



ECOLOGICAL EFFECT OF DEFORESTATION IN FOREST RESERVE: A CASE STUDY OF MOKWA LOCAL GOVERNMENT AREA OF NIGER STATE, NIGERIA

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ABSTRACT: Forest is an important resource for maintaining balance environment. Given the population pressure on forest resources in reserved forest, such as shifting cultivation, overgrazing and felling of trees, forest resources have been depleted to a great extent resulting in soil erosion, flooding and other environmental hazards. It is clear that destruction of forest is destruction of soil ecosystem, plants and communities leading to severe environmental consequences. This study was undertaken to determine ecological effect of deforestation on forest resources and environmental implications on vegetation of Mokwa forest reserve. Data were collected using structured questionnaire and reconnaissance survey. Seven communities were selected around the forest reserve namely Bokani 1, Bokani 2, Bokani Sabo, Ezhi, Takuma, Kpaki and Kudu. A total of 392 questionnaires were administered in the seven communities based on the proportion of their population from the projected 2015 population. Data were collected on cutting of trees, reason for deforestation and effect of deforestation on the environment. Data were analysed using descriptive statistics. The study showed that major causes of deforestation are cutting of trees for firewood (47%) and crop cultivation (25%) which resulted into soil erosion. The findings also revealed consequences of deforestation in the area to include loss of soil fertility (36.5%), loss of forest products (35.5%), loss of species diversity (14.5%) and accumulation of carbon dioxide (6.1%) respectively. Hence, policy makers and stakeholders need to adopt policies that will discourage deforestation by inhabitants through afforestation, reforestation, tree husbandry and planting in the areas, as well as sustainable empowerment programme to boost livelihood of the rural populace in order to reduce over dependence on the forest reserve.

Keywords: Ecological effect, deforestation, forest reserve, vegetation, forest resources

1. INTRODUCTION

Forest is naturally endowed with numerous resources that are valuable to mankind (FAO, 2003), and are available on forest land (Akpan and Ofiong 2007). Nigeria forest resources includes materials such as timber, fuel wood, nuts, fruits, honey, mushroom, medicinal herbs, bush meat/wild life, forage, spices, resin, gum, industrial raw materials and income, as well as conservation for sustainable agriculture. Nigeria was once covered by extensive vegetation varying from humid tropical forests in south to

savannah grasslands in the north. Unfortunately, a great percentage of the vegetation has been removed due to various human activities such as increase in demand for forest resources, and technology adopted by man for extraction without corresponding advancement in sustainable management has caused severe deforestation and degradation, leading to Nigeria having world highest deforestation rate of primary forest (Jimoh, 2001; Johannesburg Summit, 2002; FAO, 2008 cited in Azua 2018).

Forest reserve is an area designated by state for protection of timber and other forest resources where harvesting of timber may be allowed under permit or concession to people in surrounding communities. Deforestation is the removal, cutting or destruction of trees without sufficient replacement leading to depletion of important elements in nature thereby making it difficult for forest ecosystem to maintain its natural balance (Encyclopedia, 2008 cited in Azua, 2018). The imbalance of natural forest cycle threatens all living organisms that depend on forest for food, shelter and protection (Azua, 2018). It is a common phenomenon in forest reserve, and includes not only conversion to non-forest, but degradation which reduce forest quality, density and structure of trees, ecological services supplied, biomass of plants and animals, species and genetic diversity. Hence, view has been expressed on problems associated with deforestation which may include over exploitation of other natural resources, low efficiency in forest tax collection, misuse and abuse of forest resources, decrease in forest stocks, lack of priority given to re-investment in forest development as well as poor land management (Ibimilua, 2012).

Apart from all these and part consequences, its equally responsible for environmental degradation, loss of forest cover, reduction in livelihood base of several millions of people, increase in rural poverty, and unemployment.

