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Studies on seasonal variability, availability and utilization of giraffe's food in sumu wildlife park of Bauchi state, Nigeria

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Abstract
The study examined the seasonal variability, availability and utilization of giraffes in Sumu Wildlife Park, Bauchi State, Nigeria. The Park was sub-divided into six sites; one plot of one hectare was randomly selected from each of the site. Direct observation and total count was used in noting the forage species consumed by giraffes. The most preferred forage species were obtained following the time spent on (5 to 10 minutes and 30 minutes to 1 hour) grazing/browsing on each forage species. Descriptive statistics, Pearson's product moment, correlation coefficient and t-test were used to compare the seasonal feeding behaviour, while proximate analysis was adopted in determination of feed quality. A total of 16 different forage species (11 trees and 5 grasses) belonging to 6 families were obtained seasonally. The result obtained showed that Acacia albida showed the highest dry matter (83.3%) value with lowest ether extract value (4.1%). Balanites aegyptiaca had the highest moisture content (60.1%) value compared with ether extract (1.4%) which had the lowest value. The proximate analysis of moisture content of Pennisetum purpureum is higher (75.9%) than that of Mimosa asperata (64.2%) but lower in ether extract (3.9%) than Mimosa asperata (4.7%). The results of the correlation coefficient between food availability and utilization by giraffes showed a direct relationship between food availability and utilization by giraffes during the wet and dry seasons. A test of significance of the r values showed ($p< 0.05$) a significant and none-significant correlation coefficient for wet and dry season respectively. Further research on the nutrient contents of other plants is recommended.

Keywords: availability and utilization, seasonal variability, feeding behaviour

Introduction

Giraffe`s social interaction is flexible as they may range as solitary individuals, but also gather in clusters of 20-40 animals, with solitary bulls being more common than solitary cows (\Bercovitch *et al.*, 2010). Adult giraffes do not have strong social bonds, though they do gather in loose aggregations if they happen to be moving in the same general direction. Males establish social hierarchies through "necking", which are combat bouts where the neck is used as a weapon. Dominant males gain mating access to females, which bear the sole responsibility for raising the young. While some ancient giraffes such as *Sivatherium* had massive bodies, others such as *Giraffokeryx*, *Palaeotragus* (possible ancestor of the okapi), *Samotherium*, and *Bohlinia* are more elongated. (Badlangana, *et al.*, 2009). The Giraffe is a long-necked, hoofed mammal that is natively found grazing in the open woodlands of sub-Saharan Africa. The Giraffe is the tallest living animal on land and despite its height is mostly closely related to the much smaller and solitary Okapi that is found elusively dwelling in the dense tropical forests. There are nine recognized sub-species of Giraffe that are found in differing geographic locations and vary somewhat in the colour and pattern of their spot-like markings**.** Although the Giraffe would have once been found across sub-Saharan Africa and even in parts of North Africa, today they are extinct from much of their historically vast natural range with only small, isolated populations remaining in a handful of regions in central Africa. Further south however, Giraffe populations are considered to be stable and are even growing in some areas due to an increase in demand for them on government and private ranches (Lorraine, 2002).

Giraffe (*Giraffa camelopardalis)* is one of the tallest land animal with an average height of up to 5.5m (males), 4 to 4.5m females to top of head 1100kg (800 to 1930), females 700kg (550 to 11800) (9) for male and female respectively. Neck elongated, with a short, erect mane, shoulders much higher than croup but limbs of nearly equal length. It has a tail, Hock with long black terminal turf and Horns. The pair is up to 13.5cm, borne by both sexes, the ends knobbed and hairless in adult males, thin and tufted in females and young; a median, lumpy horn and smaller bumps in males only. Coloration: ground color brown to dark chestnut (sometimes black), broken up into patches and blotches by a network of light-colored hair, the pattern individually unique; males darken with age. Scant glands: possible a pod -crane glands on eyelids, nose, adult males have a pungent odor (Richard, 1992; Williams, 2011).

