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HABITAT COMPOSITION AND POPULATION DENSITY OF CHIMPANZEE (*PAN TROGLODYTES VELLEROSUS*) IN FILINGA RANGE, GASHAKA- GUMTI NATIONAL PARK, NIGERIA

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ABSTRACT

Habitat composition and population density of Chimpanzee (Pan Troglodytes vellerosus) in Filinga Range, Gashaka- Gumti National Park, Nigeria was survey to determine tree species composition and population density. The work was carried out in the wet (June – August) and dry (December - February) seasons, 2018/2019.A systematic sampling technique was adopted for plot establishment. Ten transects measuring 2km each at 1km apart were laid and on each transect 50m x 50m plots were laid at regular interval of 500m apart with a total of forty sample plots in all. Trees with DBH ≥ 10CM were identified and enumerated. For Chimpanzee population density, direct observation and counting were made. The transect was worked at a speed of 1 – 1.5km/hr aided with binoculars. For Each observation the following data were recorded; sex, adult, number of individual, perpendicular and sighting distance. The results obtained showed that forty-two woody species in nineteen families were identified and enumerated with a total of six hundred and sixty nine tree species in all. The Shannon Weiner index for species diversity is 3.19. Margalef index for species richness is 6.30 and Pielou evenness is 0.85. The composition of the woody species appeared to be average and members of the trees family's sampled formed important components of the Chimpanzees lower stratum habitat. Chimpanzees were encountered in both wet and dry seasons with mean of 0.118 ± 0.21 and 0.122± 0.027 respectively. The findings of this study are an important step in the characterization and understanding of the habitat and number of Chimpanzees that occupy the Park. The park may still be able to sustain the animal as long as this portion is maintained on sustainable bases.

Keywords: Habitat, population, Chimpanzee, Gashaka-Gumti, Nigeria

INTRODUCTION

Vegetation structures have been used to describe the habitat of many wildlife species, floristic composition in particular could be indicative potentials in site selection for *Pan troglodytes* conservation. Habitat quality and quantity have been identified as the primary limiting factor that influences animal population dynamics (Jansen *et al.*, 2001). One of the attribute that affects the occurrence of species include the type of habitat, forest cover, fragment shape, land use adjacent to the fragment, and extent to which the wider landscape isolates populations (Virgos 2001). Another important step in designing conservation management strategies is the assessment of habitat structure such as size, density, and distribution of a species across the landscape (Deborah and Linda, 2013). These are vital baseline data, which can be utilized to assess conservation status and to measure success of conservation efforts over time. Habitat structure, population size and density of any indicator species are important for long term monitoring, and the distribution of individuals and their use of space in targeting key areas of protection. Chimpanzees on the other hand prefer dense tropical rainforests but can also be found in secondary growth forests, woodlands, swamps, and open savannah (Hickey *et al.*, 2013).Chimpanzees

highly preferred mature forest for traveling, and avoided reverine and young secondary forest for traveling regardless of season (Nicola *et al*.,2016). Wild animals are dependent upon the vegetation that supports them, so changes in vegetation significantly affect wild animal populations. Sites that produce high amounts of biomass will generally support more Wildlife species and larger populations than poor quality sites (Fingesi *et al*., 2017).

Globally, the assessment and conservation of Chimpanzee is a concern especially in Africa since evidence of population decline is high in Nigeria (Oates *et al*., 2008). However the survival of these apes as well as that of many other non-human primate species is increasable threatened by habitat destruction, disease, civil strife and a trade in bush meat (Volker *et al.,* 2011).Chimpanzees, Gorillas, Monkeys, Lemurs, Lorises, and Tarsiers are Primates in the Order in Animal Kingdom(Lameed, 2002; Tyowua *et al*., 2017). The Nigeria Chimpanzee (*Pan troglodytes vellerosus*) is one of the rarest apes on earth, and is endemic to Nigeria and Cameroon and declared flagship species by Fauna and Flora International (IUCN, 2006) to be protected. It is designated as an endangered species by the International Union of Conservation of Nations (Morgan *et al.,* 2011). To effectively manage and conserve this species and prevent its extinction, it is important to appraise Chimpanzee habitat composition population density in our protected areas. They occupy an exceptional array of habitat ranging from rocky terrain, lowland and rainforest and are highly variable in their feeding habits (Swedell, 2011). Forest structure and understory are strong determinants of wild Chimpanzee species richness, diversity and distribution (Torres *et al*., 2010; Bortolamiol *et al*., 2014) The Nigeria-Cameroon Chimpanzee is the least numerous subspecies with a total population of less than 6500 individuals remaining. The only relatively large and secure population is in Gashaka Gumti National Park in Nigeria.(Ogunjemite *et al*.,2007).

