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Potentials of Nature-Based Solutions to Climate Change Mitigation in Nigeria

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Abstract

Nigeria has made much effort at climate change mitigation through the production of several policy documents to cut down on greenhouse gas emission over the years without success. However, there is need to explore alternative strategy of climate change mitigation in the country. Nature based climate solution offers opportunity of a more practicable, cheap, and implementable alternative to reducing GHG emissions. The study was carried out through desk review of existing literatures, complimented by interview of key stakeholders. The findings of the study reveals that the concept of nature-based climate solutions is not new to Nigeria as many government policy documents has already captured it. There are many ongoing government programmes and projects that are generally part of the nature-based climate solutions. Findings of the study reveals that nature-based solutions provide a more practicable and cheaper means to naturally remove carbon dioxide from the atmosphere and that the forests have the greatest amounts of cost-effective mitigation opportunities of up to about two thirds of all nature-based climate solutions globally. Based on the findings, the study recommends the need to build nature-based solutions as key component of the national portfolio of solutions to address the challenges of climate change in the country.

1. Introduction

Climate change is one of the greatest development challenges confronting Nigeria in recent times. The challenges posed by climate change to the socioeconomic systems of Nigeria and its environment is exacerbating the country's fragility risks (Nwankpa, 2022). According to experts, climate change is currently costing Nigeria roughly $100 billion year, and by 2050, this will increase to $460 billion annually (Ekeruche, 2022). Prof. Chuwumerije Okereke, Director of the Centre for Climate Change and Development at the Alex Ekwueme Federal University in Ebonyi State, insisted at the most recent ninth

international Lagos Climate Change Summit that from 2020 to the present, climate change has already cost Nigeria N15 trillion, or 2 to 11% of the country's GDP, and that by 2050, it will cost the country N69 trillion, or 6 to 30% of the GDP2. Nigeria has aligned herself to so many international protocols and conventions on climate change adaptation, mitigation, and reduction of greenhouse gases (GHG) emissions. Nigeria has equally partnered with so many international donor agencies in producing so many interesting and fascinating national climate change mitigation policy documents and action plans. However, the actions taken on the ground fall well short of what is needed to control the situation. Thus, not much has been achieved in the effort to mitigate climate change and cut down GHG emission in the country. Nigeria is the sixth least prepared country in the world to adapt to climate change, according to the Notre Dame Global Adaptation Index's ranking for 2021, placing it as the 53rd most vulnerable nation (Nwankpa, 2022). So many GHG emission reduction targets have been set by Nigeria but have never been met. This may be because of poor governance and stakeholder engagement, corruption, very low disposable revenue and heavy foreign debt burden among others. There is the need therefore for an alternative means of achieving the target that is different from the usual approach to minimize GHG emission and climate change mitigation in the country.

The potential of nature-based solutions (NbS) to assist the international community in reducing GHG emissions is currently receiving more and more attention. For example, Ecosystem-based Mitigation has been at the front burner which reveals the importance of ecosystem both as a source and sink of CO2. Nature based climate solution offers opportunity of a more practicable, cheap, and implementable alternative to reducing GHG emissions in Nigeria and minimizing the impact of climate change. In light of this, this study evaluates the possibility of natural climate change mitigation strategies in Nigeria.

1.1 Conceptual Clarification

1.1.1 Climate Change Mitigation

Climate change mitigation are preventive measures put in place to limit emissions of heat-trapping greenhouse gases into the atmosphere in order to keep the globe from rising to more extreme temperatures. Actions to minimize or stop GHG emissions that cause climate change are referred to as "climate change mitigation" (Arvind, 2022). The IPCC defines mitigation as "an anthropogenic intervention to reduce the anthropogenic forcing of the climate system; it encompasses methods to reduce GHG sources and emissions and to enhance GHG sinks" (Knaepen et al., 2015). Mitigating climate change entails reducing the amount of heat-trapping greenhouse gases entering the atmosphere, either by reducing sources of these gases (such as the burning of fossil fuels for transportation, electricity, or heating) or by improving "sinks" that collect and store these gases (such as the oceans, forests, and soil) (IPCC, 2014). The Intergovernmental Panel on Climate Change (2014) defines climate change mitigation as the attempt to reduce greenhouse gas (GHG) emissions and other pollutants like black carbon particles, which have an impact on the planet's energy balance, as well as their cumulative effects.

