



SPECIES DIVERSITY AND DISTRIBUTION OF SOME ARBOREAL MAMMALS IN GUMTI SECTOR OF GASHAKA GUMTI NATIONAL PARK, NIGERIA

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ABSTRACT

This study aimed at producing the arboreal mammalian species check list, estimate their absolute population densities and determine their diversity and distribution pattern in GGNP. The arboreal mammalian species checklist was obtained through direct sighting, the use of indices, literature and inspection of bush meat processing and selling centres. The line Burkea-Crotopteryx association, Riparian vegetation and the Uapaca-Propis association transect method was used for census of arboreal mammalian species in five wildlife habitats in the study area (riparian vegetation, shrub savanna, grassland savannah, Burkea-Crotopteryx association and the Uapaca-Propis association). Results obtained indicated that six (6) arboreal mammalian species belonging to three (3) families existed in the study area. Absolute population densities of mammalian species ranged from 5.04 to 6.81/km². Diversity of the arboreal mammalian species for the entire study area was 1.1364. Cluster analysis revealed that two clusters of communities of arboreal mammalian species existed in the study area. In view of the extreme decline in population densities of arboreal mammalian species in the study area, it is recommended that all illegal anthropogenic activities in the study area should be brought to a halt by legal means, regular monitoring of the abundance and distribution species of wildlife population should be carried out, habitat assessment should be carried out at regular intervals to ascertain the conditions of the habitats and patrol should be intensified to checkmate anthropogenic activities in the study area.

Keywords: Species, Diversity, Arboreal, Mammals

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INTRODUCTION

Among the outstanding worlds of renewable natural resources are the mammals (Mamman, 2007). Kingdom (1997), listed over 1150 species of mammals from Africa of which most are concentrated in the savannah zones. Mammals are warm blooded animals that give birth to their young ones alive. They feed their young ones with milk produced from their mammalian gland, they have highly developed sense of sight

and smell, and their brains are relatively large having superior intelligence. They ranged from small arboreal flying animals to large terrestrial animals like lion, leopard, eland, buffalo, roan antelope, hartebeest, rhinoceros, elephants, zebra, (Connor, 2018). Arboreal mammals spend almost their time doing various activities such as eating, socializing and breeding on the trees (Kerry 2001) Mammals both arboreal and terrestrial are more often influenced by human

activities than other animal classes. Humans interfere with mammals by hunting and domesticating for food, clothing materials, experimental objects, and so on (Kingdom 1997, 2000). Forest is a natural habitat for various animal species including arboreal mammals and plants. Usher (1991), reported that diversity is the most commonly used criterion in conservation evaluation of reserves or national parks. A national park or game reserve is often judged by the number of species that it contains especially mammals, birds and plant species. Hence, diversity has become central to majority of evaluation schemes. Managing population size which is the basis by which the success of any management programme is judged (Akosim *et al.*, 2007). Furthermore, the establishment of quantitative data on the diversity of species, distribution patterns of arboreal mammals should be carried out. Scientific data regarding the inventory of arboreal mammals in the Gashaka sector of Gashaka National Park have carried out since its establishment in 1991. However, none of these inventories concentrated on arboreal mammals, besides, this is more than two decades now. This dearth of information makes it impossible to develop sound management and utilization strategies as well as monitoring programmes for species of mammals in the Gashaka sector of the park. Hence, the import of this research.

MATERIALS AND METHODS

Study Are

Gashaka – Gumti National Park is situated at the foot of the Mambilla Plateau and covers a land area of about 6,411 km². It lies between latitude 6°55'N and 8°05'N and longitude 11°13' to 12°11'E. The park was originally gazetted as Gumti and Gashaka Game Reserves by the defunct Northeast Government in the 1970's. The two game reserves were merged and upgraded to a National park by the Nigeria National Park Decree of 26th August, 1991 which was repealed by Decree 46 of 1999. Gashaka – Gumti National Park is a vast land of spectacular wilderness (6,000 km²) in the southeast corner of Taraba State, adjoining the