The objective of this study was to determine the habitat composition of woody plants species abundance, diversity indices, and population density of Chimpanzee in the southern sector (Falinga Range) of Gashaka Gumti National Park.

MATERIALS AND METHODS

Study Area

The Gashaka Gumti National Park (Fig.1 and 2) is Located in a mountainous region of north – eastern Nigeria adjacent to the international border with Cameroon, and immediately in the north of Mambilla Plateau (Olson *et al*., 2001). The region lies within Latitude 6° 25'- 8° 13' N and Longitude 09° 15'- 12° 25' E. The region is contiguous with Adamawa Massif in Cameroon. The altitude of the environment ranges from 300M – 2400M above sea level. The region experiences two marked seasons, these are dry season which is from October – March and the rainy season, April and October. Rainfall is relatively high in the region ranging from about 1200mm in the North to 2000m in the South. Mean minimum temperature of about 21^0C occurs in January during the dry seasons and it coincides with the harmattan period. Mean maximum temperature of about 33^0C is recorded on the onset of rainy seasons in early April.

Vegetation in the region varies and is diverse. Information on the vegetation of the region has been reported by Akinsoji (2003) and Chapman *et al., (*2004).The lowland rainforest is found in Southern part at the foot of the Plateau along the Donga River valley. It is composed of emergent and sub emergent tree species with tangles of climbers, vines and secondary colonizer. The low land rainforest is also found at middle altitude with elevations of 300m – 600m within the Park. When they occur along river valley and are found to be extensive, they are referred to as gallery forests. Other parts of the region are dominated by the Savanna woodland. The sub-montane and montane forests are found at elevations that are at pal with the montane forest .This vegetatation is highly favoured for grazing cattle and horses. Grazing activities have seriously disrupted this vegetation type within the Park. The major vegetation type of the park consists of woodland. Some distinctive fauna species found in GGNP include Buffalo (*Syncerus caffer*), Roan antelope (*Hippotragus equinus*), Senegal kob (*Adenota kob*), Lion

(*Panthera leo*), Leopard (*Panthera pardus*), Chimpanzee (*Pan troglodyte*), Mona monkey (*Cercopithecus mona*), Hunting dog (*Lycaon pictus*), Gaint eland (*Taurotragus debianus*),Oribi (*Ourebia ourebi*), Guinea fowl (*Numida meleagris*) and Monitor lizards (*Varanus niloticus*) among others (Mubi andTukur, 2012).

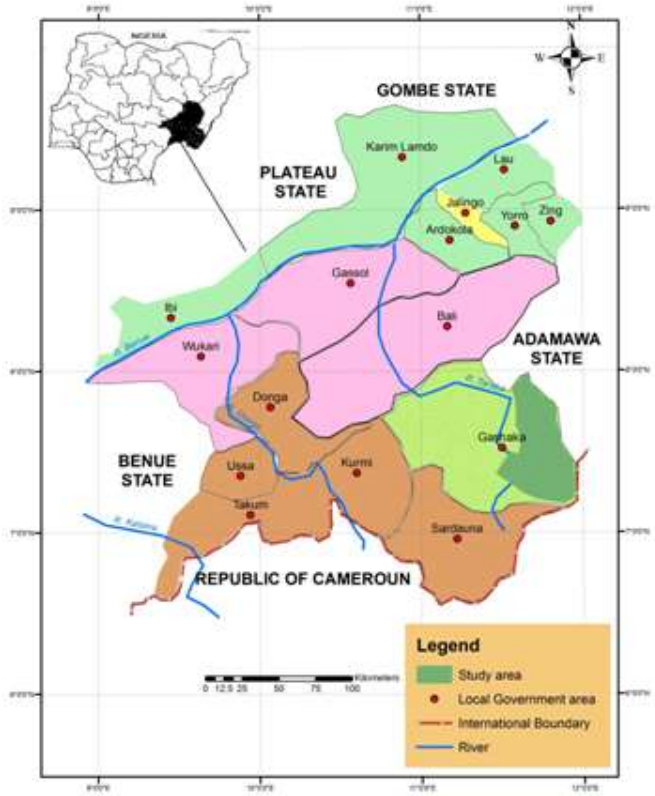

FIG.1: Map of Taraba State showing Gashaka Sector (Study Area) of Gashaka Gumti National Park
Source; Taraba State Ministry of Lands and Survey, Jalingo

