

Assessment of Environmental Impact of Deforestation in Enugu, Nigeria

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Abstract Challenges posed by constant deforestation with no reforestation programs and policies are high, constraints imposed by lack of proper awareness, inability of government to provide basic amenities and lack of proper environmental protection law to be enforced. Many are still in extreme poverty with inequality of income rising so high to the point of no more middle class, combined with rapid increase in population, domestic weakness driven from social-economic and political structure, bad government, poor Urban planning and poor access to the basic services such as electricity, kerosene and cooking gas, lack of reforestation awareness, all this contributes joined with high rate of tree cutting for domestic use such as fire-wood and charcoal production. Charcoal production is considered to be one of the major contributing factors to deforestation in the country followed by desertification and Urbanization which the later is the main contributor of deforestation in Enugu state. This paper recommends that government should create public awareness, monitoring and laws with provision of basic amenities that will substitute charcoal and fire-woods that is predominantly used by high percentage of middle and lower class in the country with proper urban planning.

Keywords Deforestation, Environmental Degradation, Reforestation

1. Introduction

Deforestation is the process of clearing, removal of forest trees where the land is converted to other types of activities for non-forest use, like conversion of forest reserves areas to residential or industrial areas, removing of forest trees as a result of road or rail construction, conversion for agricultural purposes and cutting down of forest trees for domestic and industrial use like fire-woods, timbers, paper production and charcoal production. Charcoal is widely used by high percentage of the population in the country for cooking and other uses, that's what makes it a major threat to forest reserves. About 31% of the world land surface is covered by forest, while in Nigeria it falls gradually from 16.6% in 1996 to 7.7% in 2015. According to Michael Daley, associate professor of environmental science at Lasell College in Newton, Massachusetts, the number one major problem caused by deforestation is the impact on the global carbon cycle. Gas molecules that absorb thermal infrared radiation are called greenhouse gases. If greenhouse gases are in large enough quantity, they can force climate change, according to Daley deforestation of trees not only lessens the amount of

carbon stored, it also releases carbon dioxide into the air. This is because when trees die, they release the stored carbon. High percentage of people are not aware of all this impact, not that they don't feel it but they are not being informed about it and that's main reason awareness, environmental law and monitoring is very important so that it will help to regulate the rate of unplanned deforestation, to restore and rehabilitate degraded forest landscape and evaluate the important of carbon sequestration by forest.

Deforestation has resulted in habitat damage, biodiversity loss and aridity, as a developing nation a lot of development are being taken place in daily basis like roads, rails, houses, dams and oil explorations, most of all this falls into urbanization that contributes to deforestation process due to lack of proper reforestation planning that should had been going on simultaneously with all these developments. Poverty contributes its own percentage due to lack of some basic amenities that results in people looking for means of survival and lack of proper awareness and enforcement of government policies that will guide public's of the risk of deforestation for domestic activities without reforesting. According to the 2010 Global Forest Resource Assessment, deforestation releases nearly a billion tons of carbon into the atmosphere per year, though the numbers are not as high as the ones recorded in the previous decade. This carbon released causes climate change which creates severe weather conditions like droughts, floods and hot weather conditions. According to Food and Agricultural Organization of United Nations as of 2005 Nigeria has highest deforestation rate in

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Published online at <http://journal.sapub.org/re>

