The Impact of Forest Loss on Biodiversity Systems of Cross River State, Nigeria

[1]Obongha, Ukpali E., [2]Ukam, Leonard E., & [3]Upuji, Jennifer K.

Corresponding Email: ukpalieze@crutech.edu.ng

[1-3]Department of Urban and Regional Planning, Cross River University of Technology, Calabar

ABSTRACT

The Cross River tropical forest is one of Africa's last remaining forested zones with an extremely rich wide variety of flora and fauna species and is known among the 25 biodiversity hotspots in the world. The forests have important biophysical properties that affect local, regional, and environmental quality. However, these forests are fast degrading due to pressure from the inhabitants as a result of making a living through farming activities, fuelwood consumption, settlement expansion, high demand for timber, infrastructural development, and poverty. All these have a direct impact on soil fertility, introducing soil erosion and flooding, biodiversity extinction, climate change, loss of medicinal herbs and non-forest timber products (NFTP), etc. The study revealed that the Cross River forests originally covered an area of 6,101.29KM2 but today as a result of the activities mentioned above, the area has fast lost about 69% (4,209.8901KM2). This percentage loss also brought about the extinction of biodiversity species. The study also revealed that the protected area system and the introduction of REDD+ by the UN which attracts financial value for the carbon stored in forests are the mechanisms that have salvaged the forest areas of Cross River State.

KEY WORDS: Biodiversity, Forest Loss, Protected Area System, Tropical Rainforest, REDD+, Non-forest timber products (NFTP), and Cross River State

1. INTRODUCTION

The tropical rainforest is one of the richest ecosystems in the world containing at least half of the plants and animal species. That is, it is the home of almost half of the different flora and fauna in the world (UNEP, 1993). Nigeria and Cross River State in particular by virtue of its location between Longitude 08.5988º E and Latitude 05.8702º N, is found in this rich natural environment. At least, 80% of Nigeria's forests are disappearing and consequently, the area occupied by forest has reduced by 12%. A greater part of rainforest water-shed remaining in

Nigeria covering over 700km is located in Cross River State, while a large proportion of it is found in Akamkpa Local Government Area of the State (World Rainforest Movement, 2002). These forests provide millions of people with shelter, medicinal herbs, timber, fuel wood, building materials, clothing and lots more (Yaro, Okon, and Obongha, 2018).

In Nigeria today, human activities have increased the rate of forest loss, degradation of soil fertility, and deterioration of the environment. All these problems are the direct result of irrational and unsustainable agriculture, commercial timber logging and fuel wood collection for industrial and domestic uses. The need to conserve the forest is therefore, to secure development while at the same time sustaining the productivity of natural vegetation, protecting wildlife, maintaining genetic diversity and avoiding soil and forest destruction (UN-REDD, 2015).

The study area is made up of a population which is predominantly peasant farmers operating at the level of subsistence with pressure on the natural vegetation in order to meet their daily needs directly or indirectly through biomass for example, food items, fuel wood, medicinal herbs etc. through a practice known as "biomass based subsistence" (Bisong, 2001). Other agents of forest loss in Nigeria are bush burning, oil spillage leading to loss of 10% of the mangrove forests in the Niger Delta, urbanization, drought and soil erosion. These have led to estimation of the current rate of deforestation to 3.7% nation-wide and one of the highest in the world. The land use change and forestry sector in Nigeria is also known for greenhouse gas emissions accounting for 40% of the total greenhouse gas emissions in the year 2000, mainly due to losses of forests and other woody biomass stock (Yaro, 2015).

Reducing Emissions from Deforestation and Forest Degradation plus (REDD+) is a mechanism developed by parties to the United Nations Framework Convention on Climate Change (UNFCCC). It creates a financial value for the carbon stored in forests by offering incentives for developing countries to reduce emissions from forested lands and invest in low carbon paths to sustainable development. Developing countries would receive results-based payments for results-based actions (UNFCCC, 2008). REDD+ goes beyond deforestation and forest degradation, and include the role of conventions, sustainable management of forests and enhancement of forest carbon stock. The REDD+ process follows a rule set by the UNFCCC and cited in a number of Decisions including Decision 1/CP.13, Decision 1/CP.16 para. 68-79 – the Warsaw Framework,

and most recently Article 5 of the Paris Agreement. A National REDD+ strategy is part of the requirements in order to operationalize REDD+ mechanism (UN-REDD, 2015).

In the same vein, a Cross River State-based structure for the implementation of REDD+ was put in place with funding from UN-REDD National Program and a number of studies were developed through research and consultations with groups and individuals. A pilot structure was formed between 2013 – 2015 to include the following: a preliminary assessment of the context of REDD+ in Nigeria and Cross River State; study on the drivers of deforestation and forest degradation in Cross River State; Draft Participatory Governance Assessment for REDD+ and Natural Resources Management in Nigeria; Risk-Benefit Analysis of REDD+ related policies and measures in Cross River State; and using spatial analysis to explore multiple benefits from REDD+ in Cross River State (UN-REDD, 2015). The Federal Ministry of Environment in partnership with the REDD+ unit of Cross River State and UNDP commissioned further researches and analysis in 2015 - 2016 under the theme: *"Development of the Integrated Analyses for REDD+ Strategy in Nigeria with a Focus on Cross River State"*. The research areas were: finance, incentives and benefit sharing; natural resource management and sustainable forest management; assessment of policy, legal and regulatory enabling environment; cost benefits analysis of REDD+ strategy; private sector engagement and roles; and knowledge, management and products. The results from these studies were subjected to stake-holders' validations both at national and state levels (UN-REDD, 2015).

