

Ecosystem of the Niger Delta region of Nigeria: Potentials and Threats

Abstract

The Niger Delta region has several ecosystems that play essential role for the sustenance of the different habitats and life forms in the area. Some of the notable ecosystem includes freshwater swamp forest, lowland rainforest, mangroves forest etc. In recent time, the rate of deforestation, excessive hunting of wildlife, bush burning, and intensive agricultural practices has increased in the region. This study reviews the potentials and threats of Niger Delta ecosystem region of Nigeria. The study found that the rate of deforestation and other human activities in the area is having an impact on the various ecosystems in the Niger Delta. These impacts could be affecting biodiversity of the area including mammals, reptiles, amphibians, birds, etc with regard to species diversity and population status. Furthermore, other role played by the various ecosystem including source of medicinal plants, spawning ground for fisheries, breeding and nestling ground for migratory birds, shoreline protection, habitats for wildlife, among others are under intense threat. Therefore, there is the need for improved enforcement, surveillance of the various the international and national legislations concerning biodiversity conservation and protection.

Keywords: anthropogenic activities; biodiversity; conservation; ecology; wetland protection

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Sylvester Chibueze Izah

Department of Biological Sciences, Niger Delta University,
Nigeria

Correspondence: Sylvester Chibueze Izah, Department of Biological Sciences, Faculty of Science, Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria, Tel +234 7030192466 Email chivestizah@gmail.com

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Introduction

Nigeria has a land mass of 923,770km² and is bordered to the north by Niger and Chad Republics, East by Cameroon and southern most part by Atlantic Ocean.¹ Nigeria is the most populated country in Africa with about 180 million persons. According to Idu,¹ Nigeria is one of the largest populated country in the world, and about ¼ of total Sub-Sahara African population. Nigeria is blessed with arable land for agricultural purposes, crude oil and natural gas deposits, and other minerals resources such as tin, iron ore, coal, lead, zinc, limestone, niobium etc. In addition, Nigeria has several water bodies which are distributed as freshwater (river, creek, creek lets, ponds, lakes and streams), estuarine (fresh and salt water interphase) and marine/salt water.²⁻⁵ The soil of the region varies according to types viz: clay, silts and sand. The soil is a major direct recipient of human activities including food processing such as cassava processing,^{6,7} oil palm processing;⁸ wastes from different settings including municipal wastes.

The aquatic ecosystem is also habitats to several biological species including fisheries (viz: both fin and shelled fish), some aquatic mammals, reptiles etc.^{2,3} Furthermore, in most static freshwater resources especially in Bayelsa state, aquatic insects, some species of snails, freshwater shrimps, snakes and fishes like catfish; algae, water lilies, water hyacinths and lettuce are frequently found in such habitats. While in flowing water bodies such as rivers, several species of fishes and macrophytes are found in the freshwater system. Animals including sharks, whales, dolphins are some diversity found in the marine ecosystems.

Nearly 2.6–3.0% of Nigerian land mass is wetlands^{2,9,10} especially in the Niger Delta region.^{11,12} According to Ramsar Convention, wetlands are characterized by marsh, fern, water/peatland which

are either natural or artificial, permanent or temporary, with static or flowing water which can either be estuarine, fresh or marine with a depth of ≤6 meters at low tide.^{2,13-16} According to Olalekan et al.,¹⁷ wetlands (which are classified as bog, marsh, or swamp based on the floral habitat and associated soil characteristics) are terrestrial or semi-terrestrial ecosystem with low drainage quality, slow flowing water or stagnant water bodies. Ohimain & Akinnibosun¹⁶ reported that wetlands is a habitats to so many life forms that can adapt in anoxic environment especially macrophytes.