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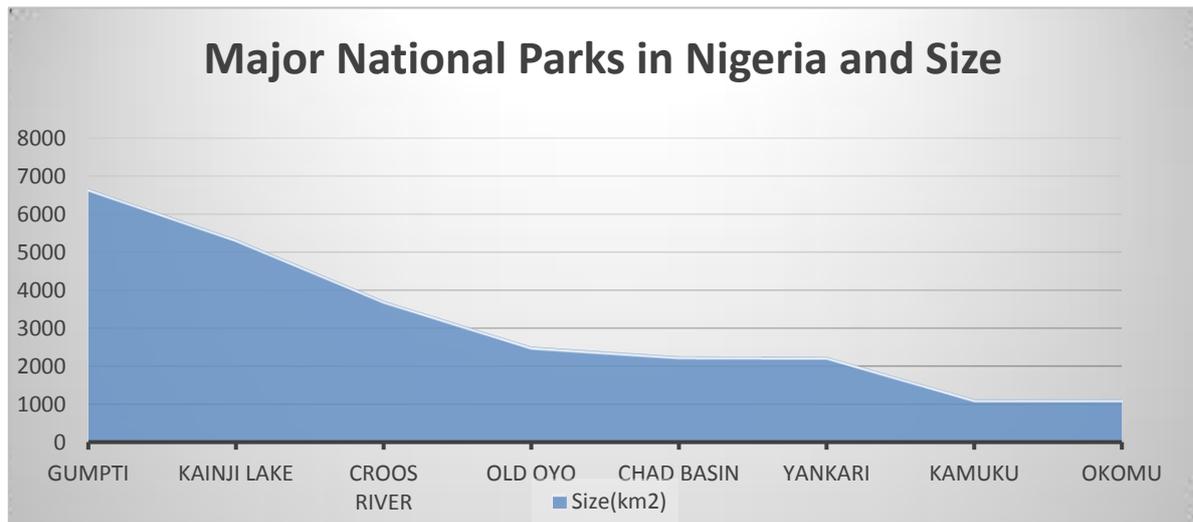
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the world at 12.2% equivalent of 11,089,000 hectares had been deforested and between (2000 to 2005), 55.7% of our primary forest was been lost and the rate of forest change increased by 31.2% to 3.12% per annum, which is approximately 350,000 to 400,000 hectares per year. Nigeria lost an average of 409,700 hectares of forest every year which is equal to annual deforestation rate of 2.38%. According to Mfon *et al* (2014) Nigeria has eight National parks; of the entire eight and damages inflicted to these parks as results of human and natural factors are tremendous and it will keep on increasing everyday if not properly addressed. This human and natural factors like, global warming, insurgency, desert encroachment, over grazing and other agricultural activities.

Table 1. Number of Major National parks in Nigeria

National Parks and their Sizes S/N	Park	Size (km ²)
1.	Gumpti	6,670
2.	Kainji lake	5,341
3.	Cross River	3,720
4.	Old Oyo	2,512
5.	Chad Basin	2,258
6.	Yankari	2,244.1
7.	Kamuku	1,127
8.	Okomu	1,127

Source: Mfon *et al* (2014)

**Figure 1**

Major causes of deforestation in Nigeria are;

- i. Desertification.
- ii. Poverty.
- iii. Urbanization.
- iv. Fuel Wood production.

Desertification: Desertification is the process desert encroaches into a land that is once fertile. This situation mostly happens in some northern states of Nigeria which are under serious threat of desertification like; Adamawa, Bauchi, Borno, Gombe, Taraba, Sokoto and Yobe States that are all prom zone for desertification. A study conducted 1901 to 2005 shows that Nigeria had temperature increase of 1.1C of the global mean temperature increase of 0.74C. Combination of high rate of deforestation with no reforestation plans increases the temperature which reduces the amount of rainfall year in and out, contributes highly to the desertification of the country, for study shows that Carbon emission from deforestation accounts for 87% of total carbon emission of the country.

Poverty: High rate of poverty in the country contributes connects much to deforestation, reason because 95% of the population depends on kerosene which is not cheap to get

due to cost, as a result of it, high numbers depends on wood fuel widely known as Charcoal in the country for their live hood for people in the rural areas and urban areas with its modern constructed charcoal burners. With the high demands of this product called charcoal which is been produced through cutting down of forest trees comes high rate of deforestation, also another source of income for many people. This charcoal production has severe effects to our forest reserves.

Table 2. Poverty Rate Per Capita in Nigeria by Zones

Zone	GHS Poverty Headcount 2010 - 2011 (%) (m)	GHS Poverty Headcount 2012 - 2013 (%) (m)	Difference j (%)
North East	47.1 19.0	50.2 20.2	3.1
North Central	33.4 20.3	31.1 21.6	-2.3
North West	46.9 37.8	45.9 40.1	-1.0
South East	31.7 16.4	28.8 17.5	-2.9
South South	27.7 21.0	24.4 22.3	-3.3
South West	21.2 33.6	16.0 35.7	-5.2

Source: NBS (2013) in World Bank (2014), Author's computation (m).

