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THE NAGI FOREST DENSITY AND NEED FOR PROTECTION

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ABSTRACT

This study analysed the types of forest, the area coverage of the forest types, tree species composition and density of the forest types in Nagi district. The study was carried out through field measurement and observation. Other forms of data are derived from documented information from the Benue State ministry of animal and forestry, topographic map of Gwer- West local government area and Rabelat Nigeria limited company. Data on the existing types of forest in Nagi district are collected into classes or categories of wild forest, reserved forest and gallery forest. Their measured spatial area is coded in tables. The observed and counted number of tree stands in the quadrant was analyzed using the poison probability distribution and quadrant analysis. The result showed that the reserved type of forest because of its protection has the highest species diversity and density, followed by the gallery and the wild forest types. Some activities such as farming, lumbering and bush burning are depleting the Nagi forest density and militating against its sustainability. Recommendations are made that will mitigate the impact of forest depleting activities in the Nagi district and ensure sustainable exploitation of the forest resources.

INTRODUCTION

The vulnerability of Nigeria forestland areas to de-reservation, encroachment and deforestation without protection, control and legislation is completely intolerable and may suffer more wearisome abuse in the future than in the past and present (Akinola and Akindele 2012). It is worth mentioning that every environment is made up of ecounits, ecogroups and ecosystem delicately balanced and related. These ecological components perform best in a relatively undisturbed environment (Okafor, 1988). Areas that are interfered with by human exploitation usually have these components disturbed and the balance disrupted. The effects of the disturbance vary in severity depending on how much of the natural environment is still preserved in the process of resources exploitation and development. Renewable natural resource managers often have to choose between actions that are economically efficient and those that are ecologically and environmentally friendly. Sustainable management that promotes maximum resources yield, use and conservation becomes paramount.

Sustainable forest management is understood as a system of management that guarantees continues exploitation of the forest

resources that are governed by operational rules and regulations which guarantee the inexhaustible or everlasting existence of the biologically diverse forests for purposes of future benefit and advantages (Papka, 2005). In order to achieve sustainability in forest management, Palmer and Synnott (1991) identified that there should be; adequate information about the forest stock, security of land use and suitable financial and political environment.

It is important to have good knowledge of the stock of diverse forest resources that are available in different ecological zones of the country. The ecological knowledge and skills should be combined with adequate planning, organizations, political good-will and management of resources. Survey of stock and potentials of natural, economic and human resource is necessary in order to develop suitable management policy and a realistic strategic ecological, socio-economic and political factor (Fuwape, 2005). Okali (1997) indicated that such a national survey should include study of flora and fauna biodiversity, land use pattern along with analysis of land capability. This should form the basis for adopting appropriate management procedure that takes account of the potential forest goods and services as well as alternative forms of land use.

Forest management policies must accommodate all human, social, political and economic factors that affect the forest. Link should be developed between ecological, demographic, economic and cultural factors that affect the pressure exerted on forests for goods and services (Osemeoba, 1988). In this study, existing forest types at Nagi disrict are identified, spatial extent of the forest types are determined, the forest density of Nagi forest is analyzed and recommendations are made that may help to protect the forest environment.

FOREST AS A RESOURCE

Forests are important for the fact that they comprise plants which are producers and they serve as habitat for animals. They have the ability to convert inorganic compounds into food using sunlight through the process of photosynthesis. Thus, forests provide the primary source of food for man and other animals. Nutrients are recycled through Plants particularly forests; the leaves from plants die and decay to form humus which adds nutrients to the soil. Forests help control micro- climate by influencing wind, temperature, humidity and rainfall.

Tress shades the ground thereby preventing part of solar radiation from reaching the ground surface. They reduce the amount of outgoing radiation thus moderating the temperature and moisture content of the atmosphere. Forested watersheds also act as a giant sponge that absorb, hold and gradually release water thus recharging springs, streams and ground water aquifers and controlling erosion. Forests are carbon sinks that absorb carbon monoxide thus reducing green house effects.

