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Assessment of Vegetation Structure of the African Buffalo *(Syncerus caffer)* Habitat in Kainji Lake National Park, Nigeria

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ABSTRACT: The study assessed the relative abundance and vegetation structure of African buffalo (*Syncerus caffer*) including plant parameters: frequency, diameter at breast height (dbh), tree height, diversity, evenness, richness, Margalef, dominance in Kainji Lake National Park. Point – Centered Quarter method was used for woody species enumeration. A total of twenty-eight (28) randomly sampled plots of 150m by 100m given 112 points per plot were established in the study area. The abundance and distribution, tree frequencies, heights, dbh and plant biodiversity indices were calculated using the Paleontological Statistics Software (PAST) for scientific data analysis. The results revealed that relative abundance of African buffalo in both morning and evening of dry and wet seasons in various habitats of the Park were 13.33 ± 4.41 and 11.33 ± 4.40 respectively. The study showed the highest mean value of 21.75 ± 6.94 representing 87 individuals in dry season compared to wet season with mean value of 15.25 ± 5.11 representing 61 individuals. A total of 91 woody plant species and 29 tree families were recorded in African buffalo habitats representing 80, 77, 68 and 59 tree species respectively. The highest average girth size of tree species was class between >10cm -50cm with 59.14 ± 4.06 and the highest mean tree height was height class of >3 - 10m with 91.43 ± 5.44. There were significant differences at ($p<0.05$) between the values of dbh, tree height, diversity, richness and evenness of plant species recorded in different habitats studied in the Park.

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African buffaloes dwell in broad habitat range from open savanna to rainforests, including all sub vegetation types: scrublands, grassland, woodlands and deciduous forests (Bennitt, 2012; Owen-Smith and Cain, 2007). The subspecies are not restricted by the topographical constraints, except areas with annual rainfall less than 250 mm. African buffalo persist in semiarid environments, as long as surface water is available within 20–40 km, year-round (Naidoo et al., 2012; Prins and Sinclair, 2013). The habitat requirements of the animal include abundant grass, shade and water (Skinner and Chimimba, 2005). Buffaloes must drink water at least every two days, taking in about 45 liters daily, as they are usually unable to survive on the moisture content of their food alone (Cornelis et al., 2011). They do not frequent wide open areas of grasslands/ floodplains, as they require adequate shade for resting in the hotter parts of the day (Sinclair, 1977; Aremu, 2005). Their habitat selection and foraging ecology have been relatively well studied (Landman and Kerley, 2001; Macandza et al., 2004). Because of their large body size and large groups, buffalo are able to fend off predators (Sinclair et al., 2003), thereby enabling them to forage in wooded vegetation with relatively low visibility and high predation risk. Habitats influence the distribution and interactions of animal species and their destruction can cause the disruption of key biological processes (Tews et al., 2004). Habitat quality and quantity have been identified as the primary limiting factors that influence animal population dynamics (Jansen et al., 2001; Winnie et al., 2008; Wiens et al., 2011). The remaining low population of African buffalo in Kainji Lake National Park is currently facing a lot of habitat modifications as a result of anthropogenic factors including wildfires, illegal logging activities, hunting pressure and habitat encroachment, overgrazing often causes by domestic cattle grazers, deforestation and urbanization resulting in decimation of their population. It is against this background of the habitat challenges that there is therefore, the need to measure the vegetation structure and quality of the African buffalo habitat for adequate conservation.

MATERIALS AND METHOD

Study area: Kainji Lake National Park is the first National Park and the second largest of all the seven National Parks in Nigeria (Ezealor, 2002; Ayeni,

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2007; Amusa et al., 2010). KLNP is located between latitude 9° 40' and 10° 30' N and longitude 3° 50' E and has a total landmass of 5,370.82km^2 (Ezealor, 2002; Ayeni, 2007). It consists of two sectors, the Borgu sector and Zuguruma sector. The Borgu sectors (Figure 1) cover an area of 3,970.02km S.E in Borgu Local Government Area of Niger State (Ezealor, 2002; Ayeni, 2007), Zugurma sector, on the other hand, occupies an area of 1370.80 km2 and situated in Mashegu Local Government area of Niger State. Milligan (1979) also included the vegetation of the KLNP in the guinea zone in the vegetation map of Nigeria and divides the vegetation into six main vegetation having significance as wildlife habitat types. These are: Wooded Savannah, Woodland, Dry Forest, Tree Savannah, Riparian forest and woodland and the Oli complex habitat.