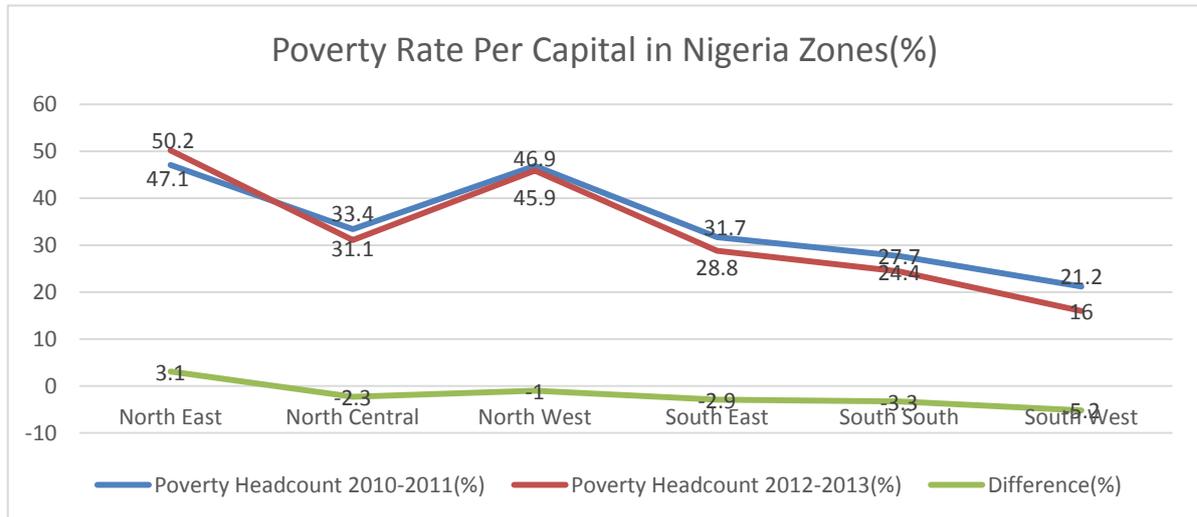


Figure 2

Note: GHS = General Household Survey. m = Population in millions.

West and South-South, a remarkable reduction in the number of people living under poverty has been recorded, with 5.3% and 3.3%, respectively.

From table 2, shows high rate of poverty which results in deforestation like tree cutting for fuel wood (charcoal) production. According to Hyde (2004) who stated that forests and poverty go hand in hand, and where one is found, there is often the other.

Urbanization: This is a process that leads large number of people to become permanently concentrated in a relatively small area that goes with more construction of settlement which will result in conversion of forest reserves to residential and agricultural purposes. This current state of the environment is been allowed by State Department of forestry which have not implemented any forestry management policies to reduce deforestation since 1970s. No conservation effort, Public awareness education, for people to know there role, advantage and threat it poses to the natural resources, environment and its health effect, that will add as a catalyst for them to engage in massive reforestation project just like Japan did (McKean 1982, 1986) which made them to start planting sugi and hinuki.

Wood Fuel Production: Wood fuel are those various forms of wood that are used as fuel for cooking, heating and to drive stem-power engines or turbines such as firewood, charcoal, chip, sheet, pallet and sawdust. The use of wood for a fuel source is older than recorded in history is believed to be main innovation that allowed for development of civilization. Over consumption of this wood fuel has led to deforestation and habitat loss with its combustion that generates emission impact to the climate change.

Table 3 and Figure 3 findings reflect on huge continuous production and consumption of wood fuel in the country from 1997 to 2016. Hyde (2004) who stated that forests and poverty go hand in hand, and where one is found, there is often the other. From the table 3 below it indicates that

within this short period of time Industrial consumption accounted for only 20.38% while the remaining 79.62% is all for domestics consumption.

It indicates high dependence of forest resources for livelihood by very large population of the country places the forest reserves at the risk and some tree species going extinct. Na'ibbi and Heady (2013), Akwa (2013) and Ibe (2014) all affirmed that in spite of the fact that income, prices of fuel wood and its substitutes are major determinants of the consumption of fuel wood, there was uniformity in reporting that the larger population are still mainly relying on this source of energy for most of their domestic uses.

Deforestation leads to environmental degradation which is disintegration of earth or deterioration of the environment by the action of humans none or unknown through depletion of resources such as air, water and soil. It can also be refer as destruction of habitat and the ecosystem, extinction of wildlife, which also generates pollution and some form of natural disaster like gully erosion which all falls to the impacts of deforestation.

