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SUSTAINABLE FOREST MANAGEMENT FOR ENVIRONMENTAL WHOLESOMENESS, BIODIVERSITY CONSERVATION AND SUSTAINABLE DEVELOPMENT IN NIGERIA

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ABSTRACT

Tropical forest has received increasing attention from global community in recent years due to high rate of deforestation and associated environmental challenges. Globally, efforts being made towards tackling environmental challenges are being frustrated leading to high rate of forest and biodiversity loss. This paper aimed at highlighting sustainable forest management for environmental wholesomeness, biodiversity conservation and sustainable development in Nigeria. In Nigeria, the highest rate of deforestation of primary forests recorded 55.7% between 2000 and 2005 with 58 (10.4%) of the tree species as endangered, in spite of the establishment of forest reserves, protected areas and associated conservation and environment laws. It has been reported that if the current trend of unsustainable forest management persists, it could step out of the limits of environmental wholesomeness and thus generating irreversible processes due to the top-bottom management structure (TBMS) of forest management. Hence, governance should be considered the best approach to sustainable forest management and conservation through improved public enlightenment and awareness in Nigeria.

Keywords: Nigeria forest, Sustainable forest management, environment and biodiversity conservation, forest governance

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INTRODUCTION

Forest, especially tropical forest, has received increasing attention from global community in recent years due to high rate of deforestation, fragmentation and degradation causing loss of biodiversity and global environmental challenges. For instance, Nigeria, which was once well endowed with diverse forest types now has less than 5% of its land area covered with high forest, and the northern states have been completely deforested (Molinos, 2013). Deforestation is a major driver of biodiversity loss and myriads of environmental challenges including global climate change. Numerous recent assessments have shown that if humanity keeps following the current trend of economic growth and development, it will step out the limits of Earth capacity thus generating irreversible processes (Ildikó *et al.*, 2010).

Among reasons for poor forest management systems in Nigeria is the lack of adequate knowledge of the silvicultural requirements of the diverse forest species and the limited objectives of the forest management (Umeh, 1992; Okojie, 1997). Many indigenous forest species are faced with threat of extinction due to land-use changes in favour of agriculture, infrastructural development and mineral exploitation where adoption of an appropriate silvicultural technique to enhance productivity of forest and the range of ecosystem goods and services derivable therefrom would've sufficed. Moreover, the nexus between forests and environmental wholesomeness was until

recently alien to human consciousness. The major interest of forestry and common uniting theme in forest science was the production of timber yielding trees while undermining the production of non-timber forest product and services (Igugu, 1997; Meregini, 2005; Markku, 2008; Innes, 2013). However, better understanding of the role of forest in environmental conservation has informed that the emphasis given in practice to timber production and meeting domestic requirements for wood products is no longer appropriate, and the concept of sustainable forest management has concomitantly spread with the wider concept of sustainable development (Maya *et al.,* 2011). Indeed, there's increasing global attention to the demands of global markets for environmental conservation (IUFRO, 2007). Several market-based schemes such as the United Nations Reducing Emissions from Deforestation and forest Degradation (UN-REDD) programme using carbon credits take advantage of a forest's ability to store carbon and thus "off-set" some of the GHGs released into the atmosphere. Policy and management decisions governing forest resources will also have critical role to play in mitigating global warming and climate change effect, thus requiring a robust method of monitoring the spatial and temporal patterns of forest biomass (Dengsheng *et al.,* 2012). Good understanding of the ingredients and dynamics of sustainable forest management will significantly enhance forest/biodiversity and environment conservation while enhancing socio-economic development. This paper highlights on sustainable forest management as central to environmental management, biodiversity conservation and sustainable development in Nigeria.

