and occasionally in the forest ecosystem belt, while poachers also employed bush burning in their hunting expedition (Akinwale, 2011). Thus, bush burning can be linked to agricultural expansion, and to some extent, poverty. The increasing use of bush burning as a method of land clearing may be due to it relatively cheapness as a method of land clearing. However, once the bush is set on fire, farmers, and poachers often loss control over the fire and sometime, the fire devour unintended areas of vegetation. Despite several repeated warning about unintended consequences of bush burning in the media, farmers and poachers still employ it. Sand mining is another major human activity especially in the vicinity of inland wetlands that is robbing it of sufficient sediments to maintain its equilibrium. Sand quarrying by individuals and corporate organization using manual or mechanized methods may deny many wetlands in the inland of sufficient sediment if the activity is not checked through appropriate legislation (Paul et al, 2011). It may alter the hydraulic conditions and intertidal habitat of wetlands (Dahdouh-Guebas et al. 2005).The increasing sand dredging being witnessed in most metropolis is being fuelled by an upsurge in construction activities and this is exacerbated by the assumption that sand from lagoon and river is a free resources that should not attract any economic cost. However, one of the environmental externality of sand mining is wetland loss. In addition, the loss of over 21000 hectares of mangrove forest in the Niger delta area of Nigeria has been partly attributed to the various dredging activities (James et al, 2007). Increasing focus on tourisms by government may also affect wetlands. Although, none of the respondents in the coastal wetland identified tourism as a threat, however, 4% of respondents in the inland wetland recognised tourism as threat to wetland integrity. Dam construction along a river course may reduce the amount of water available to wetland downstream and this may cause wetland recession. Uluocha and Okeke, (2004) noted that the construction of Tiga and Challawa dams on Hadejia and Yobe rivers may threatened wetlands within the Lake Chad basin. The decline in Hadeji-Nguru wetland from 250,000–300,000 ha in the 1960s and 1970s to 70,000–100,000 ha in the early 2004, has been linked in part to the impact of dam construction on the upstream (Barbier and

Thompson, 1998; Schuyt, 2005). The various activities involved in dam construction may also generate sediments that may lead to siltation in the downstream and this may affect wetland ecology. None of the respondents in the coastal wetlands identified dam construction as a threat to wetland, while 5% of the respondents in the inland wetland recognised it as a threat to wetlands ecosystem. Grazing, although not identified in the coastal wetlands, was the fifth most important factor identified as constituting threat to wetlands in the inland wetland areas. Some of the inland wetlands such as Hadejia–Jama'are wetlands and the Nguru–Hadejia wetlands have been threatened by overgrazing due to the effect of predominant occupation in the immediate vicinity of these wetlands (NEST, 1991; Uluocha and Okeke, 2004; Chen et al, 2012). In addition, studies from Northern Australian reveal that their wetlands face pressures primarily from cattle grazing and the impacts of intensive agricultural activities (de Groot et al., 2008).

Obviously, the natural threats to wetlands in both the inland and coastal wetlands were noted. However, while coastal wetland respondents identified sea-level rise as the major threat, respondents from inland wetlands fingered siltation. Siltation is attributed to increasing flood frequency and dam construction, which brings sediments into the wetlands and sometimes blocks drainage channels. Similarly, it is clear that although the ranking of the various human threats in both coastal and inland wetlands may be different, there are substantial similarities in the threats. It is only threat arising from grazing, sand mining, and dam construction that were not identified in the coastal wetland but were identified in the inland wetlands.

Natural and Human Environmental Problems in Coastal and Inland Environment

Natural Environmental Problems in the Vicinity of Coastal Wetlands

Natural environmental problems common in the immediate vicinity of wetlands surveyed were classified into five. Coastal and riverbank erosions were identified by 42% and 30% of the respondents in the coastal and inland wetland areas. These two processes reduced the amount of available wetlands