In Cross River State for example, the high demand for timber and other forest products has resulted to the high rate of deforestation and forest degradation/ forest loss. Deforestation is the total removal of the forest or cutting down of trees and other forms of vegetation cover from a particular site without any replacement. While forest degradation on the other hand, is the decimation of forest cover with the loss of valuable species (Yaro, Okon, Bisong, and Obongha, 2016). Degraded forests are forests that have lost some of their original capacity to provide ecosystem services, they are more vulnerable to outbreaks of pests, diseases and climate change. Forest degradation also reduces the long term ability of forest to absorb carbon from the atmosphere. The Global Partnership on Forest Landscape Restoration (GPFLR) estimates that up to 1 billion hectares of forest landscapes, equivalent to about one quarter of all forest lands, are

degraded and in need of restoration (Yaro et al, 2018). Successfully restoring these forests would result to greater benefits for people and biodiversity systems.

Protected Area System (PAS) have been used as a strategy to protect biodiversity especially those in the brink of extinction. Protected areas are areas of land and/ or sea exclusively dedicated to the protection and maintenance of biodiversity, natural and associated cultural resources which are managed through legal or other effective means (Rotich, 2012; Mcdonald, 2003). Protected areas include the parks, reserves, strict nature reserves, and wilderness among others. Protected areas arises out of the need to control the biodiversity from its rapid loss and degradation. The only problem of protected area is habitat loss around the edges of forests and others due to agricultural expansion (Kamau, 2004).

Despite the strict conservation framework of protected areas, deforestation is still in progress. Deforestation is an environmental problem due to its negative consequences like climate change, biodiversity loss, soil degradation, erosion, landslides, siltation and flooding (Bisong, 2001). Although, deforestation started since the advent of civilization and have shown in several areas that it is on the increase due to incessant tree exploitation and increase in socio-economic activities. It is also a function of the growing human population and activities propelled by such factors as land tenure system, poverty, demography, inadequate conservation status, development policies and economic incentives (Gandiwa, Matsvayi, Ngwenya, and Edson, 2011).

The rapid depletion of forest resources by human activities led to the use of several interventions by the United Nations in admonishing nations of the world to balance the exploitations of forest resources through sustainable development concept. The adoption of the protected area system was hoped to curtail the rate of species extinction and degradation (Burtler, 2005). Forests with their rich biodiversity are essential for human livelihoods and sustainable development. For example, fuel wood is the primary source of energy for cooking and heating for a 2.6 billion people as estimated by the World Bank. The Millennium Ecosystem Assessment also found that as many as 300 million people, many of them very poor, depends substantially on forest ecosystem services for their subsistence and survival (Millennium Ecosystem Assessment, 2005). Many non-timber forest products (NTFP) derived from the forest biodiversity, such as cocoa, honey, gums, nuts, fruits, flowers, seeds, snails, mushroom, rattan, fungi, wild meat and berries

are all essential for food, building material and medicine as used by indigenous people to sustain their way of life, including culture, traditions and religion (Yaro et al, 2016).

The 1992 United Nations Earth Summit (UNES) in Rio de Janeiro defined "biodiversity as the variability among living organisms from all sources, including, *inter alia*, terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are part: this include diversity within species, between species and of ecosystems". In reviewing the impact of forest loss on biodiversity, (Putz, Redford, Robinson, Finbel, and Blate, 2000) disaggregated biodiversity into five components: landscapes, ecosystems, communities, population/ species, and genes using an approach initially proposed by Noss (1990). Each of these components has structural, compositional, and functional attributes. Structure refers to the physical organization of pattern of elements. Composition refers to the identity and variety of the elements in each of the biodiversity components, and function refers to the ecological and evolutionary processes acting among the elements (Noss, 1990).

Biodiversity loss is important in its own right because biological diversity has cultural values, and many people ascribes intrinsic values to biodiversity, and because it represents unexplored options for the future (Enuoh and Ogogo, 2018). People from all walks of life value biodiversity for spiritual, aesthetic, recreational, and other cultural reasons. Species extinction at the global level is also of specific importance. Since irreversible losses of species represents losses in the constitutive elements of well-being. Population extirpation is particularly important at national and local levels insofar as most ecosystem services are delivered at the local and regional levels and are strongly dependent on the types and relative abundance of species (Millennium Ecosystem Assessment, 2005).

Biodiversity loss is closely associated with the rapid growth of human population as well as the increased per capita rate of consumption. The most important direct drivers of biodiversity loss and change in ecosystem services are habitat loss and land use change, physical modification of rivers, water withdrawal from rivers, loss of coral reefs, and damage to sea floors due to trawling, in addition to climate change, invasive alien species, overexploitation of species and population (Millennium Ecosystem Assessment, 2005). Biodiversity conservation is imperative for diminishing detrimental effects on ecosystem functioning. Forests are amazingly rich in biodiversity and estimates shows that $\frac{2}{3}$ of all land-based species lives in forests and/ or depend on

them for their survival. Presently, around 1.75 million species of plants, animals and fungi are known to science and has been estimated that there could be up to 100 million species most of them in tropical rainforests (Millennium Ecosystem Assessment, 2005). Forest biodiversity sustains human wellbeing through a multitude of ecosystem services, like water purification, provision of oxygen as well as spiritual and cultural benefits and its extinction means a lot to stake-holders like Environmentalists, Urban Planners, Botanists, and Scientists. This study is however, conducted to measure the impact of forest loss on biological diversity in the tropical rainforest zones of Cross River State, Nigeria with a view to mapping out the areas of deforestation in the study area, causes of deforestation and management of forest resources in Cross River State.