The Giraffe has an enormously long neck which allows it to exploit the leaves and vegetation that are too high up for other animals to find. Despite their length, the neck of the Giraffe actually contains the same number of bones as numerous other hoofed mammals but they are simply longer in shape. The Giraffe's elongated neck leads into a short body, with long and thin, straight legs and a long tail that is tipped with a black tuft that helps to keep flies away. The Giraffe tends to be white in color with brown or reddish markings that cover its body (with the exception of their white lower legs). The markings of each Giraffes are not only unique to that individual but they also vary greatly between the different Giraffe species in size, color and the amount of white that surrounds them. All Giraffes though have large eyes that along with their height give them excellent vision, and small horn-like ossicones on the top of their heads. (Lorraine, 2002)**.**

1. Feeding Ecology and Food quality

According to Hutchins *et al.*,2003, Giraffes are picky browsers. They eat twigs and leaves mostly from the *Acacia* and *Combretum* trees. And also some related forages depending on the seasons. Some other seasonal options are seed pods, fruits, flowers, thorns, climbing plants, and wild apricot trees. Sometimes they have been seen to be eating bird nests. In the nests, they sometimes chew on the bones of the young birds that serve as extra nutrition. They usually eat in the morning, males mostly eat upper parts of the leaves and females the lower parts. They eat about 65 pounds of twigs and leaves every day. They spend 16-20 hours eating. They get the twigs and leaves by using their strong muscular tongue, and strong lips. They chew it up, swallow it, regurgitate it up, and chew it again. This odd process is repeated several times for every mouthful. They can also go a week without water. The giraffe is a primary consumer because it doesn't eat meat, it's an herbivore. They get their food by its long legs and tall necks. Both males and females can stretch their necks in high vertical position to access their food (Hummel and Clauss, 2006).

Scientists also found that the in giraffe female's diet is nutritionally richer than the males, while the males can consume more food than females can. They eat from plats in streams and rivers banks during the dry season. They adapt their feeding to different regions and seasons. Among the species of plant consume by giraffes are *Acacia nilotica, Acacia sieberiana, Acacia seyal, Combretum nigricars, Combretum mole,* which are important sources of Calcium and Protein to sustain the giraffe's growth rate. When Giraffes are stressed, they may chew the bark off branches. Although herbivorous, the Giraffe has been known to visit carcasses and lick dried meat off bones (Wikipedia, 2014). Giraffes feed on leaves, flowers, seed pods, and fruits. In areas where the savanna floor is salty or full of minerals, they eat soil as well. Giraffes are ruminants and have a four-chambered stomach. Chewing cud while traveling helps to maximize their feeding opportunities (Maisano,2006).

Du toit, (1990), stated that Giraffe feed on Acacia flowers because of the attractive food resource to it, particularly in the dry season when many of the savanna trees who have shaded their leaves and become bare. Giraffe feeding at this time is detrimental to the reproductive success of flowering trees; a strong selection of food is used for the purpose of defense against flower predation which is expected when feeding.

The giraffe (*Giraffa camelopardalis)* is usually described as an exclusive browser, feeding on shrubs and trees, preferably between 2-5 metres above ground. Although browsing seems to be an easier form of feeding for giraffes in terms of accessibility and vigilance, a few studies mention that the giraffe also 'very occasionally' feeds on grass (DuToit, 2005). To be able to graze, a giraffe has to adopt the typical 'drinking position', where the forelegs are splayed out laterally, and sometimes the carpal joints are also flexed. In this position the animals are particularly vulnerable to predator (Seeber *et al.*,2012).

2 *Giraffe diet in the dry and wet Season*

Hutchins *et al*., (2003). observed that giraffes live in habitats where the available food varies throughout the year. During the dry season, giraffes eat evergreen leaves; However, once the rainy season begins, they switch to new leaves and stems that sprout on deciduous trees. Also, twigs and branches are pulled into the mouth of the giraffe with their long and dextrous tongues. In the wild giraffes can eat up to 66 kilograms of food daily. When there is a choice, male and female giraffes feed in different ways. Males concentrate on leaves from the highest branches, while the females arch their necks to eat closer to the ground. Because of this characteristic behavior, a giraffe can be identified as either male or female from a long distance, simply by its stance while eating. Male giraffes are also more inclined to wander into dense woodland, a habitat that females generally avoid. Giraffes drink large quantities of water and as a result, they can spend long periods of time in dry, arid areas. When searching for more food they will venture into areas with denser foliage. The giraffe has tough lips to ensure there is no damage to their mouths when chewing at trees and twigs such as thorns. Giraffes in captivity are generally fed on alfalfa hay and pellets, apples, carrots, bananas and browse (elm and alder are favorites).

