

# A Checklist of the Flora of Edaphic Grasslands in the Rainforest Belts of Edo and Delta States of Nigeria

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**Abstract:** The flora of 18 and 28 grasslands in Edo and Delta States respectively were studied using a 1 m x 1 m quadrat. In Edo State (Zone A), fifty five plant species belonging to 25 families were identified as constituting the major part of the vegetation. Detailed analysis showed that 29.1% of the plants were grasses, trees (25.5%), herbs (21.8%), shrubs (16.4%), creepers (5.5%) and sedges (1.8%). But in Delta State (Zone B), 48 taxa distributed into 21 families were encountered in the fields. Based on habits, grasses were represented by 29.2%, trees (18.8%), herbs (18.8%), sedges (16.7%), shrubs (10.4%), ferns (4.2%) and creepers (2.1%). Only 14 species of plants were common to zones A and B; both zones had similar Simpson's index of diversity as 0.97 while Sorensen's similarity index was 15.2%.

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**Key words:** Checklist; flora; edaphic grasslands; Edo and Delta States

## 1. Introduction

The entire Delta State and most parts of Edo State lie within the rainforest belt of Nigeria. In spite of their location in the rainforest, many isolated but large expanse of grasslands dot both states. Most of the grasslands in Delta State are submerged in water during the rainy season while the ones in Edo State are upland. No valid scientific reason has been advanced for the existence of the grasslands except incoherent myths.

In Nigeria, many plant biologists had enumerated the weed flora of cultivated fields. Komolafe (1976) surveyed cashew, cocoa and coffee plantations in the old Western Region of Nigeria and documented the weeds associated with them. Agbaka (1977) provided the checklist of weeds found in rubber plantations in Bendel State, now Edo and Delta States. Okafor (1987) studied the weed composition and control in irrigated cotton in Lake Chad Basin, Nigeria while Gill and Onyibe (1990, 1991) studied respectively the phytosociology of weeds of oil palm and abandoned rubber plantations in Bendel State.

Obadoni and Remison (2002, 2004) documented the weed flora of lowland and upland rice ecologies respectively in Edo State. Soladoye *et al* (2005) enumerated the angiospermic diversity of Olabisi Onabanjo University, Ago Iwoye, Nigeria. They encountered a total of one hundred and thirty eight (138)

plant species belonging to 55 families. The floristic study of Kirmir Vally, Akara in Turkey was carried out by Burcu and Sadik (2005) and they enumerated 1040 vascular plants.

Information on the flora of this unique type of biome is, to the best of our knowledge very scanty. The surveys were aimed at: (a) providing a checklist of the flora of these peculiar grasslands; (b) bridge the gap in existing information on grasslands in Nigeria; (c) the results would serve as a basis for comparison in future in the event of a shift in specialization; and (d) compare the flora of the seasonally submerged grasslands of Delta State with those of upland in Edo State.

## 2. Materials and methods

### 2.1 The areas studied

In Edo State (Zone A), the grasslands surveyed consisted of the ones found at Ekpoma (6°43'N 6°08'E) and its surrounding villages namely Ukhun, Egoronaka, Uhiele; Irrua (6°44'N 6°13'E), Ilushin (6°40'N 6°38'E) and Ozalla (6°47'N 6°01'E). In Delta State (Zone B), field trips were made to the grasslands at Kwale (5°43'N 6°26'E), Abbi (5°53'N 6°13'E), Asaba (6°11'N 6°45'E), Ibusa (6°10'N 5°35'E), Iselegu (5°53'N 6°28'E) and Aghalokpe near Eku (5°75'N 6°01'E). All the grasslands in Delta State are flooded in the rainy season but the water dries up between December and January.

## 2.2 Sampling techniques

Two line transects were cut 50 m apart along each grassland visited. Leaving 10 m from the margin of each grassland, plants were sampled along the transects at intervals of 10 m using a square quadrat of 1 m x 1 m. Each field was sampled twice and any species that had been encountered during the first sampling was ignored. Trees and shrubs encountered along the transects and 10 m on either sides of the transects were collected and recorded since they could not be sampled with a 1 m x 1 m quadrat.