2. METHODOLOGY

This study was conducted in Cross River State and made use of primary and secondary sources of data. The primary sources of data collection were carried out through administration of questionnaires for firsthand information to ascertain the impact of forest loss on biodiversity systems in the study area. The secondary sources of data employed in this study were a collection of journal articles and text books on the subject matter.

Data on the impact of forest loss, biodiversity systems, causes of forest loss and management of forest resources in the study area were captured in the questionnaire. A total of 180 (one hundred and eighty) questionnaires were distributed across the 18 Local Government Areas of Cross River State and 10 questionnaires were administered in each of the 18 LGAs. However, respondents were chosen from forestry, agriculture, environment and resources management departments of each LGA and interviewed in order to assess their views on the subject matter.

The descriptive statistics of Tables, charts, and percentages were adopted for the analysis and GIS analysis were used in mapping out areas of forest loss as well as biological diversity extinction in Cross River State. Below is Figure 1: Map of Nigeria showing Cross River State, the study area.

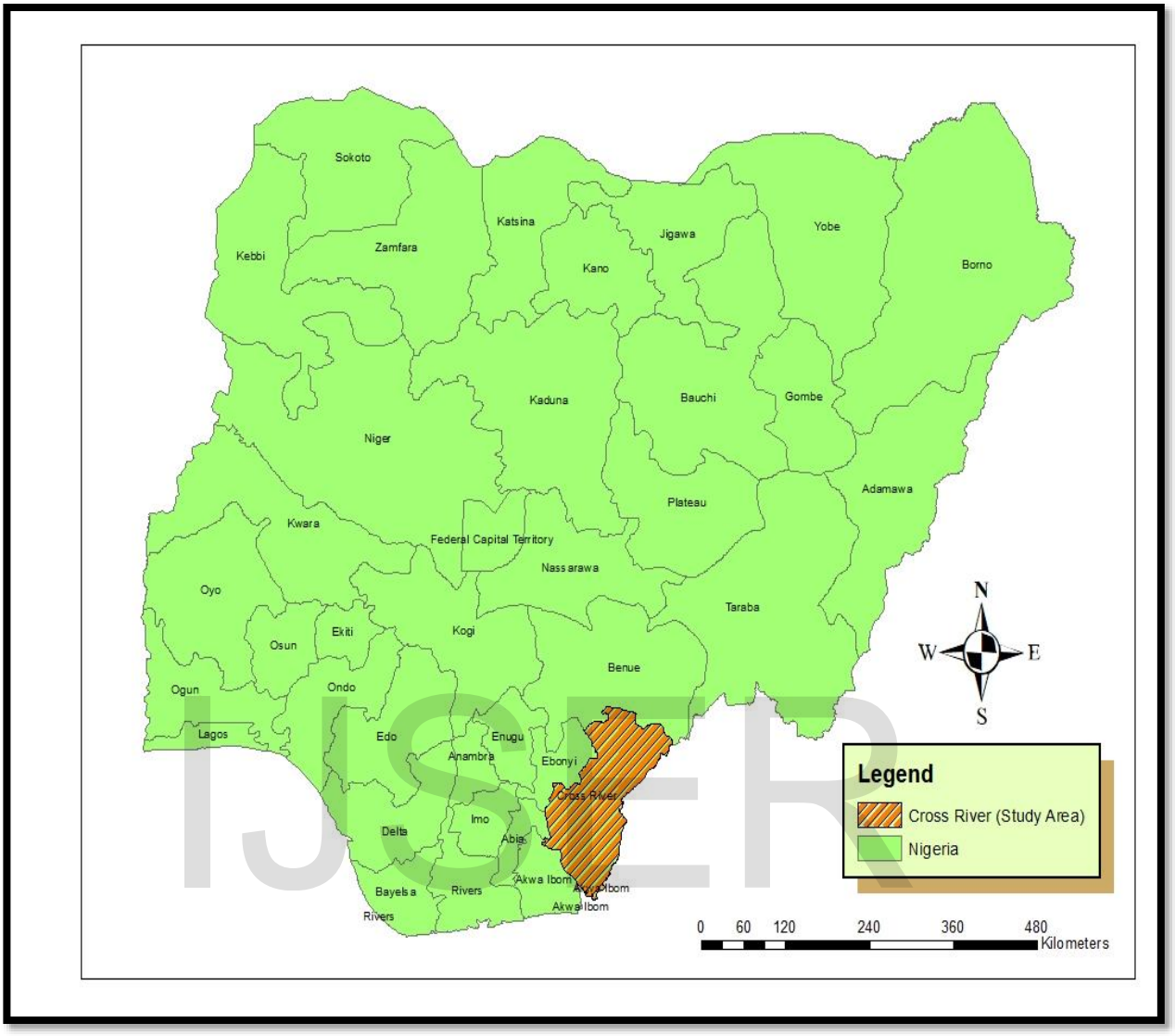

Figure 1: Map of Nigeria showing Cross River State as the study area

3. ANALYSIS AND RESULTS

Table 1: The Impact of Forest Loss

S/No.	Impact	Frequency	Percentage
1	Soil erosion	30	16.7
2	Biodiversity extinction	27	15
3	Loss of soil fertility	44	24.4

4	Loss of medicinal herbs	18	10
5	Flooding	24	13.3
6	Drought	11	6.1
7	Climate change	16	8.9
8	Loss of NTFP	10	5.6
	Total	**180**	**100**

Source: Data Analysis, 2020.

