

A Comparative Floristic Survey Of Old Barrack River And Tiba River Valleys In Nasarawa State, Nigeria.

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Abstract: Field trips were made to Old Barrack and Tiba river valleys in Nasarawa State in dry (January-March) and rainy (June-September) seasons to document the plant species found there. The surveys were carried out using a collapsible and movable quadrat with four pegs to which ropes measuring 2m x 3m long were tied in a rectangular manner was used; each quadrat was 6m². Two hundred quadrats were laid on the bank of each river valley with the river channels serving as transect lines. Detailed analyses of the vegetation in Old Barrack River showed that shrubs constituted 25.7% of species, herbs (22.9%), trees (17.1%), grasses (11.4%), climbers (5.7%) while creepers and ferns were represented by 2.9% each. In the Tiba River valley, trees accounted for 32.1%, shrubs (26.4%), herbs and climbers constituted 13.2% each; sedge (7.5%) while creepers and ferns were 1.9% each. Only 13 species of plants were common to both river valleys. The two river valleys had Simpson's index of diversity (I-D) as 0.95 for Old Barrack River and 0.96 for Tiba River Valley. Sorensen's similarity index was 18.6%.

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Key words: Floristic, survey, Old Barrack & Tiba River Valleys, Nasarawa State.

Introduction

Floristic composition of any area is a prerequisite to understanding the overall structure and function of any ecosystem. A flora enumerates plants of a particular geographical area (Venus, 2002). Botanical assessments such as floristic composition and species diversity are essential for providing information on species richness and help in understanding forest and valley ecology. It is also useful in identifying ecological and economically important plant diversities, protecting threatened plant species (Addo-Fordjour, Obeng, Anning and Addo, 2009).

Habitats can either disappear completely or they can be degraded and/or fragmented, both causing serious impacts on species development, as well as lack of balance between ecosystems' processes (Raghubanshi and Tripathi, 2009). Clearance of natural vegetation to meet the demands of an ever-increasing human population has been an ongoing process as a result of increasing demands of agricultural land that resulted in extensive forest and valley clearing for agricultural use (Soromessa, Teketay and Demissew, 2004).

Abdullahi, Sanusi, Abdul and Sawa (2009) assessed herbaceous species of Yankari Game Reserve, Bauchi State, Nigeria. They enumerated 40 plant species belonging to 33 genera and 7 families. Members of the family *Poaceae* accounted for 65.0% of the species recorded while *Caesalpinaceae* was represented by 2.5% - the least in the area. Sani,

Aliero, Aliero and Ahmed (2014) generated baseline data for woody plants genetic resources of Magama Local Government Area of Niger State, Nigeria. A total of 56 woody species from 45 genera and 28 families of angiosperms were enumerated. Olubode, Awodoyin and Sola (2011) carried out a comparative assessment of the three wetlands in a forest savanna transition ecological zone of Ibadan, Oyo State. Thirty-eight plant species from 13 families were enumerated in the three wetlands in two seasons. Nineteen species from 13 families were recorded in the dry season, while 14 species belonging to nine families were encountered in the wet season; some families were common in both seasons. Eleyele and Apete wetlands had relatively stable flora for both seasons while Oba Dam exhibited pronounced shift in flora between dry and wet seasons.

Olaloye, Oke and Akinyemi (2015) reported the floristic composition and structural diversity of a riparian forest and its adjacent upland vegetation with a view to comparatively examine the species composition and diversity of the two sites. A total of 231 woody plants which comprised 23 families, 35 genera and 37 species were enumerated in the fringing forest while 270 woody plants belonging to 26 families, 36 genera and 40 species were identified in the upland vegetation. *Euphorbiaceae* and *Apocynaceae* were the most dominant families in the riparian forest while *Apocynaceae* was the most pronounced in the adjacent upland vegetation.

In Nasarawa State, there is paucity of information on the flora of the state and none so far to the best of our knowledge on the flora of the fringing forest of the two rivers surveyed. This study is aimed at documenting the plant species that are found in the valleys of the two rivers. The results would form a basis for comparison in future in the event of shift in speciation due to human and natural phenomena.