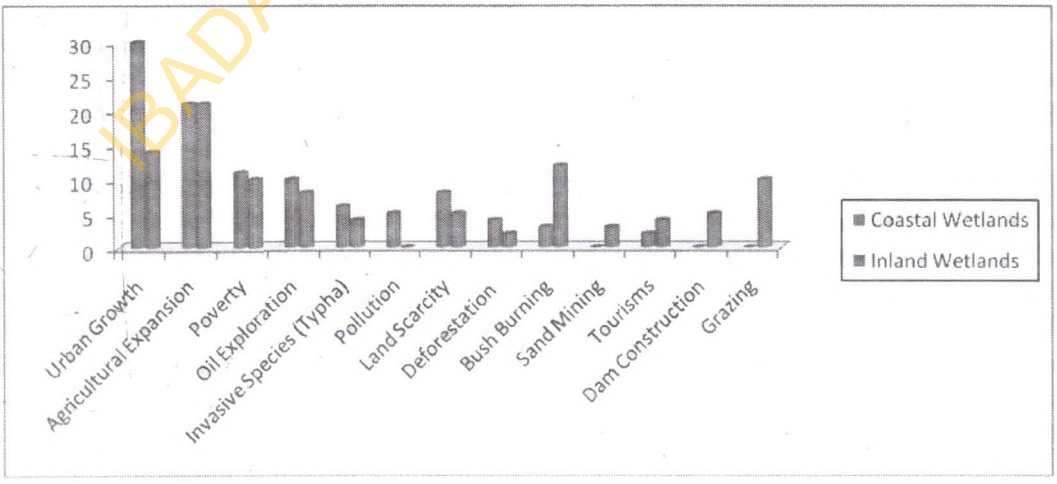

Figure 3: Comparative Analysis of Human Threats to Coastal and Inland Wetlands

physically (erosion), biologically (vegetation loss) and chemically (nutrient loss) (Chukwu et al, 2009; Junk, 2002; Umoh, 2008). Thus, this process brings more land areas under the influence of river or ocean. It is a destructive process that threatens not only wetlands, but also human life. Some parts of the Lagos and Bayelsa states coastlines are currently under the threat of coastal erosion, while most parts of the Niger River channels and other inland water channels that provided nutrients to coastal wetlands are also under the threats of bank erosion (Adekola and Mitchell, 2011). Flooding (30%) was the second major environmental problem in the coastal wetlands, while it ranked third (20%) in the inland wetlands. The occasional flooding of the Atlantic Oceans is seen as a major environmental threat because the floodwater destroys human settlements and infrastructures in its immediate vicinity. Residents around Victoria Island, Lagos have witnessed many coastal flooding episodes from the Atlantic Ocean in the recent time. More land use/land cover may likely experience flooding resulting from the predicted climate change phenomenon (IPCC, 2007). Sea level rise and siltation of channels account for 17% and 21% each in the coastal and inland wetlands respectively. Drought was identified by 17% of the respondents as the fourth natural environmental problem in the coastal wetland areas while it ranked as the second (35%) in the inland wetlands areas (Figure 4). Drought is a condition in which there is insufficient water for plant and animals and it is often associated with dryness. With climate change and its attendant water shortage, many inland wetlands may be threatened by drought (IPCC, 2007). Despite the differences in the ranking, there appeared to be similarity in the natural environmental problems in the coastal and inland wetlands surveyed.

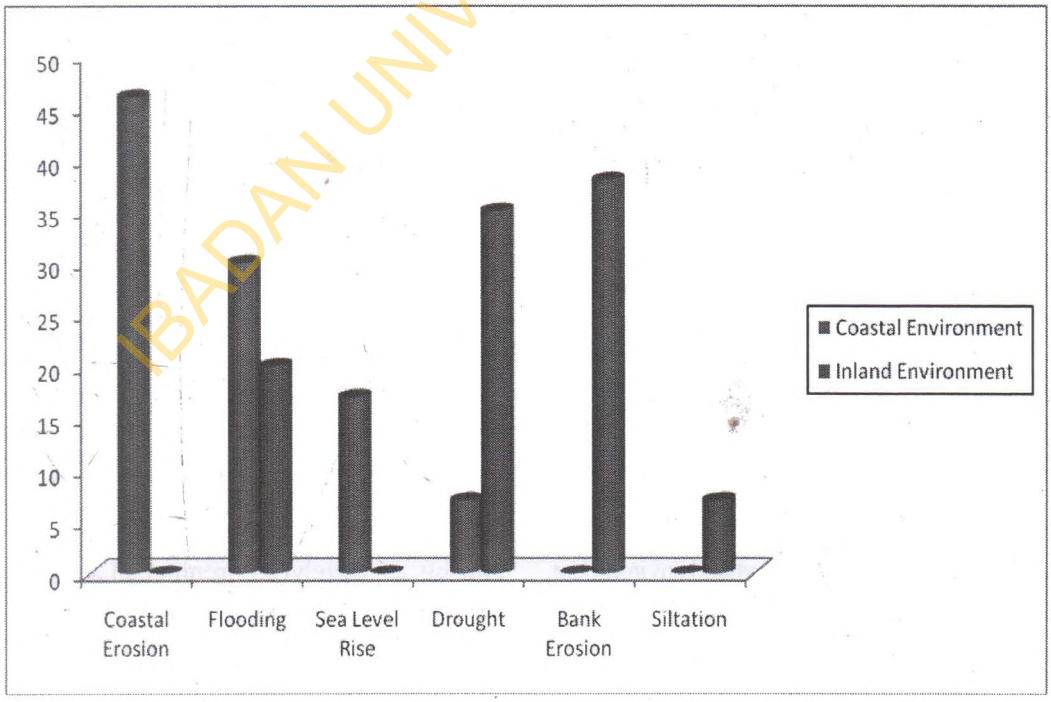

Figure 4: Coastal Environmental Problems in the Immediate Vicinity of Coastal Wetlands