Study Area

1. Location of the study area

Sumu Wildlife Park lies in the heart of Lame Burra Game Reserve along the Kano Federal Highway, barely 59 square kilometres from Bauchi town It lies between the latitudes $10^0$40' and $11^0$20', North longitudes and $10^0$09'East and $11^0$30'Eastward as shown in (Figure 1). It was created in 2006 and has been visited by Bill Clinton who attested to its potential. Although 82 sq km is allocated to the Reserve, only 12 square kilometres has been fenced off. Of which, 8 square kilometre belongs to Sumu Wildlife Park. It may seem as no remarkable feat to visit Sumu to see just six species of animals, but there are a few reasons why Sumu Wildlife park is worth the trip. One reason is you get to experience a drive through the Sudan Savannah to see Nature growing untamed and the animals roaming free; it is no secret that Bauchi State caters to both the Sudan and Sahel Savannah in its 46 thousand square kilometre mass of land. The road leading to Sumu Wildlife Park is untarred with nothing but grass-covered hills and scattered little farms by the friendly people of Kafin Madaki headquarters of Ganjuwa Local Government Area, Bauchi State., (Bauchi State Government Diary [BASGD] 2013).

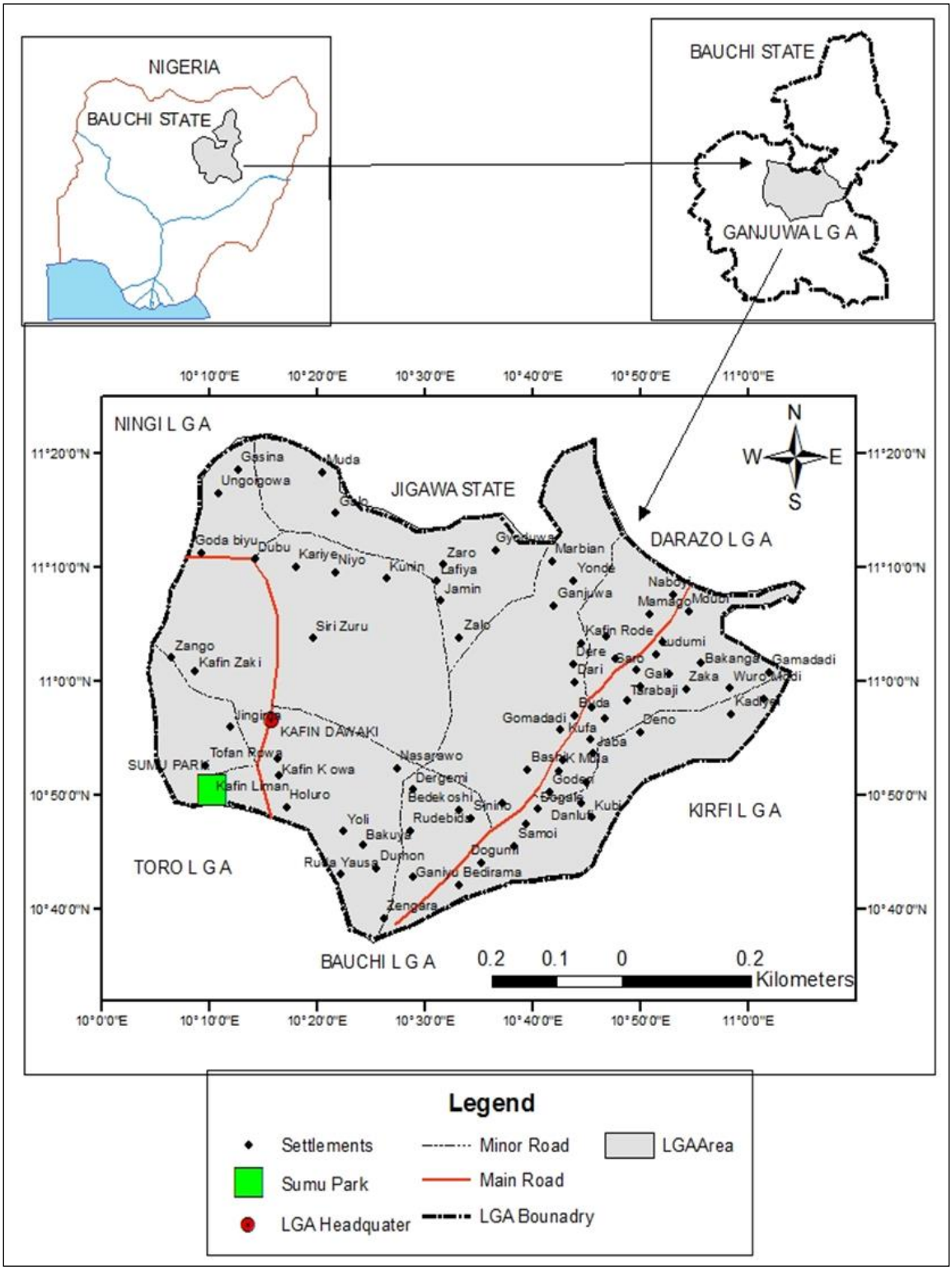
1.1 Climate

Ganjuwa has a Tropical Climatic condition. In wet/rainy season there is much more rainfall in the study area than is in the dry season. The average annual temperature is 26.8^0C while the average annual rainfall is 1021mm.The driest month is December with zero rainfall. Most precipitation falls in August with an average of 2410mm.The warmest month of the year is April with an average temperature of 30.3^0C. In December, the average temperature is 24.6^0C. It is the lowest average temperature of the whole year (BASGD 2013).