Oduntan *et al.* (2013) evaluated the degree of pressure and threats from human activities on protected areas in Yewa division Ogun State, Nigeria and observed that all the four forest reserves sampled were severely threatened by logging, conversion to land use, grazing and cross boundary influence. Quite a number of empirical studies exist on the consequences of deforestation (Brookfield, 1992; Rosenzweig and Parry, 1994; Western, 1999; Bruijnzeel, 2004), and deforestation has been confirmed to be responsible for damage to habitat, biodiversity loss and aridity, extinction of rare species of plants and animals, climate change, environmental destruction and subsequent damage to sensitive living balance of the ecosystem.

In Mokwa Local Government Area (LGA) of Niger State, forest resources are undergoing depletion as a result of active deforestation to get land for food crop cultivation, lumbering, sand excavation, road construction and fuel-wood exploitation (Jeminiwa *et al.*, 2020). More so, pressure on land due to high population density occasioned by influx of people to the area, practice of shifting cultivation and annual bush burning all combine to degrade the forest. These have impacted negatively on the forest ecosystem. Once the forest is exploited of its trees, soil physical and chemical properties are greatly affected. The increasing trend of deforestation for many agricultural

and non-agricultural activities with total disregard for attendant consequence on soil fertility, environment as well as conservation of eco-biodiversity becomes an issue of concern.

The highlighted studies were limited to change in vegetation cover in reserve forest area due to deforestation and its implications on environment. In Mokwa L.G.A, the forest reserve is along Mararaba Bida/Mokwa Jebba road. It covers an area of about 5929.12 hectares of land with species such as Teak, Gmelina, Eucalyptus and other tree species planted. It's against this background that this study was conducted to evaluate the ecological effect of deforestation in reserved forest areas.

2. MATERIAL AND METHOD

2.1. Study Area

The study covers vegetation of Mokwa forest reserve in Mokwa local government area of Niger State. It lies within latitudes 9°12' to 9°18' North and longitudes 5°4' to 5°12' East, covering a land area of about 5929.12 hectares (Jeminiwa *et al.*, 2020). It has a tropical continental climate characterized by a shorter wet season (May to September) and a longer dry season (October to April) with a temperature of 15°C to nearly 40°C (Adeniji *et al.*, 2015). It shares boundaries with other local government areas; Mashegu to the North, Lavun to the East, Edati to South East and Borgu to the West. The long southern border of is form by River Niger from Jebba Lake in the west beyond the confluence of the Kaduna River in the east with Kwara and Kogi States across the Niger from the LGA respectively (Figure 1).

2.2. Reconnaissance Survey

A reconnaissance survey was carried out to familiarized with the area. The area has seven communities namely; Bokani 1, Bokani 2, Bokani Sabo, Ezhi, Takuma, Kpaki and Kudu were identified for the purpose of generating primary data through structured questionnaire around forest reserve.

2.3. Sampling technique and Sample size

Simple random sampling technique was used to administered questionnaire in the selected communities around the forest reserve, and purposive sampling was used to select two longest serving forest field officers and male household heads among communities for interview. Yamane (1967) formula was used to calculate sample size of 392 respondents with 95% confidence level and 5% sampling error assumption based on total projected population of 18760 for 2015, and the total population was also used to determine proportion of respondents in each

village from the total estimated respondents of 392 (Table 1).

$$n = \frac{N}{1 + N(e)^2} \quad (\text{Yamane, 1967})$$

Where n= Sample size

N= Population size

e= Sampling error.