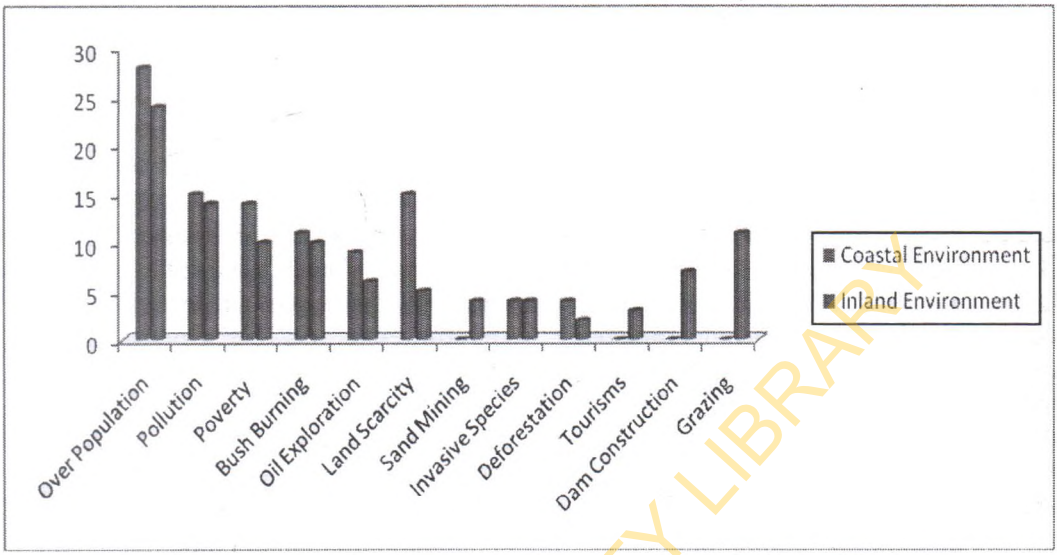

Figure 5: Inland Environmental Problems in the Immediate Vicinity of Inland Wetlands

Human Environmental Problems in the Vicinity of Coastal Wetlands

Respondents in the coastal and inland wetland areas identified thirteen human environmental challenges. Overpopulation remains the greatest threat to both coastal (28%) and inland (24%) environment in Nigeria (Figure 5). Residential and industrial incursion into wetlands was also identified as an environmental problem by respondents. The overpopulation problem could be linked directly with urban expansion, which was identified as a major threat to both coastal and inland wetlands. The continuous influx of people puts undue pressure on available resources and hence, they are over exploited. Pollution (15%) and poverty (14%) were identified as the second and third environmental threats near coastal environment, while bush burning (11%) was the fourth identified environmental problem in the inland environment. In the inland wetland environment, pollution (14%) and grazing (11%) were the second and third identified environmental challenges respectively, while bush burning (10%) and poverty (10%) ranked fourth. Other environmental threats identified include; dam construction (7%) oil exploration (6%), landlessness (5%), sand mining (4%), invasive species (4%), tourisms (3%) and deforestation (2%).

Comparative Analysis of Wetland Threats and Environmental Problems

Drought and deforestation were seen as having the same magnitude both as threat to wetlands and also as an environmental problem. A greater percentage of respondents considered flooding, sea-level rise, siltation, agricultural expansion, oil exploration, invasive species, and tourism as a threat to wetlands and less as an environmental problem in the immediate vicinity of wetlands, while greater percentage recognised bank erosion, urban expansion, poverty, pollution, land scarcity, bush burning, sand mining, dam construction and grazing as largely environmental problem than threats to wetlands (Figure 6). The analysis of the connection between environmental problems and wetland threats showed that there is no significant