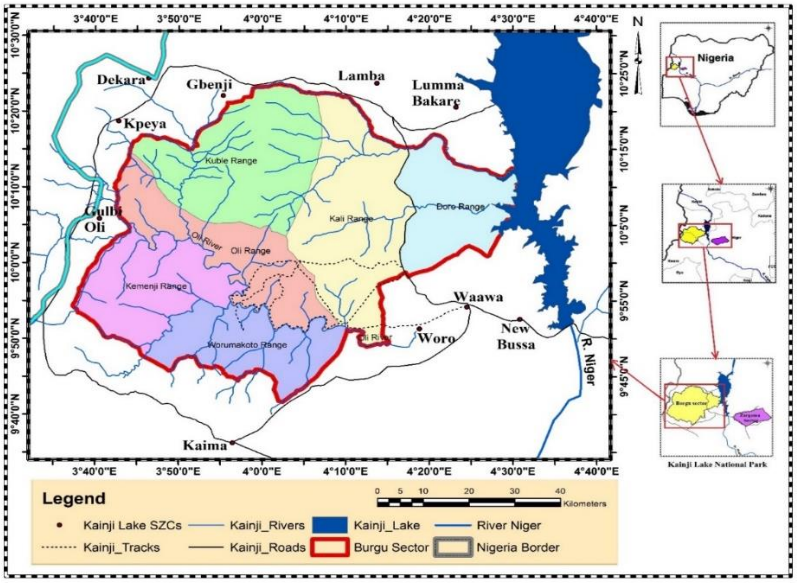

Fig 1: Borgu Sector of Kainji Lake National Park in Niger State, Nigeria. Source: Field survey, 2019

Data collection: Plot sampling technique (adopted Point Centered Quarter method) was used for woody species enumeration in four habitats (*Burkea africana/Detarium microcarpum woodland, Isoberlinia tomentosa* woodland, Riparian forest and woodland, Oli Complex habitat) where the presence of African buffalo was observed in Kainji Lake National Park. It is a pair of perpendicular lines erected at random points, forming a cross with four quadrants (Mueller–Dombois and Ellenberg 1974). A total of 28 plots of 150m x 100m given 112 points per plot represented 7 plots in each of the four habitats were randomly sampled in the study areas. At 20m interval, the PCQ was dropped and the nearest woody species in each quadrat was identified while the vegetation map of the study area described by Kuhl et al., (2008) was used as guide. At each sample point, the following ecological data were collected; the GPS co-ordinate, the species name, the distance (d) to the nearest tree in each quadrant were measured in meter, diameter at breast height (DBH) was taken with centimeter tape (Ogunjemite et al., 2013). Tree height was also taken using Haga altimeter (43913 model), Tree Height i.e. density of the foliage at the range of heights from ground level to upper canopy.

Data Analysis: All tree species within the study areas were assigned to family using Keay (1989) and Michel (2004) as guide. The Paleontological Statistics Software (PAST) for scientific data analysis was also used to calculate the biodiversity indices. Identified tree species were grouped into species common names, and families and presented in tables, chats and percentages, relative frequency, relative density were calculated (Curtis and McIntosh 1951; Natta and Van der Maesen, 2003). Species diversity values were expressed in terms of species richness for each habitat type. To quantify and compare floristic composition between habitats, the species Important Value Index (IVI) was calculated as the sum of its relative density, its relative dominance and its relative frequency (Curtis and McIntosh, 1951). Tree heights were calculated as follows: H = D x T/R where H – height, D – distance of observer from the tree, T – summation of Haga altimeter's top and bottom readings, R – range of the scale meters (25m). Species diversity, floristic composition and similarity were measured with quantitative and qualitative indices. The biodiversity indices used include Shannon wiener diversity index H^+ (Equation), Evenness diversity index H*max* (Equation), Species abundance models (Dominance diversity curves), Species relative density index (Equation), Margalef index of species richness (Margalef, 1958). The diversity index was used to determine the richness of various species and to compare their occurrence in the study areas. This was computed as follows:

(a) Shannon –Wiener diversity index (1949) was computed from: (Kent and Coker, 1992).

$$H' = \Sigma = 1P_i lnP_i \dots\dots\dots\dots\dots\dots\dots (1)$$

Where H^+= Shannon –Wiener diversity index: S= total number of species in the community: pi = proportion of S made up of the ith species; ln = natural logarithm.