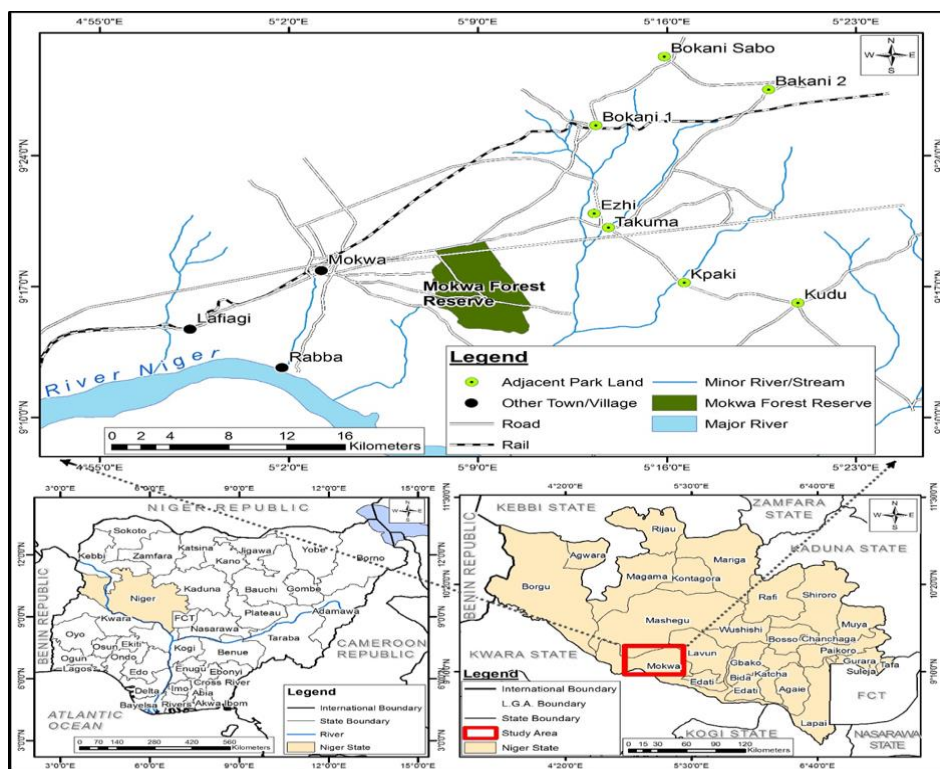


Figure: 1 Map of Niger State showing the study area
Source: Adapted from the Administrative map of Niger State

Table 1: Distribution of Sample Size of Respondents

Community	Population (1991)	Projected Population (2015)	No of Respondents	Percentage
Bokani 1	590	1296	27	6.9
Bokani 2	564	1238	26	6.6
Bokani Sabo	1738	3817	80	20.4
Ezhi	296	650	14	3.6
Takuma	1506	3307	69	17.6
Kpaki	1272	2793	58	14.8
Kudu	2577	5659	118	30.1
Total	8543	18760	392	100

Source: Compiled by Author (2015)

2.4. Data collection and Analysis.

The study utilized data from primary and secondary sources. The primary data was structured questionnaire used to obtain information from members of the communities and forest field officers on deforestation and environmental implication in the forest reserve. While secondary data were obtained from review of literature, relevant books from forest reserve, Federal and State Ministry of Forestry,

published and unpublished. Data collected were subjected to statistical analysis using descriptive statistics.

3. RESULTS AND DISCUSSION

3.1. Reasons for cutting down of trees in the reserved forest area

The various reasons adduced by respondents for continuous cutting of trees in the reserved forest are shown in figure 2.

The higher percentage (47%) of respondents reported fuel wood harvesting as major cause of deforestation, and this could be attributed to dependence by a large number of the household relying on fuel wood as a source of heat energy for domestic uses, and major energy sources for rural and urban populace (Jeminiwa *et al.*, 2020; Sedano *et al.*, 2016), 25%

attributed it to crop cultivation, while 16% indicated urbanization/industrialization and infrastructure development as another cause of deforestation. This implies that there is constant deforestation in the area which is in line with response of field officer that corruption and urbanization are some of the factors responsible for deforestation. The implication of this is that expansion of cities and towns requires land to establish various infrastructures necessary to support growing population which is done by clearing the forest.