Nigerian has several species of wildlife comprising of about 7,895 plant species (which are distributed into 338 families and 2,215 genera), over 22, 000 vertebrates and invertebrates species (including 20, 000 insects, about 1000 birds, about 1, 000 fishes, 247 mammals and 123 reptiles), 1,489 species of micro-organisms.^{12,18,19} The authors reported that out of the wildlife diversity of Nigeria, about 0.14% and 0.22% is threatened and endangered, respectively.¹² In attempts to protect biodiversity, Nigeria established several protected area including 8 national Parks, 445 forest reserves, 12 strict nature reserves and 28 game reserves.¹⁹

Typically, Niger Delta consists of mangrove, lowland rainforest freshwater forest and aquatic ecosystem that provide services to the indigene of the region and to the West African economy at large.²⁰ Several biodiversity is found in the Niger Delta region.^{11,12} Biodiversity play several ecological, social and economic roles to mankind. For instance, insects play essential role in pollination processes, wildlife are source of protein, hides and skin, while plant resources are utilized for construction works as timber, shrubs and herbs are mostly used for the treatment of several sickness and diseases.² Izah & Seiyaboh¹² also reported that several wildlifes have medicinal potentials. Probably due to these roles, Ibimilua²¹ described biodiversity as life-sustaining system in the biosphere. But at present several human activities is

having an impact on the ecosystem. Therefore, this study focused on the Niger Delta Ecosystem with regard to its potentials and threats.

Some major Niger delta ecosystem

According to Igu & Marchant,²² the Niger Delta is predominantly a flat, low-lying sedimentary basin drained by the Niger River with several crisscrossed rivers, streams, creeks, creeklets that emptied into the Atlantic Ocean through the estuaries. Authors have variously reported that the Niger Delta region (comprising of Ondo, Edo, Delta, Bayelsa, Rivers, Imo, Rivers, Abia, Akwa-Ibom and Cross Rivers states) of Nigeria consist of approximately 70,000km² is the largest wetland in Africa^{23,24} and third largest in the world.^{11,24,25} Approximately 2,370 square kilometers of the Niger Delta region includes rivers, creeks and estuaries and 8,600 square kilometers is made up of stagnant swamp.^{26,27} Probably due to the nature of the area, the major distinct ecosystem found in the zone include barrier islands, estuaries, mangroves, freshwater swamps, lowland rainforests, creeks and creeklets.^{2,23,28} Specifically, studies have mentioned the presence of six different ecological zones including rainforest, mangrove, flood forest zone, eastern flank, marsh forest zone and barrier islands.^{29,30} Another study has classified the ecosystem to include rainforest, mangrove, freshwater swamps, mountain region and derived savannah.^{30,31} This suggests slight variation in author’s opinion about different ecological zone in the Niger Delta. Typically, with the major ecological zones previously mentioned, many of them fall within the mangroves (estuarine, marine, barrier Island), freshwater forest and low land rainforest ecosystem. According to Akachi,²⁶ the Niger Delta ecosystem is highly diverse and can support several terrestrial and aquatic life forms.

Ayanlade³⁰ further reported 7 land use change in the Niger Delta including urban (comprising land for residential, commercial services, industrial, transportation, communications, industrial mixed urban and rural build-up land), farmland (comprising of agricultural pasture, and bare fields within a farmland), water (involving stable and permanent surface water such as lakes, reservoirs, streams, estuaries and ocean), mangrove (an area involving brackish swamp and beach forests with red and white mangroves and some protected area), lowland rainforest (with protected areas), freshwater forest (with protected areas) and bare ground (which are open lands without vegetal cover). Between 1987–2011, several land changes value occurred in the Niger Delta (Figure 1) (Figure 2) (Figure 3). Hence, the three major ecosystem of the Niger Delta including mangroves, lowland rainforest and freshwater forest are discussed in this subsection.

