



Tree species composition and structural variations in Falgore Game Reserve, Kano State, Nigeria

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Abstract

Tropical ecosystems are being degraded and apparently threatened; it thus becomes very necessary to assess their structure and composition more especially as the threats appear to be on the increase. In Nigeria empirical studies on protected areas (PAs) like the Falgore Game Reserve are scantily documented. This study was therefore conceived to achieve the following objectives: i. to identify tree species in Falgore Game Reserve ii. to assess and compare the uniformity or differences in composition and structure of tree species in Falgore Game Reserve, Kano State, Nigeria. Stratified and systematic sampling techniques were used in assessing vegetation cover. The study area was stratified into four topographic locations, namely: Hill top, Sloppy area, Level Ground and the Riparian forest. Hilltop and Sloppy study area sites were located around Zarara hills of the Game Reserve. Level ground site was located around Yantabarmi and Uwar Bazai areas, while the Riparian forest was sited along the Eastern and Western coastlines of River Dori (a tributary of Kogi in Kano). At each sampling station, a baseline was established parallel to the edge of the forest. A one kilometer long line transect perpendicular to the baseline was laid in each of the four study locations. 50m×50m sampling plots were systematically established at a pre-determined interval of 200m on both sides of the transect. This gave a total of ten sampling plots in each study site, and a total of forty (40) plots for the study. Tree species occurring in each 50m×50m sampling plots were identified, counted and recorded. Tree Species composition and distribution were estimated using indices such as species richness (D), and species diversity (H^1). Tree structure was assessed by determining the heights, DBH and basal areas of trees encountered. Altogether, 37 Tree species were identified out of 1,102 individuals trees sighted in the study area. The Level ground recorded the highest number of Trees species (24) with 382 individuals. This was followed by the Riparian forest with 22 trees species and 300 individuals. Sloppy area recorded 18 tree species and 258 individual trees, while the least numbers of trees species (13) and the least individual tree count (162) were recorded in the Hill top site. Highest Tree species diversity ($H^1=2.5$) was recorded at the Level ground, followed by the Riparian forest ($H^1=2.4$), while the least tree species diversity was recorded at the Sloppy area, ($H^1=2.1$). There were some similarities and dissimilarities in tree species composition and structure across Falgore Game Reserve. The fact that many flora families were represented by single species underscores the need for further research effort in order to ensure the sustainability of those fragile species in the game reserve.

Keywords: Species, composition, structure, diversity, Falgore Game Reserve.

Introduction

Plant composition refers to total sum of all plant species that make up the vegetation. Vegetation structure on the other hand is known as the composition of a plant community in terms of specific physical appearance¹. Vegetation structure and its composition are vital to the functioning of ecosystems in addition to provision of services. Nevertheless, in savanna areas the structure and composition of tree species is apparently limited by moisture availability, nutrient stock, annual bush fires and overgrazing². In the West African Savanna whether Guinea or Sahel, tree vegetation plays a vital role in the livelihood activities of rural populace. Trees provide the rural folk with basic amenities like food, shelter, clothing, fuelwood and herbal medicine. Trees also provide inputs for construction handicrafts and many other products³. The Savanna vegetation also

harbours a high density of wild animal species especially large herbivores at reduced costs, without any form of routine pasture management and improvement. The observed composition and structure of any vegetation community indicates the interaction between its component members and the surrounding environment over time⁴. The Savanna also sustains a high density of many animal species especially large herbivores even in the absence of any form of pasture improvement. The composition and structure of any given vegetation community reflects the interaction between its component members and their environment over a period of time⁵.

This study therefore investigated tree species diversity and structural variation in Falgore Game Reserve, located in Doguwa Local Government Area, Kano State, Nigeria.

Materials and methods

The study area: Falgore Game Reserve lies in-between latitude $10^{\circ}50'$ and $11^{\circ}50'$ N and longitude $8^{\circ}35'$ and $8^{\circ}45'$ E. It has a mean length of 50km North to South and a width of 28km East to West. It falls within the boundaries of Tudun-Wada, Doguwa and Sumaila Local Government Areas in the North, South and North-East respectively. From the extreme South west it borders Kaduna State; it also shares boundaries with Lame-Burra Forest Reserve in Bauchi state on the South east. Annual rainfall is about 1000mm decreasing to about 800mm around Kano metropolis⁶. The temperatures are warm to hot throughout the year, even though there is a slightly cool period during the Harmattan, between November and February. The mean monthly temperatures range between 21°C in the coolest months (December-January) to 41°C in the hottest months (April-May)⁶.

Sampling procedure: Stratified random sampling technique was employed in order to capture the variability in land cover⁷. The study area was stratified into four topographic locations, namely: Hill top, Sloppy area⁷ Level Ground and the Riparian forest. Hilltop and Sloppy area study sites were located around Zarara hills of the Game Reserve. Level ground site was located around Yantabarmi and Uwar Bazai areas, while the Riparian forest was sited along the Eastern and Western coastlines of River Dori (a tributary of Kogin Kano).

