VASCULAR PLANTS OF SURAJPUR WETLAND, NATIONAL CAPITAL REGION, INDIA

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ABSTRACT
The present attempt has been made for qualitative assessment of vascular plants of Surajpur wetland, National Capital Region, India conducted during March 2010 to February 2013 by intensive floristic surveys. A total of 257 vascular plants belonging 214 genera under 29 Orders and 65 families were documented. Poaceae and Fabaceae is the largest family represented by 32 species each followed by Asteraceae represented by 20 species. Herbs dominate the flora by 144 plant species followed by 39 trees, 31 grasses, 20 climbers, 12 shrubs and 11 species of sedges. The updated nomenclature, habit, habitat, nativity and threatened status have been provided for each species. Proper conservation and management plans are needed to save the natural resources, especially flora. The current status of floral diversity in Surajpur wetland ecosystem hitherto unreported is being attempted in the paper.

Keywords: Surajpur Wetland, Floristic Diversity, Greater Noida, Uttar Pradesh

INTRODUCTION
Vegetation forms an integral part of wildlife habitat in any landscape and hence the analysis of the diverse communities becomes a pre-requisite for better ecological understanding for preparing management plan of the conservation of the area (Singh and Rawat, 1999). Wetland ecosystem creates an important environment for aquatic, semi-aquatic and moisture loving floral and faunal associations (Adhikari and Babu, 2008). Wetlands are referred as “biological supermarkets” because they support all life forms through extensive food webs and biodiversity (Mitsch and Gosselink, 1993). Surajpur wetland is an excellent example of urban wetland in Yamuna river basin (Bura et al., 2013). Being an urban wetland, it provides an opportunity to conserve and preserve the native flora, fauna and biodiversity without hindering the development of the area.

Through the ages, urban wetlands have been the lifeline of most cities in India. They provide multiple values for suburban and city dwellers (Castelle et al., 1994). The capacity of a functional urban wetland in flood control, aquatic life support and as pollution sink implies a greater degree of protection (Ramachandran, 2001). The wetlands have been explored on various bio-ecological aspects but the studies on urban wetlands are at a nascent stage. Anecdotal references exist on studies attempted to investigate urban wetlands and the growing need for their conservation in India (Ehrenfeld, 2000; Rajashekariah, 2011; Urfi, 2006). Srivastava (2004) presented an overview of floristic diversity of Uttar Pradesh and observed 2711 angiosperm plant under 182 families and 1088 genera.

The floristic composition of the National Capital Region has so far received little attention (Maheshwari, 1963; Dash and Ahmedullah, 2012; Srivastava, 2004; Verdhana, 2007; Chaudhary et al., 2012; Manral et al., 2013; Mishra et al., 2014) and there is no systematic study was conducted in Surajpur wetland, although it supports luxuriant growth of angiospermic flora and plays an important role in the plant species conservation. The present study is, therefore, the first attempt to make an inventory and analysis of the entire flora of Surajpur wetland based on copious field observations and available literatures with a view to contribute to the overall knowledge of Surajpur flora and to the management of this urban wetland.
MATERIALS AND METHODS

Study Area
Surajpur wetland (28°31.425′N; 77°29.714′E) is located in Dadri Tehsil of the district Gautam Budh Nagar, north-west Indian state of Uttar Pradesh and it comes under the purview of Delhi- National Capital Region (NCR) India (Figure 1). The NCR comprises an urban conglomerate including Delhi, Faridabad, Gurgaon, Ghaziabad and Gautam Budh Nagar (Noida and Greater Noida). The Greater Noida City is just 3 kilometers from Surajpur wetland is one of the best planned cities and is the largest industrial townships of Asia (Joshi, 2009). The study area falls in the Upper Gangetic Plain Biogeographic Zone (Rodgers et al., 2002) at an elevation of 184.7m above MSL. The area is a reserve forest and spreads over 308 hectare (Bura et al., 2013). The area is mainly rain-fed and other sources for water recharge are Hawaliya drain which is attached to Hindon River and Tilapta irrigation canal. The climate is tropical monsoon type and maximum rainfall occurs from July to October ranging from 400-500 mm and normally the rain depends on north-west monsoon. The maximum temperature goes up to 47°C in summer (April-May) whereas the minimum falls to 2°C in winter (December-January).