Mitigation also includes efforts to enhance the processes that remove GHGs from the atmosphere, known as sinks (Arvind, 2022). The goal of mitigation is to avoid significant human interference with the climate

system, and "stabilize greenhouse gas levels in a timeframe sufficient to allow ecosystems to adapt naturally to climate change, ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner" (IPCC, 2014).

Enhancing the sinks - processes that take GHGs out of the atmosphere - is a component of mitigation (Arvind, 2022). Avoiding significant human interference with the climate system and stabilizing greenhouse gas levels "in a timeframe sufficient to allow ecosystems to naturally adapt to climate change, ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner" are the goals of climate change mitigation (IPCC, 2014).

Building energy efficiency upgrades, the use of renewable energy sources like solar, wind, and small hydro, aiding cities in developing more environmentally friendly modes of transportation like bus rapid transit, electric vehicles, and biofuels, and encouraging more environmentally friendly land and forest management are all examples of mitigation strategies (GEF, 2021). Mitigation can be accomplished by utilizing new technologies, boosting renewable energy sources, increasing the effectiveness of older energy systems, or altering management procedures or consumer behavior (Arvind, 2022). Climate change mitigation strategies include;

i. Planting trees (especicially economic trees) on farmlands and grazing lands to help diversify farmers income and reduce the carbon content in the atmosphere.
ii. Reduction in deforestation through enlightenment campaign, media advocacy, legislation and enforcement of such.
iii. Reduction in the use of generators for electricity generation through provision and subsidizing solar energy.
iv. Enhance the infrastructure for agriculture by constructing large-scale water harvesting systems, water storage ponds, faster development of irrigation support facilities, better irrigation and drainage systems, and solar powered irrigation pumps.
v. Boost spending on new technology research and development. The creation of enhanced seed varieties with features that promote resistance to drought, high temperatures, diseases and pests, and water logging for plants and animals should be prioritized together with the expansion of livestock breeding programs

Climate change mitigation is a long-term strategy to reduce anthropogenic (human) GHG emissions (Fischer et al., 2002). It is envisaged that mitigation will take decades to have an impact on rising temperatures, as such, we must be prepared for the change that is now here and will continue to affect us for the foreseeable future.

Nigeria has a large window of opportunity for climate change mitigation measures, which include reducing gas flaring in the oil and gas industry and using biomass from forested land, working toward Off-grid solar PV of 13GW (13,000MW), using efficient gas generators, 2% per year energy efficiency of 30% by year 2030, switching from driving to taking public transportation, improving the electricity grid, climate smart agriculture, and reforestation (FMEnv, 2018). These initiatives, which must be

executed without exception and with the aid of national resources, are projected to cut emissions by 20% compared to the Business as Usual (BAU) scenario. This decrease might be raised to 45% of the BAU scenario with outside assistance (FMEnv, 2021). With 5% annual economic growth, it is anticipated that these actions will allow the nation to maintain GHG emissions at the current rate of 2 tonnes CO2 eq per capita by 2030 (FMEnv, 2021).

1.1.2 Greenhouse Gas (GHG) Emissions Trend in Nigeria

Nigeria is one of the nations with large emissions of greenhouse gases is Nigeria. The GHG data used here is from the inventory study report, which covers the entire nation and is based on data from the four IPCC sectors of waste, energy, agriculture, forestry, and other land use (AFOLU), and industrial processes and product use (IPPU) as reported in Nigeria's First Biennial Update Report (BUR1) (2018). The direct GHG emissions of carbon dioxide (CO2), methane (CH4), and nitrous oxide (N2O) are included in the GHG inventory (FMEnv, 2018).

Over the years 2000 to 2017, the net emissions of the nation from all categories combined were more than the reductions from the Land category. From 464,416 Gg in 2000 to 678,184 Gg in 2017, the total emissions grew by 213,768 Gg, or 46%, during this time period (FMEnv, 2021). In the same time frame, the nation had a 23% decline in removals, from 5,908 Gg CO2-eq to 4,543 Gg CO2-eq. National net emissions grew from 458,509 Gg CO2-eq in 2000 to 673,641 Gg CO2-eq in 2017, according to the trend from 2000 to 2017 (Table 1).

