Journal of Wildlife and Biodiversity 4 (1): 73-83 (2020)
(http://jwb.araku.ac.ir/)

DOI: 10.22120/jwb.2019.115501.1096

Review paper

A review of the biodiversity conservation status of Nigeria

Odoligie Imarhiagbe[*1], Wisdom Oghenevwogaga Egboduku[2], Beluchukwu Joseph Nwankwo[3]

[1*]Department of Biological Science, Edo University Iyamho, Edo State, Nigeria
[2]Department of Botany, Delta State University, Abraka, Delta State, Nigeria
[3]Department of Plant Biology and Biotechnology, University of Benin, Benin City, Nigeria
email: imarhiagbe.odoligie@edouniversity.edu.ng

Received: 8 October 2019 / Revised: 9 November 2019 / Accepted: 9 November 2019 / Published online: 11 November 2019. Ministry of Sciences, Research and Technology, Arak University, Iran.

Abstract

Despite a plethora of policies that address issues of conservation of nature's resources, biodiversity continues to face a series of threats in Nigeria. The study aimed at a critical appraisal of the status of biodiversity conservation and utilization pattern in Nigeria. The review was carried out using published materials and personal interactions with knowledgeable individuals. Poverty, population growth, invasive alien species, habitat fragmentation were identified as core factors depleting biodiversity in Nigeria. Although no reliable record yet exists for assessing the rate of biodiversity loss in Nigeria, substantial evidence shows that biodiversity is being lost at a disturbing rate. The IUCN Red list assessment reports that 141 native animal and 168 native plant species of Nigeria are currently classified in different threat categories. With these assessments been carried out on the global level, we hypothesized that such global assessment might be biased based on the various identified peculiar threats faced by different species in their local environment. To properly monitor and reduce the current state of biodiversity, reliable data on biodiversity is necessary. The development of a red List for Nigerian flora and fauna is recommended.

Keywords: Biodiversity, conservation, IUCN, Nigeria, red List.

Introduction

Biodiversity is the variability among living organisms from all sources including, *inter alia*, terrestrial, aquatic and the ecological complexes of which they are part, this includes diversity within species, between species and of an ecosystem. Biodiversity provides valuable bioresources that support the existence of man on earth (Aguilera 2019). In addition, biodiversity also provides unquantifiable services to humans. These services include nutrient and water cycling, soil formation and retention, resistance against invasive species, pollination of plants, and regulation of climates as well as pest and pollution control by ecosystems.

The strategic position of Nigeria in West Africa that lies between longitudes 3°E and 15°E and latitudes 4°N and 14°N has endowed it with very rich biodiversity, distributed within different ecological zones, comprising: mangrove, rainforest, montane, and the savanna- Guinea, Sudan and Sahel (Federal Government of Nigeria 2015). These different eco-geographical zones support different plants and animal species, including endemic ones.

Unfortunately, Information on the status of biodiversity conservation in Nigeria is currently lacking. Although many estimated data on the status of biodiversity exist, none of these have proved convincing in the face of current reality. According to a relatively recent survey on biodiversity assessment, Nigeria has over 7,895 plant species, identified into 338 families and 2215 genera, including a significant number of them being endemic species (Borokini 2014). However, there exist a lot of factors militating against the conservation of these resources, triggering alterations at different ecosystems that make up biodiversity (Anadu 1987). In as much as humans cannot live without developmental activities which to a great extent are dependent on resources from biodiversity

pool, lack of prudent use can result in total loss or extinction of some valuable portion of it. Therefore, the need to harmonize developmental activities in such a way that the impact on biodiversity would be least must be advocated (Adewumi *et al*. 2018; Akande *et al.* 2019).

The primary goal of biodiversity conservation is to maintain all species and populations of species for present and future use. Conservation of biodiversity can either be carried out in-situ which implies the on-site conservation or the conservation of genetic resources in natural populations of plant or animal species or ex-situ (entails protecting an endangered species of plant or animal outside its natural habitat (Okorodudu 1998, Ajayi 2019). The effective conservation of biodiversity in Nigeria has been hampered by factors, such as population growth, habitat fragmentation, high poverty index perception, overexploitation, and pollution. Also, the lack of biodiversity data has hindered conservation efforts, making it almost impossible to track species extinction. Consequently, there is a need to reassess the level of biodiversity conservation in Nigeria. Hence, the current review, therefore, investigates the current status of biodiversity, factors militating against biodiversity conservation and management in Nigeria and proffer recommendations for its sustainable conservation.

