

## **Systematic Composition, Life Forms and Chorology of Agroforestry Systems of Aguié Department, Niger, West Africa**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author MS designed the study, wrote the protocol and wrote the first draft of the manuscript. Author AAM managed the literature searches, analyses of the study and performed the spectroscopy analysis. Author IDB managed the experimental process. Author SM was the supervisor and he contributed a lot to the work mostly identification of the species and corrections of the botanical names. All authors read and approved the final manuscript.*

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### **ABSTRACT**

Floristic data, life form, and chorotype identification play an important role in planning, management and conservation of vegetation regimes. This study attempted to determine the systematic composition, life forms, and chorology of Aguié department in Niger. We used a systematic sampling approach to inventory vegetation within the agroforestry systems of the Aguié department in August and September 2013. The size of the terrestrial plots was 50 mx 50 m while the aquatic plots were 4 mx 4 m. We recorded 272 plant species belonging to 52 families and 161 genera. The family Poaceae is represented the highest number of species (45) followed by Fabaceae (30), Mimosaceae (16), Caesalpinaceae (15), Euphorbiaceae (11), and Cyperaceae (10). The Shannon Weaver Diversity Index (H') calculated based on 51 plots was 2.55 bits. Therophytes (142) species

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(54.41% of therophytes species) are the dominant life forms in the study area followed by Phanerophytes 83 species (31.25%), Chamephytes 15 species (5.88%), Hydrophytes 9 species (3.30%), and Geophytes 7 species (2.5%). Hemicryptophytes and Lianas account for 3 and 4 species respectively. Chorological analysis of the inventoried flora revealed that Sudano-Zambezians (SZ) are represented by 55.28% (136 species) followed by Congolese-Sudano-Zambezians (GC-SZ) 30.48% (75 species), Sudano-Zambezians -Saharo-Sindians (SZ-Sah.S) 7.31% (16 species) and 10 (4.32%) for introduced species which indicates the anthropogenic impact on the flora of Aguié department. The analysis of biological spectrum reveals that the phytoclimate is therophanerophytic. The domination of therophytes indicates that Aguié department is a dryland area while the dominance of phanerophytes expresses the management and conservation practices within the agrosystems of Aguié department. We recommend further research that examines at the impact of land use activities on the dynamics of agroforestry systems of Aguié department.

*Keywords: Systematic composition; life form; chorology; Aguié department.*

## 1. INTRODUCTION

Niger is one of the largest countries in West Africa covering an area of 1,267,000 km<sup>2</sup>. The population is roughly 17.7 million people and growing at 3.9% per year [1]. Physically, the environment is characterized by a diverse microclimates resulting in high biodiversity within the broader Sahelian climate [2]. Agroforestry systems provide a lot of services to the rural people in Niger [3-6]. However overexploitation and climate variability constitute a great threat to Niger agroforestry systems dynamics [5].

Several botanical studies have been done in the respect of agroforestry systems in Niger [2,3,7]. A lot of studies have been carried out the agroforestry systems of Aguié [8,9,6], but there were few of them studied the combination of systematic composition, life forms and chorology of the agroforestry systems of Aguié Department.

Systematic composition refers to how many species, genera and botanical families contains a given ecosystems at a given period. While life form is an indicator used to describe world vegetation types and they are indicator of climatic conditions of a given area [10]. Further life form is a vital attribute of ecosystem. Life forms plays useful role in studying the vegetation [11]. Meanwhile chorology refers to geographical distribution of plants, it is also phytogeographical study [12]. Chorology is also a description of chorotypes found within a given area.

Botanical study about the flora, its life form and phytogeographical types are essential for providing information for sustainable parklands management of Aguié department. The study provides a comprehensive contribution to the

Flora of Aguié department. The objective of the study is determine systematic composition, life forms and phytogeographical types of the parklands of Aguié department.

