



# Systematic Composition, Life Forms and Chorology of Parklands of Commune of Mayahi, Niger West Africa

## ABSTRACT

Botanical assessment plays an important role in managing and conserving phytodiversity. This study tried to determine the systematic composition, life forms, and chorology of parklands in the commune of Mayahi in Niger. **The parklands constitute the major vegetation type in the commune of Mayahi. It consists of agricultural landscapes and pastoral zones with the scattered woody species.** We used quadrat method based on sampling approach to inventory vegetation within the parklands in September and October 2013. The size of the plots was 50mx50m along the transect. The floristical analysis revealed that 230 species and 139 genera distributed in 48 families were recorded. This showed that the parklands are floristically diverse in biodiversity. But the most represented are Poaceae (16.02%), **Leguminosae** (12.12%), Caesalpiniaceae (6.06%) and Mimosaceae (5.63%). This showed that the legume species are numerically the important species of the parklands of the commune of Mayahi. The Shannon Weaver Diversity Index (H') calculated based on 56 plots was 2.82 bits. Further, the analysis of life forms revealed that therophyte (57.82%) and phanerophyte (29%) are the dominant life form in the parklands of the commune of Mayahi. Therefore, the phytoclimate of the commune of Mayahi is therophanerophytic. Furthermore, the dominance of therophyte explains the adjustment of the flora to water balance of the area. Added to that, the predominance of the phanerophyte is an indicator of the presence woody species and the good level of management of the parklands of the farmers. Moreover, the chorological analysis showed that there were predominance Sudano-Zambezians species (SZ), 53.70% and Guineo-Congolese-Sudano-Zambezians (GC-SZ) 31.02% in the flora of the parklands. The present study recommends further research that touches the impact of anthropogenic activities on the dynamics of the parklands in the commune of Mayahi.

**Keywords:** Systematic composition; life form; Chorology; Parklands; Mayahi

## 1. Introduction

Niger is a Sahelian landlocked country which is one of the largest in West African covering an area of 1,267,000km<sup>2</sup>. But the three fourths of the country are desert. Niger population was estimated at 17.7million people and growing at 3.9% (INS,2011). About 80% of the Nigeriens live in the rural milieu(INS). Niger is characterized by four climatic zones which are Sahel and Sudan zone, Sahel and Sahara zone, Sahara zone and Sahel zone resulting in high biodiversity within the country.

Parklands constitute the dominant vegetation type in Niger. It consists of agricultural landscape and grazing areas with the scattered woody species. Parklands play a major role in the socio-economic life of rural people in Niger. For instance, the parklands are of the main sources of energy in Niger rural areas (Mahamane,1997, Dan Guimbo et al., 2010; Laouali et al., 2014; Massaoudou & Larwanou ,2015). Added to that, the parklands provide to the rural the Nigeriens timber, products of traditional medicine, raw material, animal fodder, foods such as fruits and leaves (Mahamane,1997, Dan Guimbo et al., 2010; Laouali et al., 2014; Moussa & Larwanou ,2015; Soulé et al,2016). In addition, the parklands play also in major role in fighting wind and

soil erosion. However, the parklands in Niger are under pressure due to human activities and climatic factors (Larwanou, 2005; Dan Guimbo, 2011; Katakoré, 2011). For instance, Larwanou (2005) stated that many species were lost and others are threatened.

Studying the floristic composition of parklands is of paramount importance. As the parklands in Niger are under pressure due to unsustainable land use practices such as the use of fire, inappropriate use of fertilizers, illegal logging. Added to that a lot of botanical studies have been carried concerning the floristic composition of parklands in Mayahi department. But majority of them concerned only the woody floristic composition of parklands in Mayahi department (Massaoudou & Larwanou 2015; Massaoudou et al., 2016). Further no one of them deal combined floristic composition (herbaceous and woody). Furthermore, the life form, chorology of parklands of commune of Mayahi are not known. This study aims at determining the systematic composition, life form, chorology of parklands of commune of Mayahi. Further, it aims at providing comprehensive contribution to the flora of parklands of commune of Mayahi. This goes also to provide floristic information in order to promote sustainable management of parklands biodiversity. Systematic composition refers to the number of species, genera and botanical families found in given ecosystem. Systematic composition plays a crucial role in providing floristic information. It is crucial for the sustainable vegetation management. Life form is an expression of the phytoclimate of an area (Raunkiaer (1934). Life form is an important indicator of vegetation description (Khan et al., 2014). It describes the physiognomy of the vegetation. Life form expresses also the floristic diversity of life form of given vegetation (Saadou, 1990). While chorology is defined as geographical distribution of species.

## 2. Materials and Methods

### 2.1 Study area

The commune of Mayahi is situated in Maradi region of Niger republic. The commune of Mayahi has an estimated population of 94,160 inhabitants in 2011 (PDC, 2011). The commune has fifty-nine (59) administrative villages and tribes. The capital of the commune is Mayahi. Agriculture is the main economic activity of the population of the commune of Mayahi. *Pennisetum glaucum* (millet) and *Sorghum bicolor* (sorghum) are the main food crops for the people of commune of Mayahi. While *Vigna unguiculata* (cowpea); *Arachis hypogaea* (peanut); *Sesamum indicum* (sesame) and *Cyperus esculentus* constitute the cash crops. Livestock is the

second economic activity of the people of the commune of Mayahi. The population of the commune of Mayahi exploit various parklands services such as firewood, forage to livestock, food (fruits, leaves). They exploit the parklands for therapeutic purposes. The climate of the commune of Mayahi is the Sahelian type, characterized by a short rainy season usually three to four months from June to September. The total amount of rainfall received in 2015 was 380,9mm (Agricultural direction of Mayahi,2015). The vegetation type consists dominantly of parklands. It consists also of the forest of Goulki N'kaba. There are three types of soil in the commune of Mayahi: Compacted soils scattered throughout the urban commune area; Sandy soils occupying most of the commune and The sandy clay soils located in the River Valley Goulki N'kaba. They study sites were Mayahi urban commune, Digaba, Guidan Sani, Guidan Alou, Koren Habjia, Loda, Dan Amaria, Achalou, Kotaré, they were randomly selected.