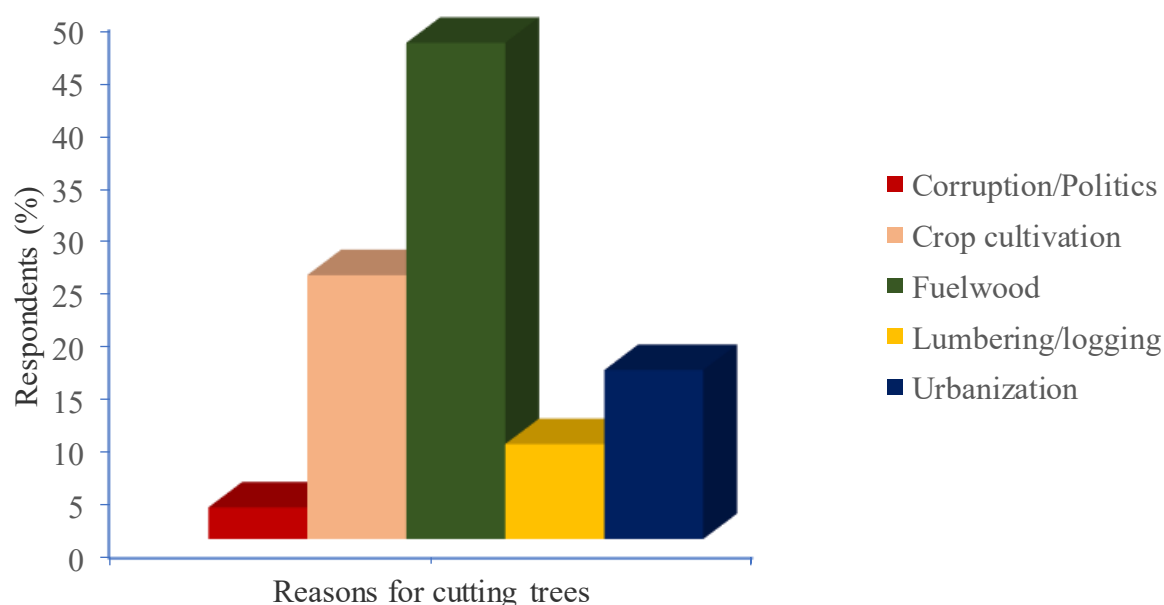


Figure 2: Chart showing reasons for cutting of trees in the forest reserve (Source: Field Survey, 2015)

Critical analysis of the result indicated that (9%) of respondents reported that lumbering and logging are among causes of deforestation in the reserved forest area, while the remaining 3% believed corruption and politics to be responsible. Selective logging does not necessarily cause deforestation. However, logging can seriously degrade forests (Putz *et al.*, 2001) but can provides access roads to follow-on settlers, and log scales can help finance cost of clearing remaining trees and preparing land for planting of crops or pasture. Logging thus catalyzes deforestation (Chomitz *et al.*, 2007).

3.2. Respondents' reasons for continuous deforestation of the forest reserve

The factors responsible for continuous deforestation of the reserved forest in the study area are given in

Table 2. The result revealed the rationale for most of respondents being much engage in tree cutting with 57.4% depending on tree cutting for income, while 21.9% and 20.7% of the respondent believed that farming activities and corruption are the reasons. Generally, irrational profit making has caused deforestation and forest degradation in the area through illegal logging, introduction of cash crop and exotic varieties which are unfriendly to forest ecology and brokerage system. The implication of the above high percentage of respondents being involved in clearing of forests for agricultural activities indicated that there is constant deforestation occurring in the area. This attest to the finding of FAO (2012) that commercial agriculture is a major cause of deforestation and forest degradation in the tropical forests in the world.