Methods
Intensive floristic surveys were made during the period of three years from March 2010 to February 2013 on monthly basis in the Surajpur wetland. The entire study area was divided into 3 different habitats; woodland, grassland and wetland on the basis of dominant floristic composition. Field visits were planned to collect the plant specimen either in flowering or fruiting stage to facilitate the process of correct identification (Pal et al., 2014). Voucher specimen numbers for each collection were assigned and important field characters habit, habitat, flowering, fruiting period, etc. were recorded and processed using standard herbarium techniques from all the habitats to prepare a comprehensive herbarium following Jain and Rao (1977) and Singh and Subramaniam (2008). The plant specimens were identified based on field characters noted during the collection and consulting different floras and literatures, (Duthie, 1903-29); (Maheshwari, 1963); (Raiizada, 1976); (Singh and Shetty, 1987, 1991, 1993); (Moulik, 1997); (Prasad et al., 1996); (Kehimkar, 2000); (Vardhana, 2007). The unidentified plant specimens were identified seeking help of experts in plant taxonomy. The voucher specimens collected for herbarium were submitted at Kumaun University, Nainital Uttarakhand, India for future reference. Based on modern Angiosperm Phylogeny study, APG-III classification system (APG III 2009; Haston et al., 2009) was followed to classify the Angiosperm species and Pteridophytes were classified following Christenhusz et al., (2011). Taxonomical categories-genera and species within the family are treated alphabetically (Tutul et al., 2009) and species are described with usual citation, verified with International Plant Names Index (IPNI, 2013) and The Plant List (2013). The frequency of occurrence of plant species was assigned into 4 abundance categories; A= Abundant (>50); F= Frequent (30-50); O= Occasional (10-30) and R= Rare (<10). The threatened categories of plant species were assessed according to IUCN Red List Criteria 2012 (IUCN 2013). The nativity of the plants was determined with the help of published literature following Reddy (2008), Singh et al., (2010) and Rather (2011).

RESULTS AND DISCUSSION
The floristic composition of the area is remarkable in its diversity and luxuriance. Altogether, 257 vascular plant taxa pertaining to 214 genera belonging to 29 orders and 65 families were recorded (Table 1). The Angiosperm plants represented by 254 species belonged to 28 orders, 62 families and 211 genera whereas Pteridophytes were represented by 3 species belonged to 2 orders, 3 families and 3 genera. The most represented orders in terms of families were Lamiiales (9 families) followed by Caryophyllales (5 families), Malpighiales, Rosales, Myrtales, (4 families each order), Alismatales, Ranunculales, Brassicales, Gentianales (3 families), Commelinales, Poales, Sapindales, Solanales, Asterales, Salviniales (2 families) and rest 15 orders were represented by only a single family each. Whereas the most represented orders in terms of species were Poales (43 species) followed by Fabales (32 species), Caryophyllales (23 species), Lamiiales (22 species), Asterales (21 species), Solanales (20 species), Malpighiales, Malvales, Gentianales (12 species each), Myrtales (10 species), Alismatales (7 species),
Rosaceae (6 species), Ranunculales, Cucurbitales, Sapindales (5 species each), Brassicales (4 species), Commelinidae (3 species), Nymphaeales (2 species), Salviniales (2 species) and rest 11 orders were represented by only a single species each (i.e. mono-specific). Among 65 families recorded, the most dominant families were Poaceae (32 species) followed by Fabaceae (32 species), Asteraceae (20 species), Amaranthaceae (14 species), Convolvulaceae (13 species), Malvaceae (12 species), Cyperaceae (11 species), Apocynaceae (9 species), Euphorbiaceae (7 species), Solanaceae (7 species), Cucurbitaceae (5 species), Lamiales (5 species), Myrtaceae, Meliaceae, Acanthaceae and Verbenaceae (4 species each) being the richest families, covering over 71% of the total species. During the study period, a comprehensive herbarium of 267 plant specimens including 229 plant species was prepared and arranged family-wise alphabetically from Acanthaceae to Zygophyllaceae, indexed in 09 display files and was deposited at Department of Forestry and Environmental Science, Kumaun University, Nainital, Uttarakhand, India for future use.

The analysis of flora shows a comparatively higher representation of herbaceous species (144) followed by 39 trees, 31 grasses, 20 climbers, 12 shrubs and 11 species of sedges during the study period. The occurrence status of plant species recorded as Abundant by 51 % (n=130 plant species), followed by Frequent 19 % (n=50 plant species), Occasional as 16 % (n=42 plant species) and Rare as 14 % (n=35 plant species) of the total recorded plant species. The nativity of the each plant species were recorded, 193 plant species as native and 59 plant species as exotic/invasive in nature to the Indian sub-continent. The inventory of the plant species includes 216 wild plant species and 41 cultivated plant species. Habitat association of each plant species was recorded. Woodland habitat recorded maximum of 157 plant species followed by 73 plant species in grassland habitat and 65 plant species in wetland habitat. The flowering and fruiting period of the plant species recorded for the all seasons. Monsoon recorded maximum plant species (177 plant species), followed by summer (87 plant species) and winters (74 plant species) in flowering and fruiting period. Based on IUCN Red List criteria of threatened species, 02 plant species viz. Delonix regia and Jacaranda mimosifolia rated as vulnerable (VU), 46 species as least concern (LC), only one species as data deficient (DD) and 208 plant species were marked under not evaluated (NE) category. However, none of the 257 plant species have been listed under the Indian Wildlife (Protection) Act (1972).

