FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 3 No. 3, September, 2019, pp 449 –455

ANTHROPOGENIC ACTIVITIES JEOPARDIZING THE ABUNDANCE OF LATEX-PRODUCING PLANTS IN THE VEGETATION BELTS OF NORTHERN NIGERIA

[1]Papi, D. Y. and [2]Onaji, I. A.

[1]Department of Plant Science and Biotechnology, Faculty of Natural Sciences, University of Jos, Jos, Nigeria.
[2]Department of Pharmacy, Microbiology and Biotechnology, Faculty of Pharmaceutical Sciences, University of Jos, Jos, Nigeria.

Corresponding authors email: **ydpapi@yahoo.com,**

ABSTRACT
Ecological studies were carried out to ascertain the niche of latex-producing plants in the different vegetation belts of Northern Nigeria considering anthropogenic activities as a factor. Global Positioning System (GPS) and Stratified random sampling were used to locate towns for data collection. Twenty (20) plots of 15 m x 20 m (300 m^2) quadrat size were considered, 5 plots from each vegetation belt of Southern Guinea Savanna (SGS), Northern Guinea Savanna (NGS), Sudan Savanna (SS) and Montane Vegetation (MV). Also, a quadrat size of 1 m x 1 m was placed 4 times in each of the 20 plots to enable the counting of forbs and grasses. The total latex-producing plants available in each of the vegetation belt revealed that Southern Guinea savanna had 6.57%, Northern Guinea savanna had 3.76%, Sudan savanna had 9.33% and Montane vegetation had 20.14% of the total number of individual plant species of 70, 53, 30 and 85 respectively collected in the each vegetation belt. Ten (10) families collected during the work were noted to produce latex namely, Aloeceae, Sapotaceae, Cohlospermaceae, Euphorbiaceae, Moraceae, Convolvulaceae, Meliaceae, Asclepiaceae, Cactaceae and Apotaceae. Thirty three (33) of the plant species collected were latex-producing plants, while 109 plant species were non-latex producing plant species. The diversity of latex-producing plants decreases to the North probably because of the increase in the open grazing and other human activities.

Keywords: Anthropogenic activities, abundance, latex–producing plants, Vegetation belts and Northern Nigeria.

INTRODUCTION

Nigeria is in the tropical zone of the world and has a land area of about 923,769 Square kilometers with the Northern region covering about 80% of the entire landmass (Salako, 2003). The country comprises of five ecological zones namely Swamp forest, Tropical rainforest, Guinea savanna, Sudan savanna and Sahel savanna (Ikhouria, 1993). Northern Nigeria is characterized by low rainfall and drought like conditions (Xue and Shukla, 1993). Despite the perceived harsh weather conditions of this region, plants such as *Acacia species*, *Adansonia digitata*, *Magifera indica*, *Citrus senesis* and *Moriga oleifera* with some suitable food crops like cereals (*Oryza sativa*, *Sorghum bicolor*, *Zea mays*) and legumes (Soya beans and Cowpea) flourish well in this area.

Latex is a complex emulsion of starch, gum, sugar, oils and alkaloids which is produced upon plant tissue damage and coagulates on exposure to air (Hunter, 1994; Hopkins and Harper, 2001). It may be natural or synthetic in nature (Richard *et al*., 2011). Latex found in nature is a milky fluid found in 10% of all flowering plant species (Angiosperm) and it has no known function in primary metabolism (Lewinsohn, 1991). Latex is also reported in Mushroom (*Lactarius species*), Conifers (*Gnetum species*) and Pteridophytes (Metcalfe, 1967). Latex is also used as a defense against grazing animals, this is because some of the plants lattices are very bitter or even poisonous (Agrawal and Konno, 2009).