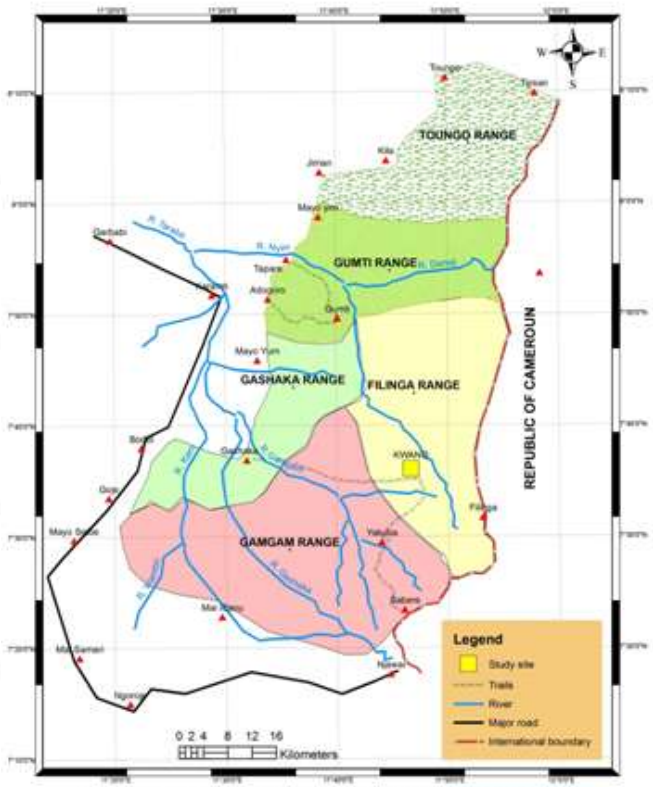

FIG.2: Map of Gashaka Gumti National Park showing the study site
Source; Taraba State Ministry of Lands and Survey, Jalingo.

Data Collection

Reconnaissance survey and available aerial map was studied to differentiate the vegetation types and efforts were made to identify the ranges and the presence of Chimpanzee communities' sites. GGNP is made of seven ranges: Filinga, Melselbe, Gumti, GamGam, Toungo, Jiman and Tipsan. Filinga range was selected for the study based on the presence of Chimpanzee. The range was stratified into four sites: Kwano site, Putty-nosed monkey site, German fort site and Mayopaa site. Among these sites, Chimpanzees communities are found in Mayopaa and Kwano. In kwano range, Ten (10) transects of 2km in length was laid along each transect, Four plots of 50 m x 50 m in size were laid in each of the transect alternatively at interval of 500m (Saka *et al*., 2018). In each plot, the numbers of trees were enumerated and the species names were recorded according to the International Plant Nomenclature Index (IPNI, 2008). In addition, the tree diameter at breast height was measured at 1.3 m above the ground level.

Tree Species Composition

The tree species composition and abundance were measured in terms of relative frequency, frequency, relative density, species relative dominance and species importance valve index, using the following equations to 8. 1, 2, 3, 4 5, 6,7 ,and 8 respectively:

$$RF = \frac{Frequency\ of\ a\ species}{Total\ frequency\ of\ all\ species} \times 100 \quad \text{-------- (1)}$$

$$F = \frac{Number\ of\ sampling\ plots\ at\ which\ the\ species\ occured}{Total\ number\ of\ plots\ sampled} \quad \text{... (2)}$$

$$RD = \frac{Number\ of\ a\ species}{Total\ Number\ of\ all\ species} \times 100 \quad \text{..... (3)}$$

$$RD_0 = \frac{Summation\ basal\ area\ of all\ trees\ of\ a\ species}{Summation\ of\ basal\ area\ of\ all\ trees} \times 100 \quad \text{. (4)}$$

$$IVI = \frac{(RD + RF + RDo)}{3} \quad \text{..... (5)}$$

Where RF is relative frequency, F is frequency, RD is species relative density, RDo is Species Relative Dominance and IVI is species importance value index.

