Evaluation of Flora Composition and Utilization in Ikwe Game Reserve, Igbor, Gwer L.G.A., Benue State, Nigeria

Mathew, L. A.*, Ashe, C.B., Sa'aondo, M. S. and James, A. O.

Department of Forestry Technology, College of Agriculture, Science and Technology Lafia, Nasarawa State Nigeria.

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*CORRESPONDING AUTHOR

alawmathew1@gmail.com

ABSTRACT

There are different types of protected areas, and the purpose for their establishment is very broad. Persistent ecosystem monitoring is crucial to the fulfillments of every conservation objectives; however, at present no comprehensive record of flora composition at the study area. This study was carried out to determine the species composition, percentage distribution, and structure and utilization level at the study area. The point centered quarter (PCQ) method and the step point line technique (SPLT) were used as sampling points. All encountered trees species within the PCQ were identified and recorded. The result revealed that there are 32 woody plant species from 20 families. The dominant family was Caesalpinodae. In woodland the common species was Prosopix africana (12.14 %) while in the riparian vegetation Syzygium guineense (24.12 %) was the dominant woody plant species. The hilly vegetation recorded Berlinia auriculata (45 31 %) as the dominant species. The riparian vegetation had the highest density per hectare (617 trees/ha) followed by the hilly vegetation (13 trees/ha) and the woodland (2 trees/ha). The species diversity index showed that the woodland is slightly above the riparian by 0.2, while the hilly has the lowest diversity index (0.3). Only two plants were utilized by animals; Oryza sativa and Manihot esculenta. The difference in species composition is attributed to human activities. It is therefore strongly recommended that Silvicultural management practices should be intensified at the study area.

INTRODUCTION

There are different types of protected areas, and the purpose for their establishment is very broad. It could be to maintain the life supporting diversity of ecosystems, protect species needed for human needs, or safe-guarding the world's areas of natural beauty (Krishna, 1997). These human needs ranges from educational, research, food, raw materials, income generation and, or ecological tourism.

According to Marguba (2002) there are about 30,000 protected areas around the world, and it is touted as one of the greatest achievements of the 20th century and a great inheritance for 21th century. Over the last two decades, there has been a relatively rapid growth in game reserves and, or protected areas obviously due to the perceived importance attached to them, Dudly N. (Editor) (2018). However, the total number of protected area records in the March 2023 released of World Database Protected Areas (WDPA) is 285534 comprising 273,268 polygons and 12266 points and covering 244 countries and territories.

Agbelusi (2000), in the study on conservation of biodiversity asserted that, Nigeria like many African countries is faced with the problems of environmental destruction fueled by increase in population growth, political instability and increasing poverty. At each point of these cycles species are lost and biodiversity is obtainable only in the National parks, game reserves, forest reserves, wildlife sanctuaries etc. In view of this, parks and protected areas will continue to be necessary for the protection of species whose habitats are not compatible with man (Eltringham, 1984). Moreover, a game reserve is an area of land set aside for the preservation of wildlife. It is pertinent to note that, wildlife cannot be preserved in isolation from flora resources. This is because the flora resources constitute a source of food, shelter, habitat and so on; to the wildlife. Although, management plays an important role in protecting habitat for flora and fauna, it is essential that established areas be manipulated to guarantee the stability or survival of certain species of plants and animals (FAO, 1988).

It is important to regularly assess the health of the vegetation and when necessary manipulate it to suite wildlife management needs (Ayodele *et. al.,* 1999). Ikwe Game Reserve is a product of an attempt by the Benue State Government to conserve biological diversity in-situ. The need to plan natural resources management on the basis of accurate inventory and taking protective measures to ensure that the resources do not become exhausted are the concepts of modern conservation. Therefore the main objective of this study is to determine the species composition and distribution of woody plants structures and their utilization at the study area.

