

A Study of Species Composition of the Derived Savanna Vegetation at Agbeji, Kogi State, Nigeria.

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ABSTRACT

The phytocological study of the Derived Savanna vegetation at Agbeji, Kogi State, Nigeria, was carried out to determine its species composition. A total of 50 plant species belonging to 23 families (6 Monocotyledons and 17 Dicotyledons) were encountered. The dominant families included those of Poaceae, Asteraceae, Cyperaceae, Mimosoideae, Apocynaceae, Euphorbiaceae, Caesalpinoideae, Meliaceae and Rubiaceae. All these are characteristics species of forest- savanna ecozones. The dominance of plant species belonging to the grass (Poaceae) family is a valid evidence for confirming the Derived Savanna status of the vegetation of the study area. The presence of *Alstonia boonei* which is a typical rainforest species reflect the relics of rainforest vegetation. The presence and relative abundance of *Prosopis africana*, *Parkia biglobosa*, *Dialium guineense* and *Daniella oliveri* reflect fire tolerant and sensitive trees of Savanna vegetation. The co-existence of the various phytocological indicator species shows the rich floristic diversity and heterogeneity of the vegetation of the study area which could provide a template and baseline information on the sustainable utilization and exploitation of the rich and abundant resources of the Nigerian savanna vegetation.

Key words: Species composition, Derived Savanna, Vegetation, Nigeria .

INTRODUCTION

The study of ecological interactions provides information to the nature and mechanisms of evolutionary change. Advances made in ecology over the last three decades have led to increased concern about the effect of human activities on the environment, which have resulted in a greater awareness of the importance of conservation (Hine and Martin, 2004).

The study of vegetation and the way in which it has been altered and developed in the course of time indicates past changes that have occurred in our terrestrial environment (Essien *et al.* 2013). Variations in climate and intensity of human activities in historic and pre-historic times have made the mark upon the vegetation with several economic species at the verge of extinction (Essien and Ige, in press). These human activities, climatic factor, fire, hydrology, soil nutrients, as well as texture and depth (geology and geomorphology) of the area are important factors in determining the location of savanna and forest (White, 1983). The differences in herbaceous production in Nigerian Savanna as well as heavy livestock grazing during the rainy season have led to high proportion of

annuals and short perennial grasses (Abdullahi and Sanusi, 2006). Therefore predicting the global distribution of vegetation under changing climate and disturbance regimes require an understanding of the factors and processes determining the current locations of the various vegetation zones (Plotkin, 1995).

In Nigeria, vegetation is determined mainly by latitudinal distribution of rainfall from South to North. This vegetation, though zoned into belts that correspond to the rainfall zones, is still controlled by edaphic, climatic and geomorphologic factors (White, 1983). It has been reported by Usman (2012) that some endangered plant species in Igala Land are in danger of extinction as a result of pressure mounted on them, and if these species are not salvaged soon, they could easily be filtered out of the vegetation.

The term “Derived Savanna” immediately begs the question Derived from what? The term was originally used in Nigeria for the first time by Jones and Keay (1946) to denote areas where the climatic conditions are those of the forest regions, that is, the lowland rainforest zone where degradation by farming and fire has resulted in savanna vegetation. Keay (1959) obvious justified in saying that there is little support for the view that lowland tropical grasslands are ever a climatic climax in equilibrium with a tropical grassland climate. The question derived with a tropical grassland climate. The question derived from what is therefore an important one, and the nature of the climatic climax is not simply an abstruse academic postulate. Evidence concerning the climatic climax of a savanna region is most valuable in accessing the potentiality of a region for agriculture, forestry and other form of land use (Essien and Ige, in press). It is also important to determine as far as possible the past vegetation of a region when other, purely scientific problems are being considered (Essien *et al.* 2013).

The climatic condition of this area is distinct with regards to temperature, rainfall and humidity. It is characterized by two seasons. The dry season and the rainy season with prevailing systems which have dominate influence on the climate of Nigeria. The moisture laden Southwesterly monsoon trade wind from the Atlantic (Tropical Maritime Air mass) responsible for the rainy season because they are warm and wet. The continental dry Northeasterly trade wind (Tropical continental Air Mass) that brings in very dry, cold and dusty weather called harmattan. These two wind system meet at the Inter-tropical Convergence Zone (ITCZ). Their long term and periodic variations both in vigor and consequent relative positions, determines the climatic conditions of the area (Ofomata, 1975).