## 2.2. Parklands inventory

The inventory of plant species took place in September which corresponds to the optimum period of vegetation development in Sahel (Saadou,1990). We used systematic sampling approach because of the homogeneity of the milieu. Plot method based on transect approach was used collect the parklands floristic data. The size of the plots was 50mX50m which corresponds to the minimal area of inventorying agroecosystems adopted by (Project SUN,2008). On each transect our plots were distant from 500 m in order to capture the heterogeneity of the milieu (Saadou and larwamou,2011). Pole and tape meter were used the delimitation of the plot size. The plots were shown in Fig1. Within each plot the herbaceous species were firstly recorded and secondly the woody species were recorded. The flora of Hutchinson, Adventrop (Bourgeois &Merlier,1995) and Michel Arbonnier (2009) book were used for the identification of the species. We used Cronquist system for the botanical classification. For the unknown species we produced the herbarium and submit to the Department of biology University Dan Dicko Dan Koulodo of Maradi for the specie identification. We took pictures of fruits, leaves and the entire plant of the unknown species for further identification. We used and applied the life form Raunkier's method used by (Saadou,1990) and Soulé et al.,2016. The method classifies the life form into five types: The method classifies the life form into five types:

- 1. Phanerophytes (Ph):** Woody plant that the renewal bud above 50cm 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 the parklands of the commune of Mayahi, the study used are those defined by (White, 1983) and Saadou (1990) 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 parklands 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.

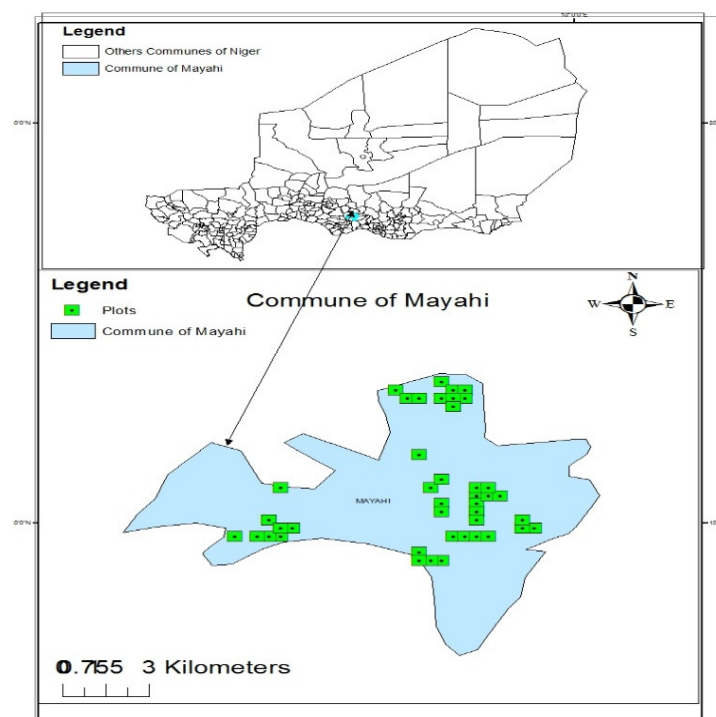


Fig1. Location of the study area

### 3. Results and Discussion

#### 3.1 Systematic composition

The floristic inventory of the parklands of the commune of Mayahi gave 230 species and 139 genera distributed in 48 families. This shows that the parklands of Mayahi are floristically diverse in phytodiversity. The most represented are Poaceae (16.02%), Fabaceae (12.12%), Caesalpiniaceae (6.06%) and Mimosaceae (5.63%). But in general the flora of the parklands of the commune of Mayahi is essentially composed of legume species. For these two most important families in this study (Poaceae and Fabaceae), similar results were found by authors such as Boulweydou (2008), Morou (2010). This study shows that families of Poaceae and Fabaceae are the best represented in the parklands of the commune of Mayahi. Our floristic findings confirm the finding found by Soulé et al.,2016 who revealed that Poaceae and Fabaceae were most represented in the parklands of Aguié department. Furthermore, the predominance of Poaceae and Fabaceae agrees with the results found by Khalik et al.,2013 in Saudi Arabia. The Shannon Diversity Index ( $H'$ ) calculated based 56 plots was low with 2.82 bits. But this index was greater than (2,55 bits) what was found by Soulé et al.,2016 in the parklands of Aguié

145 department in Maradi region. During our botanical survey *Pterocarpus erinaceus* was not  
 146 recorded at all. The people of the commune of Mayahi during our discussion with them affirm  
 147 that *Pterocarpus erinaceus* has disappeared from their terroirs.



