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## FORESTRY ACTIONS AND TECHNOLOGIES FOR ENHANCING CLIMATE CHANGE MITIGATION AND ENVIRONMENTAL SUSTAINABILITY IN NIGERIA

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### ABSTRACT

Forestry and forests have been recognized to be a critical factor in the mitigation of climate change and environmental sustainability. Thus, this paper discusses forestry actions that can enhance climate change mitigation and environmental conservation in Nigeria, which include conservation and preservation of remaining natural forests, massive reforestation and afforestation, use of eco-friendly technologies for logging and timber processing, promotion of systemic agroforestry production and promotion of urban forestry. Recommendations proffered include among others, participatory management approach should be adopted and emphasised in the management of forest resources by collaborating with communities adjoining gazetted and protected forests, waste-saving technologies should be introduced and adapted for logging and wood processing, government should promote and encourage the use of alternative products to wood by ensuring their availability and affordability to drastically reduce the high rates of cutting down the forests and trees for timber and firewood, and comprehensive review of forestry policies and laws across the country to stimulate, encourage and enable mass participatory in forest conservation and tree planting for the purpose of climate change mitigation and overall environmental sustainability.

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**Keywords:** *Forestry, Forests, Climate Change, Mitigation, Environmental Sustainability*

### INTRODUCTION

The invaluable environmental services render by forests to human include regulation and maintenance of benign climates, purification of atmosphere of pollutant gases, protection of soils against erosion, protection of water-bodies, such as rivers, perennial streams, lakes and aquifers against getting turbid, silted and dried-up. Not until recently, the

invaluable environmental services provide by forests are not accorded due importance.

Climate change refers to long-term changes of climatic parameters, such a temperature (UNFCC, 2010). It is a prevailing global phenomenon that is threatening the well-being and existence of man on the planet earth. Climate change is evident in unfavourable extremes of climatic parameters such as temperature and rainfall. The most conspicuous expression of climate change is global warming which is the harmful increase in the earth's temperature. Excessive carbondioxide (Co<sub>2</sub>) in the atmosphere has been identified as the principal cause of global warming. Excessive Co<sub>2</sub> in the lower part of the atmosphere (troposphere) traps earth infra-red radiation (heat emitted from the earth surface) and prevent it from escaping into space, thereby raising global temperatures. The burning of fossil fuels (petroleum fuels) and deforestation are the major anthropogenic activities generating excessive Co<sub>2</sub> (UNFCC, 2010). Burning of fossil fuels releases about 5 billion tonnes of Co<sub>2</sub> into the atmosphere yearly (Sato, 2008 and Sukhdev, 2010), while tropical deforestation releases 1.5 billion tonnes of carbon per annum into the atmosphere (ITTO, 2011 and Abad, 2015).

Accordingly, forests and forestry are a critical factor in the mitigation of climate change and environmental sustainability as a whole. Forests, particularly tropical forests, have been adjudged the largest biological sink of Co<sub>2</sub>(ITTO, 2011 and FAO, 2020). It has also been reported that tropical forests are absorbing nearly five billion tonnes of Co<sub>2</sub> released yearly into the atmosphere through burning of fossil fuels and other sources, thereby substantially buffering the rate of climate change (Sukhdev, 2010 and ITTO, 2011). The total estimated carbon stock in the forests worldwide is 662 gigatonnes (FAO, 2020). Forests are a much cheaper, easier and efficient reservoir for storing carbon than industrial capture storage (Tewari *et al.*, 2008 and UNFCC, 2010). This paper, therefore, discusses forestry-based actions and technologies that can considerably enhance mitigation of climate change nay environmental sustainability in Nigeria.

### **Conservation and Preservation of Natural Forests**

Conservation of natural resources is a policy which seeks to ensure a balance between consumption, income demands, ecological and environmental imperatives in the exploitation of natural resources.

Conservation of natural forests is the prudent exploitation of the needed produce or products from the forests without vitiating the resource base or impairing the renewability of the forests. The tropical rainforest, for example, is the most biologically diverse ecosystem on the earth and highly ecological robust in providing environmental services of soil protection, moderating climate and sequestering carbon. Research findings indicated that mangrove forests store exceptionally more carbon than most tropical forests, which implies that the rapid rate of their destruction along coastlines is causing significant emissions of greenhouse gases higher than was previously thought (CTA, 2011). The remaining areas of the natural forests should be brought under sustainable management particularly the gazetted forest reserves in order to enjoy their benefits in perpetuity. Accordingly, conservation of an appreciable area of remaining mangrove forest would enlarge carbon sinks and greatly complement climate change mitigation mechanisms.

Preservation is prohibition of exploitation of any produce or products from an area of forest. The exclusive objective of natural forests' preservation is biodiversity and environmental conservation. A preserved forest is managed as strict nature reserve. The Rainforest National Parks, for examples, the Cross River and Okomu National Parks, are deemed as preserved forests or strict nature reserve. The management and protection of preserved forests against poachers, particularly, illegal loggers, is a herculean task, but its valuable ecological, environmental and climatic services to local, national and inter-continental territories are unquantifiable. Traditionally preserved forests, for example, patches of sacred forests, are equally important in this context. The effective management and protection of these forests is imperative more than hitherto as they serve as huge sinks of high volumes of pollutant gases being generated by the phenomena of economic growth, which include industrial, agricultural and ore mineral exploration and exploitation activities.

