Journal of Sciences, Computing and Applied Engineering Research (JSCAER), Vol. 1, No.2, pp. 31-41

Published Online (https://jcaes.net) on July 10, 2025 by SciTech Network Press ISSN:3092-8648

Diversity Gradient and Composition of Woody Plants Species along Kogi East, Kogi State, Nigeria

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Received: May 12, 2025; Revised: June 18, 2025; Accepted: July 1, 2025; Published: July 10, 2025

Abstract: This research investigated the outcomes of deforestation on plant diversity in the eastern region of Kogi State. The study specifically focused on the assessment of implication of the destruction and interference of forest characteristics, density and plant biodiversity via anthropogenic activities. The study relied essentially on the floristic study of the sampled area which involves physical enumeration of woody plant species within the sampled communities. The data obtained were subjected to analysis using Simpson's Diversity Index and Shannon-Weiner Index in order to ascertain species diversity. Chi-square analysis (X^2) of the vegetation indexes showed no significant difference at P≤0.95. It was found that, Ankpa dominated the other axis in terms of density 2135, but Idah recorded highest Simpson and Shannon's Diversity Index of 0.84(0.82-0.86) and 2.26(2.15-2.36) respectively. The biophysical study also revealed that the vegetation in this area has suffered significant damage/changes in terms of its composition, density and characteristics. It was found that the continuous adverse anthropogenic interference on the forest landscape has contributed significantly to loss of forest resources, degradation of flora and fauna and loss of nutrient availability of the soil. This has disrupted the overall ecosystem functions in the study area. The study therefore, recommends a forest management approach that is sustainable in the study area in order to address the ugly trend in Kogi East.

Keywords: Biodiversity, Environment, Deforestation, Woody Species and Human activities.

1.0 Introduction

Forest is well-known to be a large area dominated by trees. According to [6; 7] a forest is a land area of more than 0.5 ha with a tree canopy cover of more than 10% which is not primarily under agricultural or specific non forest land use. This definition agrees with the one given by [11] as tree covered area not predominantly used for purposes other than forestry. Though the local people do not understand the technicalities of what constitute the threshold to distinguish between open vegetation and forest of some sort, their description is congruent. [9] Define forest as association of large, woody, perennial tree species, which are several time the height of human, and with a more or less closed canopy of leaves overhead.

Many years of research and structured observation showed that trees have undergone different levels of disturbance due to unprecedented increase in human population, which have led to cutting of trees for firewood collection, charcoal production, and infrastructural developments [22]. This has impacted tree diversity, abundance, species composition, indigenous knowledge of tree flora and conservation. A higher number of tree species increases the number of ecological niches and as well as the number of associated species and climax community structurally [12].

Deforestation is a global environmental problem majorly affecting the resilience and distribution of forests across different boundaries. It is simply defined as the loss of trees' cover usually as a result of forests being

cleared for other land uses [10]. Over the years, the world has experienced unprecedented loss of its forests particularly in tropical areas, though it is observed on a global scale that the rate of deforestation has shown sign of a decrease. This is because the Food and Agriculture Organization [8] states that in the 2000s about 13 million hectares of forest were converted to other uses – largely agriculture – or lost through natural causes each year as compared with 16 million hectares in the 1990s. That notwithstanding the rate of deforestation is still alarming because in 2010 it is observed that the world had just over 4 billion hectares of forested area, which corresponds to an average of 0.6 forests per capita [8]

As a recognized global challenge, tropical deforestation has gained greater impetus in policy and research. It is quintessential to manage the forest in a sustainable manner in order for it to perform its ecosystem function efficiently [3]. The essence of sustainable development is to see that humans and biodiversity coexisted side by side. To protect trees from declining, it is essential to examine the current status of species diversity, composition and abundance as it will provide guidance for their management and valuable reference for assessment as well as improve our knowledge in identification of ecologically useful species [27].