Deforestation impacts are;

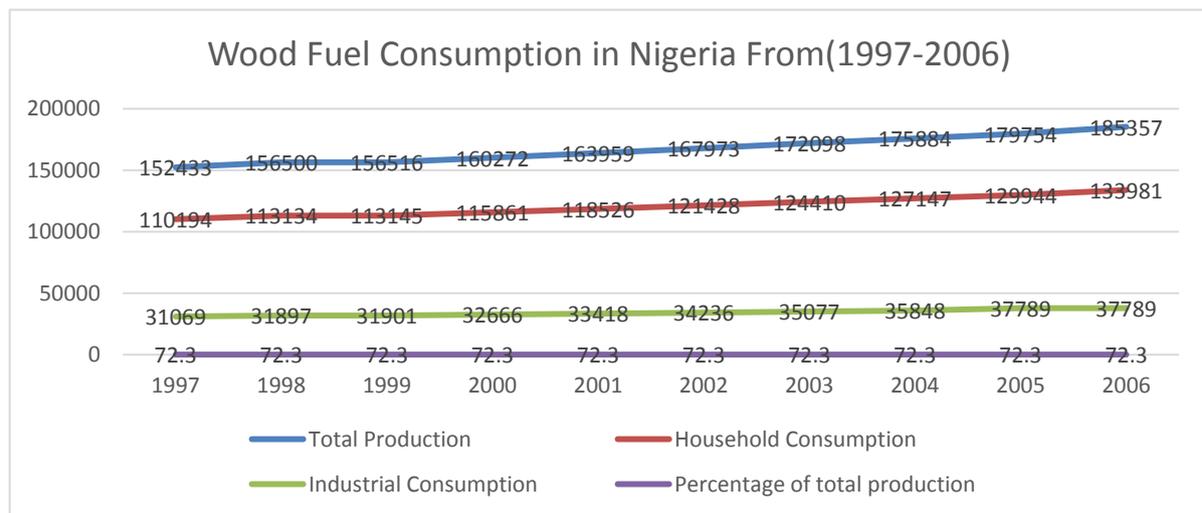
- i. Environmental impacts
- ii. Social impacts
- iii. Health impact
- iv. Economic Impact.

Environmental impacts: Environmental impacts result in loss of bio-diversity, endangering of plants and animals which is been caused by constant deforestation of forest reserves meant for the purpose of protecting immediate environment and serve as shield direct impact of downpour of rain, high temperature and wind that will result of erosion, flood and other environmental instability. For example highland vegetation of south eastern part of the country was rich thick forest but due to the massive deforestation caused by urbanization, increase in population created gully erosion problems, which could had been prevented through reforestation process to prevent downpours from washing away natural habitats.

Table 3. Wood Fuel consumption in Nigeria from (1997 – 2006; 000m³)

Year	Total Production	Household consumption	Percentage of total production	Industrial consumption
1997	152433	110194	72.3	31069
1998	156500	113134	72.3	31897
1999	156516	113145	72.3	31901
2000	160272	115861	72.3	32666
2001	163959	118526	72.3	33418
2002	167973	121428	72.3	34236
2003	172098	124410	72.3	35077
2004	175884	127147	72.3	35848
2005	179754	129944	72.3	37789
2006	185357	133981	72.3	37789

Source: ESD/UNSD (2008), in Momodu (2013).

**Figure 3**

Social impact: Social impact occurs as a result of high rate of deforestation which causes degradation to the environment and forces local dwellers to move into urban areas, resulting in overpopulation and lack of jobs, increase in crime rate, and lack of social amenities to care for the population. Example: Deforestation in Anambra that has resulted in heavy gully erosion, forcing some villages to relocate. Oil exploration in the Niger Delta has forced many villages out of their land. Results of this forced people out of their homes, which means they have no means of livelihood to move to the urban area with no hope of job or source of income.

Health impact: Health impact occurs when the greater population of people have migrated to urban areas due to degradation in their rural areas caused by crisis, deforestation, oil spills, and erosion with less infrastructures in urban centers, lack of basic amenities like water and electricity, lack of proper drainage system, which will result in outbreaks of diseases, mostly malaria, Lassa fever, and other diseases. Example: Abakpa Nike, an already densely

populated area with poor urban planning, where more people from Uguwo Nike move to the area due to deforestation caused by wood fuel and urbanization processes going on in these forest reserves.

Economic impacts: Economic impacts have also affected the environment negatively, especially in the Niger Delta, where oil exploration is taking place. As petroleum and gas sectors cover over 97% of the country's GDP, there is an increase in oil exploitation, which keeps increasing degradation on the environment, like Ogoni Oil spills that have brought a lot of damage to the ecosystem within that environment.