148 **Table 1. Systematic composition**



| Families        | Genera | %     | Species | %     |
|-----------------|--------|-------|---------|-------|
| Poaceae         | 21     | 15.11 | 37      | 16.09 |
| Fabaceae        | 12     | 8.63  | 28      | 12.17 |
| Caesalpiniaceae | 6      | 4.32  | 14      | 6.09  |
| Mimosaceae      | 5      | 3.60  | 12      | 5.22  |
| Convolvulaceae  | 3      | 2.16  | 9       | 3.91  |
| Euphorbiaceae   | 4      | 2.88  | 9       | 3.91  |
| Amaranthaceae   | 6      | 4.32  | 8       | 3.48  |
| Asteraceae      | 7      | 5.04  | 8       | 3.48  |
| Cyperaceae      | 4      | 2.88  | 8       | 3.48  |
| Malvaceae       | 4      | 2.88  | 8       | 3.48  |
| Cucurbitaceae   | 5      | 3.60  | 7       | 3.04  |
| Capparaceae     | 4      | 2.88  | 6       | 2.61  |
| Rubiaceae       | 4      | 2.88  | 6       | 2.61  |
| Asclepiadaceae  | 4      | 2.88  | 5       | 2.17  |
| Combretaceae    | 3      | 2.16  | 5       | 2.17  |
| Tiliaceae       | 3      | 2.16  | 5       | 2.17  |
| Acanthaceae     | 4      | 2.88  | 4       | 1.74  |
| Aizoaceae       | 3      | 2.16  | 4       | 1.74  |
| Pedaliaceae     | 3      | 2.16  | 4       | 1.74  |
| Caryophyllaceae | 1      | 0.72  | 3       | 1.30  |
| Lamiaceae       | 2      | 1.44  | 2       | 0.87  |
| Anacardiaceae   | 2      | 1.44  | 2       | 0.87  |
| Areaceae        | 2      | 1.44  | 2       | 0.87  |
| Burseraceae     | 1      | 0.72  | 2       | 0.87  |
| Commelinaceae   | 1      | 0.72  | 2       | 0.87  |
| Meliaceae       | 2      | 1.44  | 2       | 0.87  |
| Molluginaceae   | 1      | 0.72  | 2       | 0.87  |
| Moraceae        | 1      | 0.72  | 2       | 0.87  |
| Portulacaceae   | 1      | 0.72  | 2       | 0.87  |
| Rhamnaceae      | 1      | 0.72  | 2       | 0.87  |
| Scrofulariaceae | 1      | 0.72  | 2       | 0.87  |
| Solanaceae      | 2      | 1.44  | 2       | 0.87  |
| Amarillidaceae  | 1      | 0.72  | 1       | 0.43  |
| Annonaceae      | 1      | 0.72  | 1       | 0.43  |

|                |            |               |            |               |
|----------------|------------|---------------|------------|---------------|
| Apocinaceae    | 1          | 0.72          | 1          | 0.43          |
| Balanitaceae   | 1          | 0.72          | 1          | 0.43          |
| Bignoniaceae   | 1          | 0.72          | 1          | 0.43          |
| Bombacaceae    | 1          | 0.72          | 1          | 0.43          |
| Bombaceae      | 1          | 0.72          | 1          | 0.43          |
| Boraginaceae   | 1          | 0.72          | 1          | 0.43          |
| Liliaceae      | 1          | 0.72          | 1          | 0.43          |
| Loganiaceae    | 1          | 0.72          | 1          | 0.43          |
| Loranthaceae   | 1          | 0.72          | 1          | 0.43          |
| Nyctaginaceae  | 1          | 0.72          | 1          | 0.43          |
| Polygalaceae   | 1          | 0.72          | 1          | 0.43          |
| Sterculiaceae  | 1          | 0.72          | 1          | 0.43          |
| Tribulaceae    | 1          | 0.72          | 1          | 0.43          |
| Zygophyllaceae | 1          | 0.72          | 1          | 0.43          |
| <b>Total</b>   | <b>139</b> | <b>100.00</b> | <b>230</b> | <b>100.00</b> |

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### 3.2 Life Form

151 The overall analysis of the biological spectrum of the flora inventoried of the commune of Mayahi shows  
152 a dominance of therophytes (57.82%) followed by phanerophytes (29%).The predominance of  
153 therophytes indicates that the flora of the commune of Mayahi is composed highly with species annual. It  
154 indicates also the adjustment of the flora to water balance. The predominance of phanerophytes expresses  
155 that the flora is secondly dominated with woody plants (shrub and trees). It also shows the level of woody  
156 flora management by the farmers such as trees ownship, the use of woody species as green fertilizers and  
157 assisted natural regeneration. The phytoclimate of the commune of Mayahi is therophanerophytic. In  
158 addition, Chamephytes present the third life form of the flora. This indicates also the adjustment of the  
159 flora to water balance. Other life forms are less represented in the table 2. Our results, the predominance of  
160 therophyte and phanerophyte are similar to the findings of Reddy et al.,2011 and Soulé et al.,2016 who  
161 found respectively that the phytoclimate of their study areas was therophanerophytic.

162 **Table 2. Biological spectrum**

| Life form     | Th    | Ph | Ch   | Hy   | H    | G    | L    | Total |
|---------------|-------|----|------|------|------|------|------|-------|
| Number        | 133   | 67 | 16   | 4    | 3    | 5    | 2    | 230   |
| Percentage(%) | 57.82 | 29 | 6.92 | 1.73 | 1.29 | 2.16 | 0.86 | 100   |



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### 3.3 Chorology



165 There is a predominance of species Sudano-Zambezians(SZ),53.70% followed by species  
 166 Guineo-Congolese-Sudano-Zambezians (GC-SZ) 31.02% and species Sudano-Zambezians –  
 167 Saharo-Sindians (SZ-Sah.S) 7.87%. Such distribution shows that the study area is humid. This  
 168 agrees with the findings found by Saadou (1990) in the North sudanian zone in Southern west of  
 169 Niger. The introduced species present the third chorotype of the flora. This expresses the level of  
 170 human activity in terms of parklands management within the parklands of the commune. Other  
 171 phytogeographical types are less represented in the table 3.