Species evenness: It was determined using Shannon's equitability (Eq), which was obtained using equation (2): (Kent and Coker, 1992).

$$E_H = \frac{H_i}{H_{max}} = \Sigma - 1\,\frac{P_i lnP_i}{In} \dots\dots\dots\dots\dots\dots\dots (3)$$

Margalef species richness index (d): This was used as a simple measure of species richness according to Margalef (1958) using the following equation:

$$d = \frac{(S-1)}{\ln N} \dots\dots\dots\dots\dots\dots\dots (4)$$

Where S = total number of species; N = total number of individuals in the site and ln = natural logarithm.

Basal area: The basal area of each tree in the sample sites based on the girth size measured according to Agbelade et al., (2016) was calculated using the formula {Equation1}:

$$BA = \frac{nD^2}{4} \dots\dots\dots\dots\dots\dots\dots\dots (5)$$

Where BA = Basal area (m^2), D=Diameter at breast height (cm) and n= pie (3.142). The total BA for each plot was obtained by adding all trees BA in the sample site of the study areas.

Relative Cover (Relative Dominance) of a Species: The relative cover or relative dominance (Cottam and Curtis, 1956) for a particular species is defined to be the absolute cover for that species divided by the total cover times 100 to express the result as a percentage. For example,

$$\mathrm{RC} = \frac{\text{Total BA of species k along transect}}{\text{Total BA of all species along transect}} \times 100$$

Where RC = elative cover (Species k)

Species frequency index: Relative Frequency: used in assessing species relative occurrence (Brashears *et. al.,* 2004) and computed as:

$$\mathrm{RF} = \frac{\text{Absolute frequency of a species}}{\text{Total frequency of all specie}} \times 100$$

Where RF = relative frequency

Species relative density index: It is used for assessing species relative distribution {Brashears *et. al.,* 2004) was computed with equation {6}.

$$\mathrm{RD} = \left(\frac{ni}{N}\right) \times 100 \dots\dots\dots\dots\dots\dots\dots (6)$$

$$= \frac{\text{Number of individual species}}{\text{Total number of trees}} \times 100$$

Where RD (%) = species relative density; n, = number of individuals of species i; N = total number of all individual trees of all species in the sample site.

Species relative dominance (RD) (%): It is used in assessing relative space occupancy of a tree, were estimated using equation (3) (Aidar et al., 2001).

$$\mathrm{RD_0} = \Sigma \mathrm{Ba_i} \times 100$$
$$\Sigma Ba_0 \dots\dots\dots\dots\dots\dots\dots (7)$$

Where Ba*i*= Basal area of all trees belonging to a particular species *I*; Ba_n = basal area of all trees in the sample sites.

The Importance Value Index (IVI): The importance value of a species is defined as the sum of the three relative measures {Brashears *et. al.,* 2004):

Importance value = Relative density + Relative cover + Relative frequency:

The importance value gives equal weight to the three factors of relative density, cover, and frequency. This means that trees with small basal area can be dominant only if there are enough of them widely distributed across transects. The importance value can range from 0-300.

$$\textit{Relative Importance (RI)} = \frac{\mathrm{IVI}}{3}$$

RESULT AND DISCUSSION

Table 1 revealed the woody plant species composition in the habitat of African Buffalo in Borgu sector of Kainji Lake National Park. A total of three thousand, one hundred and thirty six (3136) trees belonging to twenty nine (29) families were enumerated in the four out of six different vegetation types where Savanna buffalo (*Syncerus caffer*) were sighted in KLNP. The findings shows that fifty (50) species were commonly distributed while fourteen (14) remained partial and twenty seven (27) were unequally spread. The study revealed that Oli River complex (Oic) habitat had the highest tree species composition in the present study with eighty (80) species from twenty four (24) families, Riparian forest woodland (Rfw) recorded seventy seven (77) species from twenty nine (29) families followed by *Burkea africana/Detarium microcarpus* woodland had sixty eight (68) species representing twenty seven (27) families and *Isoberlinia spp* woodland with the least record of fifty nine (59) species representing twenty six families of the total enumeration of woody species composition in the habitat of African buffalo in KLNP during the study period. The study reveals that there is no significant difference among frequencies of the tree species ($p > 0.05$) in the four habitats sampled in KLNP.