2.0 Materials and Methods

2.1 The Areas Studied

Nasarawa State is located approximately in the middle of guinea savanna zone of Nigeria. It is located between latitudes $7^{\circ} 45'$ and $9^{\circ} 25'$ N and longitudes $7^{\circ} 9' 37'$ East of the Greenwich Meridian. The studies were carried out at the outskirts of two urban towns - Keffi and Lafia (Figure 1). As the crow flies, Keffi is approximately 100km from Lafia. Nasarawa State is characterized by tropical sub-humid climate with distinct wet and dry seasons (Bimbol, 2007). About ninety percent (90%) of the rains fall between May and September; the wettest months being July and August (Bimbol, 2007). Temperatures are generally high during the day, particularly between the months February and April. Mean monthly temperatures in the state range between 20°C and 34°C ; the coolest months being December and January. The upper courses of the two rivers are V-shaped whereas the middle and lower courses of the river channels were widened due to abrasion.

2.2 Sampling Techniques

The river channels served as line transects even though their courses were not straight. A collapsible and movable quadrat with 4 pegs to which ropes measuring 2m x 3m long were tied in a rectangular manner was used; the quadrat had an area of 6m^2 . Two hundred quadrats were laid on the banks of each river – one hundred on each bank. Four hundred quadrats were laid in the valleys of both rivers. Throwing of quadrats commenced at about 100m from their sources because of their very steep banks. The distance between one quadrant and the other was 20m. Sampling was carried out in such a way that the position of the quadrats alternated on each side of the river banks. Floristic surveys took place between January and March of 2016 and 2017 for the dry season; May to September for rainy season. All the species enumerated in the valleys were collected; some were identified in the fields while others that could not be identified were labelled and put in black polyethylene bags and taken to the laboratory for identification using published standard texts such as Hutchinson and Dalziel (1958-1968); Keay, Onochie and Stanfield (1964); Brain and Stanfield (1966) and Akobundu and Agyakwa (1987).

In order to ascertain the extent of plant diversity within the river valleys, diversity indices were calculated for each river using Simpson's (1949) index of diversity ($1 - D$). Species diversity is a measure of heterogeneity of a site. Simpson's diversity index is calculated as:

$$D = \frac{\sum n(n-1)}{N(N-1)} \quad (i)$$

Where:

D = Simpson's diversity index

N = Total number of species encountered

n = Number of individuals of i^{th} species encountered

With this index, 0 represents infinite diversity and 1, no diversity. That is, the bigger the value of D, the lower the diversity. To get over this problem, D is often subtracted from 1 to give: Simpson's Index of Diversity ($1 - D$).

The value of this also ranges between 0 and 1, but the greater the value, the greater the sample diversity.

The similarity between the flora of the two river valleys was calculated as a measure beta diversity (β) (WCMC, 1992). Sorensen's Similarity Index was used to calculate similarity between the flora of the river valleys. It is expressed as:

$$SI = \frac{a}{a+b+c} \times 100$$

Where:

SI = Sorensen's Similarity Index

a = Number of species common to both valleys

b = Number of species present in Old Barrack valley but not in

Tiba river valley

c = Number of species present in Tiba river valley but not in Old

Barrack river valley

3.0 Results

In the Old Barrack River Valley, thirty five plant species belonging to twenty-two (22) families were enumerated and identified as constituting the vegetation of the river valley (Table 1). Nine (9) shrubs made up 25.7% of the plant species encountered in the valley; eight (8) herbs, six (6) trees, four (4) grasses and four (4) sedges representing 22.9, 17.1, 11.4 and 11.4 percent respectively. Climbers (2), fern (1) and creeper (1) also accounted for 5.7, 2.9 and 2.9 percent respectively (Figure 2a). The dominant families in the studied area were Poaceae (11.4%), Asteraceae, Apocynaceae and Cyperaceae were represented by 8.6% each while Mimosaceae, Combretaceae Melastomataceae and Rubiaceae accounted for 5.7% each. Other families were represented by 2.9% each. Among Poaceae, *Panicum*

maximum (230) was most abundant followed by *Setaria barbata* (140), *Axonopus compressus* (121) and *Cynodon dactylon* (90). The valley had Simpson's Index of diversity (I – D) of 0.95.

River Tiba Valley, Lafia contained fifty three plant species belonging to 32 families (Table 2). There were 17 tree species accounting for 31.1 percent of the vegetation; these were followed by shrubs (14) representing 26.4 percent of the flora. Climbers and herbs were represented by 13.2 percent each whereas grasses and sedges accounted for 5.6 and 7.5 percent respectively; also creeper and fern were represented by 1.9 percent each (Figure 2b). Analyses of the families showed that Caesalpiniaceae, Euphorbiaceae, Poaceae and Rubiaceae accounted for 5.7 percent each but Amaranthaceae, Annonaceae, Asteraceae, Papilionaceae, Sapindaceae and Tiliaceae were represented by 3.7 percent each of the vegetation. Araceae and Cyperaceae were represented by 7.5 percent of the flora and nineteen (19) other families accounted for 1.9 percent each. The vegetation had Simpson's Index of Diversity of 0.96.