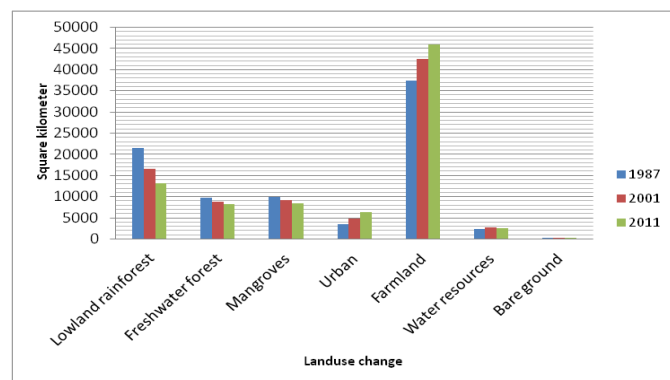


Figure 1 Land use change in the Niger Delta between 1987–2011. Adapted from.³⁰

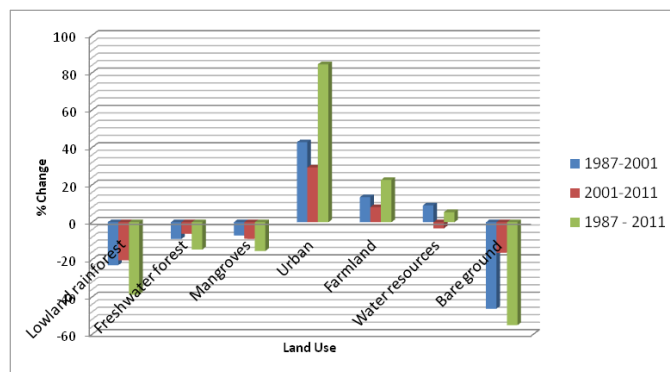


Figure 2 Percentage land use change in the Niger Delta between 1987–2011. Adapted from.³⁰

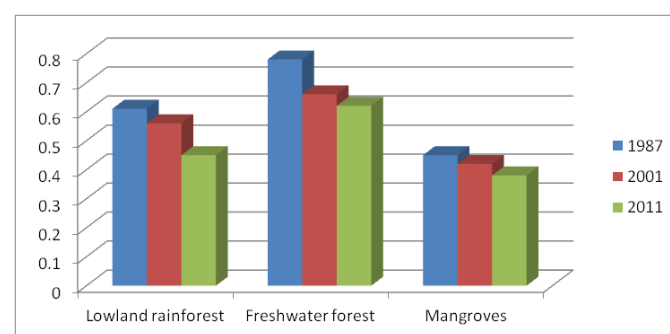


Figure 3 Normalized Difference Vegetation Index (NDVI) for different forest types in the Niger Delta between 1987–2011. Adapted from.³⁰

Lowland rainforest

The lowland rainforest is among the complex ecological zones in the Niger Delta with regard to diversity of species. According to Ayanlade,³⁰ the rainforest zone is characterized by tall trees (1st layer/stratum which is characterized by thick/dense forest with smooth bark trees of about 40 to 50metre tall and often a times, epiphytes and lianas are attached to the back of the tree), big trees with canopy (2nd layer/stratum which are plants with high branch, 20–35metre tall and can provide shade), lower trees with bare trunks (3rd layer/stratum which are plant that about 20metre tall) and 4th layer which areas with mosses, small stemmed shrubs, lichens, herbs and ferns) (4th layer/stratum). The vegetation found in rainforest are mainly used for timber, firewood, saw wood, particleboard, pulp/paper, poles and traditional medicine and some of the commonly found species include *Khaya ivorensis*, *Guarea thompsonii*, *Entandophragma cylindricum*, *Entandophragma angolense*, *Guarea cedrata*, *Lovoa trichilioides*, *Gossweilerodendron balsamiferum*, *Milicia excelsa*, *Terminalia ivorensis*, *Triplochiton scleroxylon* and *Terminalia superba*.³⁰

Mangroves ecosystem (estuarine and marine)

