

Land Use and Forest Dynamics in the Context of Redd+: Pathway to Sustainable Environmental Management*

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Abstract

Reverting to nature as a major arsenal in a universal fight against Climate Change impact and loss of biodiversity, the United Nations Convention to Combat Desertification (UNCCD), views sustainable Land use and Forest (the main crux of the Glasgow declaration 2021) as the way to go. Forest conservation, protection and management in the context of REDD+ would guarantee sustainable ecosystem and mitigate climate change impacts. At National and subnational levels, the Nigerian REDD+ readiness scheme holds out hope for environmental sustainability. This study throws light into the historical background of trends in land use forest change in Nigeria, and places Nigeria on a “red” stage 3 (Low Forest Cover, High Deforestation Rate-LFHD) status while maintaining optimism that with REDD+ properly implemented in Nigeria, Stage 4: Low forest cover, Low Deforestation Rates (LFLD) and Stage 5: Low forest cover, Negative Deforestation Rates (LFND) can be achieved by 2030 and 2050 respectively, if the trio of reforestation, afforestation and natural restoration is practiced as a matter of national policy and subnational implementation within the context of REDD+. Four (4) broad drivers of deforestation and forest degradation were identified as direct, indirect, pre-disposing and planned /unplanned. The paper concludes that a viable pathway to sustainable environmental management is appropriate monitoring and evaluation of land use and forest dynamics in the context of REDD+.

Keywords

Land Use, Forest, REDD+, Sustainable, Environment, Management

*REDD stands for “Reducing emissions from deforestation and forest degradation” in developing countries. The “+” stands for additional forest-related activities that protect the climate, namely sustainable management of forests and the conservation and enhancement of forest carbon stocks (UNFCCC, (n.d.)).

1. Introduction

Sustainable Land use and Forest were identified as the main crux of the Glasgow declaration 2021. Reverting to nature as a major arsenal in a universal fight against Climate Change impact and loss of biodiversity, the United Nations Convention to Combat Desertification (UNCCD), views land use and forest as, “crucial to our survival as a species and to our collective efforts to combat the worse effects of land degradation, desertification and drought” (Thiaw, 2021). This is possible through effective protection, conscious conservation, planned restoration and sustainable environmental management, in the context of Reducing Emissions from Deforestation and forest Degradation Plus (REDD+).

The Nigerian REDD+ Programme is bifurcated into both National and Sub-national level with an effective National Framework Strategy for REDD+ and corresponding State Frameworks Strategies. All framework were outputs of extensive stakeholder engagement, knowledge sharing, and communication at all level. Whereas the National level provides policy and guidelines for the subnational; pilot test were successfully done at subnational level, with Cross River state recoding a huge success. Lessons learnt from Nigeria REDD+ readiness process includes, the process of planning, the art of stakeholders engagement, the development of requisite structure, sourcing of technical staff and setting up a secretariat. In addition, community approach is best in conservation of the forest.

Forest are like the “kidney” of the earth, removing toxic CO₂ from the atmosphere, thus, serving as carbon sink. Harris et al. (2021) estimates that mean carbon taken off the earth’s atmosphere by forest is about 2 billion metric tons. Sustainable forest management therefore is key to sustainable environment and ecosystem. This is largely because about one in every 3 CO₂ emission results from deforestation (Le Quéré et al., 2016). Afforestation, reforestation and regeneration of forest naturally can change the trend of Climate change.

1.1. Study Aim and Objectives

The overall aim of this paper is to evaluate the crucial role of land use and forest in the context of REDD+, as a pathway to sustainable environmental management.

Specific objectives and scope of work are:

- 1) Historical background on trends in land use forest change in Nigeria
- 2) Determine Nigeria’s place on a Forest Transition Matrix (FTM)
- 3) Forecast Nigeria’s FMT to 2050 with Sustainable REDD+ Initiative in view
- 4) Identify / report likely drives of deforestation in Nigeria

1.2. Study Area

Nigeria is located in western Africa, at the extreme inner corner of the Gulf of Guinea. Between Latitude 4 degree to 14 degree North of the Equator and longitude 2 degree to 15 degree east of the Greenwich Meridian. Nigeria occupies an area of 923,768 square kilometers extending 1127 Km East to West and 1046 Km North to South. Nigeria is bordered by Chad on the North East, by Cameroon

on the East, by the Atlantic Ocean (Gulf of Guinea) to the South, and by Benin Republic in the West, together with Niger Republic in the North West and North as shown in **Figure 1** as modified.