In both river valleys, eighty-eight species of plants were enumerated – thirty five in Old Barrack River and 53 in River Tiba Valleys respectively. Thirteen species of plants were common to both river valleys while 18 species were encountered in Old Barrack River Valley but not in Tiba River Valley. It was observed that 39 species of plant were unique to River Tiba valley but not seen at Old Barrack River Valley (Tables 3, 4 and 5). Sorensen's similarity index between the two river valleys was 18.6%.

4.0 Discussion

The authors observed no change in species composition in the river valleys during rainy and dry seasons in both years. Even though the volume of water in both rivers was considerably reduced in the dry season, *Axonopus compressus*, *Cynodon dactylon*, *Panicum maximum* and *Setaria barbata* were alive in both river valleys while those on the adjoining land dried up due to desiccation. Both rivers are located in Nasarawa State in the central guinea savannah zone of Nigeria – a region known for grass vegetation, shrubs and isolated trees that can resist intense heat generated by annual bush burning. River Tiba had wide valley, deeper and contained larger volume of water throughout the year. These attributes attracted more rain forest and swamp forest species to its valley. These species consisted of *Megaphyllum macrostachyum*, *Raphia hookeri*, *Tetracera alnifolia*, *Cyrtospermum senegalense*, *Mitragyna stipulosa*, *Carapa procera*, *Ermospatha macrocarpa*, *Secleria verrucosa* and *Paullinia pinnata*. The presence of

these species in river valleys located in central guinea savanna zone indicated that availability of water not necessarily amount and duration of rainfall alone determined where plant species were found.

In these studies, thirty-five (35) and 53 plant species were enumerated in Old Barrack and River Tiba valleys respectively. This report was similar to the findings of Olabode *et al.*, (2011) who compared the flora of three wetlands in a forest savanna transition ecological zone of Ibadan, Oyo State. They recorded 38 plant species belonging to 19 families in the three wetlands in dry and rainy seasons; eight families were common to both seasons. Eleyele and Apete wetlands had relatively stable flora for both seasons while Oba Dam exhibited pronounced shift in flora between dry and wet seasons.

Olaloye *et al.*, (2015) examined the species composition and diversity of two sites of a riparian forest and its adjacent upland vegetation in southwestern Nigeria. They enumerated 231 woody plants consisting of 37 species while 270 woody plants comprising of 40 species were observed and identified in the adjacent upland vegetation. The number of species (37 and 40) recorded in their study did not vary so much from the results of the present survey where 35 and 53 species were encountered. The similarity emanated from the fact that both studies were carried in a near similar environments – southwestern guinea savanna (Ibadan) and north central guinea savanna (Keffi and Lafia) zones. Grass species which naturally dominated savanna vegetation was limited in this study because the river valleys had trees and shrubs which cut off most of the sunlight and provided shade that did not favour the growth of grasses.

Essien, Idachaba, Alege, Amodu and Usman (2014) studied the species composition of the derived savanna vegetation at Agbeji, Kogi State, Nigeria. The findings of the workers were similar to the results obtained in the present study. A total of 50 plant species belonging to 23 families were enumerated by them whereas in the two river valleys, 35 and 53 plant species were reported and distributed into 22 and 32 families in Old Barrack and Tiba river valleys respectively. One would state that even though tropical rain forest species were enumerated in the river valleys, they were very few in terms of diversity compared to surveys in typical rain forest ecosystem by Soladoye, Sonibare, Adeniyi and Alabi (2005) at (Olabisi Onabanjo University, Ago Iwoye, Nigeria, Gill and Onyibe (1990 and 1991) on the phytosociology of weeds of oil palm and abandoned rubber plantations in Bendel State (now Edo and Delta States) of Nigeria.