Brackish water is also referred as estuarine (salt and fresh water interphase)² and they compromises of part of the Niger Delta mangroves. Typically, the Niger Delta mangroves is one of the largest in Africa. In estuarine, the salinity level is lower than that of marine water but higher than that of freshwater. The area is dominated by some mangroves plants with narrow strip of beach ridges. Jamabo & Chinda,³² Ogamba et al.,³³ Ohimain et al.³⁴ reported Niger Delta mangroves to include *Rhizophora racemosa* (tall red mangrove), *R. mangle* and *Rhizophora harrisonii* (short red mangrove), *Avicennia*

germinans (white mangrove), and *Laguncularia racemosa* etc. Typically the genus *Rhizophora* and *Avicennia* account for a significant mangrove species found in the Niger Delta region. In the Niger Delta, freshwater (10,000km²) and mangroves are separated by transition wetlands dominated by *Dalbergia escatophyllum*, *Machaerum lunatus* and *Pandanus* sp.³⁴ Other species such as *Nypa fruticans* are also found in the mangrove ecosystem of the Niger Delta.

In the brackish water resources in the Niger Delta, the predominant shell fish found include the genera *Tympanotonus* and *Pachymelania*,³⁵ and within them *Tympanotonus* have one species with two varieties i.e. *T. fuscatus* var *fuscatus* and *T. fuscatus* var *radula*.³³ *T. fuscatus* is predominantly found in the intertidal area rich in detritus and mud substratum where they co-habits with *Neritina adansoniana* and *Pachymelania fusca* var *quadriseriata*.^{32,33} Apart from the shelled fish, several other fin fishes, planktons (phytoplankton and zooplanktons) and macro benthic organisms are found in both estuarine and marine ecosystem. Furthermore, mangroves protects the area against influx of saline water, and the plant is a potential source of timber, medicine, breeding ground for fisheries and specifically the tilt roots of the mangroves and mud surface usually support different species of oysters, crabs and other invertebrates.³⁰

Freshwater swamp

In the Niger Delta, the freshwater swamp is situated between the lowland rain forest in the north and the mangrove swamp in the south.²² The freshwater forest swamps provides transition zone between the two ecosystems and a passageway for the migration of biodiversity.²² According to Ayanlade,³⁰ the Niger Delta freshwater swamp is silt laden from River Niger. The freshwater swamp is essential habits for fisheries particularly during the flooding period. The freshwater is also an important habitat for crayfish, prawn, crabs and crocodile.²²

The vegetation of freshwater forest characterized by tall trees such as *Musanga cecropioides*, *Annona senegalensis*, *Anthocliasta vogelii*, *Eleais guineensis*, *Harungana madagascariensis*, *Juncus* sp, *Pandanus* sp, *Raphia hookeri*, *R. vinifera* and *Tectonia grandis*.³⁰ Majority of the plant species on the area is used as fuel food, medicine, boat carving and it's also protect the shoreline.³⁰

Furthermore, freshwater are water resources that are mostly used for domestic purposes including drinking, bathing, cooking etc. The areas with freshwater resources are often referred to as freshwater swamps. Within the freshwater swamps, other habitats such as riparian and arable farmland are common. In the Niger Delta several studies have reported biodiversity in some freshwater swamps.

Niger Delta region has several freshwater creeks and creeklets, and they are called by several names. For instance, in Bayelsa state some notable water bodies include Epie creek,³⁶ Sagbama creek,^{37,38} Ikoli creek,³⁹⁻⁴¹ Kolo creek,^{42,43} Taylor creek,⁴⁴ Nun River⁴⁵⁻⁴⁹ among others. Most fresh water resources in the area are linked to estuarine from where they emptied into the Ocean. The activities of makeshift oil refinery on Nun River estuary is having impact on the physicochemical characteristics of water,⁵⁰ sediment⁵¹ and macro-invertebrates⁵² leading to severe impacts on mangroves plants and macro-invertebrates (such as *Marphysa*, *Lumbrinereis*, *Lillyalla*, *Mandippi* species, *Marphysa sanguinae*, *Notomastus latericeus*, *Marianida pinniger*, *Littorina anguilifera*, *Neritina owenensis*, *Pachymelania aurita*, *Pachymelania bryonensis* and *Crassostrea gasari* etc).⁵²

