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Utilization of Selected Browses Species by Primates in Four Locations of Obudu Cattle Ranch, Cross Rivers State, Nigeria

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Abstract
The study examines the extent and intensity of lopping as well as their relation to free size in Becheve Nature Research (BNR), Golf Course Range (GCR), Beau Range (BR), and Ikwette Range (IR) all located at Obudu Cattle Ranch, Cross River State, Nigeria. Four species, *Afzelia africana*, *Daniellia oliveri*, *Pterocarpus erinaceous* and *Ficus thoningii*. were chosen for the study. The vegetation study and results indicate varying degrees of utilization between the locations of the tree species. The crown condition had difference between the locations of the tree species. The frequency of crown condition is higher in BNR and Ikwette Range. The BNR had the highest frequency of woody plant that provide primate food with value 0.52 while Golf Course range, Beau range, Ikwette range has 0.32, 0.30, and 0.27 use value respectively. The human use value is more in Golf Course Range with 0.324 and very minimal in BNR with 0.29. The mean crude fiber (CF) content of the four plants (11.52%) is low. In conclusion, the spatial distribution of food strongly influences primates' patterns of movement.
Keywords: Utilization, browse species, human use, Obudu Cattle Ranch

1. Introduction

Activities of primates affect the wildlife resources of protected habitats in so many ways. According to Knight and Cole (1995), these disturbances are classified into four distinct division vis-à-vis harvesting, habitat modification, pollution and disturbances. Depending on the type and severity of disturbance, behaviour changes may be short lived and insignificant to the wildlife and or population or they may be very significant.

Most primates live in wooded environment in the tropics. These environments often appear highly productive in some seasons. Much of what is produced is not edible to primates however, and what is edible by any given species is almost always patchily distributed in both time and space. The problems of primates' utilization of browse species in protected areas have affected ecological systems resulting into various stresses, perturbations and disturbances regimes. These differences in structures and functions, combined with differences in habitat, produce a wide range of diets. This variety has been well summarized by Harding (1991) who shows that eclecticism is the rule in primate diets. Akinyemi and Kayode (2012) reported that the food material eaten by Baboon and Tantalus monkey feed on *Tamarindus indica*, *Zea mays*, *Diospyros mespiliformis*, Grasshopper and other insects. *Vittelaria paradoxum* and *Kigelia africana* was only consumed by baboons. Baboons consumed more of the seeds of *Zea mays* while Tantalus monkeys consumed more of the shoots. The major food nutrients in all food plant species are Nitrogen free extract and crude fibres.

The great majority of species eat a combination of fruits, leaves, and flowers and most also eat some animal material. Roots, bark, seeds and gum also feature prominently in many diets. With the exception of the Gelada baboon *Theropithecus gelada* and some populations of Savannah baboons (*Papio* spp) that feed heavily on grasses and herbs (Dunbar, 1979, Iwamoto, 1989. Post, 1992, Oyatogun et. al, 1983), most primates get the majority of their food from woody-stemmed plants- trees especially.

The rate and intensity of utilization of these browse species plants among the primate and between the locations, Golf Course Range, Ikwette Range, Beau Range and Becheve Nature Reserve (BNR) were studied to gain insight into the effect of utilization and location on the productivity and regeneration of these plants.

This study examines the extent and intensity of lopping as well as their relation to tree size and relate the levels of browse plant utilization to any climatological character of the area. It also analysed the proximate composition of the four browse species.

1.1 Methodology

1.1.1 Study Area

The Obudu Plateau is located on Latitude $6^0 40^1$N, Longitude $9^0 1^1$E in the northeast of Cross River State Nigeria, close to the Nigeria-Cameroon border. It is approached by a paved road from Obudu town approximately 60km northwest of the Plateau covering an entire area of 72,000ha. Topography is rugged with many disjunction and connected ridge systems, isolated peaks and rock out-crops. However, land area is generally at altitude 1500-2000m above mean sea level. Climate is essentially temperate. Temperature is low with a daily minimum and maximum of 14 - 16^0C and 18 - 25^0C respectively. Rainfall is heavy, up to 4280mm, distributed unevenly throughout the year. Soils are generally ferruginous soils, susceptible to erosion.