Mambilla Plateau (Figs. 1 and 2). The Park, like any other Park, was established as a protected area for the purpose of nature conservation, recreation, ecotourism, scientific and medical research, and to promote art, craft and other cultural values of the indigenous people of the immediate environment. The Park is an outstanding tourist landmark. Its unique position is underlined by the fact that it is not only the largest of all the eight national parks in the country, but it is the most diverse in terms of species in the whole of West Africa, harboring such rare animals like the colobus monkey and warthogs, including buffalo, roan antelope, chimpanzee, hippopotamus, hyena, giant forest hog, lion and leopard (Dunn, 2000). Its vast expanse of land contains river valleys and peaks that are suitable to holiday makers. The park is crisscrossed by many rivers (notably rivers Kam, Gashaka, Yim and Gam-Gam) which, among other ecological functions, act as reservoirs of diversity. Dunn (1997), visitors to this secluded region will find no roads here, but only a small number of footpaths snaking through the wooded mountains in the direction of Republic of Cameroon. Visitors to the Gashaka-Gumti National Park would be able to take pleasure in the flourishing forests, the extensive sweeping grasslands, the fresh highland plateaus, the rockymountains, rich wildlife and the captivating ethnic cultures. The climate of the park ranges from tropical to humid at different times of the year. The ethnic groups in the area are Jibu, Dakka, Ngoro, Tigun, Gbaya, Kuteb, Tiv, Mambilla, Kaka and Fulani in the southern part of the park, while in the northern part or Tongo sector are the Chamba, Kutim Potopore, Fulani, Dakka, Nyamnyam and Kona. Dunn (1997), the major occupations of the enclave communities are farming, livestock husbandry, vocational jobs, civil service with few hunters and fishermen. They engage in subsistence farming and crops cultivated include maize, groundnut, millet, guinea corn, beans, soya beans, rice, yams, sugar cane, and cassava (Oruonye *et al.*, 2017).

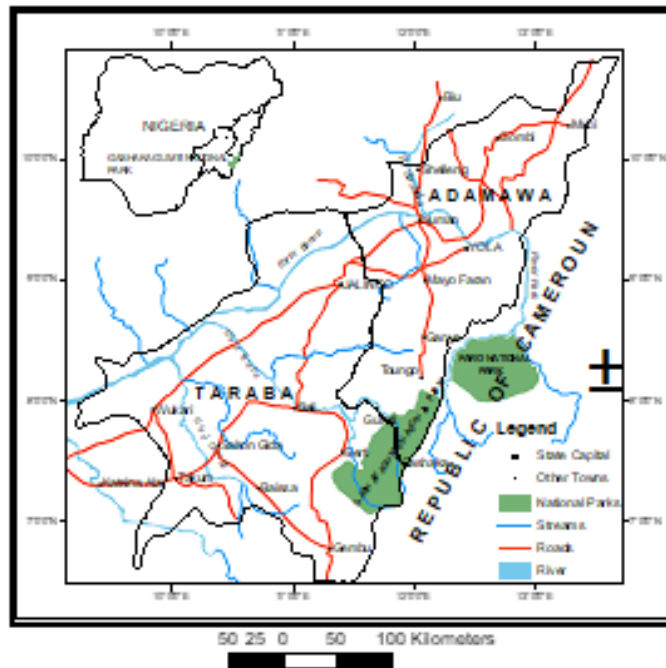


Figure 1. The Location of Gashaka Gumti National Park
Source: Durm (1999)

