TOWARDS SUSTAINABLE CONSERVATION OF BIODIVERSITY AND ENDANGERED SPECIES IN NIGERIA.

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Abstract

Biodiversity on planet earth includes different plants, animals, microorganisms, their genes, and the ecosystem. Biodiversity is a life support system and is imperative in upholding the functions of physical environment such as utilitarian values, ecological services, reduction of global warming, reduction of pollution, promotion of soil fertility, biogeochemical cycle support, and general climate regulation. Biodiversity in Nigeria is seriously under the threat of extinction. Loss of biodiversity is on the rise and is increasing daily, and as such, our ecosystems are adversely perturbed by natural and anthropogenic activities. Most plant and animal populations have declined in numbers and geographical distribution. There is empirical evidence connecting the abundance of native species to the health of ecosystems and the human standard of living. The primary purpose of this review is to provide a current understanding of biodiversity issues in Nigeria in line with the theme of the 2023 International Day for Biodiversity, "From Agreement to Action: Build Back Biodiversity," by turning commitments into tangible actions. Out of several methods to ensure sustainability in biodiversity conservation, this paper concentrated on the Biodiversity Action Plan and Sustainable Development Goals pathway.

Keywords: Biodiversity, Ecosystem, Species, Population, Environment.

Introduction

According to FAO (2019), biodiversity is the variety of life at genetic, species, population, community, and ecosystem levels. It explains the variety of plants, animals, microorganisms and the genetic differences between and within species in the natural system. Biodiversity represents an enormous but largely under-explored genetic and biological pool that can be harnessed for novel genes, their products, and metabolic pathways. Each living entity works together like an intricate

web to maintain ecological balance, thus providing support for life. Biodiversity is considered at three (3) significant levels, the first being genetic diversity. This is the variety of genes in all the individual plants, animals and microorganisms within species and populations. Within a species exist several varieties, races or strains that slightly differ in physiological characters and functions such as size, shape, activities, and adaptive features to environmental conditions. The second is species diversity; which is the variety of living organisms in an area in terms of species richness. The biotic components in an ecosystem may be few or many species of plants, animals, and microbes that interact among themselves and with abiotic factors of the environment (Asthana and Asthana, 2012). The relative number among species is tagged species abundance. If species have the same abundance, it is described as high species diversity, but a high variation in abundance is tagged as low species diversity. It is also possible to classify species based on their functions; functional types are those species that perform different ecological functions, while functional analogues represent distinct species performing the same or similar ecological functions. As the third level, ecosystem diversity refers to the multiplicity of habitats, biotic communities, and ecological processes in the biosphere.

Literature review

The characteristic community of living organisms in an ecosystem depends mainly on the available abiotic factors and other environmental variables; for instance, small ponds and rivers ecosystems have different flora and fauna, and each ecosystem has its unique characteristic biotic community (Asthana and Asthana, 2012). Life generally depends on biochemical activities and environmental conditions, and environmental factors influence biochemical activities. Environmental conditions determine the biodiversity that will inhabit and optimally survive in a habitat. Climatic changes primarily influence the distribution of living things and the biodiversity

pattern on our planet. As one moves from the mild tropics to the taigas, the severe tundras, and the polar region without trees, the number of species present per unit area decreases. The equator tends to have the highest level of terrestrial biodiversity because of the warm climate and high primary productivity (Asthana and Asthana, 2012).

Recent changes in climate, such as warmer temperatures in certain regions, have significantly impacted biodiversity and ecosystems. The Western Pacific coasts, which have the highest sea surface temperatures and the mid-latitudinal band in all oceans, tend to have the highest marine biodiversity. The variety of species exhibits latitudinal gradients (Rawat and Semwal, 2014). Although biodiversity has been growing, it tends to concentrate in hotspots and is expected to slow down in the coming years (Robosky, 2009; Mora *et al.*, 2011). United Nations Environment Programme estimates that about 9 to 52 million biodiversity species exist.