172 **Table 3. Phytogeographical spectrum**

| Chorotypes    | GC-Sah.S | GC-SZ | I    | GC-Sah.S | SZ    | SZ-Sah.S | S    | Sah.S | SZ-Sah.S-Med | Total  |
|---------------|----------|-------|------|----------|-------|----------|------|-------|--------------|--------|
| Number        | 1        | 67    | 8    | 1        | 116   | 17       | 1    | 1     | 4            | 216    |
| Percentage(%) | 0.46     | 31.02 | 3.70 | 0.46     | 53.70 | 7.87     | 0.46 | 0.46  | 1.85         | 100.00 |

173  
 174 **Conclusion**  
 175 The parklands of the commune of Mayahi are floristically diverse in biodiversity. The systematic  
 176 composition of the parklands of the commune is rich in species, genera and botanical families.  
 177 But Poaceae and Fabaceae are the best represented botanical families in the parklands of the  
 178 commune of Mayahi. The flora of the parklands of the commune of Mayahi is dominated by  
 179 legume species. Besides that, the life forms are diverse but the therophyte and phanerophyte are  
 180 the dominant. Their predominance makes the phytoclimate of Mayahi therophanerophytic. In  
 181 addition, the Sudano-Zambezians and Guineo-Congolese-Sudano-Zambezians present the  
 182 dominant chorotypes of the parklands of the commune of Mayahi. The study recommends  
 183 further study that will examine the impact of anthropogenic activities on the dynamics of the  
 184 parklands of the commune of Mayahi.

185 **List of recorded species**

| Species                                                             | Families    | Life form | Chorotypes |
|---------------------------------------------------------------------|-------------|-----------|------------|
| <i>Leucas martinicensis</i> (Jacq.) Ait.f.                          | Lamiaceae   | Th        | GC-SZ      |
| <i>Leonotis africana</i> T.K. Morton                                | Lamiaceae   | Th        | GC-SZ      |
| <i>Peristrophe bicalyculata</i> (Retz) Nees<br>Ruellia Patula Jacq. | Acanthaceae | Th        | SZ         |
| <i>Monechma ciliatum</i> (Jacq.) Milne-Redhead                      | Acanthaceae | Th        | GC-SZ      |
| <i>Blepharis maderaspatansis</i> (L.) Heyne ex Roth.                | Acanthaceae | Th        | GC-SZ      |

|                                                    |                |    |          |
|----------------------------------------------------|----------------|----|----------|
| <i>Achyranthes aspera</i> L.                       | Acanthaceae    | Th | GC-Sz    |
| <i>Trianthema portulacastrum</i> L.                | Aizoaceae      | Th | SZ       |
| <i>Limeum viscosum</i> ( Gay.) Hermerl.            | Aizoaceae      | Th | SZ-Sah.S |
| <i>Limeum pterocarpum</i> (Gay.)<br>Heimerl.       | Aizoaceae      | Th | SZ       |
| <i>Gisekia pharnaceoides</i> L.                    | Aizoaceae      | Th | SZ       |
| <i>Pupalia lappacea</i> (L.) Juss.                 | Amaranthaceae  | Th | GC-SZ    |
| <i>Pandiaka involucrata</i> (Moq .)<br>Hook.f.     | Amaranthaceae  | Th | GC-SZ    |
| <i>Celosia trigina</i> L.                          | Amaranthaceae  | Th | GC-SZ    |
| <i>Amaranthus viridis</i> L.                       | Amaranthaceae  | Th | GC-SZ    |
| <i>Amaranthus spinosus</i> L.                      | Amaranthaceae  | Th | GC-SZ    |
| <i>Amaranthus graecizans</i> L.                    | Amaranthaceae  | Th | GC-SZ    |
| <i>Alternanthera sessilis</i> Dc.                  | Amaranthaceae  | Th | GC-SZ    |
| <i>Aerva javanica</i> (Bura.f.)<br>Juss.ex.Schult. | Amaranthaceae  | np | SZ-Sah.S |
| <i>Crinum ornatum</i> (Ait.) Bury.                 | Amarillidaceae | G  | Pan      |
| <i>Sclerocarya birrea</i> (A. Rich.)<br>Hochst.    | Anacardiaceae  | mP | S        |
| <i>Lannea microcarpa</i> Engl. Et K.<br>Krause     | Anacardiaceae  | mp | GC-SZ    |
| <i>Annona senegalensis</i> Pers.                   | Annonaceae     | np | SZ       |
| <i>Caralluma dalzielii</i> N.E. Br                 | Apocinaceae    | Ch | SZ       |
| <i>Hyphaene thebaica</i> (L.) Mart.                | Arecaceae      | mp | SZ       |
| <i>Borassus aetiopum</i> Mart.                     | Arecaceae      | mP | GC-SZ    |
| <i>Pergularia tomentosa</i> (L.) Mant.             | Asclepiadaceae | np | SZ-Sah.S |
| <i>Leptadenia pyrotechnica</i> (Forsk.)<br>Decne   | Asclepiadaceae | np | SZ       |
| <i>Leptadenia hastata</i> (Pers.) Decne            | Asclepiadaceae | mp | SZ       |
| <i>Glossonema boveanum</i> Decne.                  | Asclepiadaceae | Ch | SZ-Sah.S |
| <i>Calotropis procera</i> (Ait.) R. Br.            | Asclepiadaceae | mp | Sah.S    |
| <i>Vernonia perrottetii</i> Schb. Bip.             | Asteraceae     | Th | SZ       |
| <i>Vernonia pauciflora</i> (Willd.).Less.          | Asteraceae     | Th | SZ       |
| <i>Dicoma tomentosa</i> Cass.                      | Asteraceae     | Th | SZ       |
| <i>Centaurea perrottetii</i> Dc.                   | Asteraceae     | np | SZ       |
| <i>Blainvillea gayana</i> Cass.                    | Asteraceae     | Th | SZ       |
| <i>Bidens pilosa</i> L.                            | Asteraceae     | Th | GC-SZ    |
| <i>Aspilia kotschy</i> (Sch.Bip.).oliv             | Asteraceae     | Th | SZ       |
| <i>Acanthospermum hispidum</i> Dc                  | Asteraceae     | Th | GC-SZ    |
| <i>Balanites aegyptiaca</i> (L.) Del.              | Balanitaceae   | mp | SZ-Sah.S |
| <i>Stereospermum kynthianum</i> Cham.              | Bignoniaceae   | mp | SZ       |