In the Niger Delta, several macrophytes have been reported in

surface water including *Eichhornia crassipes*, *Nymphaea lotus*, *N. maculate*, *Pistia stratiotes*, *Salvinia nymphellula*, *Azolla pinnata* var *africana*^{16,45,48,53} among others. In the terrestrial habitats several plant species have been reported in the area. In the terrestrial ecosystem of the freshwater swamps, several plant species have been reported in the Niger Delta region. The importance of freshwater swamp forest ecosystems is poorly studied, estimated and understood.²² The Niger Delta ecosystem is fragile with several useful resources for the people of the region, as such, exploring its sustainability will help to maximize the potential of the ecosystem.²²

In addition to the three major ecosystems in the Niger Delta, derived savannah (comprising of different type grasses, shrub and relatively few trees) is also found in the northern parts of the region. According to Ayanlade,³⁰ the savannah in the region may have derived from secondary rainforest which was reduced to open woodland due to agricultural activities, and consistent human activities; as such it becomes difficult for the trees in the area to mature. The authors further reported that land shortage due to population growth, industrialization and urbanization as major cause of derived savannah in the area.

Status of Niger delta ecosystem

The Niger Delta wetlands have been referred to as largest biodiversity hotspots in Africa that inhabit several species that are endemic to the region.^{2,11,12} Ogbe²³ also reported that several biodiversity that are internationally and locally endangered are also found in the Niger Delta region. Typically, biodiversity involves all species of life forms including plants, animals and microbes that play essential role in the ecosystem.² Several species of plants, mammals, reptiles, avian fauna, amphibians, fisheries, insects, microbes have been reported in the Niger Delta ecosystem. For instance, Akani et al.⁵⁴ reported the presence 28 species that belong to the genera *Bufo*, *Nectophryne*, *Silurana*, *Hymenochirus*, *Hylarana*, *Ptychadena*, *Aubria*, *Conraua*, *Hoplobatrachus*, *Phrynobatrachus*, *Arthroleptis*, *Chiromantis*, *Phrynomantis*, *Hyperolius*, *Afrixalus*, *Leptopelis*, *Phlyctimantis*, *Opisthoxylax* around oil and gas facilities in four locations in southern Nigeria between 1996–2002.

Several species of biodiversity have been reported in the Niger Delta region, some are endemic while several others are threatened, endangered or critically endangered.^{11,12} According to Ikemeh,⁵⁵ Niger Delta is home to some endemic species including Slclater's guenon (*Cercopithecus sclateri*), Nigerian white-throated guenon (*Cercopithecus erythrogaster pococki*), red-capped mangabey (*Cercocebus torquatus*) and the endangered Nigeria–Cameroon chimpanzee (*Pan troglodytes ellioti*). Furthermore, WCS⁵⁶ also indicated that endemic Niger Delta Red Colobus monkey (*Procolobus epieni*), Nigerian white-throated guenon (*Cercopithecus erythrogaster pococki*)^{30,56} is also found in Apoi creek in Bayelsa state. Based on International Union for Conservation of Nature classification *Procolobus epieni* have been rated as 'Critically Endangered'.⁵⁷ Furthermore, WCS⁵⁶ rated the Niger Delta Colobus monkey as among the 25 endangered primates in the world. As such, Ikemeh⁵⁵ is with the opinion that the fate of the monkey will be determined if proactive measures is taken towards sustainable conservation. Furthermore, other endemic mammals such as Heslop's pygmy hippopotamus (*Hexaprotodon liberiensis heslopi*) have gone on extinction in the Niger Delta probably due to their excessive exploitation.⁵⁵