The Table 1 above shows the various impact caused by forest loss in the study area and the analysis demonstrated that loss of soil fertility has the greatest impact with 24.4%. This has a multiplier effect on reduction in food productivity, shortage of food and create chances of poverty. The second highest is soil erosion with 16.7% followed by biological diversity extinction with 15%. Others are flooding, loss of medicinal herbs, climate change, drought and loss of non-timber forest products. This is graphically represented below.

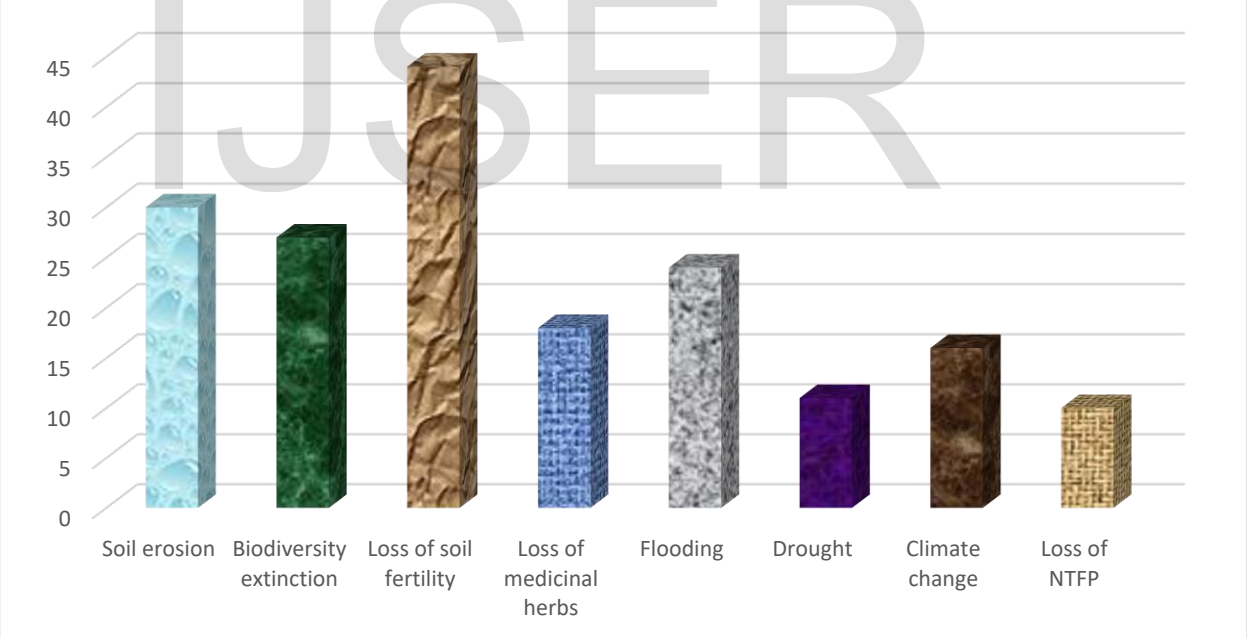

Figure 2: Bar Graph of the Impact of Forest Loss

Figure 2 above shows the graphical representation of the impact of forest loss derived from Table 1 above. The chart shows loss of soil fertility, soil erosion, biodiversity extinction and flooding as the highest impact. Below is the Map of Cross River State showing the

concentration of forests in the study area, however, these forest areas are also areas of active deforestation.