Measurement of biodiversity

Biodiversity is vital to the continued survival of man on earth. Its benefits are enormous and many of these are hard to quantify in monetary terms. However, bioresources, which are directly sourced from biodiversity, contribute significantly to the economy of many developing nations of the world, including Nigeria. Considering its importance to livelihood, documentation of biodiversity and identifying threat factors becomes paramount. Nigeria has relatively rich and diverse biodiversity owing to the varieties of habitats types it habours, including savannas, tropical forests, wetlands, lakes, rivers, coastal areas, etc. these different ecosystems support a diversity of flora and fauna, including endemic ones. According to the USAID report on Nigeria biodiversity and tropical forestry assessment (2008), among 42 African countries, Nigeria is ranked eleventh and ninth in terms of plant species diversity and endemic species respectively. Unfortunately, Biodiversity in Nigeria is currently under threat from several global and local factors (Aguilera 2019). Although no reliable record yet exists for assessing the rate of biodiversity loss in Nigeria, substantial evidence shows that biodiversity is being a loss at a disturbing rate. This has necessitated an urgent need to generate reliable data that can be used to monitor the loss of biodiversity. Such an up-to-date checklist will not only proffer insights into which species require urgent conservation need, but also stimulate technological innovation and providing the framework for sustainable development (NBSAPs 2015).

In designing an up-to-date threat assessment list for native plant and animal species in Nigeria, there is a need to conduct a thorough ecological survey on these species within the country's territory. The use of the global IUCN red list assessment for compiling such a list can be misleading. And because the IUCN red list categories and criteria were developed to assess risk at the global level, the outcome of such an assessment can either be overestimated or underestimated at the local level. For instance, species with a wide range of distribution may have a low risk of becoming extinct globally and hence may be listed as Least Concern (LC) on the Red List. But it may locally be declining in parts of its range as a result of different local threats. If this trend is not recognized and reversed, the species could disappear from the locality. Cases such as this have necessitated the need to device a local assessment guideline that can take into cognizance native species and the local threats faced.

To mitigate this challenge, the International Union for Conservation of Nature developed criteria to enable assessment at the regional and national levels. The guidelines for applying the Red list criteria at the national and regional level are available to download from the IUCN web site: www.iucnredlist.org. With the availability of such guidelines, it is hoped that Nigeria can now be able to generate threat categories and produce up-to-date information on the national conservation status of Nigerian native plant and

animal species. An updated record of the conservation status of some selected indeginous plant and animal species is represented in Table 1 and 2 respectively.

Conservation of biodiversity

Conservation of biodiversity in Nigeria has gone through several phases over the years. Before the creation of the forestry administration by the British, the indigenous people have traditionally conserve biodiversity through cultural processes and religious beliefs (Martin 1991). The forest was highly revered by the people. The majority of people believed that the forest has spirits living within them and that one must be fortified spiritually before you can venture into the forest. Consequently, only the brave hunters and native doctors attempted entering into the high forest (Aigbokhan 2016). An ethnobotanical investigation from knowledgeable respondents in southern Nigeria shows that it was a serious crime to cut certain tree species, for example, the Iroko (*Milicia excelsa*) which was perceived as the king's tree and many more. Plants species used as fuel woods were carefully selected that only abundant species and fell trees were mostly used. In the case of animals, hunting of animals was not carried at random. Only does recognize as village hunters engaged in the practice. Clearly, the people had an idea of biodiversity conservation and even though at that time the farming practices were largely characterized by slash and burn, the locals, customarily allow certain important tree species on the farmland, a system otherwise known as Agroforestry.

The advent of civilization brought about by the Europeans resulted in adulteration and deterioration of some of the beliefs and customs which primarily assisted in biodiversity preservation. The Europeans demand for tropical timbers, conversion of forest lands into rubber and oil plantations and the mechanization of forest operations were highly significant in the loss of biodiversity in most West African countries, including Nigeria. These encroachment process was further exacerbated the rapidly rising population for agricultural land for food production, the establishment of settlements and the provision of various types of infrastructure and most of these previously revered areas have lost protection (USAID report on Nigeria Biodiversity and Tropical Forestry Assessment 2008).

In the face of current reality, two major approaches have now been used to conserve biodiversity in Nigeria; these include in-situ and ex-situ methods.