2. Materials and Methodology

This study was conducted in Enugu state of Nigeria, which is located in the South-Eastern part of the country and shares boundaries with 5 other states like Anambra, Abia, Ebonyi, Kogi, and Benue states. Major contributors to deforestation in this area are urbanization and industrial development, which is caused by high population increase. This impact of high

population increase and economics growth has endangered the forest reserves in the state. Ministry of environment and solid minerals which houses the state forestry commission has four major forestry zones, Enugu, Awgu, Orji River and Nsukka which comprises developed, undeveloped or abandoned forest reserves like; Enugu, Enugu-water, Enugu-extension, Akpakume-nze, Agu-Obu Owa, Miliken Hill, Oji-River, Awlaw-Isikwe Achi, IfiteAmoli, Akwari Ani and Mammu-River forest reserves.

Table 4. Forest Reserve, Location and Areas covered in Enugu State

S/N	Forest Reserves Names	Location LGA	Area (Ha)
1	Enugu	Enugu	1139.00

2	Enugu Water W.H.W	Enugu	116.20
3	Enugu Extension	Enugu	100.36
4	Akpakume Nze	Udi	911.00
5	Agu-Obu Owa	Ezeagu	800.00
6	Miliken Hill	Enugu	94.09h
7	Oji-River	Oji-River	361.80
8	Awlaw Isikwe Achi	Oji River	40.00
9	Ifite Amoli	Awgu	46.60
10	Akwari Ani	Nsukka	220.00
11	Mmamu-River	Oji-River	46.80
12	Umualor	Isi-Uzo	140.00

Source: Enugu State Forestry Commission, January 2002.

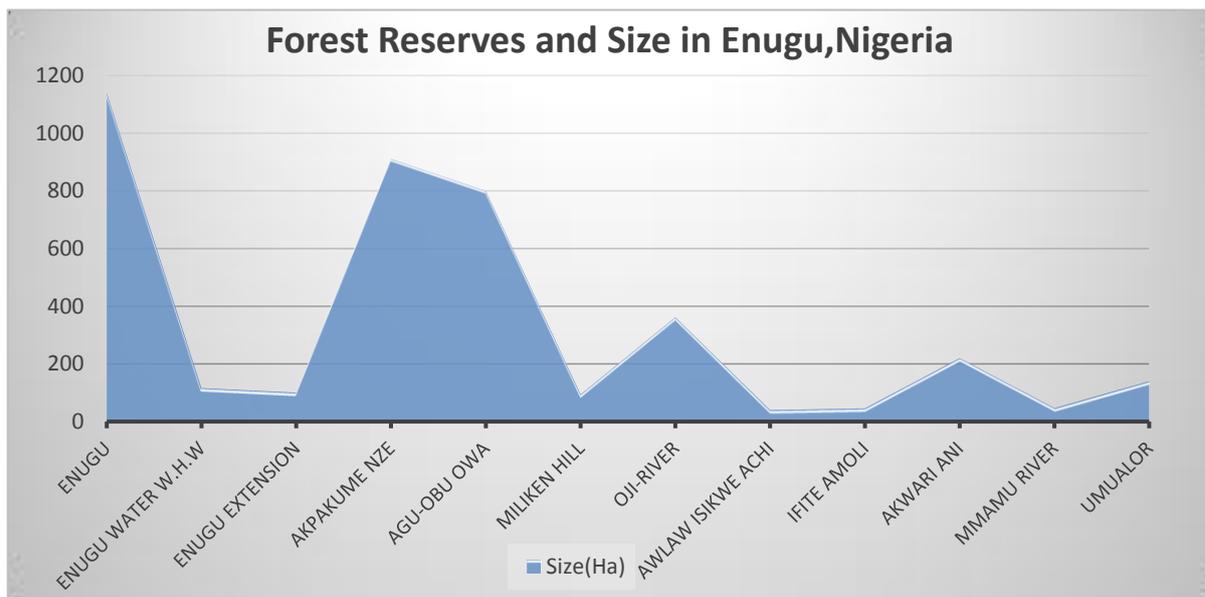


Figure 4



Figure 5

Mammu - River Reserve Aerial view marked, (Total area: 8889,010.53m²)



Figure 6

Akwari Reserve Aerial view marked, (Total area: 2.98 km²)

This paper is based on primary and secondary source, interviews, discussions with Enugu state forestry commission, forest guards and information's accessed through review of relevant texts, interviews, discussions, journals, newspapers, official publications, magazines and internet which served as tangible source of insight into deforestation and its effects to the environment.