Nigeria is rich in biodiversity and endowed with wild fauna resources and abundant animal species. There are 22,000 vertebrate and invertebrate species, about 20,000 insects, 1,000 birds, 1,000 fishes, 247 mammals and 123 reptile species (Nigeria Fourth National Biodiversity Report, 2010). About 2,000 microbial species have also been identified. The diversity of Nigeria's wild animals can be attributed to the country's tropical location, size, and ecosystems (FAO, 2000). These ecosystems range from the mangrove around the coastal ridges to the rainforests in the south, through the moist savannas in the central part of the country and dry arid savannas in the far north. Freshwater, brackish, and marine ecosystems are also occurring, while montane vegetation features have been found at high altitudes in the eastern borderlands (Falade and Adebanjo, 2008).

The country's rich fauna is also as a result of the diverse vegetation types of the ecosystems. There are mammalian species, such as the African Elephants (*Loxodonta africana*), African buffalo *(Synceruscaffer*) and hippopotamus (*Hippopotamus amphibius*), existing in the rainforest. Other

large mammalian species found here are the large duikers (*Cephabius niger),* Chimpanzee (*Pantroglodytes*), and red river hog (*Potamochoerus porcus).*The savannah areas house the hartebeest (*Alcephalus buselaphus),* warthog (*Phacochoerus aethiopicus),* and most carnivores. Grass cutters (*Thryonomys swinderiannus*), Giant rats (*Cricetomys* sp.) and tree squirrels (*Funisciurus* sp.) are among the wide variety of small mammals that exist in the savannahs as well as a range of primates (wcsnigeria.org, 2012). The lowland rainforest also provides habitat for about 200 species of birds (FAO, 2000). Four of the bird species; Anambra waxbill (*Estrildapoliopareia),* Ibadan malimbe (*Malimbus ibadanensis),* Jos Plateau indigo-bird (*Vidua maryae*) and the RockFire-Finch (*Lagonosticta sanguinodorsalis)* are endemic to the country, making them globally essential species for conservation (Nigeria National Biodiversity Strategy and Action Plan, 2007). Nigeria is also noted as a global hotspot for some species of primate. A great diversity of this is primarily found in Cross River State's Gulf of Guinea forests. Some of these species are endemic to Nigeria, like the white-throated monkey (*Cercopithecus erythrogaster*), Sclater's guenon (*Cercopithecus sclateri)* and the Niger Delta red colobus (*Procolobus pennantii epieni*).

Some endangered species in Nigeria include Pangolins, Lions, Elephants, Cross-River Gorillas, Nigeria-Cameroon Chimpanzee, African Grey Parrots, African Wild Dogs, Olive Colobus, Red Colobus, West African Manatees, Hippopotamus, Drill Monkeys, etc. An endangered species is a population of organisms at a high risk of going extinct due to either low population size or threats from predation or changing environmental conditions. Critically Endangered means that a species is either facing an extremely high risk of extinction, its numbers have declined or will continue to decline. The estimate of the endangered wildlife is usually underestimated because there are enormous numbers of species that are not yet enlisted or described (Asthana and Asthana., 2012).

The invertebrate group has over a million species that benefit human beings, and their loss may pose severe ecological consequences. About 50,000 invertebrate species are lost annually, almost 25% of Germany's 40,000 invertebrate fauna has been recorded as threatened, and freshwater snails in the United States of America are facing extinction or have already become extinct. Several small creatures, such as prawns, lobsters, crabs, mussels, squids, octopus, cuttle fish, etc., are rapidly declining in numbers worldwide (Asthana and Asthana., 2012).

Fishes represent more than 50% of the total number of vertebrate species present on earth, but due to pollution of aquatic ecosystems, there is a decline in fish populations in both freshwater and marine ecosystems. In North America, about 30% of the entire fish stock and about 400 fish species of Lake Victoria in Africa are tending towards extinction. The adverse effects of anthropogenic activities have contributed immensely to the decline of the fish population. Overfishing threatens marine resources worldwide. In Nigeria, for example, changes in fishing activities, especially by Non-National fleets, are exerting immense pressure on her coastal waters and those of other developing countries, in part because of the use of "flags of convenience" (Ferrel, 2005; Miller and Sumaila, 2014). FAO (2018a) reported that an estimated 33.1% of world fish stocks were fished at unsustainable levels in 2015. Overfishing also affects many of the world's rivers, lakes, and streams.