Meteorological records showed that rainfall starts in April and peaks between August and September. Dry season begins in November and last till late March. December and January are cool months due to the influence of the North-East Trade Wind otherwise known as Harmattan. The Wind Velocity generally varied, increasing gradually from 3.6Km.hr in November to 4.0Km/hr. in April and decreasing with the onset of rainy season to 3.7km/hr. in June (Essien, 2014).

The composition of the savanna can be seen in terms of the presence or absence of forest species and their ecological role, the species of savanna trees and the species of grasses. A well-known feature of African plant life as it exists today is the fact that certain species are characteristic of forest and others of savanna. Only a comparatively few species e.g. *Azelia africana* are regularly found in both types of vegetation, the same sharp division also applies to Fauna of all kinds. The presence of forest species in savanna is therefore the most interesting and important feature. On the whole, forest species are easily killed by fire but some are more tolerant than others and may persist in savanna and betray its derived status. According to Usman (2004), vegetation can be described as derived savanna when forest and savanna species co-exist side by side with relics of forest vegetation disappearing to be succeeded by fire-hardy species of the savanna. Essien (2014)

reported that the activities of people that engage in hunting expedition with the use of bush fire have also helped in the destruction of several flora and fauna in derived savanna vegetation and these can in a long run, result in loss of biodiversity and extinction of germplasm if adequate conservation and restoration measures are not taken.

Evidence from the species of relatively fire-tolerant savanna trees seems at first sight to be somewhat less valuable than that from the forest species. It appears, however, that certain species of savanna trees e.g. *Isobertinia* species are normally found on site unfavorable for farming whereas other species e.g. *Daniellia oliveri* and *Hymenocadia acida* occur commonly in farmed areas; in addition certain species especially *Parkia biglobosa* and *Vitellaria paradoxa* are deliberately encouraged by farmers. It is therefore possible to deduce the intensity of farming from the composition and also the structure of savanna. Areas which on other grounds are known to be derived savanna usually show by their composition that farming and other anthropogenic activities has been heavy (Keay, 1959, Essien and Aniam, 2014).

The status of savanna in the lowland rainforest and Derived Savanna is restricted to types which have been derived from moist forest by degradation and anthropogenic activities. Wherever forest and savanna species adjoin today, it is usually to find a strip of transition woodland containing both fire-tolerant and non-fire tolerant species. In some places, quite extensive areas of this intermediate type may be found.

Agbeji which is a small town in Dekina Local Government Area in Eastern Senatorial District of Kogi State, Nigeria. It is a unique town in Dekina Local Government because of its proximity to Anyigba – a university town in Kogi State. Agbeji lies approximately latitude 7°30'N and longitude 7°10'E within the Derived Savanna vegetation zone of Nigeria (Amhakhani and Achimugu, 2011; Aina *et al.* 2013; Essien, 2014). Agbeji is surrounded by smaller towns, villages and homesteads, whose inhabitants in numerous ways have left their impact on the environment. It has an altitude of 420m above sea level and covers an area of 10kilometres square. Agbeji has a humid tropical climate. The climate is characterized by seasonal alternation of the Tropical Continental (TC) and Tropical Maritime (TM) air masses and all year round high temperature with an annual range of 24.1° to 31.2°C (Essien, 2014). One major characteristic of this climate is wet and dry seasons. The floristic composition of the Derived Savanna at Agbeji, Kogi State is characterized by the presence of fire tolerant and fire sensitive trees with appreciable occurrence of grasses and is co-inhabited by forest and savanna species. Anthropogenic and natural events have resulted in varying floral composition of the vegetation in different parts of the study area. Typical plants found in these area include *Daniella oliveri* (Copaiba), *Prosopis africana* (Red mortal wood), *Parkia biglobosa* (Locust bean plant) *Melicia excelsa*, *Elaeis guineensis* (oil palm), *Syzygium guineense* (waterberry tree or kerosene wood), *Bombax buonopozense* (red silk cotton tree), *Khaya senegalensis* (dry zone mahogany), *Dalium guineense* (velvet tamarind), *Parinari curatellifolia* (rough-skinned plum), *Eythroleum suaevolens* (sassafras), *Lophira lanceolata* (red wood), *Huragana madagascariensis*, *Rauwolfia vomitoria* (African snake root), *Alstonia boonei*, *Pentaclatra macrophyla* (oil bean tree), *Hymenocardia acida* (wedding heart), *Vitex doniana* (black plum) and *Lannea* species.