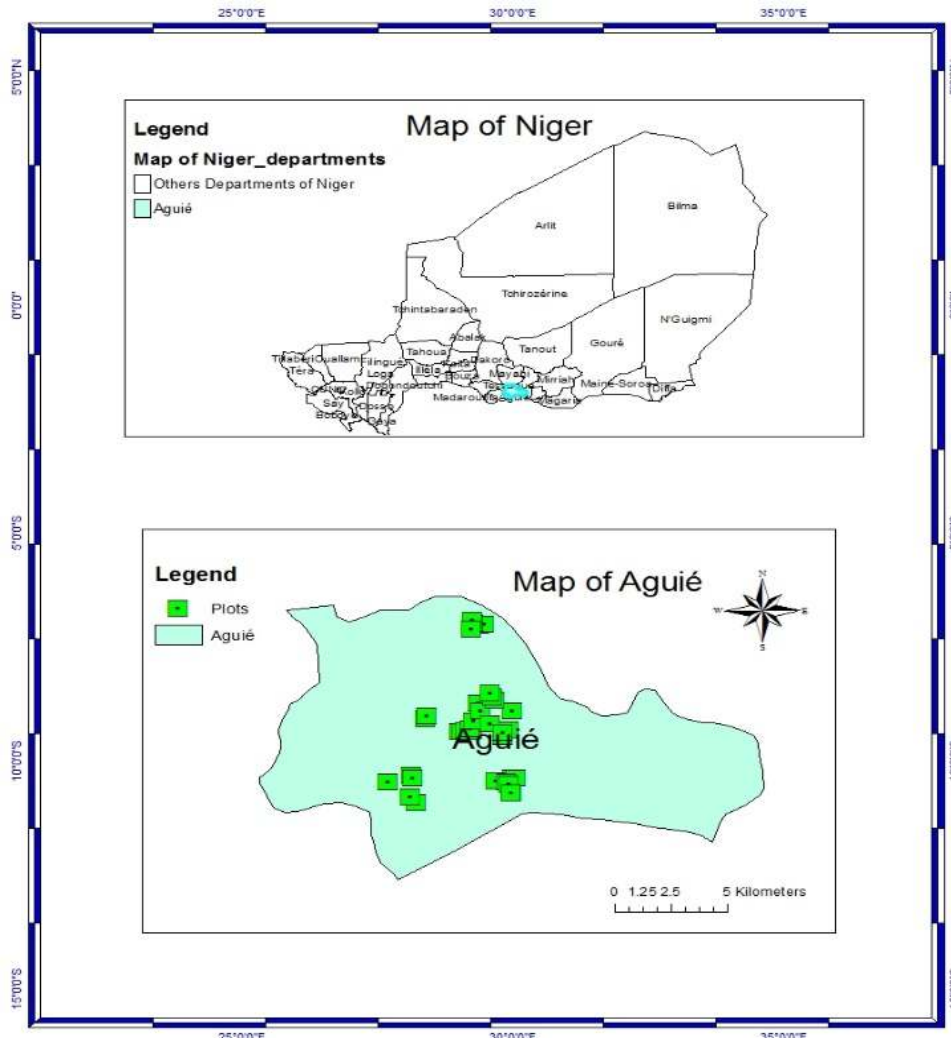
## 2. MATERIALS AND METHODS

### 2.1 Study Area

Aguié is a department found of Maradi region of Niger republic. Aguié lies between 13°51'21"N and 08°18'12"E (Fig. 1). Population of Aguié department was estimated at 386.197 [1]. Agriculture is the principal activity of the people of Aguié. But *Cyperus esculentus* is the cash crop characteristic of the department. Besides agricultural activity, the people of Aguié engage in livestock production. Parklands provide many services to the people of Aguié such as firewood, raw materials, animal fodder etc. They provide to them the food such as the leaves and fruits.

The climate of Aguié is south sahelian type with following characteristics [2]: Rainfall index = 400 mm < RI < 600 mm; relative humidity = 18% (March) < RH < 70.5 % ( August); Temperature = 19°C (January) < T° < 32°8C (May).

Aguié has various soil types including sandy soil and ferruginous tropical soils. The vegetation of Aguié belongs to south sahelian central (B2) compartment for the phytogeographical subdivision [2]. Dan Kada Dodo forest reserve, Dan Gado forest reserve and, Bakabé forest reserve are the types of the vegetation of Aguié department. But the parklands such as croplands, fallow lands and pasturelands is the dominant vegetation types within the department. The study sites were Dodo, Bamo, Dan kéri, Gamji Saboua, Guidan Tanko, Guidan



**Fig. 1. Map of study area Aguié department showing sample plots**

Nahantchi, Saja Manja, Bakabé, Mai Sanho, Dan Saga, Aguié commune, and Dan Kada, they were randomly selected.

## 2.2 Data Collection and Data Analysis

The inventory of plant species of Aguié department was carried out in August and September which corresponds to the period of optimum for sahelian vegetation [2]. A systematic sampling was used in order to capture the environmental heterogeneity [8]. The size of the plots was 50m x 50m (2500 m<sup>2</sup>) which is minimal area the agroforestry systems and 16 (4 m x 4 m) for aquatic prairie adopted by [13]. Pole and meter were used to delimit the plots size. Data was collected from 51 plots but 7 plots were aquatic. The plots were showed in Fig. 1. Within

each plot all the species were recorded, GPS coordinates of each plot was taken. The flora of Hutchinson and Michel Arbonnier book [14] were used to identify the species. The botanical classification used was the Cronquist system. Herbarium was also used to identify some species at Department of Biology, University Dan Dicko Dan Koulodo of Maradi, Niger. Furthermore the pictures of some plants, fruits and leaves were taken with camera for species determination. In this study to determine the life form Raunkaier's method, in [2], applied by [15] and [16] was used. The method classifies the life form into five types:

1. **Phanerophytes (Ph):** Woody plant that the renewal bud above 50 cm from soil surface. The subdivision such as

Nanophanerophytes (NnPh 0.5 to 2 m); Microphanerophytes (McPh 2 to 8 m); Mesophanerophytes (MsPh, 8 to 30 m) and Megaphanerophytes (MPh, more than 30 m) constitutes the phanerophytes (Ph).

2. **Chamephytes (Ch):** Woody plant or suffrutescent perennial that the renewal bud situated at 50cm above of the soil.
3. **Hemicryptophytes (H):** Perennial plant that the renewal bud is at the soil surface.
4. **Geophytes (G):** Plant that the renewal bud is buried within the soil.
5. **Therophytes (Th):** Annual plants that form their spores or seeds within only one period of life. Therophytes Liana (L). Among the five life form types, they can be hydrophytes (Hy) which are the plants that the renewal bud is situated at the bottom of the water.

To identify the chorological types of Aguié agroforestry systems the study used are those defined by [17] and [2] at African scale. They chorotypes used are: Guineo-Congolese-Sudano-Zambezians (GC-SZ); Sudano-Zambezians (SZ); Sudano-Zambezians –Saharo-Sindians (SZ-Sah. S); Saharo-Sindians (Sah. S); Saharo-Sindians- Mediterranean (Sah.S-Med); Sudano- Zambezians- Saharo- Sindians-Mediterranean (SZ-Sah.S.med), Sudanian: S and Introduced Species: I.

The Shannon diversity index (H') was used to characterize species diversity in agroforestry systems of Aguié Department using this formula:

$$H' = -\sum_{i=1}^S p_i (\log_2 p_i)$$

S = total number of species  $p_i = (n_i / N)$  relative frequency of species ( $\sum p_i = 1$ ).  $n_i$  = relative frequency of species  $i$  in the sampling unit  $N$  = sum of the specific relative frequencies.