Amphibians represent a group with about 2,400 species. Globally, a decline in the population of amphibians is observed; about 50% of amphibian species move to extinction due to environmental pollution, habitat destruction and invading species. The common amphibians are toads, frogs, salamanders, caecilians, etc., while common reptiles include snakes, lizards, tortoises, and crocodiles. Forest loss represents a major global threat to biodiversity and the supply of ecosystem services such as habitat provision, clean water, soil conservation and protection, and carbon

sequestration (FAO, 2018b). The destruction of forests has caused reptile species to be endangered, and with over 84,001 species of birds on earth, more than 50% are now being threatened or endangered. Some, such as the Bermuda Petrel, the Peregrine falcon, the Golden eagle, the Sparrows-hawk, and the Osprey are considered threatened or endangered (Asthana *and Asthana*, 2012).

A group of plants growing together in a particular habitat or environment is called vegetation. It is grouped into forest (Abundant trees with little grasses) and savanna (Abundant grasses with short, scattered trees). The Savanna biome covers a large portion of Nigerian vegetation cover. The three significant savannas in Nigeria are the Guinea savanna, the Sudan savanna, and the Sahel savanna. The tree species in the Guinea savanna include Shea butter, Oil palm, *Isoberlina* sp., *Daniellia oliveri*, *Lophira alata*, and *Terminalia* sp. (Buba, 2015). The significant grass genera are *Andropogon, Cymbopogon, Hyparrhenia, Pennisetum* and *Setaria (*Buba, 2015). The major plants are grasses, *campos*, and *lanos;* popular trees include acacia, baobab, and shea butter. The common trees in the Sudan savanna include *Acacia* sp, *Ceiba pentandra* the *Adansonia digitata* (baobab), *Hyphaene thebaica, Parkia* sp, *Butyrospermum* sp., and *Acacia albida.* The common grasses are *Andropogon pseudapricus, Hyarrhenia* and *Loudetia* sp. Also, the main plant species are *Acacia raddianna, A. Senegal, A. Laeta* and *Commiphora Africana,* while the grasses include *Aristida stipoides, Schoenefeldia gracilis* and *Chloris priean.* The low-green plants that do not produce flowers include algae, fungi, bryophytes, pteridophytes and gymnosperms; they play a vital role in making the environment suitable for other organisms to inhabit. Each group's disappearing species may take away many species of animals and other microorganisms.

Benefits of Biodiversity

Utilitarian benefits**:** The utilitarian benefits include agricultural produce or food, medicine, industrial raw materials, oils, resins, tannins, household equipment, fuelwoods, furniture, and building materials for subsistence. Others are rattan cane (*Lacospermasedndifora*), chewing sticks (*Garcinia manii*), and wrapping leaves (*Thaumatococcusdanielli*) for income. Most of the biodiversity sustains the rural economy. About 70% of the rural population derives their livelihood from wild species of biodiversity. Many plants provide most of the drugs people use. According to a World Health Organization report, nearly 80% of people living in Africa rely on traditional medicines derived from plants as the primary source for their health care needs. More than 70,000 different plant species are used in traditional and modern medicine, while antibiotics for treating ailments are obtained from microorganisms.

Ecosystem services: Ecosystem services are activities of natural resources that support human activity (Singh *et al*. 2006). Biodiversity plays a vital function in the provision of services in the ecosystem. Some outstanding ecosystem services provided by biodiversity are stated below

i. Climate change mitigation: Mangrove forests have the potential to store up to five times as much carbon as mature tropical forests in an equivalent area. (International Union for Conservation of Nature, 2012). Biodiversity improves ecosystem resilience and is essential in disaster risk reduction and peace-building strategies. Forests, wetlands, and mangroves play an important role in mitigating the effects of extreme weather events like droughts and floods.

ii. Regulation of biogeochemical cycles: Microorganisms and biological resources are prevalent in biogeochemical cycles such as carbon, Nitrogen, Oxygen, Sulphur, Phosphorus, and hydrological cycles. Microorganisms convert pollutants and waste

materials to mild toxic substances through decomposition, biodegradation, mineralisation, and biotransformation processes which purify the environment.

iii. Protective Services: Provision of shield for human beings against extreme weather events such as floods, heavy wind, and hot weather, among others. Also wild species are essential in pest regulation. Bats, toads, birds, snakes, and so on consume some animal pests on crops or in forests.

Ethical and moral benefits**:** Mankind is part of nature, and the natural world has value for human heritage. Ecosystems provide services and locations that support human ethics and moral well-being. The well-being of future generations is a social responsibility of the present generation.