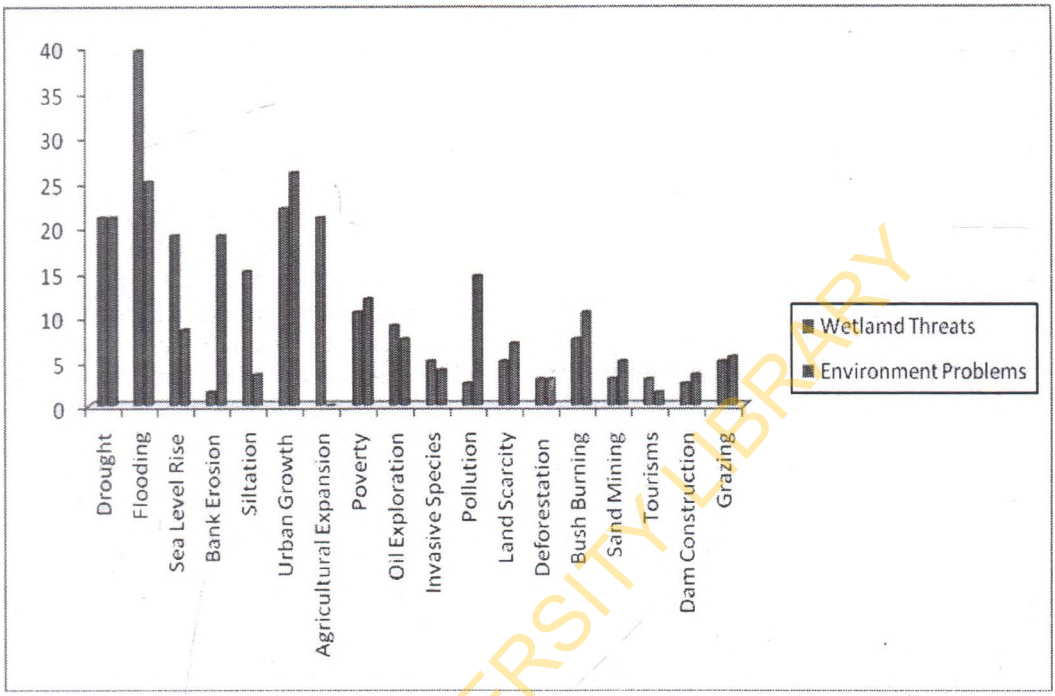

Figure 6: Comparative Analysis of the Wetland Threats and Environmental Problems

difference between prevailing environmental problems and the various identified threats to wetlands ($r=0.321, P>0.05$). Hence, both the physical and the human environmental problems on one hand and the physical and human threats to wetland on the other hand are similar. This implies that the threats observed in most wetlands may simply be an extension of the prevailing environmental problems in the vicinity although no causal relationships could be established at this level. This is quite not surprising since wetland is a component of the environment and based on this, the prevailing environmental problems are bound to affect wetlands. The implication of this is that it might be possible to mitigate threats to wetlands by dealing with the prevailing environmental and human threats in the immediate environment of the wetlands.

Conclusion

Threats to wetlands generally have been attributed to a combination of factors such as increasing human population and pressure on coastal lands, sea-level rise, and inadequate legislation for wetland protection, pollution etc. In Nigeria, there is paucity of information on the extent of wetlands and this is largely because there has not been any national inventory of wetland till date. Individuals, NGOs (local and international), and occasionally, government agencies have featured in isolated and patchy assessment of wetlands in different part of the country. One shortcoming of these isolated studies is that results often are not comparable due to different methodologies adopted. Broadly, two types of wetland recognised in Nigeria include the coastal and inland wetlands. There is almost a near similarity in the physical threats faced by coastal and inland

wetland and the little variation could be explained in terms of geographical variations in their location. While coastal erosion and sea level rise are peculiar to coastal wetlands, bank erosion and siltation were noted as distinctly peculiar to inland wetlands areas. On the other hand dam construction, grazing, and sand mining were the only human threats that were not identified in the coastal wetlands. Indeed, the numbers of environmental problems identified in both coastal and inland wetlands were more than the number of threats identified respectively. The threats and problems identified were in consonance with much of the earlier work on wetland threats and environmental problems in Nigeria (Adekola and Mitchell, 2011; Chukwu et al, 2009; Uluocha and Okeke, 2009; NEST, 1991). It is clear from the study that close similarity exist in the physical and human threats to wetlands and environment in general in both the coastal and inland wetlands areas. Wetlands are thus not immune from the myriads of environmental challenges occurring in their immediate vicinity despite the numerous environmental benefits they provide. Hence, they are mostly affected by the prevailing environmental challenges in their immediate vicinity. Wetlands are a major component of the environment, therefore whatever problem is evident in the environment is most likely to affect wetlands and whatever problem threatens wetland is typically perceived as a part of the prevailing environmental problem. It might be necessary for resource managers and environmental managers to address environmental problems and by so doing, might be addressing threats affecting wetlands. It should however be noted that variations may exist in wetland threats and environmental problems which may necessitate a different approach, thus more rigorous empirical comparisons may still be needed to validate this observations.

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