The relative frequency of each botanical families, species' life form and chorotypes were calculated using the number of species using Excel.

### 3. RESULTS AND DISCUSSION

#### 3.1 Systematic Composition of Aguié Agroforestry Systems

The results of this study show that 272 plant species belonging to 53 families and 161 genera

were recorded in agroforestry systems of Aguié Department. The family Poaceae is represented by the highest number of species (45 species) followed by Fabaceae (30 species), Mimosaceae (17), Caesalpiniaceae (15 species), Euphorbiaceae (11 species) and Cyperaceae (10 species). Forty six families were represented by 139 species (Table 1). The Shannon Diversity Index (H') calculated based 51 plots was low with 2.55 bits. But it was greater than the results found by [18,7] in Maradi region. Further, [19] found Shannon Diversity Index (H') of 2.8 bits in Maradi region which was considered greater 1.9 bits found in Diffa region in Niger. Our result was greater than 1.9 bits found in Diffa by [19]. Our result is also greater than 2.34 bits found by [20] in Aguié department. Our result explained due to the fact that Aguié department we collected the floristic data from the three forest reserves, sudanian zone of Aguié, aquatic plots from the wetlands and the implementation in zone of farmer managed tree natural regeneration and woody species tenure in parklands management. The dominance of Poaceae means that the flora is composed of annuals. This is explained due to the area is semi-arid. The dominance of Poaceae (42 species) and Fabaceae (28 species) in the agroforestry systems of Aguié agree with the results found in Niger by some authors of [15,21,16]. Furthermore, the dominance of Poaceae and Fabaceae coincides with the results found by [22] in Saudi Arabia. The current result in this regard also agrees with the result found by [23] which considered that Poaceae and Fabaceae as the most dominant botanical families at Khulais region in Saudi Arabia.

#### 3.2 Life Forms of Aguié Agroforestry Systems

The analysis of life forms of Aguié department shows that therophytes 148 species (54.41%) are the dominant life forms in the study area followed by Phanerophytes 85 species (31.25%), Chamephytes 16 species (5.88%), Hydrophytes 9 species (3.30%), and Geophytes 7 species (2.5%). Hemicryptophytes and Lianas account for 3 and 4 species, representing 1.47% and 1.10 % respectively. The dominance of therophytes means the flora is annual which develops the strategy to avoid water shortage. The dominance of phanerophytes within Aguié flora indicates the management practices such as the farmer managed tree natural regeneration and conservation methods such as woody species ownership used by agroforestry systems farmers to conserve the woody species within their

**Table 1. Systematic composition**

<b>Families</b>	<b>Genera</b>	<b>Species</b>	<b>%</b>
Poaceae	45	45	16.54
Fabaceae	14	30	11.03
Mimosaceae	6	17	6.25
Caesalpinaceae	7	15	5.51
Euphorbiaceae	6	11	4.04
Cyperaceae	5	10	3.68
Convolvulaceae	3	10	3.68
Capparaceae	7	9	3.31
Malvaceae	5	9	3.31
Asteraceae	7	8	2.94
Amaranthaceae	5	8	2.94
Cucurbitaceae	5	7	2.57
Rubiaceae	5	7	2.57
Combretaceae	4	6	2.21
Commelinaceae	3	6	2.21
Tiliaceae	2	6	2.21
Asclepiadaceae	4	5	1.84
Aizoaceae	3	4	1.47
Pedaliaceae	3	4	1.47
Acanthaceae	3	4	1.47
Anacardiaceae	2	3	1.10
Burseraceae	2	3	1.10
Caryophyllaceae	1	3	1.10
Scrofulariaceae	1	3	1.10
Arecaceae	2	2	0.74
Liliaceae	2	2	0.74
Loganiaceae	1	2	0.74
Meliaceae	2	2	0.74
Molluginaceae	1	2	0.74
Moraceae	1	2	0.74
Nymphaeaceae	1	2	0.74
Portulacaceae	1	2	0.74
Rhamnaceae	1	2	0.74
Solanaceae	2	2	0.74
Lamiaceae	1	1	0.37
Agavaceae	1	1	0.37
Amaryllidaceae	1	1	0.37
Annonaceae	1	1	0.37
Apocinaceae	1	1	0.37
Balanitaceae	1	1	0.37
Bignoniaceae	1	1	0.37
Bombacaceae	1	1	0.37
Bombaceae	1	1	0.37
Boraginaceae	1	1	0.37
Ebenaceae	1	1	0.37
Nyctaginaceae	1	1	0.37
Olacaceae	1	1	0.37
Polygalaceae	1	1	0.37
Sapotaceae	1	1	0.37
Sterculiaceae	1	1	0.37
Tribulaceae	1	1	0.37
Verbenaceae	1	1	0.37
Zygophyllaceae	1	1	0.37
Total	161	272	1

croplands. Further, the dominance of species for agroforestry purposes. The phanerophytes within the inventoried flora phytoclimate of Aguié department is explains that the farmers conserve woody therophanerophytic. Our result, the dominance of

**Table 2. Chorotypes and their relative percentage in flora of agroforestry systems of Aguié**

Chorotypes	SZ	GC-SZ	SZ-Sah.S	SZ-Sah-Med	Sah-S	i	S	Total
Number	136	75	18	4	1	10	2	246
Percentage (%)	55.28	30.48	7.31	1.62	0.40	4.06	0.81	100

therophytes confirms what some authors found in Niger ecosystems [15,21,16] who found respectively that the therophyte was dominant life form in their study zones. Further, the current results are similar to some authors [24,11,25] who found also respectively that the therophyte was dominant life form in their study areas.

