

Wetland Resources of Nigeria: Case Study of the Hadejia-Nguru Wetlands

Elegbede Isa Olaekan^{1*}, Li-Hammed Morufat Abimbola², Matemilola Saheed¹ and Omosanya Azeezah Damilola³

¹Environmental and Resource Management, Brandenburg University of Technology, Cottbus, Germany

²Department of Food Biotechnology, Universiti Sains Islam Malaysia, Malaysia

³Department of Science and Technology Education, Chemistry Education, University of Lagos, Akoka, Lagos State, Nigeria

Abstract

Wetlands are water body in the terrestrial or semi-terrestrial ecosystem characterized with low drainage, soil, and plant. Wetlands are very important and valuable components of the ecosystem. They serve as habitat for man and animal, source of food, shelter and other ecosystem services etc. There are different wetlands in the world and Nigeria owns one of the internationally recognized wetlands in the world, the first wetland recorded as a Ramsar site. Hausa, Kanuri and Fulani are the most pronounced tribes that dominate the area. The resources attributed to the wetlands in Nigeria are highly valuable; they contain fish, reptile species, mammal species, amphibian species, and bird's species. In Nigeria, the Hadejia-Nguru wetlands is a wide expanse of floodplain wetlands, which is situated in the North-East Nigeria; it is located in the Sudanosahelian zone, which is the zone between the Sudanian Savanna in the south and the Sahel in the North. Some of the activities carried out on the Hadejia-Nguru wetlands include fishing, agriculture and tourism activities. There are different challenges facing wetlands globally, some of which are pollution, over intensification of agriculture activities, industrialization and urbanization. Some of the challenges in wetlands are due to the lack of monitoring and sustainability measures from government and lack of awareness of the inhabitants.

Keywords: Aquatic resources, water management, wetlands habitat, water sustainability, ecosystem services, Nigerian wetland

Introduction

Wetlands are terrestrial or semi-terrestrial ecosystem characterized with low drainage quality, slow waters or seldom standing water body filled with soil. Wetlands can be categorized as bog, marsh, or swamp based on the floral habitat and associated soil components. They are also referred to as boundary ecosystem because of their occurrence in nature at water body interface [1]. Wetlands are the life-enhancing systems of the environment; they consist of the direct and indirect components. Wetlands have been ascribed to ancient civilization because it emanated from the river. Wetland resources are used for many purposes and benefits which include soils for agriculture purpose, fishing for food and economy, trees for various purposes and reeds to make shelter materials [2]. Wetlands also refer to areas with water level very close to soil surface and possess water, plants, and soils. Wetlands have general functions and values which significantly recognizes the uniqueness of the environment [3].

The importance of wetlands to life is enormous; it is used for recreational activities such as bird watching, sailing, research activities, nutrient decomposition and recycling. Despite all these wonderful values derived from wetlands, human induced impacts have made some of the wetlands gone into extinction [2]. Wetlands also provide various multiple ecosystem services such as water treatment and purification, serves as buffers zone, provide important resource for humans and animals [4]. Globally, wetland resource is huge and large including rivers, reefs lakes, river, tidal flats, and artificial reservoirs and rice field [5].

According to [3], wetland functions includes recharge of the hydrology of groundwater, sediment protection and trapping, flood and erosion control, treatment and recycling of waste water, and provision of breeding and rearing ground for natural habitats, animals and aquaculture resources. They are also useful for farming, especially for the cultivation of rice and fish. The peat lands, which are a type of wetlands, are also good for production of fuels. They are also used for sports and recreational purpose, for amusements, boating festivals,

fishing and sailing events [3]. Wetlands occupy about 1,280 million hectares of the entire world's surface. However, about 134,216,253 ha, of the total world wetlands are internationally recognized as wetland and this excludes marine and coastal wetlands. Presently about 50% of the world wetlands are lost due to drainage, and water diversions [4].