MATERIALS AND METHODS

Study area

Ikwe Game Reserve is situated in Igbor, Gwer Local Government Area of Benue State, Nigeria. It is about thirty kilometers (30 km) south of Makurdi, the State Capital. The towns and villages bordering the reserve are Otukpo, Aliade, Igbor, Kwagh Akume, Koodar and Makurdi. The reserve is located at latitude 7°15-7°17'N and 8°20-8°22'E geographic coordinate. It surrounds Ikwe Hills and covers a total area of about 40 km². Ikwe Game Reserve could have been very accessible, since it is surrounded by many towns and villages. A 9 km fence is erected using chain link fence wire supported with concrete poles.

The major drainage channel comprises of tributaries of River Benue, which includes Aundu and Bai streams which drains the upper part of the reserve. Akume Arite, and Tyumando streams drains the central part of the reserve, while Fete drains the lower part. In the dry season these tributaries breaks into brooks, pools, streams and water holes which provide water for wildlife population in the reserve Jimoh *et al.,* (2010).

The climate is similar to that of Guinea Savanna, the duration of rainfall ranges from 125-200 days (6-7 months), Annual rainfall of the zone ranges from 1,140mm-1,520mm and evapotranspiration is between 0.40-0.70. The trees and grasses are characteristically tall. Sampling Method

Systematic and stratified random sampling was adopted based on structural appraisal and dominant features of the environment; Woodland, Riparian and Hilly. Three line transect were laid each for the vegetation types systematically, making a total of nine transects. The point centered quarter (PCQ) method by Pollard (1971) and Mitchell (2010) and the step point line technique (SPLT) by Ridney (1963) were used as sampling points at 0.25/ha. A total of 10 PCQ were laid in each of the three vegetation zone. All encountered trees species within the PCQ were identified and recorded by their local and scientific names with the help of a taxonomist, trees species that could not be identified in the field, their specimen were collected and taken to the Herbarium of Federal University of Agriculture Makurdi, for identification.

Data Analysis

Woody plant density, percentage distribution of woody plant, and species diversity index were calculated from the formulae given by Cottam and Curtis (1956), Ayodele *et. al.,* (1999) and Simpson (1949). Species Diversity Index (SI) was calculated using the formulae:

$$(1)$$

$$SI = \frac{N(N-1)}{\sum_{i=1}^{q} n(n-1)}$$

Where; SI = Diversity Index, N = Total number of individual trees q= No of different species of trees, n = number of individuals of ith species of trees.

RESULTS

Species composition and distribution percentage of woody plants in the three vegetation types

The results of Species composition and percentage (%) distribution of woody plants in vegetation types as presented in Table 1 depicted that there was paucity of species per vegetation type where an individual species occurred in all the vegetation types was examined. The dominant woody plant species that was recorded in the hilly vegetation was *Berlinia auriculata* (45.31 %), followed by *Lophira lanceolata* and *Pericopsis laxiflora* (10.94) while the lowest was *Lannea schimperi* (3.13) %. In the riparian vegetation, the dominant woody plant species was *Syzygium guineense* (24.12%) followed by *Berlinia auriculata* (14.47%), *Diospyros mespiliformis* (9.21%), *Acacia polyacantha, Khaya senegalensis* and *Vitex doniana* (7.02%) while *Phyllanthus muellerianus*had the lowest percentage (1.32) %. In the woodland vegetation, *Prosopis africana* (12.14%) is the dominant woody plant species, followed by *Lonchocarpus laxiflorus* (8.57%), *Ficus sycomonus, Vitex doniana* (7.86), *Detarium senegalensis* and *Lannea schimperi* (7.14%). The least species in woodland was *Stereopermum kunthianum* (1.44%).