1.1.2 Methods

Four species, *Afzelia africana*, *Daniellia oliveri*, *Pterocarpus erinaceous* and *Ficus thoningii* were chosen for this study. Choice was based on observed preference shown by primates in the rangelands. During sampling, data was taken form snags and badly deformed trees. The following parameters were measured for each species: Crown Diameter (CD), Diameter at Breast Height (DBH), Bole height (BH), Total Height (TH), and their ecological guide.

Crown diameter was measured by vertical projection of the edge of the crown to the ground. This vertical projection was done for four axes namely: the long axis, an axis perpendicular to the long axis and two other randomly chosen axes. The mean of the four measurements was taken as the crown diameter. Diameter at Breast Height was measured with a girthen tape. Bole height and Total height were measured with a Spiegel Relascope. Crown condition at time of data collection was given a ranked score- Zero, depicting full crown with no signs of being lopped, (1) Full crown but with signs of looping, (2) Crown has sparsely distribution leaf clumps, (3) Crown more or less bare. Scores were summed up for all trees in each species encountered in the sample data analysis.

1.1.3 Data Analysis

No preliminary transformation was done on the data. To determine whether there is any effect of location on crown status, analysis of variance (ANOVA) was carried out on the crown diameter/location data. Plants were categorised into their use by primates for food. Each category attracted a score of 1.0. The mean score per category for a given site was regarded as the weighted value of that site under that category.

1.1.4 Dry Matter Productivity

This trial was designed to determine the productivity of four pasture species. The productivity was measured at fortnight interval at four locations in the ranch. Harvesting was done with the help of a wire quadrant (25 x 25cm) placed at several locations of varying performances. The plants within the quadrants were clipped as close to the soil surface as possible and the samples oven dried for 24 hours at 80^0 C.

1.1.5 Chemical analysis

Fresh foliage of the selected browse plants was sun-dried for 3 days, cut into pieces (2 to 5cm), oven-dried at 60 to 70^0C for 24 hours and ground through 1mm screen for subsequent analysis. Proximate composition was determined for percentage of dry matter (DM), crude protein (CP), crude fibre (CF), and ether extract (EE), ash and nitrogen free extract (NFE) according to the methods of AOAC (1990). The fiber fractions, acid detergent fibre (ADF) and neutral detergent fiber (NDF) where determined according to the method described by Goering and van Soest (1970). Percentage hemi-cellulose content was obtained by finding the difference between NDF and ADF values (Church, 1975).

Tannin content was determined with the Folin-Denis reagent method of Pearson (1976). Phytin in the plant samples was estimated as phytic acid using the method of Maga (1982), while hydrocyanic acid (HCN) was determined by the Knowels and Watkins distillation method as described by Pearson (1976).

1.1.6 Statistical analysis

The means and standard error of means were calculated for the proximate and anti-nutritional factor values. Means were subsequently separated using the least significant difference (LSD) method. (Steel and Torrie 1980).

1.1.7 Results and Discussion

Field studies showed that primates make highly directed movements to particular patches of food and other resources in a way strongly suggestive of goal direction and the existence of mental maps of the environment. In table 1, the values for the crown condition is observed to be different between locations but between species. For instance, there is a higher frequency of rank (3) crown condition in Becheve Nature Reserve (BNR), Golf Course Range (GCR) and Beau Range (BR) than in Ikwette Range (IR) where most trees are of zero to (1) crown condition (Table 1).