Table 1. National GHG Emissions (Gg, CO_2-eq) by Sector (2000-2017)

Year	Energy	IPPU	AFOLU	Waste	Total Emissions
2000	142,674	2,511	301,970	17,261	464,416
2001	161,275	2,512	306,131	17,956	487,874
2002	150,384	2,481	309,999	18,637	481,500
2003	170,277	5,895	314,851	19,378	510,402
2004	178,980	6,013	319,492	20,121	524,605
2005	196,640	6,181	325,040	20,938	548,799
2006	192,145	6,300	331,070	21,641	551,157
2007	196,041	6,772	335,509	22,351	560,673
2008	199,933	7,360	338,957	23,147	569,396
2009	187,354	7,864	343,968	23,961	563,147
2010	211,571	8,247	315,483	24,870	596,171
2011	213,507	9,128	355,361	25,632	603,628
2012	218,109	10,835	361,925	26,460	617,328
2013	225,842	12,294	367,524	27,354	633,014
2014	244,136	12,468	373,884	28,273	658,761

2015	254,996	13,271	379,036	29,337	676,641
2016	235,166	12,004	383,882	30,208	661,261
2017	245,918	11,618	389,790	30,857	678,184

Source: (FMEnv, 2021)

According to Table 1, the energy sector is responsible for the second-highest level of GHG emissions in the nation, after AFOLU operations. These include removals for harvested wood products (HWP), usage of nitrogen-based synthetic fertilizers, emissions from changes in forestland, and emissions from animal operations. Industrial Processes and Product Use (IPPU) sector has the lowest GHG emission.

1.1.3 Nature-based Solutions (NbS)

In the 2000s, the idea of a natural climate solution emerged as a concept. It has primarily been utilized in messages aimed at policymakers. However, recently, it has appeared in scientific literature (e.g. Eggermont et al., 2015; Kabisch et al., 2016; Maes & Jacobs, 2015). In its 2009 position statement on the United Nations Framework Convention on Climate Change (UNFCCC) COP 15, the International Union for Conservation and Nature (IUCN) strongly pushed the NbS concept. In 2012, IUCN formally accepted NbS as one of the three areas of action under its 2013-2016 Programme.

The use of nature for simultaneous benefits to biodiversity and human well-being was first articulated in a resolution (WCC-2016-Res-069) accepted by IUCN members at the 2016 World Conservation Congress and members' assembly. Nature-based Solutions (NbS), as defined by the resolution, are "actions to protect, sustainably manage, and restore natural or modified ecosystems, which address societal challenges (such as climate change, food and water security, or natural disasters) effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits." (IUCN, 2009). The European Commission, on the other hand, described NbS as living solutions that are motivated by, continuously supported by, and using Nature to address various societal challenges in a resource-efficient and adaptable manner while simultaneously delivering economic, social, and environmental benefits (Maes & Jacobs, 2015). The European Commission's definition of NbS is rather broader and places more focus on using solutions that not only use nature but are also inspired by and supported by it. The IUCN definition emphasizes the necessity for a well-managed or restored ecosystem to be at the center of any NbS initiative. The European Commission included NbS in its Horizon 2020 Research and Innovation Program and is funding a number of initiatives to increase the body of research on NbS (Maes & Jacobs, 2015).

Conservation, restoration, and better land management practices that boost carbon storage or reduce greenhouse gas emissions in wetlands and landscapes around the world are examples of nature-based climate solutions. More carbon will need to be removed from the atmosphere than is now being released in order to prevent the world temperature from rising.

NbS are designed to help society achieve its development goals, protect human well-being in ways that are consistent with cultural and societal values, and improve the resilience of ecosystems as well as their

capacity for renewal and service provision. Major societal issues like food security, climate change, water security, human health, disaster risk, and social and economic development are the focus of NbS (Cohen-Shacham et al., 2016). The use of nature-based solutions is frequently combined with other sorts of interventions. The best way to address issues with food security, for instance, is to combine NbS (introducing agroforestry systems, restoring wetlands, etc.) with more traditional solutions, such enhancing access to food and changing trade policy to be more supportive of local food supply.

2. Methodology

The methodology that was adopted in this study comprised of desk research, data collection through interviews with relevant stakeholders. There was a review of relevant nature-related national and multilateral commitments, plans and strategies on climate change adaptation and mitigation in Nigeria. The review paid more attention to various climate change policy documents of the country especially Nigeria's Nationally Determined Contribution (NDC) 2015 and 2021 Update and the first and second Biennial Update Report (BUR1 & BUR2) of the Federal Republic of Nigeria among others. Interviews and consultations were carried out to collect additional data for the study. The data collected were analyzed using descriptive statistics and content based analysis.