1.2 Vegetation

The vegetation of the Sumu wildlife park comprises of various types of forage species such as *Acacia seyal, Acacia senegalensis, Anona senegalensis, Combretum molle, Acacia hebeclada* etc. While herbaceous plants like *Andropogon spp, Imperata cylindrical, Aristida spp, Pannicum maximum, Pennisetum purpureum,* among others. Grass species abundant in the Open Woodland included several species with a high grazing value such as

Andropogon gayanus, *Panicum maximum* and *Digitaria eriantha* (Van Oudtshoorn 1999; Matthews *et al*., 2001: Ibrahim, *et al.*, 2012; Sauer 1983). Growing tall gave the giraffes access to a 2m band of foliage beyond reach of all other large browsers but elephant aided by its 45mm tongue and a modified atlas-axis joint that enables the head to tilt to the vertical, a giraffe can be seen feeding on crowns of small trees. Big bulls can reach up to 5.8m, nearly a meter higher than cows. Where a choice exists between high and low browse, there is a clear ecological separation between the sexes, the bulls browse on the high trees, while females concentrate on regenerating trees and shrubs below 2m. The sexes of distant giraffes can usually be predicted by whether the animals are feeding high or bending low. Differences in feeding ecology as well as lower vulnerability to predators (based on size and absence of parental responsibility) allow males to enter taller and denser woodland more readily than females, leading also to measure.