Mace (2004) feels that, the inventorying of species in a region is one of the very important conservation practices, which helps in setting priority based species cataloguing for conservation. Biodiversity inventories or checklists serve as repositories of baseline information on species occurrences, biogeography and their conservation status. They are essential tools for developing our knowledge and understanding of biodiversity and often the first step to undertake effective conservation action (Nayar and Krishna, 2013). This is the first scientific study in Surajpur wetland forms the basis of research for the long term planning and management of the area. This study also forms the first record of vascular plants for the district Gautam Budh Nagar. With the aim of inventorisation, the overview of floristic biodiversity of Surajpur wetland was recorded.

Surajpur wetland revealed a total of 257 vascular plants that represents about 47% of the total NCR flora (Maheshwari, 1963) and 10% of the total Uttar Pradesh flora (Srivastav, 2004) respectively. High diversity of vascular plants in the region is mainly attributed to climatic, topographic and edaphic factors. Similar floristic studies were also conducted in Indian region, Manral et al., (2013) reported 192 plant species in Okhla Bird Sanctuary in Noida, NCR; Chaudhary et al., (2012) reported 95 species only from Poaceae and Cyperaceae family in Noida, NCR, Mishra and Narayan (2010) reported 129 plant species in Bakhira wetland Uttar Pradesh; Adhikari and Babu (2008) reported 178 plant species in Baanganaga wetland, Uttarakhand.

The species Heliotropium europaeum belong to Boraginaceae placed in Lamiid group, because the most developed Angiosperm Phylology Classification (APG III, 2009) have not assigned family Boraginaceae to any of the order. Family Poaceae, Fabaceae, Asteraceae, recorded as the most dominant family in Surajpur wetland. Several authors have also reported these families as dominant families (Manral et al., 2013; Islam et al., 2009; Mishra and Narayan, 2010; Mulchand, 2013).
Surajpur wetland represented by 40 invasive plant species as these plants are widely recognised as one of the most important threats to native plant biodiversity (Kolar and Lodge, 2001). Invasive species have caused major problems for many ecosystems. These plants grow aggressively and cause changes in the habitat (Manral et al., 2013; Janick, 1979). Excessive growth of herbaceous weeds such as *Alternanthera philoxeroides* and *Eichhornea crassipes* are issues of concern in wetland habitat and *Parthenium hysterophorus* in woodland and grassland habitat. These weeds become a growing menace in India (Varshney et al., 2008). Preliminary studies reveal that over the years, the flora of National Capital Region (NCR) has undergone a tremendous change, with loss of earlier recorded native floral elements (Maheshwari, 1963, 1966) due to rapid urban growth and associated human activities and replenishment of the flora by way of latter-day introductions and migrations, particularly of invasive weeds (Dash and Ahmedulla, 2012). The geo-morphological changes from the developmental activities have modified the landscape thereby affecting the ecology of entire region. The present-day flora of NCR thus comprises a mixed composition of the indigenous with the introduced and naturalized plants (Dash and Ahmedulla, 2012).

Surajpur wetland has a mosaic of habitats that is responsible for a rich avifauna and other biodiversity. The mosaic of habitat types within a wetland help colonise a wide range of specialist and generalist species (Masing et al., 2000). The record of 6 species of mammals, 186 species of avifauna, 13 species of herpetofauna, 15 species of fishes and 58 species of invertebrates from Surajpur wetland ecosystem corroborates the fact. There is a need to monitor these habitats for long-term protection and conservation of various groups of flora and fauna in the area. The present findings can be used as a baseline for future studies and a comparison with previous works suggests that steps should be taken to curtail the growth of invasive species and plantation of native species should be encouraged. Appropriate measures need to be taken to check the growth of invasive species. The diverse floral composition and the better management practices have made the site a safe haven for particularly water birds in the region. Since the hydrological regime is a major environmental factor controlling the vegetation composition of the site, the maintenance of natural flooding regimes is a vital component for the conservation and management of the diverse vegetation mosaic at Surajpur.

Figure 1: Map of the Study Area
Table 1: List of Vascular Plant Species in Surajpur Wetland, National Capital Region, India