Forest provide habitat for organisms that make up the earth's biodiversity. Many small animals use tress as shelter and projection from predators. Forests help absorb noise and some air pollutants, cool the air and nourish the human spirit by providing solitude and beauty.

Tee and Ageende (2005) enumerated the economic benefit potentials of Benue forest as fuel wood, lumber, food, oil, exudates, fiber and medicinal extracts.

STUDY AREA

The Nagi forest district has a spatial coverage of about 12.5km^2 and is located on longitude 8^0 9^1 E latitude 7^0 41^1 N. The Nagi forest district is found about 12km along Naka-Agagbe road (Figure 1). The study area is located within the tropical sub-humid climate, i.e. tropical wet and dry (Aw) climate. It experiences two seasons. The dry season starts from late November and terminates in March. During this period, the tropical continental air mass dominates and harmattan wind which is characteristically dry, cold and hazy prevails.

The wet season starts from April to October. It characterized by rainfall and wet conditions with the peaks in August/September. Early November records sparse rainfall and usually serves as a period of transitional weather. Annual mean rainfall is about 1200mm while mean annual temperature is about 32.5^{0}C. The study area is identified with the guinea savannah vegetation type. Trees grow side by side with very tall grasses. The dominant tree specie is *daniella olivera.* Other species include *propsis african,* and *vitax doniana* There are natural occurring wild forests, gallery forests, village forests and reserved forests.

The study area has an undulating terrain characterized by interfluves with hills averaging 30-40 meters. Most of the remaining area lies below 600ft (183m). The area is drained by Nagi and Kpukujembe streams. The soil is mostly tropical ferruginous formed from different parent materials. Clay-loamy soil type dominates with sandy lateritic soil type occurring at Nagi town.

MATERIAL AND METHODS

This study is carried out through measurement and observation. The researcher measures and makes critical observations at the Nagi forest and directly obtains information for this work. Other forms of data sources include documented information from the Benue State ministry of animal and forestry, information from topographic map of Gwer-West local government area and data from Rabelat Nigeria limited company, a company the Ministry of animal and forestry Benue State has contracted to collect revenue accruing from the use of forest resources. The needed data for this research was acquired through the following ways:

a) The researcher went to Nagi district and observed the forest. This helped to ascertain the types of forest at Nagi as wild, reserved and gallery forests.

b) The spatal extent of the various types of forests at Nagi district was determined from the topographic map of the area and gazette information from the ministry of animal and forestry Benue state.

c) The number of tree stands per M^2 was acquire for the different types of forest through field observation by identifying the species composition and counting using quadrant sizes of 20m x 20m squares and 40mx10m rectangles in the forests for five different points . The stratified sampling method is adopted for the quadrant. The various forest types, namely wild, reserved and gallery forests formed the strata. In the wild and reserved forests each, five 20mx20m square quadrant sizes were sampled while in the gallery forest, five 40mx10m rectangular quadrant sizes were observed. This is due to the longitudinal nature of gallery forests. The quadrant sample are taken along a line transect depicted in figure 2.