Figure 1. Nigeria. Source: Rand McNally as modified by author, 2023.

2. The Forest Transition Theory

The Forest Transition Theory refers to the “pragmatic consistency that a geographic region or country over time moves through a series of stages that reflect the overall status of forest and the rate in which the forest is Changing” (Mather 1992). Starting with a substantial portion of the country's landmass being forest; as forest degradation and deforestation gradually sets in, forest begins to reduce, then with an increase in deforestation, the forest shrinks further. At some point, there would be conscious efforts towards stopping deforestation and efforts to restore and reverse the deforestation trend leads to reforestation. The CGIAR Research Program on Forest, Trees and Agroforestry (FTA), Indonesia developed the forest transition curve (CGIAR Research Program on Forest, Trees and Agroforestry 2011). The Forest Transition Curve (FTC) as seen in **Figure 2**, depicts forest and ecosystem services nexus. The greater the forest, the more the ecosystem service and the lower the forest, the lower the ecosystem services. The FTC was created by FTA scientists to help a comprehension of anthropogenic impact on forest landscape over time. This makes prediction possible and helps to forecast the positive and negative impact of economic development on tree-covered landscapes.

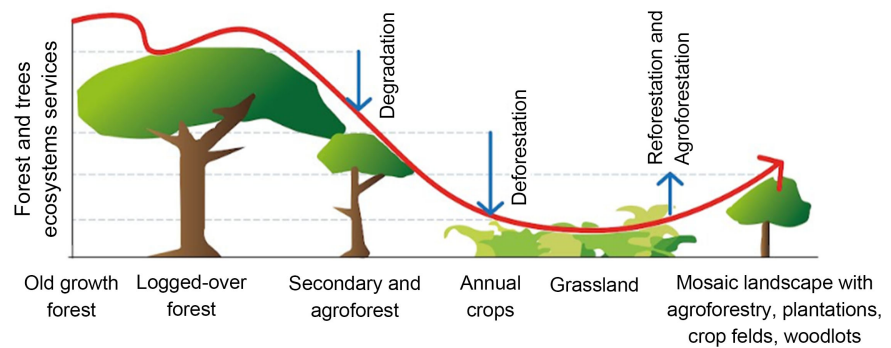


Figure 2. Forest Transition Curve. Source: CGIAR Research Program on Forest, Trees and Agroforestry, 2011.

The Forest Transition Curve of the FTA correlates perfectly with the Forest Transition matrix developed by the Forest Carbon Partnership Facility (FCPF, 2009). This reality, guided the placement of Nigeria in the Forest Transition Matrix. **Figure 3** as modified, shows Nigeria in West African region in the Forest Transition Matrix (FTM) chart.

The FTM has various stages. It does not happen unnoticed overnight. Rather, over time, the forest passes through various stages broadly classified into five (5) stages, namely

Stage 1: High forest cover, Low Deforestation Rates (HFLD)

Stage 2: High forest cover, High Deforestation Rates (HFHD)

Stage 3: Low forest cover, High Deforestation Rates (LFHD)

Stage 4: Low forest cover, Low Deforestation Rates (LFLD)

Stage 5: Low forest cover, Negative Deforestation Rates (LFND)

From all indices, literatures and analysis, Nigeria is currently on RED zone. There is Low Forest cover and High Deforestation rate (LFHD) as shown in **Figure 4**.

Bringing this within the context of REDD+, Nigeria can attain stage 4 of Low Forest Cover, Low Deforestation rate (LFLD) by 2030 and possibly Low Forest Cover, Negative Deforestation Rate (LFND) by 2050, if the trio of reforestation, afforestation and natural restoration is practiced as a matter of national policy and subnational implementation within the context of REDD+. Putting the FTM within a timeline, can help to forecast where Nigeria is likely to be in 2030 and 2050. This would help in policy formation and climate change mitigation strategies through REDD+ initiative. Initially, REDD+ would reinforce existing passive forest conservation. Then going forward, REDD+ would help to accentuate the idea of forest reserves to discourage forest conversion. For instance, policies to discourage agricultural expansion through forest clearing should be put in place. This is a hard choice to make in the light of rising population and the need to feed people. In the final stages of the forest transition, the restoration of environmental services through Payments for Ecosystem Services (PES) measures would assume more importance. The REDD+ initiative promises to push up the forest conservation effort and help to move Nigeria from the current stage 3