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Order, Family and Species</th>
<th>Habit</th>
<th>Habitat</th>
<th>Flowering &amp; Fruiting</th>
<th>Abundance Status</th>
<th>IUCN Status</th>
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</thead>
<tbody>
<tr>
<td>1.</td>
<td>Nymphaeaceae</td>
<td></td>
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<td>3.</td>
<td>Araceae</td>
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<td>6.</td>
<td>Hydrocharitaceae</td>
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<tr>
<td>6.</td>
<td>Hydrilla verticillata (L.f.) Royle</td>
<td>Herb</td>
<td>WT</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>LC</td>
</tr>
<tr>
<td>7.</td>
<td>Vallisneria spiralis L.</td>
<td>Herb</td>
<td>WT</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>LC</td>
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<tr>
<td>8.</td>
<td>Potamogetonaceae</td>
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<td>8.</td>
<td>Potamogeton crispus L.</td>
<td>Herb</td>
<td>WT</td>
<td>Nov-Feb</td>
<td>Abun</td>
<td>LC</td>
</tr>
<tr>
<td>9.</td>
<td>Zannichellia palustris L.</td>
<td>Herb</td>
<td>WT</td>
<td>Jul-Feb</td>
<td>Abun</td>
<td>LC</td>
</tr>
<tr>
<td>10.</td>
<td>Amaryllidaceae</td>
<td></td>
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<tr>
<td>10.</td>
<td>Zephyranthes candida (Lindl.) Lindl.</td>
<td>Herb</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Freq</td>
<td>NE</td>
</tr>
<tr>
<td>11.</td>
<td>Areceae</td>
<td></td>
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<td>12.</td>
<td>Commelinaceae</td>
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<tr>
<td>13.</td>
<td>Cyanotis axillaris (L.) D.Don ex Sweet</td>
<td>Herb</td>
<td>WT</td>
<td>Jul-Oct</td>
<td>Freq</td>
<td>LC</td>
</tr>
<tr>
<td>14.</td>
<td>Pontederiaceae</td>
<td></td>
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<tr>
<td>15.</td>
<td>Cyperaceae</td>
<td></td>
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</tr>
<tr>
<td>15.</td>
<td>Bolboschoenus maritimus (L.) Palla</td>
<td>Sedge</td>
<td>WT, GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>16.</td>
<td>Carex fedia Nees</td>
<td>Sedge</td>
<td>GR</td>
<td>Nov-Jun</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>17.</td>
<td>Cyperus alopecuroideus Rottb.</td>
<td>Sedge</td>
<td>WT, GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>18.</td>
<td>Cyperus alulatus J.Kern</td>
<td>Sedge</td>
<td>WT, GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>LC</td>
</tr>
<tr>
<td>19.</td>
<td>Cyperus compressus L.</td>
<td>Sedge</td>
<td>WT, GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>20.</td>
<td>*Cyperus difformis L.</td>
<td>Sedge</td>
<td>WT, GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>LC</td>
</tr>
<tr>
<td>21.</td>
<td>Cyperus laevigatus L.</td>
<td>Sedge</td>
<td>WT, GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>22.</td>
<td>Cyperus rotundus L.</td>
<td>Sedge</td>
<td>WT, GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>LC</td>
</tr>
<tr>
<td>23.</td>
<td>Eleocharis dulcis (Burm.f.) Trin. ex Hensch.</td>
<td>Sedge</td>
<td>WT</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td></td>
<td>Plant Name</td>
<td>Family</td>
<td>Type</td>
<td>Growth Period</td>
<td>Frequency</td>
<td>Location</td>
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<td>25.</td>
<td><em>Pycreus flavidus</em> (Retz.) T.Koyama</td>
<td>Sedge</td>
<td>WT, GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>26.</td>
<td>†<em>Avena sativa</em> L.</td>
<td>Grass</td>
<td>GR</td>
<td>Nov-Feb</td>
<td>Occa</td>
<td>NE</td>
</tr>
<tr>
<td>27.</td>
<td><em>Brachiaria ramosa</em> (L.) Stapf</td>
<td>Grass</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>LC</td>
</tr>
<tr>
<td>28.</td>
<td><em>Cenchrus ciliaris</em> L.</td>
<td>Grass</td>
<td>GR</td>
<td>Throughou t the year</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>29.</td>
<td><em>Chloris barbata</em> Sw.</td>
<td>Grass</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>30.</td>
<td><em>Chrysopogon zizanioides</em> (L.) Roberty</td>
<td>Grass</td>
<td>WT, GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td>31.</td>
<td><em>Cynodon dactylon</em> (L.) Pers.</td>
<td>Grass</td>
<td>GR</td>
<td>Jul-Feb</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>33.</td>
<td><em>Desmostachya bipinnata</em> (L.) Stapf</td>
<td>Grass</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>34.</td>
<td><em>Dichanthium annulatum</em> (Forssk.) Stapf</td>
<td>Grass</td>
<td>WT, GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td>35.</td>
<td><em>Digitaria ciliaris</em> (Retz.) Koeler</td>
<td>Grass</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td>41.</td>
<td><em>Hemarthria compressa</em> (L.f.) R.Br.</td>
<td>Grass</td>
<td>WT, GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>LC</td>
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<tr>
<td>42.</td>
<td><em>Hygroryza aristata</em> (Retz.) Nees ex Wight &amp; Arn.</td>
<td>Grass</td>
<td>WT</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td>43.</td>
<td><em>Imperata cylindrica</em> (L.) Raesusch.</td>
<td>Grass</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<td>44.</td>
<td><em>Leptochloa panicea</em> (Retz.) Ohwi</td>
<td>Grass</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>LC</td>
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<tr>
<td>46.</td>
<td><em>Paspalum distichum</em> L.</td>
<td>Grass</td>
<td>WT, GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<td>47.</td>
<td><em>Pennisetum glaucum</em> (L.) R.Br.</td>
<td>Grass</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>48.</td>
<td><em>Perotis indica</em> (L.) Kuntze</td>
<td>Grass</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td>49.</td>
<td><em>Phalaris minor</em> Retz.</td>
<td>Grass</td>
<td>GR</td>
<td>Nov-Feb</td>
<td>Abun</td>
<td>NE</td>
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<td>50.</td>
<td><em>Polypogon monspeliensis</em> (L.) Desf.</td>
<td>Grass</td>
<td>GR</td>
<td>Nov-Jun</td>
<td>Freq</td>
<td>NE</td>
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<td>51.</td>
<td><em>Saccharum ravennae</em> (L.) L.</td>
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<td>GR</td>
<td>Jul-Feb</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>52.</td>
<td><em>Saccharum spontaneum</em> L.</td>
<td>Grass</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>LC</td>
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<tr>
<td>55.</td>
<td><em>Sorghum halepense</em> (L.) Pers.</td>
<td>Grass</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Freq</td>
<td>NE</td>
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<tr>
<td>57.</td>
<td><em>Typha domingensis</em> Pers.</td>
<td>Herb</td>
<td>WT</td>
<td>Throughout the year</td>
<td>Abun</td>
<td>NE</td>
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</tbody>
</table>