Source: BASGD, (2016)

Fig 1: Map of the Study Area

spatial separation of the sexes, (Richard,1992). Individual plants can exhibit a multitude of responses to herb ivory. Among the most conspicuous of these strategies are. Induced responses may constitute an allocation cost, whereby resources that otherwise would be devoted to growth or reproduction are used to defend the individual from attack by herbivores. Where (and when) herbivores occur, it follows that induced responses should mitigate the negative effects of herb ivory, if not provide a net benefit to individuals. By contrast, induced responses are unnecessary where herbivory is absent (Brown et al.,2007). The habitat of ungulates provides them with food, water and cover and the feeding styles of each species are therefore of primary importance in determining their preferred habitat (Van Rooyen 1990). The giraffe has suffered a major reduction in population size across its range primarily due to habitat loss, commercial overutilization, and severe poaching, and such decline continues unabated. The Federal Endangered Species Act has a duty to protect the iconic giraffe by listing the species as endangered under the Federal Endangered Species Act, which would meaningfully contribute to giraffe conservation by strictly regulating the import, export, and interstate commerce in giraffes and their parts and products. As mentioned earlier the giraffes nowadays are not as geographically widespread in Africa as they used to be.

Data collection techniques

Direct observation of the types of forage species eaten by giraffes seasonally was assessed in each of the selected plot. Data on quantity of herbaceous plants consumed were collected using quadrat of 1m x1m. The total count of the most preferred forage plant species eaten by the giraffes was adopted following Sutherland (1999) method. Data on the forage most preferred by the giraffes were obtained following the time spent on sighting the giraffe's browsing on each of the species among the individuals. Time spent browsing was measured between 5 to10 minutes, 30 minutes to 1 hour on a species preference and also the percentage availability was determined by dividing the mean number of each forage species in the six (6) plots by the total mean of all the species x 100.The food availability is assessed in terms of the density of each species relative to every other species as outlined by Mitchell and Skinner (2004).

1. Seasonal Variability and Availability of Giraffe's Forage Species in the Study Area

The results of seasonal variability and availability of giraffe's forage species in the study area is presented in Table 3. *Acacia sayel* is the most preferred species in the wet season (13.79% followed in this order: *Acacia senegal* (13.35%), *Acacia sieberiana* (12.92%), *Ziziphus mucronata* (12.25%)), *Diospyrus mespiliformis* (10.47), *Combretum hypopilinum* (10.46%), ,*Acacia nilotica* (9.73%) *Pannisetum purpureum* (9.49%) and *Combretum molle* (9.13%) while in the dry season followed in this order are *Acacia albida* (36.54%) , *Balanites aegyptiaca* (17.51%), *Acacia hebeclada* (15.88%) *Andropogan gayanus* (12.82%) *Mimosa asperata* (11.71%),*Pannicum maximum* (10.16%),and *Mimosa pudica* (9.02%). Plates I ---VI showed the result of plants most preferred by giraffe in the study area; plate I indicates giraffe feeding on *Acacia senegl* species during wet/raining season, Plate II: Giraffe eating leaves of *Combretum hypopilinum* species in wet season, Plate III: Giraffe browsing on *Acacia sieberiana* species in wet season, Plate IV: Giraffe reaching high leaves on *Balanites aegyptiaca* tree in dry season, Plate V: Giraffe eating *Acacia nilotica* species in dry season, Plate VI: Giraffes feeding on *Acacia albida* species during dry season.

2. Percentage of forage species availability on food utilization by giraffe during wet and dry seasons in Sumu Wildlife Park.

The results of the availability of forages in the wet and dry seasons showed that *Acacia sayel* were more available (13.79%) followed by *Acacia senegal* (13.35%) the least available forage was *Pannisetum purpureum* (7.41%). On utilization in the wet season *Acacia senegal* had the highest utilization value of (23.71%) followed by *Acacia seyal* (22.81%). Least value was recorded in *Combretum molle* (4.70%). During the dry season, Balanites aegpytiaca was more available (17.51%) followed by *Acacia hebeclada* (15.88%). *Mimosa pudica* had the lowest availability value of (9.02%). Utilization of forages in the dry season showed that *Acacia albida* (36.54%) followed by *Acacia hebeclada* (31.21%). The least utilized forage species during the dry season was *Andropogan gayanus* (6.7%).

The results indicate that the correlation coefficient between food availability and utilization by giraffes are r = 0.62 and r = 0.28 for wet and dry season respectively that there is a positive or direct relationship between food availability and utilization by giraffes during the wet and dry season respectively. A test of significance of the r values showed that the correlation coefficient for wet season was significant ($p < 0.05$) while that of dry season was not significant at ($p > 0.05$).