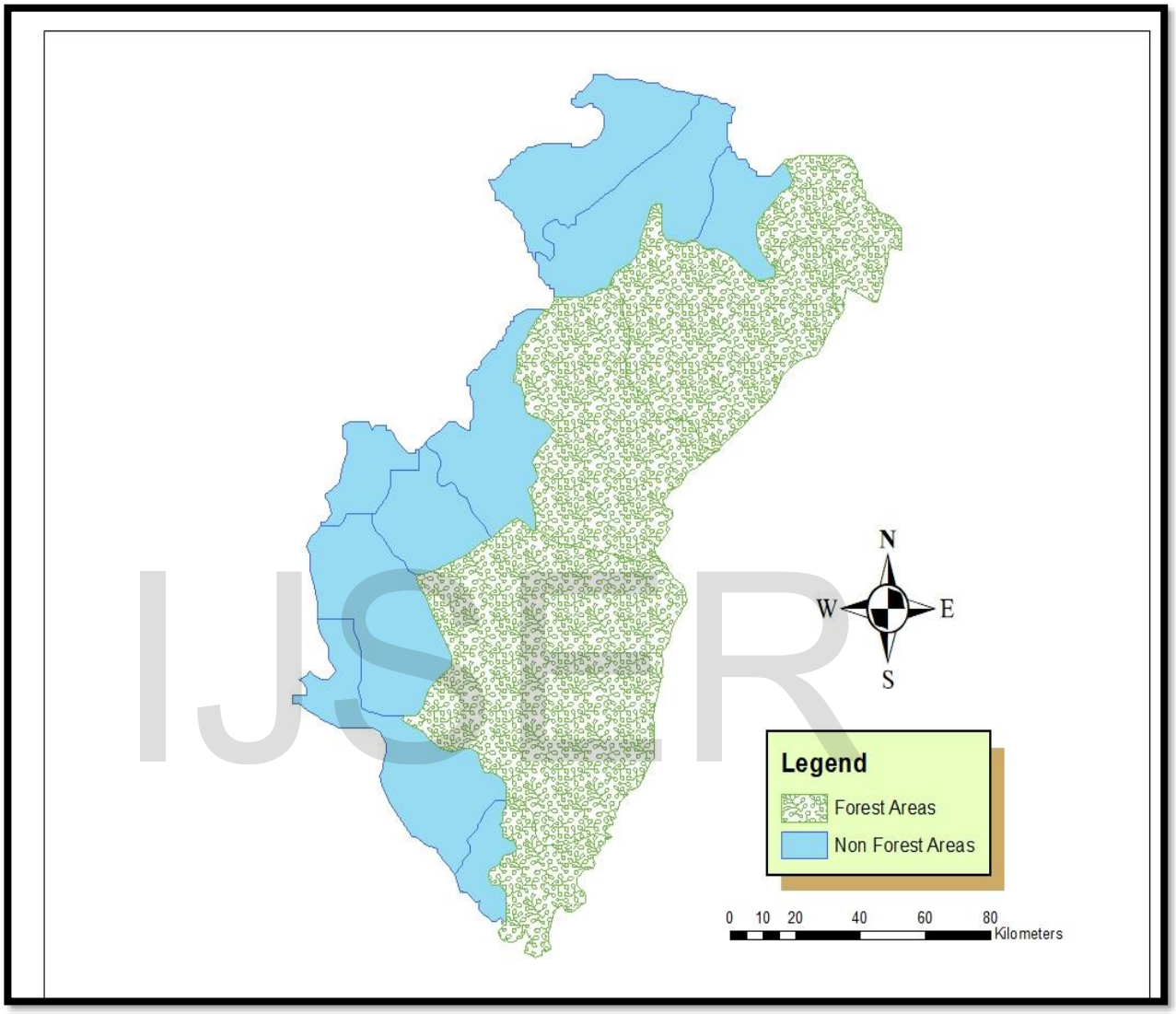

Figure 3: Map of Cross River State Showing Forest Areas

The concentration of forests in the Eastern flank of the state has over the years attracted deforestation (forest loss) in the area. The areas include Ikot Nakanda, Akamkpa, Odukpani, Biase, Yakurr, Ikom, Boki and Obudu. The high demand for timber, the high number of people using fuel wood, the percentage of people engage in subsistence farming, and the level of poverty prevailing in the study area have all resulted to the pressure on forest resources, which also affected the biodiversity specie.

Table 2: Biodiversity Extinction

S/No.	Name of Forest Reserve	Year Established	Area (KM^2)	% of Biodiversity Loss
1	Afi River Forest	1930	383.32	31%
2	Agoi Forest Reserve	1940	46.62	33%
3	Boshi Forest Reserve	1951	41.44	51%
4	Boshi Extension Forest	1958	67.34	35%
5	Cross River North Forest	1930	129.50	61%
6	Cross River South Forest	1930	349.65	21%
7	Ekinta Forest Reserve	1953	108.78	89%
8	Gabu Forest Reserve	1960	5.18	100%
9	Ikom Fuelwood Plantation	1960	1.06	100%
10	Ikrigon Forest Reserve	1928	5.29	100%
11	Lower Enyiong Forest	1930	28.49	100%
12	Cross River National Park, Oban	1912	3742.55	14%
13	Cross River National Park, Okwankwo	1930	468.79	17%
14	Ukpon River Forest	1930	313.39	16%
15	Umon Ndealeachi Forest	1930	108.78	49%
16	Uwet Odot Forest Reserve	1930	284.90	38%
17	Yache Forest Reserve	1931	15.54	100%
	Total		**6101.29KM^2**	

Source: Cross River State Forestry Project, 1994 & in Enuoh and Ogogo, 2018.

The Table 2 above shows the analysis of biodiversity extinction as a result of forest loss. The Table illustrated the nature of forest reserves in Cross River State, the year established, the area originally occupied by the forest, and the percentage of biodiversity lost due to deforestation.

Table 3: Causes of Forest Loss

S/No.	Causes	Frequency	Percentage
1	Poverty	11	6.1
2	Farming activities	45	25
3	Timber exploitation	42	23.3
4	Infrastructural development	12	6.7
5	Settlement expansion	19	10.6
6	Fuel wood consumption	51	28.3
	Total	**180**	**100**

Source: Data Analysis, 2020.

The Table 3 above shows about six (6) causes of forest loss (deforestation) in the study area. The greatest of all is fuel wood consumption with 28.3% followed by farming activities with 25% owing to the fact that about 75% of the entire population of the study area are engaged in subsistence farming with the very poor whose livelihood depends heavily on fuel wood for day to day living. Others are timber exploitation 23.3%, settlement expansion 10.6%, and infrastructural development 6.7% etc.