|                                                      |                 |    |          |
|------------------------------------------------------|-----------------|----|----------|
| <i>Adansonia digitata</i> L.                         | Bombacaceae     | mP | SZ       |
| <i>Bombax costatum</i> Pellegr.                      | Bombaceae       | mP | SZ       |
| <i>Heliotropium strigosum</i> Willd.                 | Boraginaceae    | Ch | SZ-Sah.S |
| <i>Commiphora pedunculata</i> (Kotschy. Peyr.) Engl. | Burseraceae     | mp | A        |
| <i>Commiphora africana</i> (A. Rich.) Engl.          | Burseraceae     | mp | SZ       |
| <i>Tamarindus indica</i> L.                          | Caesalpiniaceae | Th | SZ       |
| <i>Piliostigma reticulatum</i> (Dc.) Hochst          | Caesalpiniaceae | mp | SZ-Sah.S |
| <i>Parkinsonia aculeata</i> L.                       | Caesalpiniaceae | mp | i        |
| <i>Delonix regia</i> (Hook.) Raf.                    | Caesalpiniaceae | mp | i        |
| <i>Cassia singueana</i> Del.                         | Caesalpiniaceae | mp | SZ       |
| <i>Cassia sieberiana</i> DC.                         | Caesalpiniaceae | mp | GC-SZ    |
| <i>Cassia siamea</i> L.                              | Caesalpiniaceae | mp | i        |
| <i>Cassia occidentalis</i> L.                        | Caesalpiniaceae | np | GC-SZ    |
| <i>Cassia obtusifolia</i> L.                         | Caesalpiniaceae | Th | GC-SZ    |
| <i>Cassia nigricans</i> Vahl.                        | Caesalpiniaceae | Th | SZ       |
| <i>Cassia mimosoides</i> L.                          | Caesalpiniaceae | Th | GC-SZ    |
| <i>Cassia italica</i> (Mill.) Lam. Ex Fw.Andr        | Caesalpiniaceae | Ch | SZ       |
| <i>Cassia absus</i> L.                               | Caesalpiniaceae | Th | GC-SZ    |
| <i>Bauhinia rufescens</i> Lam.                       | Caesalpiniaceae | mp | SZ       |
| <i>Maerua crassifolia</i> Forsk.                     | Capparaceae     | mp | SZ-Sah.S |
| <i>Maerua angolensis</i> Forsk.                      | Capparaceae     | mp | SZ       |
| <i>Gynandropsis gynandra</i> (L.) Briq               | Capparaceae     | Th | GC-SZ    |
| <i>Cleome viscosa</i> L.                             | Capparaceae     | Th | GC-SZ    |
| <i>Cleome monophylla</i> L.                          | Capparaceae     | Th | SZ       |
| <i>Boscia senegalensis</i> (Pers.) Lam. Ex poir .    | Capparaceae     | mp | SZ       |
| <i>Polycarpaea linearifolia</i> (Dc) Dc.             | Caryophyllaceae | Th | SZ       |
| <i>Polycarpaea eryantha</i> Hochst ex A. Rich.       | Caryophyllaceae | Th | SZ       |
| <i>Polycarpaea corymbosa</i> (L.) Lam.               | Caryophyllaceae | Th | SZ       |
| <i>Terminalia avicennioides</i> Guill. et Pers.      | Combretaceae    | mp | SZ       |
| <i>Guiera senegalensis</i> J.F.Gmel.                 | Combretaceae    | mp | SZ       |
| <i>Combretum micranthum</i> G. Don                   | Combretaceae    | mp | SZ       |
| <i>Combretum glutinosum</i> Perr. ex Dc              | Combretaceae    | mp | SZ       |
| <i>Combretum aculeatum</i> Vent                      | Combretaceae    | mp | SZ       |
| <i>Commelina forskalaei</i> Vahl.                    | Commelinaceae   | Th | SZ       |
| <i>Commelina benghalensis</i> L.                     | Commelinaceae   | Th | GC-SZ    |

