

# Non-Timber Forest Products (NTFPs) as Alternatives for Climate Change Mitigation and Adaptation in Nigeria

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**Abstract:** Climate change is a glaring reality the world faces as one of its latest and most serious challenges to sustainable human development. It is an outcome of both natural and anthropogenic factors, of which the most prominent is the preponderance of Green House Gases (GHGs) in the atmosphere. Burning of fossil fuels, deforestation, growing population and industrialization have greatly contributed to this. The forecast that in the absence of mitigation and adaptation measures, climate change could result in a loss of between 2% and 11% of Nigeria's GDP by 2020, rising to between 6% and 30% by the year 2050 is a great cause for concern. Climate change mitigation and adaptation measures have traditionally amongst other measures, focused on the forest option targeted at only trees as means of creating and protecting forest carbon stocks. Non-Timber Forest Products (NTFPs) as relatively fast growing components of forests are posited in this paper as veritable alternatives or complements towards a more wholistic approach to climate change mitigation and adaptation against the background of their contribution to multiple income streams, and carbon sequestration. In addition, the current global dependence of about 2.6 billion people on biomass for cooking and other domestic needs presents a robust potential for bio-fuel production and utilization.

**Key Words:** Adaptation, bio-fuel, climate change, mitigation, Non-Timber Forest Products

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## INTRODUCTION

Climate change and global warming are often used interchangeably. Global warming or climate change refers to a gradual but systematic increase in global temperatures experienced over a long period of time [22]. It refers to statistically significant climatic variations that persist for an extended period, typically decades or longer [17]. Global warming is brought about by rising levels of green-house gases (water vapour, carbon-dioxide- CO<sub>2</sub>, ozone - O<sub>3</sub>, methane - CH<sub>4</sub>,

Chlorofluorocarbons, nitrous oxide - N<sub>2</sub>O, and other synthetic chemicals). These gasses trap radiant energy from the sun, thereby providing a greenhouse effect. Atmospheric concentrations of GHGs increase when emissions are larger than removal processes and excess of these gases over a long period due to natural or anthropogenic forces result in heating of the earth and eventually climate change. There is international consensus that climate change is one of the latest and most serious challenges to sustainable human

development, both currently and in the future “[7], [17].”

There is now clear evidence that the earth’s climate is warming. Global surface temperatures have risen by 1.3 degrees Fahrenheit (°F) over the last 100 years. Worldwide, the last decade has been the warmest on record. The rate of warming across the globe over the last 50 years (0.24°F per decade) is almost double the rate of warming over the last 100 years (0.13°F per decade). But the evidence of climate change extends well beyond increases in global surface temperatures. It also includes: changing precipitation patterns, melting ice in the arctic, melting glaciers around the world, increasing ocean temperatures, rising sea level, around the world, acidification of the oceans due to elevated carbon dioxide in the atmosphere, responses by plants and animals, such as shifting ranges [27].

And Nigeria as a country has to strategize in order to confront the challenges, especially considering the recent 2012 flood disaster which was partly attributed to climate change. The gradual loss of the coastal areas in Lagos and parts of the Niger Delta region are imminent cause of concern.

Forests are tremendously naturally endowed to combat climate change by protecting people and livelihoods, and creating a basis for more sustainable economic and social development [24]. But this natural mechanism is often hampered by anthropogenic activities. It is therefore imperative to take measures which are environmentally sustainable not only for mitigation, but also for its adaptation. The use of Non-Timber Forest

Products (NTFPs) is proffered as an option in this paper.

Non-Timber Forest Products (NTFPs) are defined as biological materials other than timber which are extracted from the forest for human use [7]. NTFPs encompasses as all tangible animals and plants forest products other than industrial wood, coming from natural forests, managed secondary forests and enriched forests. The tropical forests contain a wealth of timber and non-timber products which have thus been exploited for food, fuel wood, watershed, pharmaceutical royalties, honey, snail and other marketable and non-marketable products “[8], [25]”.

NTFPs contribute to livelihoods of about 2 billion of the world’s poorest people in urban and rural settlements and are among the most valuable plant resources for present and future food security [1]. They provide food, fuel, medicine and incomes and keep traditional knowledge alive, provide fodder, and materials for construction of traditional houses, fencing and barns. Wildlife which also constitutes a greater part of NTFPs if properly managed can provide good sources of animal protein and income to the immediate communities as well as promote tourism “[3], [4].”

### **Climate change in Nigeria: Causes, impacts, adaptation and Mitigation**

Climate change is attributed to two major causes namely natural and anthropogenic (or human) activity, with the latter being a major player over the last few decades globally [17]. The natural drivers of climate change include volcanic

eruptions and solar activity. Human activity in Nigeria as in other parts of the world has been a major cause for the build-up of greenhouse gases (GHGs) namely:

**Burning of fossil fuels.** Carbon dioxide (CO<sub>2</sub>) is one of the main greenhouse gases and contributors to the greenhouse effect. When fossil fuels like coal, oil and gas burn, they release greenhouse gases. Anyadike [5] stated that through energy creating activities like heating homes and building, transportation and cooking, traveling (for example, by car, plane, bus and train), treating water to make it drinkable, heating it and piping it into homes, manufacturing, leakages from refrigerators, gas flaring, and bush burning, carbon dioxide is emitted into the atmosphere.