Grasslands in Edo State were surveyed between September and November in 2007 and 2008 while the ones in Delta State were sampled between January and April in 2007, 2008 and 2009. A total of 18 grasslands were surveyed in Edo State whereas in Delta State, 28 of them were sampled. The number of quadrats laid in each field ranged between 150 and 220 depending on their sizes. Some of the plants were identified in the field while those we could not identify immediately were properly labeled, put in black polyethylene bags and taken to the Department of Botany Laboratory for identification. Taxa were identified using reference materials by Hutchinson and Dalziel (1958 - 1968), Keay *et al* (1964), Akobundu and Agyakwa (1987). Plant specimens collected were poisoned as described by Okoli and Wilcox-Evwaraye (1992) and mounted in accordance with convectional herbarium practice and deposited at Department of Botany Herbarium, Ambrose Alii University, Ekpoma.

In order to investigate the extent of plant diversity within the grasslands, diversity indices were calculated for each zone using Simpson's (1949) index of diversity (I-D). Species diversity is a measure of heterogeneity of a site. Simpson's diversity index is calculated as:

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

Where:

D = Simpson's diversity index

N = Total number of species encountered

n=Number of individuals of  $i^{\text{th}}$  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 index also ranges between 0 and 1, but the greater the value, the greater the sample diversity.

The similarity between the zones was calculated as a measure of beta diversity ( $\beta$ ). The difference between habitats are referred to as ( $\beta$ ) diversity (WCMC, 1992). Sorensen's similarity index (SI) was used to calculate similarity between zones A and B. It is expressed as:

$$SI = \frac{a}{a + b + c} \times 100 \quad (2)$$

Where:

SI = Sorensen's similarity index

a = Number of species common to both zones

b = Number of species present in zone A but not in zone B

c = Number of species present zone B but not in zone A

## 3. Results

In the grasslands of Edo State, fifty five plant species belonging to twenty five families were identified as constituting the major part of the vegetation (Table 1). Poaceae accounted for sixteen (16) species representing 29.1 % of the entire taxa; while Asteraceae and Caesalpiniaceae accounted 6 and 4 species respectively (Table 2). Among the grasses, *Cymbopogon giganteus* was most abundant followed by *Panicum maximum*. Trees in the sampled grasslands constituted 25.5% of the vegetation; shrubs, herbs, sedges, grasses and creepers represent 16.4, 21.8, 1.8, 29.1 and 5.5. percent respectively (Figure 1a). The grasslands had high Simpson's index of diversity (1 - D) of 0.97.

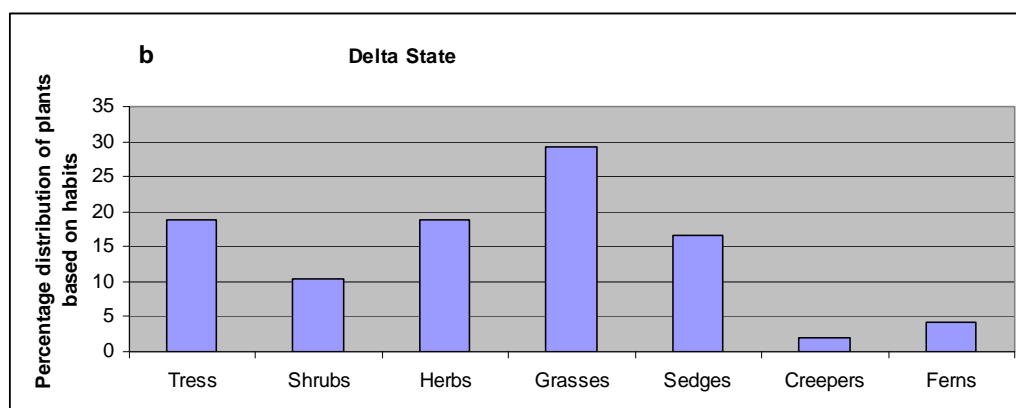
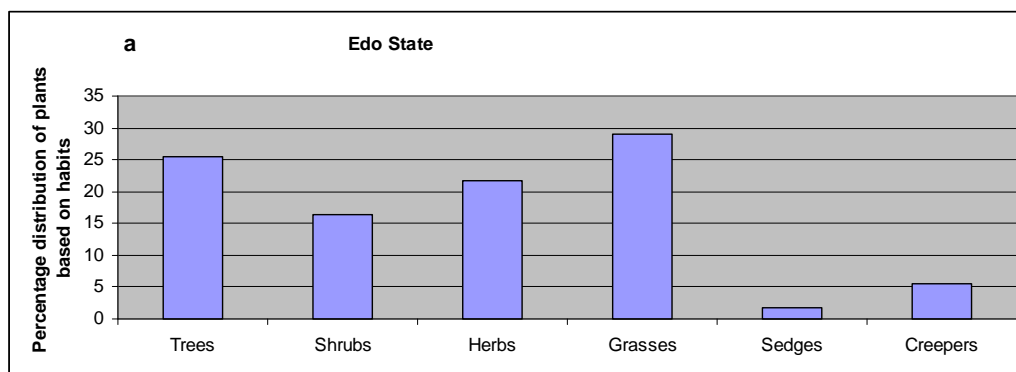
Table 1. Plants found in grasslands of Edo State