Table 1: Species composition and percentage (%) distribution of woody plants in vegetation types

S/n	Species	Hilly (%)	Riparian	Wood land (%)
1	*Acacia polyacantha*	-	7.20	
2	*Annona senegalensis*	-	-	3.57
3	*Berlinia auriculata*	45.31	14.47	5.71
4	*Bridelia ferruginea*	-	3.07	2.86
5	*Cussonia arborea*	-	-	2.86
6	*Daniellia oliveri*	8.59	3.07	-
7	*Detarium senegalenssi*	5.47	-	7.14
8	*Diospyros mespiliformis*	-	9.21	-
9	*Diospyros senegalensis*	-	2.63	-
10	*Ficus congensis*	-	2.63	-
11	*Ficus sycomorus*	-	-	7.86
12	*Garcinia smeathmannii*	-	3.07	-
13	*Khaya senegalensis*	-	7.02	-
14	*Lannea schimper*	3.13	-	7.14
15	*Lonchocarpus laxiflorus*	-	-	8.57
16	*Lophira lanceolata*	10.94	-	4.30
17	*Mangifera indica*	-	-	3.5
18	*Maytenus senegalensis*	-	2.19	-
19	*Parinari curatellifolia*	-	-	5.00
20	*Parkia bigloss*	-	-	2.86
21	*Pericopsis laxiflora*	10.94	-	3.57
22	*Phyllanthus muelleriansus*	-	1.32	-
23	*Piliostigma thonningil*	-	2.19	-
24	*Prosopis africana*	3.91	-	12.14
25	*Pterocarpus erinaceus*	5.47	-	-
26	*Quassia undulate*	-	-	2.86
27	*Sarcocephalus latifolius*	-	3.07	4.28
28	*Stereopermum*	-	-	1.3
29	*Syzygium guineense*	-	24.12	4.3
30	*Terminalia macroptera*	6.24	2.02	2.32
31	*Uapaca togoensis*	-	5.70	-
32	*Vitex doniana*	-	7.02	7.86
	Total	100	100	100

Family composition, the frequency occurrence of species and their relative abundance

Table 2 showed the results of the families and their number of species compositions. The two predominant families were *Caesalpiniodae* and *Papilionoidae,* comprising of four (4) species each, and percentage relative abundance of stems per family of 28.03% and 8.87% respectively.

Woody (tree) plant density/hectares and species diversity of the vegetation types in the study area

Table 3 revealed that tree density/ha and species diversity of the vegetation types, the highest mean tree density of 617 trees/ha occurred in the Riparian vegetation. The least mean tree density/ha of 2 trees/ha occurred in the woodland. The results on species diversity in the same Table revealed that the Woodland had the highest mean species diversity of 9.79. The riparian vegetation had 9.59 as its species diversity index while in the Hilly vegetation 0.3 was obtained for the hilly vegetation

Among all the plants species in the vegetation zone, only two were identified to be utilized by wild animals out of the 48 plants species recorded in the game reserve. These two plants were *Oryza sativa* and *Manihot esculenta*. These plants were found to be slightly utilized. In the case of *Oryza sativa*, the part utilized was the leaves, while for *Manihot esculenta*, it was the stem.

Table 2: Family composition, number of species per family and relative abundance of each family

S/N	Families	Species per Family	% Relative Abundance
1	Anacardiaceae	2	3.83
2	Annonaceae	1	1.01
3	Araliaceae	1	0.81
4	Bignoniaceae	1	0.40
5	Caesalpimiodeae	4	28.03
6	Celastracea	1	1.01
7	Chrysobalanaceae	1	1.41
8	Combretaceae	1	3.23
9	Ebanaceae	1	4.23
10	Euphorbiaceae	3	5.44
11	Guttiferae	1	1.41
12	Melaceae	1	3.23
13	Melaceae	3	8.48
14	Moraceae	2	3.43
15	Myrtaceae	1	12.30
16	Ochnaceae	1	4.03
17	Papilionoidae	4	8.87
18	Rubiaceae	1	2.62
19	Simaroubaceae	1	0.81
20	Verbanaceae	1	5.44

Table 3-: Woody (tree) plant density/hectares and species diversity of the vegetation types of Ikwe Game Reserve

Riparian Vegetation		Woodland Vegetation		Hilly Vegetation	
Density/ha	Species Diversity	Diversity/ha	Density species	Density/ha	Species diversity
644	3.69	0.93	10.07	14	0.20
729	13.45	2.07	8.67	12	0.30
47	11.62	1.94	10.64	14	0.30
Mean 617	9.59	2.00	9.79	13	0.30