In situ conservation

In situ conservation is on-site conservation or the conservation of genetic resources in natural populations of plant or animal species such as forest genetic resources in natural populations of tree species (Ajayi 2019). In situ conservation maintains not only the genetic diversity of species but also the evolutionary adaptations that enable them to adapt continually to shifting environmental conditions, such as changes in past populations and climate. It ensures that along with target species, hosts of other interlinked species are also preserved as a by-product. It is generally cheaper than ex-situ methods (although not cheap). It may often be the only conservation option, for example for species of plants with recalcitrant seeds. In Nigeria, areas habouring a considerable amount of biodiversity are mapped as protected areas and conserved (Ejidike and Ajayi 2013). The natural tranquility of these protected areas along with communities of plants, animals, and birds in them, combine to make each a niche destination (Sawe 2019). National parks, Forest and game reserves, and sacred grooves constitute the major hallmark of In situ conservation of biodiversity in Nigeria.

National Parks

Table 3, (appendix) shows the size, locations and period of establishment of National Parks in Nigeria. There are currently has 7 national parks, strategically located represent major Nigerian ecosystems, including rainforest, montane forests, freshwater wetlands/lakes, guinea savanna, Sudan savanna and, Sahel savanna. These parks are monitored by the Federal Government of Nigeria, but under the jurisdiction of the Nigeria National Park Service (NNPS). The Gashaka-Gumti national park (GGNP) is located in Taraba and Adamawa state and it the largest National Park in Nigeria, covering a total land area of 6.402 km, comprising savanna grassland in the northern

part and a montane forest in the southern part. The GGNP is home to a wide range of fauna species such as Mountain reedbuck (*Redunca fulvorufula*), the African elephant (*Loxodonta africana*), the West African wild dog (*Lycaon pictus*), and the world largest antelope (*Taurotragus derbianus*). Also included are various plant species, notably, the red sunbird bush plant (*Metarungia pubinervia*), an afro tropical species with an isolated population in eastern Africa, South Africa and Nigeria (Darbyshire *et al.* 2009). The Kainji National Park is the second largest after Gashaka Gumti and it is located in Niger and Kwara state, Nigeria. it consists of three distinct sections; the Borgu game reserves which constitute the savanna forest part of the Park, the Kainji lake, a 136 km long reservoir that divides the Borgu game reserve into two parts and the Zugurma sector which is highly inaccessible due to lack of adequate roads.

The Cross River National Park is made up of two divisions, the Okwango and Oban, both located in Cross River state. The park falls under the Guinea-Congolian region, comprising of lots of endemic flora and fauna species (Terborgh 2002*)*. The Cross River National Park habours one of the oldest rain forests in Africa and it is the most notable biodiversity hot spot in Nigeria. Recent reports indicate that both divisions of the park are currently threatened by illegal logging, slash and burn farming and poaching activities. The old Oyo national park is located in Oyo State and cut across the southern part of Kwara State, Nigeria. The Park is home to plant and animal species of both the rainforest and savanna origin. However, recent developments indicate that the Park has been extremely encroached due to the expanding human population. Consequently, many species that were previously widely distributed in the Park are now being rare. For example, the endangered West African wild dog (*Lycaon pictus manguensis*).

The Chad Basin National Park is located in northeastern Nigeria, in the Chad Basin, with a total area of about 2,258 km^2. The park is made up of three sectors. The Chingurmi-Duguma sector is in Borno State and has a Sudanian savanna zone while the Bade-Nguru Wetlands and Bulatura sectors are in Yobe State with a Sahel ecological zone. Despite its strategic location, there has been a low turnout of tourist visitors due to the limited number of spectacular wildlife in the Park. Other factors militating against the success of the Park include security challenges, climate change, increasing population, and environmental degradation. Also present in the northern part of the country is the Kamuku National Park, which is located in Kaduna State. It has Guinea -Sudan Savanna vegetation and protects the most diverse form of this vegetation type in the country. The park is important for species such as the secretary bird (*Sagittarius serpentarius*), Denham's bustard (*Neotis denhami*) and the Abyssinian ground-hornbill (*Bucorvus abyssinicus*) which are rare in other parts of Nigeria.

In the southern part of Nigeria, the Okomu National Park in Edo State holds a remnant of the Nigerian lowland forests that once formed a continuous 50–100 km wide belt from the Niger River west to the Dahomey Gap in Benin. To the south and southeast, the forest was separated from the coast by mangrove and swamp forests, while to the north it merged into the Guinean Forest-Savanna Mosaic ecoregion. However, the park has witness shrinkage in size due to immediate community encroachment on it and is now less than one-third of its original size (Williams 2008) .

Forest and game reserves

Table 4, shows the size and location of forest reserves in Nigeria. Forest reserves are portions of lands, controlled by the state government, where commercial harvesting of wood products is prohibited in order to capture elements of biodiversity that can be missing from sustainably harvested sites. Initially, the system was designed in a way that deforestation rates due to logging activities are balanced with a recurrent afforestation plan. But a different scenario exists. According to the USAID's report on Nigeria Biodiversity and Tropical Forestry Assessment (2008), Nearly 1,000 forest reserves included in the IUCN World Database on Protected Areas are currently not in existence. The few remaining ones, such as the Idanre Forest Reserve, Akure Ofosu Forest Reserve, and Oban Hills Forest Reserve have lost a significant portion of their original to

encroachment and subsequent forest conversation to plantations and farmlands.