<i>Botanical Name</i>	<i>No. of Species</i>	<i>Family</i>	<i>Habit</i>
<i>Annona senegalensis</i> Pers	57	Annonaceae	Shrub

<i>Aspilia africana</i> (Pers) C.D. Adams	30	Asteraceae	Herb
<i>Chromolaena odorata</i> R.M. Kings & Robinson	101	Asteraceae	Shrub
<i>Melanthera scandens</i> Schum and Thonn	25	Asteraceae	Herb
<i>Syndrella nodiflora</i> Gaertn	76	Asteraceae	Herb
<i>Combretum paniculatum</i> Vent	12	Combretaceae	Tree
<i>Ipomoea involucreata</i> Beauv	18	Convolvulaceae	Creeper
<i>Ipomoea triloba</i> Linn	26	Convolvulaceae	Creeper
<i>Cnestis ferruginea</i> DC	21	Connaraceae	Shrub
<i>Cyperus rotundus</i> Linn	23	Cyperaceae	Sedge
<i>Sida acuta</i> Burm.f.	15	Malvaceae	Shrub
<i>Platostoma africanum</i> P. Beauv	30	Lamiaceae	Herb
<i>Urena lobata</i> Linn	46	Malvaceae	Shrub
<i>Andropogon tectorum</i> Schum & Thonn	120	Poaceae	Grass
<i>Andropogon gayanus</i> Kunth	48	Poaceae	Grass
<i>Cynodon dactylon</i> Linn	88	Poaceae	Grass
<i>Oplismenus gayanus</i> Beauv	91	Poaceae	Grass
<i>Imperata cylindrica</i> (Anders) C.E. Hubbard	206	Poaceae	Grass
<i>Panicum repens</i> Linn	150	Poaceae	Grass
<i>Dioda scandens</i> SW	86	Rubiaceae	Herb
<i>Setaria megaphylla</i> (Steud) Dur. & Shinz	97	Poaceae	Grass
<i>Pennisetum polystachion</i> (Linn) Schult	82	Poaceae	Grass
<i>Dissotis rotundifolia</i> (Sm) Triani	111	Melastomataceae	Herb
<i>Harungana madagascariensis</i> Lam. ex. Poir	33	Hypericaceae	Tree
<i>Alchornea cordifolia</i> (Schum & Thonn) Muell. Arg.	28	Euphorbiaceae	Shrub
<i>Lophira lanceolata</i> DC	172	Ochnaceae	Tree
<i>Alstonia boonei</i> De Wild	52	Apocynaceae	Tree
<i>Terminalia glaucescens</i> Planch ex. Bth	61	Combretaceae	Tree
<i>Vitex cuneata</i> Schum and Thonn	28	Verbenaceae	Tree
<i>Mitragyna inermis</i> (Wild) O. Kuntze	31	Rubiaceae	Tree
<i>Cassia mimosoides</i> Linn	81	Caesalpinaceae	Shrub
<i>Cassia obtusifolia</i> L.	38	Caesalpinaceae	Herb
<i>Smilax kraussiana</i> Meisn	22	Smilacaceae	Creeper
<i>Eragostis atrovirens</i> (Desf.) Trin. ex Steud	162	Poaceae	Grass
<i>Rottboellia cochinchinensis</i> (Lour.) Clayton	34	Poaceae	Grass
<i>Rauwolfia vomitoria</i> Afz.	42	Apocynaceae	Shrub
<i>Costus afer</i> Ker	84	Zingiberaceae	Shrub
<i>Pouzolzia guineensis</i> Benth	52	Urticaceae	Herb
<i>Daniellia oliveri</i> (Rolfe) Hutch & Dalz	170	Caesalpinaceae	Tree
<i>Funtumia elastica</i> (Preuss) Stapf	18	Apocynaceae	Tree
<i>Panicum maximum</i> Jacq.	209	Poaceae	Grass
<i>Hyparrhenia involucreata</i> Stapf	182	Poaceae	Grass
<i>Acanthospermum hispidum</i> DC	90	Asteraceae	Herb
<i>Alternantera pungens</i> H.B.K	82	Asteraceae	Herb
<i>Hypoestes cancellata</i> Nees	50	Acanthaceae	Herb
<i>Anacardium occidentale</i> L.	105	Anacardiaceae	Tree
<i>Bomhax buonopozense</i> P. Beauv	8	Bombacaceae	Tree
<i>Cassia fistula</i> L	17	Caesalpinaceae	Tree
<i>Ceiba pentandra</i> (L.) Garten	8	Bombacaceae	Tree
<i>Elaeis guineensis</i> Jacq.	29	Palmae	Tree
<i>Gloriosa superba</i> L	8	Liliaceae	Herb
<i>Setaria pallide-fusca</i> (Schum) Stapf C.E. Hubbard	90	Poaceae	Grass
<i>Pennisetum pedicellatum</i> Trin.	107	Poaceae	Grass
<i>Axonopus compressus</i> (Sw) P. Beauv.	83	Poaceae	Grass
<i>Cymbopogon giganteus</i>	303	Poaceae	Grass