Data collected from both forest reserves (Mmamu and Akwari) where on indication of deforestation, the two criteria and indicator associate developed for Nigeria context by Ebo (2000) which was used to check status of deforestation of forest reserve caused by Urbanization, Agricultural and poor policies and monitoring. Both forest reserves generate highest and lowest income revenues respectively.

Table 5. Criteria and Indication (C&I) Framework

S/N	Criteria	Indicator	Measure/Unit
1	Socio-Economic Integrity	(a) Forest land conversion (b) Forest Products Harvesting	(i) Percentage forest area converted to farmland. (ii) Percentage change in incidence of forestland conversion to agriculture. (iii) Percentage forest area lost due to infrastructure, housing and other non-agricultural users. (i) Percentage annual removal of forest products relative to the volume of removal determined to be sustainable.
2	Forest Sector Policy Factors and Management Strategies	(a) Enforcement of laws and regulations guiding forest reserves. (b) Existence of forest management plan. (c) Forest inventory (d) Participatory strategies (e) Funding for forest reserves.	(i) Incidence of compliance with forest reserve law/regulation. (i) Incidence of implementation of forest management plans. (ii) Percentage of forest area under completed management plans. (i) Availability/existence of up to date forest inventory. (i) Number of communities with forest management status (ii) Incidence of participation communities in decision making relating to forest. (iii) Incidence of participation by communities on implementation of decision, monitoring of progress towards sustainable forest management. (i) Total budgetary expenditure on forest reserves. Percentage change in the forest sector share of total budget.

Source: Eboh, E.C, (2000)

3. Results and Discussion

Mammu-River reserve covers total land area of 46.80ha and 61% which is 28.548ha are area left covered, while since

1927 an estimation of 11.975ha of trees has been lost.

Akwari reserve area covered area predominantly by cashew trees is 134.2ha and since 1974 the forest reserve covers over 220ha with estimation loss of 3.597ha per

annum.

Forest rangers agreed and some disagreed that high access to farmland within this forest contributed to its high depletion, 80% of forest rangers agreed while 20% disagreed on the impact of high access to farmland and believe is low.

Mmamu-River reserve forest alone total of 30% which is 14.04ha of the reserve is been converted to farmland, with this 30% conversion mostly happens annually in maximum basis in the forest.

Table 6. Mmamu River forest reserve depletion factors and rate (%)

Depletion Factors	Percentage (%)	Hectare (46.80ha)
Agricultural	30	14.04
Erosion	1	0.488
Development	8	3.74400
Area left	61	28.54800

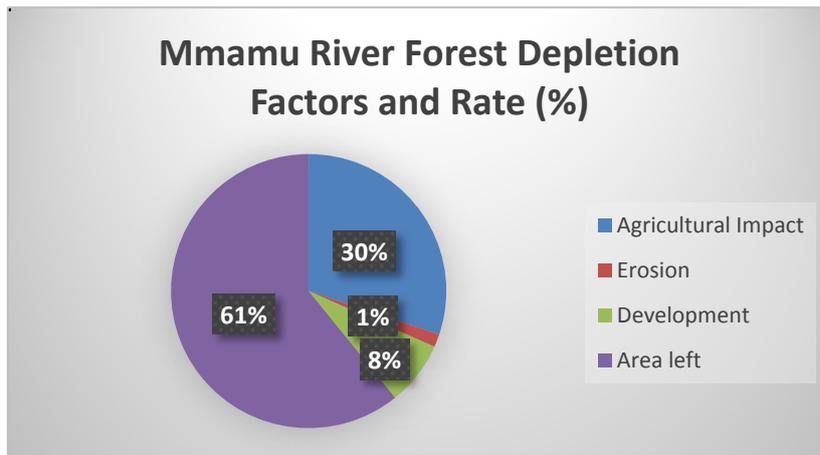


Figure 7

While over 24% of Akwari forest reserves is been depleted through domestic activities like wood fuel productio, other factors like Agricultural activities, infrastructural development and erosion contributes some parts.