DISCUSSIONS

The result of the evaluation of vegetation types of Ikwe Game Reserve showed that the plants species compositions in the reserve were consistent with those in the Guinea Savanna of West Africa confirming the findings of Keay (1959) and Adeniji *et al.* (2022). The predominant representation of most of the families by one or two species is a feature that is peculiar to the savanna vegetation. In this study *Prosopis africana* is the predominant woody plant species in the woodland. This is probably due to the protection it enjoys based on its economic importance to the rural economy. It serves as a source of local condiment to the local people. The absence of common woodland vegetation species such as *Khaya senegalensis, Vitallaria paradoxa* and *Vitex doniana* in relatively high abundance could be due to the fact that the woodland vegetation has been grossly degraded by the rural people for agricultural activities and the fact that they are exploited for timber and char coal. These species are the commonest in the Guinea savanna zone of Nigeria as documented by Afolayan (1977), Ayeni *et al*. (1982), Tyowua (2002) and Adeniji *et al*. (2022)

The riparian recorded species such as *Syzygium guineense* (24.12%), *Berlinia auriculata* (14.47%) and *Diospyros mespiliformis* (9.21%) as predominant species respectively. Geerling (1973) asserted that the riparian vegetation is peculiar vegetation consisting of species more characterized of forest zone such as *Syzygium guineense*. The hilly vegetation recorded species like *Berlinia auriculata* (45.31%) followed by *Lophira lanceolata* and *Pericopsis laxiflora* (10.94%) as the predominant species respectively.

This study revealed that the number of trees/ha in the riparian vegetation was more than that of the hilly and woodland vegetations, despite the fact that area covered by the woodland was more than the riparian. This could be explained by the fact that the woodland vegetation has been grossly intruded by the surrounding communities. Thus human activities such as farming, firewood collection for fuel and logging could be attributed to the immense loss in the flora resources within the woodland vegetation, hence, destruction of wildlife habitat being eminent. To further buttress the aforementioned fact, Table 2 showed that there are more trees/ha in the hilly vegetation than there are in the woodland.

Woodland vegetation has the highest diversity index compared to riparian and hilly Vegetation. Diversity index therefore, is a number that gives the resource manager an idea of the variation of species varieties between stable and unstable environment over

successional times. It also reflects the health of a given environment. Communities that have been stressed usually have lower diversity index than the unstressed communities. However, the results of the number of trees/ha depicts the true state of the three types of vegetation. The lowest diversity index value for the hilly vegetation could be due to the nature of the terrain which most likely restricts woody plants growth.

The conversion of the woodland into grassland or bare-ground is attributed to human population growth and antecedent increase in demand for land by humans for activities such as farming, firewood collection, char coal production, logging and so on. The woodland is tempered with annually for these purposes. These concurs with the findings of Hopkins (1965) as cited by Afolayan and Agbelusi (1995) and Tyowua (2002), who reported that man's interference with the woodland vegetation through clearing of vegetation for farming, firewood for fuel consumption and indiscriminate use of fire. On utilization by animals, the result showed a very low utilization status, thus implying that there is low population of wild animals in the game reserve and also considering the period of the year that the study was carried out.

CONCLUSION

The differences in species composition in the study area is attributed to human activities such as logging, farming and felling of trees for fuel-wood consumption in the woodland vegetation. The species composition of Ikwe game reserve conforms to other conservation areas within the Guinea savanna region of West Africa. The most ubiquitous woody species in the study area are *Berlinia auriculata* and *Terminalia macroptera*. The study area depicted low utilization of plants by animals at the moment hence there is need for further evaluation in terms of the fauna resources in the appropriate time and season, so that the park can be put into use properly.