A game reserve comprises a large area of land where animals live safely. In Nigeria, the majority of the games reserves have been cleared off and used for other developmental purposes and as such now only exist in the paper. Game and forest reverse in the country have faced serious managerial crises as a result of the incapability of the State governments to properly handle the affairs of these protected areas. For instance, the Yankari game reserves, now under state control, provide an illustration of how things can change under new management. The game reserve is now a shadow of its original self.

Sacred groves

Sacred grooves are relics forest patches preserved in the name of religion and culture (Agarwal 2016). Sacred groves comprise stands of trees that are of special religious importance to a particular culture and based on its relevance, the conservation of species in the grove is guaranteed. Scared groves are well distributed among various cultures in Nigeria owing to the fact that a preponderance of the Nigerian population still practices traditional religion. For example, the Osun-Osogbo sacred grove, Osun State, a registered UNESCO World Heritage Site, is highly revered by the local people and in so doing helps to protect and conserve the biotic species that are inherent in it.

Ex-situ conservation in Nigeria

Ex-situ conservation entails protecting an endangered species of plant or animal outside its natural habitat, through colony relocation where part of the population is taken to a less threatened location or human care methods such as zoos and botanical gardens (Okorodudu 1998). Ex-situ conservation, while helpful in man's efforts to sustain and protect our environment, is rarely enough to save a species from extinction. It is mostly used as the last resort or as a supplement to in-situ conservation because it cannot recreate the habitat as a whole, protect the entire genetic variation of a species, its symbiotic counterparts, or those elements which, over time, might help a species adapt to its changing surroundings. Home garden, seed bank, botanic and zoological garden constitute the major hallmark of ex-situ conservation of biodiversity in Nigeria.

Home gardens

A home garden is an agricultural production system that involves the cultivation of a small portion of land which may be around the household or within walking distance from the family home. It offers a steady harvest of fresh produce all year round, with low input and high output. In addition to biodiversity conservation (Castineiras 2000, Osawaru and Dania-Ogbe 2012) home gardens could also serve as important sites for on-farm experiments (Dania-Ogbe *et al.* 1992, Osawaru *et al.* 2015). Home gardens are normally located adjacent to homes, close association with family activities and a wide diversity of crop and livestock species to meet family needs. In the rural parts of Nigeria, home gardens play a central role in household security for food, fuel, fibre, materials, and even land ownership. However, in the urban environment, population pressures and increased demand for housing has reduced the potentially available lands required for home garden cultivation. The practice of home garden systems has contributed immensely to the stability and sustainability of the ecosystem especially in the rural parts of Nigeria, where home gardens are a customary practice.

Seed banks

Seed banks are ex-situ storage facilities use to store seeds in order to forestall the loss of genetic diversity in rare and threatened plant species (Imarhiagbe *et al.* 2016). In seed banks, seed collections are stored at constant low temperatures and low moisture to guard against loss of genetic resources that are otherwise maintained in situ or in field collections, which could be damaged by disease outbreaks or as a result of any other natural disasters. Ex-situ conservation of biodiversity is carried out by different research institutions in Nigeria. some

of which include the International Institute of Tropical Agriculture (IITA), National Centre for Genetic Resources and Biotechnology (NACGRAB), and National Horticultural Research Institute (NHRI). Collections held in these facilities are made available for plant breeders and researchers for crop improvement and food security.

Botanical and zoological gardens

Living collections of plant and animal species are housed in botanical and zoological gardens respectively. There are approximately a total of 16 botanical gardens in Nigeria with an approximate 10, 000 - 20, 000 living plant accessions. In addition, there are several notable zoological gardens in Nigeria, such as the Abuja Zoo Abuja, Audu Bako zoo, Kano; Enugu zoo, Enugu; Ibadan University zoo, Ibadan; Jos Wildlife Park, Jos; Port Harcourt zoo, Port Harcourt, Ogba zoo, Benin; Sanda kyarimi zoo, Maiduguri. Botanic and zoologic gardens do not only conservation of the living specimens of plants and animal species, but they also serve as resort centers for Nigerians and foreign tourists, thereby generating income for the country.

