Determination of Species Composition, Frequency and Woody Species Dominance of Egume Derived Savanna, Kogi State, Nigeria

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Abstract:- Ecological studies of Egume Derived Savanna in Kogi State, Nigeria was carried out to determined the species composition, frequency and woody species dominance using random distribution method and basal area index for determination of woody species dominance. A total of 25 herbaceous species distributed in 8 different families were recorded during the study. Family *Poaceae* had recorded the highest number of species followed by the family *Asteraceae* while the rare families were *Acanthaceae, Caesalpiniodeae, Convolvulaceae, Compositae* and *Cyperaceae*. The most common species recorded in the study area were *Chamaecrista mimosoiders, Andropogon gayanus, Acrceras zizaroides* and *Impomoea ericarpa*. A total of 22 woody species were recorded from the study plots. *Parkia biglobosa* had the highest percentage (%) frequency (12.69), followed by *Khaya senegalensis* (10.59), while the rarest frequent woody species recorded were *Piliostigma thonningii* (1.48) and *Bridelia ferruginea* (1.23). *Parkia biglobosa* (African Locust Kean) had the largest basal area index of 8.0m^2 followed by *Daniellia oliveri* (6.29m^2). The high % frequencies and even distribution of the species recorded in the area were more than the one recorded in other parts of Africa, indicating that, the area is species rich which may be due to the fertility of the soil and favorable climate conditions of the place. In view of the species dominance of the two woody species, it will be interesting if the vegetation of the study area may be named after the two "leading woody species" as "*Parkia Daniellia* species vegetation.

Keywords: **Ecological studies, Derived savanna, species composition, frequency and dominance, Basal area index.**

I. INTRODUCTION

Although savanna covers about 83% part of the world's land surface, there is still limited understanding about what determines its structure and distribution. Savanna is broadly defined as that tropical seasonal ecosystem with a continuous herbaceous cover on the ground, with variable cover of trees and shrubs. Derived Savanna is the type of savanna that is derived from Rain forest in which forest and savanna species co-exist side by side (Usman, 2004 ; Bond *et al.*2005). Savannas occur in seasonal climates with a distinct dry and wet season and they are important socio-economically in tropical regions (Scholes and Archer, 1997). An increase in woody plant density has been reported as a problem in grassland and savanna ecosystems because increased woody cover can result in decreased herbaceous production and diversity. Trees, shrubs and thicket species invade open grasslands through a process well known as bush encroachment and thicken up in already wooded areas to form woodlands through a process known as "woody plant encroachment". Woody plant encroachment has occurred in many parts of the world, including Africa.

Conversion of savanna woodlands to forest/thicket stands is referred to as forest colonization. Forest colonization is a process whereby forest/thicket species colonize savannas to form a closed woody stand. At times, grasslands and savannas are replaced by scrub thicket and eventually closed forest (Bond *et al.* 2005). Invasion of forest species in savannas causes a complete replacement of savanna biome to a forest/thicket formation, bringing about a biome shift. Archer *et al.* (1988) reported the natural succession, invasion of forest species in savanna environment resulting in the formation of forest/thicket stands.

The Savanna, especially Derived savanna presently is under exploited because of inadequate information on vegetation composition and its uses as well as soil composition and therefore it is necessary to carry out research on Ecological studies to determine the species composition, frequency and woody species dominance around Egume in Kogi State, Nigeria where such research has not been conducted before, although this research has been conducted in other parts of Nigeria. And for this purpose, it is hoped that the information obtained from this research will inform the immediate community and the government on the importance of having ecological knowledge to improve conservation and to reduce destruction of plants species in the study area.

II. MATERIALS AND METHODS

2.1 Determination of Species Composition of the Derived Savanna.

The species composition around Egume in Kogi State, Nigeria was conducted from the month of March 2012 to April 2014 using random distribution method following Usman (1990) and Aina *etal.* (2013) procedures .A plot of one hectare was marked out using strides (one stride being an equivalent of one meter).100 slips of paper were made and 50 sampling sites were located using paired numbers. This was done by drawing the first number from the 100 slips to represent the X- axis coordinate and after returning it, drawing

the second number to represent the Y-axis coordinate. It is important to return the first slip in order to give it an opportunity of being picked again. The two coordinates paced and the point of intersection became the center of the $1m^2$ quadrat. All the species obtained within the vertical extension of the quadrat were identified and recorded using the Flora of West Tropical Africa of Hutchinson and Dalziel (1992).