The dominant grasses and grassy materials make a continuous cover of the derived savanna land. Most of these grasses are perennial and grow to a height of about 3m. These include *Hyparrhenia involucreta*, *Andropogon gayanus*, *Andropogon tectorum*, *Loudetia flavida*, *Imperata cylindrica*, *Laucia spp.*, *Panicum maximum*, *Ctenium newtonii*, *Diheteropogon grandiflorus*, *Rothbolia cochinchinensis*, *Schizachyrium sanguineum*, *Anthephora ampulacea*, *Pennisetum pedicellatum*, *Aristida kerstingii*, *Pennisetum unisetum*, *Digitaria horizontalis*, and *Pennisetum purpurum*.

There are several forbs interspaced among the grasses. These include *Senna obtusifolia*,

Chamaecrista mimosoides, *Crotalaria incana*, *Crotalaria retusa*, *Desmodium ascendens*, *Desmodium velutinum*, *Indigofera hirsuta*, *Eriosema laurentii*, *Sesbania sudanica*, *Stylosanthes mucronata*, *Tephrosia nana*, *Tephrosia peniculata*, *Vigna racemosa*, *Vigna reticulata*, *Tridax procumbens*, *Emilia sonchifolia*, *Ageratum conyzoides*, *Amaranthus spinosus*, *Aspilia africana*, *Nauclea latifolia*, *Biden pilosa*, *Boerhavia diffusa*, *Boerhavia repens*, *Celosia argentea*, *Centrosema pubescens*, *Cleome ruidosperma*, *Euphorbia hirta*, *Gloriosa superba*, *Helianthus annuus*, *Hibiscus mutabilis*, *Ipomoea biloba*, *Mimosa pudica*, *Mirabilis jalapa*, *Mucana pruriens*, *Mucana utilis*, *Nicotiana plumbaginifolia*, *Sesamum radiatum*, *Solanum welwichii*, *Talinium triangulare*, *Stanchytarpheta jamaicensis*, etc (Essien and Nkang, 2013).

There are other herbs which resemble grasses but are really not grasses. These include *Afromomum danielli* (family Zingiberaceae), *Ascolepis elata*, *Bulbostylis barbata*, *Cyperus rotundus*, *Kyllinga odorata*, *Mariscus alternifolius* and *Rhyncho sporatriflora*.

In addition to these, around villages and towns are established/introduced trees such as *Gmelina arborea*, *Eucalyptus spp*, *Tectona grandis*, *Magnifera indica*, *Citrus spp*, *Psidium guajava*, *Anacardium occidentales*, *Azadirachta indica*, and *Cocos nucifera*. Both cash and food crops such as yam, cassava, maize, bean, rice, and melon are grown extensively. The plants in this area are green in the rainy season with fresh leaves and tall grasses, but the land is open during the dry season, showing charred trees and the remains of burnt grasses. The trees which grow in clusters are up to six meters tall, interspersed with grasses which grow up to about three meters. The different types of plants are, however, not in their natural luxuriant state owing to the careless human use of the plant and the resultant deciduous and savanna vegetation.

The choice of the study area for this study is due to its minimally disturbed nature in terms of anthropogenic activities such as farming, lumbering, grazing, firewood gathering, and the activities of people that engage in hunting expedition with the use of bush fire. The homogenous nature of its physiognomy and species composition as well as safety and security of experimental materials, logistics and proximity to Anyigba town and convenience of vegetation analysis. The main aim of this study was to determine the species composition of the study area so as to generate information for effective utilization of Nigerian savanna.

MATERIALS AND METHOD

A plot of one hectare was marked out following the method of Usman (1990) in which one pace of an average man is about one metre. Four plots were marked out without using tape, that is, pacing 100 along the x-axis coordinate, and then turning at right angle and pacing another 100 on the y-axis coordinate, and then the vertexes were joined to make a hectare. 100 slips of paper were made and 50 sampling sites were located using paired numbers. These were done by drawing the first slip from the 100 slip to represent the X- axis coordinate and after returning it, drawing the second slip out to represent the Y- axis coordinate. According to Aina *et al.* (2013) it is important to return the first slip to give it an opportunity of being picked again.