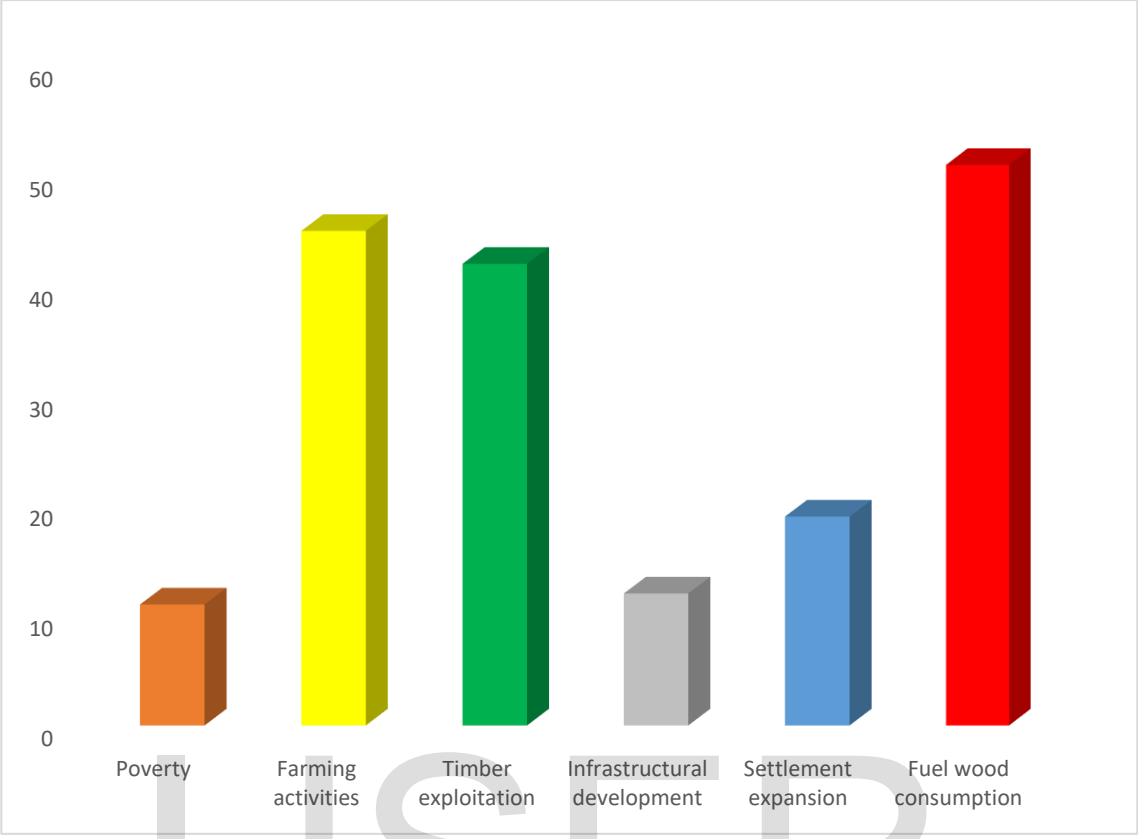

Figure 4: Bar Graph Showing Causes of Forest Loss

The Figure 4 above shows the various causes of forest loss with fuel wood consumption and farming activities as the highest followed by timber exploitation and settlement expansion etc.

Table 4: Management of Forest Resources

S/No.	Management	Frequency	Percentage
1	Youth	00	00.0
2	Government	52	28.9
3	Community	84	46.7
4	Individuals	00	00.0
5	Families	00	00.0
6	Companies	44	24.4
	Total	**180**	**100**

Source: Data Analysis, 2020.

The Table 4 above shows the management of forest resources in the study area with community forests leading with 46.7%, followed by government forests with 28.9 like the parks and protected areas, and finally companies with 24.4% like the Pamol and gmelina owned by the Calabar woods.