2.2 Determination of Woody Species Dominance Using Basal Area Index (BAI).

Woody species dominance of the vegetation was determined using the same random distribution procedures (Usman 1990) as applied in determining the woody species composition of the vegetation. The girth (dimension of the circumference in (m) at breast height of every woody species above 3m tall and at the midpoint of those less than 3m tall within the plot were determined using the relationship; $\mathbf{BAI} = \boldsymbol{\pi r^2}$,where $\boldsymbol{\pi}$ = **22/7**as a constant and **r** = diameter of the emerging stem (trunk). The process was repeated 50 times and the mean value of the girth of each woody species was noted and recorded at the end of the exercise.

III. DATA ANALYSIS

The percentage (%) value indexes of both woody and herbaceous species of the area were calculated by summing the irrelative frequency and relative dominance.

IV. RESULTS

4.1 Herbaceous Species Composition and Frequency of the Vegetation

A total of 25 species, distributed in 8 families were recorded during the study (Table1). Family Poaceae had the largest number of species followed by the family Asteracea while the rare families were *Acanthaceae*, *Caesalpiniodeae*, *Convolvulaceae*, *Compositae* and *Cyperaceae.* The most common species recorded in the study area were *Chamaecristamimosoides, Andropogongayanus, Acrceraszizariodes* and *Impomoeaeriocarpa*.

4.2 Woody Species Composition and Frequency of the Study Area

The results of woody species composition and their percentage, (%) frequency per area quadrat of the study area is presented in Table2. A total of 22 woody species were recorded from the study plots. *Parkia biglobosa* had the highest percentage (%) frequency (12.69%) followed by *Khayasenegalensis* (10.59%),*Daniellaoliveri*(9.85%) and *Quassiaundulata* (9.85%) while the rarest frequent woody species recorded during the study were *Piliostigma thonningii* (1.48%), and Bridelia *ferruginea* (1.23%).

4.3 Woody Species Dominance

The woody species dominance of the vegetation was determined using Basal Area Index (BAI). The result of the woody species dominance in the area is shown in Table3.*Parkia biglobosa* (African Locust bean) had the largest basal area index of $8.80m^2$ followed by *Daniellia oliveri* ($6.29m^2$), while the lowest basal area index of $1.89m^2$ was recorded for *Vitexdoniana* (Black plum).

Table 1: List of Herbaceous Plant species Identified in the Vegetation

S/No.	Botanical Nomenclature	Family
1.	*Asystasiagangetica* Linn	*Acanthaceae*
2.	*Ageratum conyzoides* Linn	*Asteraceae*
3.	*Acroceraszizaniodes* Linn	*Poaceae*
4.	*Andropogongayanus* Kunth	*Poaceae*
5.	*Andropogontectorum* Schum & Thonn	*Poaceae*
6.	*Aspilia africana* Pers	*Asteraceae*
7.	*Chamaecristamimosoides* Linn	*Caesalpiniodeae*
8.	*Commelinadiffusa J.K. Morton*	*Commelinaceae*
9.	*Commelinaerecta J .K.Morton*	*Commelinaceae*
10.	*Cyperusesculentus* Linn	*Cyperaceae*
11.	*Dactyloctenumaegyptium* Linn	*Poaceae*
12.	*Desmodiummauvitianum* Linn	*Poaceae*
13.	*Emilia coccinea* Sims	*Asteraceae*
14.	*Eragrostisciliaris* Linn	*Poaceae*
15.	*Euphorabia granulate* Forsk	*Euphorabiaceae*
16.	*Euphorabiaheteropylla* Linn	*Euphorabiaceae*
17.	*Imperata cylindrical* Linn	*Cyperaceae*
18.	*Ipomoea eriocarpa* R. Br.	*Convolulaceae*
19.	*Paspalumscrobiculatum* Linn	*Poaceae*
20.	*Pennisetumunisetum* Linn	*Poaceae*
21.	*Solanumnigrum* Linn	*Solanaceae*
22.	*Solanumwelwichii*	*Solanaceae*
23.	*Sporobuluspyramidalis* P. Beauv	*Poaceae*
24.	*Tridaxprocumbens* Linn	*Compositae*
25.	*Vernoniacinerea* Linn	*Asteraceae*

Table 2: List of Woody Species and Their Frequency in the Study Area

S/No.	Botanical nomenclature	Common/trade name	Mean ($\bar{x}$) Freq. Per Area Quadrat	%Frequency
1	*Albizzialebbek*	Siris/woman's tongue tree	3.7	4.56
2	*Anacardiumoccidentale*	Cashew tree	3.3	4.06
3	*Annonasenegalensis*	Annona	2.7	3.33
4	*Bridelia ferruginea*	Bridelia	1.0	3.57
5	*Burkeaaficana*	Burkea	2.9	1.23
6	*Cucurbiaferruginea*	Cucurbits	3.0	3.70
7	*Daniellia oliveri*	African Balsam	8.0	9.85
8	*Dialiumguineense*	Velvet tamarind	2.3	2.83