Table 1: Tree species diversity and frequency of occurrence in the habitat types of African buffalo in KLNP

S/n	Speces	Families	Badmw	OiC	Itw	Rfw
1	*Acacia ataxacantha*	Mimosoideae	0	4	0	0
2	*Acacia brownie*	Mimosoideae	2	1	1	3
3	*Acacia gourmaensis*	Mimosoideae	24	20	18	21
4	*Acacia hockii*	Mimosoideae	0	1	0	2
5	*Acacia laeta*	Mimosoideae	0	2	0	2
6	*Acacia seyal*	Mimosoideae	1	2	3	6
7	*Afzelia Africana*	Fabaceae	12	9	5	20
8	*Allophylus africanus*	Sapindaceae	1	0	0	1
9	*Annona senegalensis*	Annonanceae	10	4	4	10
10	*Anogeissus leicarpus*	Combretaceae	29	22	12	22
11	*Berlinia grandifolia*	Caesalpiniaceae	0	1	0	0
12	*Bombax constatun*	Bombacaceae	1	3	1	3
13	*Bosweli dalzielii*	Burseraceae	0	0	1	5
14	*Bridelia ferruginea*	Euphorbiaceae	5	10	7	10
15	*Bridelia micrantha*	Euphorbiaceae	4	3	6	4
16	*Burkea Africana*	Fabaceae	47	30	32	50
17	*Cassia mimosoides*	Fabaceae	0	1	0	3
18	*Cassia sieberiana*	Fabaceae	2	1	1	6
19	*Cordia pinnata*	Caesalpiniaceae	0	0	1	0
20	*Combretum fragrans*	Combretaceae	19	13	23	8
21	*Combretum molle*	Combretaceae	5	2	5	5
22	*Combretum nigricans*	Combretaceae	34	14	57	4
23	*Crossopterix februfuga*	Rubiaceae	31	26	68	31
24	*Cussonia arborea*	Araliaceae	0	4	0	2
25	*Cussonia barteri*	Araliaceae	3	3	2	2
26	*Dalium guinnese*	Anacardiaceae	0	0	0	2
27	*Danielia oliveri*	Caesalpiniaceae	24	22	14	41
28	*Detarium microcarpum*	Caesalpiniaceae	56	33	85	52
29	*Dichrostacys cinerea*	Fabaceae	0	1	0	0
30	*Diopyrous mespliformis*	Ebenaceae	3	2	1	7
31	*Entanda Africana*	Mimosaceae	3	5	0	10
32	*Fi cus exasperate*	Moraceae	2	2	0	7
33	*Fi cus syncomoros*	Moraceae	0	7	5	2
34	*Ficus capensis*	Moraceae	0	1	0	0
35	*Ficus mucus*	Moraceae	1	2	0	4
36	*Ficus sur*	Moraceae	0	0	2	1
37	*Gardenia acqualla*	Rubiaceae	14	10	17	0
38	*Gardenia erubescen*	Rubiaceae	3	11	1	6
39	*Gardenia ternifolia*	Rubiaceae	6	0	0	0
40	*Grewia molii*	Tiliceae	5	6	7	11
41	*Haemostaphis barteri*	Anacardiaceae	2	2	1	2
42	*Hannoa undulate*	Simaroubaceae	1	0	0	0
43	*Hymenacardia acida*	Hymenocardiaceae	11	18	9	14
44	*Isoberlinia doka*	Anacardiaceae	82	134	17	32
45	*Isoberlinia tomentosa*	Anacardiaceae	8	6	8	16
46	*Khaya senagalensis*	Meliaceae	3	4	1	2
47	*Kigelia aficana*	Bignonanceae	1	5	0	2
48	*Lannea acida*	Anacardiaceae	8	9	8	6
49	*Lannea barteri*	Anacardiaceae	3	3	0	0
50	*Lannea skimperi*	Anacardiaceae	5	15	3	5
51	*Lecanodiscus cupanioides*	Sapindaceae	0	3	0	0
52	*Lonchocarpus cyanensis*	Fabaceae	1	1	0	4