FOREST MANAGEMENT IN NIGERIA

Forest management in Nigeria traversed three major historical stages of the life of the people. The Pre-colonial era which is marked by purely traditional practices, the Colonial era and the post-colonial era. Thus, forest management in Nigeria predates the advent of the colonial master. It is well known that from time immemorial mankind has depended on the forest for her sustenance particularly for food, clothing and shelter. Borokini *et al.* (2012) noted that from time immemorial, human settlements have been associated with tropical forests, and to date, in Nigeria, human settlements are found within or beside forest regions, mostly the rural dwellers, whose lives and existence are solely dependent on the forests and their resources. The people of Nigeria have an extensive history and based on archaeological evidence, human habitation of the area dates back to at least 9000 B.C. (Okunomo and Egho, 2010). According to this author, the people of Nigeria have been planting trees for thousands of years for food, shelter, ceremonial or religious purposes.

These ancient people devised a way of harnessing forest resources sustainably in other to survive long before the arrival of the colonialists. Although forest was taken for granted in those past because they were found almost everywhere, people started becoming increasingly aware of the direct and far reaching influences of the forest as available forest are continually diminishing and the demand for forest goods and services soar (Nwoboshi, 1982). Important crops such as *Dacroides edulis, Elaeis guineense, Irvingia gabonensis* were effectively domesticated long before the colonial masters. Be that as it may, the foundation of forest administration in Nigeria was laid by the early colonial officers (Etukudo, 1994). Forest management in Nigeria started in earnest in the 18th century with the establishment of regional forestry authorities followed by a period of nearly sixty years of forest reservation, introduction of timber licensing systems, development of royalty determination systems, introduction and development of silviculture and silvicultural systems in natural forest, achievement of reliable regeneration methods, establishment of plantations, development of fire protection practices and the building up from scratch of forestry research and forestry education at technical and tertiary levels (Umeh, 1992). Nevertheless, the management of Nigerian forest was directed towards sustainable production of forest goods and service, particularly timber. It is usually aimed at maintaining adequate supply of forest produce, first for internal consumption and secondly for exports (Umeh, 1992).

However, the emphasis given in practice to timber production and meeting domestic requirements for wood products is no longer appropriate. The role of forests in global warming and climate change mitigation and

adaptation is increasingly being appreciated worldwide, and the concept of sustainable forest management has concomitantly spread with the wider concept of sustainable development (Maya *et al.*, 2011). It is ironical that sustainable forest management currently deemphasizes on timber production due to global environmental challenges such as climate change and global warming. This is because the word sustainability was coined by Hans Carl von Carlowitz, a German mining administrator, to ensure the perpetual supply of timber (FAO, 2013). Hans Carl von Carlowitz, according to FAO (2013) was vexed by the dwindling supply of wood for the silver mines he oversaw, and was critical of the profit-driven thinking that was causing overharvesting of the forest. He published a book, *Sylvicultura oeconomica*, in which he coined the German term for sustainability, *Nachhaltigkeit*. Von Carlowitz said that the *Nachhaltigkeit* principle should be applied to the management of forests to ensure the perpetual supply of timber, and he urged the adoption of measures that would make forests a permanent economic resource. Over the next decades and centuries, the *Nachhaltigkeit* principle spread through Central Europe and to India, the United States of America and elsewhere. Arguably, it was the start of the modern approach to sustainable forest management (SFM) (FAO, 2013).

Concept of Forest Management

Forest management has been severally defined. It describes the process involving prudent allocation of resources in order to achieve defined forest management objective(s) which may include any or all of the following benefits derivable from the forest:

i. Food and medicines
ii. Timber and/or pulp wood production
iii. Provision of industrial raw materials such as gum, tans, dyes etc
iv. Conservation, Wildlife habitat, Recreation and Scenic beauty
v. Ecological services such as erosion control and climate stabilization and
vi. Biomass production and carbon sequestration

Thus, the management of forests is complex. It includes consideration of diverse components—soil, vegetation, wildlife habitat, water, recreation, aesthetics—as well as diverse products and values. Management involves determining what balance of revenues and outputs is desired and what costs and inputs are needed to sustain those outputs (Malmsheimer *et al.* (2008).