Human activities such as agriculture expansion, pastoralism, fuel-wood extraction, loading of fuel-wood, vehicular movement, hunting, poaching, mining, bush burning have been suggested to be part of the causes of land degradation in Nigeria (Warren, 2002). These anthropogenic activities have immensely down-graded the natural vegetation cover and subsequently exposed the soil surface and rendered it vulnerable to the element of weather. About 80% of the inhabitants of Northern Nigerian are involved in crop production, pastoral farming and nomadic pastoralism (Omokaye *et al.,* 2001). Farmers will always seek new land for expansion not because of decline in fertility of the soil while the pastoralists are not always stable and search for new land and grasses to obtain fresh and uncontaminated plants especially grasses and herbs (Schaefer, 1998; Sobulo, 1985). Humans and large mammals' activities is key in generating vegetation changes with extensive down effects on ecological pattern and processing. Herbivores body size and hoof structure influence the number of imprints and area trampled (Cumming and Cumming, 2003; Holtmeier, 2015). The size of herbivores and the habitat productivity is

paramount too and commensurate the magnitude of destruction on the vegetation. Herbivores eat plant materials and pass out waste matter on the vegetation (Dove and Mayes, 1991). Human activities have immense impact on the natural world on issues including climate change, habitat destruction, over harvesting and the introduction of invasive species in new settlements of man. Although changes to the environment have been occurring long before the arrival of humans on earth but man has fast tracked it, thus the plant species are confronted with numerous environmental conditions than encountered previously resulting from the extensive anthropogenic activities (Sih *et al*., 2011; Sih, 2013).

Herbivory can reduce the abundance of woody plants, shifts in woody plant species composition and modify vegetation responses to climate and soils (Bakker *et al.,* 2015). Ordinarily, plants are defenseless against herbivores but the production of spines and thorns reduce the palatability of plants to herbivores (Young *et al*., 2003). This work is carried out to ascertain the effects of anthropogenic activities on the abundance of latex-producing plants in the various vegetation belts of Northern Nigeria.

MATERIALS AND METHODS

Selection of Sampling Area

This study was carried out in four study areas using Global Positioning System (Arc-Gps 9.3 Version) from National Centre for Remote Sensing, Jos and stratified random sampling to select state capitals for data collection. The following state capitals fell on a particular longitude, each of which represents a vegetation belt namely. Lokoja represents Southern Guinea Savanna (SGS), Minna represents Northern Guinea Savanna (NGS), Katsina represents Sudan Savanna (SS) and Jos represents Montane Vegetation (MV). The state capitals or towns that represent the savanna study areas (SGS, NGS and SS) were picked on longitude 7.00 while the town that represents Montane Vegetation (MV) was optioned on longitude 9.50 to avoid being bias. Figure 1 shows coordinates for selection of state capitals while figure 2 shows state capitals of Northern Nigeria visited for date collection.

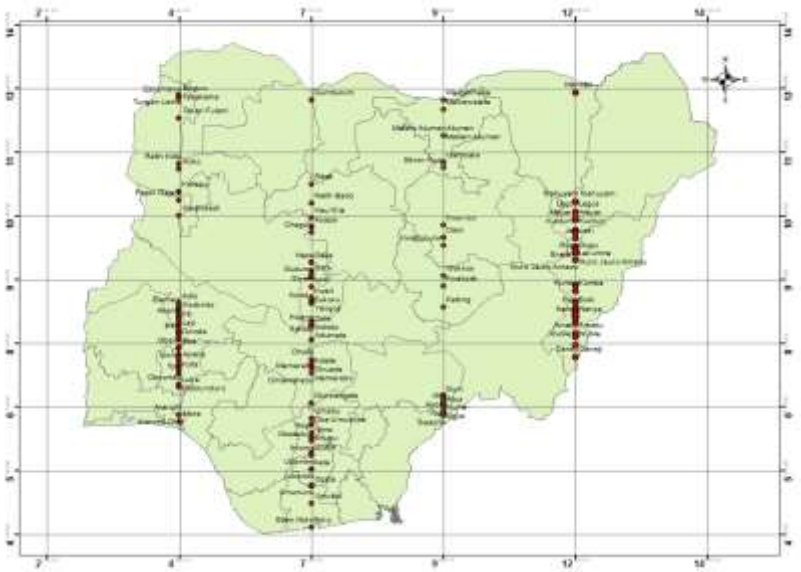

Fig. 1: Map of Nigeria showing the different coordinate for selection of state
Source – National Centre for Remote Sensing, Jos, Nigeria