Data collection and analysis: Tree species composition was determined by identifying, counting and recording each species and individuals of each species of trees occurring within the area of the 50m \times 50m sampling plots. Tree species were mostly recorded in their Hausa names after which they were converted to scientific names by referencing to Agishi, who compiled vernacular names of Nigerian plants⁸. Diameter at breast height (dbh) of plants with vertical height of $3\text{m} \geq$ were measured at 1.3m from the ground level, using diameter tape, while dbh of trees with multiple branches were determined by measuring the diameter of individual branches separately and then adding and dividing by the number of branches to get a single diameter value for the tree. Tree heights were measured, using Haga altimeter.

Results and discussion

Tree species identified in Falgore Game Reserve: A total of 1,102 individuals spread within 37 species and 17 families were identified as trees in the study. Level ground recorded the highest number of Trees (24) with 382 individuals. This was followed by the Riparian forest with 22 trees species and 300 individuals. Sloppy area recorded 18 tree species and 258 individual trees, while the least numbers of trees species (13) and the least individual tree count (162) were noted in the Hill top site (Table-1). Result in Table-1, indicated that level ground and the Riparian forest alone, account for more than 61% of the total density of Trees species sampled for the study.

Tree species diversity in Falgore Game Reserve: The highest Tree species diversity ($H^1=2.5$) was observed at the level ground

with species richness $D=3.9$ and species evenness $J=0.78$. This was followed by the riparian forest, with Species diversity, $H^1=2.4$, species richness $D=3.6$ and a relatively low Species evenness, $J=0.77$ which was less than the species evenness observed in the Sloppy area. Sloppy areas recorded the lowest tree Species diversity, $H^1=2.1$, moderately high species richness, $D=3.0$ and species evenness $J=0.72$. A relatively low tree species diversity, $H^1=2.2$ was recorded for the hill top. It had the least species richness, $D=2.4$ but with the highest species evenness $J = 0.85$ (Table-2).

Tree species diversity in Falgore Game Reserve: Highest Tree species diversity ($H^1=2.5$) was recorded at the Level ground with Species richness ($D=3.9$) and species evenness $J=0.78$. This was followed by the Riparian forest, with Species diversity, $H^1=2.4$, Species richness $D=3.6$ and a relatively low Species evenness, $J=0.77$ which was less than the species evenness observed in the Sloppy area. Sloppy areas recorded the lowest Tree Species diversity, $H^1=2.1$, moderately high species richness, $D=3.0$ and species evenness $J=0.72$. A relatively low Tree Species diversity, $H^1=2.2$ was recorded for the hill top. It had the least species richness, $D=2.4$ but with the highest species evenness $J=0.85$ (Table-2).

Structural characteristics of plant species across the study sites: Results in Table-3 indicates that tallest trees with average heights of 14.81m were recorded in the Riparian forest while the least tree average height (10.56) was recorded at the Hill top study site. Similarly, highest average Diameter at breast height (DBH) of 1.36m was recorded in the Riparian forest while the lowest DBH of 0.61m was observed at the Hill top. Highest average basal area of 63.50m² was recorded at the Level ground while the lowest average basal area was observed at the Hill top site (Table-3).

Discussion: The variation in the density of Tree species between the four locations was evidently due to differences in the level of human interference as well as differences in elevation gradient. Level ground being more accessible to farmers and wood harvesters, due to its relative proximity to Falgore town, Yantabarmi and Hayin gada communities was observed to suffer an intermediate level of disturbance and incidentally recorded the highest species richness D (3.9) and diversity H^1 (3.2) among the four study sites (Table-2). This conforms to the work of Huston and DeAngelis as well as Todaria *et al.* who reported in their studies that Maximum number of species richness has been obtained in intermediately disturbed forest types^{9,10}. Generally, the present Trees species richness of FGR with highest number of 24 species and lowest of 13 species is considered low when compared to that of semi-evergreen forests of Indian Eastern Ghats and Western Ghats, that is: the number of the species in Kolli Hills (26-56); Kalrayan Hills (42-47 species), Shervarayan Hills (33-50 species)¹¹⁻¹³, Tree species richness in FGR was however similar to that of Sal forest of central Himalayas: 13-21 species and greater than that of Corbett national park: 3-20 species^{14,15}.

There were significant variation in DBH across the four study sites. There were also significant differences in basal area across the four study locations. Riparian forest was observed to have recorded the highest average diameter and height mean values for trees among the four study locations. This was largely due to

presence of large and permanent water body in the Riparian area. This conforms to the findings at Buton forest in Indonesia, where large numbers of big and tall trees were found apparently due to abundant supply of groundwater¹⁵.

Table-1: Tree Species identified in Falgore Game Reserve, Kano State, Nigeria, 2016.