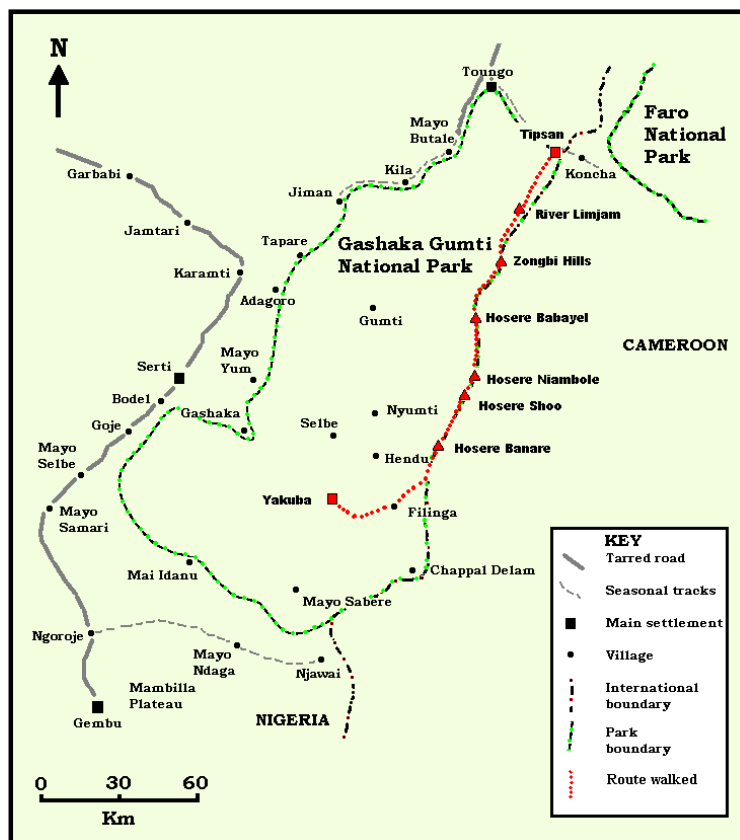


Figure 2: Map of Gashaka Gumti National Park

Data Collection

The line transect method as outlined by Kingdom (1997) was used for the census. The transects were placed randomly in each vegetation type, starting from known landmark in the woodland and ensuring that they were at least 0.5km apart. The length of the transects ranged from 4km-6km, depending on the nature and size of the area. Each transect was cut in a U-shape following a sighting compass on a predetermined bearing. The width of the cut line was 1.5m. The number of transects established in each vegetation type depend on the size of the habitat. Each transect was walked twice in a day for 20 days. The census took place in the morning between 6:00am to 11:00am and the evening between 4:00pm to 6:00pm. The researcher and the park ranger moved slowly at the rate of 1 to 1.5 km per hour, stopping occasionally to listen and watch for mammals, encountered mammals are recorded as individuals or groups. The sighting distance from the observer was measured and recorded. Other information such as category of sighting (group or solitary), activity or behavior exhibiting when sighted, habitat type, sighting angle and time were recorded also.

Species diversity of arboreal mammals in each vegetation type and for the entire Gashaka sector was determined using census data obtained through the line transects established as adopted by Akosim *et al.* (2007). The distribution pattern of species of arboreal mammals was determined using the method outlined by Dunn (1993).

Data Analysis

Estimate of population density of solitary mammals was done using the Kings Census model as described by Akosim (1997) while the (Whiteside *et al.*1988) model was used to estimate the population density of arboreal mammals occurring in groups.

Absolute population density using Whiteside *et al* (1988) model:

Step 1: Determination of Fall-off Distance (FD). This is obtained from the histogram.

Step 2: Determination of Effective Distance (ED). This obtained from the formula;

$$ED = Nt/N (FD) \dots\dots\dots [1]$$

Where;

Nt= species-specific total number of group sighting

N= species-specific total number of group sightings at distance less than fall off distance.

Step 3: Determination of transect-species width (TSW). This was obtained from the formula;

$$TSW = 2(ED + \text{half average group spread}). \dots\dots\dots [2]$$

Step 4: Determination of area sampled. This was obtained from the following formula;

$$A = TSW \times \text{total length of transect} \dots\dots\dots [3]$$

Step 5: The density (D) was obtained using the formula;

$$D = \text{Total number of groups recorded} / \text{Total area sampled} \dots [4]$$

Diversity of the arboreal mammals was determined using Shannon Diversity Index as adopted by (Usher, 1991):

$$\text{Diversity (D)} = \sum P_i \ln P_i \dots [5]$$

Where;

Pi = the total proportion of the ith species in the sample i.e. n_i/N

Where;

n_i = abundance of each species

N = the total number of individual species

lnPi = natural logarithm of the species proportion

Population Distribution Pattern of the Arboreal Mammals was determined using McNaughton and Wolf (1979) model which is stated as;

$$C = \sum (2m) / \sum (a_i + b_i) \dots [6]$$

Where;

a = the abundance of species “i” in community “a”

b = the abundance of species “i” in community “b”

m = minimum value for the species in either “a” or “b” whichever is smaller.

RESULTS

Species List of Arboreal Mammals of the study area

The result of species List of Arboreal Mammals of the study area. A total of six (6) species of arboreal mammals belonging to three (3)

families were identified in the study area by direct sighting. Information from literature

affirms this numbers (table 1 shows).