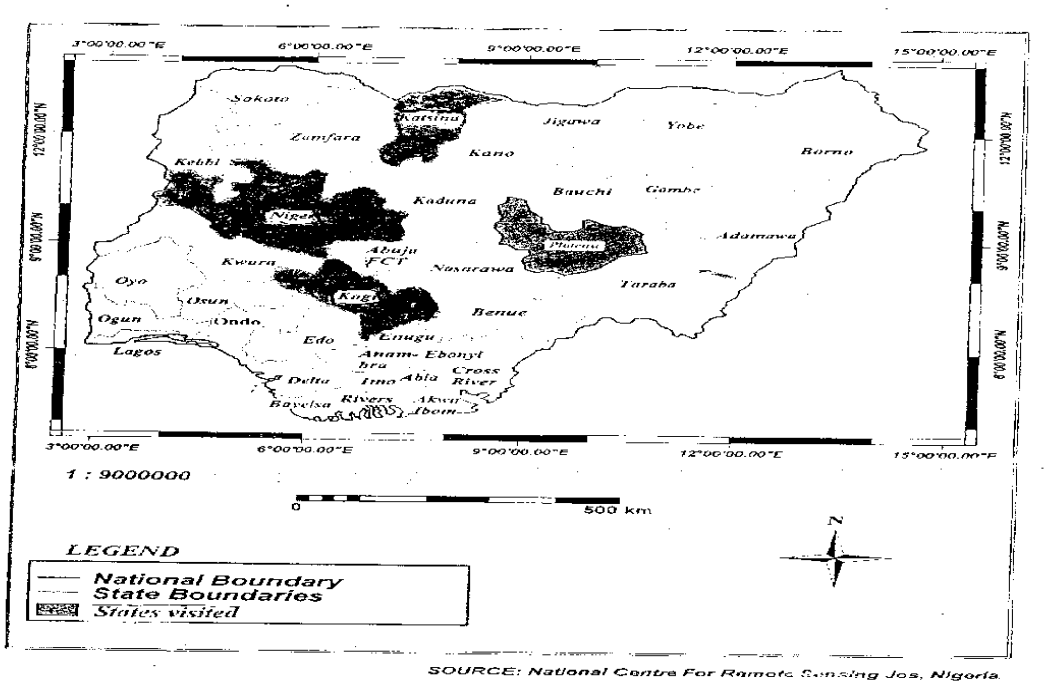

Fig. 2: Map of Nigeria showing the different states capital visited
Source – National Centre for Remote Sensing, Jos, Nigeria

Description of Study Areas

Lokoja the capital of Kogi state is located between 7° 46¹N – 6° 48¹E. The mean annual temperature is about 27.7 °C and average relative humidity of 48 %. Minna the capital of Niger State lies between 8° 20¹N - 7° 20¹E. Niger State experiences distinct dry and wet seasons with annual rainfall varying from 1,000 mm to 1,200 mm. It has a temperature of 25 °C - 37 °C and average relative humidity of 42 %.

Katsina the state capital of Katsina State is located between 12° 59¹N – 7° 35¹E, with total annual rainfall figures ranging from 600 mm to 700 mm. The average relative humidity ranges from 13 % to 22 %. The semi-arid area has an average temperature of 33 °C. Jos, the Plateau State capital is in Nigeria's middle. It is located between 9° 53¹N and 9° 51¹E. Bare rocks are scattered across the grasslands of the plateau. Though situated in the tropical zone, a higher altitude means that Plateau State has a near temperate climate with an average temperature of 20 °C. The mean annual rainfall varies from 1,100 mm to 1, 600 mm on the Plateau. The average relative humidity ranges from 39 % (Iloeje, 2001). A total of 20 plots were used for data collection.