Deforestation is primarily a concern for developing countries of the tropics as it is shrinking areas of the tropical forest [2; 3; 4] causes loss of biodiversity and enhancing the greenhouse effect [2] Deforestation is primarily one of the global developmental challenges. Specifically, it is the most serious long term environmental challenge facing the country and Kogi East is not an exception by virtue of agrarian nature of the people. According to [14], deforestation accounts for approximately 30 percent of the atmospheric buildup of carbon dioxide over the past century, and rainforests are being depleted by approximately 160,000 square kilometers annually. Human societies have seriously brought about changes in their environment in the pursuit of wealth and power [15] and the inhabitant of the study area are not an exception. [15] have opined that, the world forest area has been reduced by some 20 percent and a large area of land converted from its original vegetation cover to other form which has also resulted in the alteration of plant species diversity in this area. Hence, the research focused on "The Effects of Deforestation on Plant Diversity and Composition in Kogi East, Kogi State. Nigeria"
In Africa, about two-thirds of the land that serves as habitats for wild plants and animals is now being utilized for other purposes as opposed to being kept under forest state. [23]. Nevertheless, African forests still contain a wealth of biodiversity, whereas in some parts of the world it may be too difficult to reverse the loss of much of the biodiversity that formerly existed in the time past. In most of African countries, Nigeria especially, there is still hope for proactive intervention. But the extent of damages brought by uncontrolled exploitation of forest resources is so great that it has attracted a great attention from various scholars, governments and individuals in recent times. This growing concern is not unconnected with the fact that over 40% of the earth's fauna and flora are lost to deforestation annually [16].
According to the United Nations Framework convention on Climate Change (UNFCCC) secretariat, the most important direct cause of deforestation is agriculture. Subsistence farming is responsible for 48% of deforestation, commercial agriculture is responsible for 32% of deforestation, logging is responsible for 14% and fuel wood gathering make up 5% of deforestation (UNFCCC).

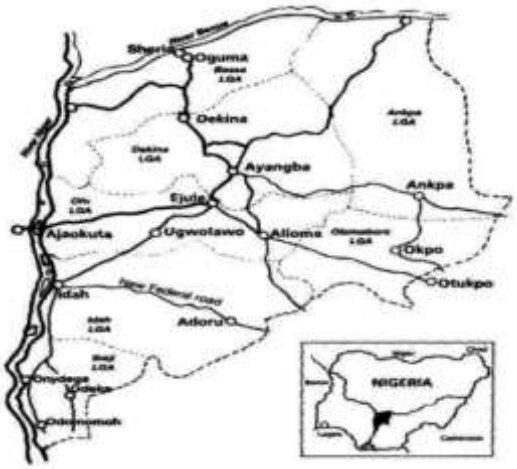
2.0 Materials and Methods

2.1 Location of the Study Area

Kogi East is located between Latitudes 06° 05' - 08° 00' N; and Longitude 06° 07' - 07° 05' E [17], the study area is located in the North Central part of Nigeria. The area shares boundary with the Federal Capital Territory in the North, Benue state in the East, Enugu State in the South and with its neighbors, the Central and Western Senatorial Districts in the West. In terms of its political administration, the study area which is situated in the eastern flank of Kogi State covers a total of nine Local Government Areas (LGAs). These include Ankpa, Dekina, Ibaji, Idah, Igalamela/Odolu and Ofu. Others are Olamaboro, Bassa and Omala Local Government Areas. Kogi East is drained by two major Rivers, namely River Niger and River Benue. While the western flank of the study area is bounded by the River Niger, the northern part of Kogi East is bounded by the River Benue. Other moderate sized Rivers and streams such as Imaboro, Okura, Inachalo, Ofu, Ubele, and Omala also traverses the landscape of Kogi East.
The region lies within the warm humid climatic zone of Nigeria with distinctive wet and dry seasons. The climate of the area is thus affected by two main air masses: the Tropical Maritime, mT and the Tropical Continental, cT. rainfall is heavy within the rainy months with an average of about 1500 – 2000mm annually, [19]. Kogi East has a mean annual temperature of 24.5^0C. The dominant vegetation communities remain the tropical savanna woodland of secondary types and mixtures of scattered tropical trees and grassland formations.