Aesthetic value: Provision of beautiful and admirable sights. Human beings enjoy watching the natural environment. The shapes, structure and colours stimulate our senses and enrich our culture.

Threats to Biodiversity

Some natural and enormous anthropogenic factors ultimately posed severe threats to biodiversity. Although natural occurrences such as wildfires, hurricanes, typhoons, cyclones, tornadoes, tsunamis, earthquakes, flooding, mudslides, and volcanic eruptions leave in their wake a myriad of mind-boggling habitat destruction (Agarwal *et al.,* 2014). The destruction occasioned by man's actions remains a global concern. Available evidence indicates an alarming rate of biodiversity loss in Nigeria which is mainly human factor-related. This is due to the interactions with the environment for development, improved life quality from industrialisation, technological advancements, and urban growth. Population pressure (200 million people) is putting more demands on food and natural resources such that natural habitats are destroyed for plantation establishment, irrigation, crops, and livestock production. The effort to supply enough safe and

nutritious food for the growing population poses many challenges. Among the most serious challenges is the need to increase food production without undermining the capacity of available lands and seas to meet the food needs of future generations while at the same time delivering other ecosystem services to the present generation. Despite repeated warnings about the rapid loss of biodiversity and the mounting evidence of its vital role in food security and nutrition, production systems are now becoming less diverse in terms of the ecosystems, species, and genetic resources they utilize (MEA, 2005a; Steffen *et al*., 2015; Bommarco, Kleijn, and Potts, 2013; Cunningham *et al.*, 2013; Diaz *et al*., 2011; Pinstrup-Andesen, 2013; Rockstrom *et al*., 2017; Sunderland, 2011; Tittonell *et al*., 2016 and Tscharntke *et al.*, 2012; FAO, 2010a, 2014a, 2015a)

Loss of Biodiversity

According to the UN Food and Agriculture Organization, natural habitats and ecosystems are being destroyed at over 10 million hectares yearly. Over 31,000 plant and animal species are threatened with extinction; at least one livestock breed dies out every week. Although species extinction is natural but anthropogenic activities quickens the extinction rate. A threat is a process or event, either natural or artificial that can cause adverse effects on the status or sustainable use of any component of biological diversity. Loss of biodiversity is caused by various factors such as habitat alteration, land-use change, climate change, invasive species, overexploitation and pollution, erosion (coastal and gully), etc. Biodiversity in Nigeria is seriously threatened by extinction, and the endangered species in Nigeria are reviewed by this paper based on aquatic, estuaries, and terrestrial ecosystems.

Aquatic Ecosystem species

The aquatic ecosystem in Nigeria has vast native and exotic aquatic resources. Aquatic biodiversity common in Nigeria includes *Pistia stratiotes* (water lettuce), Lemna and *Wolfia*

(duckweeds), *Azolla* and *Salvinia (*water ferns), *Chlamydomonas and* blue, green algae, *Spirogyra*, *Utricularia* (bladderwort), Sedges and Reeds, *Daphnia* (water flea), Copepods, water snails, water boatman, water scorpion, water bugs, water spider, leeches, frogs, toads, water snakes, crocodiles, fishes, heron, duck, hippopotamus etc. Popular fishes in Nigerian waters include tilapia, claries, mackerel, shark, carp, mudfish, ladyfish, dogfish, electric fish, and herrings. Studies showed that many Nigerian aquatic resources are endangered due to habitat degradation, overfishing, and other anthropogenic activities. Aquatic resources are vital to environmental sustainability, tourism, and human health. Fifteen fish families in Nigeria have been listed as being threatened and endangered, and this list is on the increase with time as new species are found to be near extinct. Commercially and economically valued food fish, include silver catfish, *Chrysichthys nigrodigitatus*, *Heterotis niloticus* and *Erpetoichthys calabaricus*, have been reported to be threatened by factors such as destruction of breeding grounds, exotic species, habitat demolition, overexploitation, water pollution and other anthropogenic activities (Ekpo, Asuquo, Abiobo, 2010). Another study by Amos, Ali and Abubakar (2020) identified abundant and endangered fish species in River Donga, Taraba state, Nigeria, between March 2018 and August 2019. Data collated were analysed, and the most abundant fish species was *Oreochromis niloticus* (9.18%), while the lowest was *Hyperopsus bebe* and *Labeo barbusbynni* (0.19%) each. The most endangered fish species was *Gymnarchus niloticus* (21.28%), and the lowest was *Malapterurus electricus* (0.53%).The Causes of endangerment of fish species were poisonous chemicals and other crude fishing techniques, which introduced hazards of various magnitudes to the entire aquatic environment.