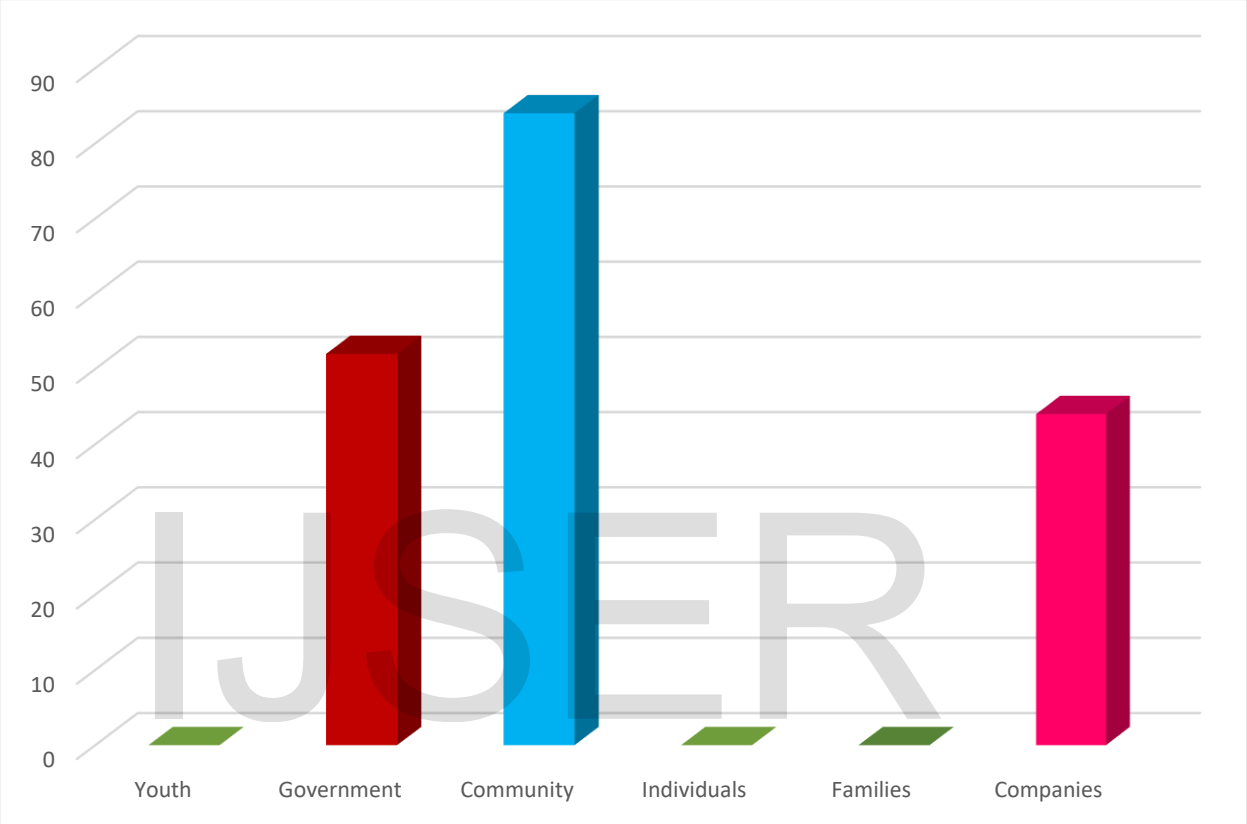

Figure 5: Bar Graph Showing Management of Forest Resources

The Figure 5 above, shows the management of forest resources in the study area. This explains that forest loss and biological extinction are quite greater in forest resources managed by communities, followed by government forests and lastly, those belonging to companies. The Figure 6 below shows the protected area system of forest management.

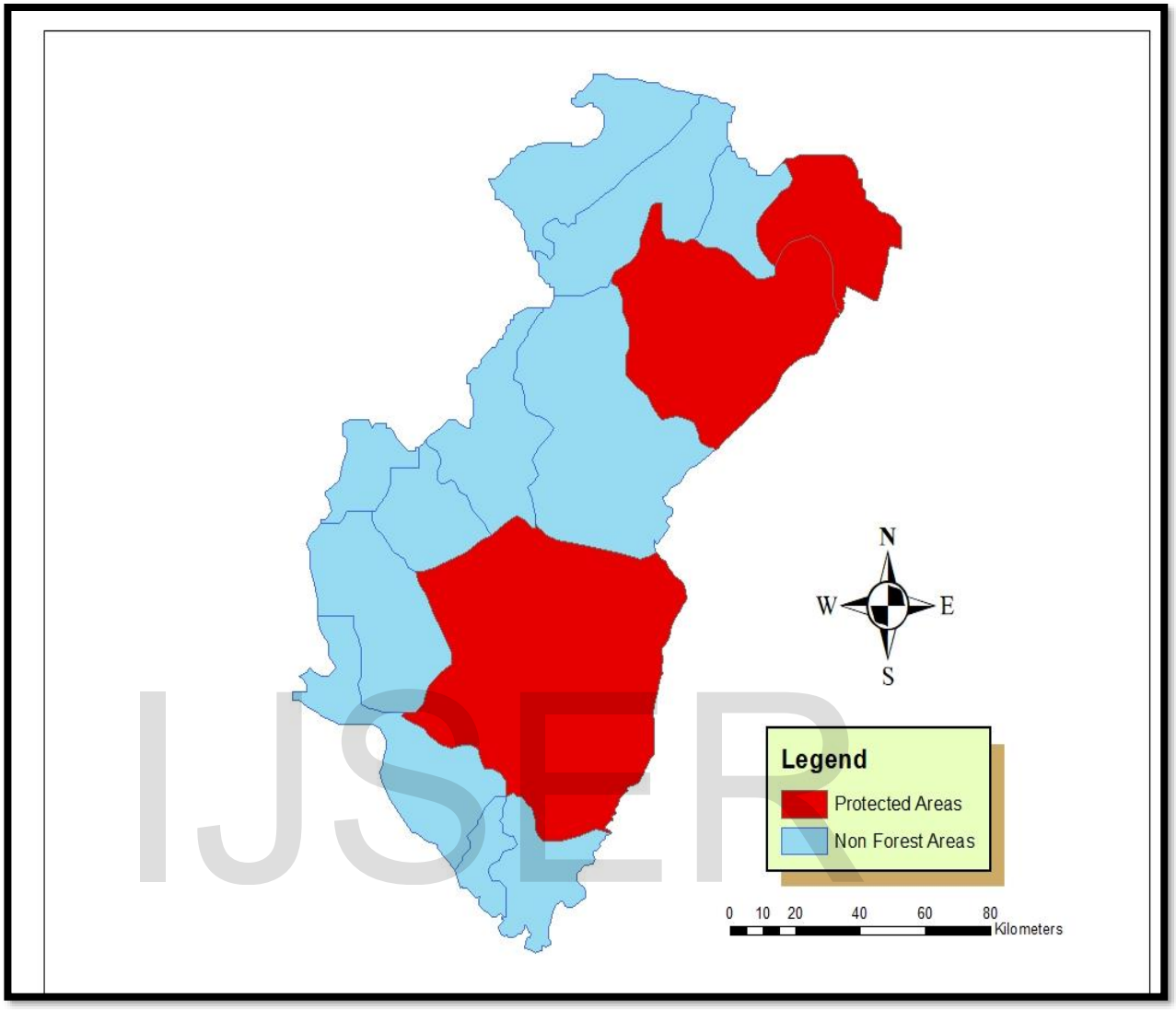

Figure 6: Map of Cross River State Showing the Protected Area System (PAS)

The Figure 6 above explains that the protected forest areas in Cross River State are the only areas where biodiversity specie exist at the moment example, the Cross River National Parks of Akamkpa and Oban division as well as the Sankwala area of Obudu where species like the Cross River Gorilla (*Gorilla gorilla* diehli) and the grey-necked rockfowl (*Picathartes oreas).* Others are Pottos (*Artocebus spp*), Monkeys (*cercopithecidae*), Baboons (*Papio anubis*), Drills (*Papio leucophaeus*), Chimpanzees (*Pan troglodytes*) etc. Many of which have long gone extinct especially in those areas that are predominantly experiencing loss of forest cover.