Table 1: Preference ranking of utilization and availability percentages of forage species consumed by giraffe in the wet season.

Forage species	% Utilization	% availability	preference	Preference ranking
Trees				
Acacia sieberiana	7.41	9.13	1.23	3
Acacia nilotica	11.01	9.49	1.16	4
Acacia sayel	22.81	13.79	1.65	2
Acacia senegal	23.71	13.35	1.77	1
Ziziphus mucronata	6.50	12.25	0.53	7
Combretum hebeclada	4.70	10.46	0.44	9
Combretum molle	7.40	9.13	0.81	6
Diospyrus mespiliformis	10.49	10.10	1.03	5
Grass species				
Pannisetum purpureum	6.58	12.92	0.50	8

Source: Field survey (2017)

Table 2: Preference ranking of utilization and availability percentages of forage species consumed by giraffe in the dry season.

Forage species	% Utilization	% availability	preference	Preference ranking
Acacia albida	36.54	11.35	3.21	1
Acacia hebeclada	31.21	15.88	1.96	2
Balanite aegyptiaca	13.91	17.51	0.79	5
Mimosa pudica	8.50	9.02	0.94	3
Grass species				
Andropogon gayanus	6.70	12.82	0.52	7
Pannicum maximum	8.53	10.61	0.80	4
Mimosa asperata	8.73	11.71	0.74	6

Source: Field Survey (2018)

Conclusion

The findings of this study indicated that giraffes forage resources in the study area is presently adequate in terms of diversity, variability and availability, and nutritional content distribution. Sixteen forage species were identified which are available either in the wet or dry seasons. The density and the percentages of the important forage species is adequate. Therefore, feed abundance may be attained in the study area if the available trees are protected from fire and indiscriminate cutting by fuelwood collectors. However, regeneration or enrichment planting should be encouraged in the study area. This in turn will increase the carrying capacity of the habitat with the attendant increase in giraffe's population. Thereby increasing tourism potentials of the Sumu Wildlife Park.

Recommendations

In view of the findings from this study the following recommendation are made:

1. Judging from the number of available forage species, the study area is moderately species rich. However, indiscriminate cutting of trees and shrubs in the area should be checked to prevent the depletion of these resources.
2. Further research on the nutrient content of all the forage species eaten by giraffe in the study area could be done, especially on the carbohydrate, potassium and phosphorus.
3. Therefore, further data on the concentration of micronutrients in the plants eaten should be of great interest to draw conclusions on the functions of browsing/grazing in giraffes in Sumu Wildlife Park.
4. Enrichment planting of the forage plant species most preferred by giraffe in the study area should be encouraged.
5. More food supplementation should be sustained during the drought periods and salt licks should also be provided. This is presently being done in Sumu Wildlife Park.