Modern forestry can therefore be defined as the scientific management of forest resources for the continuous production of the above goods and services (Nwoboshi, 1982). The current trend is that forest resources management should be regarded as any other industrial management with the aim of being profitable. However, unlike all other natural resources, forest resources are biologically renewable; they can grow and regrow after harvesting on the same site. Hence, to work effectively, forest resources management must be biologically as well as economically sound.

Paradigm Shift in Forest Management

In many countries including Nigeria, forests were managed basically for timber with literally no environmental conservation attachments or interest. Markku (2008) noted that until recent decades, the common uniting theme in forest science has been timber production and that only in the most recent decades that other forest products and services than timber have gained relative importance. This rather single-use of the forest led to a lot of wasting of forests resources which contributed to the loss of several forest species with many others currently under threat of extinction. In fact, the low enrolment into forestry in recent years was blamed on the association of forestry with the destruction of forests, rather than with their care and nurturing (Innes, 2013). However, the emphasis given in practice to timber production and meeting domestic requirements for wood products is no longer appropriate and a new balance is emerging. The important role of forests in global warming and climate change mitigation and adaptation is increasingly being appreciated. Hence, from the 1980s onward the concept of sustainable forest management has concomitantly spread with the wider concept of sustainable development (Maya *et al.*, 2011). Carbon storage is a new "ecosystem service" that is being added to the forest management opportunities that traditionally included wood, water, wildlife, and recreation (Malmsheimer *et al*., 2008). Whereas in the past, Foresters manage forests to provide a variety of objectives like direct extraction of raw material, outdoor recreation, conservation, hunting and aesthetics; emerging management practices

include managing forestlands for biodiversity, carbon sequestration and air quality, all of which is monumental for environmental conservation. In the context of global change and sustainable development, forest management activities play a key role through mitigation of climate change (IPCC, 2007). It is now well known that forest management can either exacerbate or reduce the effects of climatic change on the productivity and biological diversity of forest landscapes.

Forest Management for Environmental Conservation

As much as forest is shaped by climate, climate is also shaped by forest. Forest influence both local and global climate. They moderate the diurnal range of air temperature and maintain atmospheric humidity levels (Gbetnkom, 2011). They also absorb atmospheric carbon and replenish the oxygen in the air we breathe. Forests act as a carbon sink, helping to offset greenhouse gas emissions, sequestering more than 750 million tonnes of CO_2 equivalent" (FAO, 2005). Forest could serve to mitigate global warming and climate change through Wood and Biomass Substitution, Wildfire Behaviour Modification, Avoiding Land Use Changes, and Promoting Carbon Credits (FAO, 2005; Malmsheimer *et al.*, 2008). They also play indirect roles through watershed management, biodiversity conservation etc. Consequently, forest and forestry occupy prominent position in environmental management particularly in global climate change mitigation and adaptation strategy. Innes (2013) considered the various uses to which forest could be put and concluded as follows: "There is no easy answer to the question: What will we use our forests for? The issue is complex and the parameters forever changing. Uses will change faster in some parts of the world than in others, potentially leading to further inequalities between regions. Within the strict field of forestry, the academic community has been slow to recognise some of these changes, and as a result, scientists from other fields are increasingly working in what was once considered to be 'forestry'. This represents a major challenge for those involved with the management of research institutions, be they government agencies or university departments, as does the increasing involvement of the private sector. It would seem prudent for foresters, forest scientists and forest academics to pay more attention to the changes that are happening around us." One area in which developing nations like Nigeria should aspire to catch up with global trend is in the sustainable management of her rich forest estate. This will require effective forest management planning and the key is in determining suitable silvicultural systems for greater range of forest products and services. Although the country seems to be keying into this new paradigm in forest management with calculated steps.