**CERATOPHYLLALES**

**Ceratophyllaceae**

<table>
<thead>
<tr>
<th></th>
<th>Plant Name</th>
<th>Type</th>
<th>Growth Period</th>
<th>Frequency</th>
<th>Location</th>
</tr>
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<tr>
<td>58.</td>
<td><em>Ceratophyllum demersum</em> L.</td>
<td>Herb</td>
<td>WT</td>
<td>Jul-Oct</td>
<td>Abun</td>
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### RANUNCULALES

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<th>Family</th>
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<th>Season 1</th>
<th>Season 2</th>
<th>Frequency</th>
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<td>Cocculus hirsutus (L.) W.Theob.</td>
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<td>*Argemone mexicana L.</td>
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<td>Papaveraceae</td>
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<td>Ranunculaceae</td>
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<td>Proteaceae</td>
<td>†Grevillea robusta A.Cunn. ex R.Br.</td>
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<td>*Oxalis corniculata L.</td>
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<td>†<em>Luffa cylindrica</em> (L.) M.Roem.</td>
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<td>83.</td>
<td><em>Mukia maderaspatana</em> (L.) M.Roem.</td>
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<td><em>Trichosanthes cucumerina</em> L.</td>
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#### Fabaceae

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<td><em>Clitoria ternatea</em> L.</td>
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<td>†<em>Delonix regia</em> (Hook.) Raf.</td>
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<td><em>Melilotus indicus</em> (L.) All.</td>
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<td><em>Melilotus officinalis</em> subsp. <em>alba</em> (Medik.) H.Ohashi &amp; Tateishi</td>
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<td>†<em>Pongamia pinnata</em> (L.) Pierre</td>
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<td><em>Teramnus labialis</em> (L.f.) Spreng.</td>
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<td><em>Senna obtusifolia</em> (L.) H.S.Irwin &amp; Barneby</td>
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<td>125. †<em>Lagerstroemia speciosa</em> (L.) Pers.</td>
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<td>126. †<em>Lawsonia inermis</em> L.</td>
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<td>128. †<em>Eucalyptus globulus</em> Labill.</td>
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<td>130. <em>Syzygium cumini</em> (L.) Skeels</td>
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<td>136. <em>Cleome viscosa</em> L.</td>
<td>Herb</td>
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<th>MALVALES</th>
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<tr>
<td><strong>Malvaceae</strong></td>
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<tr>
<td>137. <em>Abutilon indicum</em> (L.) Sweet</td>
<td>Herb</td>
</tr>
<tr>
<td>138. <em>Corchorus capsularis</em> L.</td>
<td>Herb</td>
</tr>
<tr>
<td>139. <em>Corchorus trilocularis</em> L.</td>
<td>Herb</td>
</tr>
<tr>
<td>140. <em>Malva parviflora</em> L.</td>
<td>Herb</td>
</tr>
<tr>
<td>141. <em>Malvastrum coromandelianum</em> (L.) Garcke</td>
<td>Herb</td>
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<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Type</th>
<th>Season</th>
<th>Abundance</th>
<th>Distribution</th>
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</thead>
<tbody>
<tr>
<td><em>Melochia corchorifolia</em> L.</td>
<td>Herb</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td><em>Sida acuta</em> Burm.f.</td>
<td>Herb</td>
<td>Jul-Oct</td>
<td>Abun</td>
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<tr>
<td><em>Sida cordata</em> (Burm.f.) Borss.Waalk.</td>
<td>Herb</td>
<td>Jul-Oct</td>
<td>Abun</td>
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<tr>
<td><em>Sida cordifolia</em> L.</td>
<td>Herb</td>
<td>Jul-Oct</td>
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<tr>
<td><em>Sida rhombifolia</em> L.</td>
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<tr>
<td><em>Triumfetta rhomboidea</em> Jacq.</td>
<td>Herb</td>
<td>Jul-Oct</td>
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<tr>
<td><em>Urena lobata</em> L.</td>
<td>Herb</td>
<td>Jul-Oct</td>
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**SAPINDEALES**