Table 2: Reasons for Continuous Deforestation

Reasons for deforestation	Frequency	Percentage
Farming	86	21.9
Source of income	225	57.4
Corruption	81	20.7
Total	392	100

3.3. Effect of deforestation on the environment

The effect of deforestation in the forest reserve on the environment is highlighted in Table 3. The results from table 3 showed effect of deforestation in the area with 36.5% of respondents reporting soil fertility loss as a major deforestation effect in the environment. This could be due to loss of vegetation cover leading to soil erosion/surface run-off resulting in low productivity of the forest soil. This is in line with the report of Habtamu *et al.* (2017) who observed that soil erosion is one of the grievous effects of forest degradation in tropical zone, while 35.5%, 14.5% and 7.4% of the respondents attributed effect of deforestation to loss of forest products, loss of local species richness and biodiversity, and loss of aesthetic value respectively. This is because deforestation and forest degradation are the principal causes of forest cover change in tropical forests (Achard *et al.*, 2007). Similarly, 6.1% of the respondents were of the view that carbon dioxide accumulation also results from

deforestation, and contribute to global warming which occur from increased atmospheric concentrations of greenhouse gases (GHG) leading to net increase in global mean temperature as forests are primary terrestrial sink of carbon. This corroborates the report that deforestation is one of the major drivers of global warming through reduction in vegetation cover of tree species which play a principal role in carbon sequestration that helps in reducing atmospheric concentration of greenhouse gases (GHG) (Jeminiwa *et al.*, 2020). It has also been reported that over two billion tons of carbon (CO₂) were emitted into the atmosphere per year as a result of deforestation of tropical forests (Houghton, 2005). This is in line with the report of Sumit *et al.* (2012) who opined that deforestation have a debilitating effect on global atmosphere with consequential impacts on human wellbeing around the world. Thus, deforestation disrupts global carbon cycle with increase in concentration of atmospheric carbon dioxide.

Table 3: Effect of deforestation on the environment

Effect	Community							Total	%
	Bokani 1	Bokani 2	Bokani Sabo	Ezhi	Kpaki	Kudu	Takuma		
LSF	7	5	30	4	20	48	29	143	36.5
LFP	15	14	25	5	28	30	22	139	35.5
LLS	5	1	15	3	10	15	8	57	14.5
LAV	0	2	6	2	0	15	4	29	7.4
ACO ₂	0	4	4	0	0	10	6	24	6.1
Total	27	26	80	14	58	118	69	392	100

LSF = Loss of soil fertility **LFP** = Loss of forest products **LLS** = Loss of local species richness and biodiversity

LAV = Loss of aesthetic value **ACO₂** = Accumulation of carbon dioxide

Source: Field survey 2015

4. CONCLUSION

The study examined effect of deforestation in forest reserve in Mokwa LGA of Niger state, and its environmental implication. It was observed that forest resources are under serious depletion due to deforestation activities. The findings also revealed that deforestation has a significant effect on natural biodiversity and physical environment. The rate of deforestation is at an alarming rate in the area with

negative impact on natural biodiversity and physical environment. Hence, it is hereby concluded that effective measures and policies should be implemented to prevent continuous act of deforestation now and in future.

REFERENCES

Achard, F., De Fries, R., Eva, H., Hansen, M., Mayaux, P. and Stibig, H. J. (2007). Pan-tropical