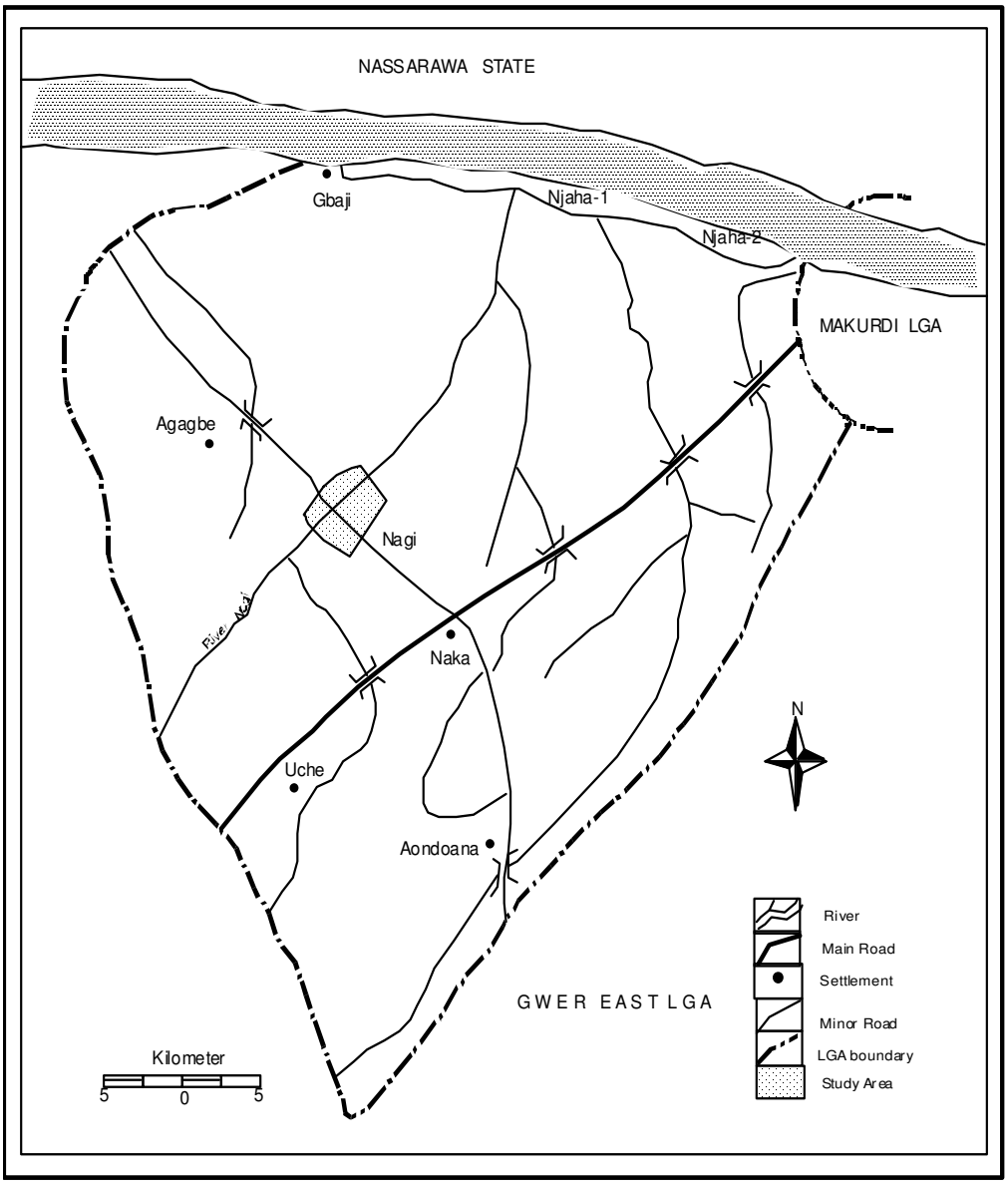

Figure 1: Gwer- west local government showing the study area

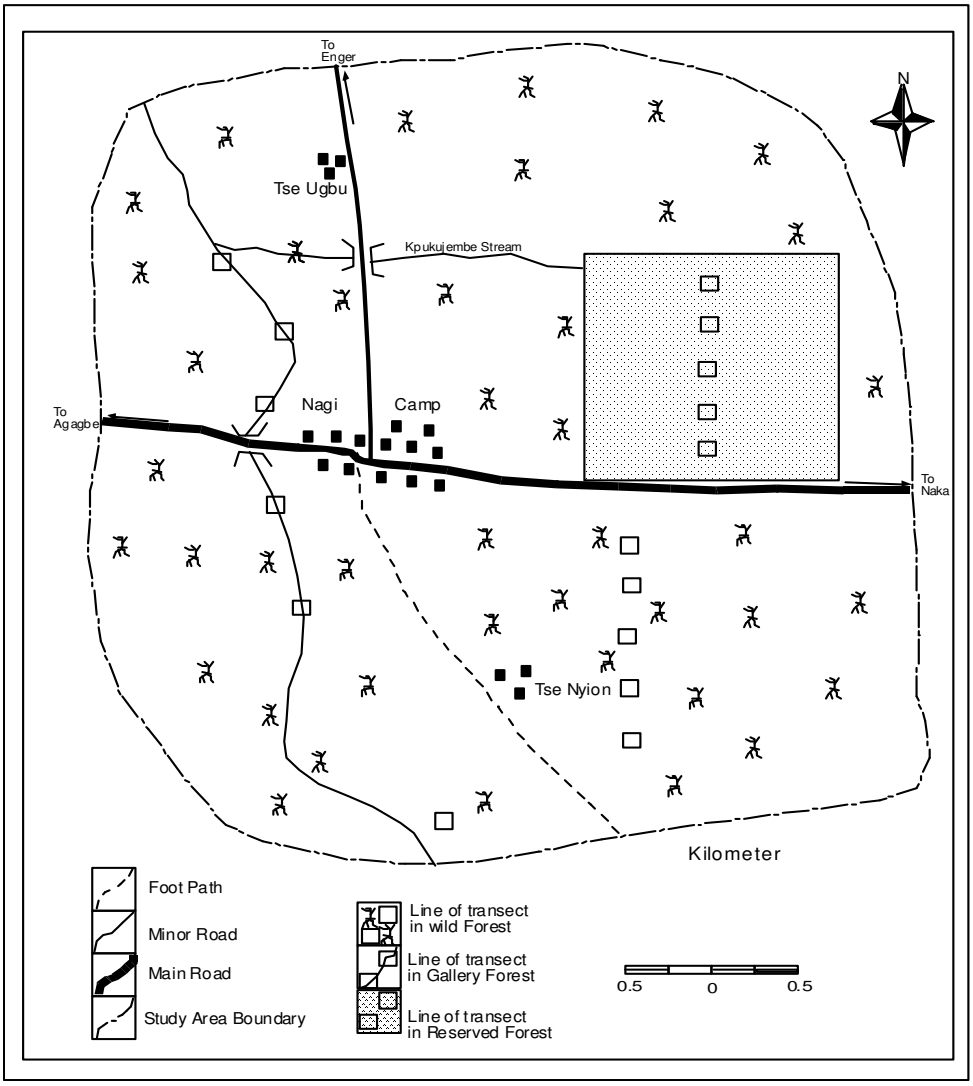

Figure 2: Line transects along the different forest types in Nagi district.

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All data collected for this study was coded an analyzed as follows:

Data on the existing types of forest in Nagi district are collected into classes or categories of wild forest, reserved forest and gallery forest. Their measured spatial area is coded in tables. The observed and counted number of tree stands in the quadrant is analyzed using the "poison probability distribution and quadrant analysis" with formula:

$$P(X=K) = \frac{e^{-\lambda} \cdot \lambda^{K}}{K!}$$

Where;

X= quadrant

K= number of points (k = 0,1,2…n)

e = constant approximated 2.7183 (Napierian log)

λ = mean density of points

- This is used to calculate the expected number of tree stands for the various forest types, which shows the variation in density of the forest types.

RESULT AND DISCUSSION

TYPES OF FORESTS AT NAGI DISTIRCT AND THEIR AREA COVERAGE

The researcher's observation of Nagi district recognizes three types of forest in the area namely; Wild forest, Gallery forest and Reserved forest. The spatial areas of these types of forests are shown in the table 1. The wild forest covers a greater area of the Nagi region. This type of forest grows naturally and little attention is accorded it by forest managers. The gallery forest type occurs along river banks. Moisture from the river valley supports the growth of such trees on the bank. This type of forest is not wide spread because its limitation to riverbanks. The reserved type of forest is part of the wild forest that is protected by forest managers. The land was declared reserved in 1965 by the Tiv Native Authority and named "Mbakpa Forest Reserve" (Divisional forest office, Gwer-west LGA, 2006).