Map of Nigeria Showing Kogi State

Map of Nigeria Showing Kogi State



Details of the sampling communities.

2.2 Sampling Techniques

Multi-stage random sampling technique was used as described by [21] to select a sample size of 18 communities. In the first stage, a random selection of three Local Government from the eastern part of Kogi State which comprised Ankpa, Dekina, and Idah Local Government were selected. Secondly, two wards were randomly sampled from each Local Government selected for the study making six wards. And lastly three communities were randomly selected from each ward making a total of eighteen communities. Populations of all the Woody plant species encountered at various communities were recorded.

2.3 Data collection

The data obtained from the field was analyzed and each community was also analyzed for its richness which is the number of woody plant species encountered in each sampled community. The Alpha diversity was measured using Simpson's diversity index [26], Shannon's diversity index [20].

Simpson's diversity index (D)

$$=\frac{\sum n \quad (n-1)}{N(N-1)} \qquad (1)$$

where: n = the number of individual species in a sampled plot

N = the total number of individual counted. Since Simpson's diversity index (D) as expressed in the formula above has an indirect relationship with diversity (i.e the lower the index the higher the diversity), the result was expressed as below to allow for a direct relationship.

Simpson (1-D) = 1-

$$\frac{\sum n \quad (n-1)}{N(N-1)} \qquad (2)$$

Shannon's diversity index (H) = -

$$\sum_{i=1}^{8} pilogpi \qquad (3)$$

Where: pi = the proportion of individual in the sampled plot, S = the total number of species

Evenness index (E) = H'/logS (4)

Where H' is the Shannon wiener Diversity index,

Log S is the natural logarithm of the total number of taxon (S defined as taxon richness) recorded. It is used to measure the degree to which the abundances are equal among the groups present in a sample or community. These indices were used to obtain the estimation of species diversity, species richness.

3.0 RESULT

3.1 Characteristics, Density and Types of vegetation in the study area:

The outcome of the field study revealed that the vegetation of the study area comprises of mixed complex plant types ranging from trees, shrubs, herbs, and grasses. A checklist of names was used to identified and describe the distribution in the study area. There are indeed variations in the type, density and composition of vegetation in the study area, particularly along streams and river sides and in the more urbanized areas where there is significant human impact.

In a comprehensive study however, it was found that the variation appears to be influenced by the combined factors of habitat and changes caused by human activities. An observation on the field showed that the present vegetation cover of the area is mainly a secondary type, generally referred to as derived savanna. The characteristics of this type of vegetation were found and are explained by the fact that the inhabitants have used the forest lands for many of their socio-economic activities in order to secure food, shelter and comfort, a confirmation of the earlier assertion that the variation appears to be influenced by the combined factors of habitat and changes that are caused by human activities. The prominent activities include farming, firewood harvesting, development of new settlements and lumbering. The change in the structure and characteristics of the vegetation of Kogi State was affirmed by [19], he found that the forest ecosystem in the area has witnessed alterations in the composition and structure of the vegetation.

Most of the trees in the area are scattered and have short to moderate heights due to persistent lumbering. This type of vegetation can also be called secondary forest. The P.T.F.(1997) thus classifies the height of such vegetation at ~1.2m tall and above. Consequently, many of the plant species, particularly the trees have fallen victims of this menace as most of the tree species were cut down for fuel wood, timber, electric Pole and the likes.