Table 1: Species composition along Old Barrack River Valley, Keffi

<i>Species</i>	<i>Family</i>	<i>Number species</i>	<i>Habit</i>
<i>Axonopus compressus</i>	Poaceae	121	Grass
<i>Cynodon dactylon</i>	Poaceae	90	Grass
<i>Chromolaena odorata</i>	Asteraceae	152	Shrub
<i>Cyperus difformis</i>	Cyperaceae	85	Sedge
<i>Eclipta alba</i>	Asteraceae	127	Herb
<i>Ficus exasperata</i>	Moraceae	32	Tree
<i>Gomphrena celosoides</i>	Amaranthaceae	270	Herb
<i>Lcacina trichantha</i>	Icacinaceae	50	Shrub
<i>Kyllinga erecta</i>	Cyperaceae	71	Sedge
<i>Kyllinga bulbosa</i>	Cyperaceae	82	Sedge
<i>Laportea asetuans</i>	Urticaceae	34	Herb
<i>Luffa cylindrica</i>	Cucurbitaceae	33	Climber
<i>Mimosa invisa</i>	Mimosaceae	81	Shrub
<i>Peperomia pellucida</i>	Piperaceae	105	Herb
<i>Panicum maximum</i>	Poaceae	230	Grass
<i>Setaria barbata</i>	Poaceae	140	Grass
<i>Vernonia cinera</i>	Asteraceae	205	Herb
<i>Dissotis erecta</i>	Melastomataceae	84	Shrub
<i>Dissotis rotundifolia</i>	Melastomataceae	91	Herb
<i>Alchornia cordifolia</i>	Euphorbiaceae	86	Shrub
<i>Dioda scandens</i>	Rubiaceae	91	Herb
<i>Anthocleista vogelic</i>	Loganiaceae	15	Tree
<i>Polygonum lanigerum</i>	Polygonaceae	84	Herb
<i>Paullinia pinnata</i>	Sapindaceae	21	Shrub
<i>Funtumia elastic</i>	Apocynaceae	14	Tree
<i>Albizia zygia</i>	Mimosaceae	11	Tree
<i>Lophira alata</i>	Ochnaceae	8	Tree
<i>Combretum hispidum</i>	Combretaceae	12	Shrub
<i>Alstonia boonei</i>	Apocynaceae	8	Tree
<i>Nauclea latifolia</i>	Rubiaceae	15	Shrub
<i>Landolphia owariensis</i>	Apocynaceae	3	Shrub
<i>Ipomoea aquatica</i>	Convolvulaceae	41	Creeper
<i>Kyllinga squamulata</i>	Cyperaceae	91	Sedge
<i>Nephrolepis biserrata</i>	Dennestidaceae	80	Fern
<i>Momordica charantia</i>	Cucurbitaceae	81	Climber

Table 2: Species compositions along River Tiba Valley Lafia

<i>Species</i>	<i>Family</i>	<i>Number species</i>	<i>Habit</i>
<i>Alchornia cordifolia</i>	Euphorbiaceae	72	Shrub
<i>Alternanthera seasilia</i>	Amaranthaceae	102	Herb
<i>Anthocleista vogelii</i>	Loganiaceae	21	Tree
<i>Ficus thoningii</i>	Moraceae	18	Tree
<i>Amnona senegalensis</i>	Annonaceae	25	Tree
<i>Amnona squamosa</i>	Annonaceae	31	Tree
<i>Nauclea latifolia</i>	Rubiaceae	52	Shrub
<i>Axonopus compressus</i>	Poaceae	105	Grass
<i>Megaphrynium macrostachyum</i>	Marantaceae	150	Herb
<i>Rhaphia hookeri</i>	Araceae	127	Tree
<i>Chromolaena odorata</i>	Asteraceae	80	Shrub
<i>Cyperus difformis</i>	Cyperaceae	91	Sedge
<i>Cynodon dactylon</i>	Poaceae	88	Grass
<i>Daniella oliveri</i>	Caesalpinaceae	10	Tree
<i>Dissotis erecta</i>	Melastomataceae	89	Shrub