### 3.3 Chorology of Agroforestry Systems of Aguié Department

Chorological analysis at Africa scale of the inventoried flora of Aguié Department shows that Sudano-Zambezians (SZ) are represented by 55.28% (136 species) followed by Congolese-Sudano-Zambezians (GC-SZ) 30.48% (75 species), Sudano-Zambezians –Saharo-Sindians (SZ-Sah.S)) 7.31% (18 species). 10(4.06%) introduced species were also recorded. Our result, the dominance of Sudano-Zambezians (SZ) in parklands of Aguié is similar to the results of [26] who revealed the dominance of Sudano-Zambezians (SZ) in all Western part of Niger. The only difference is that our result reveals the dominance of SZ in the parklands in south-central Niger. But [20] found the same result which revealed that (59.5%) was represented by Sudano-Zambezians (SZ) in Dan kada Dodo-Dan Gado forest reserve in Aguié department.

### 4. CONCLUSION

The Agroforestry systems of Aguié department is rich in phytobiodiversity. The systematic composition of Aguié department is diverse in terms of species, genera and botanical families. In the present study, the high percentage of therophytes indicate that Aguié department is semi- arid while the dominance of phanerophytes is an indicator of sustainable woody species management in the parklands. The phytoclimate of Aguié is therophanerophytic. The study recommends further study that will look at the impact of human activities on the agroforestry systems dynamics in Aguié department.

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### COMPETING INTERESTS

Authors have declared that no competing interests exist.

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## APPENDIX

## List of recorded species

Species	Families	Life forms	Chorotypes
<i>Achyranthes aspera</i> L.	Acanthaceae	Th	GC-SZ
<i>Blepharis maderaspatensis</i> (L.) Heyne ex Roth	Acanthaceae	Th	GC-SZ
<i>Monechma ciliatum</i> (Jacq.) Milne-Redhead	Acanthaceae	Th	GC-SZ
<i>Peristrophe bicalyculata</i> (Retz)	Acanthaceae	Th	SZ
<i>Sansevieria liberica</i> Cer. Et Labr.	Agavaceae	G	GC-SZ
<i>Gisekia pharnaceoides</i> L.	Aizoaceae	Th	SZ
<i>Limeum pterocarpum</i> (Gay.) Heimerl.	Aizoaceae	Th	SZ
<i>Limeum viscosum</i> (Gay.) Hermerl.	Aizoaceae	Th	SZ-Sah.S
<i>Trianthema portulacastrum</i> L.	Aizoaceae	Th	SZ
<i>Aerva javanica</i> (Bura.f.) Juss.ex.Schult.	Amaranthaceae	Np	SZ-Sah.S
<i>Alternanthera sessilis</i> Dc.	Amaranthaceae	Th	GC-SZ
<i>Amaranthus graecizans</i> L.	Amaranthaceae	Th	GC-SZ
<i>Amaranthus spinosus</i> L.	Amaranthaceae	Th	GC-SZ
<i>Amaranthus viridis</i> L.	Amaranthaceae	Th	GC-SZ
<i>Celosia trigyna</i> L.	Amaranthaceae	Th	GC-SZ
<i>Pandiaka involucrata</i> (Moq.) Hook.f.	Amaranthaceae	Th	
<i>Pupalia lappacea</i> (L.) Juss.	Amaranthaceae	Th	GC-SZ
<i>Crinum ornatum</i> (Ait.) Bury.	Amaryllidaceae	G	Pan
<i>Lannea acida</i> A.Rich.	Anacardiaceae	Mp	GC-SZ
<i>Lannea microcarpa</i> Engl. Et K. Krause	Anacardiaceae	Mp	GC-SZ
<i>Sclerocarya birrea</i> (A. Rich.) Hochst.	Anacardiaceae	mP	SZ-SZ
<i>Annona senegalensis</i> Pers.	Annonaceae	Np	SZ
<i>Caralluma dalzielii</i> N.E. Br	Apocinaceae	Ch	SZ
<i>Borassus aethiopicum</i> Mart.	Arecaceae	mP	GC-SZ
<i>Hyphaene thebaica</i> (L.) Mart.	Arecaceae	Mp	SZ
<i>Calotropis procera</i> (Ait.) R. Br.	Asclepiadaceae	Mp	Sah.S
<i>Glossonema boveanum</i> Decne.	Asclepiadaceae	Ch	SZ-Sah.S
<i>Leptadenia hastata</i> (Pers.) Decne	Asclepiadaceae	Mp	SZ
<i>Leptadenia pyrotechnica</i> (Forsk.) Decne	Asclepiadaceae	Np	SZ
<i>Pergularia tomentosa</i> (L.) Mant.	Asclepiadaceae	Np	SZ-Sah.S
<i>Acanthospermum hispidum</i> Dc	Asteraceae	Th	GC-SZ
<i>Aspilia kotschyi</i> (Sch.Bip.) Oliv	Asteraceae	Th	SZ
<i>Bidens pilosa</i> L.	Asteraceae	Th	GC-SZ
<i>Blainvillea gayana</i> Cass.	Asteraceae	Th	SZ
<i>Centaurea perrottetii</i> Dc.	Asteraceae	Np	SZ
<i>Dicoma tomentosa</i> Cass.	Asteraceae	Th	SZ
<i>Vernonia pauciflora</i> (Willd.) Less.	Asteraceae	Th	GC-SZ
<i>Vernonia perrottetii</i> Schb. Bip.	Asteraceae	Th	SZ
<i>Balanites aegyptiaca</i> (L.) Del.	Balanitaceae	Mp	SZ-Sah.S
<i>Stereospermum kunthianum</i> Cham.	Bignoniaceae	Mp	SZ
<i>Adansonia digitata</i> L.	Bombacaceae	mP	SZ
<i>Bombax costatum</i> Pellegr.	Bombacaceae	mP	SZ
<i>Heliotropium strigosum</i> Willd.	Boraginaceae	Ch	SZ-Sah.S
<i>Boswellia dalzielii</i> Huctch.	Burseraceae	Mp	SZ
<i>Commiphora africana</i> (A. Rich.) Engl.	Burseraceae	Mp	SZ
<i>Commiphora pedunculata</i> (Kotschy. Peyr.) Engl.	Burseraceae	mP	A
<i>Bauhinia rufescens</i> Lam.	Caesalpiniaceae	Mp	SZ
<i>Cassia absus</i> L.	Caesalpiniaceae	Th	GC-SZ
<i>Cassia italica</i> (Mill.) Lam. Ex Fw.Andr	Caesalpiniaceae	Ch	SZ
<i>Cassia mimosoides</i> L.	Caesalpiniaceae	Th	GC-SZ
<i>Cassia nigricans</i> Vahl.	Caesalpiniaceae	Th	SZ
<i>Cassia obtusifolia</i> L.	Caesalpiniaceae	Th	GC-SZ
<i>Cassia occidentalis</i> L.	Caesalpiniaceae	Np	GC-SZ
<i>Cassia siamea</i> L.	Caesalpiniaceae	Mp	i
<i>Cassia sieberiana</i> DC.	Caesalpiniaceae	Mp	GC-SZ
<i>Cassia singueana</i> Del.	Caesalpiniaceae	Mp	SZ
<i>Delonix regia</i> (Hook.) Raf.	Caesalpiniaceae	Mp	i
<i>Detarium microcarpum</i> Guill. Et Perr.	Caesalpiniaceae	Mp	SZ