|                                                                     |                |     |              |
|---------------------------------------------------------------------|----------------|-----|--------------|
| <i>Jacquemontia tamnifolia</i> (L.) Griseb.                         | Convolvulaceae | Th  | GC-SZ        |
| <i>Ipomoea vagans</i> Bak.                                          | Convolvulaceae | Th  | SZ           |
| <i>Ipomoea pes-tigridis</i> L.                                      | Convolvulaceae | Th  | SZ           |
| <i>Ipomoea eriocarpa</i> R. Br.                                     | Convolvulaceae | Th  | SZ           |
| <i>Ipomoea dichroa</i> Hochst. Ex Choisy                            | Convolvulaceae | Th  | SZ           |
| <i>Ipomoea coscinosperma</i> Hechst. Ex Choisy                      | Convolvulaceae | Th  | SZ           |
| <i>Ipomoea coptica</i> (L.) Roth.                                   | Convolvulaceae | Th  | GC-SZ        |
| <i>Ipomoea asarifolia</i> ( Desr.) Roem. Et Schult                  | Convolvulaceae | Ch  | GC-SZ        |
| <i>Evolvulus alsinoides</i> (L.) L.                                 | Convolvulaceae | Th  | GC-SZ        |
| <i>Mukia maderaspatana</i> (L.) Roem.                               | Cucurbitaceae  | Th  | GC-SZ        |
| <i>Momordica balsamina</i> L.                                       | Cucurbitaceae  | Th  | SZ           |
| <i>Merremia tridentata</i> (L.) Hallier                             | Cucurbitaceae  | Th  | GC-SZ        |
| <i>Merremia pinnata</i> ( Hochst.) Hallier                          | Cucurbitaceae  | Th  | GC-SZ        |
| <i>Lagenaria seceraria</i> ( Molina) Standl.                        | Cucurbitaceae  | Lth | Pan          |
| <i>Citrillus lanatus</i> (Thunb.) Matsumara et Makai                | Cucurbitaceae  | Ch  | SZ           |
| <i>Citrillus colocinthis</i> (L.) Schrad.                           | Cucurbitaceae  | Ch  | SZ           |
| <i>Kyllinga squamulata</i> Thonn.ex Vahl.                           | Cyperaceae     | Th  | GC-Sz        |
| <i>Kyllinga pumila</i> Michaux                                      | Cyperaceae     | Th  | Ant          |
| <i>Fimbristylis hispidula</i> (Vahl.) Kunth.Subsp. <i>Hispidula</i> | Cyperaceae     | Th  | GC-SZ        |
| <i>Cyperus rotundus</i> L.                                          | Cyperaceae     | G   | GC-SZ        |
| <i>Cyperus iria</i> L.                                              | Cyperaceae     | Th  | Pan          |
| <i>Cyperus esculentus</i> L.                                        | Cyperaceae     | G   | Cos          |
| <i>Cyperus amabilis</i> Vahl.                                       | Cyperaceae     | Th  | GC-SZ        |
| <i>Bulbostylis barbata</i> (Rottb.) C.B. Cl.                        | Cyperaceae     | Th  | GC-SZ        |
| <i>Phyllanthus pentandrus</i> Schum. Et Thonn.                      | Euphorbiaceae  | Th  | SZ           |
| <i>Euphorbia poissonii</i> Pax                                      | Euphorbiaceae  | np  | SZ           |
| <i>Euphorbia hirta</i> L.                                           | Euphorbiaceae  | Ch  | GC-SZ        |
| <i>Euphorbia glomerifera</i> (Millsp.) L.C. Wheeler                 | Euphorbiaceae  | Th  |              |
| <i>Euphorbia forskalii</i> Gay                                      | Euphorbiaceae  | Th  | SZ-Sah.S-Med |
| <i>Euphorbia convolvuloides</i> Hochst. Ex. Benth.                  | Euphorbiaceae  | Ch  | SZ           |
| <i>Euphorbia balsamifera</i> Ait.                                   | Euphorbiaceae  | mp  | SZ-Sah.S-Med |
| <i>Chrozophora brocchiana</i> Vis                                   | Euphorbiaceae  | np  | SZ           |

|                                                       |               |     |          |
|-------------------------------------------------------|---------------|-----|----------|
| <i>Acalypha ciliata</i> Forsk.                        | Euphorbiaceae | Th  | GC-SZ    |
| <i>Zornia glochidiata</i> Reichb.ex Dc.               | Fabaceae      | Th  | GC-SZ    |
| <i>Voandzeia subterranea</i> ( Thouars (L.)) Verdec.  | Fabaceae      | Th  | SZ       |
| <i>Vigna unguiculata</i> (L.) Walp.                   | Fabaceae      | Th  | GC-SZ    |
| <i>Tephrosia purpurea</i> (L.) Pers.ssp. Leptostachya | Fabaceae      | Th  | GC-SZ    |
| <i>Tephrosia obcordata</i> (Lam.ex Poir.)             | Fabaceae      | Ch  | SZ       |
| <i>Tephrosia lupunifolia</i> DC.                      | Fabaceae      | Ch  | SZ       |
| <i>Tephrosia linearis</i> (Willd.) Pers.              | Fabaceae      | Ch  | SZ       |
| <i>Tephrosia bracteolata</i> Guill. Et Perr.          | Fabaceae      | Th  | SZ       |
| <i>Stylosanthes erecta</i> P.Beauv.                   | Fabaceae      | mp  | GC-SZ    |
| <i>Sesbania pachycarpa</i> Dc.                        | Fabaceae      | Th  | SZ       |
| <i>Indigofera tinctoria</i> L.                        | Fabaceae      | np  | GC-SZ    |
| <i>Indigofera stenophylla</i> Guill. Et Perr.         | Fabaceae      | Th  | SZ       |
| <i>Indigofera pilosa</i> Poir.                        | Fabaceae      | Th  | SZ       |
| <i>Indigofera nummulariifolia</i> (L.) Liv. ex Alston | Fabaceae      | Th  | SZ       |
| <i>Indigofera hirsuta</i> Var.hirsuta                 | Fabaceae      | Th  | SZ-Sah.S |
| <i>Indigofera diphylla</i> Vent.                      | Fabaceae      | Th  | SZ-Sah.S |
| <i>Indigofera dendroides</i> Jacq.                    | Fabaceae      | Th  | GC-SZ    |
| <i>Indigofera bracteolata</i> DC.                     | Fabaceae      | Th  | SZ       |
| <i>Indigofera berhautiana</i> Gillet                  | Fabaceae      | Th  | SZ       |
| <i>Indigofera astragalina</i> Dc.                     | Fabaceae      | Th  | SZ       |
| <i>Crotalaria senegalensis</i> (Pers.) Bak. Ex.DC.    | Fabaceae      | Th  | SZ-Sah.S |
| <i>Crotalaria retusa</i> L.                           | Fabaceae      | Th  | GC-SZ    |
| <i>Crotalaria goreensis</i> Guill. Et Perr.           | Fabaceae      | Th  | GC-SZ    |
| <i>Canavalia rosea</i> (L.) DC.                       | Fabaceae      | Lmp | i        |
| <i>Arachis hypogaea</i> L.                            | Fabaceae      | Th  | i        |
| <i>Alysicarpus ovalifolius</i> (Schum. Et Thonn.)     | Fabaceae      | Th  | GC-SZ    |
| <i>Aeschynomene indica</i> L.                         | Fabaceae      | Hy  | GC-SZ    |
| <i>Crotalaria podocarpa</i> DC.                       | Fabaceae      | Th  | SZ       |
| <i>Dipcadi tacazzeanum</i> (Hochst.ex.K. Rich.) Bak.  | Liliaceae     | G   | SZ       |
| <i>Strychnos spinosa</i>                              | Loganiaceae   | mp  | Pan      |
| <i>Tapinanthus dodoneifolus</i> (DC.) Danser          | Loranthaceae  | mp  | GC-SZ    |
| <i>Wissadula amplissima</i> (L.) R.E.                 | Malvaceae     | mp  | GC-SZ    |