53	*Lophinra lanceolata*	Ochnaceae	11	0	8	15
54	*Maranthes polyandra*	Chrysobalanceae	34	32	23	20
55	*Maytenus senegalensis*	Celastraceae	15	29	29	8
56	*Milicia excels*	Moraceae	0	1	0	1
57	*Mimosa pigra*	Fabaceae	0	0	0	2
58	*Mitragyna inermis*	Rubiaceae	0	2	0	2
59	*Montees kerstingii*	Dipterocarpaceae	8	6	12	13
60	*Morelia senegalensis*	Rubiaceae	0	2	0	0
61	*Nauclea laifolia*	Rubiaceae	5	9	5	13
62	*Ochna schweinfurthiana*	Ochnaceae	0	1	0	0
63	*Parinari polyandra*	Chrysobalanceae	8	1	7	8
64	*Parkia biglobosa*	Caesalpiniaceae	2	1	0	7
65	*Pericopsis laxiflora*	Fabaceae	19	11	9	14
66	*Piliostigma thonnigyl*	Caesalpiniaceae	4	9	11	11
67	*Prosopsis Africana*	Mimosaceae	9	7	0	13
68	*Pseoducedrella kotschii*	Meliaceae	11	19	4	17
69	*Pteleopsis suberosa*	Combretaceae	12	5	12	4
70	*Pterocarpus erinoceous*	Fabaceae	12	9	7	18
71	*Pterocarpus satalinioides*	Fabaceae	0	1	0	2
72	*Securidaca longipenduculata*	Fabaceae	2	2	3	4
73	*Securinega virosa*	Euphorbiaceae	1	0	0	3
74	*Spondias mobin*	Anacardiaceae	1	2	0	2
75	*Sterculia setigera*	Sterculiaceae	6	1	2	1
76	*Stereospermum kunthianum*	Bignonanceae	3	7	6	13
77	*Strchnos innocua*	Loganiceae	4	4	3	0
78	*Stricnus spinosa*	Loganiceae	3	5	5	9
79	*Swartzia madagascariense*	Papilinioideae	4	3	6	2
80	*Sygium guinnese*	Myrtaceae	0	1	1	3
81	*Tamarindu indica*	Caesalpiniaceae	4	4	2	14
82	*Terminalia albida*	Combretaceae	6	10	1	6
83	*Terminalia brownie*	Combretaceae	0	0	8	0
84	*Terminalia glaucoscen*	Combretaceae	26	21	37	22
85	*Terminalia macroptera*	Combretaceae	5	61	40	36
86	*Trichilia emetic*	Meliaceae	1	4	2	1
87	*Uapaca togoensis*	Euphorbiaceae	11	5	1	5
88	*Vitelaria paradoxa*	Sapotaceae	67	23	114	35
89	*Vitex doniana*	Vernenaceae	11	4	0	11
90	*Vitex madiensis*	Vernenaceae	0	1	0	2
91	*Xmenia Americana*	Ochnaceae	7	3	0	1

From table 2, the highest Shannon wiener index of 3.873 was estimated in the riparian forest woodland followed by Oli complex habitat (3.622) and *Burkea africana/Detarium* woodland (3.594) while the least was in *Isoberlinia spp* woodland (3.304). Furthermore, the index of dominance and mean of observation was highest in *Isoberlinia spp* woodland (0.05925, 8.62 ± 1.91) while Sorenson co-efficient of community similarities is 9.06 in the habitat of the animal.

Table 3 showed the girth size distribution of the woody species in KLNP. The study reveals that the class between >10cm -50cm in KLNP had the highest average girth size of tree species (59.14 ± 4.06), and this is followed by the class 51cm – 100cm with (41.71 ± 1.86) and the class between 101cm -150cm with (10. 29 ± 5.05) while the class >151cm had the lowest (4.29 ± 1.91).