- monitoring of deforestation, *Env. Res. Letters* 2:45-67
- Adeniji, O. A., Zaccheaus, O. S., Ojo, B. S. and Adedeji, A. S. (2015). Charcoal production and producers' tree species preference in Borgu local government of Niger State, Nigeria. *J. Energy Tech. and Pol.* 5: 1-8.
- Akpan, P. L. and Ofiong, M. O. (2007). Effective forest resource management in Nigeria: A panacea for sustainable development, www.ssm.com/abstract=1447875.
- Azua, S. (2018). The impact of deforestation on land use system in Zaria. *Nigeria Journal of Surveying and Geoinformatics*, 3(1): 32-41
- Brookfield, H. C. (1992). "Environmental Colonialism, "Tropical Deforestation and Concerns other than Global Warming. *Global Environmental Change* 2: 93-96
- Bruijnzeel, L. A. (2004). "Hydrological Functions of Tropical Forests: Not seeing the soil for the trees? *Agriculture Ecosystems and Environment* 104 (1): 185-228.
- Chomitz, K. M., Buys, P., Luca, G. D., Thomas, T. S. and Wertz-Kanounnikoff, S. (2007). At loggerheads? Agricultural expansion, poverty reduction and environment in the tropical forests. World Bank Policy Research Report. World Bank, Washington DC.
- FAO (2003) Forestry Outlook Study for Africa – African Forests: *A View to 2020*, African Development Bank, European Commission and, Food and Agriculture Organization of United Nations, Rome, 18 www.ftp.fao.org/docrep/fao/005/Y4526B/y4526b00.pdf.
- FAO, (2012). Drivers of deforestation and forest degradation: A synthesis Report for REDD+ policy makers. *Kagera Agro-Ecos.*, 2:1-10.
- Habtamu, W. E., Debela, H. F. and Serekebirhan, T. (2017). Impacts of deforestation on the livelihood of smallholder farmers in Arba Minch Zuria Woreda, Southern Ethiopia. *Afr. J. Agric. Res.* 12(15): 1293-1305.
- Houghton, R. A. (2005). Tropical deforestation as a source of greenhouse gas emissions. In: Tropical deforestation and Climate change, eds. Moutinho, P. and Schwartzman, S. Amazon Institute for Environmental Research, Belem Brazil 13-20.
- Ibimilua, A. F. (2012). Appraisal of the Causes and Consequences of Human Induced Deforestation in Ekiti State, Nigeria. *Journal of Sustainable Development in Africa*, 14(3): 37-52
- Jeminiwa, O. R., Jeminiwa, M. S., Taiwo, D. M., Dauda, M. and Olaoti-Laaro, S. O. (2020). Assessment of forest degradation indices in Mokwa forest reserve, Niger State, Nigeria. *J. Appl. Sci. Environ. Manage.*, 24 (8): 1351-1356.
- Jimoh, S. C. (2001). Mangrove Degradation in the Coastal South-East of Nigeria: Causes, Effects and Remedies for the Future, In: Popoola, L., Abu, J.E. and Oni, P.I. (eds), Forestry and National Development, FAN publication, Ibadan, pp.17-38.
- Johannesburg Summit (2002). Combating deforestation in Nigeria. Published by United Nations.
- Oduntan, O. O., Soaga, J. A. O., Akinyemi, A. F. and Ojo, S. O. (2013). Human activities, pressure and its threat on forest reserves in Yewa division of Ogun State, Nigeria, *Journal of Environmental Research and Management* 4(5): 260-267.
- Putz, F. E., Blate, G. M., Redford, K. H., Fimbel, R. and Robinson, J. (2001). Tropical forest Management and Conservation of Biodiversity: An overview. *Conservation Biology* 15: 7-20.
- Rosenzweig, C. and Parry, M. L. (1994). Potential Impact of Climate Change on World Food Supply. *Nature* 367: 133-138
- Sedano, F., Sila, J. A., Machoco, R., Meque, C. H., Siteo, A., Ribeiro, N., Anderson, K., Ombe, Z. A., Baule, S. H. and Tucker, C. J. (2016). The impact of charcoal production on forest degradation: A case study in Tete, Mozambique. *Env. Res. letters* 11(9): 1088-1100.
- Sumit, C., Gosh, S. K., Suresh, C. P., Dey, A. N. and Gopal, S. (2012). Deforestation: causes, effects and control strategies. Intech open: Creative Commons Attribution 3.0 License, *Global Perspectives on Sustainable Forest Management*, 51:958-981
- Western, D. J. (1999). "Biodiversity as a form of Land Use". *Environment and Development Economics* 44(2): 233-236.
- Yamane, T. (1967). Statistics: An Introductory Analysis, 2nd edition New York. Harper and Row.