In the early period of the 60s, the need to manage wetlands arose, however around 1971 governmental and non-governmental bodies interested in biodiversity, wetlands, and sustainability of resources initiated a Multilateral Environmental Agreement (MEA) in the Asian city of Iran called Ramsar. These MEA was called the Ramsar convention and entered into force in the mid-70s particularly December 1975. The motives behind the convention are the wise use approaches to wetlands, conservation of wetlands and designation of wetland sites as a very important and internationally recognized environmental habitat [6].

The convention further defined wetland as "areas of marsh, fen, peatland, or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish, or salt, including areas of marine water with depth of which at low tide does not exceed six meters" [7].

Africa is endowed with abundant wetland resources. The continent shares about 16% of her coverage for wetlands, with estimates of about 5,600,000 km², which contains wetland soils namely histosols, gleysols, fluvisols and some of the flooded soils. The wetlands resources in the Sub-Saharan Africa consists of the coastal wetlands, inland basins,

***Corresponding author:** Elegbede Isa Olaekan, Environmental and Resource Management, Brandenburg University of Technology, Cottbus, Germany, Tel: +4915214704717, E-mail: isaelegbede@gmail.com

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river, valleys and floodplains, all these are estimated to about 2.4 million km² (24 Mha) of the area [8]. Due to mismanagement of the Nigeria's wetlands, the hydrology and water resources status of the country's wetland environment have been affected. These negative impacts have affected all the potential resources and all the benefits expected to be ecosystem services for humans and the environment at large [3]. The varieties of wetlands in Nigeria consists of the swamp (inland, mangrove and freshwater) water bodies (Shallow and deep waters). In Nigeria most of the important wetlands are the Matgadr-Kabok floodplains, Lake Chad, Komduge, Adiami-Nguru Floodplains, Hydejia and Kirikasama, Yobe, Kanji Lake, Baturiya, Niger delta floodplains, Adiami-Nguru floodplains, delta of the Cross River and the Lagos coastal floodplains [8].

There are few reviews and publications on the assessment of the Hadejia-Nguru wetlands as one of the prominent Nigeria's Ramsar site with international recognition and abundance prospect. Hence the aim of this review is to evaluate the prospect and values of the Nigeria wetland resources and to critically examine the status of the Hadejia-Nguru wetland in Nigeria.

Wetlands of Nigeria

The country is uniquely bestowed with freshwater wetlands and the coastal saline wetlands. The freshwater wetlands comprises the Imo River, Lake Chad, Ogun-Osun River, Niger delta, Cross River, Niger River and the Benue River, while the coastal saline wetlands consists of the Cross River estuary, Imo River, Qua Iboec River estuary and the Niger River [8].

A stretched expanse of about 2,988,000 ha of the terrestrial lands in Nigeria is categorized as wetlands, while the freshwater swamp and mangrove region of the wetland environment are about 2,130,000 and 858,000 ha respectively [8]. The vast majority of the wetlands are

located in the Chad, Niger and Benue Basins, the Niger delta wetlands are known as one of the largest wetland in the world [9]. About 14 wetlands belts are available by regions, in Nigeria ranging from the North to the Southern part of the country. They are namely, the Sokoto-Rima, Komadugu Yobe, Lake Chad, Upper Niger Lake, Kainji Lake, Middle Niger (Lokoja wetlands, Jebba wetlands, Lower Kaduna wetlands, Lower Benue (Makurdi Wetlands), trans boundary wetlands of the Upper Benue and the Cross River. Others are the Lower Niger, Niger Delta, Benin (Owena River and the Okomu River), Lower Ogun River, Yewa Creeks, Badagry Creeks, Ologe Lagoon Lekki Peninsula and the Lagos Lagoon (Figure 1). Some of these are enlisted in the Ramsar sites [9].