|                                                                  |               |    |              |
|------------------------------------------------------------------|---------------|----|--------------|
| Fries Var rostrata (Schum. Et Thonn.) R .E. Fries                |               |    |              |
| <i>Sida rhombifolia</i> L.                                       | Malvaceae     | Ch | GC-SZ        |
| <i>Sida cordifolia</i> L.                                        | Malvaceae     | Th | GC-SZ        |
| <i>Sida alba</i> L.                                              | Malvaceae     | Ch | GC-SZ        |
| <i>Pavonia hirsuta</i> Guill. Et Pers.                           | Malvaceae     | np | SZ           |
| <i>Hibiscus sabdarifa</i> L.                                     | Malvaceae     | Th | Pan          |
| <i>Hibiscus cannabus</i> L.                                      | Malvaceae     | Th | Pan          |
| <i>Hibiscus asper</i> Hook.F.                                    | Malvaceae     | Th | GC-SZ        |
| <i>khaya senegalensis</i>                                        | Meliaceae     | mP | SZ           |
| <i>Azadirachta indica</i> A.Juss.                                | Meliaceae     | mp | i            |
| <i>Prosopis juliflora</i> (SW) DC.                               | Mimosaceae    | mp | i            |
| <i>Prosopis africana</i> (Guill. Et Perr.) Taub.                 | Mimosaceae    | mp | SZ           |
| <i>Faidherbia albida</i> Del.                                    | Mimosaceae    | mp | SZ-Sah.S     |
| <i>Dichrostachys cinerea</i> (L.) Wight et Arn.                  | Mimosaceae    | np | GC-SZ        |
| <i>Albizia lebbeck</i> (L.) Benth.                               | Mimosaceae    | mp | i            |
| <i>Albizia chevalieri</i> Harms.                                 | Mimosaceae    | mp | SZ           |
| <i>Acacia tortilis</i> Subsp. <i>raddiana</i>                    | Mimosaceae    | mp | SZ-Sah.S     |
| <i>Acacia sieberiana</i> DC.                                     | Mimosaceae    | mp | SZ           |
| <i>Acacia seyal</i> Del.                                         | Mimosaceae    | mp | SZ           |
| <i>Acacia senegal</i> (L.) Willd.                                | Mimosaceae    | mp | SZ           |
| <i>Acacia nilotica</i> (L.) Willd. Ex Del.Subsp. <i>nilotica</i> | Mimosaceae    | mp | SZ           |
| <i>Acacia ataxacantha</i> Dc.                                    | Mimosaceae    | mp | SZ           |
| <i>Mollugo nudicaulis</i> Lam.                                   | Molluginaceae | Th | GC-SZ        |
| <i>Mollugo cerviana</i> (L.) Seringe                             | Molluginaceae | Th | SZ-Sah.S-Med |
| <i>Ficus platyphylla</i> Del...                                  | Moraceae      | mp | SZ           |
| <i>Ficcus dekdekena</i> (Mig.) Steud. Ex. A. Rich.               | Moraceae      | mP | GC-SZ        |
| <i>Boerhavia repens</i> L.                                       | Nyctaginaceae | Th | SZ-Sah.S     |
| <i>Sesamum indicum</i> L.                                        | Pedaliaceae   | Th | SZ           |
| <i>Martinia annua</i> L.                                         | Pedaliaceae   | Th | Pan          |
| <i>Ceratotheca sesamoides</i> Endl.                              | Pedaliaceae   | Th | SZ           |
| <i>Sesamum alatum</i> Thon.                                      | Pedaliaceae   | Th | SZ           |
| <i>Zea mays</i> L.                                               | Poaceae       | Th | GC-SZ        |
| <i>Sorghum bicolor</i> (L.) Moench                               | Poaceae       | Th | SZ           |
| <i>Schoenefeldia gracilis</i> Kunth                              | Poaceae       | Th | SZ           |
| <i>Schizachyrium exile</i> (Hochst.) Pilger                      | Poaceae       | Th | SZ           |