3. Potentials of Nature Based Climate Solutions to Climate Change Mitigation

The potential of natural climate solutions, even when constrained by safeguards for food and fiber security and biodiversity, has been estimated to be more than 30% than previously believed (Sengupta & Siikamäki, 2018). Sengupta and Siikamäki found that natural climate solutions are incredibly effective in terms of cost-effective mitigation when compared to mitigating GHG emissions from other economic sectors, such as the energy, transportation, and household sectors. They provide an estimated 37% of the cost-effective mitigation required between now and 2030 to keep global warming below 2 ℃.

Despite the variations in each ecosystem's capability, forests have been claimed to have the most cost-effective mitigation options worldwide, accounting for up to nearly two thirds of all nature-based climate solutions (Sengupta & Siikamäki, 2018). Reforestation offers the greatest potential to reduce climate change within the forest sector, followed by avoided deforestation and improved forest management.

About one-fifth of the natural solutions to keep global warming below 2 ℃ come from grassland and agricultural routes, with cropland nutrient management, including tree cover in croplands, and conservation agriculture as significant practices. Improving feed and animal management in the livestock industry offers a significant potential to cut methane emissions.

Although they are not as large as woods and grasslands, wetlands contain the most carbon per unit of area. Studies on mangroves, for instance, have demonstrated that their preservation is generally justified due to their capacity to store carbon, even when the wide range of additional advantages they offer are disregarded (Sengupta & Siikamäki, 2018). These include maintaining fisheries, defending coastlines, controlling water quality, and offering wildlife with timber and habitat.

Ecosystems contribute to both climate resiliency and adaptation in addition to helping to mitigate climate change. For instance, after Hurricane Sandy in 2012, wetlands prevented direct flood damages of over $600 million. More broadly, it has been estimated that coastal wetlands in the US offer storm protection services worth $23 billion a year (Sengupta & Siikamäki, 2018).

3.1 Nigerian Climate Change Policies and Nature-based Solutions to Climate Change Impact

The Nigerian President in one of his address maintained that the country is committed to implementing nature based solutions at all levels to address environmental challenges that threaten the well-being and resilience of the people. Nigeria has over the years produced a number of climate change policy documents to help drive its climate change adaptation and mitigation effort. Among these documents, the Nigerian Nationally Determined Contribution (NDC) provision for nature-based climate solutions are reviewed here.

Agroforestry, better forest management, and forest restoration were the top three nature-based solutions to climate change mentioned by Nigeria in the NDCs. These have a total annual mitigation potential of 89 metric tons of carbon dioxide equivalent, according to the policy paper. With the start of mangrove restoration in Ogoni territory after many years of oil pollution, Nigeria has committed to restore mangroves through its "mangroves for life" programme. This action would aid in reducing risks associated with natural disasters like coastal flooding, according to the NDC text. Despite this, it is still a concern that the cleanup is taking so long.

Regarding forestry practices, the NDCs mentioned that the development of 10 more national parks had been authorized by the federal government, increasing the total number of federal protected areas to 17. Additionally, the federal government is now working on a nationwide programme to plant 25 million trees (The Cable, 2022).

The climate change mitigation measures for AFOLU is one of the Forest management initiatives, according to the Federal Republic of Nigeria's Second Biennial Update Report (BUR2) (which include Afforestation, reforestation and reduction in wood removals). With a combined mitigation potential of 110 million tonnes CO2-eq in 2035, these initiatives are primarily nature-based solutions, leaving the energy sector to handle the remaining 60 million tonnes (FMEnv, 2021). The Low Emissions Analysis Platform (LEAP) model was used to simulate and estimate Nigeria's emissions reductions by the year 2035, and it led to this conclusion.

Table 2. Mitigation Potential of Measures Under LCD Scenario in Nigeria's TNC

S/No	Sector and Category	Mitigation potential (Gg CO2 eq)
1	National	170,016.51
2	Energy	60,002.18
3	Fuel Combustion	53,426.40
4	Energy industries	45,248.40

5	Electricity Generation	45,248.40
6	Manufacturing industries & Construction	405.30
7	Transport	4,897.90
8	Road Transport	4,897.80
9	Other Sectors	2,875.20
10	Commercial / institutional	3,196.80
11	Residential	6,072.00
12	Fugitive Emissions (oil & Natural gas)	6,575.38
13	AFOLU	110,014.33
14	LAND	110,014.33

Source: (FMEnv, 2021)