Since the industrial revolution which began in the 18th century, the amount of carbon dioxide in the atmosphere has increased by 35%. The Niger Delta region of Nigeria is reported to have over one hundred and twenty three gas flaring sites making Nigeria one of the highest emitters of greenhouse gases in Africa [13]. A study by the World Bank [28] revealed that Nigeria accounts for roughly one-sixth of worldwide gas flaring, as it flares about 75% of her gas. The flares have apparently contributed more greenhouse gases and invariably to climate change in the country.

**Deforestation.** This is a phenomenon, where forests are cut down faster than are replaced. It is a major contributor to climate change and accounts for 20 percent of the world's carbon emissions (more than what the entire transport sector produces). When trees are indiscriminately cut,

there are fewer trees left to absorb CO<sub>2</sub>, and then it will build up in the atmosphere. With deforestation, GHGs such as carbon-dioxide, carbon-monoxide, methane, nitrous oxide, are released, offsetting the natural balance immensely, consequently contributing to global warming [20].

According to the FAO [12], Nigeria ranks first among ten countries with the highest rate of deforestation in the world in succession during the 1990-2000 and 2000-2010 Forestry Resources Assessment (FRA). The average annual rate of deforestation was 3.3% for the period 1990-2010 so much that the country's forest coverage declined to about 10% of its total land area. The demand for fuel wood has been attributed as one of the major cause of this phenomenon. This calls for concern considering the importance of forests in controlling the build-up of GHGs.

**Growing Population/Industrialization.** As the world's population grows, there are more people who need food, livestock and energy. Nigeria has an estimated population of 170.1million as at mid-2012 which is projected to rise to 402.4million by mid-1950 [26]. This has a corollary increasing demand for clearing the forest for land, processing of food, household, and industrial goods which contribute to the emission of carbon and other hazardous substances to the environment.

### **Climate Change Impacts in Nigeria**

In general, Nigeria is strongly predisposed to severe negative impacts of climate change due to its fragile economy, weak resilience and low adaptive capacity. Much of the economy is

dependent on climate-sensitive resources. For example, the agriculture, forestry and fishing sectors employ up to 70% of the workforce. Its fossil fuel-dependent economy will be particularly vulnerable to climate change-induced frequent and severe extreme events, such as floods and droughts. The heavy concentration of GDP generating industry in locations that are highly vulnerable to climate change-induced sea level rise, e.g. Lagos and the Niger Delta makes the country extremely vulnerable. The 2011 Climate Change Vulnerability Index (CCVI) published by the UK-based risk company, Maplecroft, classifies Nigeria as being of high risk [14].

Climate change is already having significant impacts in Nigeria due to the interplay of four main climate change-related hazards: increased temperature, change in amount, intensity, and pattern of rainfall, extreme weather events (including sea surge and drought), and sea level rise as shown on table 1. These impacts are expected to increase in the future. Recent estimates suggest that, in the absence of adaptation, climate change could result in a loss of between 2% and 11% of Nigeria's GDP by 2020, rising to between 6% and 30% by the year 2050. This loss is equivalent to between N15 trillion (US\$100 billion) and N69 trillion (US\$460 billion). This large projected cost is the result of a wide range of climate change impacts affecting all sectors in Nigeria: agriculture, water resources (fresh, coastal and fisheries), forest, biodiversity, health and sanitation, human settlements and housing, energy, transportation and communication, industry and commerce, disaster,

migration and security, livelihoods, vulnerable groups, education [7].

**Table 1.** Summary of key trends in climate parameters for Nigeria by ecological zone

	Mangrove	Rainforests	Guinea/Savanna	Sahel/savannah
Temperature	↑	↑	↑	↑
Rainfall amount	↑	↑	↓	↓
Rainfall variability	↑	↑	↑	↑
Extreme rainfall events-droughts	Likely	Like	↑	↑
Extreme rainfall events-storms and floods	↑	↑	Likely	Likely
Sea level rise	↑	NA	NA	NA

Legend: ↑ = increase; ↓ = decrease; N A = Not applicable

**Source:** BNRCC (2011).

**Climate change Adaptation and Mitigation.**

Climate change affects every aspect and sector of our socio-economic development and is cross-sectoral in nature. It transcends the traditional focus on environmental issues because it affects Nigeria's overall well-being and economic growth. It then implies that the response must be all encompassing, addressing impacts on all sectors especially natural resources management, agriculture, economic development, infrastructure, energy and transportation. Desertification has been advancing southwards, and equally critical is the potential submergence of the 853 kilometers stretch of coastline along the Atlantic Ocean "[7], [14]".

Given this scenario, both adaptation and mitigation measures are inevitable in Nigeria. The IPCC [17] referred to climate adaptation as the ability to respond and adjust to actual or potential change in order to reduce harm or exploit opportunities. Some of the options that are available include: changing the cropping patterns; stopping further development on wetlands, flood plains, and close to sea level; developing crops that are resistant to drought, heat and salt; strengthening public health and environmental engineering defences against diseases; designing and building new water projects for flood control and drought management; construction of dykes and storm surge barrier against sea level rise [6].