The two coordinates were paced and the point of intersection was the centre of the 1m² quadrat. All the above-ground herbaceous materials (plant species) within the 1m² quadrant were collected and properly identified using the flora of West Tropical Africa by Hutchinson and Dalziel (1992); Akobundu and Agyakwa (1998); Omotoye (2012) as well as other standard literatures for the proper identification of the plant species. Species composition analyses were carried out to identify the diversity of the species in the study area and the plants were harmonized by name and authority as stated above. Voucher specimens of all identified species were prepared and deposited in the Kogi State University Herbarium with the plants classified and arranged into their various families.

RESULT AND DISCUSSION

Species composition analysis of derived savanna vegetation around Agbeji, Dekina Local Government Area of Kogi State, Nigeria was carried out to identify the diversity and floristic composition of the study area and the results are given in table 1 and the distribution of the plant families are shown in figure 1 below:

Table 1: Species Composition showing the Plant Families represented

Plant Families	Plant Species	Plant Form
Asteraceae	<i>Ageratum conyzoides</i>	Forb
;	<i>Aspilia africana</i>	Forb
;	<i>Chromolena odorata</i>	Forb
;	<i>Emilia coccinea</i>	Forb
;	<i>Tridax procumbens</i>	Forb
Amaranthaceae	<i>Gomphrena celosoides</i>	Forb
Apocynaceae	<i>Alstonia boonei</i>	Tree
;	<i>Landolphia owariensis</i>	Twiner
;	<i>Rauvolfia vomitoria</i>	Tree
Caesalpinoideae	<i>Dialium guineense</i>	Tree
;	<i>Daniella oliveri</i>	Tree
Commelinaceae	<i>Commelina benghalensis</i>	Herb
;	<i>Commelina erecta</i>	Herb
Cyperaceae	<i>Cyperrus esculentus</i>	Sedge
;	<i>Cyperrus rotundus</i>	Sedge
;	<i>Mariscus alternifolia</i>	Sedge
;	<i>Maricus flabelliformis</i>	Sedge
Dennistaedticeae	<i>Pteridium aquilinum</i>	Shrub
Dioscoreaceae	<i>Dioscorea bulbifera</i>	Climber

Euphorbiaceae	<i>Bridellia ferruginea</i>	Shrub
;	<i>Euphorbia hirta</i>	Forb
;	<i>Hymenocardia acida</i>	Tree
Fabaceae	<i>Chameacrista mimoisoides</i>	Forb
Loganiaceae	<i>Spigellia anthelmia</i>	Forb
Malvaceae	<i>Sida acuta</i>	Forb
Meliaceae	<i>Azadirachta indica</i>	Tree
;	<i>Khaya senegalensis</i>	Tree
Mimosoidae	<i>Acasia seyal</i>	Tree
;	<i>Albezia lebbeck</i>	Tree
;	<i>Parkia biglobosa</i>	Tree
;	<i>Prosopis africana</i>	Tree
Myrtaceae	<i>Syzygium guineense</i>	Tree
Ochinaceae	<i>Lophira lanceolata</i>	Tree
Papilionoideae	<i>Crotolaria incana</i>	Forb
Poaceae	<i>Andropogon gayanus</i>	Grass
;	<i>Andropogon tectorum</i>	Grass
;	<i>Antherophora ampulaceae</i>	Herb
;	<i>Axonopus flexus</i>	Grass
;	<i>Brachiaria distichophylla</i>	Grass
;	<i>Chloris pilosa</i>	Grass
;	<i>Dactylostenium aegypticum</i>	Grass
;	<i>Digitaria horizontalis</i>	Grass
;	<i>Imperata cylindrica</i>	Grass

;	<i>Pennisetum purpureum</i>	Grass
Rubiaceae	<i>Crossopteryx febrifuga</i>	Tree
;	<i>Nauclea latifolia</i>	Shrub
Sapindaceae	<i>Paulina pinnata</i>	Tree
Verbanaceae	<i>Vitex doniana</i>	Tree
Vitaceae	<i>Cissus populnea</i>	Forb
Zingiberaceae	<i>Aframamon melegueta</i>	Herb