3.2 Actionable Nature-based Climate Solution in Nigerian Climate Change Policies

i. The National Forest Policy included a target to increase forest cover from the current 6% to 25% by 2030 (The Cable, 2022). There is an urgent need for aggressive tree planting activities in the country. This is a good actionable point of nature-based climate solution in Nigerian policy document.

ii. The pilot Reducing Emissions from Deforestation and Degradation (REDD+) Strategy of the Federal government which is already in progress in Cross River State should be pursued with a determined commitment. Also, the Cross River State own REDD+ strategy and approach should be emulated by other states in the country.

iii. Nigeria must continue to be committed to the Great Green Wall (GWW) concept. According to UNCCD (UNCCD, 2020), 1,396 jobs have reportedly been created, 2,801 hectares of land have been replanted, and a shelterbelt spanning 1,359 km from Kebbi State in the northwest to Borno State in the northeast has been formed in Nigeria. If this is done vigorously, it can significantly reduce local GHG emission.

iv. The Federal Republic of Nigeria (2016) stated that the success of the Sustainable Energy for All (SE4ALL) Action Agenda in Nigeria, which aims to provide 90% of the population with access to electricity and 80% of them using modern cooking fuel by 2030, will go a long way in greatly reducing deforestation and use of smaller fuel generators by the people to power their homes and small businesses.

v. The National Renewable Energy and Energy Efficiency Policy (NREEEP) of Nigeria, which set the ambitious goal of over 23 GW of renewable capacity by 2030, including major hydropower, will significantly reduce GHG emissions in the nation and deforestation. Progress toward and acceleration of Nigeria's renewable energy target, as well as limiting the expansion of natural gas, are essential actions to close the gap between present policies and the country's NDC targets.

vi. Increase employment of forest guards and park rangers and their empowerment with modern state of the art facilities and equipment.

vii. Provision of cheap alternative sources of domestic energy to both urban poor households and rural dwellers.

viii. Empowerment of local farmers with farming inputs and improved seedling.

ix. The Federal Government decision to establish two more Marine Protected Areas (MPAs) in the country.

3.3 Existing Nature-based Climate Solutions in Nigeria

a. With the UNDP-sponsored Ecosystem-Based Adaptation for Food Security Assembly, EBA is already being implemented in Nigeria (EBAFOSA). Through the Agriculture and Environment pillar of Nigeria's development plan, EBAFOSA was incorporated into the 2015/2016 budget. The objective is to apply the EBAFOSA policy framework to advance Agenda 2030's SDGs 2 (Zero Hunger), 8 (Decent Work and Economic Growth), 13 (Climate Action), 15 (Life on Land), and 17 (Partnership to Achieve the Goal) as well as SDGs on climate change adaptation and food security (EBAFOSA, n.d.). With regard to adaptation, the EBA model has promising implications in various sectors and should pique interest in Nigeria's NAP process.

b. Afforestation effort to improve forest covering by planting seedlings to cover 131,000 hectares of land was one of the Projects supported with Nigeria's First Sovereign Green Bond (FMEnv) (2020).

c. Establishment of National Parks, Game reserve, Forest reserve and grazing reserves.

d. Legislations against deforestation and lumbering in most states of the federation and the federal government.

e. The various afforestation drives by both state and federal government such as the Great Green Wall project.

3.4 Benefits of Nature-based Climate Solution

There are a lot of benefit in using natural climate solutions in climate change mitigation efforts. Some of these benefits include carbon sequestration, ecosystem service (which increases resilience to impact of climate change), provision of employment opportunities, prevention of erosion, and stabilization of coastal areas. In addition to helping the climate, the majority of natural climate solutions also provide a variety of other advantages, including as habitat for biodiversity, water filtering, flood control, soil health, and livelihood support.

4. Conclusion

This study has examined the potentials of nature-based solutions to climate change mitigation in Nigeria. The findings of the study reveals that the concept of nature-based climate solutions is already part of the climate change policy documents of Nigeria and some ongoing government programmes and projects. The findings of the study reveals that nature-based solutions provide a more practicable and cheaper

means to naturally remove carbon dioxide from the atmosphere and has the greatest prospect of helping the country achieve its objective of cutting down on greenhouse gas emission. What is required is more commitment and incorporating nature based solutions in all national climate change mitigation strategies.

5. Recommendations

Based on the findings of the study, the following recommendations are suggested;

i. More commitment to afforestation and reforestation drive in Nigeria.

ii. There is need to build nature based solutions as key component of the national portfolio of solutions to address the challenges of climate change.

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