Wetland Species Resources of Nigeria

The value and resources of the Nigeria freshwater wetlands could produce about 510,000 tonnes of fish, the wetland resources for vertebrates worth over 14 reptile species, 7 mammal species, 5 amphibian species, about 72 birds species and over 200 species of fish [10]. Some of these species especially the birds are endemic to Nigeria while some are non-endemic; in the food chain many of the birds and mammals are categorized as piscivorous. The mammals enjoy swimming in the wetlands, some examples include the otter, marsh, civets, mongoose and the genets [10]. The Nigeria wetland resource is endowed with two species of hippopotamus, namely the *Choeropsis liberiensi* and the *Hippopotamus amphibious* found around the rivers of the savanna and River Niger of the forest zone. The manatee species, *Trichechus senegalensis* is also a local breed found in the wetland, especially in the delta and coastal wetlands area in the eastern part of the country [10]. The reptiles found in the Nigeria wetlands also include the *Varanus niloticus* (Nile monitor), *Crocodylus niloticus* (Nile crocodile), *C. cataphractus* (long snouted) and the *Osteolaemus tetraspis* (West African dwarf crocodile) [10].

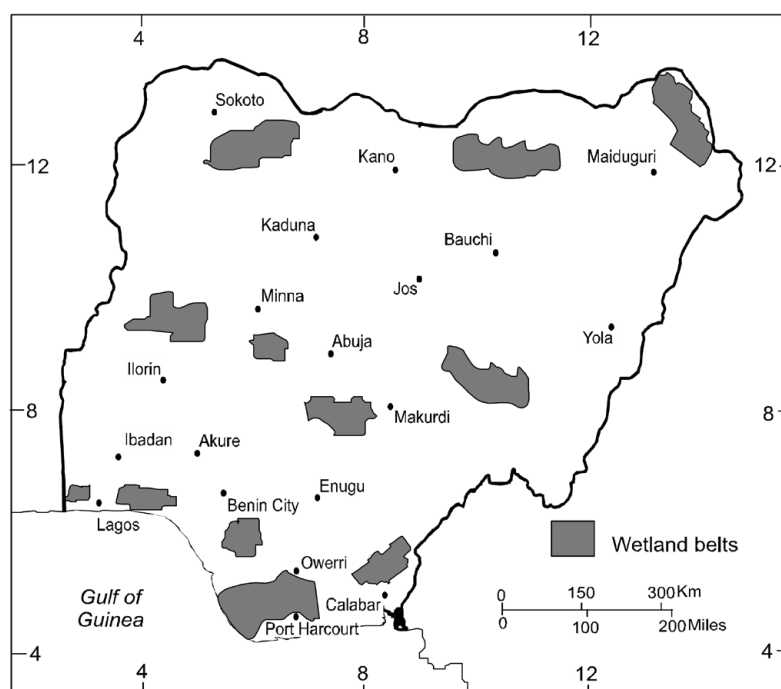


Figure 1: Representation of the Nigerian wetlands belts region [3,15].

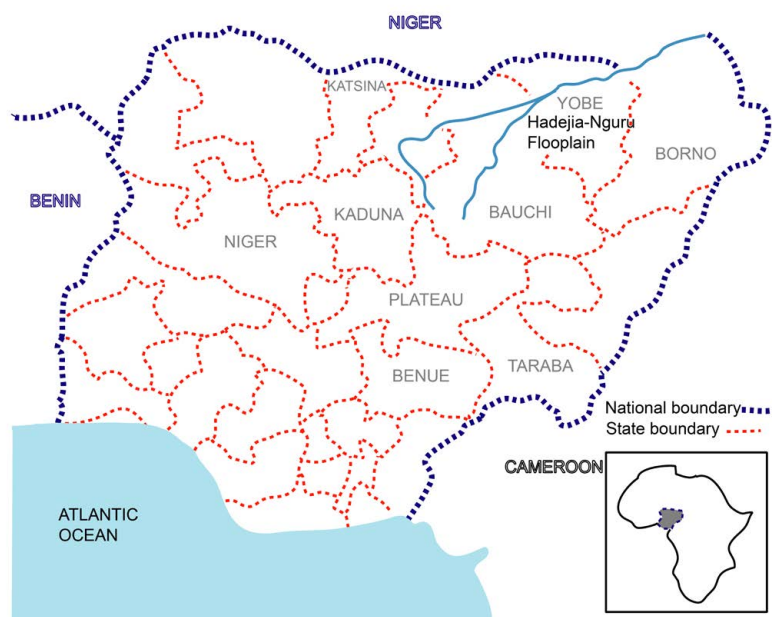


Figure 2: Map showing the location of the Hadejia-Nguru Wetland in Nigeria [11].