### **Massive Reforestation and Afforestation**

The Nigerian forests have been widely degraded and destroyed. The agents of destruction include subsistence farming, logging, mining and infrastructural development. Firewood collection and charcoal production also play very prominent role in deforestation in Nigeria. Nigeria has the highest rate of deforestation in the world and this has resulted in the disappearance of the primary forests such that the relics remaining are

insignificant (Akindele, 2012 and Olajide, 2018). Deforestation in Nigeria translates to loss of over 400,000 ha of forest land per year (Akpan-Ebe, 2015 and FAO, 2020). Deforestation endangers the environmental, economic, social and in fact entire wellbeing of the citizenry. According to Akindele (2012), a lot of damage is done to the land through increase soil erosion, siltation of water bodies, loss of biodiversity, habitat loss for wildlife and desertification. When one hectare of forest goes up in smoke, between 100 and 200 tons of carbon dioxide (principal gas causing global warming) are released into the atmosphere (CTA, 2007). The regeneration of forests by artificial planting of fast-growing tree species on the degraded and destroyed forest lands is a must in a fast-growing economy like Nigeria in order to ameliorate the concomitant adverse environmental effects of economic development activities.

The vast areas of the country that have been eaten up by human-induced savanna and desertification should be afforested by planting fast-growing, draught and fire resistant tree species. The principal object of intensive reforestation and afforestation activities should be the establishment of planted forests to provide ecological, environmental and favourable climatic services. In other words, the establishment of forests plantation should not entirely be for timber or wood production. Tropical forest trees are absorbing about 18 percent of the CO<sub>2</sub> added to the atmosphere each year from burning fossil fuels, substantially buffering the rate of climate change (Sato, 2008 and ITTO, 2011). Both government and private sector of the economy should be involved in intensive afforestation of the country to create a friendly and healthy environment for the citizenry as the economy grows. The denuded forest estates or reserves and other lands dedicated to forestry can be given out to organized private sectors on very simple terms to establish forest plantations, while government provides them with attractive and encouraging incentives and subsidies.

### **Use of Eco-Friendly Technologies for Logging and Wood Processing**

Timber harvesting involves a number of operations, which include construction of roads and skidrides, cutting of associated plants around marked trees for harvesting, felling and cross-cutting of trunks to logs, loading and transportation of logs to sawmills and/or conversion of logs into flitches right at the stump site and transportation to resawing mills. All of the logging operations are often indiscriminately carried out, thereby culminating in a considerable damage and degradation of the

ecosystem with the attendant loss of juvenile trees (regeneration) which are supposed to constitute the future forest stock.

Wood is a raw material that can be processed into different valuable products. Every cubic metre of wood should be prudently utilized. This can only be accomplished by using efficient and integrated technologies and greatly minimize wastes. It has been reported that most of the wood processing machines in use in Nigeria generate huge waste at every stage of production (Molinos, 2011 and 2013). Waste generation starts right from the forest through the inefficiency of chainsaw operators (Udo, 1996). Crooked logs, off-cuts, large branches and sawdust are abandoned in the forests, while in the factories; wastes are generated in the forms of slabs, sawdust and half-processed materials. However, these wastes can be processed into other useful products, but this is not often the case. The use of reduced impact logging (RIL) technologies in timber harvesting will greatly reduce ecological and environmental impacts of timber exploitation and result in greater future productivity of the forests. The use of more efficient and integrated production technologies will lead to greater efficiency in processing, less waste generation in the forest and factory and provide room for the recycling of waste generated.

Localization and establishment of integrated wood-based industries especially in the timber-rich areas, should be encouraged by the government. What this implies is that different wood-based industries are sited in a close range or a neighbourhood. An integrated wood-based industry is one with different components (factories) producing different wood products. These approaches, among others, foster interdependence of the wood-based industries/factories in the area of raw material supply, that is, the by-product or waste from one industry serving as raw material to another. It has been suggested that the peeler core from the plymill and slabs from sawmills should be used for the manufacture of small items such as floor tiles, blocks and machete handles, while sawdust should be recycled to power stations as fuel for the generation of steam (Oyagade, 1997 and Olajide, *et al.*, 2008). These suggestions would translate to drastic reduction in the number of wood-based industries that directly exploit the forests for their wood raw material and this would invariably enhance the capacity of the forests to mitigate climate change.

### **Institutionalised Urban Forestry**

Urban forestry is the art, science and technology of managing trees and forest resources in and around urban community ecosystems for environmental, sociological, economic and aesthetic benefits that trees provide in the society (Konijnandijket *al.*, 2006). Furthermore, urban forestry practice involves planting of trees in green-belts, along major avenues or roads, recreational parks, botanical gardens in and around urban areas. It also encompasses planting and management of trees around the premises of residential and corporate buildings. The benefits of urban forestry practice include erosion control, purification of atmosphere air and stream water, reduction of wind speed, carbon sequestration, noise abatement, amelioration of ambient temperatures, improvement of property values and provision of food, fuelwood, herbal medicine and timber for urban dwellers (Vyas, 2006 and Larinde, 2010).