Species	Families	Life forms	Chorotypes
<i>Parkinsonia aculeate</i> L.	Caesalpiniaceae	Mp	i
<i>Piliostigma reticulatum</i> (Dc.) Hochst	Caesalpiniaceae	Mp	SZ-Sah.S
<i>Tamarindus indica</i> L.	Caesalpiniaceae	Th	SZ
<i>Boscia senegalensis</i> (Pers.) Lam. Ex poir .	Capparaceae	Mp	SZ
<i>Cadaba farinosa</i> Forsk.	Capparaceae	Mp	SZ
<i>Capparis tomentosa</i> Lam.	Capparaceae	Lmp	SZ
<i>Cleome monophylla</i> L.	Capparaceae	Th	SZ
<i>Cleome viscosa</i> L.	Capparaceae	Th	GC-SZ
<i>Crataeva adansonii</i> DC.	Capparaceae	Mp	Pal
<i>Gynandropsis gynandra</i> (L.) Briq	Capparaceae	Th	GC-SZ
<i>Maerua angolensis</i> Forsk.	Capparaceae	Mp	SZ
<i>Maerua crassifolia</i> Forsk.	Capparaceae	Mp	SZ-Sah.S
<i>Polycarpaea corymbosa</i> (L.) Lam.	Caryophyllaceae	Th	SZ
<i>Polycarpaea eriantha</i> Hochst ex A. Rich.	Caryophyllaceae	Th	SZ
<i>Polycarpaea linearifolia</i> (Dc)	Caryophyllaceae	Th	SZ
<i>Anogeissus leiocarpus</i> (DC.) Guill. Et Perr.	Combretaceae	Mp	SZ
<i>Combretum aculeatum</i> Vent	Combretaceae	Mp	SZ
<i>Combretum glutinosum</i> Perr. ex Dc	Combretaceae	Mp	SZ
<i>Combretum micranthum</i> G. Don	Combretaceae	Mp	SZ
<i>Guiera senegalensis</i> J.F.Gmel.	Combretaceae	Mp	SZ
<i>Terminalia avicennioides</i> Guill. et Pers.	Combretaceae	Mp	SZ
<i>Commelina benghalensis</i> L.	Commelinaceae	Th	GC-SZ
<i>Commelina erecta</i> L.	Commelinaceae	Th	SZ
<i>Commelina forskalaiei</i> Vahl.	Commelinaceae	Th	SZ
<i>Commelina subulata</i> Roth.	Commelinaceae	Th	SZ
<i>Cyanotis lanata</i> Bentham	Commelinaceae	Th	GC-SZ
<i>Evolvulus alsinoides</i> (L.)	Convolvulaceae	Th	GC-SZ
<i>Ipomoea aquatica</i> Forsk.	Convolvulaceae	Hy	
<i>Ipomoea asarifolia</i> ( Desr.) Roem. Et Schult	Convolvulaceae	Ch	GC-SZ
<i>Ipomoea coptica</i> (L.) Roth.	Convolvulaceae	Th	GC-SZ
<i>Ipomoea coscinosperma</i> Heehst. Ex Choisy	Convolvulaceae	Th	SZ
<i>Ipomoea dichroa</i> Hochst. Ex Choisy	Convolvulaceae	Th	SZ
<i>Ipomoea eriocarpa</i> R. Br.	Convolvulaceae	Th	SZ
<i>Ipomoea pes-tigridis</i> L.	Convolvulaceae	Th	SZ
<i>Ipomoea vagans</i> Bak.	Convolvulaceae	Th	SZ
<i>Jacquemontia tamnifolia</i> (L.) Griseb.	Convolvulaceae	Th	GC-SZ
<i>Citrillus colocynthis</i> (L.) Schrad.	Cucurbitaceae	Ch	SZ
<i>Citrillus lanatus</i> (Thunb.) Matsumara et Makai	Cucurbitaceae	Ch	SZ
<i>Lagenaria siceraria</i> (Molina) Standl.	Cucurbitaceae	Lth	
<i>Merremia pinnata</i> (Hochst.) Hallier	Cucurbitaceae	Th	GC-SZ
<i>Merremia tridentata</i> (L.) Hallier	Cucurbitaceae	Th	GC-SZ
<i>Momordica balsamina</i> L.	Cucurbitaceae	Th	SZ
<i>Mukia maderaspatana</i> (L.) Roem.	Cucurbitaceae	Th	GC-SZ
<i>Bulbostylis barbata</i> (Rottb.) C.B. Cl.	Cyperaceae	Th	GC-SZ
<i>Cyperus amabilis</i> Vahl.	Cyperaceae	Th	GC-SZ
<i>Cyperus esculentus</i> L.	Cyperaceae	G	Cos
<i>Cyperus iria</i> L.	Cyperaceae	Th	Pan
<i>Cyperus rotundus</i> L.	Cyperaceae	G	GC-SZ
<i>Fimbristylis hispidula</i> (Vahl.) Kunth.Subsp.	Cyperaceae	Th	GC-SZ
<i>Kyllinga pumila</i> Michaux	Cyperaceae	Th	
<i>Kyllinga squamulata</i> Thonn.ex Vahl.	Cyperaceae	Th	GC-Sz
<i>Kyllinga welwitschii</i> Ridley	Cyperaceae	Th	SZ
<i>Mariscus squarrosus</i> (L.) C. B. Cl.	Cyperaceae	Th	SZ
<i>Diospyros mespiliformis</i> Hochst ex .A. Dc	Ebenaceae	Mp	GC-SZ
<i>Acalypha ciliata</i> Forsk.	Euphorbiaceae	Th	GC-SZ
<i>Chrozophora brocchiana</i> Vis	Euphorbiaceae	Np	SZ
<i>Euphorbia balsamifera</i> Ait.	Euphorbiaceae	Mp	SZ-Sah.S- Med
<i>Euphorbia convolvuloides</i> Hochst. Ex.	Euphorbiaceae	Ch	SZ
<i>Euphorbia forskalii</i> Gay	Euphorbiaceae	Th	SZ-Sah.S- Med
<i>Euphorbia glomerifera</i> (Millsp.) L.C.	Euphorbiaceae	Th	
<i>Euphorbia hirta</i> L.	Euphorbiaceae	Ch	GC-SZ
<i>Euphorbia poissonii</i> Pax	Euphorbiaceae	Np	SZ