<i>Species</i>	<i>Family</i>	<i>Number species</i>	<i>Habit</i>
<i>Dissotis rotundifolia</i>	Melastomataceae	70	Herb
<i>Imperata cylindrica</i>	Poaceae	201	Grass
<i>Parquetina nigrescens</i>	Asclupiadaceae	18	Climber
<i>Kyllinga erecta</i>	Cyperaceae	31	Sedge
<i>Ludwigia abyssinica</i>	Onagraceae	41	Shrub
<i>Neptunia oleracea</i>	Papilionaceae	51	Herb
<i>Nephrolepis biserrata</i>	Denndistidaceae	178	Fern
<i>Elaeis guinensis</i>	Araceae	21	Tree
<i>Blighia unijugatus</i>	Sapindaceae	8	Tree
<i>Senna hirsuta</i>	Caesalpiniaceae	21	Shrub
<i>Glyphaea brevis</i>	Tiliaceae	8	Shrub
<i>Napoleona vogelii</i>	Lecythidaceae	8	Shrub
<i>Azalia africana</i>	Caesalpiniaceae	9	Tree
<i>Tetracera alnifolia</i>	Dilleniaceae	7	Climber
<i>Smilax anceps</i>	Smilacaceae	3	Climber
<i>Spondia mombin</i>	Anacardiaceae	4	Tree
<i>Cyrtospermum senegalense</i>	Araceae	37	Herb
<i>Synedrella nodiflora</i>	Asteraceae	82	Herb
<i>Maniophyton fulvum</i>	Euphorbiaceae	8	Shrub
<i>Triumfetta cordifolia</i>	Tiliaceae	10	Shrub
<i>Mitragyna stipulosa</i>	Rubiaceae	7	Tree
<i>Murraya koenigii</i>	Rutaceae	12	Shrub
<i>Mussaenda erythrophylla</i>	Rubiaceae	8	Shrub
<i>Parkia bicolor</i>	Mimosaceae	11	Tree
<i>Margaritaria discoideus</i>	Euphorbiaceae	10	Tree
<i>Synclisia scabrida</i>	Menispermaceae	12	Climber
<i>Bateria nigriflora</i>	Passifloraceae	2	Tree
<i>Discorea praeiensili</i>	Dioscoreaceae	2	Climber
<i>Carapa procera</i>	Meliaceae	8	Tree
<i>Carpolobia lutea</i>	Polygalaceae	12	Shrub
<i>Centrosema pubescens</i>	Papilionaceae	50	Creeper
<i>Ermospatha macrocarpa</i>	Araceae	4	Climber
<i>Eugenia uniflora</i>	Myrtaceae	12	Shrub
<i>Gomphrena globosa</i>	Amaranthaceae	80	Herb
<i>Pycreus lanceolatus</i>	Cyperaceae	91	Sedge
<i>Secleria verrucosa</i>	Cyperaceae	70	Sedge
<i>Paullinia pinnata</i>	Sapindaceae	10	Climber
<i>Alstonia boonei</i>	Apocynaceae	10	tree

Table 3: Species common to both River Valleys

<i>Species</i>	<i>Family</i>
<i>Alchornea cordifolia</i>	Euphorbiaceae
<i>Axonopus compressus</i>	Poaceae
<i>Cynodon dactylon</i>	Poaceae
<i>Chromolaena odorata</i>	Astraceae
<i>Cyperus difformis</i>	Cyperaceae
<i>Kyllingi crecta</i>	Cyperaceae
<i>Dissotis erecta</i>	Melastomataceae
<i>Dissotis rotundifolia</i>	Melastomataceae
<i>Anthocleista vogelii</i>	Loganiaceae
<i>Paullinia pinnata</i>	Sapindaceae
<i>Nephrolepis biserrata</i>	Denndistidaceae
<i>Alstonia boonei</i>	Apocynaceae
<i>Nauclea latiflora</i>	Rubiaceae

Table 4: Plant species enumerated at Old Barrack River valley but not observed at River Tiba Valley

Species	Family
<i>Eclipta alba</i>	Asteraceae
<i>Ficus exasperata</i>	Moraceae
<i>Gomphrena Celosoides</i>	Amaranthaceae
<i>Icacina trichantha</i>	Icacinaceae
<i>Laportea aestuan</i>	Urticaceae
<i>Luffa cylindrica</i>	Cucurbitaceae
<i>Mimosa irvisa</i>	Mimosaceae
<i>Momordica charantia</i>	Cucurbitaceae
<i>Peperomia pellucida</i>	Piperaceae
<i>Panicum maximum</i>	Poaceae
<i>Setaria barbata</i>	Poaceae
<i>Vernonia cinera</i>	Asteraceae
<i>Dioda scandeus</i>	Rubiaceae
<i>Albizia zygia</i>	Mimosaceae
<i>Lophira alata</i>	Ochnaceae
<i>Landolphia owariensis</i>	Apocyoaceae
<i>Ipomoea aquatica</i>	Conolulaceae
<i>Kyllinga squamulata</i>	Cyperaceae