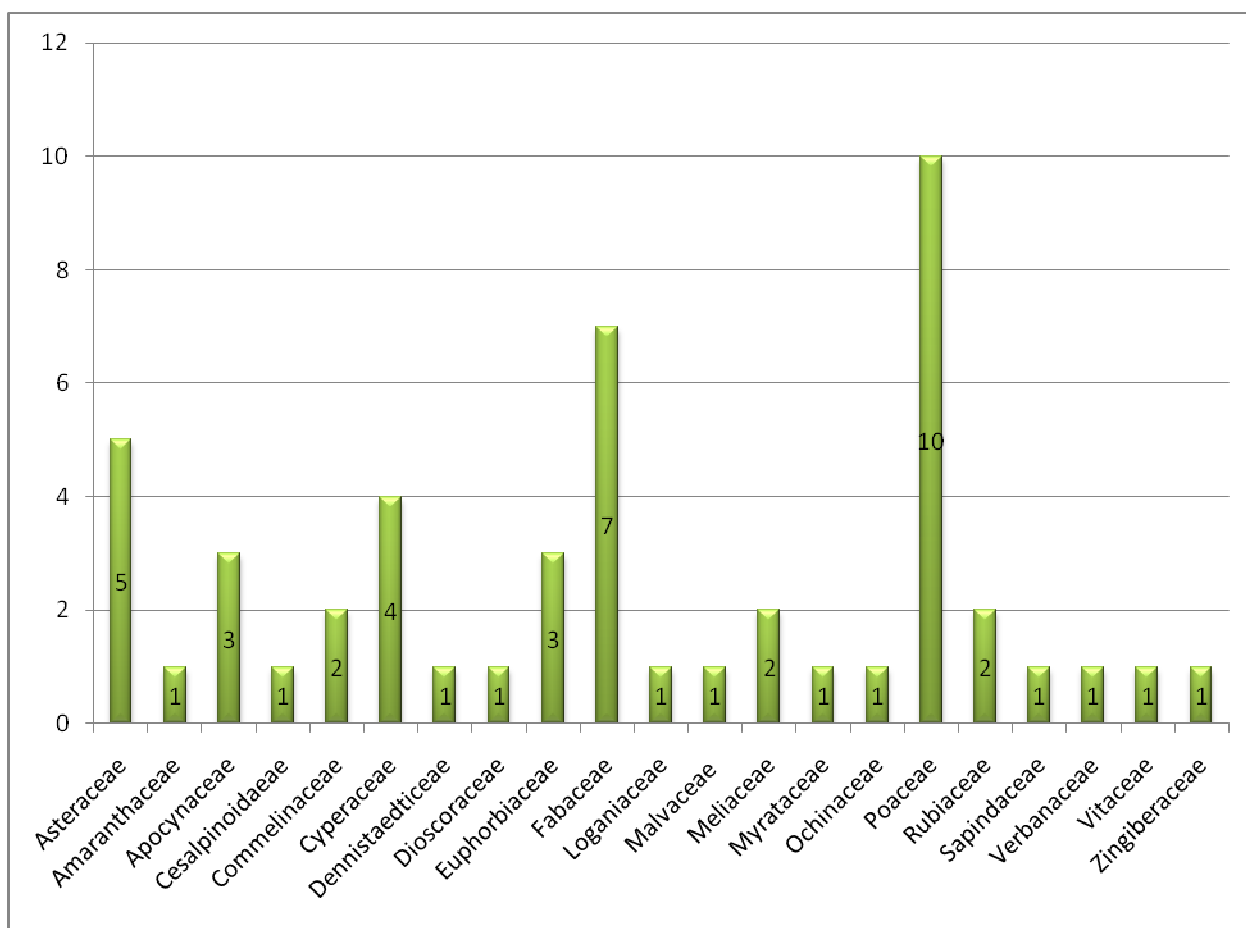


Fig. 1: Histogram showing the distribution of Plant Families of the Derived Savanna Vegetation at the Study Area.

Discussion

Species composition analytical study of Derived Savanna around Agbeji, Dekina Local Government Area of Kogi State, Nigeria revealed plant species of different ecological indicator species. Results revealed that a total of 50 species belonging to 23 (twenty three) families (6 Monocotyledon and 17

Dicotyledon) were encountered. Most of the plant species encountered were identified and grouped into different plant forms based on their physiognomy. These included those of trees, shrubs, forbs, sedges, twiners, climbers, herbs, grass, etc. Findings corroborated with the reports of Essien and Nkang (2013) who reported similar species when evaluating the phytoecological indicator species in the airborne palynomorphs in Anyigba, Kogi State.

Practically, the results of this study have shown a true picture of the floristic composition of the vegetation of Agbeji, in Dekina Local Government Area of Kogi State. Result corroborated favourably with the report of Agwu *et al.* (2013) who analyzed honey samples from four different localities in Dekina Local Government Area of Kogi state and opined that the floral sources and ecological origin reflected Derived Savanna ecovegetational zone.