Table 1: Variation of ranked crown condition for tree species at four locations in Obudu Cattle Ranch

Location	Tree species															
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Becheve Nature Reserve	8	15	6	4	12	10	12	3	14	10	24	22	4	5	4	4
Golf Course Range	0	0	14	5	1	6	7	24	21	18	5	1	20	16	24	12
Beau Range	0	2	8	2	4	5	17	5	17	20	11	20	21	1	14	15
Ikwette Range	0	5	14	0	2	0	12	11	10	12	12	14	32	1	24	0

Species 1: Afzelia africana; Species 2: Daniella oliveri; Species 3: Pterocarpus erinaceous; Species 4: Ficus thoningii

Table 2 shows the previous year's twigs and Diameters at Breast Height (DBH). The twigs were evidently more abundant at the base of larger trees. The lack of differences in crown condition between species suggests that all species studied were utilized at equal intensity at all location whereas the difference of crown condition between locations suggests that species are more heavily utilized at some locations.

The frequency of crown condition is higher in BNR and IR. With increasing DBH, twigs observed on the ground (Table 2) in the three locations indicated that larger trees provide larger and more climbable branches which enable the grazers to obtain twigs of smaller diameter which are completely consumed by the livestock. The BNR had the highest frequency of woody plants that provide primate food. This site therefore, had the highest score of 0.52 (Table 3) for primate use value, thus regarded as the site with the best potential in supporting primate populations.

In general, the wider the areas over which primate population food resources are spread, the greater is an individual's daily path length and annual home range size. The immediate effect of tree lopping is the disturbance of the flowering/fruiting cycle thus impairing regeneration by seed. The BNR has demonstrated the potential of degraded montane forest to regenerate under effective conservation strategies.

In all the locations, the primate's food is distributed in a patchy fashion, with areas of high food concentration separated by areas of low concentration. The size of the patches, the separation of the patches in space and time, and the density of items within patches all vary according to the particular food type and the particular environment.

Table 2: Previous years Twigs and Diameter Breast Height (DBH)

DBH	1	2	3	4
	1 2 3 4 1 2 3 4	1 2 3 4 1 2 3 4	1 2 3 4 1 2 3 4	1 2 3 4 1 2 3 4
BNR	8 7 35 0 2 10 5 1	18 12 4 2 0 0 0 0	8 35 7 0 0 0 0 0	1 18 12 0 13 10 1 0
Golf Course	21 3 16 1 28 11 1 2	0 0 0 0 21 10 3 5	24 16 2 1 21 14 2 1	0 0 0 0 3 3 2 1
Beau Range	7 4 14 0 34 10 2 0	36 10 1 0 21 11 5 0	7 14 5 0 7 14 7 0	1 2 0 0 14 6 4 2
Ikwette	34 1 15 0 20 18 4 0	27 18 5 0 10 11 12 0	24 14 2 0 0 0 0 0	7 4 2 1 0 0 0 0

DBH size classes vary from species to species as indicated below

Afzelia africana	*Danielia oliveri*	*Pterocarpus erinaceous*	*Ficus thoningii*
Class 1= 16cm – 34cm	Class 1= 11cm – 31cm	Class 1= 10cm–34cm	Class 1= 10cm– 36cm
Class 2= 35cm – 53cm	Class 2= 32cm – 52cm	Class 2= 35cm–51cm	Class 2= 37cm–63cm
Class 3= 54cm – 72cm	Class 3= 53cm – 72cm	Class 3= 52cm – 74cm	Class 3= 64cm– 90cm
Class 4= 73cm – 91cm	Class 4= 74cm – 94cm	Class 4= 75cm – 92cm	Class 4= 91cm– 92cm

Table 3: Primate use value of woody plants that provide primate food

Location	Potential primate use value	Human use value
Golf Course	0.32	0.324
BNR	0.52	0.29
Beau Range	0.30	0.306
Ikwette Range	0.27	0.311

Results of proximate analysis are extensively employed in research and industry for quick estimation of nutrient potentials of feedstuffs. Although, such results may not give a true indication of the nutritive value of a feed, they supply clues in research, to plants of potential value for further in vitro or in vivo studies (Mecha and Adegbola 1980; D'Mello and Fraser 1981; D'Mello 1992). However, proximate analysis is specifically useful in screening the potentials of the array of tropical browse plants utilized by foragers.