Scientific name of species	Common name of species	Local name of species	Family
<i>Ficus sycomorus</i>	Fig mulberry	Baure	Moraceae
<i>Ficus glumosa</i>	Mountain rock fig	Farin baure	Moraceae
<i>Combretum molle</i>	Velvet bush willow	Wuyan damo	Combrataceae
<i>Combretum ghasalense</i>	Four-leaved bush willow	Bakar tarauniya	Combrataceae
<i>Combretum hypopilium</i>	Combretum	Farar tarauniya	Combrataceae
<i>Terminalia macroptera</i>	Terminalia	Kwandari	Combrataceae
<i>Anogeissus leucarpus</i>	Axle wood	Marke	Combrataceae
<i>Combretum nigerican</i>	Combretum	Tsiriri (Sokoto)	Combrataceae
<i>Combretum collinum</i>	Bicoloured bush willow	Kantakara	Combrataceae
<i>Diospyrous mespliformis</i>	African ebony	Kanya	Ebanaceae
<i>Gardenia aquala</i>	Ceylon boxwood	Gaude	Rubiaceae
<i>Nauclea latifolia</i>	Pin cushion	Tafashiya	Rubiaceae
<i>Mitragyna inermis</i>	False abura	Giyayya	Rubiaceae
<i>Borassus aethiopum</i>	Borassus palm/Seleb palm	Giginya	Palmeae
<i>Strychno spinosa</i>	Kafir orange	Kokiyar kadarko	Loganiceae
<i>Hymenocardia acida</i>	Large Red-heart	Jan-yaro	Hymenocardiceae
<i>Sterculia setigera</i>	Karaya Gum tree	Kukkuki	Sterculiaceae
<i>Parkia biglobosaa</i>	African locust bean	Dorawa	Mimosoideae
<i>Vitellaria paradaxum</i>	Shea butter tree	Kadanya	Sapotaceae
<i>Lansea acida</i>	Wild sage	Faru	Anacardiaceae
<i>Commiphora Africana</i>	African myrrh	Dashi	Burseraceae
<i>Boswellia Africana</i>	African nut tree	Hannu (Kano)	Burseraceae
<i>Tamarindus indica</i>	Tamarind	Tsamiya	Fabaceae
<i>Isorbelina doka</i>	Doka/Kobo tree	Doka	Caesalpinoideae
<i>Burkea Africana</i>	Wild seringa	Bakin makarfo	Caesalpinoideae
<i>Danellia oliveri</i>	Wood oil tree	Maje	Caesalpinoideae
<i>Cassia sieberana</i>	Drum stick tree	Marga	Caesalpinoideae
<i>Dioscorea bulbifera</i>	Air potato vine	Tuwon-biri	Dioscoreaceae
<i>Entarda Africana</i>	St Thomas bean	Tawatsa	Fabaceae
<i>Polio stigma thoningii</i>	Camel's foot	Kargo	Fabaceae
<i>Dalbergia saxatilis</i>	Simbah	Runhun zaki	Fabaceae
<i>Polio stigma reticulatum</i>	Rhodesian bauhinia	Kalgo	Fabaceae
<i>Acacia seyel</i>	Whistling thorn	Dushe	Fabaceae
<i>Detarium macrocarpum</i>	Tallow tree	Taura	Fabaceae
<i>Unidentified species</i>	-	-	-
<i>Strespermum kunthianum</i>	African blackwood	Sansami	Bignoniaceae
<i>Pseudocedrela koschyl</i>	Segodore (Senegal)	Tunas	Meliaceae

Table-2: Tree Species Diversity in the four study sites at Falgore Game Reserve, Kano State, Nigeria 2016.

Site Topography	Shannon diversity (H^1)	Species evenness (J)	Species richness (D)
Level ground	3.2	0.78	3.9
Hilltop	2.2	0.85	2.4
Sloppy area	2.1	0.72	3.0
Riparian forest	2.4	0.77	3.6

Table-3: Variations in Structural attributes of Tree Species in Falgore Game Reserve, Kano State, Nigeria 2016.

Plant Morphology	Site Topology				P-Value
	Hilltop	Level ground	Riparian forest	Sloppy area	
Height (m)	10.56±0.25 ^b	11.78±0.42 ^a	14.81±1.37 ^a	11.71±0.75 ^b	<0.01
Dbh (m)	0.61±0.05 ^b	0.82±0.10 ^b	1.36±0.20 ^a	1.01±0.23 ^{ab}	0.02
Basal Area (m ²)	10.65±1.54 ^c	63.50±19.50 ^a	44.59±3.28 ^{ab}	26.46±4.66 ^{bc}	<0.01

Means on the same row with different superscript are statistically significant ($p < 0.05$).

Conclusion

Results in the study indicated some similarities and dissimilarities in Tree species composition across Falgore Game Reserve. Generally, findings of the study had also indicated significant differences in structural attributes i.e. tree average height, DBH and basal area.

Recommendations: Based on the findings of this study, the following recommendations were made: i. Government shall create more awareness on the dangers associated with forest degradation through television and Radio jingles, religious sermons, town hall meetings etc., ii. Neighboring communities shall be carried along in the management of the reserve, through participatory forest management, so as to give them sense of belonging. iii. Open grazing of livestock in the Reserve should be abrogated and cattle ranching introduced to reduce forest degradation through overgrazing and annual fires. iv. There is need for reviewing the existing forest laws by the Kano State assembly in order to stem the contemporary challenges of rapid forest degradation in the state.

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