Species diversity, Evenness and richness in the sampled plots were calculated using the Shannon-Wiener function (*H*), Shannon equitability (E) and Margalef Index (*MI*) as follows:

$$H = -\sum_{i=1}^{s} p_i \ln p_i \quad \text{..... (6)}$$

$$E = \frac{H}{lnS} \quad \text{..... (7)}$$

$$MI = \frac{S-1}{lnN} \quad \text{.....8)}$$

Where *S* is the total number of species p_i is the proportion of individuals in the ith species, *ln* is the natural logarithm, *H* is the Shannon–Wiener function, and *N* is the number of individuals.

Chimpanzee Population Survey

Line transects method:

Direct observation along ten transects using distance sampling technique of 2 km long and 1km width was adopted (Ogunjemite *et al*., 2010). The transects were walked along at the speed of 1-1.5km/h as described (Revero and Marshall, 2004) aided with binoculars. For each observation, the following data were recorded; type of species, sex, adult, young, numbers of individual, perpendicular distance and sighting distance to the nearest meter from the line to the position of each detected animal as stated. Distance was measured with a tape.

Chimpanzee Population Density

One way ANOVA was used to compare species density per season. Abundance and encounter rate of Chimpanzee was estimated using the formula:

$$D = \frac{E(n).f(0)}{2L} objects/km$$

Where: D = density, n = number of individuals detected, f (0) = detection function, E= perpendicular distance L= length of transect (Buckland *et al.*, 1993).

RESULTS

Tree Species Composition and Diversity Indices

A total of 669 individual trees belonging to 42 species in 19 families from the forty 50 m x 50 m plots were enumerated in GGNP. The stand tree density was 134 trees/ ha (Table1) .Fabaceae had the number of (5 species), followed by Apocynaceae, Moraceae and Meliaceae with (4 species) each. Caesalpinioideae, Sterculiaceae and Leguminosae contributed (3 species). While 4 families had only two species each and 8 families contributed only a single species in the study area.The species most frequently encountered include *Cola gigantean, Diospyros mespiliformis, Erythrophleum suaveolens, Mitragyna stipulosa and Carapa procera. Cola gigantean* with (9.15) has the highest importance value hence it is the leading tree dominance. Some other species have reasonable high important values, namely *Erythrophleum suaveolens (*7.02*), Parkia bicolour* (6.27), *Mitragyna stipulosa (*6.22), *Vitex doniana* (4.94) and *Pterocarpus erinaceus* (3.83). Diversity of tree species was calculated using the Shannon-Weiner Index (H') has species diversity of 3.19, species evenness index of 0.85 and Margalef index value of 6.30 (Table 2).

Chimpanzees' population Density Estimate through Direct Estimate:

Twenty eight Chimpanzee species were encountered at different transects for both dry and wet seasons (Table3). Wet season recorded the highest density of 0.314 in Transect 5 and the least density of 0.071 in Transect 6. The dry season survey recorded high species density of 0.228 in Transect 6, followed by Transect 1 with density of 0.210 and least density of 0.060 was recorded in transect 8. The result in Table 4 shows that the Dry season had a higher mean density of 0.122±0.027 while the least was 0.118±0.021 for the *wet* season. There were no significant differences *(P*≥0.005*)* in the seasons.

Table 1: Woody plants Species Composition and Abundance in the Filinga Range Gashaka-Gumti National Park.