The values for crude protein showed that the mean value of the four plants analysed (16.14% in DM) is high compared to that of tropical grass species, which seldom exceed a level of 15% (Reynolds et al 1992). The value obtained exceeds the minimum protein requirements of ruminants (10 to 12%) estimated by ARC (1985). At 18.17% CP, *Ficus thorningii* compares favorably with 16.41% result obtained for the same specie by Gidado et.al, 2013. Variations were observed between the CP values obtained in the present study and other reported values. For example, Gidado et. al. (2013) reported 21.0% for *Afzelia africana*, while in the present study it was 13.12%. Similarly, the CP value obtained for *Daniellia oliveri* (11.16%) in Gidado *et al* 2013 is lower than the 15.34% reported in this study while the 13.13% CP for *Pterocarpus erinaceous* is lower than the 17.92% obtained for the same plant in this study. This variability in the nutrient content of browses has been attributed to within species differences, plant parts, season, harvesting regimen, location, soil type and age (Norton, 1994).

Table 4: Mean values for proximate composition of selected browse plants at Obudu Cattle Ranch, Nigeria (on DM basis except for DM which is on air-dry basis)

Browse species	DM	CP	ASH	CF	EE	NFE
Afzelia africana	92.00ab	13.12c	6.00ab	7.90c	3.60c	54.18a
Daniella oliveri	93.60a	15.34bc	10.80a	10.90c	2.10c	54.46ab
Pterocarpus erinaceous	91.40ab	17.92b	12.80a	15.40b	5.20a	40.08b
Ficus thoningii	92.22ab	18.17c	9.60ab	11.90c	4.60c	46.18a
Mean	92.30	16.14	9.80	11.52	3.87	48.72
SEM	0.46	1.19	1.42	1.54	0.67	3.46

abc- Means in the same column without superscript in common are different at $p<0.05$ DM=Dry Matter, CP=Crude Protein, CF=Crude Fiber, EE=Ether Extract, NFE=Nitrogen Free Extract.

The mean crude fiber (CF) content of the four plants (11.52%) is low when compared with that of tropical grass species, which may be as high as 45to 50% at more mature stages of growth (Uwechue 1990). Ash contents of *Pterocarpus erinaceous* (12.80%), *Daniellia oliveri*. (10.80%) and *Ficus thorningii* (9.60%) were relatively high and comparable to the values 6.99%, 4.26% and 11.49% reported by Gidado et.al 2013 for *Pterocarpus erinaceous*, *Daniellia oliveri* and *Ficus thoningii* respectively.

Table 5: Mean values for acid detergent fiber and neutral detergent fiber of selected browse plants of Obudu Cattle Ranch, Nigeria

Browse plants	ADF	NDF	HC
Afzelia Africana	45.35b	49.45a	4.1c
Daniella oliveri	30.16c	58.94b	28.78c
Pterocarpus erinaceous	37.14a	44.12c	6.98c
Ficus thoningii	46.41a	52.50b	6.09b
Mean	39.76	51.25	11.49
SEM	3.81	3.09	5.79

abc Means in the same column without superscript in common are different at $p<0.05$
ADF=Acid Detergent Fiber, NDF=Neutral Detergent Fiber, HC=Hemi-Celluose

Table 5 shows the mean ADF (39.76), NDF (51.25) and HC (11.49) obtained for the preferred browse species which are tolerable for primate digestive system. Concentrations of tannin, phytin and hydro cyanic acid in the browse plants are shown in Table 6. Tannin levels in the plants were generally low and ranged from 0.55% in *Pterocarpus erinaceous* to 0.93 % in *Afzelia africana*. Mean phytin content of all the plants was 18.63 mg/g ranging from 15.40 mg/g to 21.20 mg/g. Hydrogen cyanide (HCN) content of the browses ranged from 1.44 mg/g to 1.62 mg/g. One of the constraints to the use of browse species is the presence of toxic and anti-nutritional constituents. These may have different adverse effects on animal performance including loss of appetite and reductions in dry matter intake and protein digestibility. The determination of tannins, phytin and HCN for the four browse plants was carried out and the mean tannin content of the four browse plants (Table 6) was 0.75% with the range of 0.55% to 0.93%.