3.2 Floristic analysis of woody species in the study area:

3.2. 1 The Dominance:

The dominance index of shrub species in Kogi East ranges from 0.35 – 1.00 with *Dennettia tripetala* having dominance of 1.00, followed by *Lophira lanceolata* with 0.44. Dormancy values of the shrubs observed in table 4.3.1a indicated that about 88% of the shrubs have low dominance whereas about 12% has a high dominance value. Similarly, the trees population had similar range of 0.35 – 1.0. The dominance value of about 52% recorded by the following species shows that the species has low dominance, the species includes; *Azadiracta indica*, *Gmelina aborea*, *Tectona grandis* etc. the highest dominance was recorded by *Vitex doniana*, (1.00) as shown in table 4.3.1b followed by *Triplochyton schleroxylon,* (0.71) and *Erynthropleum ivorensis* (0.63) with dominance value of about 15.7%. However, it was observed that, *Ceiba pentandra, Cocos nucifera, Diallium guineensis, Neuboudia laevis and Prosopis africana* have average dominance of 0.50 each. The dominance value is about 26%. This implies that, the lowest species with the lowest dominance have been subjected to highest human exploitations for various reasons such as fuel wood, charcoal, timber, electric poles etc. the other species with the highest and average dominance experienced lesser anthropogenic disturbance, this is due to the value attached to them, hence; the selective exploitation.

3.2.2 The Simpson Index

The Simpson's diversity index for the Kogi East as presented ranges from 0.00 – 0.65. *Anarcardium occidentale* had the highest diversity of 0.65, followed by *Ficus thorningii* and *Vernonia amygdalina* with diversity of 0.64 respectively. It was observed that, the lowest diversity was recorded by *Dennetia tripetala* which has Simpson Index H = 0.00. Majority of the shrubs has high diversity because majority are close to the upper limit of the range except *Dennetia tripetala, Irvingia gabonensis* with 0.00 and 0.38 respectively which recorded the lowest diversity. The index value of the shrubs observed indicated that, about 55% has low density.
The tree species had equally a range of 0.00 – 0.65 with *Azadirachta indica* recording the highest diversity of 0.65 which was closely followed by *Khaya senegalensis* with diversity of H =0.64. The result further indicated that, tree with index value of about 63% had low Simpson Index. Whereas, index value of about 36% indicate high diversity. This implies that, various levels of anthropogenic activities were recorded in the area. Various tree species such as *Parkia biglobosa, Newbouldia laevis, Vitex doniana, Prosopis africana* where logged indiscriminately but species such as *Elaeis guineensis, Tectona grandis, Gmelina aboreal* were selectively exploited due to economic importance attached to them.

3.2.3 The Shannon Diversity Index

Shannon diversity like Simpson diversity account for both dominance and evenness. The results indicated that, *Anarcardium occidentale* had the Highest Shannon diversity of 1.07. This may be due to its abundance because most of the species of *Anarcardium occidentiale* exist as plantation or in clusters, and the lowest diversity was observed in *Dennettia tripetala* of 0.00 because it happens to be the most accidental plant in the study area. Similarly, *Cola nitida,* and *Azadiracta indica* had the highest diversity of 1.08 each, closely followed by *Khaya senegalensis* which has 1.07. The index value observed, showed that about 36% had high diversity while about 63% had low diversity.

3.2.4 The Evenness

The evenness takes into account the relative abundance of species with respect to their distribution. Evenness is high, if all species has similar distribution. The attached table showed that *Dennettia tripetala* is more even in terms of distribution with evenness e^H/S = 1.00 while *Mangifera indica* and *Lophira lanceolata* recorded 0.87 each which is the lowest in that category.
On the other hand, *Cocos nucifera, Newbouldia laevis, Prosopis africana and Vitex doniana* had evenness of 1.00 each which is the highest as shown in table. *Triplochyton schleroxylon* recorded the lowest evenness of 0.59