Species	Families	Life forms	Chorotypes
<i>Jatropha curcas</i> L.	Euphorbiaceae	Mp	
<i>Phyllanthus pentandrus</i> Schum. Et Thonn.	Euphorbiaceae	Th	SZ
<i>Securinega virosa</i> (Roxb. Ex Willd) Baill.	Euphorbiaceae	Np	GC-SZ
<i>Aeschynomene indica</i> L.	Fabaceae	Hy	GC-SZ
<i>Alysicarpus ovalifolius</i> (Schum. Et Thonn.)	Fabaceae	Th	GC-SZ
<i>Arachis hypogaea</i> L.	Fabaceae	Th	i
<i>Canavalia rosea</i> (L.) DC.	Fabaceae	Lmp	i
<i>Crotalaria goreensis</i> Guill. Et Perr.	Fabaceae	Th	GC-SZ
<i>Crotalaria podocarpa</i> DC.	Fabaceae	Th	SZ
<i>Crotalaria retusa</i> L.	Fabaceae	Th	GC-SZ
<i>Crotalaria senegalensis</i> (Pers.) Bak. Ex.DC.	Fabaceae	Th	SZ- Sah.S
<i>Dalbergia sissoo</i> DC.	Fabaceae	Mp	i
<i>Indigofera astragalina</i> Dc.	Fabaceae	Th	SZ
<i>Indigofera berhautiana</i> Gillet	Fabaceae	Th	SZ
<i>Indigofera bracteolata</i> DC.	Fabaceae	Th	SZ
<i>Indigofera dendroides</i> Jacq.	Fabaceae	Th	GC-SZ
<i>Indigofera diphylla</i> Vent.	Fabaceae	Th	SZ-Sah.S
<i>Indigofera hirsuta</i> Var.hirsuta	Fabaceae	Th	SZ-Sah.S
<i>Indigofera nummulariifolia</i> (L.) Liv. Ex Alston	Fabaceae	Th	SZ
<i>Indigofera pilosa</i> Poir.	Fabaceae	Th	SZ
<i>Indigofera stenophylla</i> Guill. Et Perr.	Fabaceae	Th	SZ
<i>Indigofera tinctoria</i> L.	Fabaceae	Np	GC-SZ
<i>Pterocarpus erinaceus</i> Poir.	Fabaceae	Mp	SZ
<i>Sesbania pachycarpa</i> Dc.	Fabaceae	Th	SZ
<i>Stylosanthes erecta</i> P.Beauv.	Fabaceae	Mp	GC-SZ
<i>Tephrosia bracteolata</i> Guill. Et Perr.	Fabaceae	Th	SZ
<i>Tephrosia linearis</i> (Willd.) Pers.	Fabaceae	Ch	SZ
<i>Tephrosia lupunifolia</i> DC.	Fabaceae	Ch	GC-SZ
<i>Tephrosia obcordata</i> (Lam.ex Poir.)	Fabaceae	Ch	SZ
<i>Tephrosia purpurea</i> (L.) Pers.ssp.	Fabaceae	Th	SZ
<i>Vigna subtereranea</i> ( Thouars (L.)) Verdec.	Fabaceae	Th	GC-SZ
<i>Vigna unguiculata</i> (L.) Walp.	Fabaceae	Th	GC-SZ
<i>Zornia glochidiata</i> Reichb.ex Dc.	Fabaceae	Th	GC-SZ
<i>Leonotis africana</i> T.K. Morton	Lamiaceae	Th	GC-SZ
<i>Leucas martinicensis</i> (Jacq.) Ait.f.	Lamiaceae	Th	GC-SZ
<i>Dipcadi taccazeamum</i> (Hochst.ex.K. Rich.)	Liliaceae	G	SZ
<i>Gloriosa simplex</i> L.	Liliaceae	G	SZ
<i>Strychnos innocua</i> Del	Loganiaceae	Mp	GC-SZ
<i>Strychnos spinosa</i> Lam.	Loganiaceae	Mp	SZ
<i>Tapinanthus dodoneifolius</i> (DC.) Danser	Loranthaceae	Mp	SZ
<i>Hibiscus asper</i> Hook.F.	Malvaceae	Th	GC-SZ
<i>Hibiscus cannabinus</i> L.	Malvaceae	Th	
<i>Hibiscus sabdarifa</i> L.	Malvaceae	Th	
<i>Pagonia hirsuta</i> Guill. Et Pers.	Malvaceae	Np	SZ
<i>Sida alba</i> L.	Malvaceae	Ch	GC-SZ
<i>Sida cordifolia</i> L.	Malvaceae	Th	GC-SZ
<i>Sida rhombifolia</i> L.	Malvaceae	Ch	GC-SZ
<i>Urena lobata</i> L.	Malvaceae	Th	SZ
<i>Wissadula amplissima</i> (L.)	Malvaceae	Mp	GC-SZ
<i>Azadirachta indica</i> A.Juss.	Meliaceae	Mp	i
<i>Khaya senegalensis</i> (Desr.) A. Juss.	Meliaceae	mP	SZ
<i>Acacia ataxacantha</i> Dc.	Mimosaceae	Mp	SZ
<i>Acacia holosericea</i> A.Cunn.ex G.Don	Mimosaceae	Mp	i
<i>Acacia nilotica</i> (L.) Willd. Ex Del.subsp. <i>nilotica</i>	Mimosaceae	Mp	SZ
<i>Acacia polyacantha</i> Subsp. <i>Campylacantha</i>	Mimosaceae	Mp	SZ
<i>Acacia senegal</i> (L.) Willd.	Mimosaceae	Mp	SZ
<i>Acacia seyal</i> Del.	Mimosaceae	Mp	SZ
<i>Acacia sieberiana</i> DC.	Mimosaceae	Mp	SZ
<i>Acacia tortilis</i> Subsp. <i>raddiana</i>	Mimosaceae	Mp	Sah.S
<i>Albizia chevalieri</i> Harms.	Mimosaceae	Mp	SZ
<i>Albizia lebeck</i> (L.) Benth.	Mimosaceae	Mp	i
<i>Dichrostachys cinerea</i> (L.) Wight et Arn.	Mimosaceae	Np	GC-SZ