References

1. Ezenwa IV, Reynold Z, Okenoya ME, Attakpalis A, Cobbina N. The Effect of Season on the Chemical Composition of Some Forage Grass and Legumes Found in Nsukka Derive Savannah Zone of Nigeria, 2010.
2. Friedmann Y, Daly B. Red Data Book of the Mammals of South Africa: A Conservation Assessment. Southern Africa, Conservation Breeding Specialist Group CBSG), Endangered Wildlife Trust, South Africa, 2004.
3. Fennessy J. Ecology of theDesert-dwelling giraffe *Giraffa camelopardalis angolensis in Northwestern* Namibia. University of Syney, 2004.
4. Fennessy J. Home Range and Seasonal Movement of *Giraffa camelopardalis angolensis* in the Northern Namibia Desert. Africa Journal of Ecology,2009:47:3:318- 327.
5. Gotch AF. The Giraffe Grzmekes Encyclopedia of mammals Van Nastrand Reinhold, New York,1990:13:255-266.
6. Gotch AF. The Giraffe, Its Biology, Behaviour and Ecology. New York van Notes on the Biology of the Giraffe. East African Journal,1995:10:1-16. Down loaded on 7/5/2017.
7. Han-joachim GJ. Analysis of Forage Fiber and Cell Walls in Ruminant Nutritio.n. The Journal of Nutrition,1997:127(5):810S -813S.
8. Hoffman LC, Cawthorn DM. Animal Frontiers – Article. What is the role and contribution of meat from wildlife in providing high quality protein for consumption?,2014:2(4):40-53.
9. Hutchins M, Kleinan D, Geist V, Medade M. Grzenek's Animal Life Encyclopedia. Okapis and Giraffes, Vol. 15: iv, 2 Edition forming ton Hills, mi: Gale group, 2003, 399-408.
10. Hummel J, Sudekum KH, Jurgen WS, Marcus C. Forage Fermentation Patterns and their Implications for Herbivore Ingest a Retention Times, 2006.
11. Hummel J, Clauss M. Feeding. In EAZA Husbandry Management Guidelines for *Giraffa Camelopardalis,* 2006, 26-61.
12. International Sustainability Council, ISC Home Resources Koppen Climate and Biomes the Tropical Climate Savanna Biome- Wet-Dry Tropical Climate (AW), 2013. Down loaded on 24-6-2018.
13. James M. Wikipedia, Giraffe, the Free Encyclopedia, 2011.
14. John R. Giraffe under Threat: Population Down to 40 Percent in Just 15 Years, 2014.
15. Kerk IZ. Sixteen Active Plant Explained: The Encyclopedia of Medical Plants, 2009.
16. Klein H. The Giraffe Conservation Foundation, Frequently Asked Question about Giraffe, 2017. www.giraffeconservation.org. Retrieved on 08-05-2017
17. Kitilit JK, Tuitoek JK, Musalia LM. Nutrient Composition of White thorn (*Acacia seyal*) and Desert date (*Balanites aegyptiaca*). Bulletin of Animal Health and Production in Africa,2002:50(2):130-132.

18. Kingdon J. East African Mammals: An Atlas of Evolution in Africa, and Part B: Large Mammals. University of Chicago Press, 1988:3:313-37.
19. Lawal B, Ossai PC, Shittu OK, Abubakar AN. Evaluation of Photochemical Proximate, Minerals and Anti-Nutritional Compositions of Yam Peel, Maize Chaff and Bean Coat, 2014.
20. Lauren EC, William MS, Allen G. Female Tannin Avoidance: A Possible Explanation for Habitat and Dietary Segregation of Giraffes *(Giraffa camelopardarlis peralta)* in Niger. African Journal of Ecology,2003:41:201-210.
21. Leuthold BM. "Social Organization and behaviour of giraffe in Tsavo East National Park". African Journal of Ecology,1979:17(1):19-34.
22. Le Pendu Y, Ciofolo I, Gosser A. The social organization of giraffes in Niger. African Journal of Ecology,2000:38:1(78-85).
23. Lorraine J. Literature Review of Giraffe *Giraffa,* 2002. *camelopardalis* www.aszk.org.
24. Lukhele MS, Van ryssen JBJ. The Chemical Composition and Potential Nutritive Value of the Foliage of Four Subtropical Tree Species in Southern Africa for Ruminants. *South African Journal of Animal Science,* 2003, 132-141. http://www.sasas.co.za/Sajas.html.
25. Matthews WS, Van wyk AE, Van rooyen N, Botha GA. Vegetation of the Tembe Elephant Park, Maputa land, South Africa. South African Journal of Botany,2001:67:573-594.
26. Maisano S. "*Giraffa camelopardalis*" (On-line), Animal Diversity Web (ADW), 2006. http://animaldiversity.org/accounts/Giraffa_camelopardalis. Accessed August 25, 2018
27. Mitchell G, Skinner JD. On the Origin, Evolution and Phylogeny of Giraffes *Giraffa camelopardalis*" Transactions of the Royal Society of South Africa 58(1): 51-73. Fauna and Flora,2003:59(2):49-57.
28. Mitchell G, Skinner JD. "Giraffe Thermoregulation: A Review" Transactions of the Royal Society of South Africa: Proceeding of a Colloquium on Adaptations in Desert Fauna and Flora,2004:59(2):49-57.