Table 1: Checklist of species of arboreal mammals in the study area

Family Name	Common Name	Scientific Name	DS	INF	ID	PC
Cercopithecidae	Red patas monkey	<i>Erythrocebus patas</i>	X	X	X	X
	Tantalus monkey	<i>Cercopithecus aethiops</i>	X	X	X	-
	Putty noded monkey	<i>Cercopithecus nictiterus</i>	X	X	X	-
	Olive Baboon	<i>Papio cynocephalus Anubis</i>	X	X	X	X
Pongidae	Cimpanzee	<i>Pan troglodytes</i>	X	X	X	X
Colobidae	Colobus monkey	<i>Colobus guereza</i>	X	X	X	-

Key: DS = Direct Sighting; ID = Indices; INF = Information from literature X = Present; BC = Bush meat Processing Centres = Absent

Species Diversity of Arboreal Mammals in each Vegetation Type of the Park

The species diversity indexes for arboreal mammalian species in four vegetation zones are presented in tables 3 to 6 while table 7 shows the diversity index of the entire park, the species diversity for Uapaca-prosopis Association (table

6) is 1.0 (table 6) is 1.0372. The results in tables 3, 4 and 5 indicate species diversity indexes for riparian vegetation, shrub savanna and grassland savannah as 0.602, 0.2969 and 0.6633 respectively. Table 7 shows that, the mammalian species diversity index for the entire study area is 1.1364.

Table 2: Arboreal Mammalian Diversity Index for Riparian Vegetation

S/No	Species Name (i)	N0. Of Individuals (n _i)	Proportion(Pi)	Shannon Index (-∑Pi ln Pi)
1	<i>Papio cynocephalus Anubis</i>	196	0.7101	0.2431
	<i>Erythrocebus patas</i>	80	0.2899	0.3589
Total		276	1.000	0.602

Species Diversity Index = 0.602

Table 3: Arboreal Mammalin Species Diversity Index for Shrub Savanna

S/N	Species Name (i)	No. of Individuals (n _i)	Proportion(Pi)	Shannon Index (-∑Pi ln Pi)
1	<i>Cercopithecus aethiops</i>	24	0.6486	0.2431
2	<i>Cercopithecus nictiterus</i>	13	0.3514	0.00161
Total		37	1.0000	0.2969

Species Diversity Index = 0.2969

Table 4: Arboreal Mammalian Species Diversity Index for Shrub Savanna

S/No.	Species Name (i)	N0. Of Individuals (n _i)	Proportion(Pi)	Shannon Index (-∑Pi ln Pi)
1	<i>Cercopithecus aethiops</i>	42	0.3784	0.3677
2	<i>Erythrocebus patas</i>	69	0.6216	0.2956
Total		111	1.0000	0.6633

Species Diversity Index = 0.6633

Table 5: Arboreal Mammalian Species Diversity Index for Uapaca-Prosopis Association

S/No.	Species Name (i)	No0. of Individuals(n_i)	Proportion(P_i)	Shannon Index ($-\sum P_i \ln P_i$)
1	<i>Papio cynocephalus Anubis</i>	178	0.5	0.3466
2	<i>Colobus guereza</i>	80	0.2247	0.3355
3	<i>Cercopithecus aethiops</i>	98	0.2753	0.3551
Total		356	1.0000	1.0372

Species Diversity Index = 1.0372

Table 6: Arboreal Mammalian Species Diversity Index in the Gumti Sector of GGNP

S/No.	Species Name (i)	No. of Individuals(n_i)	Proportion(P_i)	Shannon Index ($-\sum P_i \ln P_i$)
1	<i>Papio cynocephalus Anubis</i>	374	0.4686	0.3552
2	<i>Erythrocebus patas</i>	210	0.2632	0.3514
3	<i>Colobus guereza</i>	18	0.0226	0.8856
4	<i>Cercopithecus aethiops</i>	182	0.2281	0.3371
5	<i>Cercopithecus nictiterus</i>	14	0.0175	0.0071
Total		798	1.0000	1.1364

Arboreal Mammalian Species Diversity Index = 1.1364

Distribution Pattern of Species of Arboreal Mammals in the Study Area

The result of arboreal mammalian species distribution in five vegetation zones of the park is shown in Tables 8 while Table 9 shows the matrix of similarity coefficients for the mammalian composition in the five vegetation zones. The results indicated that the Shrub Savanna contained eighty-five (85) while Reparian vegetation contained two hundred and

seventy-six (276) mammalian species, Uapaca-prosopis Association consists of two hundred and ninety-four (294) species and Burkea-Crosopteryx has none. Grassland Savanna consists of one hundred and eleven (111) species. The result in Table 9 shows that the highest similarity index occurred between Grassland Savanna and Shrub Savanna (0.66). The least was between Burkea-Crosopteryx and Grassland Savanna (0.009).