On the other hand, mitigation entails actions to reduce GHG emission and enhance sinks for GHGs. In other words, mitigation entails eliminating or minimizing the frequency, magnitude or severity of climate change while adaptation implies taking measures to

accommodate the anticipated and sometimes inevitable impact of climate change. According to IPCC, the mitigation options includes reduction in burning of fossil fuels and reduction of greenhouse gases and soot from the energy sector; reduction of deforestation; increase in reforestation and afforestation; modification of agricultural practices to reduce emissions of greenhouse gases and build up soil carbon "[6], [23]".

Traditionally, climate change efforts using the forest option were targeted at only trees as means of creating and protecting forest carbon stocks [21]. But this paper discusses NTFPs as three-pronged instruments for climate change adaptation and mitigation through providing multiple-income streams, carbon sequestration, and biofuel energy options.

### **NTFPs Contribution to Multiple Income Sources**

As a cardinal feature of multi-functional forest system, NTFPs contribute to diversified income sources to rural communities. This diversity invariably increases the adaptive capacity and response options of the people to climate change shocks, since they are not dependent on a single species or crop [21].

The implication is that since the rural communities have an array of alternate income sources from NTFPs like medicinal herbs, honey, mushrooms, dyes, bush-meat, snail farming and fruits, they are less inclined especially with proper enlightenment, to engage in indiscriminate felling of trees as a means of getting income.

### **NTFPs Contribution to Carbon Sequestration**

Forests store large amounts of carbon in trees, under-storey vegetation, and soils. They have been estimated to globally contain 1.2 trillion tonnes of carbon, which is just over half the total in terrestrial vegetation and soils [24].

Non-timber timber products can contribute directly or indirectly to carbon storage or sequestration. The growing of fast-growing woody NTFPs like bamboo can be used to reduce emissions. In the case of indirect impact, the production of NTFPs like maple syrup or Brazil nuts (in Brazil), and other fruit crops entails a functional forest and an incentive to protect forest systems. Thus the maintenance of such a forest cover can indirectly help to store and sequester carbon. Although there is the extraction angle (in terms of removal of biomass from the forest) as a limitation of NTFPs contribution to carbon sequestration, it is comparably infinitesimal when their short re-vegetation and re-growth cycles are considered viz a viz those of trees. This also underscores the need to treat NTFPs differently in forest policies in order to harness their potential in forest conservation and carbon sequestration [21].

### **Potential of NTFPs in Biofuel Production**

Energy which is the ability to work plays significant roles in our life. Most energy demand is met by fossil fuels - oil, coal and natural gas [11]. According to the IEA [16], an estimated 1.3 billion people do not have access to electricity and 2.6 billion people globally rely on biomass for domestic cooking most of who are in Sub Saharan Africa. Use of fossil fuels has increased along with

improvement of standard of living, proliferation of the world's population and rapid industrialization of the developed countries. It has been recognized for some time that current use of fossil fuels will not only deplete the world's oil reserves but also have serious impact on the environment, leading to increased health risk and global climate change. Biomass energy refers to the energy available in non-fossil, live or recently living organic material. It can be harvested from plants, animals, insects, and waste; and can be developed into a variety of gaseous, liquid, and solid products [18].

The world is currently moving from petroleum-based to a bio-based global economy. Biological wastes (including NTFPS wastes), which are usually seen as low-valued materials, are now being transformed to usable forms for the production of eco-friendly and sustainable fuels [15]. This is because most biological wastes contain high levels of cellulose, hemicelluloses, lignin, starch, proteins, and lipids, which provide good options for the biotechnological production of liquid bio-fuels without interfering with the ever-increasing need for world's food supply [19]. NTFPS that can be converted into biofuel include bark, leaves, cork residue, cross-cut ends, edgings, grinding dust and saw dust through; thermal, chemical or biochemical conversion processes [10]. Apart from forest product wastes, *Jathropa curcas* which is a non-timber forest plant has been documented to have as high as 40% biofuel seed content. It is fast growing, prolific in nature and as well has the ability to thrive on marginal soils makes it most suitable for biofuel production [12].

Biofuel produced through these processes could help reduce world's dependence on oil and CO<sub>2</sub> emission, thus mitigating global warming. In addition, bi-products of biofuel production can provide new income and employment opportunities in rural areas. In focusing on renewable energy sources from biological wastes and NTFPs, the global warming problem as it relates to excess generation of greenhouse gases of which carbon dioxide is paramount, could be mitigated because lost carbon sources (fossil fuels) that are deeply buried in the earth crust may not be seriously exploited to compound the environmental greenhouse gas problem [10].

## CONCLUSION

Climate change mitigation and adaptation measures can only be effective when they are all-embracing and directed at addressing the causes of climate change itself. Embracing NTFPs as platforms for carbon sequestration, biofuel energy sources, and alternate incomes sources for forest resources- dependent population provides a complementary alternative to addressing the climate change challenges.

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