Plot Size used for the Study

In each study area, a minimal plot size of 15 m x 20 m (300 m^2) was randomly established for data collection through stratified random sampling (Braun-Blanquet, 1964; Van- der Maarel, 1988). Each plot was divided into four and 1m x 1m woody quadrat was randomly placed, one in each quarter to enable the counting of grasses and forbs.

Vegetation Sampling and Analysis

When a plot is selected and a dimension determined, trees and shrubs in each plot were counted, plant parts were cut, those that produced latex were recorded and all plants encountered were collected in a plant press for identification. Unidentified plants on the field were coded and photographs of the plants encountered were also taken.

Books by (Cope, 2001; Zhang *et al*., 2008) and authorities were contacted for identification in various higher institutions (Federal School of Forestry, Jos and University of Jos, Nigeria).

RESULTS

The abundance of latex-producing plants declined towards the North as it is applicable to other plants due to reduced rainfall, increase in light intensity, reduced humidity and increase in rearing of animals and other anthropogenic activities.

Table 1 depicts the total percentage of latex-producing plants available in each of the vegetation belt occurred in this order: Southern Guinea Savanna had 6.57%, Northern Guinea Savanna had 3.76%, Sudan Savanna had 9.33% and Montane vegetation had 20.14% of the total number of individual plant species collected in the various vegetation belts.

Table 2 shows that a total of 33 plant species retrieved in ten (10) families of Latex-producing plants were encountered during the study. The results are as follows; 1 Apocynaceae, 2 Aloaceae, 1 Cochlospermaceae, 10 Euphorbiceae, 10 Moraceae, 3 Convovulaceae, 1 Meliaceae, 1 Asclepiaceae, 3 Cactuceae and 1 Sapotaceae

Table 1, mean of total number of latex-producing plants (± 95 % confidence limit) compared with the mean number of all individual species in study area

	Study Area	Latex-producing plants	All Individuals
1	SGS	4.6 ± 3.57	70.0 ± 28.58
	% total of latex-producing plants	6.57%	
2	NGS	2.0 ± 1.24	53.2 ± 40.71
	% total of latex-producing plants	3.76%	
3	SS	2.8 ± 1.04	30.0 ± 6.74
	% total of latex-producing plants	9.33%	
4	MV	17.2 ±14.19	85.40 ± 17.78
	% total of latex-producing plants	20.14%	

Table 2: Latex-producing plants and plant families collected in the study areas.

	Botanical name	Family	Common name
1	*Aloe schweinfurthii* Engl.	Aloaceae	'-
2	*Carissa edulis* Vahl.	Aloaceae	Simple Spine num-num
3	*Chrysophyllum albidum* G.Don	Aloaceae	white star apple
4	*Cochlospermum Planchonii* Hook F. ex. Planch	Cochlospermaceae	Dye plant
5	*Euphorbia heterophylla* L.	Euphorbiaceae	Painted euphorbia
6	*Euphorbia hirta* L.	Euphorbiaceae	Pill-pod sand mat
7	*Euphorbia Kamerunica* Pax.	Euphorbiaceae	Cactus
8	*Euphorbia lactea* L	Euphorbiaceae	Mottled spurge
9	*Euphorbia mauritanica* L	Euphorbiaceae	Spurge
10	*Euphorbia milli* L	Euphorbiaceae	Christ thorn
11	*Euphorbia neriifolia* L.	Euphorbiaceae	India spurge tree
12	*Euphorbia tirucalli* L.	Euphorbiaceae	Pencil plant
13	*Euphorbia trigona* L	Euphorbiaceae	African milk Weed
14	*Euphorbia unispina* N.E.Br.	Euphorbiaceae	Candle plant
15	*Ficus abutilifolia (*Miq) Miq	Moraceae	Fig discifera
16	*Ficus aurea*	Moraceae	Florida strangler fig
17	*Ficus capreifolia* Delile	Moraceae	River sand paper
18	*Ficus exaperata* Vahl.	Moraceae	Paper fig
19	*Ficus glumosa* Del.	Moraceae	Mountain rock fig
20	*Ficus platyphylla* Delile	Moraceae	Flake rubber
21	*Ficus sur* Forssik	Moraceae	Broom cluster fig
22	*Ficus sycomorus* (Miq.)E.C.Berg	Moraceae	Sycamor fig
23	*Ficus thonningii* Blume	Moraceae	Common fig
24	*Ipomea carnea (*Mart. Ex Choisy) D. Austin	Moraceae	Gloria Da La Manana
25	*Ipomoea asarifolia* (Desr.) Roem &Schult	Convolvulaceae	Ginger leaf morning glory
26	*Ipomoea involcrata* P.Beauv.	Convolvulaceae	Morning glory
27	*Ipomoea triloba*	Convolvulaceae	Little bell
28	*Khaya sensgalensis* (Desr)A.Juss	Meliaceae	African mahogany
29	*Leptadenia hestata* (Pers.) Decne	Asclepiaceae	Laptaden
30	*Opuntia dillenii* Haw	Cactaceae	Prickly pear
31	*Opuntia lindheimeri* Engelm	Cactaceae	Taxas prickly Pear
32	*Opuntia littoralis (*Engelm.) J.M. Coult.	Cactaceae	Coastal Prickly Pear
33	*Vitellaria paradoxa* Gaertn F.	Sapotaceae	Shea butter tree