Some benefits of biodiversity conservation

Biological resources

Biological resources are those products that we harvest from nature. These resources fall into several categories: food, medicine, fibers, wood products, and more. A significant proportion of the population in rural areas depends on plants for medicine. Plants such as *Alstonia boonei, Morinda lucida*, and *Enantia chlorantha* are used to cure Malaria. Fibers for clothing, ropes, sacking, webbing, netting, and other materials are provided by a large number of plants, including cotton plants, flax plants (linen), hemp (cordage and sail canvas), *Agave* plants (sisal), *Corchorus* plants (jute), bamboo and palms. Trees provide wood products used in making homes, furniture, and paper products. In addition, living organisms provide inspiration for engineers seeking better and more efficient products.

Ecosystem services

Ecosystem services are processes provided by nature that support human life. These services include the decomposition of waste, pollination, water purification, moderation of floods, and renewal of soil fertility. Often time, these ecosystem processes are often overlooked and are not valued as part of the economy. When the economic value is assigned to these services, it is often startlingly high. For example, insect pollinators help produce many commercially important fruits such as almonds, melons, blueberries, and apples (Gallai and Sales 2009) .

Social and spiritual benefits

Some specific plant and animal species are useful in different traditional events like festivals. Throughout human history, conservation has involved protecting nature for the spiritual gifts it provides and protecting sacred places in the local landscape. Stories of indigenous people incorporate detailed knowledge of the animals and plants that make up their world. The heterogeneity of the world's mythology, folk art, and folk dances show the effects of biodiversity on cultural development and contribute to the richness of global arts and literature. Different cultures developed in different landscapes that influenced activities, occupations, diet, language, and architecture.

Intrinsic value

Biodiversity has an intrinsic value that is worth protecting regardless of its value to humans. The first argument for the intrinsic value of biodiversity is the idea that humans are part of nature. The argument for conservation of biodiversity often emphasizes the need to facilitate the continued evolution of evolution as humans are and were part of nature, they benefited from the evolutionary process. The tenet that humans are part of nature questions whether humans should endanger their own milieu and the process from which they stem.

Major causes of biodiversity loss in Nigeria

Although biodiversity, in essence, has to do with genes, species, and ecosystems, it is also related to issues far beyond the confines of biology.

Understanding the threats to biodiversity and offering solutions to them necessitates insights from the socio-economic and applied sciences. The effectiveness and success of protection in any part of the world normally depend on many local factors of economic, social and political nature (Jianguo *et al.* 2003). Some of the main factors militating against biodiversity conservation in Nigeria include:

Population growth

Population growth is recognized as an indirect driver of biodiversity loss, as human demands for bioresources, such as food and fuel play a key role in driving biodiversity degradation. It exacerbates every other factor having an impact on the ecosystem (UN 2019). The Nigeria National Bureau of Statistics, 2012, estimated the population of the citizens in Nigeria to average around 166.2 million people and it is projected that by 2050, the population of Nigeria is expected to surpass that of the US; thereby making it the world's third most populous (Stewart 2005). The high rate of population increase in Nigeria has led to an unceasing search for more arable land for food production and livestock grazing, and for wood for fuel, construction, and energy. Humans have tended to settle in areas of high biodiversity, which often have relatively rich soils and other attractions for human activities. This constitutes a great threat to biodiversity, especially since many of these areas have numerous endemic species (Audu and Ayuba 2016). The consequence of such high population pressure has resulted in the high intensity of logging, poaching, illegal exploitation, agricultural expansion and collection of fuelwood has continued to pose serious threats to the country's forest resources (Perrings *et al.* 2010).

Habitat fragmentation

Habitat fragmentation refers to the discontinuity or 'break down' of large contiguous habitats into smaller, isolated patches of habitats. The consequences of such fragmentation impact negatively the species interactions, community structure and the general ecosystem of those fragments. In Nigeria, habitat fragmentation is currently the main threat to terrestrial biodiversity. The Federal Government of Nigeria (2015) report indicates that 90 percent of agricultural produce in Nigeria are gotten from the activities of peasant farmers who arbitrarily carry out the shifting cultivation farming method. This system unlike other modern agricultural systems leads to forest depletion and subsequent loss of endangered species. When large habitats are broken up into small fragments due to various human activities, mammals and birds requiring large territories and certain animals with migratory habits are badly affected, leading to population declines. In Nigeria, habitat degradation or forest degradation occurs in an immeasurable and uncontrollable rate. Government agencies saddled with the responsibility of checking these menaces are either complacent or are simply just corrupt.