The small quantity in tannin content of the browse species may likely suggests the nutritional quality of the different species. That is, level of tannin which adversely affects digestibility in ruminants is between 2% and 5% (Diagayete and Huss, 1981). Therefore, Afzelia africana which recorded the highest, i.e 0.93% in this study is within the tolerable level of tannin acceptable to primates. It would appear that all the browse species analyzed in this research contain tolerable levels of tannins to primates.

Table 6: Mean values for tannin, phytin and HCN content of selected browse plants of Obudu Cattle Ranch, Nigeria.

Browse plants (mg/g)	Tannin (%)	Phytin (mg/g)	HCN (mg/g)
Afzelia africana	0.93b	21.20b	1.62
Daniella oliveri	0.92a	20.60b	1.72
Pterocarpus erinaceous	0.55b	15.40a	1.44
Ficus thoningii	0.62a	17.32a	1.54
Means	0.75	18.63	1.58
SEM	0.09	1.37	0.05

abc Means in the same column without superscript in common are different at $p<0.05$

The phytin levels reported in the present study (15.4mg/g to 21.2mg/g) are unlikely to have any adverse consequence in primates although they could be of dietary importance to monogastric animals since they lack the phytase needed to break down the phytin to release phosphorus. The HCN contents of the browses were equally low. Siegler *et al* (1989) reported that most commonly consumed browses are cyanogenic. However, the quantity of HCN produced by most of these species is too low to pose major animal health problems (Kumar and D'Mello 1996). Generally, only plants that produce more than 20mg HCN/100g fresh weight are considered deleterious (Everist, 1981).

1.1.8 Conclusion

The vegetation study and results of data analysis indicated varying degrees of utilization between the locations of the tree species. Generally, all the species were abundant with *Pterocarpus erinaceous* commonly encountered in river bed, swampy and rocky terrain. The spatial distribution of food strongly influences primates' patterns of movement. Although, relationships between food distribution and ranging are complicated by factors such as body and the form of locomotion employed.

The browses analyzed in the study have good levels of nutrients particularly protein and contained low levels of toxic constituents such as tannin, phytin and hydro cyanic acid. *Afzelia africana* which recorded the highest in this study is within the tolerable level of tannin acceptable to primates. It would appear that all the browse species analyzed in this research contain tolerable levels of tannins to primates.

References

AOAC (1990) Official methods of analysis, 15th ed. Association of Official Analytical Chemists, Washington D C.

Akinyemi, A. F. and Kayode, I. B. (2012): Nutritional Composition of Plant Materials Consumed by Baboon (*Papio anubis*) and Tantalus Monkeys (*Chlorocebus tantalus*) in Yankari Game Reserve, Nigeria. Journal of Primatology, 1:3 http://dx.doi.org/10.4172/2167 6801.1000105.

Church, D. C. (1975): Digestive physiology and nutrition of ruminant 2nd ed. Corvallis, Oregon, A and B Books.

D'Mello J. P. F. and Fraser, K. W. (1981): The composition of leaf meal from Leucaena leucocephala, Tropical Science, Volume 23 pp.75-78

D'Mello. J. P. F. (1992): Nutritional potentialities of fodder trees and shrubs as protein sources in Monogastric nutrition, In: Speedy A and Pugliese P L (eds), Legumes trees and other fodder, Food and Agriculture Organization, Rome. pp. 115 – 127

Diagayate M. and W. Huss, (1981): Tanin contents of African pasture Plants, Effects of analytical data and in vitro digestibility, Animal Research and development, 15: pp. 79-90.