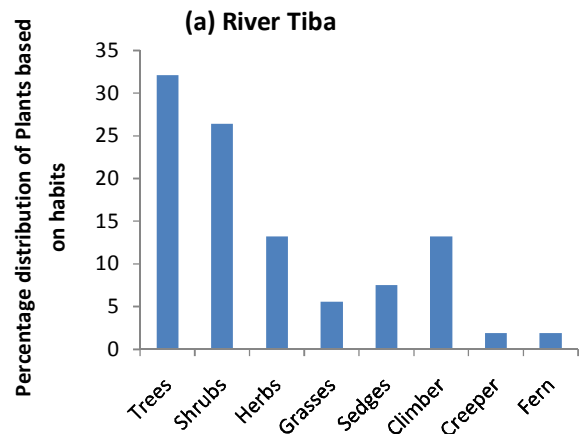
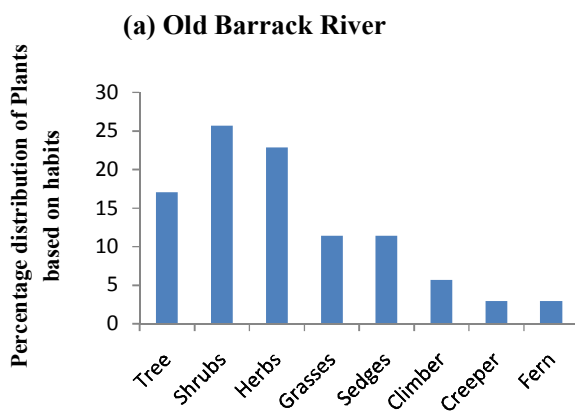
Table 5: Plant species encountered at Tiba River Valley and not at Old Barrack River Valley

Species	Family
<i>Alternanthera sessilis</i>	Amaranthaceae
<i>Ficus thoningii</i>	Moraceae
<i>Annona senegalensis</i>	Annonaceae
<i>Megaphrynrium macrostachyum</i>	Maranthaceae
<i>Raphia hookeri</i>	Araceae
<i>Daniella oliveri</i>	Caesalpiniaceae
<i>Imperata cylindrica</i>	Poaceae
<i>Crytospermum senegalense</i>	Araceae
<i>Parquetina nigresceas</i>	Aschiplidiaceae
<i>Ludwigia abyssinica</i>	Onagraceae
<i>Blighia unijugatus</i>	Sapindaceae
<i>Ghyphaea brevis</i>	Tiliaceae
<i>Senna hersuta</i>	Caesalpiniaceae
<i>Neptunia oleracea</i>	Papilionaceae
<i>Elaeis guineensis</i>	Arecaceae
<i>Napaleona vogelli</i>	Lecythidaceae
<i>Afezlia africana</i>	Mimosaceae
<i>Tetracera alnifolia</i>	Dilleniaceae
<i>Similax anceps</i>	Similacaceae
<i>Spondia mombin</i>	Anacardiaceae
<i>Syndrella nodiflora</i>	Asteraceae
<i>Maniophytum fulvum</i>	Euphorbiaceae
<i>Triumfetta cordifolia</i>	Tilliaceae
<i>Mitragyna stipulosa</i>	Rubiaceae
<i>Mussaenda erythrophylla</i>	Rubiaceae
<i>Parkia bicolor</i>	Mimosaceae
<i>Murraya koenigii</i>	Rutaceae
<i>Margaritaria discoideus</i>	Euphorbiaceae
<i>Synclisia scabrada</i>	Menispermaceae
<i>Bateria nigriflora</i>	Passifloraceae
<i>Discorea praedihensili</i>	Discoreaceae

Species	Family
<i>Carapa procera</i>	Meliaceae
<i>Carpolobium lutea</i>	Polygaleace
<i>Centrosema pubescens</i>	Papilionaceae
<i>Ermospatha macrocarpa</i>	Arecaceae
<i>Eugenia uniflora</i>	Myrtaceae
<i>Gomphrena globosa</i>	Amaranthaceae
<i>Pyrerus lanceotatus</i>	Cyperaceae
<i>Scleria verrucos</i>	Cyperaceae



Figure 1. Map of Nasarawa State Showing the locations of Keffi and Lafia



Figures 2a and 2b. Percentage distribution of plants based on habits (a) Old Barrack River Valley (b) River Tiba Valley.

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