No.	Species	Family	N	N/ha	NSP	RF(%)	RD(%)	RDo(%)	IVI
1	*Afzelia Africana*	Caesalpinioideae	11	2.2	6	3.0457	1.6442	2.6724	2.4541
2	*Antiaris africana*	Moraceae	17	3.4	6	3.0457	2.5411	3.5577	3.0482
3	*Anogeissus leiocarpa*	Combretaceae	7	1.4	4	2.0305	1.0463	0.7713	1.2827
4	*Albizia gummifera*	Leguminosae	2	0.4	2	1.0152	0.2990	0.3966	0.5702
5	*Brachystegia eurycoma*	Leguminosae	2	0.4	1	0.5076	0.2990	0.4440	0.4168
6	*Bridelia ferruginea*	Euphorbiaceae	8	1.6	4	2.0305	1.1958	3.2428	2.1564
7	*Burkeaafricana*	Caesalpinioideae	21	4.2	6	3.0457	3.1390	2.8237	3.0028
8	*Cola gigantean*	Sterculiaceae	64	12.8	14	7.1066	9.5665	10.7799	9.1510
9	*Cola nitida*	Sterculiaceae	16	3.2	6	3.0457	2.3916	0.7887	2.0754
10	*Cola millenii*	Sterculiaceae	3	0.6	2	1.0152	0.4484	0.2891	0.5843
11	*Carapa procera*	Meliaceae	22	4.4	9	4.5685	3.2885	1.9330	3.2634
12	*Detarium macrocarpum*	Caesalpinioideae	2	0.4	2	1.0152	0.2990	0.1151	0.4764
13	*Diospyros mespiliformis*	Ebenaceae	54	10.8	13	6.5990	8.0717	4.5275	6.3994
14	*Elaeis guineensis*	Palmae	2	0.4	2	1.0152	0.2990	1.4727	0.9290
15	*Erythrophleum suaveolens*	Fabaceae	71	14.2	11	5.5838	10.6129	4.8746	7.0237
16	*Ficus capensis*	Moraceae	2	0.4	1	0.5076	0.2990	0.1569	0.3212
17	*Ficus exasperate*	Moraceae	2	0.4	2	1.0152	0.2990	0.6761	0.6634
18	*Hunteria umbellate*	Apocynaceae	4	0.8	2	1.0152	0.5979	0.5366	0.7166
19	*Isoberlinia doka*	Fabaceae	5	1	2	1.0152	0.7474	0.2350	0.6659
20	*Isolona campanulata*	Annonaceae	16	3.2	9	4.5685	2.3916	3.1212	3.3604
21	*Khaya grandifolia*	Meliaceae	3	0.6	2	1.0152	0.4484	0.5409	0.6682
22	*Landolphia owariensis*	Apocynaceae	1	0.2	1	0.5076	0.1495	0.0688	0.2420
23	*Mitragyna stipulosa*	Rubiaceae	46	9.2	10	5.0761	6.8759	6.7201	6.2240
24	*Monodora tenuifolia*	Annonaceae	44	8.8	5	2.5381	6.5770	3.2741	4.1297
25	*Newtonia buchananii*	Fabaceae	4	0.8	2	1.0152	0.5979	0.7302	0.7811
26	*Parkia bicolour*	Fabaceae	63	12.6	7	3.5533	9.4170	5.8319	6.2674
27	*Prosopis Africana*	Fabaceae	5	1	1	0.5076	0.7474	0.8335	0.6962
28	*Prunus Africana*	Rosaceae	6	1.2	3	1.5228	0.8969	1.1369	1.1855
29	*Pterocarpus erinaceus*	Leguminosae	9	1.8	6	3.0457	1.3453	7.0888	3.8266
30	*Pseudospondia microcarpa*	Anacardiaceae	15	3	5	2.5381	2.2422	1.9329	2.2377
31	*Psuedocedrela kotschyi*	Meliaceae	26	5.2	3	1.5228	3.8864	3.6804	3.0299
32	*Rauvolfia vomitoria*	Apocynaceae	5	1	5	2.5381	0.7474	0.3679	1.2178
33	*Strombosia pustulata*	Olacaceae	3	0.6	3	1.5228	0.4484	0.8463	0.9392
34	*Strephenoia mannii*	Combretaceae	1	0.2	1	0.5076	0.1495	0.2372	0.2981
35	*Strychnos innocua*	Loganiaceae	18	3.6	5	2.5381	2.6906	0.7383	1.9890
36	*Strombosia gradifolia*	Olacaceae	5	1	3	1.5228	0.7474	1.7631	1.3444
37	*Symphonia globulifera*	Clusiaceae	17	3.4	6	3.0457	2.5411	2.1110	2.5659
38	*Tabernaemontana holstii*	Apocynaceae	23	4.6	8	4.0609	3.4380	2.4335	3.3108
39	*Trichilia dregeana*	Meliaceae	1	0.2	1	0.5076	0.1495	0.1585	0.2719
40	*Trilepisium madagascarience*	Moraceae	7	1.4	2	1.0152	1.0463	3.1435	1.7350
41	*Uapaca guineesis*	Euphorbiaceae	20	4	8	4.0609	2.9895	3.5563	3.5356
42	*Vitex doniana*	Verbenaceae	16	3.2	6	3.0457	2.3916	9.3909	4.9427
	Total		669	134	197				

Where: N is number of individuals, N/ha is numbers if individuals per hectare, NSP is number of sampling plots in which the species were encountered, RF is relative frequency, RD is relative density, Do is relative dominance and IVI is importance value index.