Alien invasive species

According to IUCN definition of 'alien species': An alien species is a species which becomes established in natural or semi-natural ecosystems or habitat, is an agent of change, and threatens native biological diversity (IUCN 2000). These species can cause damage to the environment by modifying ecosystem processes which could potentially lead to the extinction of native species. A species is invasive if it can successfully establish and spread to new habitats after its introduction, seemingly without further assistance from humans. Invasive species can spread into new areas already occupied by native flora and displace those species (Lowe 2013). Such invasions from the intentional or Unintentional transport of plants to new regions now seriously threaten the Biodiversity, structure, and function of many of the world's ecosystems.

The problems caused by invasive species have potentially large economic consequences. Threats from invasive alien species include direct predation of native wildlife, competition for resources and ecosystem damage (e.g. through the removal of a key species such as a pollinator). Apart from the impact on wildlife,

invasive species can have a huge economic impact if they target commercial crop species, or indirectly influence them through effects such as soil destabilization (Global Invasive Species Programme 2001). The problems that invasive alien species cause have been shown to cost the global economy hundreds of billions of dollars a year and the environmental harm caused is considered one of the greatest threats to the ecological well-being of the planet (Ibimilua 2011). In Nigeria, much work needs to prevent and control the impact of invasive alien species. Preliminary studies to ascertain the number of alien species competing with the native species of plants in Nigeria is a major prerequisite to controlling the occurrence of invasive alien species.

Poverty and over-exploitation

Poverty remains a big threat to Biodiversity conservation in Nigeria. When people who reside in a rural environment which habours a large chunk of its biodiversity, are extremely poor, Biodiversity becomes their resort. Ibimilua (2011) reported a significant direct relationship between poverty and environmental degradation. The potentials for Nigeria to become one of the leading economies in the world is not in dispute. This is so due to the abundant human capital and natural resources the country is blessed with. But it is shocking to note that, reality conveys the opposite. Nigeria has overtaken India as the country with the largest number of people living in extreme poverty, with an estimated 87 million Nigerians, or around half of the country's population, thought to be living on less than $1.90 a day. Therefore in order to ensure a proper system of biodiversity conservation, the level of poverty needs to be reduced.

In Africa, there has been an over-reliance on herbal medicine as a way of seeking primary health care. It is estimated that about 80 percent of the population of Nigeria uses traditional medicine and of which 85% of traditional medicine involves the use of plant extracts (Falodun, 2010). The use of plants for herbal medicines requires the collection of plant parts such as root for herbaceous plants and stem bark for trees. The excessive peeling of stem bark affects the phloem which could harmful to the plant. Such practices can lead to the death of the plant and for more vulnerable species; it could even result in extinction. In addition, biodiversity also provides materials used for cultural practices during festivals. The likelihood of the survival of such dependent is linked to its continuous exploitation which further depletes biodiversity.

According to the National Biodiversity Strategy and Action Plan, more than 80 % of forest cover in Nigeria has been lost since 1990, with only 5.04 % now remaining. Most protected areas lack adequate protection because illegal logging, encroachment by farmers and cattle herders, firewood gatherers and poaching still continue in most areas. The continuous exploitation of tree species to the international market has significantly impacted negatively on the biodiversity of Nigeria. Hence, tree species such as the mahoganies, *Nauclea diderrichii* (opepe), *Terminalia ivorensis* (Odigbo), *Terminalia superba*(Afara), *Triplochiton sceleroxylon* (Ob eche) are now endangered. High intensity of logging and illegal exploitation of these and other species has continued to pose serious threats to the country's forest resources (the Federal Republic of Nigeria 2015). Other Lesser-known causes of overexploitation of forest resources are due to "knock-on" effects which occur when species that are co-evolved with another, such as plants with specialized insect pollinators. A negative impact on one of such species will have a negative ripple effect on the other go. For example, Moabi (*Baillonella toxisperma*) used to be a common tree in West-Africa. The fruits are eaten, cooking oil is extracted from the seeds (karite) and the bark is used for medicinal purposes. For its reproduction, the plant depends on the gastrointestinal tract of elephants to disperse and help initiate germination of the Moabi seeds. The impressive reduction of elephants has impacted negatively on the distribution of Moabi. The locals in some instances have rendered little assistance to conserving species especially the very rare ones. Recently, Odiegwu (2019) reported the activities of some

local inhabitants of the Brass community, Bayelsa State, Nigeria, about the butchering a stranded whale on the seashore (Figure 1). These actions militate against the sustainable conservation of wild species of plants and animals.