Species	Families	Life forms	Chorotypes
<i>Entada Africana</i> Guill. & Perr.	Mimosaceae	Mp	SZ
<i>Faidherbia albida</i> Del.	Mimosaceae	Mp	SZ-Sah.S
<i>Parkia biglobosa</i> (Jacq.) Benth	Mimosaceae	Mp	SZ
<i>Prosopis africana</i> (Guill. Et Perr.) Taub.	Mimosaceae	Mp	SZ
<i>Prosopis juliflora</i> (SW) DC.	Mimosaceae	Mp	i
<i>Mollugo cerviana</i> (L.) Seringe	Molluginaceae	Th	SZ-Sah.S- Med
<i>Mollugo nudicaulis</i> Lam.	Molluginaceae	Th	GC-SZ
<i>Ficus dekdekena</i> (Mig.) Steud. Ex. A. Rich.	Moraceae	mP	GC-SZ
<i>Ficus platyphylla</i> Del...	Moraceae	Mp	SZ
<i>Boerhavia repens</i> L.	Nyctaginaceae	Th	SZ-Sah.S
<i>Nymphaea lotus</i> L.	Nymphaeaceae	Hy	
<i>Nymphaea micrantha</i> Guill. Et Pers.	Nymphaeaceae	Hy	
<i>Ximenia americana</i> L.	Olacaceae	Mp	SZ-Sah.S
<i>Ceratotheca sesamoides</i> Endl.	Pedaliaceae	Th	SZ
<i>Martinia annua</i> L.	Pedaliaceae	Th	
<i>Sesamum alatum</i> Thon.	Pedaliaceae	Th	SZ
<i>Sesamum indicum</i> L.	Pedaliaceae	Th	
<i>Andropogon gayanus</i> Kunth. Var. <i>gayanus</i>	Poaceae	H	SZ
<i>Anthephora nigriflora</i> Stapf. et Hubb.	Poaceae	H	SZ
<i>Aristida adscensionis</i> L.	Poaceae	Th	SZ
<i>Aristida mutabilis</i> Trin et Rupr.	Poaceae	Th	SZ
<i>Aristida sieberiana</i> Trin.	Poaceae	H	SZ
<i>Aristida stipoides</i> Lam.	Poaceae	Th	SZ
<i>Brachiaria ramosa</i> (L.) Stapf.	Poaceae	Th	SZ
<i>Brachiaria xantholeuca</i> (Hack. ex. Schinz) Stapf	Poaceae	Th	SZ
<i>Cenchrus biflorus</i> Roxb.	Poaceae	Th	SZ-Sah.S
<i>Cenchrus ciliaris</i> L.	Poaceae	Th	SZ-Sah.S- Med
<i>Chloris pilosa</i> Schumach	Poaceae	Th	GC-SZ
<i>Chloris prieurii</i> Kunth.	Poaceae	Th	SZ
<i>Ctenium elegans</i> Kunth	Poaceae	Th	SZ
<i>Cymbopogon schoenanthus</i> (L.) Spreng.	Poaceae	H	SZ
<i>Cynodon dactylon</i> (L.) Pers	Poaceae	G	GC-SZ
<i>Dactyloctenium aegyptium</i> (L.) P. Beauv.	Poaceae	Th	GC-SZ
<i>Digitaria argillacea</i> Hitch. et Chase) Fern.	Poaceae	Th	SZ
<i>Digitaria gayana</i> Kunth (A.) Chev.	Poaceae	Th	SZ
<i>Digitaria horizontalis</i> Willd.	Poaceae	Th	GC-SZ
<i>Dinebra retroflexa</i> (Vahl.) Panzer	Poaceae	Th	SZ
<i>Echinochloa colona</i> (L.) Link	Poaceae	Hy	SZ
<i>Echinochloa stagnina</i> (Petz.) P. Beauv.	Poaceae	Hy	SZ
<i>Eleusine indica</i> (L.) Gaertn.	Poaceae	Th	SZ
<i>Elionurus elegans</i> Kunth	Poaceae	Th	GC-SZ
<i>Eragrostis atrovirens</i> (Desf.) Steud.	Poaceae	Hy	SZ
<i>Eragrostis ciliaris</i> (L.) R. Br.	Poaceae	Th	GC-SZ
<i>Eragrostis tenella</i> (L.) Roem. & Schult.	Poaceae	Th	GC-SZ
<i>Eragrostis tremula</i> Steud.	Poaceae	Th	SZ
<i>Eragrostis turgida</i> (Schumach.) De Wild.	Poaceae	Th	SZ
<i>Heckelochloa granularis</i> (L.) Kuntze	Poaceae	Th	SZ
<i>Microchloa indica</i> (L. f.) P. Beauv.	Poaceae	Th	SZ
<i>Oryza barthii</i> A. Chev.	Poaceae	Hy	SZ
<i>Panicum anabaptistum</i> Steud.	Poaceae	Ch	SZ
<i>Panicum laetum</i> Kunth	Poaceae	Th	SZ
<i>Panicum nigerense</i> Hitchc.	Poaceae	Th	SZ
<i>Panicum subalbidum</i> Kunth.	Poaceae	Hy	SZ
<i>Panicum turgidum</i> Forsk.	Poaceae	Ch	SZ-Sah.S
<i>Pennisetum pedicellatum</i> Trin.	Poaceae	Th	SZ
<i>Pennisetum thypoides</i> (Burm.) Stapf & C.	Poaceae	Th	SZ
<i>Schizachyrium exile</i> (Hochst.) Pilger	Poaceae	Th	SZ
<i>Schoenefeldia gracilis</i> Kunth	Poaceae	Th	SZ
<i>Sorghum bicolor</i> (L.) Moench	Poaceae	Th	SZ
<i>Sporobolus festivus</i> Hochst. ex A. Rich.	Poaceae	Th	SZ
<i>Tripogon minimus</i> (A. Rich.) Steud.	Poaceae	Th	
<i>Zea mays</i> L.	Poaceae	Th	