3.3.0 BETA Diversities of the three Locations

Physical enumeration of the three local governments was carried out and the result showed that Ankpa had a total of 2135, followed by Dekina with a total of 1534 while Idah had the lowest population size of woody species which is 395.Floristic analysis revealed that Idah had Shannon diversity index "H" of 2.26 (2.15 –2.36) which is higher than Ankpa and Dekina with H = 1.30 (1.24 – 1.36) and 1.32 (1.25 – 1.39) respectively. Although, Ankpa and Dekina had higher number of individuals, the degree of diversity (entropy) of Idah is higher measured by "H" compared to Ankpa and Dekina. This is so because, the Idah axis is richer in terms of

diversity in the area compared to Ankpa and Dekina which are composed mainly of economic species such as *Elaeis guiniensis,_Anarcardium occidentale, Mangifera indica, Gmelina aborea and Tectona grandis.* These species are found in more places in Ankpa and Dekina in pattern of monoculture plantations.
Simpson's index of diversity also showed that, Idah had of 0.84 (0.82 – 0.86) above that of Ankpa and Dekina with 0.52 (0.50 – 0.54) and 0.54 (0.51 – 0.56) respectively. This implies that, the probability of picking two or more species which are evenly distributed is higher in Idah axis than Dekina and Ankpa axis, Although Ankpa and Dekina had the highest number of individuals dominated by few species, for a self-sustaining natural ecosystem, higher diversity of climax forest Savanna is important for the complex multidimensional inter-dependence of plant and animal species. It is therefore, suggested that, natural forest be allowed to develop with little human interference for maximum recovery of degraded forest in the study area.

4.0 DISCUSSION

The floristic enumeration of woody plant species in Kogi East senatorial district was repeatedly studied from July 2018 to October 2024. The result showed that, a total of 28 woody species were encountered in the fields studied which were classified into 9 shrubs and 19 tree species. Of these species, *Elaeis guiniensis,* had the greatest population size of 2582, followed by *Gmelina aborea,* with 295, *Azadiracta indica* 73 and *Tectona grandis* 82 respectively, this means *Elaeis guiniensis* the commonest plant species in this region. Similar observation was reported by [19] who stated *Elaeis guiniensis* is the most dominant plant species in Ankpa and Dekina with 91.5% and 90% respectively. This was followed by *Anacardium occidentale* and *Mangifera indica* recording 1.53% and 1.52% respectively. [20] also stated that the most abundant family is *Araceae* and *Fabaceae* in his work.
The fact that *Elaeis guiniensis* is the commonest plant in the three axes is due to the numerous values attached to the plant; among which are, nutritional, economic, socio-cultural and agricultural importance. The prominence of this crop is an indication that, the sampled area was predominantly agricultural areas. Considering the shrub population, *Anacardium occidentale,* had the highest population size of 371, the next is *Mangifera indica* with 364, followed by *Moringa oleifera* with 42 and *Danielia oliveri* with 29 members respectively, similar reason for the commonest tree species in the area being majorly economical is also applicable to the shrubs. This further support the perception that, the activities of the residents of the study area could be directly or indirectly responsible for increasing rate of deforestation/logging in those areas too.
Other species with lower population size were observed to have other importance which are not directly linked to fruit consumption by man, but fuel wood, charcoal, pulp, transmission pole and medicinal purpose, hence, there seems to be subjected to higher selective exploitation, these species include; *Dennentia tripetata, Gardenia florida, Prosopis africana, Newbouldia laevis, Vernonia amygdalina, Erythrophleum ivorensis* and the host of others.
This vegetation is a result of centuries of forest degradation through bush clearing, bush burning and overgrazing. Kogi State Ministry of Budget and Planning [13], sees bush burning and overgrazing as recurrent human activities that are responsible for large scale deforestation in Kogi state. The effects of these activities on the forest open space for the scorching effects of solar insolation on the top soil. This bring about significant increase in soil temperature (22.8– 27℃) for soil and (30 – 36℃) for ambient temperatures.
In this study, it was observed that, human activities are an ongoing process in the study area but more pronounced in Ankpa and Dekina Local Government Area. Notwithstanding the highest density of plant species recorded in the two axis, the commonest and the predominant species which is *Elaeis guiniensis* is also an agricultural plant which means that agricultural activities is more pronounced in this region where the plant is grown on a commercial scale. Idah axis on the other hand has the lowest density but with the highest Shannon and Simpson's index of diversity of H = 2.26 (2.15 – 2.36) and 1-D = 0.84 (0.82 – 0.86) respectively, higher than Dekina with H = 1.32 (1.25 – 1.39) and 1-D = 0.54 (0.51 – 0.56) and Ankpa with H = 1.30 (1.24 – 1.36) and 1-D = 0.52 (0.50 – 0.54). It was also noted from the table that, Idah had the highest diversity in terms of species evenness with e^H/S = 0.40 (0.36 – 0.45) followed by Dekina with 0.16 (0.15 – 0.17) and Ankpa 0.14 (0.13 – 0.15). This means that most of the species in Idah axis has similar or uniform distribution (Baker and Savage, 2008). It implies that, there is as well human foot print in this area (Idah) but lesser than what is obtainable in Ankpa and Dekina axis because of the degree of plant species distribution. Similar case was also observed by [25] who stated that forest in Idah has higher Shannon-Wienner diversity index which is diminishing rapidly due to uncontrolled timber harvest and other anthropogenic activities within the forest. [4] Also stated that increase in human population leads to corresponding increase in land use intensity and likely worsen the negative effect of deforestation. Tree species are very important due to essential services they provide to the inhabitant of the study area. *Mangifera indica, Elaeis guineensis, Anacardium occidentale* were listed by [1] as some of the trees that are of great importance and these trees were encountered in the study area. Hence; the call for relevant Government agencies ministries and stakeholders to collaborate in other to halt this