Estuaries, Wetland, and Mangrove Species

Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land covered by shallow water or part of our landscape that is defined by the presence of water. Nigeria has some typical wetlands located in areas such as the Sokoto-Rima Basin, Komadugu–Yobe Basin, Lake Chad Basin, Upper Niger Basin, Kanji Lake, middle Niger Basin (Lokoja wetlands) Jebba wetlands, lower Kaduna wetlands, lower Benue Basins (Makurdi wetland), transboundary wetlands of the Upper Benue and the Cross River Basin (Nwankwoala, 2012). Some common wetland types in Nigeria include swamps, Fens, and Seep Bogs.

Swamps are wetlands characterised by a predominance of woody vegetation and usually contain standing water at least occasionally throughout the year. They frequently inhabit low-elevation floodplains near rivers or still streams. (Idris, 2008).These areas experienced problems of water

logging that arise either due to surface flooding or high water table. According to Deswal and Deswal (2008), water-logged soil productivity is poor due to less oxygen availability for the respiration of plants and aerobic microbial populations. Fens and seeps are wetlands fed by groundwater that jets out to the soil surface. The vegetation type within these wetlands depends on the water chemistry and pH level (Idris, 2008). Bogs are basin wetlands where the only source of water is precipitation. Sphagnum mosses, which may form a floating mat over water and support a wide variety of specially adapted species, are typically the dominant vegetation in bogs. (Idris, 2008).

Wetland habitats are home to a variety of creatures, such as beavers, bobcats, deer, minks and muskrats, alligators, snakes, turtles, salamanders, as well as invertebrates like crayfish, shrimp, mosquitoes, snails and dragonflies and birds like plover, grouse, storks, and herons. (Ellie, 2017). Three types of plants grow in wetlands: submerged plants that grow underwater, plants that grow on the water's surface and emergent plants, which comprise most wetlands plants. Bogs and fens are home to carnivorous plants, evergreen trees and shrubs, thick sphagnum moss mats, and other plants. Mangrove and cypress trees can be found in both freshwater and saltwater swamps. Freshwater marshes support grasses, wildflowers, and shrubs, whereas saltwater marshes are home to rushes, feeds, sedges, and saltbush. Wetland vegetation aids in the habitat's ability to retain water, preventing local rivers and streams from overflowing (Jennifer, 2017).

Terrestrial Ecosystem Species

Terrestrial biodiversity common in Nigeria includes Ferns, Herbs, Epiphytes, Saprophytic fungi, Bacteria, Earthworms, Beetles, Millipedes, Snails, Ants, Squirrels, Snakes, Bats, Rats, Lizards, Chameleons, Birds, Monkeys, Grass cutters, Antelopes, Iroko, Obeche, Mahogany, Ebony, African walnut, Opepe, and Limba. However, many of these organisms, which provide about 95%

of human food, face extinction threats. The savanna plants face challenges such as seasonal drought, low water and nutrient availability, the impact of fire, herbivores overgrazing and extreme weather events that threaten their survival (Asthana and Asthan, 2012).

Global Assessment Report on Biodiversity

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) presented a report tagged Global Assessment Report on Biodiversity. The report is summarised as follows;

i. Nature is declining globally at unprecedented rates in human history – and the rate of species extinctions is accelerating, with grave impacts on people worldwide.

ii. Biodiversity and nature's contributions to people are our shared heritage and humanity's most important 'life-supporting safety net'. But our safety net is stretched almost to breaking point.

iii. The health of ecosystems human beings and all other species depend on is deteriorating more rapidly than ever. We are eroding the foundations of our economies, livelihoods, food security, health, and quality of life worldwide.

iv. The diversity within species, between species and of ecosystems, and many fundamental contributions we derive from nature are declining fast. However, we still have the means to ensure a sustainable future for people and the planet.

v. Around one million animal and plant species are now threatened with extinction, many within decades, more than ever in human history.

vi. Ecosystems, species, wild populations, local varieties and breeds of domesticated plants and animals are shrinking, deteriorating, or vanishing. Earth's essential, interconnected web of life is getting smaller and increasingly frayed; this loss directly results from human activity and threatens human well-being in all regions.