In different locations in the Niger Delta region, biodiversity have been reported through survey, questionnaire, semi-structured

interview and sighting (alive or dead as in bushmeat).^{11,12} In Bayelsa state, Akani et al.⁵⁸ reported the presence 21 mammalian species sold in Swali market, Yenagoa, Bayelsa state as bush meat. Some other notable wildlife species sold alive in the market include *Cercopithecus mona*, *Cercopithecus sclateri*, *Cercopithecus nictitans*, pangolins.⁵⁸ Furthermore, in Swali market, *Thryonomys swinderianus*, *Cricetomys* cf. *emini*, *Atherurus africanus*, *Crossarchus platycephalus*, antelopes, and monkeys were the predominant wildlife sold as bush meat.⁵⁸ In Wilberforce Island, Bayelsa state, Ohimain et al.⁵⁹ reported the presence of 45 mammal (in 21 families); 78 avian fauna (in 27 families); and over 56 species of plants. In Nun River forest reserve of Bayelsa state, Hamadina et al.⁶⁰ also reported the presence of 36 mammals (belonging to 18 families); 18 reptiles (belonging to 12 families); 67 avian fauna (belonging to 25 families). In Edumanom Forest Reserve of Bayelsa State, two-spotted civet (*Nandinia binotata*) has been reported by Amadi et al.⁶¹ Akani et al.⁶² reported the presence of *Raphia hookeri*, *Mitragyna ciliata*, *Nauclea diderrichii*, *Khaya ivorensis*, *Irvingia gabonensis*, *Eleais guineensis*, *Musanga cecropoides*, ferns, epiphytes and macrophytes in freshwater forest resource of Taylor creek. The authors further reported the wildlife resources to comprise of 27 species of mammals, 34 species of reptiles and 10 species of amphibians using quantitative and qualitative approach. In Delta state, Lameed⁶³ reported the presence of 47, 7, and 3 species of mammals, reptiles and amphibians in Kwale forest reserve and Okpai ecosystem. Furthermore, Lameed⁶³ also reported that due to movement nature of birds, at different locations of the ecosystem varying species were found including 19 species in villages and farmlands, 49 species in forest area and 14 species around river bank and beaches.

Insects is another diversity that play essential ecological roles.^{11,12} Some insects are consumed intentionally and while several others are consumed unintentionally in some African countries including Nigeria.⁶⁴ Within the Niger Delta region several species of edible insects have been reported in literature for instance. Okore et al.⁶⁵ reported the presence of *Macrotermes* species, *Brachytrypes membranaceus*, *Zonocerus* species, *Rhynchophorus phoenicis*, *Rhinoceros oryctes*, *Heteroligus meles*, *Sitophilus oryzae*, *Callosobruchus maculatus*, *Dermestes maculatus*, *Daraba (Sceloides) laisalis*, *Gonimbrasia belina*, *Apis mellifera*, *Musca domestica* and some other species of cotton stainer, aphids and locust in the Niger Delta. Like birds, their distribution and occurrence frequency shows high dissimilarity depending on the region and prevailing human activities of an area.

In different locations in the Niger Delta, several plant species have been reported. For instance, Ubom⁶⁶ reported the presence of 339 plant species which are distributed into 88 families in some areas within the Niger Delta region. In different locations, several plant species have been reported. Eludoyin et al.⁶⁷ reported the presence of 37 plant species with medicinal properties around University of Port Harcourt, Rivers state. Uzodimma⁶⁸ also reported the presence of 72 plant species used by the indigenous people of Oyii in Okigwe, Imo State for the treatment of different type of ailments.