negative trend and to avert potential implications which may arise from such activities. Over exploitation and human activities which has replaced the forest ecosystem has result in decimation of tree species [11]. There is urgent need to preserve genetic diversity including plant resources of known and unknown economic importance in other to guarantee the availability of their potentials in the interest of future generation and the environment [1; 2; 3].

5.0 Conclusion

The result of the study showed that, greater part of the studied area has undergone deforestation of some sort which had also affected the soil characteristics. Similarly, over exploitation of forest resources were also investigated through floristic study of the woody plant species to ascertain the composition, density and distribution. Deforestation as a result of unsustainable use of plants and forest products may result in near-extinction of some species in the region.

This study further revealed that the principal factors responsible for deforestation in Kogi East are socioeconomic activities such as agriculture, construction and search for domestic energy sources. The local communities in these areas are majorly concerned with basic survival strategies because of widespread poverty and intricate link with the natural environment. The adverse effects of forestry and wildlife exploitation in the state were overbearing. These includes; loss of biodiversity, reduction in plant density, erosion and flooding, reduced soil fertility, loss of fauna and flora, low agricultural yield among others.

On a global comparison, Africa has seen a decline in her biodiversity since 1970, mainly due to habitat destruction, invasive species, diseases, and overexploitation of fish and mammals. Latin America and the Caribbean have experienced a 94% decline, primarily driven by poaching, and habitat destruction. Asia Pacific has also seen a 45% decline, with changes in land use and overexploitation of species being major drivers. Europe and Central Asia have experienced a 24% decline, with high consumption footprints contributing to the loss. (www.wikipedia.org)

In the world over and Nigeria the major driver of deforestation and biodiversity loss has been overexploitation due to consumption.

The only way to bring about a reverse in the dangerous trends of forest and wildlife exploitation is through proper policy formulation and implementation. The various actors that would implement these actions include donors, governments, NGOs and the private sectors. Donors could provide the necessary financial resources to complement the State Assembly's review of the draft state policy on forestry. Such financial assistance would be used by forestry experts, environmental and agricultural economists, and town planners among other specialist in identifying well documented programs of afforestation. NGOs have closer contacts with the local population and could serve as the vital link in mobilizing the local population in taking part in sustainable forest management.