vii. Based on a thorough analysis of the available evidence, the five direct drivers of change in nature with the most significant relative global impacts so far are stated in descending order: (i) changes in land and sea use; (ii) direct exploitation of organisms; (iii) climate change; (iv) pollution and (v) invasive alien species.

viii. Since 1980, greenhouse gas emissions have doubled, increasing average global temperatures by at least 0.7 degrees Celsius. Climate change has already impacted nature, affecting everything from ecosystems to genetics. It is expected to have an even more significant impact in the coming decades, sometimes even outpacing the effects of other drivers, such as land and sea use changes.

ix. Human actions have significantly altered three-quarters of the land-based environment and about 66% of the marine environment. On average, these trends have been less severe or avoided in areas held or managed by Indigenous Peoples and Local Communities.

x. Land degradation has reduced the productivity of 23% of the global land surface, up to US$577 billion in annual global crops are at risk from pollinator loss, and 100-300 million people are at increased risk of floods and hurricanes because of loss of coastal habitats and protection.

xi. In 2015, 33% of marine fish stocks were being harvested at unsustainable levels; 60% were maximally sustainably fished, with just 7% harvested at levels lower than what can be sustainably fished.

xii. Plastic pollution has increased tenfold since 1980. Three hundred to four hundred million tons of heavy metals, solvents, toxic sludge, and other wastes from industrial facilities are dumped annually into the world's waters, and fertilisers entering coastal ecosystems have produced more than 400 Ocean 'dead zones.'

xiii. Negative trends in nature will continue to 2050 and beyond in all the policy scenarios explored in the Report, except those that include transformative change due to the projected impacts of increasing land-use change, exploitation of organisms and climate change, although with significant differences between regions.

Biodiversity Conservation

Conservation is the sustainable use of resources and encompasses protection and exploitation. In simple terms, biodiversity conservation is all about saving life on Earth in all its forms and keeping natural ecosystems functional and healthy. Sustainable development is another intricate aspect of biodiversity conservation. It is the development that meets the needs of the current generation without compromising the ability of future generations to meet their needs. A balance between the environment, development and society results in sustainable development, which ensures biodiversity conservation. This is only possible with proper enforcement and environmental stakeholders implementing policies/conventions.

Conservation methods of biodiversity include *ex-situ* conservation, involving the conservation of species of biodiversity outside their natural habitats, for example, museums, zoological gardens,

botanical gardens, and gene banks. *In-situ* conservation involves conserving biodiversity species in their natural habitats by maintaining, recovering, and repopulating species in games and forest reserves, national parks, protected areas, wildlife sanctuaries, and gene banks. Many efforts have been put in place in other climes to collect and preserve the genetic material of crops, birds, and fish species (Agarwal *et al*., 2009; Agarwal, 2011). Community participation in biodiversity conservation is essential as no legal provisions can be adequate without community involvement in the planning, management, and monitoring of the implementation of the conservation programs and international efforts through conventions, treaties, and protocols (Dobhal *et al*., 2011).

In Nigeria, some government Ministries, Departments, Agencies, and non-governmental organisations like the Federal Ministry of Environment (FMEnv), National Resources Council (NARECO), and Nigerian Conservation Foundation (NCF) in collaboration with the United Nations Environmental Program (UNEP), the Worldwide Fund (WWF), and several other agencies have embarked on programs to protect and preserve the nation's biodiversity. Nonetheless, the nation's goals of managing wild animals for tourism, maintenance of ecosystem balance, justifiable cropping of game meat and protection of our national heritage have been challenging to achieve as we keep facing new and mounting economic problems, rapidly growing population, and the consequent continuous destruction of wild habitat (Anadu, 1987).