As a result of seemingly ever increasing rural-urban migration and coupled with recent policy actions of urban renewal and development across the length and breadth of Nigeria, vast areas of forest in many villages adjoining cities and towns have been cleared to give way for city expansion and infrastructural development in the forms of road network expansion, establishment of housing estates, markets, stadia, airports industrial estates etc. In other words, many villages have been completely engulfed by city expansion and eventually turned to urban areas. The Nigerian cities or urban areas are generally characterized by seas of cement pavement, coal-tarred and interlocked stones surfaces, which cause rise in ambient temperatures. The adverse environmental effects of widespread clearance of forests for urban expansion and development include aggravated soil erosion and flooding, loss of watersheds, increase incidence of damage of property (particularly houses) by storms, exacerbated air pollution, aggravated global warming and climate change. The practice of urban forestry is more imperative now than hitherto in order to appreciably mitigate the adverse environmental consequences of urban expansion and development, thereby engendering sustainable healthy living in Nigerian towns and cities.

### **Adoption and Promotion of Systemic Agroforestry Systems**

Agroforestry is the cultivation of forest crop, arable crop and/or rearing of animals on the same piece of land simultaneously on sustainable basis. Shifting cultivation or slash-and-burn agricultural practice has caused widespread destruction of forests in West and Central Africa sub-regions.

Shifting cultivation practice involves a process whereby a farmer clears an area of forest to cultivate a combination of arable crops for about two or three years and thereafter abandon the area, because of declined fertility of the soil and clear another expanse of forested land for cultivation. However, in the chains of shifting cultivation, farmers allow some forest tree and shrub species, which produce products of economic and social values to remain on their farms. In addition to the economic and social values, the standing trees and shrubs on the farms protect the soils against erosion and enrich the fertility of the soils. Moreover, the trees standing on the farms provide firewood, poles and in some cases, timber for the use of farming households and also, sources of income. It therefore implies that agroforestry has been a long time practice.

Due to rapid increase in human population and increase demand for lands for economic development activities, land has become scarce for agricultural production and consequently, continuous cultivation of a piece of land year in and year out by a farmer using chemical fertilizers to enhance soil fertility becomes a prevalent practice. The production and use of chemical fertilizers generate a lot of greenhouse gases. IPPC (2007) attested to the fact that agriculture accounts for at least one quarter of all the world's greenhouse gas emissions. Agricultural activity plays a significant role in the issue of global warming nay climate change by producing methane (CH<sub>4</sub>), the second most important greenhouse gas, though it is hard to assess these emissions with accuracy (Adedire, 2010).

The development of agroforestry is a contemporary prominent focus in agricultural and renewable natural resources management circles with the aim of exploiting its environmental, economic and social benefits. Optimal production of forest and agricultural products on the same area of land simultaneously and sustainably, would greatly reduce the rate of clearance of the remaining areas of forest for cultivation of arable crops. From research, a number of tree species that are capable of continual and steady maintenance of mineral nutrients' enrichment of soils have been identified and incorporated into agroecosystem. Organized agroforestry systems, like alley cropping and alley farming have been developed, but yet to be widely adopted and practiced by farmers across the country. Possibly because of poor extension service. in other words, deliberate and systemic planting of trees capable of continual renewing soil fertility and produce economically valued non-timber products, has not been widely adopted and practiced. In addition to the drastic reduction in the rate of

deforestation and enhanced environmental services of the forests, organized agroforestry systems protect the soil against erosion, sequester carbon and create favourable micro-climate for high productivity of arable crops.

## **CONCLUSION AND RECOMMENDATIONS**

Forestry actions are undoubtedly imperative in sustaining friendly environment and mitigating the adverse effects of climate change as economic development activities is rapidly on the rise. For forestry to play the needed roles in greening the Nigerian growing economy, attention must be given to the following:

- i) community participatory management approach should be adopted and emphasised in the management of forest resources by mutually beneficially involving communities adjoining the gazetted and protected forests in all forest conservation actions.
- ii) comprehensive review of policies and laws pertaining to forestry across the country to enable and encourage private sector involvement in forest property ownership and practice of urban forestry.
- iii) provision of subsidies and incentives by government to individuals and organizations investing in forest plantations' establishment for the purpose of environmental protection.
- iv) forestry Directorates and Agricultural Extension Services of government should partner to spread the adoption and practice of organized or systemic agroforestry by farmers.
- v) Nigeria should modify and domesticate the international practice of carbon credit through enforceable legislation that will make it mandatory for big industries to commit a percentage of their profits before tax to afforestation for the purpose of climate change mitigation.
- vi) waste-saving technologies should be introduced and adapted for logging and wood processing
- vii) Government should promote and encourage the use of alternative products to wood by ensuring their availability and affordability to drastically reduce the high rates of cutting during the forests and trees for timber and firewood.

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