DISCUSSION

Human activities on the savanna biomes are so devise thereby causing immense impact on the ecosystem, killing non target organisms especially the latex-producing plants which are easily trampled upon by man or his animals on the field during rearing, mining of minerals, farming, cutting of firewood and loading of fire wood for sale to the public. This is in line with the findings that in Northern Nigeria, Sahel and Sudan savanna plants are cut down for money (Mortimore and Adams, 2001).

Cattle are reared by the pastoralists who navigate from the Sahel savanna to the Southern Guinea Savanna via Montane and Sudan savanna in search of fresh fodders on the bank of river Benue yearly and they returned to the North at the commencement of the raining season (Adebayo, 1997). The pastoralists prefer to go back to the north because of the existence of Tse-tse fly in the southern part of Nigeria that causes Trypanomaisis in human beings and Nagana in herbivores. Also the size, number and the weight of the herbivores trampling on the vegetation including latex-producing plants that are fragile as the cattle move from the north to south and vice versa. The magnitude of the destruction caused on the vegetation is immense as observed by (Bakker *et al.*, 2006).

The diversity of latex-producing plants decreased from the Southern and Northern Guinea Savanna probably because of the increase in the open grazing and other human activities which impact on plants negatively (Bello *et al.*, 2013). Some of the latex-producing plants are delicate and are hollow as a result, it reduces the resistance to pressure resulting from trampling effects by the large animals and man's activities in the different vegetation belts of Nigeria. Rainfall decrease from south to north but latex-producing plants are xerophytic in nature and they are assumed to exist better in the northern part of Nigeria because of their aridity trait but the reverse is the case.

Latex- producing plants survive for a long time because of their stringent adaptive features. According to Heinrich and Siegmar, (2002) latex-producing plants of Cactaceae and Euphorbiaceae families grow very slowly and are not available at the pioneer stage of succession. For example, Saguaro plant (*Cactus* species) grows slowly but may live up to 200 years. When at 9 years old, they are about 15 cm high and after about 75 years, the cacti (Saguaro) develop their first branches. So, this plant species cannot grow to a reasonable height before they are destroyed in places that experience intermitted anthropogenic activities.

As a back up to this finding, Smith and Young, 1987 opined that rocky areas are unreachable by man, his animals and even the spread of bush fire, this is because, any injury inflicted on the succulent and spongy tissue of latex-producing plants can easily get healed and dry up, thus microbes would not gain entrance into the tissues to cause more havoc through damage or cause diseased condition, while in the savanna vegetations where temperature and relative humidity are high, hence favour the activities of microbes. The abundance of latex-producing plant species on the Montane vegetation was not unconnected to the fact that the rocky terrain of the Jos study area exposes the vegetation to strong cold wind which could be responsible for low mean temperature value thus, low microbial activities favoured latex- producing plant survival. According to Senioniti *et al.* (1986) when temperature is about 44^0C, microbes work at their best but when temperature is at 15^0C, the microbes are passive, so the plants are scanty in all savanna vegetations and any injury on either latex and non-latex producing plants would easily kill the plant because of the activeness of microbes as a result of favourable climatic conditions.