The Federal Military Government of Nigeria promulgated the Endangered Species Decree No 11 of 1985.The decree prohibits the hunting, capture of or trade in various sorts of wildlife that will go into extinction if not protected; they include gorillas, chimpanzees, crocodiles, all reptiles, lizards, pythons, parrots, all monkeys, elephants, all antelopes, lions, and other related species. Other conservation laws include prohibition of bush burning and cutting down trees. Conservation refers to actions taken to protect and sustainably use natural resources for present and future

generations. Hence, wildlife conservation is an attempt to exploit wild populations reasonably so that they will be available for future use. Anadu (1987) reviewed the history of conservation in Nigeria from colonial times and explained the reasons for the lack of effective conservation measures until the early 80's. The Nigerian Conservation Foundation (NCF) established in 1980, has achieved some laudable strides in sustaining conservation ethics and wise use of natural resources in the country. The Convention on Biological Diversity's Strategic Plan lays out five goals:

i. Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society.

ii. Reduce direct pressures on biodiversity and promote sustainable use.

iii. Improve the status of biodiversity by safeguarding ecosystems, species, and genetic diversity.

iv. Enhance the benefits to all from biodiversity and ecosystem services.

v. Enhance implementation through participatory planning, knowledge management and capacity building.

The Convention on Biological Diversity's (CBD) Strategic Plan (2011) envisages that by 2050, biodiversity should have been valued, conserved, restored, and wisely used, maintaining ecosystem services, sustaining a healthy planet, and delivering benefits essential for all people. The IPBES Report also states that it is not too late to make a difference, but only if we start now at every level, from local to global, that nature can still be conserved, restored, and used sustainably through transformative change. By transformative change, we mean a fundamental, system-wide reorganisation across technological, economic, political, and social factors.

IPBES Report also revealed global goals for 2030 and beyond may only be achieved through transformative changes across economic, social, political, and technological factors. Current negative trends in biodiversity and ecosystems will undermine the progress of achieving the

assessed targets of the Sustainable Development Goals. Loss of biodiversity is therefore shown to be not only an environmental issue but also a developmental, economic, security, social and moral issues. To address the leading causes of damage to biodiversity and nature, indirect drivers of change should be considered. Increased population and per capita consumption, technological innovation, which has sometimes reduced and sometimes increased environmental damage, and, most importantly, governance and accountability issues are the main indirect drivers.

The report also presents a wide range of illustrative actions for sustainability and pathways for achieving them across and between sectors such as agriculture, forestry, marine systems, freshwater systems, urban areas, energy, finance, and many others. It highlights the importance of, among others, adopting integrated management and cross-sectoral approaches that consider the trade-offs of food and energy production, infrastructure, freshwater and coastal management, and biodiversity conservation.

Sustainable Approaches to Conservation

Governments and civil society are collaborating through the Convention on Biological Diversity (CBD) to reverse the tide of devastation that humanity has inflicted upon the natural world. The stakes are high: although about 40% of the world economy is derived directly from biological diversity, humanity is pushing ecosystems, species, and gene pools to extinction. United Nations Environment Programme 1992 (UNEP, 1992) adopted a convention, the first global treaty to provide a comprehensive framework that addresses all aspects of biodiversity- ecosystems, species, and genetic diversity. It also introduces a new strategy for the biodiversity crisis known as the ecosystem approach, which aims to reconcile the need for environmental conservation with concern for economic development. By promoting sustainable development, the Convention seeks to ensure that the earth's renewable resources are not consumed so intensively that they cannot

replenish themselves. The Convention has three goals: the conservation of biodiversity, the sustainable use of the components of biodiversity, and the fair and equitable sharing of the benefits of using genetic resources (CBD, 2011).

Biodiversity Action Plan (BAP)

Biodiversity action plan is a structured approach to conservation and sustainable use of our natural capital (biodiversity). It is a set of future actions and strategies designed to protect and restore biological systems, especially in High Biodiversity Value Areas (HBVAs). BAP is planned and carried out based on internationally accepted protocols applicable at the local, state, national(Strategic biodiversity programme), regional, and international levels; it is multidisciplinary in practice. The principal components of BAP are inventories of biological information for selected species or habitats, assessment of the conservation status of species within specified ecosystems, targets for conservation and restoration, the establishment of timelines and institutional partnerships for implementing the BAP and budgets, framework for reporting to stakeholders (host, govt. NGO, public), monitoring and evaluation.

Biodiversity inventories - Rapid assessment is carried out when an HBVA is identified. An inventory of the biodiversity is done to ascertain the status of either the species or habitat of intervention interest, the constitution of a multidisciplinary team of experts such as a Wildlife manager, Conservation expert, GIS expert, Vegetation expert, Soil scientist, Hydro-Geologist, Environmental chemist, Microbiologist, Hydro biologist Socio-economist, medical team for health assessments depending on needs. The rapid assessment report proffers reasons for the choice of conservation actions.