(LFHD) to stage 5 (LFND). The **Figure 5** shows the upward curve of National forest cover being pushed up by effective implementation REDD+ initiative from 2023 through 2025, tending towards an upward trajectory. This is possible through consistency in the REDD+ policy framework strategy at national and subnational levels. However, reversing stage 3 (LFHD) countries like Nigeria is unlikely to occur unless global policy initiatives provide incentives like carbon credit payment for national and subnational governments and landowners to maintain existing forest to stage 4 (LFLD) and then to negative deforestation (Stage 5 – LFND) or even increasing the forests through afforestation, reforestation and natural restoration (Angelsen and Rudel, 2013).

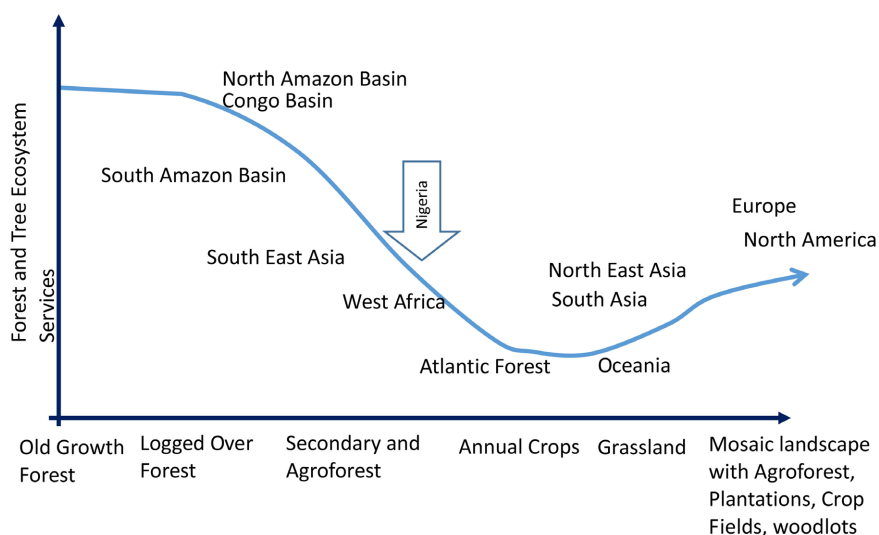


Figure 3. Forest Transition Theory. Source: FCPF 2009 as modified by Author, 2023.

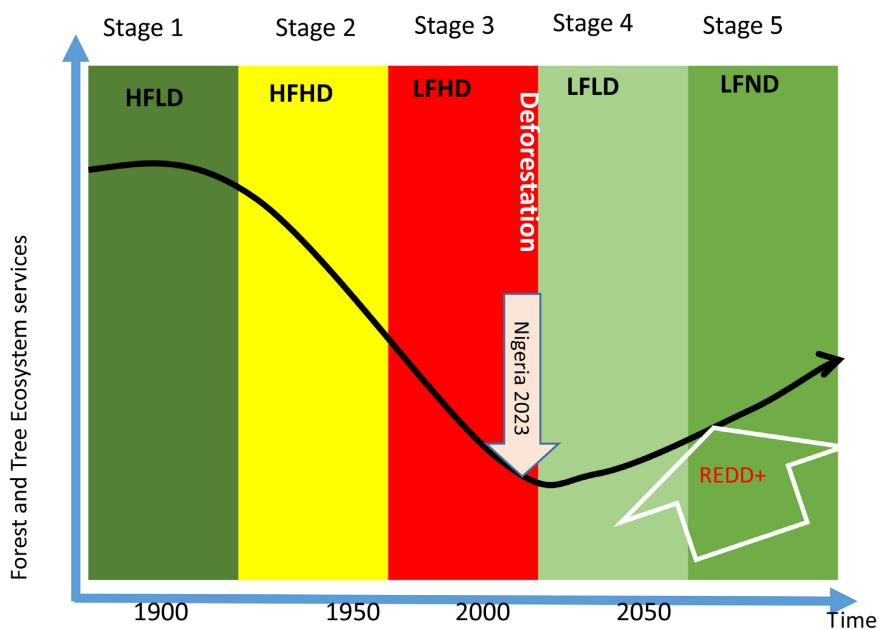


Figure 4. Forest Transition Stages. Source: Author, 2023, Adapted from FCPF (2009).