Potentials of Niger delta wetlands

Wetlands play essential ecological, social and economic roles.^{2,11} According to Kadafa,⁶⁹ wetland has the tendency to break down and assimilate pollutants. In the Niger Delta, the wetland resources is essential because it is a source of fuel wood, timbers etc used for art and construction works, breeding ground for several wildlife, nestling

arena for migratory birds, spawning place for different fish species, and source of plants with insecticidal and antimicrobial properties.^{2,30,70} The region has been widely reported as area of endemic species of biodiversity including plants, mammals, birds, reptiles, amphibians.⁷⁰ The Niger Delta ecosystem forest products including food, fuel wood, protein sources – crabs, crayfish, fishes, prawn, periwinkles, snails and other raw materials.^{22,30}

Some of the biodiversity including plants and animal has some medicinal uses. This is because fats, oil, skin of some animals are used in treating some certain diseases in human in addition to their food purposes. For instance, Costa-Neto⁷¹ which stated that the tusks of hippo (*Hippopotamus amphibious*) can be used for aphrodisiacs and ornamentals, and the fat extracted from manatee (*Trichechus senegalensis*) can be used to cure rheumatism, boils, and backache. Costa-Neto⁷¹ also reported that the blood of the black caiman (*Melanosuchus niger*) can used to treat epilepsy and stroke; ants of the genus *Pseudomyrmex* can be used for the treatment of toothache and reliving painful joints pains; the various anatomical parts of the rattlesnake (*Crotalus* sp.) are used for the treatment of infirmities ranging from boils to bronchitis; the fresh manure of a dromedary (*Camelus dromedaries*) is applied externally on the affected parts to alleviate arthritis; the fats of lion (*Panthera leo*) and hyena (*Crocuta crocuta*) can be used to alleviate abdominal pains; hooves of duikers (*Sylvicapra grimmia*) and antelopes (*Hippotragus equines*) are used as special container for concoctions with herbs to appease traditional gods and witches. Different parts of animal are used in traditional medicine.⁷² Costa-Neto⁷¹ noted that the hooves, tusks, bones, feathers, skins of most mammals have serious medicinal properties. Some of the animals mentioned by Costa-Neto⁷¹ have been previously reported in the Niger Delta region. However, most of them have not been sighted in the region within the last 20 decades.

Several plants found in Niger Delta region have been widely reported to have medicinal purposes. In a review study by Basse & Izah,⁷³ several Nigerian plants are potent against mosquito at several stages of development. Some of the plants mentioned by the authors are found in the Niger Delta region. Several plants have been reported to have antimicrobial effects including *Musanga cecropioide*,⁷⁴ *Vitex grandifolia*,⁷⁵ *Alstonia boonei*,⁷⁶ *Alchornea cordifolia*,⁷⁷ and many other species of plants. Some of this plants species have emerged as credible source for synthesis of new medicine.^{78,79} According to Costa-Neto,⁷¹ Izah & Seiyaboh,⁷² Izah et al.,⁷⁸ indigenous knowledge of biological resources especially as it's related to its health benefits aid in their exploitation for its commercial commercialization. Several part of mangrove plant is used as poles communication lines, foundation piles, local sign posts, the saplings and twigs mud and thatch house construction.⁸⁰ James et al.,⁸¹ reported that Niger Delta mangroves have social values including therapeutic, amenity, spiritual, heritage and existence values.

According to Ohimain & Akinnibosun,⁸² a unique wetland is developed from the interaction of soil, vegetation and hydrology of an area. The forest acts as a shield for soils beneath, especially from effects of natural factors such as heavy rainfall, high temperatures and destructive winds and erosion.⁸³ According to Eleanya et al.,⁸⁰ mangroves acts as buffer against wave action, aid in filtering water resources, carbon sink, and thereby minimize the effect of global warming, protection of arable land and coastal region, and minimizing the effect of erosion and flooding.