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APPENDIX 1

Table Showing the Diversity Indices Based on Locations

Indices	Ankpa	Dekina	Idah
Individuals	2135	1534	395
Dominance_D	0.48 (0.46 - 0.50)	0.46 (0.44 - 0.49)	0.16 (0.14 - 0.18)
Simpson_1-D	0.52 (0.50 - 0.54)	0.54 (0.51 - 0.56)	0.84 (0.82 - 0.86)
Shannon_H	1.30 (1.24 - 1.36)	1.32 (1.25 - 1.39)	2.26 (2.15 - 2.36)
Evenness_e^H/S	0.14 (0.13 - 0.15)	0.16 (0.15 - 0.17)	0.40 (0.36 - 0.45)

APPENDIX 2 **: PLANT SPECIES DENSITY IN ANKPA L.G.A: ANKPA 1 AND OJOKU 1 WARD**

S/No	Species	Emere	Ejegbo	Ikebe	Agbodo	Odogomu	Ajobe	Total
1.	*Anacardium occidentale*	25	30	28	14	30	25	152
2.	*Anthocleista djalonesis*	5	-	-	3	-	2	10
3.	*Azadiracta indica*	10	5	3	5	5	6	34
4.	*Ceiba pentandra*	1	-	-	-	1	-	2
5.	*Cocos nucifera*	1	-	1	-	-	-	2
6.	*Cola nitida*	-	1	-	1	-	-	2
7.	*Daniella oliveri*	3	3	5	-	4	3	15
8.	*Dennenttia tripetala*	-	-	-	-	1	1	2
9.	*Dialium guineense*	1	1	-	1	-	1	3
10.	*Elaeis guineensis*	300	250	209	210	243	239	1451
11.	*Erythrophleum ivorensis*	-	-	-	-	-	1	1
12.	*Ficus exasperate*	1	1	-	-	1	2	5
13.	*Ficus thorningii*	1	-	-	-	-	-	1
14.	*Gmelina aboreal*	19	21	23	17	27	20	127
15.	*Irvingia gabonensis*	2	1	2	-	-	-	5

16.	*Khaya senegalensis*	1	-	2	-	-	-	3
17.	*Lophira lanceolata*	10	11	9	12	2	-	44
18.	*Mangifera indica*	50	20	35	43	33	15	196
19.	*Milicia excels*	-	-	-	1	1	-	2
20.	*Moringa oleifera*	5	7	10	5	-	-	27
21.	*Newbouldia laevis*	-	-	-	1	-	-	2
22.	*Parkia biglobosa*	1	-	1	1	-	-	3
23.	*Prosopis Africana*	1	-	-	-	-	-	1
24.	*Tectona grandis*	15	3	13	-	7	-	38
25.	*Triplochiton scleroxylon*	1	1	-	-	-	-	1
26.	*Vitex doniana*	-	-	-	-	-	-	-
27.	*Gardenia florida*	-	1	-	-	-	-	1
28.	*Vernonia amygdalina*	2	1	-	-	-	-	3

APENDIX 3: PLANT SPECIES DENSITY IN DEKINA L.G.A ANYIGBA AND IYALE WARD TOTAL:

S/No	Species	Emere	Ejegbo	Ikebe	Agbodo	Odogomu	Ajobe	Total
1.	*Anacardium occidentale*	26	15	27	13	24	28	133
2.	*Anthocleista djalonesis*	3	-	-	-	2	-	5
3.	*Azadiracta indica*	7	3	1	5	4	7	27
4.	*Ceiba pentandra*	-	-	1	-	1	-	2
5.	*Cocos nucifera*	-	-	-	-	-	-	-
6.	*Cola nitida*	1	-	-	1	1	-	3
7.	*Daniella oliveri*	-	2	1	-	3	4	10
8.	*Dennenttia tripetala*	-	-	-	-	-	-	-
9.	*Dialium guineense*	1	-	-	-	-	-	1
10.	*Elaeis guineensis*	201	190	185	134	253	57	1020
11.	*Erythrophleum ivorensis*	-	-	-	-	-	-	-
12.	*Ficus exasperate*	-	1	-	-	1	-	2
13.	*Ficus thorningii*	1	-	-	1	-	-	2
14.	*Gmelina aboreal*	19	27	-	15	30	36	127
15.	*Irvingia gabonensis*	-	-	2	-	10	3	15
16.	*Khaya senegalensis*	1	-	1	-	1	-	3
17.	*Lophira lanceolata*	15	-	-	-		-	15