CONCLUSION

The poor distribution of latex-producing plants in Southern guinea savanna, Northern guinea savanna and Sudan savanna study areas could be attributed to human interferences and the limited time allowed for latex-producing plants to regenerate from injury or damage due to anthropogenic activities. Latex-producing plants collected in Sudan savanna were scanty and recorded only Convolvulaceae family while ten (10) families were recorded on Montane vegetation due to its inaccessible terrain.

The most significant finding of this work is that the distributions of latex-producing plants show a decline to the North even for the increase in aridity since they are xerophytic by nature. Xerophytes are domicile in the desert thus, are supposed to dominate the North if not for the huge anthropogenic activities. Therefore, the vegetation of Northern Nigeria, especially latex-producing plants were noted to be scanty in abundance in the Southern, Northern and Sudan savannas, while it is higher on Montane vegetation, understanding is pointing to possible climate, physiographic and biotic influences.

ACKNOWLEDGMENT

The following people namely Mr. Solomon Zakka of Bama-Ali Polytechnic Zaria Kaduna State and Mr. Fada Yakubu of Ministry of Culture and Tourism Minna, Niger State were recognized for assisting in data collection on the field.

REFERENCES

Adebayo, A. (1997): Contemporary dimensions of migration among historically migrant Nigerians. *Journal of Asian and African Studies.* **32**: 93–109.

Agrawal, A.A. and Konno K. (2009). Latex: a model for Understanding Mechanisms, Ecology, and Evolution of Plant Defense Against Herbivory. *Annual Review of Ecology, Evolution, and Systematics*. **40**: 311–331.

Bakker, E.S, Gill, J. L, Johnson, C.N, Frans W.M.V , Sandom C.J , Asner, G.P , Svenning J.C (2015). Combining paleo-data and modern exclosure experiments to assess the impact of megafauna extinctions on woody vegetation. *Proceedings of the*

National Academy of Sciences of the United States of America. 113:846-855.

Bakker E. S., Ritchie M. E., Olff H., Milchunas D. G., and Knops J. M. H. (2006). Herbivore impact on grassland plant diversity depends on habitat productivity and herbivore size. *Ecology Letters.* 9, 780–788.

Bello, A. G., Isah, A. D. and Ahmad, B. (2013). Tree species diversity analysis of Kogi forest reserve in North-western Nigerian. *International Journal of Plant, Animal and Environmental Services.* **3**(3): 189 – 196.

Braun-Blanquet, J. (1964) *P. Janzensoziologie.* 3. Auflage. Springer-Verlag, Wien. Bredenkamp, G., Chytrj, M. Fischer, H.S., Neuhauslova, *2.* & van der Maarel, E. (eds) (1998) Vegetation mapping: Theory, methods and case studies. *Applied Vegetation Science.* **1,**161-266.

Cope, E.A (2001). Muenscher's Key to Woody Plants: An Expanded Guide to Native and Cultivated Species. Cornell University Press, Ithaca, New York. Pp. 337.

Cumming D. H. M., and Cumming G. S. (2003). Ungulate community structure and ecological processes: Body size, hoof area and trampling in African savannas. *Oecologia*. 134, 560–568.

Dove, H., and Mayes R. W. (1991). The use of plant wax alkanes as marker substances in studie of the nutrition of herbivores – A review. *Australian Journal of Agricultural Research*.**42**,913–952.

Heinrich, W. and Siegmar, W. B. (2002). Walter's Vegetation of the earth: The ecological systems of geo-biosphere. *Springer*. Pp 457.

Hopkins, T. L, Harper M. S. (2001). Lepidpoteran peritrophic membranes and effects of dietary wheat germ agglutinin on their formation and structure. *Archives of Insect Biochemical Physiology,* 47:100–9 Howard JB, Glazer AN. 1969. Papaya lysozyme: terminal sequences and enzymatic properties. *Journal of Biological Chemistry.* 2**44**:1399–409.