Genetic erosion and pollution

The use of improved varieties of crops and complete neglect of local varieties and the land-races lead to loss of biodiversity. Farmers now rely on a few high yielding varieties of a plant at the expense of maintaining previously available genetic diversity. As a result, many local varieties of plants have been lost-the use of improved dwarf okra (*Abelmoschus esculentus*) in the place of the native material of the tall okra. Some other the local plant varieties like sword bean (*Canavalia ensiformis*), African yam bean (*Sphenostylis stenocarpa*) and lima beans (*Phaseolus lunatus*) are now becoming extremely rare as only improved cowpea (*Vigna unguiculata*) is being cultivated in many farms. Similarly, *Dioscorea dumetorum*, *Dioscorea bulbfera*, *Trichosanthus species* (Snake tomato) and *Digitaria exiles* are no longer in popular cultivation as they were replaced by commercially driven improved varieties thereby causing the loss of important gene resources of all the above plant species (Emma *et al.* 2009).

The production of toxic chemicals in the environment constitutes a major threat to biodiversity worldwide. Humans have been the major culprit of environmental pollution. Emissions from refineries through gas flaring, industrial processes, plastic waste, burning of liquid and solid waste, oil spillage, Pesticides and inorganic fertilizers from agricultural activities are released into the air, soil and water. And because some of these released chemicals do not degrade easily, they accumulate to a toxic level and affect organisms at the different levels of the food chain. This results in disruption of the ecosystem, affecting the adaptation of species (Egboduku and Olorunfemi 2016) and ultimately resulting in species extinctions. The greatest impact on aquatic biodiversity in Nigeria is attributed to pollination (Emma *et al.* 2009). Lethal pollutants such as polychlorinated biphenyls, dioxins, and DDT that are nonbiodegradable get into water bodies and result in a drastic loss of aquatic species. Therefore proper understanding the many aspects of human influences on biodiversity, and their underlying driving forces, is of crucial importance for setting priorities and counteracting the current negative trends imposed by environmental pollution (Agbogidi *et al.* 2016).

Administrative factor

In Nigeria, various factors militates are against the effective implementation of conservation policies. However, the lack of adequate data on the status of biodiversity still remains a fundamental issue. The convention on biological diversity requires its member states to report regularly on the status of biodiversity within their countries and implement conservation actions and policies to maintain healthy populations of species within their jurisdiction. Regarding the above mandate, CBD recommends the development of the Red List assessment process to effectively assess and maintain the status of species at the country level. This deficiency has made it difficult to design adequate conservation programs for species facing high risks of extinction in Nigeria. In addition, policies are mostly made on the hoof without proper consultation of specialists. Just recently, Vanguard (2019) published a report stating how the Edo State Government and the Police Command, in an effort to check incessant incidents of kidnapping in the state, mandated all local government authorities to cut trees and bushes along federal highways in their domains to flush out kidnappers hiding in the bush. Bulldozers were deployed for this purpose. However, why the fight against bandits is important, it is detrimental to biodiversity to destroy the forest in the process.

Recommendation

1. To ensure sustainable biodiversity utilization and conservation, two key payers

must show leadership, first, the Government must integrate principles of sustainable developments into its policies and programs. Second, ecologists must seek to make comprehensive data on biodiversity available for policymakers to use.

2. There must be mass awareness about the importance of biodiversity conservation, especially in rural areas, where a preponderance of our biodiversity still exists. Conservation programme that enables indigenous people to secure their biodiversity in order to give them a sense of belonging should be encouraged. Local people should be trained as guides and in administration, so they could run a profitable ecotourism operation. Also, monies realized from tourism should enable the local economy to develop, provides the incentive to maintain the habitat, and provides funds for the local health clinic and scholarships for local students.

3. Economic activities are primarily responsible for the depletion of biodiversity and destabilize the natural system, therefore, such biodiversity depletion activities should carry financial penalties and conservation should carry financial incentives. In this way, economic activities that do not destabilize the natural system will be favoured.

4. Lastly, the majority of degree programs in the management sciences should incorporate courses in Bioresource management most especially in the aspect of conservation. This can best enlighten future graduands on the consciousness to conserve biodiversity.

Conclusion

This study has documented the status of biodiversity utilization and conservation in Nigeria. It identifies the current efforts to conserve biodiversity as well as unmask grey areas that need urgent conservation attention. The study will guide scientists, the government and other policymakers to identify and mark out more protected areas in the country and proffer urgent conservation strategies to threatened species. Thus, we advocate for a National Red List of threatened species in Nigeria.

Acknowledgments

The authors are grateful to the management of their respective institutions for the time resource to carry out this research.

References

Adewumi A. A., Edward J. B., Agunbiade R. O., Oyeniran B.H. 2018. The Nigerian Wildlife Management Policy, Institutional and Legal Framework. Journal of Scientific and Engineering Research 5(8): 6-13.