Table 2. Species distribution according to families

Edo State grasslands (A)	No. of Species	Delta State grasslands (B)	No. of Species
Acanthaceae	1	Amaranthaceae	1
Anacardiaceae	1	Annonaceae	1
Annonaceae	1	Apocynaceae	2
Apocynaceae	2	Asteraceae	2
Asteraceae	6	Athyriaceae	1
Bombacaceae	1	Azollaceae	1
Caesalpimaceae	4	Boraginaceae	1
Combretaceae	2	Convolvulaceae	1
Connaraceae	1	Cyperaceae	7
Convolvulaceae	2	Euphorbiaceae	1
Cyperaceae	1	Hydrophyllaceae	1
Euphorbiaceae	1	Lamiaceae	1
Hypericaceae	1	Melastomataceae	2
Lamiaceae	1	Meliaceae	1
Liliaceae	1	Ochnaceae	1
Malvaceae	2	Onagoraceae	2
Melastomataceae	1	Palmae	2
Ochnaceae	1	Poaceae	15
Palmae	1	Rubiaceae	3
Poaceae	16	Sterculiaceae	1
Rubiaceae	2	Tiliaceae	1
Similacaceae	1	-	-
Urticaceae	1	-	-
Verbenaceae	1	-	-
Zingiberaceae	1	-	-



Figures 1a and b. Percentage distribution of plants based on their habits:

a) Edo State grasslands; b) Delta State grasslands

In Delta State, the vegetation of the sampled grasslands was made up of 48 plant species belonging to 21 families (Table 3), Poaceae was also the most common. *Andropogon incanellus* was the dominant grass in most of the grasslands sampled. The

distribution of the enumerated plant species based on habit was presented in Figure 1 b. The grasslands also had a high Simpson's index of diversity of 0.97 indicating that both zones had similar index of diversity.