Table 2: Tree Species Diversity indices in Filinga Range of Gashaka- Gumti National Park.

Biodiversity Indices	Pooled Values
Number of Species	42
Number of trees	669
Number of trees ha^{-1}	134
Shannon-Wiener index	3.19
Pielou Evenness	0.85
Margalef Index	6.30

Table 3: Wet and Dry season Density of Chimpanzees through Direct Count in Filinga Gashaka Gumti National Park

Season	Transect	No. of individuals Sighted	Density
Wet (Aug. – Oct.)	T1	2	0.105
	T2	-	-
	T3	-	-
	T4	-	-
	T5	2	0.314
	T6	4	0.071
	T7	-	-
	T8	-	-
	T9	-	-
	T10	-	-
Dry (Jan - March)	T1	4	0.210
	T2	-	-
	T3	-	-
	T4	-	-
	T5	-	-
	T6	6	0.228
	T7	-	-
	T8	2	0.060
	T9	4	0.118
	T10	4	0.090

Table 4. Mean Species Density of Chimpanzee per Season in Filinga Range of Gashaka-Gumti Park

Species	Season		Df	T-Value	P-Value
	Wet	Dry			
Chimpanzee	0.118±0.021	0.122±0.027	6	0.14	0.89

No significance difference $P > 0.05$

DISCUSSION

In the present study, Six hundred and Sixty nine individual plants belonging to forty two species, in nineteen families were encountered as shown in Table 1.This is found to be higher than the number of plant species recorded in the montane forest of Gashaka Gumti by Akinsoji *et al*., 2016 who reported a total of 426 species belonging to 306 genera and 104 families. The findings of the work gave an indication that the general composition of woody plants species appears to be same. The top ranking species were *Erythrophleum* suaveolens (71), *Cola gigantean* (64), *Parkia bicolour* (63), *Diospyros mespiliformis* (54). These were followed by *Mitragyna stipulosa* (46), *Monodora tenuifolia* (44), while the least species were *Landolphia owariensis* (1)*,Strephenoia mannii* (1) and *Trichilia dregeana*(1). The important plants families in the Filinga Range include; Fabaceae, Sterculiaceae, Caesalpiniodeae, Euphorbiaceae, Meliaceae, Moraceae and Sterculiaceae, which were similar to those recorded in the study of Wakawa et al.,(2017). It is apparent that some families dominate the habitat. The dominant groups appear to be important to the existence of chimpanzees at the range. Plant composition, abundance and species diversity of some key families could be an influencing factor in the management and conservation of chimpanzee's habitat within the Park Range. The Shannon Wiener and evenness recorded values were 3.19 and 0.85 respectively for the study while the Shannon Wiener and evenness values of 3.75 and 0.82 was recorded in the work of Adekunle *et al.,* 2013 who worked in a strict nature reserve. The Shannon-Weiner diversity index usually varies from 1.5 to 3.5 and really exceeds 4.5 (Kent and Coker, 1992). Biodiversity indices are obtained to bring the diversity of species in different habitat to a similar scale for comparison and the higher the value, the greater the species richness. The higher value of the diversity indices of the habitat in the study area with high tree species diversity indicates that the chimpanzee habitat is in good condition.

Twenty eight species of Chimpanzees were encountered in this study and a population density of 0.314, 0.105 and 0.071 were recorded in wet season while 0.228, 0.210, 0.118, 0.090 and 0.060 were recorded in dry season. The population densities were higher than those recorded by Kamgang *et al*.,(2018).The mean density for dry season was 0.122± 0.027 higher than 0.118±0.021 for wet season.. Chimpanzees were encountered in both seasons, but there were little or no variation on effect of season on the population of Chimpanzee due to relatively stable weather condition, cover and availabity of food and feeding behavior of Chimpanzee. Even those chimpanzees which live in protected areas, like National park and reserves are subject to illegal mining, logging and agricultural activities. As these habitats become more fragmented, Chimpanzee populations are forced to live in greater isolation, which results in a less diverse gene pool.

CONCLUSION

This study reveals that the Filinga range of the Gashaka Gumti National Park support tree species composition and families which are important component of the Chimpanzees environment which provide food and cover. This has shed some insight on plant species list that are associated with Chimpanzee habitat in Nigeria. The park may still be able to sustain the animal as long as this portion of the park is maintained on sustainable bases. This further shows that the park management promotes conservation ethics.

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