9	*Grewiavenusta*	Savanna grew's tree	2.0	2.46
10	*Hymenocardiaacida*	Wedding heart	2.4	2.96
11	*Khaya senegalensis*	Savanna mahogany	8.6	10.59
12	*Chamaecristamimosoides*		2.2	2.71
13	*Lophiralanceolata*	Ekki tree	2.3	2.83
14	*Maranthesployandra*	Marathes	3.2	3.94
15	*Parkia biglobosa*	African locust bean	10.3	12.69
16	*Piliostigma thonningii*	Monkey's bread/camel's foot	1.2	1.48
17	*ProsopisAfricana*	Nigeria iron/red mortar wood	2.1	2.59
18	*Quassiaundulate*	Savanna quassia	8.0	9.85
19	*Sarcocephaluslatifolius*	Savanna nauclea	3.3	4.06
20	*Terminaliaaviceniodes*	Narrow long leafed terminalia	1.7	2.09
21	*Vitexdoniana*	Black plum	3.6	4.19
22	*Vitexsimplicifolia*	Savanna black plum	3.4	4.43

Table 3: Woody Species Dominance using Basal Area Index (BAI)

S/No	**Botanical Nomenclature**	**Common/Trade Name**	**Mean Girth (M^2)**	**BAI(πr^2)**
1	*Bridelia ferruginea*	Bridelia	1.4	4.40
2	*Cucurbitamoscata*	Sweet goard/cucurbits	1.8	5.66
3	*Daniellia oliveri*	African balsam/copaiba	2.0	6.29
4	*Khaya senegalensis*	Savanna mahogany	1.9	5.97
5	*Hymenocardiaacida*	Weeding heart	1.2	3.77
6	*Lophiralanceolata*	Ekki tree	0.8	2.51
7	*Maranthespolyandra*	Maranthes	1.4	4.40
8	*Parkia biglobosa*	African locust bean	2.8	8.80
9	*ProsopisAfricana*	Nigerian iron wood	1.6	5.03
10	*Vitexdoniana*	Black plum	0.6	1.89

Note:$\pi = \frac{27}{7} = 3.143$ (**a constant**)

r = diameter girth of the emerging stem (trunk)

V. DISCUSSION

5.1 Species Composition of the Vegetation

A total of 25 and 22 different herbaceous and woody plants species per unit area respectively were recorded during the study. Despite the soaring rates of species extinction which may usually be caused by anthropogenic activities of the area, yet the various species (i.e. herbaceous and woody species) observed during the study were recorded in relatively high percent (%) frequencies and were distributed in various families. The high % frequencies and even distribution of these species around the study area were more than the percentage recorded (68%) by Wasonga (2001) in South-Central Kenya. This has given an indication that the area is species rich which may be due to the fertility of the soil and favorable climatic conditions of the place. The species rich vegetation has correlated with other measures of ecological, morphological, phylogenenic or functional diversity of the area which provide a reasonably useful measure of biodiversity of the study area. The biodiversity of a place has been reported to be essential for human survival, economic well being for the ecosystem function and stability of that area more so, Kinyamario *et al*, (1995) attributed the differences in herbaceous plant species composition between the canopy zones and adjacent open grass land to differences in carbon assimilation rate and water use efficiencies among the herbaceous plant species. Therefore, selective grazing, phyto toxic effects of the leaves, shading and competition for soil moisture are some of the most important factors that might have contributed to the low grass species under the canopies of the woody species (Kahi *et al*, 2009).

The woody species dominance of the vegetation investigation revealed two woody species (*Parkia biglobosa* and *Daniellia oliveri*) with the highest basal area index of 8.80 m^2 and 6.29 m^2 respectively. In view of this species dominance of the two woody species, it will be interesting if the vegetation of the study area may be named after these "Leading woody species" as" Parkia *Daniellia species* vegetation" as similarly done by Usman (1990).

VI. CONCLUSION

Conclusively, the Savanna especially Derived Savanna, presently is under exploited because of inadequate information on the vegetation composition. Therefore this research had successes in generating a base line information on the herbaceous and woody species composition of the Derived Savanna around Egume, Kogi State, Nigeria, using normal random distribution methods. The information obtained from this research will inform the immediate community and the government on the importance of having ecological knowledge to improve conservation and to reduce destruction of plants species and also informing that, the vegetation is species rich with two" leading woody species" *Parkia biglobosa* and *Daniellia oliveri* using their basal area index.

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