Sustainable Forest Management (SFM)

Several definitions for sustainable forest management have been advanced by organizations and individuals. The United Nations General Assembly (2008) defines sustainable forest management (SFM) as a "dynamic and evolving concept, which aims to maintain and enhance the economic, social and environmental values of all types of forests, for the benefit of present and future generations". It is defined by ITTO (2005) as the process of managing forest to achieve one or more clearly specified objectives of management with regard to the production of a continuous flow of desired forest products and services without undue reduction of its inherent values and future productivity and without undue undesirable effects on the physical and social environment. Fredericksen and Putz (2003) described it as the management of the forest for all goods and services, as well as maintenance of ecological functions, or at least with the more specific goal of sustaining timber yield. The SFM concept encompasses natural and planted forests in all geographic regions and climatic zones, and all forest functions, managed for conservation, production or multiple purposes, to provide a range of forest ecosystem goods and services at the local, national, regional and global levels (CPF, 2012). It gives due attention to economic, biological, cultural, social and spiritual values (Young and Wesner, 2003). Hence, it is generally accepted that in addition to conserving biodiversity, conscientious forest managers should strive to ensure the sustained flow of timber and other forest products demanded by society (Fredericksen and Putz, 2003).

The term has a link with the concept of sustainable development which was defined in the Brundtland report (WCED, 1987) as development that satisfies the needs of the present without compromising the ability of

future generations to meet their own needs. This link is even more obvious considering that sustainable forest management incorporates sustainable management methods based on establishing economic, social and environmental criteria and indicators. Taken into cognisance the dynamics of ever changing global demands for forest goods and services, a sustainable forest management needs be flexible. Inness (2013) pointed out that a potential forest governance problem is that as demands for goods and services increase, the capacity of the existing forest estate to deliver them may be reached. This, according to the author, will require some new thinking about the way we organise the delivery of these goods and services. Sustainable forest management incorporates a suitable framework to meet the needs of the times without compromising on forest conservation and environmental protection.

Assessment, monitoring and implementation of SFM

Sustainable Forest Management is measured by internationally accepted categories of criteria and indicators. The criteria and indicators developed for boreal, temperate and tropical forests provide a framework to assess, monitor and report on the implementation of SFM based on: the extent of forest resources; biological diversity; forest health and vitality; productive functions; protective functions; socio-economic functions; and the legal, policy and institutional framework. (CPF, 2012; Young and Wesner, 2003). The contribution of ITTO to the development of sustainable forest management is noteworthy and commendable. The organization in 1990 was the first to establish criteria as an evaluation tool for sustainable forest management (Ahimin *et al*., 2016). It expanded these to include measurable indicators in 1992 and has revised its C&I several times since then, with the most recent version published in in 2016 (ITTO, 2016; Ahimin *et al*., 2016). In 1998 the African Timber Organization (ATO) established its own principles, criteria and indicators (PCI) for SFM, and shortly after this, the ATO and ITTO combined efforts to establish a common set of PCI applicable in African countries (ITTO, 2013). The Criteria and Indicators (C&I) for sustainable forest management (SFM) are arguably one of the most important and innovative policy instruments for the operationalizing the SFM concept (ITTO, 2011; Blaser and Johnson, 2017). C&I are playing important roles in a range of forest related developments and issues, including as a foundation for international initiatives to assess forest governance in the context of REDD+ and to establish principles, criteria and indicators for sustainable intensive woodfuel production (FAO, 2010). C&I are also relevant to the assessment of forest-related trends pertaining to the convention on Biodiversity (CBD)'s Aichi Biodiversity Target (ITTO 2013). The roles and benefits of C&I is well documented by Blaser and Johnson (2017). Criteria characterize the essential components of SFM, and indicators are ways of assessing each component. When monitored over time, C&I show changes and trends in the biophysical, socioeconomic and policy conditions relevant to SFM (Blaser and Johnson, 2017).

Policy Implications

The role of governments in the forest management of every nation cannot be overemphasized. Gbetnkom (2011) noted that managing the remaining forest resource for climate change in Africa requires the introduction of improved forest management and harvesting policies, and technologies to stimulate the existing forests capacity for carbon sequestration and storage. Several federal government programs affect forestry practices and thus carbon sequestration. Activities in federal forests have been reported to affect carbon storage and release; with timber harvesting as the most controversial of such activity (Gorte, 2009). Federal programs also provide technical and financial help for managing and protecting private forests, and even government tax provisions affect private forest management. Various federal programs can also affect the extent of forested area, by supporting development (which may cause deforestation) or encouraging tree planting in open areas, such as pastures (Gorte, 2009). Gbetnkom (2011) suggested the following management measures for African forests:

- Making investments that minimize the loss of forest are to deforestation, such as rewarding tree planting initiatives
- Improving tree growth, minimising soil disturbances, and ensuring quick and satisfactory regeneration of new forests.