Challenges and threats of the Niger delta ecosystem

Urbanization, industrialization, intense agricultural practices, deforestation, use of chemical based fertilizers, pesticides, emission from the consumption of fossils fuel are the major factor leading to environmental degradation. Uluocha & Okeke,¹⁰ Izah et al.,² Nwankwoala⁹ listed human activities and biogeophysical effects including positive population growth rate, urbanization/industrialization, emission emanating from industrial activities such as mining, oil and gas activities, unrestrained tilling of soil for crop production, over-grazing, logging/lumbering, unmatched land reclamation, dam construction, physical infrastructure, erosion, sea rising, alien invasion, sand storm, desertification, droughts etc. as important factors threatened wetland resource of the Niger Delta region.

The rate of deforestation is high leading to loss of valuable plants species and animal habitats thereby exposing them to excessive exploitation. According to Ogboru & Anga,⁸³ World Fact book in 2005 reported that Nigeria as one of the leading country with high forest loss in the world of 3.3%, and 37.7% since 1990. Between 1990 to 2005 Nigeria lost 79% of her forest thereby challenging its sustainability.⁸³ In the environment, different species of biodiversity comprising of plants and animals are needed to ecological balance in the food web and chains.⁸³ But the rate of degradation or loss is high without corresponding replacement, thereby causing a major threat to humans and the environment itself. Some of the effects of environmental degradation include increased rate and intensity of erosions, flooding, etc.

The loss of forest resources through excessive exploitation, illegal poaching, deforestation, uses of chemicals, logging, bush burning is having an impacts on the diversity, composition, abundance of biodiversity in the Niger Delta. Thereby predisposing majority of species to IUCN criteria such as (threatened, endangered, critically endangered and extinction). As such some species have not been seen in the region with the last 4-5 decades thereby assuming that they have gone on extinction in the region.^{11,12} Specifically, between 1987–2011, the region has lost many of its forest resources through land use. The decline in the forest is affecting bare ground (195km²), water (132km²), farmlands (8338km²), urban area (2898km²), mangroves (1535km²), freshwater forest (1424km²) and lowland rainforest (8324km²).³⁰ Among the major ecosystem, loss is more in the lowland rain forest.⁸⁴ This could be due to potential of agricultural activities in the land of lowland rainforest.⁸⁵ Specifically Ayanlade & Drake⁸⁴ reported that 40%, 30% and 11% of the lowland rainforests, freshwater swamp forest reserves mangrove forests, respectively have been loss in the last 3 decades in the Niger Delta region. Enaruvbe & Atafo⁸⁶ reported that high rate of deforestation, loss of cropland/secondary vegetation and water body is leading to environmental degradation thereby enhancing loss of biodiversity and forest goods and services.

Several human activities including oil and gas exploration, dredging, invasive plant infestation and wetland reclamation in addition to increased exploration, population growth and weak governance have led to increase case of water pollution/contamination, fish migration, and shrinkage of wetland region of the Niger Delta.¹³

Due to the importance of medicinal animals, excessive exploitation could pose danger to traditional health practitioners that use different

parts of the aquatic mammals for treatment.⁷² Similarly, Costa-Neto⁷¹ has stated that poaching of wild animals for meat and medicinal purposes is a major problem in all the game reserves and national parks in Africa.

Conclusion and the way forward

Mangroves, lowland rainforest and freshwater forest ecosystems of the Niger Delta which is essential for the survival of several families of plants and animal under intense threat due to human activities in the region. This is having impact on the biodiversity of the ecosystem, thereby predisposing some species to IUCN classification such as threatened, endangered and extinction. This study showed that lowland rainforest is the major ecosystem being loss. The loss of ecosystem due to human activities is a threat to the ecological role of the Niger Delta forest including protection of shoreline, breeding ground for several migratory birds, spawning group to both shell and fin fish, habitats to several endemic wildlife. Hence there need for improved enforcement, surveillance of the various the international legislations/ law/ treaties concerning the protection and conservation of biodiversity in which Nigeria is part of, as well as national and local law promoting biodiversity conservation.

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Conflict of interest

There is no conflict of interest to declare regarding the publication of this paper.

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