Table 7. Akwari Forest depletion factors and rate (%)

Depletion Factors	Percentage (%)	Hectare (220.00ha)
Agricultural	8	17.6
Erosion	2	4.4
Development	5	11
Wood Fuel	24	52.8
Area left	61	134.2

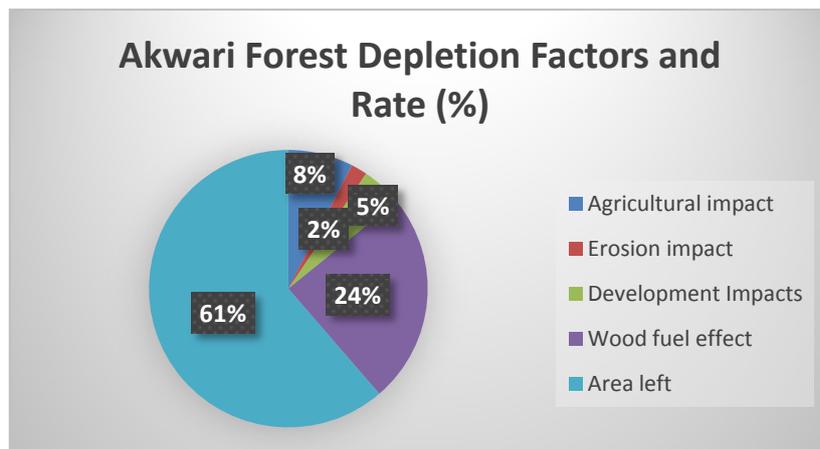


Figure 8

Akwari reserve experience minimum impact of agricultural activities and high impact domestic activities like wood fuel production.

Other factors contributing to deforestation in this two forest reserves mentioned are;

- i. Lack of law enforcement
- ii. Lack of afforestation program
- iii. Poor awareness
- iv. Poor funding

Lack of law enforcement: According to the ministry of forestry, poor manpower contributes highly to this situation, inadequate funding which effects logistics for the rangers movement.

Lack of Afforestation program: Both forest reserves has no afforestation program, according to the rangers some programs only ends up in paper with no implementation process so they only depends on natural regeneration of trees.

Poor Awareness: Most villages around this reserves has no knowledge of effects of deforestation, of over 35 individual only 3 has like 60% knowledge of deforestation effects which is like 80% knows nothing about it and ministry with the rangers don't carry them along, no public participation so they will know some ways in which they can also contribute to the problem.

Poor Funding: Ministry of forestry has the lowest budget in the state, which comes down to that lack of manpower and logistic, recruitment of new rangers never take place for a while and even the once working there are ill equipped for the job, only there for the monthly pays.

With all this data and report if the situation is not been addressed within 11 to 12years most forest reserves will be lost to deforestation effects and once that will remain will be highly depleted.

4. Recommendations and Conclusions

Solution to deforestation challenges in Nigeria policy and resilience, careful choice of priorities, prudent forest management and getting involve the private sectors, combined with proactive actions and policies. Nigeria leaders current and future should prioritize educating the young generations' dangers posed by this maniac going on in all the major forest reserves. The poor are most vulnerable to environmental hazards and owing to unequal distribution of assets in the country, will also suffer most from the effects generated by deforestation. Increase in temperature, Erosion, Flood, and other forms of degradation effects. Increasing the opportunity for the vulnerable is the only way to sustain overall growth and reduce disparity. Disparity on basic amenities like kerosene, cooking gas and electricity must be reduced drastically so the even if the laws is been enforced, poor people will have alternatives and see reason to keep to the rules and regulations.

Public should focus more in creating enabling environment by engaging on tree planting not only in the forest but within our environs while government should be to facilitate, support and make those basic amenities easy to access also leverage the strength of the stakeholders to create policies with significant outreach at maximum efficient with less burden on the public resources. Contribution of the public sector, NGO, global partnerships, research and academics communities discovering the best species of trees forest for each region of the country and also normal settlements. Poor population itself are essential with proper awareness and education. Monitoring on kerosene been supplied to the public's to avoid adulterated products which most time causes fire outbreak at home that also discourage some household from using kerosene. Re-using of papers and plastic bags to discourage deforestation.

Nigeria have good enabling environment for forestry but need to expend in scope, coverage, efficient to sufficiently serve other some regions that had been disadvantaged by heavy deforestation and environmental degradation that had been happening on their environs. Government will benefit in pursue a well-articulated forestry policies programs significantly reducing the burden on the major towns and cities; also improve in the supply of affordable basic amenities thereby making life unproblematic to the citizenry.

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