18.	*Mangifera indica*	15	9	13	20	14	42	113
19.	*Milicia excels*	-	1	-	-	-	-	1
20.	*Moringa oleifera*	1	-	2	-	1	1	5
21.	*Newbouldia laevis*	-	-	-	-	1	1	2
22.	*Parkia biglobosa*	-	-	-	-	-	1	1
23.	*Prosopis Africana*	-	-	-	-	-	-	-
24.	*Tectona grandis*	7	-	2	-	10	1	20
25.	*Triplochiton scleroxylon*	-	-	1	-	-	-	1
26.	*Vitex doniana*	2	-	-	3	1	4	10
27.	*Gardenia florida*	-	1	1	-	-	-	2
28.	*Vernonia amygdalina*	2	1	-	-	1	-	4

APPENDIX 4: PLANT SPECIES DENSITY IN IDAH L.G.A: EGA AND IGALA-OGBA WARD

S/No	Species	Emere	Ejegbo	Ikebe	Agbodo	Odogomu	Ajobe	Total
1.	*Anacardium occidentale*	18	20	13	5	7	23	86
2.	*Anthocleista djalonesis*	-	2	-	1	-	3	7
3.	*Azadiracta indica*	3	7	-	7	4	-	21
4.	*Ceiba pentandra*	-	5	-	3	-	-	8
5.	*Cocos nucifera*	1	-	-	-	-	1	2
6.	*Cola nitida*	2	-	-	-	-	-	2
7.	*Daniella oliveri*	2	-	-	-	2	-	4
8.	*Dennenttia tripetala*	-	-	-	-	-	-	-
9.	*Dialium guineense*	-	-	-	-	1	-	1
10.	*Elaeis guineensis*	38	27	13	15	-	18	111
11.	*Erythrophleum ivorensis*	1	1	1	-	-	-	3
12.	*Ficus exasperata*	-	-	-	3	-	-	3
13.	*Ficus thorningii*	1	-	-	1	-	-	2
14.	*Gmelina aboreal*	9	-	10	5	9	8	41
15.	*Irvingia gabonensis*	-	-	-	-	-	-	-
16.	*Khaya senegalensis*	2	-	1	2	-	-	5
17.	*Lophira lanceolata*	10	-	-	5	-	-	15
18.	*Mangifera indica*	17	7	3	7	4	7	45
19.	*Milicia excelsa*	-	-	-	-	-	2	2
20.	*Moringa oleifera*	6	-	-	4	-	-	10

21.	*Newbouldia laevis*	-	-	-	-	-	-	-
22.	*Parkia biglobosa*	-	-	-	-	2	-	2
23.	*Prosopis africana*	-	-	-	-	-	1	1
24.	*Tectona grandis*	-	9	6	-	-	-	15
25.	*Triplochiton scleroxylon*	2	-	2	-	3	3	10
26.	*Vitex doniana*	-	-	-	-	-	-	-
27.	*Gardenia florida*	-	-	-	-	1	-	1
28.	*Vernonia amygdalina*	1	-	1	-	-	-	2

PHOTO TAKEN FROM THE STUDY SITE

Vigna Unguiculata Farm at Ankpa

Parkia biglobosa tree cut down during contruction .

Partially burnt forest in one of the Study Site.

Woodfuel Harvested from one of the Forest.