RECOMMENDATION

Ikwe Game Reserve is an asset that the Benue State Government can explore for its renewable potentials and richness in terms of flora and fauna resources, scenery and other natural features. It has the potentials of becoming a major source of revamping the local economy of the rural people and the state at large. Based on these, we wish to make the following recommendations;

Successive research aimed at providing quantitative and qualitative data on the fauna resources endemic in the area. These data will serve as baseline information for further researches in the future.

i. Silvicultural management practices should be encouraged to be able to revamp the various vegetation types to enhance speedy recovery from the disturbances that it has suffered in the past. For instance, in the riparian vegetation, management practices that will encourage the growth of seedlings and saplings should be employed so that there will be even distributions of the various diameter classes of trees in the future.

ii. There is an urgent need for strong advocacy, community sensitization and continuous engagement to sensitize locals on the need for conservation and sustainable use of resources in the reserve.

REFERENCES
Adeniji A. O., Eri I. and Adigun O. J (2022). Diversity and abundance of tree species of protected woodland, southern guinea savannah zone, Nigeria. *Turkish Journal of Biodiversity*. DOI:10.38059/biodiversity.889433
Afolayan, T.A. (1977). The Effects of Fires on the Vegetation in Kainji Lake National Park. Oikos 31:376-382
Afolayan, T.A. and Agbelusi, E.A. (1995). An Overview of the Role of Fire in the Management of Savanna Ecosystem in the West African Sub-Region. In: Proceeding of the Regional Training Workshop held at FUTA Akure, Nigeria Between 23rd-26th July, 1995. p.61-92.
Agbelusi, E.A. (2000). Conservation of Biodiversity. Paper Presented at the Year 2000 World Environmental Day in Akure Ondo State.
Ayeni, J.S.O.; Afolayan, T.A. and Ajayi, S.S. (1982). Introductory Hand Book on Nigerian Wildlife, Kainji Lake Research Institute, New Bussa, Nigeria, pp.43-45.
Ayodele, I.A.; Ebin, C.O. and Alarape, A.A. (1999). Essentials of Wildlife Management. 2 Edition, Jachin Publisher, Ibadan. Pp.46-51
Dudley, N. (Editor) (2018). Guidelines for Applying Protected Area Management Categories. Gland, Switzerland: IUCN. x + 86pp. WITH Stolton, S., P. Shadie and N. Dudley (2013). IUCN WCPA Best Practice Guidance on Recognising Protected Areas and Assigning Management Categories and Governance Types, Best Practice Protected Area Guidelines Series No. 21, Gland, Switzerland: IUCN. ISBN: 978-2-8317-1636-7
Eltringham, S.K. (1984). Wildlife Resources and Economic Development.
Food and Agriculture Organisation (1988). National Parks Planning: A Manual with Annotated Example. Conservation Guide, 17, Rome, Italy.
Hopkins, B. (1965). Observation on Savanna Burning in the Olokomeji Forest Reserve Nigeria. Journal Applied Ecology
Keay, R.W.J. (1959). An Outline of Nigerian Vegetation. 3rd Edition. Federal Ministry of Information, Printing Division, Lagos, Nigeria. Pp.44.
Krishna, B.G. (1997). Social Change and Conservation. Published by Earthscan Publication Limited UK. Marguba, L.B. (2002). National Park and their Benefits to Local Communities in Nigeria.
Mrguba B. (2002). Nigerian National Parks their Significance and Potentials to the Nation. The Magazine of the Nigerian National Parks, 1, 7-10.
Mitchell W. K. (2010). Qualitative Analysis by the Point-Centered Quarter Method. Arexiv

Pollard, J.H. (1971). On Distance Estimate of Density in Randomly Distributed Forest Biometrics 27: 991-1002.

Simpson, E.H. (1949). Measurement of Diversity. Nature 163:888.

Tyowua, B.T. Evaluation of Vegetation Types in Wildlife Park of the University of Agriculture Makurdi. Unpublished M.Sc. Thesis. Federal University of Technology, Akure 2002.

March 2023 update World Data Base Protected Areas (WDPA) and World Data and Other Effectve Area-Based Conservation Measures (WD-OECM) www.protectedplanet.net