Others include ensuring satisfactory natural regeneration of harvested forests and forests damaged by fire, improving forest fire suppression and management capabilities, adopting reduced-impact logging practices; and minimising the negative impact of road construction and maintenance.

Silvicultural Practices in Forest Management

Silviculture is the art and science of controlling the establishment, growth, composition, and quality of forest vegetation for any or the full range of forest resource objectives. It ensures the long-term continuity of essential ecologic functions, and the health and productivity of forested ecosystems (Nyland, 1996). Silviculture comes into forest resources management in the biological sector, and was described by Nwoboshi, (1982) as the science of how a forest crop can be produced naturally or artificially and cultured under prevailing economic conditions to maturity for the projected use, so as to realise the highest profit in terms of land owner's objective in managing the forest. According to the author, it is literally understood to involve the formation of new or regeneration of old forests and caring for them until they are matured for the intended use. Silvicultural system describes the collection of treatments to be applied over the life of a stand. It is a planned program of treatments during the whole life of a stand designed to achieve specific stand structural objectives. This program of treatments integrates specific harvesting, regeneration, and stand tending methods to achieve a predictable yield of benefits from the stand over time. The systems are often typically described by the method of harvest and regeneration employed.

The survival, growth and development of forests and forest species depend on interplay of site and stand management factors and by genetic factors of the species (Unwin and Krieddemann, 2000; IPCC, 2007). Tree crops thus respond differently to different kinds of external stimuli, and this is the bases of the practice of silvicultural principles and forest management operations for carbon sequestration, water protection and biodiversity conservation which are key environmental services provided by forests, and each of them are linked to soil properties and quality. Thus, various types of forest management have different effects on forest services, and knowledge on how the forest management can help maintain and enhance them is crucial to sound decision making in the forest sector and in policy development. For instance, it has been demonstrated experimentally that carbon assimilation and direct effects of elevated CO_2 on tree growth and biomass accumulation are compounded by soil nutrient input and foliar nutrition (Wong *et al.*, 1992; Unwin and Krieddemann, 2000). The rate of biomass increase and hence rate of carbon sequestration also vary through rotation of a new plantation as an integration of genetic, environmental and silvicultural determinants (Unwin and Krieddemann, 2000). However, since conversion of atmospheric carbon to assimilated carbohydrate (*eg* providing the cellulose content of new wood) is limited by quantum requirements for photosynthesis and by diminished efficiencies in strong sunlight (both factors of which are intrinsic to green plants and neither is amenable to forest improvement), future gains in carbon sequestration by trees will come from elsewhere, especially from site improvement, improved silvicultural strategy and targeted genotype selection (Unwin and Krieddemann, 2000).

Forest Management for Climate Change Mitigation

It is now well known that forest is shaped by climate as much as climate is shaped by forest. Thus, the world's forests are critically important in carbon cycling and balancing of atmosphere's carbon dioxide and oxygen stocks. Malmsheimer *et al*. (2008) observed that of the many ways to reduce GHG emissions and atmospheric concentrations, the most familiar are increasing energy efficiency and conservation and using cleaner, alternative energy sources, while the less familiar yet equally essential is using forests to address climate change. However, following the ratification of the Kyoto Protocol, there has been increasing focus on possibilities to sequester more carbon in biological systems. Unique among all possible remedies, forests can both prevent and reduce GHG emissions while simultaneously providing essential environmental and social benefits, including clean water, wildlife habitat, recreation, forest products, and other values and uses (Malmsheimer *et al*., 2008). Forests can be net

sinks or net sources of carbon, depending on age, health, and occurrence of wildfires and how they are managed.