Table 1: Spatial areas of types of forest in Nagi District

Types of forest	Area	Percentage area of the forest
Wild	10.1km^2	89.7%
Gallery	0.056km^2	0.5%
Reserved	1.1km^2	9.8%
Total	11.258km^2	100%

Source: Researchers field work 2013.

The Wild type of forest at Nagi district is larger having a spatial area of 10.1km^2 which constitutes 89.7% of the entire forest area of Nagi district. The reserved type of forest follows with a spatial area of 1.1km^2 comprising 9.8% of the total forest area of Nagi district and the gallery forest has an area of 0.056km^2 which is 0.5% of the total spatial area of Nagi district.

TREE DENSITY OF THE FOREST TYPES

Table 2 shows the result of observed quadrants of the different types of forest in Nagi district. It shows the number of trees within each quadrant and the specie composition of the quadrants. In the wild forest, the first quadrant has 12 tree stands, the second 10, the third 8, the fourth 11 and the fifth 9 tree stands. Tree species composition in the wild forest shows 12 species in the first quadrant, 8 in the second, 6 in the third, 9 in the fourth and 4 species in the fifth quadrant.

In the reserved forest, the first quadrant has 55 numbers of tree stands, the second 53, the third 61, the fourth 49 and the fifth quadrant has 57 tree stands. The tree species composition show 15 species in the quadrate, 22 in the second, 25 in the third, 21 in the fourth and 19 species in the fifth quadrant.

Within the gallery forest, the first quadrant has 25 tree stands, the second has 16, the third has 20, the fourth 19 and there were 15 tree stands in the fifth quadrant. The species composition is 10 species in the first quadrant, 7 in the second, 8 in the third, 6 in the fourth and 6 species again in the fifth quadrant.

The types of forest at Nagi district are seen to have different tree densities. The reserved type of forest because of its protection has the highest species diversity and is densely forested. It therefore has greater potentials of resources for exploitation. The gallery forest because of the moisture supplement has density greater than the wild forest type. Gallery forests are not affected by bush fires because of the moisture from the river valley thus supporting its greater density. It is however, not wide spread thus limiting the quantity or amount of resources it offers. The naturally occurring extensive wild type of forest has the lowest density of tree stands in Nagi district. This is due to almost unrestricted exploitation since the forest type is least protected. If the wild forest type is protected, it will regenerate and provide greater resources.

Table 2: Quadrant result of types of forest at Nagi district

Types of forest	Total number of trees observed in a quadrant					Total number of species in a quadrant					Density (Tree/m^2)
	1st	2nd	3rd	4th	5th	1st	2nd	3rd	4th	5th	
Wild	12	10	8	11	9	12	8	6	9	4	0.046
Reserved	55	53	61	49	57	15	22	25	21	19	0.25
Gallery	25	16	20	19	15	10	7	8	6	6	0.086

Source: Researchers field work 2013.

FOREST DEPLETING ACTIVITIES

The Nagi forest has some activities militating against its sustainability. Observations show that certain activities such as farming, lumbering and bush burning are depleting the forest resources. These activities are discussed as:

FARMING: This is the act of cultivating crops for human use. Farming entails clearing the existing vegetation before the cultivating is made. In the process, Forests are destroyed. In Nagi district, the main occupation of the people is farming, consequently, the forest especially the wild type is continuously been degraded to make land available for cultivation.

LUMBERING: This is the totality of all operations of felling and extracting logs from the forest. It encompasses the creation of routes, falling, disbranching, cross cutting and transportation. It should be noted that the rate of harvesting especially of *daniela olivera* species in Nagi forest is completely without a plan towards sustainability and the technology employed is ecologically destructive. Table 3 shows an alarming rate of exploitation of timber in only the month of January 2006 in Gwer-West local government with the Nagi forest inclusive.