Table 4 showed the height class distribution of tree species in the habitat of African buffalo in KLNP. The study reveals that in KLNP the height class >3-10m occurred as the highest mean height (91.43 ± 5.44), followed by the class 11 -20m with 29.29 ± 7.32 while the lowest average mean height was class >21m with 0.50 ± 0.30 .

Table 2: Flora quality of species diversity indices in the habitat of African buffalo in KLNP

Habitat	Shannon_H	Margalef	Dominance_D	Evenness_e^H/S	Mean ± SE	Sorenson_C
Badmw	3.594	10.05	0.04167	0.5349	8.62 ±1.52	
Olc	3.622	11.85	0.05108	0.4676	8.62 ± 1.73	
Itw	3.304	8.703	0.05952	0.4615	8.62 ± 1.91	
Rfw	3.873	11.4	0.02852	0.6245	8.62 ± 1.15	9.06

Badmw = Burkea africana/Detarium microcarpum woodland, Olc= Oli Complex, Itw =Isoberlinia tomentosa woodland, Riparian forest woodland.

Table 5 presents the summary of the phytosociological indices of the different habitat types. Eighty species (80) tree species were recorded in the Oli complex habitat, 77in Riparian forest woodland and this is followed by 68 in *Detarium microcarpum* woodland and 59 in *Isoberlinia tomentosa* woodland. Tree density in the Oli complex habitat was calculated to be 399 trees/ hectare with the mean basal area of 2.74m^2/hectare, in the *Burkea africana*/*Detarium microcarpus* woodland it was 322 trees/hectare with the basal area of 2.63m^2/ hectare and this is followed by *Isoberlinia tomentosa* woodland was 314 trees/hectare with the mean basal area of 3.00m^2/hectare and in the Riparian forest was 309 trees/hectare with mean basal area of 3.00 m^2/hectare. The Importance Vale Index (IVI) and Relative Importance is 300 and 100% all through the habitat types.

Table 3: Girth size class distribution of tree species in the habitat of *i* African buffalo in KLNP

Girth size (cm)	Average girth size of tree species **(Mean ± SE)**			
Class	**Badmw**	**Rfw**	**Itw**	**Olc**
10 -50	58.86 ± 4.47	58.71 ± 2.54	59.14 ± 4.06	55.57 ± 3.42
51 -100	41.71 ± 1.86	38.57 ± 1.94	40.14 ± 3.10	39. 71 ± 2.11
101 -150	7.14 ± 2.30	7.57 ± 1.00	8.57 ± 1.14	10. 29 ± 5.05
>150	4.29 ± 1.96	4.29 ± 1.91	4.14 ± 1.68	6.43 ± 1.29

Table 4: Height class distribution of tree species in the habitat of African buffalo in KLNP

Height class (m)	Average height classes of tree species **(Mean ± SE)**			
Class	**Badmw**	**Rfw**	**Itw**	**Olc**
Under Storey >3 -10	91.43 ± 5.44	82.14 ± 7.53	89.30 ± 3.85	81.71 ± 4.85
Middle Storey 11 – 20	20.00 ± 5.63	29.29 ± 7.32	21.29 ± 3.74	29.43 ± 5.05
Upper Storey >21	0.50 ± 0.30	0.57 ± 0.43	1.71 ± 0.99	0.86 ± 0.34

Table 5: Summary of phytosociological indices of the different habitat types in KLNP

Habitat types	**No of Species recorded**	**Tree density/hectare**	**Basal area (m^2) (Mean)**	**Importance Value Index**	**Relative Importance**
Burkea africana/ Detarium microcarpum woodland	68	322	2.63	300	100
Oli complex habitat	80	399	2.74	300	100
Isoberlinia tomentosa woodland	59	314	3.00	300	100
Riparian forest woodland	77	309	3.00	300	100