Forest management and use of wood products add substantially to the capacity of forests to mitigate the effects of climate change. Some of the ways by which forest could mitigate climate change include:

- ***Wood Substitution.*** Substituting wood for fossil fuel–intensive products addresses climate change in several ways.
- ***Biomass Substitution.*** The use of wood to produce energy opens two opportunities to reduce GHG emissions. One involves using harvest residue for electrical power generation, rather than allowing it to accumulate and decay on site or removing it by open field burning. The other is the substitution of woody biomass for fossil fuels.
- ***Avoided Land-Use Change.*** More carbon is stored in forests than in agricultural or developed land. Preventing land-use change from forests to non-forest uses is thus another way to reduce GHGs. For instance, the Michael Okpara University of Agriculture Umudike (MOUAU) relic forest (Plate 1) is being managed more importantly for environmental services to the University and surrounding communities. Chukwu *et al*, (2024) noted the usefulness of the forest for research, biodiversity conservation, social and economic benefits, besides its usefulness for environmental and ecological services.

Plate 1 (a, b and c). Sections of the MOUAU Relic forest with some researchers at work.

- ***Wildfire Behavior Modification.*** Reducing wildland fires, a major source of GHG emissions, prevents the release of carbon stored in the forest.

The management procedures involved for each of the above management objectives was well described by Malmsheimer *et al*. (2008).

The UN-REDD Initiative

In view of the enormous role of forest in climate change mitigation the Reducing Emissions from Deforestation and Degradation (REDD) programme was initiated at the UN Kyoto protocol. The Programme which was founded in 2008 by a joint undertaking of the Food and Agriculture Organization of the United Nations (FAO), United Nations Development Programme (UNDP) and United Nations Environment Programme (UNEP) to fight deforestation and forest degradation, was developed to advance the United Nations Framework Convention on Climate Change (UNFCCC) and to foster innovative and collaborative approaches to address the existential challenge of climate change (UN-REDD Programme Fund, 2018). The UN-REDD Programme supports nationally led REDD+ processes and promotes the informed and meaningful involvement of all stakeholders, including indigenous peoples and other forest-dependent communities, in national and international REDD+ implementation (FAO, 2019). It offers enormous opportunities for forest holders to increase their annual income through forestry carbon trading, and substantial amount of

money are involved (Pasa, 2009). Under the REDD+ framework, forest-rich developing nations would be paid by industrialized nation, if they achieve long-term reductions in carbon emissions by reducing deforestation and forest degradation (REDD), protecting and enhancing carbon stocks, and replacing unsustainable forest practices with ones that sequester more carbon (Nix, 2008; Nzegbule, 2013). Although many tropical countries in Africa are yet to have strong footing on this new dimensions, there is a significant comparative advantage for these countries due to relatively low tree establishment costs, and rapid tree growth and carbon sequestration in the region (Nzegbule, 2013). The UN-REDD+ is already playing key role in climate change mitigation efforts and Nigeria needed build capacity to enhance participation and benefit from the initiative. It has been predicted that carbon management in forest plantations will probably be the single most important agenda of the first half of the 21st century in the context of the greenhouse effect and mitigation of global climatic changes (Nzegbule, 2013) with several countries already structuring their forest management to promote forests capacity for carbon storage and to take advantage of the emerging international trade in carbon (Malmsheimer *et al*, 2008; Gorte, 2009; Cedergren, 2009). The Un-REDD programme which has helped partner countries improve governance and advance national policy and institutional systems to safeguard forests and mitigate climate change, was reported to encompass 64 partner countries and haa become a flagship United Nations partnership for the Paris Agreement, and for delivering on the Sustainable Development Agenda (UN-REDD Programme Fund, 2018). Nigeria is in apposition to leverage the opportunities of UN-REDD not just for economic advancement but for the conservation of her endangered forest species, restoration of her degraded areas and to decrease her vulnerability to climate change and other environmental crisis.