Table 7: Distribution of Arboreal Mammalian Species in five (5) habitat types in the study area

Mammalian Species	BC	UP	RV	SS	GL
<i>Papio cynocephalus Anubis</i>	-	178	196	-	-
<i>Erythrocebus patas</i>	-	-	80	61	69
<i>Colobus guereza</i>	-	18	-	-	42
<i>Cercopithecus aethiops</i>	-	98	-	24	42
Total					

BC= Burkea-Crosopteryx association; UP = Uapaca-prosopis association; RV= Reparian vegetation; SS = Shrub Savanna; GL= Grassland Savanna

Table 9: Matrix of Coefficient for Arboreal Mammalian Species Composition in four (4) habitat types in the study area

Types of Vegetation	RV	SS	GL	UP
BC	0.23	0.29	0.009	0.06
RV		0.46	0.30	0.58
SS	0.66	0.16		
GL				0.20

DISCUSSION

This study identified five (5) major vegetation types. The vegetation types revealed that the

study location is a Guinea Savanna, having Riparian forest and floodplain appearing in small pockets of wetland areas of the park. Each vegetation type provides conducive habitat for primates and other mammals. The ability of the vegetation types to provide cover and food for these wild animals indicates that each of the four vegetation types can be referred to as wildlife habitat. A total of six (6) species of arboreal mammals were identified in the study area. The six (6) species of arboreal mammals identified represent about 0.2% of the 247 species reported by Hapold (1987, 2000) for Nigeria. The number of arboreal mammals identified in the study is also lower than the 123 species for Guinea Savanna as reported by Hapold (2000). The low species richness of arboreal mammals in the study area might not be unconnected to the observation made by Dunn (2000) which he attributed to the migration of the arboreal mammals due to disturbances caused by high level of illegal livestock grazing and the increasing poaching activities in the area. Umaru *et al* (2022) observed that poachers in the area use unselective methods such as poisoning in hunting. The dominance of arboreal mammalian species in the study area is in the following order: Red patas monkey ($6.81 \pm 6.56 \text{ km}^2$), Olive baboon ($6.33 \pm 6.07 \text{ km}^2$), Tantalus monkey ($6.18 \pm 3.95 \text{ km}^2$), Colobus monkey ($5.04 \pm 1.50 \text{ km}^2$) and the high incidence of primates in the study area may be attributed to the observation made by Hapold (2000) that, primates of Nigeria have extensive geographical distribution in relation to their preferred vegetation type. However, these results indicated an extremely low population densities compared to the results of Akosim and Mamman (2007) for which he obtained for the same species of primates (Red

patas monkey (11 ± 4.81 in 50 km^2 and Baboon $62.41 \text{ km}^2 \pm 5.34$) in a proposed Game Reserve within a similar habitat type in Adamawa State. When values of arboreal mammal species in the study area were compared with the Shannon Diversity Index for communities considered as standard (McDonald, 2003), it ranged from 1.5 to 3.5, none of the diversity value fell within the range as that of the study area is 1.1364. The high similarity of coefficient between the Grassland and the Shrub Savanna can be attributed to the similarity of the habitats and abundance of food resources in the habitats. The matrix of the similarity coefficients is a measure of how many arboreal mammalian species are common among the habitat types of Grassland and Shrub Savanna containing similar arboreal mammalian species. Similarly, the *Burkea-Crotopteryx* association, Riparian vegetation and the *Uapaca-Propis* association contain similar species of arboreal mammals. These results are useful in monitoring, planning and management strategies for ecotourism as well as habitat conservation of the Gashaka Gumti National Park.

CONCLUSION

Arboreal mammalian species composition in the study area is low compared with the recent studies; this is probably due to illegal grazing, poaching and other anthropological activities carried out around and within the park. It is therefore recommended that regeneration of exploited habitats should be encouraged and patrol should be intensified to curtail anthropogenic activities. Regular monitoring should be done to ascertain population distribution and abundance.

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