Dunbar, R. I. M. (1979): Feeding Ecology of Gelada Baboons. A Preliminary Report. *In Primate Ecology:* Studies of Feeding and Ranging Behaviour in Lemurs, Monkeys and Apes. Ed. T.H.Clutton Brock, London: Academic Press

Everist S. L. (1981): Poisonous plants of Australia. Revised edition. Angus and Robertson, Sydney

Gidado, O.G, Kibon, A, Gwargwor, Z. A, Mbaya, P. and Baba, M. J. (2013): Assessment of Anti-Nutritive Factors and Nutrient Composition of some Selected Browse Plants use as Livestock Feeds in Taraba State. Inter J Applied Science Engineering. 1(1): pp. 5-9.

Goering, H. K. and van Soest, P. J. (1970): Forage fiber analysis Agric. Handbook No. 379. ARS, USDA, Washington DC

Harding, R. S. (1991): An order of Omnivores Nonhuman Primates diets in Gathering and Hunting in Human Evolution ed. R. S O. Harding and G. Teleki, New York: Columbia University Press.

Iwamoto, T. (1989): Feeding Ecology, Ecological and Sociological Studies of Gelada Baboons. Primatology Vol. 16: pp. 46 – 58.
Knight, A. and C. A. Cole (1995): Prospect in People Oriented Conservation. Published in the Newsletter as supplement WWF and IUCN: pp. 24 – 27.
Kumar, R. and D'Mello, J. P. F. (1996): Anti-nutritional factors in forage legumes. In: Tropical legumes in animal nutrition D'Mello J P F and D Devendra (eds) CAB international Wallingford UK.
Maga, J. A. (1982): Phytate, its chemistry, occurrence, food interaction, nutritional significance and methods of analysis, Journal of Agriculture Food and Chemistry, Volume 30 pp. 1-5
Mecha, I. and Adegbola, T. A. (1980): Chemical composition of some southern Nigeria forage eaten by goats, In: Browse in Africa the current state of knowledge. Le Houerou H N (ed). ILCA, Addis Ababa, Ethiopia, pp. 303 - 306
Norton, B. W. (1994): The nutritive value of tree legumes, In: Gutteridge R C and Shelton M (eds). Forage tree legumes in tropical Agriculture. CAB International, Wallingford, pp. 177 - 191.
Oyatogun, M. O. O. . Kasim, A. R., Obot, E. A. and J. S. O. Ayeni (1983) Utilization and Relationship Between some Parameters of Selected Browse Species in four different locations of the Kainji Lake Basin Annual Report. Kainji Lake Research Institute: pp. 183 – 188.
Post, D. O. (1992): Feeding Behaviour of Yellow Baboons (Papio cynocephalus) in the Ambosed National Park, Kenya. Int. J. of Primatology 3: pp. 403 - 430
Pearson, D. (1976): The chemical analysis of foods. Churchill Livingston, Edinburgh. pp 352 - 354
Reynolds, L, Attah – Krah, A. N. and Francis, P. A. (1992): Alley Farming with livestock - guidelines, Humid Zone Research Site. ILCA 1992, pp 20
Seigler D. S, Maslin, B. R. and Conn, E. E. (1989): Cyanogensis in the Leguminosa. In: Stirton H H and Zarchi J L (eds), Advances in Legume Biology, Monograph systematic Botany. Missouri Botanical Garden, Volume 29 pp. 645 – 672
Steel, G. D. and Torrie, J. H. (1980): Principles and procedures of statistics, 2nd (ed) McGraw Hill Book Co. Inc New York
Uwechue, N. P. (1990): The effect of level of fertilizer application and stage of maturity on the yield and chemical composition of threes tropical grasses in Western Nigeria. MSc. Dissertation, University of Ibadan, Ibadan Nigeria. Unpublished.

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