|                                                         |         |    |              |
|---------------------------------------------------------|---------|----|--------------|
| <i>Pennisetum thypoides</i> (Burm.) Stapf & C. E. Hubb. | Poaceae | Th | SZ           |
| <i>Pennisetum pedicellatum</i> Trin.                    | Poaceae | Th | SZ           |
| <i>Panicum turgidum</i> Forsk.                          | Poaceae | Ch | SZ-Sah.S     |
| <i>Panicum subalbidum</i> Kunth.                        | Poaceae | Hy | SZ           |
| <i>Panicum nigerense</i> Hitchc.                        | Poaceae | Th | SZ           |
| <i>Panicum laetum</i> Kunth                             | Poaceae | Th | SZ           |
| <i>Panicum anabaptistum</i>                             | Poaceae | Ch | SZ           |
| <i>Microchloa indica</i> (L. f.) P. Beauv.              | Poaceae | Th | SZ           |
| <i>Eragrostis turgida</i> (Schumach.) De Wild.          | Poaceae | Th | SZ           |
| <i>Eragrostis tremula</i> Steud.                        | Poaceae | Th | SZ           |
| <i>Eragrostis tenella</i> (L.) Roem. & Schult.          | Poaceae | Th | GC-SZ        |
| <i>Eragrostis atrovirens</i> (Desf.) Steud.             | Poaceae | Hy | SZ           |
| <i>Eleusine indica</i> (L.) Gaertn.                     | Poaceae | Th | GC-SZ        |
| <i>Echinochloa colona</i> (L.) Link                     | Poaceae | Hy | SZ           |
| <i>Dinebra retroflexa</i> (Vahl.) Panzer                | Poaceae | Th | SZ           |
| <i>Digitaria horizontalis</i> Willd.                    | Poaceae | Th | GC-SZ        |
| <i>Digitaria gayana</i> Kunth (A.) Chev.                | Poaceae | Th | SZ           |
| <i>Digitaria argillacea</i> Hitch. et Chase) Fern.      | Poaceae | Th | SZ           |
| <i>Dactyloctenium aegyptium</i> (L.) P. Beauv.          | Poaceae | Th | GC-SZ        |
| <i>Cynodon dactylon</i> (L.) Pers                       | Poaceae | G  | GC-SZ        |
| <i>Ctenium elegans</i> Kunth                            | Poaceae | Th | SZ           |
| <i>Chloris prieurii</i> Kunth.                          | Poaceae | Th | SZ           |
| <i>Chloris pilosa</i> Schumach                          | Poaceae | Th | GC-SZ        |
| <i>Cenchrus ciliaris</i> L.                             | Poaceae | Th | SZ-Sah.S-Med |
| <i>Cenchrus biflorus</i> Roxb.                          | Poaceae | Th | SZ-Sah.S     |
| <i>Brachiaria xantholeuca</i> (Hack. ex. Schinz) Stapf  | Poaceae | Th | SZ           |
| <i>Brachiaria ramosa</i> (L.) Stapf.                    | Poaceae | Th | SZ           |
| <i>Aristida stipoides</i> Lam.                          | Poaceae | Th | SZ           |
| <i>Aristida siberiana</i> Trin.                         | Poaceae | H  | SZ           |
| <i>Aristida mutabilis</i> Trin et Rupr.                 | Poaceae | Th | SZ           |
| <i>Aristida adscencionis</i> L.                         | Poaceae | Th | SZ           |
| <i>Anthephora nigritana</i> Stapf. et Hubb.             | Poaceae | H  | SZ           |
| <i>Andropogon gayanus</i> Kunth. Var. gayanus           | Poaceae | H  | SZ           |

|                                                       |                 |    |          |
|-------------------------------------------------------|-----------------|----|----------|
| <i>Polygala arenaria</i> Willd.                       | Polygalaceae    | Th | GC-SZ    |
| <i>Portulaca oleracea</i> L.                          | Portulacaceae   | Th |          |
| <i>Portulaca grandiflora</i>                          | Portulacaceae   | Th |          |
| <i>Ziziphus spina-christi</i> (L.) Desf.              | Rhamnaceae      | mp | Pal      |
| <i>Ziziphus mauritiana</i> Lam.                       | Rhamnaceae      | mp | SZ-Sah.S |
| <i>Mitracarpus villosus</i> (Swartz) de Candolle      | Rubiaceae       | Th | GC-Sah.S |
| <i>Kohautia senegalensis</i> Chamsso et Schelchtendal | Rubiaceae       | Th |          |
| <i>Feretia apodantera</i>                             | Rubiaceae       | mp | SZ       |
| <i>Borreria stachydea</i> (DC.)Hutch. Et Dalz.        | Rubiaceae       | Th | SZ       |
| <i>Borreria scabra</i> (Schum. Et Thonn.) K. Schum.   | Rubiaceae       | Th | SZ       |
| <i>Borreria radiata</i> DC.                           | Rubiaceae       | Th | SZ       |
| <i>Striga hermontheca</i> ( Del.) Benth.              | Scrofulariaceae | Th | SZ       |
| <i>Striga gesnerioides</i> (Willd.) Valke             | Scrofulariaceae | Th | SZ       |
| <i>Solanum incanum</i> L.                             | Solanaceae      | np | SZ       |
| <i>Datura innoxia</i> Mill                            | Solanaceae      | np | SZ       |
| <i>Waltheria indica</i> L.                            | Sterculiacera   | np | GC-SZ    |
| <i>Grewia villosa</i> Willd.                          | Tiliaceae       | np | SZ       |
| <i>Grewia cissoides</i>                               | Tiliaceae       | mp | SZ       |
| <i>Corchorus tridens</i> L.                           | Tiliaceae       | Th | SZ       |
| <i>Corchorus olitorius</i> L.                         | Tiliaceae       | Th | SZ       |
| <i>Corchorus fascicularis</i> Lam.                    | Tiliaceae       | Th | SZ       |
| <i>Tribulus terrestris</i> L.                         | Tribulaceae     | Th | SZ       |
| <i>Triumpheta pentandra</i> A.Rich.                   | Zygophyllaceae  | Th | GC-SZ    |



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