Agarwal M. 2016. Conserving water and biodiversity: traditions of sacred groves in India. European Journal of Sustainable Development 5(4) 129-140.

Aguilera J. 2019. The numbers are just horrendous. Almost 30,000 species face extinction because of human activity. TIME. Available at: https://time.com/5629548/almost-30000species-face-extinction-new-report/. [Accessed: September 15, 2019].

Aigbokhan E. I. 2016. Tree conservation in Nigeria. A paper presented at the workshop-Tree conservation: Prioritizing and protecting Nigeria's most threatened trees, Ibadan, Nigeria.

Ajayi S. S. 2019. Principles for the management of protected areas in wildlife conservation in Africa: A scientific approach. Academic Press, 250p.

Akande O. A., Ahmad Y. A., Yusuf H. O., Akinade T. G. 2019. Assessment of Wildlife Conservation Awareness and practices in some selected secondary school around Kainji Lake National Park, Nigeria. World Scientific News 115:91-103.

Anadu P. A. 1987. Progress in the conservation of Nigeria's Wildlife Biological Conservation. Biological Conservation 41(4):237-251.

Borokini T. I., 2014. A systematic compilation of endemic flora in Nigeria for conservation management. Journal of Threatened Taxa 6(11): 6406–6426.

Castineiras L., Fundora M. Z., Pico S., Salinas E. 2000. The use of home gardens as a component of the national strategy for the In situ conservation of plant genetic resources in Cuba. Plant Genetic Resources Newsletter 123: 9-18.

Dania-Ogbe F. M., Egharevba R. K. A., Bamidele J. F. 1992. Field survey of indigenous and useful plants, their preparation for food and home gardens in Edo and Delta States. The United Nations University, 95p.

Darbyshire I., Vollesen K., Chapman H. M. 2009. A remarkable range disjunction recorded in Metarungia pubinervia (Acanthaceae). Kew Bulletin. 63 (4): 613–615. doi:10.1007/s12225-008-9073-3.

Ejidike B. N., Ajayi S. R. 2013. Trends in wildlife conservation practices in Nigeria. International Journal of Biodiversity and Conservation 5(4): 185-191.

Federal Government of Nigeria. 2015. Nigeria Fifth Biodiversity Report. Federal Ministry of Environment, Abuja. 89p.

Gallai, N., Sales J. 2009. Economic valuation of the vulnerability of world agriculture confronted with pollinator decline. Ecological Economics 68: 810-821.

Imarhiagbe O., Osazee J. O., Aiwansoba R. O., Shittu O. H. 2016. *In vitro* germplam collection and storage: A review. International Journal of Biology Research 1(1):10 - 15.

Jianguo L., Daily G. C., Ehrlich P .R., Luck G. W. 2003. Effects of household dynamics on resource consumption and biodiversity. Nature: 421

Martin C. 1991. The Rainforests of West Africa: Ecology-Threats-Conservation. Springer Basel AG. 235p.

National Biodiversity Strategies and Action Plans (NBSAPs) 2015. Convention of Biological Diversity. Federal Ministry of Environment, Abuja. 157p.

Okorodudu F. M. T. 1998. Law of Environmental Protection: Materials and Text, Ibadan, Nigeria: Caltop Publication Ltd, 333p.

Okorodudu F. M. T. 1998. Law of Environmental Protection: Materials and Text, Ibadan, Nigeria: Caltop Publication Ltd, 333p.

Osawaru M. E., Ogwu M. C., Imarhiagbe O. 2015. Principal Component Analysis as a tool for analyzing On-farm Experimental Data. Biological and Environmental Sciences Journal for the Tropics 12(2): 148 - 158.

Osawaru M. E., Dania-Ogbe F. M. 2012. Crop diversity and utilization pattern in home garden from Southern Edo State, Nigeria. African Scientist Volume 13(1): 23-39.

Sawe B. E. 2019. The National Parks of Nigeria: Role in Protecting the Country's Biodiversity, WorldAtlas, Available at https://www.worldatlas.com/articles/the-national-parks-of-nigeria-role-in-protecting-the-country-s-biodiversity.html/. [Accessed August 20, 2019].

Terborgh J. 2002. Making parks work: strategies for preserving tropical nature. Island Press. 65p.

United Nations (UN). 2019. World population prospects. Department of Economic and Social Affairs, Population Division, UN, 46p.

USAID (2008) Nigeria biodiversity and tropical forestry assessment-Maximising agricultural revenue in key enterprises for target sites (MARKETS). Chemonics International Inc. 98p

Williams L. 2008. Okomu National Park. Nigeria: the Bradt travel guide. Bradt Travel Guides. 191p.