Holtmeier F.K. (2015). Animals' influence on the landscape and ecological importance Natives, newcomers, home-comers. New York: *Springer*.

Hunter, J.R. (1994). Reconsidering the Functions of Latex. *Trees Structure and Function*, 9: 1-5.

Iloeje, N.P. (2001). A new Geography of Nigeria. New Revised Edition. Longman Nigeria PLC. Pp, 200.

Ikhouria, I.A., 1993. Vegetation and Landuse Changes in a Rainforest Ecosystem. *Nigerian Journal of Remote Sensing*, **1**(1):73-82.

Lewinsohn, M.T. (1991). The Geographical Distribution of plant latex. *Chemoecology* **2** (1): 64–68.

Metcalfe, C. R. (1967). Distribution of latex in the plant kingdom. *Economy Botany*, **21**:115–27.

Mortimore, M.J, Adams W.M.(2001) Farmers Adaptation, Change and crisis in th Sahal. *Global Environmental change. 11.49 -57.*

Omokaye, A.T., R.O. Balogun, O.S. Onifade, R.A. Afolayan and Olayemi, M.E. (2001). Assessment of preference and intake of browse species by Yankassa sheep at Shika, Nigeria. *Small Ruminant Research*. 42:203-210.

Richard, G. Jones, Przemyslaw Kubisa, Ingrid Meisel, Werner Mormann, Stanisław Penczek Robert F. T. Step-to (2011). Terminology of polymers and polymerization processes, *Pure and Applied Chemistry*. **83** (12): 2229–2311.

Salako, F.K. (2003) *Soil Physical Condition s in Nigerian Savanna and Biomass production,*Department of Soil Science and Agricultural Mechanization, University of Abeokuta, Nigeria Lecture given at the College of Soil Physics, Trieste, Italy.

Schaefer, C. (1998). Pasterale Wiederkauerhal-tung in der sudan savanne. Eine untersuchung im Zamfara forstschutzgebiet im Nordwestern. Nigeria. Cuvvilier, Goettingen, the Netherland Pp. 217.

Senioniti, E., Manetos, Y. and Gavales, N.A. (1986). Cooperative effects of light and temperature on the activity of phosphoenolpyruvate carboxylase from *Amaranthuspaniculatus. Plant Physiolog.* **82**: 518-522.

Smith, A.; Young, T. P. (1987). Tropical Alpine Plant Ecology, *Annual Review of Ecology and Systematics.* **18**.18.1.137.

Sih. A. (2013).Understanding Variation in Behavioural responses to Human-induced rapid Environmental change: a conceptual overview. *Animal Baheviour*. **85**: 1077 – 1088.

Sih , A. Ferrari, M.C.O. and Harris, D.J.(2011). Evolution and Behavioral Responses to Human-Induced Rapid Environmental Change. *Evolution Applied.* **4,** 367– 387.

Sobulo, R.A. (1985). Soil Fertility and Management in Nigeria. In: Saka Nuru and R.G. Ryan eds. *Proceedings of Nigeria-Australia Seminar on Collaborative Agricultural Research, Shika, Nigeria*, 4: 33-37.

Van- der Maarel, E. (1988) Vegetation dynamics: patterns in time and space. *Vegetatio.* **77,** 7-19.

Warren A. (2002). Land Degradation is contextual. *Land Degradation and Development*. 13: 449 - 459.

Xue, Y. and Shukla, J. (1993). The Influence of Land Surface Properties on Sahel Climate Part 1: Desertification. *Journal of Climate.* **6**: 22332-2245.

Young, TP, Stanton ML, Christian,CE (2003). Effects of Natural and Simulated Herbivory on Spine Lengths of *Acacia drepanolobium* in Kenya. *Oikos*. **101**:171-179

Zhang, Q., Guan, Y. and Yang, H. (2008). ENSO Amplitude Change in Observation and Coupled Models. *Advances in Atmospheric Sciences.* **25** (3): 331–336.