**Anacardiaceae**

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<th>Type</th>
<th>Season</th>
<th>Abundance</th>
<th>Distribution</th>
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</thead>
<tbody>
<tr>
<td>†Mangifera indica L.</td>
<td>Tree</td>
<td>Mar-Jun</td>
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**Meliaceae**

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<thead>
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<th>Season</th>
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<th>Distribution</th>
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</thead>
<tbody>
<tr>
<td>†Azadirachta indica A.Juss.</td>
<td>Tree</td>
<td>Mar-Jun</td>
<td>Occa</td>
<td>NE</td>
</tr>
<tr>
<td>†Chukrasia tabularis A.Juss.</td>
<td>Shrub</td>
<td>Mar-Oct</td>
<td>Occa</td>
<td>LC</td>
</tr>
<tr>
<td>†Melia azedarach L.</td>
<td>Tree</td>
<td>Mar-Oct</td>
<td>Occa</td>
<td>NE</td>
</tr>
<tr>
<td>†Toona ciliata M.Roem.</td>
<td>Tree</td>
<td>Mar-Oct</td>
<td>Occa</td>
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**CARYOPHYLLALES**

**Aizoaceae**

<table>
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<tr>
<th>Plant Name</th>
<th>Type</th>
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<th>Abundance</th>
<th>Distribution</th>
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</thead>
<tbody>
<tr>
<td>Trianthema portulacastrum L.</td>
<td>Herb</td>
<td>Jul-Oct</td>
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**Amaranthaceae**

<table>
<thead>
<tr>
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<th>Type</th>
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</thead>
<tbody>
<tr>
<td>Achyranthes aspera L.</td>
<td>Herb</td>
<td>Throughout</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td><em>Alternanthera philoxeroides</em> (Mart.) Griseb.</td>
<td>Herb</td>
<td>WT</td>
<td>Mar-Jun</td>
<td>Abun</td>
</tr>
<tr>
<td><em>Alternanthera pungens</em> Kunt</td>
<td>Herb</td>
<td>Jul-Oct</td>
<td>Rare</td>
<td>NE</td>
</tr>
<tr>
<td><em>Alternanthera sessilis</em> (L.) R.Br. ex DC.</td>
<td>Herb</td>
<td>Jul-Oct</td>
<td>Freq</td>
<td>LC</td>
</tr>
<tr>
<td><em>Amaranthus spinosus</em> L.</td>
<td>Herb</td>
<td>Jul-Oct</td>
<td>Freq</td>
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<tr>
<td>Amaranthus viridis L.</td>
<td>Herb</td>
<td>Jul-Oct</td>
<td>Freq</td>
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<tr>
<td><em>Celosia argentea</em> L.</td>
<td>Herb</td>
<td>Jul-Oct</td>
<td>Occa</td>
<td>NE</td>
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<tr>
<td><em>Digera maricata</em> (L.) Mart.</td>
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<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td><em>Gomphrena serrata</em> L.</td>
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<td>Throughout</td>
<td>Freq</td>
<td>NE</td>
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<tr>
<td>Pupalia lappacea (L.) Juss.</td>
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<td>Jul-Oct</td>
<td>Occa</td>
<td>NE</td>
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<tr>
<td>Suaeda vermiculata Forssk. ex J.F.Gmel.</td>
<td>Herb</td>
<td>Nov-Feb</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td><em>Chenopodium album</em> L.</td>
<td>Herb</td>
<td>Jul-Feb</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td>Chenopodium murale L.</td>
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<td>Nov-Feb</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td>Dysphania ambrosioides (L.) Mosyakin &amp; Clemants</td>
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<td>Mar-Oct</td>
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**Caryophyllaceae**

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<th>Abundance</th>
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</thead>
<tbody>
<tr>
<td>Polycarpaea corymbosa (L.) Lam.</td>
<td>Herb</td>
<td>Jul-Oct</td>
<td>Rare</td>
<td>NE</td>
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<tr>
<td>Spergula arvensis L.</td>
<td>Herb</td>
<td>Nov-Feb</td>
<td>Occa</td>
<td>NE</td>
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<tr>
<td>Stellaria media (L.) Vill.</td>
<td>Herb</td>
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Research Article

**Nyctaginaceae**

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<th>Distribution</th>
<th>Season</th>
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<th>Notes</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Boerhavia diffusa L.</td>
<td>Herb</td>
<td>throughout the year</td>
<td>Rare</td>
<td>NE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>† Bougainvillea spectabilis Willd.</td>
<td>Shrub</td>
<td>WD, GR</td>
<td>Nov-Feb</td>
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**Polygonaceae**