Figure 3: Pictures showing the people of Hadejia-Nguru Wetlands area of Yobe state, Nigeria.

The Hadejia-Nguru Wetlands

The Hadejia-Nguru Wetlands is a wide expanse of floodplain wetlands situated in the northeast Nigeria, the location lies in the sudanosahelian zone, which is the zone between the Sudanian Savanna in the south and the Sahel in the North. The wetland is found in Yobe state, located in the northern part of Nigeria, which include the Nguru lake (Figure 2) [11]. According to [7], the Nguru Lake and the Marma Channel complex, which is a section of the Hadejia Nguru Wetlands, is located on the Latitude 10°22'N and Longitude 12°46'E. The catchment area of the wetlands covers an area of about 3,500 km², which includes two rivers, the Hadejia and the Jama'are, which flows and converges into the Chad Lake. The wetlands are notably known for recharge and replenishment of underground water in the Komadugu-Yobe Basin, it is an ecological and economical rich habitat for biodiversity of various fauna and flora. The area is a major tourism location for the Palaearctic and Afrotropical migrant water birds [11].

The Hadejia Nguru wetland is the first Nigeria wetland to be named as a Ramsar site [7]. The area is dominated by Hausa, Fulani, Kanuri and the Bede ethnic group with population capacity of 1,000,000 people; these people depend on this wetland for water supply and other daily activities. The pictures of some of the people and the lifestyle are shown in Figure 3. Some of the inhabitants of the area emigrated around the 60s at the time of drought, the wetland area has abundant agricultural resources worth about €26,982,651.60, and the region serves as a centre point of cattle trade worth of 250,000 cattle [11,7] (Figure 3).

Hydrology of the Hadejia-Nguru Wetlands

The hydrological genealogy of the Hadejia-Nguru Wetlands sustains water from rainfall and runoff supplements from the wet season and later depleted by other hydrological output like infiltration to underground, soil moisture recharge and evaporation [12]. The Hadejia-Nguru wetland is located as part of the Komadugu-Yobe River basin, has a semi- arid climate influenced by the strong convection storm of the Inter-Tropical Convergence Zone (ITCZ) [13]. The