Table 3: Number of logs deposited/sawmill/day in the month of January 2006 in Gwer-west LGA

DATE	Iri	Alayi	Segun
06/01/2006	269	164	202
07/01/2006	255	157	193
08/01/2006	244	150	192
09/01/2006	244	150	182
10/01/2006	233	135	182
11/01/2006	221	122	198
12/01/2006	197	104	190
13/01/2006	176	88	188
14/01/2006	168	83	182
15/01/2006	154	83	179
16/01/2006	154	76	164
17/01/2006	154	68	164
18/01/2006	154	68	160
19/01/2006	165	105	137
20/01/2006	185	130	128
21/01/2006	243	107	129
22/01/2006	255	100	130
23/01/2006	272	107	136
24/01/2006	281	117	131
25/01/2006	275	128	121
26/01/2006	289	157	113
27/01/2006	298	189	101
28/01/2006	288	172	95
29/01/2006	280	165	89
30/01/2006	283	157	81
31/01/2006	290	179	80
Total	**6195**	**3384**	**3800**

Source: Rabelat Nigeria Limited Company, 2006.

From the three sawmills, an unimaginable 13 379 number of logs were deposited only in the month of January 2006 - a rate at which the entire forest of Gwer-west LGA can be cleared in less than 10 years. Many of the remaining standing small trees are badly damaged by the felled ones. The situation is worsened by the activities of illegal loggers who often desperately log premature trees in a hurry without regard for the ecological integrity of the forest.

BUSH BURNING: The location of Nagi forest in the tropical wet and dry climate poses the danger of bush burning. During the dry season, the forest litters as well as the underneath grasses are dry making the forest susceptible to fire damage. Bush burning is ignited by someone. In Nagi forest district, bush burning stems from the desire to hunt animals. The fire destroys the vegetation, killing the young plants. It also kills animals and renders the remaining homeless thus exposing them to predators.

The Nagi forest is well stocked with diverse resources for human exploitation and consumption. However, the forest sustainability is at stake, therefore, there should be adequate planning, organization and management of the resources.

RECOMMENDATIONS

In order to mitigate the impact of forest depleting activities in the Nagi district and ensure sustainable exploitation of the forest resources, the following measures are recommended:

i. It is obvious that certain activities like indiscriminate logging and bush burning degrade the Nagi forest quality, yet most people engaged in these activities are not aware of this fact or are simply not bothered. The ministry of animal and forest resources should together with their local government counterpart improve public awareness and support for forest conservation measures.

ii. Forest conservation agencies at Nagi district should also intensity efforts at averting, prosecuting and punishing defaulters of forest laws. This will serve as a deterrent to others and will result to strict compliance to the forest legislations.

iii. Government should use the revenue derived from exploration of forest resources to embark on afforestation programmes so as to ensure continued existence of forests and sustainable use of its resources.

iv. Private individuals should be encouraged to plant trees in Nagi district. Loans should be given to individuals to burst afforestation and thus provide more forest resources for use and avoid overdependence on the existing forests.

v. Cost- benefit evaluation should be carried out for any forest resource exploitation in Nagi district. An environmental impact assessment (EIA) should be done for every exploitative project as this will reveal the negative externalities and the needed measures to ameliorate them.

vi. The exorbitant prices of other energy sources also results to entire dependence on firewood as a source of energy in the Nagi district

and mostly in other parts of the nation at large. Prices of other sources of energy should therefore be made affordable such that there will be divergence from the use of firewood to other energy sources.

vii. Lastly, the wild type of forest in Nagi district is considered a common pool resource and the associated phenomenon called the "tragedy of commons" is likely to occur. Therefore, the forest conservation agency should increase its control and monitor over wild forest type in Nagi district to avert it's over exploitation.

CONCLUSION

The Nagi district is made up of different forest types with varying densities. It is however noted that activities such as faming, lumbering and bush burning are militating against the sustainability of the Nagi forest and its resources. The government, forest management agencies, the local community and all other forest stakeholders are to be cautious about the Nagi forest entire ecosystem quality and its degradation.

The recommendations in this study should be applied by conservationists in preserving and mitigating forest depleting activities in the Nagi district and ensure its sustainable exploitation. Ultimate of all, this study concludes that the game of resources exploitation should be played with the Nagi forest and not against it.

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