4. FINDINGS AND DISCUSSION

From the analysis and results above, it has been observed that loss of vegetation is the result of livelihood sustainability and occupation of the people of the study area, they depend basically on fuel wood for domestic purposes. Again, over 75% of the population is engaged in subsistence farming activities which is practiced yearly with a direct impact on the forests. There is also evidence of timber exploitation basically for commercial purposes and construction as well as settlement expansion.

With the aforementioned drivers of forest loss, it therefore, impact negatively on the soil leading to loss in its fertility which brings about low productivity giving rise to food shortage, hunger and poverty. Soil erosion and flooding are also induced, leading to environmental degradation, climate change and loss of NTFP. Biological diversity systems are in mass exodus going on extinction alongside forest clearance. The biodiversity extinction began as a direct impact on forest loss. The forests were original habitats for the organisms and formed a base and home for all the species some of which were wild, endangered, and rare and are not found any more in the remaining forests.

Over 69% (4209.8901KM^2) of the total forests of 6101.29KM^2 (see Table 2) in Cross River State has been lost. This clearance resulted to biodiversity loss because, a large population of these rare organisms went extinct, some of which were killed by hunters, others damaged, and some escaped to the nearby forests in the Republic of Cameroon. All these have made the left over forests in the study area not attractive as it were 50 years ago. However, the protected area system has remained the mechanism through which some forest areas have been reserved.

5. CONCLUSION

This study investigated the impact of forest loss on biodiversity systems of Cross River State, Nigeria. The results revealed that forest loss is caused by fuel wood consumption, farming activities, timber exploitation for commercial purposes, settlement development and infrastructure as well as poverty. This has direct impact on soil fertility loss, soil erosion and flooding, biological diversity extinction, climate change and reduction in the supply of NTFP.

The study also revealed that most of these species were dwelling in the forest areas and had long gone in extinction due to rapid clearance of their original habitats. It is also obvious that

community managed forests were cleared easily while the government managed forests only experiences encroachment. This was possible due to the mechanism of PAS available in government reserved forests like the Cross River State National Park. The introduction of REDD+ also give room for a climate resilient economy and improved the livelihoods of the people of Cross River through sustainable management of forests and reduced emissions from deforestation and forest degradation by at least 20% by the year 2030 and also attracts financial value for the carbon stored in forests.

REFERENCES

Bisong, F. E. (2001). *Nature Resource use and conservation for sustainable Rural Development.* Calabar: Baa Intern'l Computer Ltd.

Burtler, R. (2005). *World deforestation rates and forest cover statistics*. Retrieved from mongabay.com.

Enuoh, O. O. and Ogogo, A. U. (2018). Assessing tropical deforestation and biodiversity loss in the Cross River Rainforest of Nigeria. *Journal of Forestry*, 393-408.

Gandiwa, P., Matsvayi, W., Ngwenya, P., and Edson, G. (2011). Assessment of Wildlife and human settlement encroachment into the Northern Gonarezhou National Park Zimbabwe. *Journal of sustainable development in Africa*, 5-13.

Kamau, P. (2004). *Forage diversity and impact of grazing management on rangeland ecosystems in Mbeere District of Kenya.* Nairobi: Intern'l livestock research institute.

McDonald, M. A. (2003). The role of corridors in biodiversity conservation in production of forest landscapes: A Literature Review. *Tasforests*, 41-52.

Millennium Ecosystem Assessment. (2005). *Ecosystems and human wellbeing: Synthesis.* Washington DC: Island Press.

Noss, R. F. (1990). Indicators for monitoring biodiversity: A hierarchical approach. *Conservation Biology*, 355-364.

Putz, F. E., Redford, K. H., Robinson, J. G., Fimbel, R., and Blate, G. M. (2000). *Biodiversity conservation in the context of tropical forest management.* Chicago: The World Bank.

Rotich, D. (2012). Concept of zoning management in protected areas. *Journal of Environment and Earth Science*, 173-183.

UNEP. (1991). *United Nations Environmental Program: Global Biodiversity.* England: World Publications.

UNFCCC. (2008). *United Nations Framework Convention on Climate Change: Climate change, impact, vulnerability and adaptations in developing countries.*

UN-REDD. (2015). *Study on the drivers of deforestation and forest degradation in Cross River State.* UN: National Space Research and Development Agency.

World Rainforest Movement. (2002). *world rainforest movement.*

Yaro, M. A. (2015). The impact of forest encroachment on the distribution of tree species in Cross River National Park, Oban division, Nigeria. *Journal of Environmental Protection*, 744-754.

Yaro, M. A., Okon, A. E., and Obongha, U. E. (2018). Impact of Deforestation on livelihood Sustainability in Awi, Akamkpa LGA, Nigeria. *Journal of Geography and Development*, 990-1007.

Yaro, M. A., Okon, A. E., Bisong, F. E., and Obongha, U. E. . (2016). Impact of forest encroachment on rural livelihood in Akamkpa division of Cross River National Park, Nigeria. *Journal of Environment and Earth Science*, 76-86.