Table 3. Plants encountered in grasslands of Delta State

<i>Botanical Name</i>	<i>No. of Species</i>	<i>Family</i>	<i>Habit</i>
<i>Melochia corchorifolia</i> Linn.	45	Sterculiaceae	Herb
<i>Dissotis rotundifolia</i> (Sm) Triani	192	Melastomataceae	Herb
<i>Hydrolea glabra</i> Schum & Thonn.	86	Hydrophyllaceae	Herb
<i>Eclipta prostrata</i> (Linn.) L.	56	Asteraceae	Herb
<i>Cyperus haspan</i> Linn	157	Cyperaceae	Sedge
<i>Fuirena ciliaris</i> (Linn.) Roxb.	193	Cyperaceae	Sedge
<i>Leersia hexandra</i> Sw	81	Poaceae	Grass
<i>Axomopus compressus</i> Beauv	204	Poaceae	Grass
<i>Ludwigia abyssinica</i> A.Rich	115	Onagraceae	Herb
<i>Sacciolepis africana</i> Hubb & Snowden	221	Poaceae	Grass
<i>Leptochloa caerulea</i> Steud	212	Poaceae	Grass
<i>Oplismenus bumanii</i> P.Beauv.	159	Poaceae	Grass
<i>Clappertonia ficifolia</i> (Wild) Decne	183	Tiliaceae	Shrub
<i>Echinochloa pyramidalis</i> Hitch & Chase	221	Poaceae	Grass
<i>Chromolaena odorata</i> (L) King & Robinson	82	Asteraceae	Shrub
<i>Alstonia boonei</i> Engl.	11	Apocynaceae	Tree
<i>Entandrophragma cylindricum</i> Spr	21	Meliaceae	Tree
<i>Lophira alata</i> Banks ex. Gaertn f.	12	Ochnaceae	Tree
<i>Annona senegalensis</i> Pers.	35	Annonaceae	Shrub
<i>Alchornea cordifolia</i> (Schum, & Thonn.)	31	Euphorbiaceae	Shrub
<i>Funtumia elastica</i> (Preuss) Stapf.	18	Apocynaceae	Tree
<i>Borassus flabellifer</i>	23	Palmae	Tree
<i>Mitragyna inermis</i> (Wild) O. Kuntze	9	Rubiaceae	Tree
<i>Brachystegia euryocona</i> Harms	7	Boraginaceae	Tree
<i>Hyptis lancoelata</i> Poir	35	Lamiaceae	Herb
<i>Diodia scandens</i> Sw	58	Rubiaceae	Herb
<i>Dissotis erecta</i> (Guill & Perry) Dandy	116	Melastomataceae	Shrub
<i>Imperata cylindrica</i> (Anderss.) C.E. Hubbard	93	Poaceae	Grass
<i>Cyperus difformis</i> Linn	88	Cyperaceae	Sedge
<i>Ischaemum rugosum</i> Salisb	71	Poaceae	Grass
<i>Ludwigia decurrens</i> Walt	94	Onagraceae	Herb
<i>Acroceras zizanioides</i> Dandy	191	Poaceae	Grass
<i>Scleria verrucosa</i> Wild	201	Cyperaceae	Sedge
<i>Paspalum vaginatum</i> Sw	245	Poaceae	Grass
<i>Killingia erecta</i> Shumach	221	Cyperaceae	Sedge
<i>Pycnus lanceolata</i> (Poir) C.B.Cl.	91	Cyperaceae	Sedge
<i>Panicum repens</i> Linn	192	Poaceae	Sedge
<i>Paspalum orbiculare</i> Forst	87	Poaceae	Grass
<i>Mariscus longibracteatus</i> Cherm	221	Cyperaceae	Sedge
<i>Oryza barthii</i> A. Chev.	86	Poaceae	Grass
<i>Alternanthera sessilis</i> (L.) R.Br ex Roth	61	Amaranthaceae	Herb
<i>Diplazium sammatii</i> (Kuhn) C. Chr.	101	Athyriaceae	Fern
<i>Azolla africana</i> Desv.	92	Azollaceae	Fern
<i>Ipomoea aquatica</i> Forsk	42	Convolvulaceae	Creeper
<i>Elaeis guineensis</i> Jacq.	22	Palmae	Tree



<i>Mitragyna stipulosa</i> (DC) O. Ktze	183	Rubiaceae	Tree
<i>Paspalum conjugatum</i> Berg.	261	Poaceae	Grass
<i>Andropogon incanellus</i>	341	Poaceae	Grass

Only 14 species of plants belonging to 8 families were found to occur in both zones A and B (Table 4). The total number of plant species encountered in grasslands of Edo and Delta States were 4038 and 5537 respectively. Result of Sorensen's similarity index between the zone was 15.2%.