<table>
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<tr>
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<th>Abundance</th>
<th>Notes</th>
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<tbody>
<tr>
<td></td>
<td>Persicaria barbata (L.) H.Hara</td>
<td>Herb</td>
<td>WT</td>
<td>Throughout the year</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td></td>
<td>Polygonum plebeium R.Br.</td>
<td>Herb</td>
<td>WT</td>
<td>Throughout the year</td>
<td>Abun</td>
<td>LC</td>
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<tr>
<td></td>
<td>Rumex dentatus L.</td>
<td>Herb</td>
<td>WT</td>
<td>Nov-Jun</td>
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**ERICALES**

**Primulaceae**

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<th>Abundance</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td></td>
<td><em>Anagallis arvensis</em> L.</td>
<td>Herb</td>
<td>WT, GR</td>
<td>Nov-Jun</td>
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**LAMIIDS GROUP**

**Boraginaceae**

<table>
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<th>Type</th>
<th>Distribution</th>
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<th>Abundance</th>
<th>Notes</th>
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<tbody>
<tr>
<td></td>
<td>Heliotropium europaeum L.</td>
<td>Herb</td>
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**GENTIANALES**

**Apocynaceae**

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<th>Abundance</th>
<th>Notes</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>† Alstonia scholaris (L.) R. Br.</td>
<td>Tree</td>
<td>WD</td>
<td>Nov-Feb</td>
<td>Occa</td>
<td>LC</td>
</tr>
<tr>
<td></td>
<td>† Carissa carandas L.</td>
<td>Shrub</td>
<td>WD</td>
<td>Jul-Feb</td>
<td>Occa</td>
<td>NE</td>
</tr>
<tr>
<td></td>
<td>† Cascabela thevetia (L.) Lippold</td>
<td>Tree</td>
<td>WD</td>
<td>Jul-Feb</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td></td>
<td>* Catharanthus roseus (Murray) G.Don</td>
<td>Herb</td>
<td>WD</td>
<td>Jul-Oct</td>
<td>Freq</td>
<td>NE</td>
</tr>
<tr>
<td></td>
<td>† Nerium oleander L.</td>
<td>Tree</td>
<td>WD</td>
<td>Mar-Jun</td>
<td>Abun</td>
<td>NE</td>
</tr>
<tr>
<td></td>
<td>† Plumeria alba L.</td>
<td>Tree</td>
<td>WD</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td></td>
<td>† Tabernaemontana divaricata (L.) R.Br. ex Roem. &amp; Schult.</td>
<td>Shrub</td>
<td>WD</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td></td>
<td>* Calotropis procera (Aiton) D.Don</td>
<td>Herb</td>
<td>WD</td>
<td>Mar-Jun</td>
<td>Abun</td>
<td>NE</td>
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<td></td>
<td>Oxystelma esculentum (L. f.) Sm.</td>
<td>Climber</td>
<td>WD</td>
<td>Jul-Oct</td>
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**Gentianaceae**

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<td>Centaurium pulchellum (Sw.) Druce</td>
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**Rubiaceae**

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<tbody>
<tr>
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<td>Oldenlandia corymbosa L.</td>
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<td>WT, GR</td>
<td>Jul-Oct</td>
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<td></td>
<td>Spermacoce pusilla Wall.</td>
<td>Herb</td>
<td>WT</td>
<td>Jul-Oct</td>
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**LAMIALES**

**Acanthaceae**

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<th>Abundance</th>
<th>Notes</th>
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<tr>
<td></td>
<td>* Dicliptera paniculata* (Forssk.) I.Darbysh.</td>
<td>Herb</td>
<td>WD</td>
<td>Nov-Feb</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td></td>
<td>Hemigraphis hirta (Vahl) T. Anders.</td>
<td>Herb</td>
<td>WD, GR</td>
<td>Mar-Jun</td>
<td>Freq</td>
<td>NE</td>
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<td></td>
<td>Justicia japonica Thunb.</td>
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<td>Rungia pectinata (L.) Nees</td>
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<td>Nov-Feb</td>
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**Bignoniaceae**