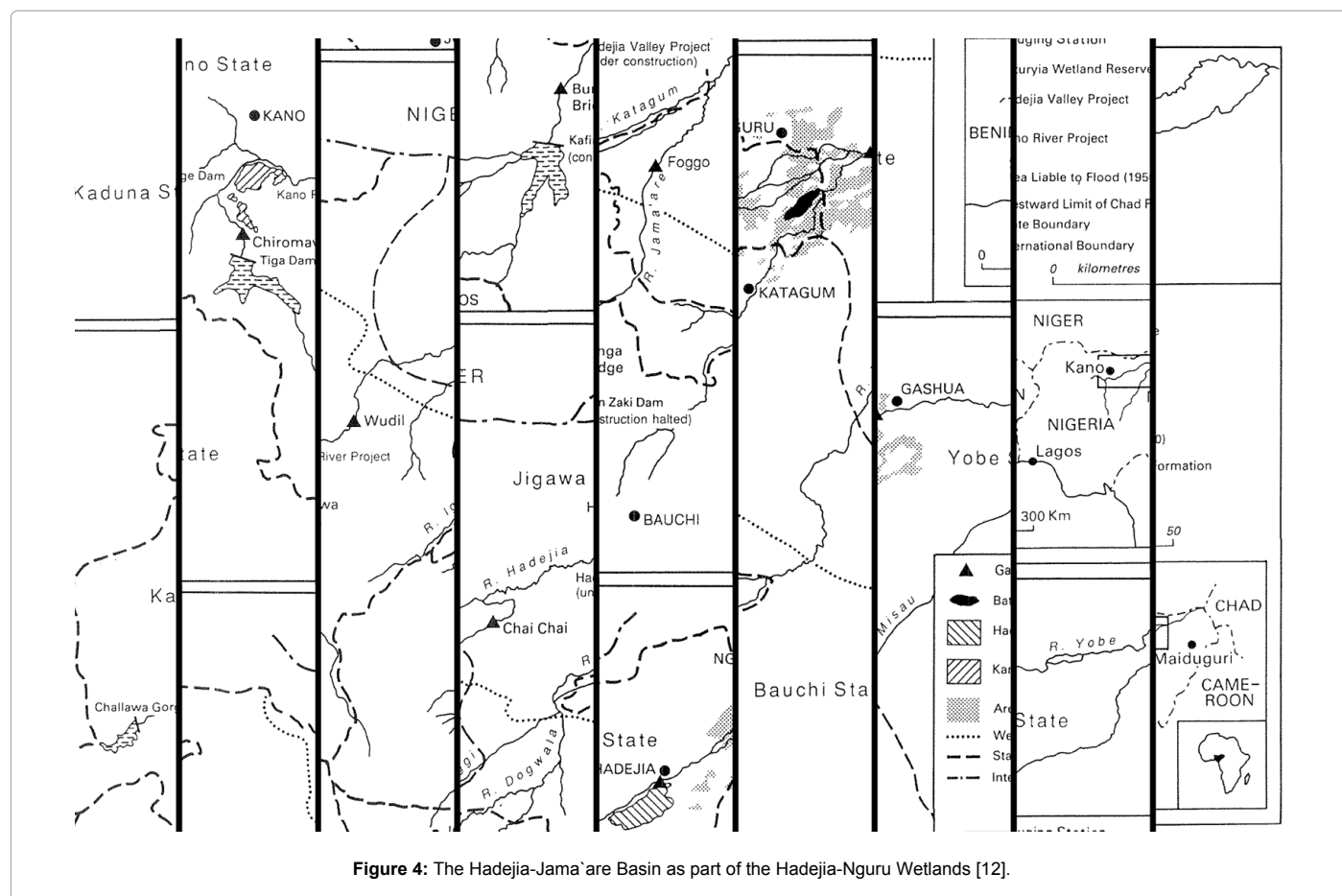


Figure 4: The Hadejia-Jama'are Basin as part of the Hadejia-Nguru Wetlands [12].

connection between the southerly moist and the northerly dry tropical maritime and air volume converge at the basin from the southwestern location around the month of April and May and finally gets to the Northern side in August [13]. The return of the storm migrates from the north back to the south around September; hence, this creates a precipitation on a seasonal basis. This further activates the rainfall from May to October.

Another impact of the migration storm is the variation and inconsistency in the rainfall along some locations, which enables the southeastern part of the basin to experience abundant rainfall. This has created average yearly rainfall of about 500 mm [13]. During the period of abundant rainfall, some part of the basin are flooded which have imparted the wetlands resources [12]. At another period of time, drought has been seen as a factor that affects the development of the basin water resources which has led to the reduction in water channels to the rivers, however in the wet season of between 400 and 2000 km² of the floodplain have been flooded since 1969 [12]. The annual average evaporation experienced around the wetlands is around 3000 mm, due to this high amount of evaporation, the wetlands survives from drought by receiving water from the rivers around the southern region of the basin. When the annual flows diminishes around September, inconsistent runoffs system have been modified by the irrigation projects and dams construction projects [12].

The catchment of the Hadejia and the Jama'are Rivers associated with the wetlands are raised in the western area and the upper basin are affiliated to the Kano and Jos Plateau (Figure 4). These are rooted

by basement complex, which consist of the Precambrian granite and metamorphic layers which are characterized with sloppy hills and steep [12].

Livelihoods in the Wetlands

According to [14], the Hadejia-Nguru wetlands community benefit from various activities that surround the wetlands, such as income generations and provision of food, from the different activities such as agriculture, land grazing, wood for domestic fueling, other wood products, tourism and mechanisms for protection against drought. The Hadejia-Nguru wetlands are considered to have an economic value of around €11.7 million [14].