Table 4. Plant species common to Zones A and B

<i>Plant Species</i>	<i>Family</i>
<i>Annona senegalensis</i>	Annonaceae
<i>Alstonia boonei</i>	Apocynaceae
<i>Funtumia elastica</i>	Apocynaceae
<i>Chromolaena odorata</i>	Asteraceae
<i>Alchornia cordifolia</i>	Euphorbiaceae
<i>Dissotis rotundifolia</i>	Melastomataceae
<i>Dissotis erecta</i>	Melastomataceae
<i>Axonopus compressus</i>	Poaceae
<i>Cymbopogon giganteus</i>	Poaceae
<i>Imperata cylindrica</i>	Poaceae
<i>Panicum repens</i>	Poaceae
<i>Elaeis guineensis</i>	Palmae
<i>Diodia scandens</i>	Rubiaceae
<i>Mitragyna inermis</i>	Rubiaceae

#### 4. Discussion

The disappearance of many plant species due to human activities is depleting the world's genetic resources and is putting man's heritage of biodiversity under serious threat (Soladoye *et al*, 2005). Most of the grasslands in Edo State (zone A) provide arable lands for the Igbiras who migrated from Kogi State. Besides, they are prone to annual bush burning set by the cattle rearers who also came from the northern parts of the country. Excessive cultivation to feed the ever-increasing human population and bush burning to ensure nutritious fodder for the farm animals were responsible for the very few plant families found in these fields. Most of the trees, shrubs, grasses and sedges encountered were those that could withstand intense heat of fire or able to regenerate few weeks after burning (Table 1). *Panicum maximum* is widely grazed upon by cattle and constituted one of the most dominant plants in the fields; it burns aggressively when dry but regenerates at about 2-3 weeks after the fire to produce very fresh and nutritious fodder for the animals.

Grasslands in Delta State were intensively utilized for cultivating paddy rice in the 1960's before the oil

boom of the 1970's. Being submerged under water for about six months (June - November) of the year, only plant taxa that could survive hydromorphic environment or complete their life cycles during the short dry period inhabit this unique habitat (Table 3). However, some plants could tolerate both hydromorphic and upland habitats because their roots were able to respire in the oxygen-deficient soil characteristic of hydromorphic environment.

Similarity in Simpson's index of diversity (0.97) for both zones was expected. The sampled grasslands occurred in rainforest belt known for high species richness or large number of plants per unit area – a fundamental feature of tropical rainforest (Peters, 1996). Result of Sorensen's similarity index (15.2%) between the zones did not reveal any variability between them. This was due to the occurrence of the grasslands in the same climatic belt with similar amounts of rainfall, photoperiod and temperature. This was also very evident in the number of plant families encountered in both zones - 25 in Edo State and 21 in Delta State (Table 2).

Although grasslands were sampled, trees and shrubs were many in both zones (Figures 1a and b). The shade effect of these trees did not encourage undergrowth regeneration or their establishment. This could contribute to reduction in plant diversity. Observations of soil samples in the fields from both zones showed marked variations in their physical properties in terms of colour, texture and water contents; these did not significantly affect the diversity of plants collected. Though located in the rainforest, the total number of species recorded during the surveys (55 for zone A and 48 for zone B) showed a marked decrease in plant species compared to 308 species reported by MacGregor (1937), to 50-100 plants per hectare reported by Lowe (1993) in a typical rainforest.

The large decrease was due to several human activities that had taken place in the grasslands over the years. As at today, the grasslands in Edo State are still being intensively cultivated and also grazed upon by cows, while in Delta State, large areas of the fields are destroyed by natives who obtain white sand for construction purposes after removing the top, black and muddy soil. The flora of these grasslands therefore have a very bleak future.

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