Stemming Our Massive Deforestation Rate

The loss of forest ecosystems carries severe consequences on every aspects of human existence-social, economic and ecological. Deforestation causes among other things, land degradation, soil erosion and loss of biodiversity (Okojie, 1997, Afuwape *et al*, 2002, Akachuku, 2006). Loss of biodiversity robs the earth of its biological richness, and undermines long-range ecological security, psycho-social wellbeing and global economic potential. At the rate of deforestation of natural forest, many Nigerian plant species especially the endemic ones (species with specialized habitat) are in serious danger of extinction (Okojie, 1997, Afuwape *et al*, 2002, Akachuku, 2006, Borokini et al., 2012). These trees have enormous ecological, socio-cultural, economic and medicinal values such that when really considered, the consequence of our forest loss is huge and disturbing.

The Imperative of Forest Governance Approach

An effective forest governance will be one that incorporates the ideals and principles of community participation. Ignorance has been implicated as one of the causal factors of massive deforestation in Nigeria (Akachuku, 2006; Ogbonnaya and Nwajiobi, 2012). Many Nigerians are ignorant of the usefulness of forest especially as it relates to environmental conservation. In essence, while people suffer and cry over environmental disasters in their communities and environ, they ignorantly continue with unfriendly agricultural and forestry practices that erodes the resilience of environmental components and systems to climate change impact, and which predisposes the environment to worst ecological crisis. Many people in Nigeria are still unaware of the value of the forest in protecting the environment and this is a major problem (Ekwebelam and Onyewotu, 1989; Ogbonnaya and Nwajiobi, 2012). The majority opinion of usefulness of forest seems limited to its role in providing fuelwood, timber, food, and few other forest resources. This myopic perception of forests favoured massive deforestation that has exposed lands to agents of erosion; and has contributed immensely to most agricultural land loss through erosion, flooding and desertification. This is in direct contrast to what obtains in developed nations. A study conducted by Kraxner *et al* (2009) in Japan indicated that forest was perceived as an ecosystem with a protective function against e.g. soil erosion or flooding, rather than a place that might serve for wood production and providing jobs. Thus, in forging a formidable management strategy for the sustainable management of Nigerian forest, due emphasis should be given to public enlightenment and education. The high rate of biodiversity loss in

Nigeria occurs in spite of the establishment of forest reserves, protected areas and associated conservation and environment laws, indicating failure of these legal and institutional frameworks alone for effective nature conservation in Nigeria. A good example of this was reported by Borokini *et al*. (2012) on studies of chimpanzees in Southwest Nigeria. According to the author, in most of the forest reserves visited by the researchers, the state and local forest departments are unable to control the large-scale illegal activities taking place within the forest reserves. Sustainable forest management which incorporates the principles of community participation is essential to stemming the tide of forest degradation and loss which is at the core of biodiversity loss, environmental degradation and associated crisis in Nigeria.

CONCLUSION

The Nigerian forest is a repository of great biodiversity and plays central roles in the environmental conservation and socio-economic development of the nation. The forest in most places today however is no longer in healthy state to sustain the socio-economic and ecological services they originally provided people and communities. Along with the disappearing of forest and forest species is the dwindling economic fortunes and social wellbeing of the country. These ordinarily ought to be pointers and indicators of the development priorities of the country. However, ignorance of the nexus of the forest estate to the economic fortunes of the country, escalated by poor understanding of the content and principles of sustainable forest management, remained a major handicap of forest resources and the environment managers. As abuse of natural resources, especially forest and associated resources, is the fundamental causative factor for environmental degradation and disasters, environmental management must of necessity be understood first and foremost as the science and art of policing humanity against abuse of natural resources, chiefly the forest and associated resources. Sustainable forest management is recommended to governments and development partners as the primary essential to the sustainable development of Nigeria and most developing tropical countries. While laws and institutions are relevant, it should not be allowed to becloud a strong need for community enlightenment and participation in the management process in order to ensure the sustainability of the benefits for a significant ecological and socio-economically impactful ends.

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