In the present study, the distribution of African buffalo across four out of the six habitat types where African savanna buffaloes were sighted showed a wider distribution and utilization of the habitat which may be due to availability of food resources, water and shelter in those areas. This is ideal for population growth as it will reduce inter and intra-specific competition. The finding is in agreement with the report by Aremu et al., (2007); Aremu and Obasogie (2011) and Aremu and Onadeko (2016) who reported the presence of buffalo in those habitat types. The floristic composition of woody plants in *Syncerus caffer* habitat in KLNP depicts a typical guinea savannah of Sub- Saharan Africa. The floristic composition of woody plants in *Syncerus caffer* habitat in KLNP depicts a typical guinea savannah of Sub- Saharan Africa. The vegetation of the Park, is quite an open type, a kind of vegetation characterized by predominantly grasses which subjected to periodically bush burning as well as herbs, shrubs, scattered trees and other woody plants, confirming the characteristics is the scattered woody stands belonging to ninety one (91) species of woody plants in 29 families enumerated in the habitat of African buffalo in the present study. Annual burning is a common practice in savannas in order to increase grass production and to remove shrubs and saplings, though the usual practice in the Park is prescribed burning (early burning and late burning), however evidence shown in the present study through phytosociological indices of the different habitat types revealed that most of the vegetation in the Park is subjected to annual burning, albeit in no particular manner. This may not be unconnected with the fact that most fire in the Park are started by accident or by poachers to flush out animals which are believed to have significant changes in the distribution/composition and the structure of the Park's vegetation. The findings agree with Ezealor (2001) also Bowman and Murphy (2012) that indiscriminate bush burning affects biological resources and ecosystem functioning by damaging habitats and causes habitat alteration in savanna ecosystems. The result of the study also observed that *Terminalia macroptera* tree, which is normally used as shelter by Kobs (*Kobus kob*) during the rainy season, is now disappearing at an alarming rate due to the effect of burning and seasonal flooding. The habitat structure of *Syncerus caffer* revealed that most of the woody plants occurred in the lower diameter at breast height (10 -50 cm), while few of the woody plants occurred in dbh classes of >150cm. This might be a result of considerable germination as a result of absence of canopy suppression and variation in climate. Evidence from the study revealed that uncontrolled late bush burning has constantly taken place in the habitats therefore changing the vegetation structures in the habitat of the species and might affects habitat selection and distribution of wild herbivores in the study area. This findings agrees with Tyouwa et al., (2012) who reported that late fires are very disastrous as a result of higher combustible materials which burns at a higher temperature destroying wildlife habitats significantly. The important families of plants in the Park include *Fabaceae, Combretaceae, Caesalpinioideae, Mimosideae,* Anacardaceae and M*oraceae*. The members of the *Fabaceae* are *(Afzelia africana*, *Detarium microcarpum*, *Pterocarpus erinoceous*, *Burkea africana*, and *Tamarinda indica*) and *Combretaceae* (*Isoberlina tomentosa*, *Isoberlinia doka*, *Termnalia spp*) are essential components of the vegetation. African buffaloes feed mainly on grasses but occasionally observed to browse on *Combretum spp*, *Afzelia africana*, *Pterocarpus erinoceous*, *Acacia spp* and some other woody shrubs during critical season. This is supported by (Aberham et al., 2016; Macandza et al., 2004; Ryan, 2006), who reported that when pastures diminish African buffaloes feed extend their home range and food components foraging on a range of herbs, shrubs, twigs and young shoots. The study observed that the canopy covers of the woody species such as *Isoberlinia tomentosa*, *Burkea africana*, *Detarium microcarpum* and *Afzelia africana* located in the open woodland at Mamudu Lapai junction along Shehu Shagari tracks and other areas such as Zaure axis, Uffa, Nanu and Klm 3 and Sunday Ibeun track which has a combination of woodland providing the species with shelter, most especially in the mid –day when the species are likely to be resting against the ambient temperature. This findings agrees with Goni (2002) who attributed the distribution of Buffaloes along Zaure, Oli River complex, Shehu Shagari track and Mamudu Lapai to the combination of *Isoberlinia tomentosa*, *Burkea africana*, *Detarium microcarpum* and *Afzelia africana* which provided shelter to Buffaloes in the areas.

Conclusion: It is quite clear from the study that vegetation structure and distribution of KLNP depicts a typical guinea savannah of Sub-Saharan Africa. This research have been able to note the rapid change in structure and composition of the Park vegetation due to increasing human population, evidently creating pressure on land use, which has become primary causes of wildlife depletion in the savanna ecosystems of Nigeria. Therefore it is important that adequate protection should be given to the habitat types where the species were sighted.

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