In the dry season, nomadic farmers move to the area for grazing and the environment has the capacity to accommodate about 320,000; 370,000 and 375,000 of cattle, goats and sheep respectively [14]. The livelihood status of the people is strengthened by the construction of water dams, irrigation construction for the public; this has promoted the income and the standard of living of the people. The community around the wetlands have been benefiting immensely on the wetlands environment [14]. Control of floods has been one of the greatest challenges affecting people around this wetland, which has taken the expanse of 70% of their agricultural farms [14]. Fishing activities have been one of the main sources of food in the area (Figures 5 and 6).

Challenges Facing the Hadejia-Nguru Wetlands

Globally, different threats have been observed affecting the world wetlands, namely pollution, over intensification of agricultural activities,



Figure 5: Picture showing people engaging in fishing activities in the Hadejia-Nguru Wetlands [14].



Figure 6: Picture showing people engaging in fishing activities in the Hadejia-Nguru Wetlands [14].

industrialization and urbanization. One of the major challenges is the overused of the resources in the dry arid regions which are the decrease of water resources for the establishment, construction of irrigations for agricultural and for other purposes. In the western part of Africa, more than 100 dam projects have been constructed which affected the existence and sustainability of wetlands [12]. The rate and level of wetlands reduction is highly alarming all over the world, a reduction percentage of about 50% have been observed, these affected the wetland resources hence species became affected and endangered. Climate change is also a challenge of the wetland resource in Nigeria, this is significantly affected by change in hydrology and biogeochemistry of the aquatic ecosystem [3].

Bioinvasion has been recognized as a major problem affecting the wetlands. Typha grass has been reported to invade the rice and cassava field, which blocks and redirect the flow and channel of the associated river, also the fisheries resources of the area are affected [7]. The Hadejia-Nguru wetlands are prone to environmental degradation and ecosystem, food chain imbalance, biodiversity deformation, these are majorly caused by human induced impacts, such as industrialization, mineral exploitation, urbanization and civilization [3]. Nigeria has a vast amount of surface and groundwater resources, these are being sustained by wetlands, however, the degradation of the wetlands has greatly affected the supply and channeling of the surface water and ground water resources. The rate of degradation confirms maximum abuse for eco-diversity, which the international and local community should do something positive to save the wetland resources [15]. However about 78 wetlands reclamation and intervention initiatives have been engaged in West Africa which are attempts to resuscitate some of the wetlands, but social and political issues have proved some intervention projects abortive [12].

The Economic Significance of the Wildlife Resources in the Hadejia-Nguru Wetlands

The economic importance attributed to the wetlands area is greatly derived from the wildlife resources in the floodplain. These resources are harvested and create a source of income to the people and the government of the location [11]. The Doum palm fronds are a major resource from the wetlands, it has a very high market value, generates income to individuals that are more than wages derived from the agricultural activities. The firewood also creates wealth for people in the location; the wood is collected from the forest around the wetlands. People engage in the insistent and uncontrolled practice of the resources around the wetland, this is attributed to governmental measures, which are not in place in order to monitor and control forest resources. Fishing, agricultural and tourism activities are among the key economic advantages ever derived from the wetlands [11].

The fruit leaves and bark of the deciduous tree Baobab is economically important in the wetland. It's a good edible product to prepare sauces and soup; this is mostly used by people living around the wetlands. Also honey is produced by the people which also serve as a means of economic exchange [16,17].

Conclusions

The Hadejia-Nguru Wetlands is highly rich in both aquatic and terrestrial resources, the area of the wetlands is dominated many people who engage in various economic and social activities around the water body. The wetland is filled with waters from rainfall inflow from the rivers through channels. The wetland faces various impacts and challenges due to lack of monitoring and sustainability measures from the government and lack of awareness of the inhabitants. The wetlands also provide great importance in terms of economic values for the inhabitants. The resource of the wetlands includes birds, turtle, fish, amphibians and mammals; these have improved the wetland as a well-functioning ecosystem with that requires great attention. Some of the wildlife resources have been going into extinction as a result of water reduction, climate change, bioinvasion and inadequate monitoring and protection of the resources. The wetland area remains on the Ramsar site with great tourism attention. However, in order to harness more opportunities from this wetland, the government is urged to invest in the sustainability and improvement of the hydrological feature, resources and the surrounding environment.

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