Moreso, the identified plant species reflected different phytoecological zones co-existing together. Indicator of savanna type included those of *Parkiabiglobosa*, *Prosopis africana*, *Acacia seyal*, *Nauclea latifolia*, *Hymenocardia acida*, *Khaya senegalensis*, *Rauwolfia vomitoria* and the entire species in the families of Poaceae and Cyperaceae among others. Indicator of forest type included those of *Alstoniaboonei*, *Paullina pinnata*, *Crossopteryx febrifuga*, etc. Indicator of human impact / introduced type included members of the families of Asteraceae, Amaranthaceae, *Azadirachta indica*, *Euphorbia hirta* etc. The co-existence of these species is a valid evidence of the status of the vegetation of the study area. Findings agrees favourably with the report of Usman (2012) who opined that a Derived Savanna was developed from attenuated or modified tropical rainforest vegetation and is co- inhabited by forest and savanna species with relics of the forest vegetation disappearing to be succeeded by fire resistant species of the savanna.

The predominant plant families in terms of species composition is the Poaceae (grass) family followed by the family Asteraceae, Cyperaceae, Mimosoideae, Apocynaceae, Euphorbiaceae, Ceasalpinoideae, Meliaceae and Rubiaceae. The dominance of the grass family is not a surprise and this can be interpreted as a valid evidence for confirming the Derived Savanna status of the vegetation of the study area. Findings agrees favourably with the reports of Essien (2014) who opined that the grass family was the major contributor to airborne pollen of Anyigba and also confirmed the vegetation of his study area to be Derived Savanna with rich growth of luxuriant grass community.

The species richness of the study area as reflected by the dominance of the grass (Poaceae) family also affirms that the vegetation of the study area is Derived Savanna type. Finding corroborated with the report of Essien *et al.*, (2013) who opined that members of these family flower and shed their floral parts (anthesis) which eventually makes the entire plants dry up as the environment approaches extreme dryness and destruction through annual bush fire.

The vegetation of the study area is also characterized by the presence of the fire tolerant trees such as *Prosopis africana*, *Parkiabiglobosa*, *Dialium guineense*, *Daniella oliveri*, etc. Findings agrees with the report of Essien and Aniana (2014) who opined that anthropogenic activities such as annual bush fire and the activities of people that engage in hunting expedition with the use of bush fire have destroyed several flora in the environment.

The presence of *Alstoniaboonei* which is a typical rainforest plant is reflecting the relics of rainforest vegetation zones and this also confirmed the Derived Savanna nature of the vegetation of the study area as reported by Essien (2014).

A comparative analytical evaluation of the predominant plant families revealed that they can serve for horticultural, agricultural, economic and aesthetic values in the surrounding environment. These families include Poaceae (grass) which can serve as fodder for livestock and good pasture for

nomadic agriculture. Species in the families' Asteraceae and Cyperaceae were reported by Essien and Ige (in press) to reflect common weeds and agricultural activities associated with their study environment. Those in the families of Meliaceae and Rubiaceae, are sources of timber, wood and other raw material sources to agro- allied industries in the catchment savanna environment. Those in the family of Amaranthaceae are important vegetable species in Nigeria.

CONCLUSION

The phytocological studies and vegetation analysis of the species composition of the Derived Savanna vegetation around Agbeji, Kogi State, Nigeria revealed great diversity of plant species which represent the flora of the regional vegetation which is a derived savanna . The dominance of Poaceae and other savanna species in association with those of forest and anthropogenic taxa confirmed the authenticity of the reports that the vegetation of the study area is a Derived Savanna type. The various ecological indicator species identified confirmed their origin to be from forest – savanna ecological zone that is anthropogenically disturbed. Species composition analysis from this study also revealed that the identified plant species and the floristic diversity and heterogeneity of the vegetation of the study area can serve as a good repository of medicinal, agricultural, aesthetic, horticultural and economic values for the sustainable exploitation of the abundant resources of the savanna vegetation.

The finding that 50 plant species belonging to 23 plant families (6 Monocotyledon and 17 Dicotyledon) were encountered in the phytocological study is novel because such information is not given in any published literature. The results of this study would provide standardized baseline information which could be used for effective management of Nigerian savanna which covers more than 82% of the surface area of Nigeria's land mass.

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