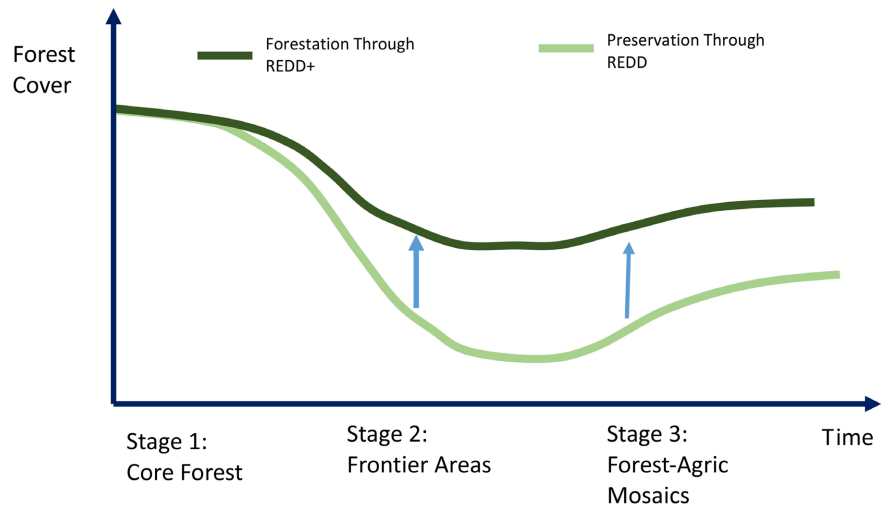


Figure 5. Preservation through REDD vs. Forestation through REDD+. Source: Angelsen & Rudel, 2013.

Figure 5 shows precisely what REDD+ aims to do in 3 stages. Whereas REDD seeks the preservation of forest. REDD+ advocates for afforestation, reforestation and natural restoration. With REDD+ initiative, the forest resources and corresponding ecosystem services becomes higher. For Nigeria, Strategic Environmental and Social Assessment (SESA) and Environmental and Social Management Framework (ESMF) are vitally essential. In other words, according to the forest transition theory, REDD+ policy interventions should focus on forestation, conservation other related best practices.

3. Historical Background on Trends in Land Use/Land Cover Change in Nigeria

According to Global Forest Watch (2011), the forest sector of Nigeria contributes 991.8 US dollars to Nigeria Economy in the year 2011. This is about 0.4 per cent of the Nigeria's National Gross Domestic Product (GDP) (Rex, 2005). An analysis of Nigeria's Land Use and forest conducted by the Forest Outlook Studies in Africa (FOSA, 2005), reveals that agriculture accounts for the larger portion of 554,657.10 Hectare annually while prevailing category of trees/woodlands and shrubs is losing the larger portion of 858,720.40 ha annually. Using Markor Chain Analysis (MCA), a land use transition matrix done from 1978 till 1995 and the result was used to predict the land use forest change for 2020.

The summary in **Table 1** shows that forest and indeed all woodland are most likely to be heavily depleted and converted to agricultural crop land. This finding is consistent with general prediction of Conservation and Environmental Sciences.

4. Major Drivers of Land Use Forest Change in Nigeria

Complex forest dynamics are not easily explained by linear single factors (NIMOS, SBB & UNIQUE, 2017). Hence the drivers of forest change are usually a

Table 1. Nigeria land use dynamics.

S/no	Land-use Category	Years 1995	years 2010	Year 2020	Steady State
1	Agricultural Crop Land	61,900,000	68,063,519.12	70,652,157.40	87,408,772.80
2	Flood Plain Agricultural	2,400,000	3,141,000.30	3,390,061.50	479,782.74
3	Grassland	3,150,000	4,398,237.70	4,765,522.33	1,071,156.36
4	Dominantly Tree/Wood Land & Shrub	9,000,000	3,866,595.70	2,276,169.60	7,309.53
5	Dominant Shrub & grass	7,100,000	4,290,518.19	3,017,151.27	102,582.79
6	Dominant Grasses	1,100,000	1,065,057.36	1,040,003.02	227,529.66
7	Forest	2,650,000	1,436,848.03	938,066.41	928.69
8	Freshwater Mash/Swamp	620,000	181,072.05	100,943.30	3,534.37
9	Mangrove Forest	1,800,000	1,820,088.57	1,834,929.55	3,134,485.64
10	Forested freshwater swamp	1,190,000	978,706.18	845,074.30	701.26
11	Water	680,000	1,065,985.97	1,144,629.79	172,307.77
12	Bare Surface	1,892,000	3,174,370.71	3,477,292.00	872,908.43
	Total	93,482,000	93,482,000	93,482,000	93,482,000