SDG Pathway towards conservation

Other sustainable approaches are anchored on Sustainable Development Goals (SDGs).

Goals12, 13, 14 and 15, when achieved, will halt or reduce the rate at which biodiversity goes into extinction.

Goal 12

"Ensuring sustainable consumption and production patterns" This can be achieved through:

i. Policy actions and societal initiatives: These help to raise awareness about the impact of consumption on nature, local environmental protection, sustainable local economies, and restoration of degraded areas. Policy actions with societal initiatives at various levels can strengthen area networks and other effective area-based conservation measures such as the protection of watersheds, incentives, and sanctions to reduce pollution, integrated landscape and watershed management, conservation of the diversity of genes as well as approaches that empower consumers and producers through market transparency and distribution.

ii. Resource efficiency: Governments and all citizens should work together to improve resource efficiency, reduce waste and pollution, and shape a green economy.

Goal 13

"Take urgent action to combat climate change and its impacts."

The impacts of climate change also include flooding and drought, displacing millions of people, and pushing some biodiversity into extinction. Taking urgent action to combat climate change and its devastating impacts is imperative to save lives and livelihoods. Biodiversity can be conserved by climate-positive actions such as

i. Green transition: Investments must accelerate the decarbonisation of all aspects of our economy.

ii. Green jobs and sustainable growth

iii. Green economy: making societies and people more resilient through a transition that is fair to all and leaves no one behind.

iv. Invest in sustainable solutions: Fossil fuel subsidies must end, and polluters must pay for their pollution.

v. Confront all climate risks.

vi. Cooperation – no country can succeed alone.

vii. Reduction of greenhouse gas emission

Goal 14

"Conserving and sustainably use the oceans, seas and marine resources for sustainable development."

The ocean absorbs about one-quarter of the world's annual carbon dioxide (CO2) emissions, mitigating climate change and alleviating its impacts. It is essential to conserve and sustainably use them.

i. Marine ecosystem:

Marine ecosystems can be conserved through ecosystem-based approaches to fisheries management, spatial planning, effective quotas, marine protected areas, protecting and managing critical marine biodiversity areas, reducing run-off pollution into oceans, and working closely with producers and consumers.

ii. Freshwater ecosystem

The freshwater ecosystem can be conserved through policy options and actions, including, among others, more inclusive water governance for collaborative water management and more significant equity; better integration of water resource management and landscape planning across scales; promoting practices to reduce soil erosion, sedimentation and pollution run-off; increasing water storage; promoting investment in water projects with clear sustainability criteria; as well as addressing the fragmentation of many freshwater policies.

Goal 15

"Protecting, restoring and promoting sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and biodiversity loss."

Goal 15 is about conserving life on land. It is to protect and restore terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and stop biodiversity loss. Healthy ecosystems and the biological diversity they support are sources of food, water, medicine, shelter, and other material goods. They also provide ecosystem services such as the cleaning of air and water, which sustain life and increase resiliency in the face of mounting pressures. Terrestrial biodiversity can be conserved by promoting good agricultural and agro-ecological practices, multifunctional landscape planning (providing food security, livelihood opportunities, maintenance of species and ecological functions) and cross-sectoral integrated management. In urban areas, the report highlights, among others, the promotion of nature-based solutions, increasing access to urban services and a healthy urban environment for low-income communities, and improving access to green spaces. Enhance policy implementation through participatory planning, knowledge management and capacity building.

Conclusion

Nigeria is rich in biodiversity and has various micro and macro flora and fauna. These species occur in different numbers within the country's terrestrial, aquatic and estuary ecosystems, from the mangrove forests around the coastal South to the Sahel North. In Nigeria, most biodiversity is endangered because most of the population depends on them for livelihood, energy, and construction. Hence, there is an urgent need to conserve them for sustainability. The Biodiversity Action Plan approach and Sustainable Development Goal pathway should be rigorously adhered for sustainability to be achieved. It is also imperative that Nigerian government should take more decisive action and rise to the challenge of conserving the biodiversity resources so as to build a

future where the children will live in harmony with nature. Therefore, the government should strengthen awareness of the dangers of extinction and implement actions to protect endangered species. At the same time, research should be doubled in identifying and documenting these species.

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