Species	Families	Life forms	Chorotypes
<i>Polygala arenaria</i> Willd.	Polygalaceae	Th	GC-SZ
<i>Portulaca grandiflora</i> Hook.	Portulacaceae	Th	
<i>Portulaca oleracea</i> L.	Portulacaceae	Th	
<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	Mp	GC-SZ
<i>Ziziphus spina-christi</i> (L.) Desf.	Rhamnaceae	Mp	Pal
<i>Borreria radiata</i> DC.	Rubiaceae	Th	SZ
<i>Borreria scabra</i> (Schum. Et Thonn.) K. Schum.	Rubiaceae	Th	SZ
<i>Borreria stachydea</i> (DC.) Hutch. Et Dalz.	Rubiaceae	Th	SZ
<i>Feretia apodanthera</i> Del.	Rubiaceae	Mp	SZ
<i>Gardenia erubescens</i> Stapf et Hutch.	Rubiaceae	Mp	S
<i>Kohautia senegalensis</i> Chamsso and Schelchtendal	Rubiaceae	Th	
<i>Mitracarpus villosus</i> (Swartz) de Candolle	Rubiaceae	Th	GC-Sah.S
<i>Vitellaria paradoxa</i> Gaertn.f.	Sapotaceae	Mp	SZ
<i>Striga asiatica</i> (L.) Kuntze.	Scrofulariaceae	Th	SZ
<i>Striga gesnerioides</i> (Willd.) Valke	Scrofulariaceae	Th	SZ
<i>Striga hermonthea</i> (Del.) Benth.	Scrofulariaceae	Th	SZ
<i>Datura innoxia</i> Mill	Solanaceae	Np	SZ
<i>Solanum incanum</i> L.	Solanaceae	Np	SZ
<i>Waltheria indica</i> L.	Sterculiaceae	Np	GC-SZ
<i>Corchorus fascicularis</i> Lam.	Tiliaceae	Th	SZ
<i>Corchorus olitorius</i> L.	Tiliaceae	Th	SZ
<i>Corchorus tridens</i> L.	Tiliaceae	Th	SZ
<i>Grewia bicolor</i> Juss.	Tiliaceae	Mp	SZ
<i>Grewia cissoides</i> Hutch.&Dalz	Tiliaceae	Mp	S
<i>Grewia villosa</i> Willd.	Tiliaceae	Np	SZ
<i>Tribulus terrestris</i> L.	Tribulaceae	Th	GC-SZ
<i>Vitex simplicifolia</i> Oliv.	Verbenaceae	Mp	GC-SZ
<i>Triumpheta pentandra</i> A.Rich.	Zygophyllaceae	Th	SZ

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