Source: Rex ARUOFOR, 2025 Forest Outlook Studies in Africa (FOSA).

variety of actors, scenarios, and associated relationships that require localized forest analysis. In most cases, the drivers of deforestation are from outside the forest itself. Geist & Lambin's (2001, 2002), opined that "When analysing drivers of forest change, a balance needs to be struck between a number of important variables". For this study, the major forest land use change drivers are broadly grouped into four (4), which are Direct, Indirect, Predisposing, and planned /unplanned drivers.

4.1. Direct (Proximate) Drivers of Deforestation in Nigeria

Human activities are the direct drivers of deforestation and forest degradation. These anthropogenic activities includes but not limited to:

1) Agricultural expansion, such as commercial agriculture, shifting cultivation or cattle ranching; globally, clearing forest for agricultural purposes is adjoined the highest direct driver of deforestation and forest degradation (Kissinger et al., 2012).

2) Wood extraction, such as lumbering, non-sustainable logging, production of charcoal, land degradation resulting from unplanned infrastructure development may become the precursor for deforestation, as previously inaccessible forest areas may become open to temporary or permanent land users (Chomitz 2007).

3) Infrastructure extension like expansion of settlements, construction of super highways and other transportation infrastructures and extraction of mineral resources.

4.2. Indirect Drivers of Deforestation in Nigeria

Acting across multiple scales, the indirect drivers of deforestation in Nigeria encompasses policy, economic, institutional and technological factors. They could be as a result of local or international situations (Kissinger et al., 2012). Some REDD+ readiness plans views weak institutions and governance of the forest sector, lack of synergy and weak to zero enforcement due to corruption as indirect or underlying causes of deforestation and forest degradation in Nigeria (WRI, 2012).

4.3. Predisposing Factor Responsible for Deforestation in Nigeria

Some predisposing factors responsible for deforestation and forest degradation include land characteristics associated with land degradation. For example, slope, topography, soil type, drought and other biophysical issues. Social unrest like refugee movements and other societal triggers do also account for deforestation and forest degradation in Nigeria.

4.4. Planned versus Unplanned Drivers of Deforestation in Nigeria

Unchecked deliberate government approved activities like unsustainable construction of super highways through forest and other planned activities like government programme on agricultural expansion results in massive deforestation in Nigeria. Reducing deforestation and forest degradation (REDD+) discourages all planned and unplanned actions leading to deforestation, by stopping deforestation on forest lands that are legally authorized and documented to be converted to non-forest land, and enhances carbon stocks of degraded and secondary forests (if present in the programme/project area) that would be deforested in the absence of the project activity (ACR, 2011).

5. Conclusion

Land Use and forest remains veritable weapons to combat climate change impacts and loss of biodiversity. To have a balanced Ecosystem and ensure sustainable environmental management, more attention should be given to land use and forest like the “kidney” of the earth because of their CO₂ sequestration capabilities. If properly done within the context of Reducing Emissions from Deforestation and forest Degradation Plus (REDD+), it promises to yield high level effective results and in the Nigerian case study, move the country from “red” Low Forest Cover, High Deforestation Rate (LFHD) stage 3 to Low Forest Cover, Low Deforestation Rate (LFLD) stage 4 by 2030 and further to Stage 5 Low Forest Cover, Negative Deforestation rate (LFND) by 2050. Given the direct, indirect, pre-disposing and planned /unplanned drivers of deforestation in Nigeria, this paper seeks to further accentuate the REDD+ initiative through the Strategic Environmental and Social Assessment (SESA) and Environmental and Social Management Framework (ESMF) to ensure proper implementation of afforestation.

tion, reforestation and natural forest restoration as a sure pathway to environmental sustainability.

RECOMMENDATIONS

The following recommendations are hereby put forward.

- 1) More pilot studies at subnational levels;
- 2) Strategic strengthening of institutions;
- 3) Putting all forest conservation plans in context of REDD+;
- 4) Effective Monitoring, Reporting and Verifications of GHG;
- 5) Strategic Policy on REDD+ at national and subnational level with full implementations.

Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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