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<th>Abundance</th>
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<tbody>
<tr>
<td></td>
<td>† Jacaranda mimosifolia D.Don</td>
<td>Tree</td>
<td>WD</td>
<td>Mar-Jun</td>
<td>Occa</td>
<td>VU</td>
</tr>
<tr>
<td></td>
<td>† Kigelia africana (Lam.) Benth</td>
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<td>Occa</td>
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<tr>
<td>197</td>
<td>†Tecoma stans (L.) Juss. ex Kunth</td>
<td>Shrub</td>
<td>WD</td>
<td>Jul-Feb</td>
<td>Freq</td>
<td>NE</td>
</tr>
<tr>
<td>198</td>
<td>†Volkamera inermis L.</td>
<td>Herb</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td>199</td>
<td>Anisomeles indica (L.) Kuntze</td>
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<td>Jul-Oct</td>
<td>Abun</td>
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<tr>
<td>200</td>
<td>Leucas cephalotes (Roth) Spreng.</td>
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<td>Ocimum americanum L.</td>
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<td>WD</td>
<td>Jul-Oct</td>
<td>Occa</td>
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<tr>
<td>202</td>
<td>Salvia plebeia R.Br.</td>
<td>Herb</td>
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<td>Nov-Feb</td>
<td>Rare</td>
<td>NE</td>
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<tr>
<td>203</td>
<td>†Tecoma stans (L.) Juss. ex Kunth</td>
<td>Herb</td>
<td>WT</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td>204</td>
<td>Sesamum indicum L.</td>
<td>Herb</td>
<td>GR</td>
<td>Jul-Oct</td>
<td>Rare</td>
<td>NE</td>
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<tr>
<td>205</td>
<td>Mazus pumilus (Burm.f.) Steenis</td>
<td>Herb</td>
<td>GR</td>
<td>Nov-Feb</td>
<td>Rare</td>
<td>NE</td>
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<tr>
<td>206</td>
<td>Bacopa monnieri (L.) Wettst.</td>
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<td>WT, WD</td>
<td>Jul-Oct</td>
<td>Rare</td>
<td>LC</td>
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<tr>
<td>207</td>
<td>Veronica anagallis-aquatica L.</td>
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<td>WT</td>
<td>Nov-Jun</td>
<td>Abun</td>
<td>NE</td>
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<td>208</td>
<td>Verbascum chinense (L.) Santapau</td>
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<td>WD</td>
<td>Mar-Oct</td>
<td>Occa</td>
<td>NE</td>
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<td>209</td>
<td>*Duranta erecta L.</td>
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<td>Throughout the year</td>
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<td>NE</td>
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<tr>
<td>210</td>
<td>*Lantana camara L.</td>
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<td>WD</td>
<td>Jul-Oct</td>
<td>Occa</td>
<td>NE</td>
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<td>211</td>
<td>Phyla nodiflora (L.) Greene</td>
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<td>Mar-Oct</td>
<td>Freq</td>
<td>LC</td>
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<tr>
<td>212</td>
<td>†Verbena bipinnatifida Nutt.</td>
<td>Herb</td>
<td>GR</td>
<td>Nov-Feb</td>
<td>Occa</td>
<td>NE</td>
</tr>
<tr>
<td>220</td>
<td>*Ipomoea eriocarpa R. Br.</td>
<td>Climber</td>
<td>WD</td>
<td>Jul-Oct</td>
<td>Freq</td>
<td>NE</td>
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<td>221</td>
<td>Ipomoea nil (L.) Roth</td>
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<td>Jul-Oct</td>
<td>Freq</td>
<td>NE</td>
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<td>222</td>
<td>*Ipomoea pes-tigridis L.</td>
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<td>WT</td>
<td>Jul-Oct</td>
<td>Freq</td>
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<td>Ipomoea purpurea (L.) Roth</td>
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<td>Nov-Feb</td>
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<td>NE</td>
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<tr>
<td>224</td>
<td>Ipomoea violacea L.</td>
<td>Climber</td>
<td>WD</td>
<td>Nov-Feb</td>
<td>Freq</td>
<td>NE</td>
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<tr>
<td>225</td>
<td>*Merremia hederacea (Burm. f.) Hallier f.</td>
<td>Climber</td>
<td>WT</td>
<td>Jul-Oct</td>
<td>Freq</td>
<td>NE</td>
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</tbody>
</table>

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## Research Article

### Solanaceae

<table>
<thead>
<tr>
<th>No.</th>
<th>Species</th>
<th>Type</th>
<th>WD</th>
<th>Season</th>
<th>Habitat</th>
<th>Prop.</th>
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</thead>
<tbody>
<tr>
<td>226</td>
<td><em>Datura metel</em> L.</td>
<td>Herb</td>
<td>WD</td>
<td>Nov-Feb</td>
<td>Occa</td>
<td>NE</td>
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<tr>
<td>227</td>
<td><em>Lycopersicon esculentum</em> Mill.</td>
<td>Herb</td>
<td>WD</td>
<td>Nov-Feb</td>
<td>Rare</td>
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<td>228</td>
<td><em>Nicotiana plumbaginifolia</em> Viv.</td>
<td>Herb</td>
<td>WD</td>
<td>Mar-Jun</td>
<td>Occa</td>
<td>NE</td>
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<tr>
<td>229</td>
<td><em>Physalis angulata</em> L.</td>
<td>Herb</td>
<td>WD</td>
<td>Jul-Oct</td>
<td>Freq</td>
<td>NE</td>
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<tr>
<td>230</td>
<td><em>Physalis minima</em> L.</td>
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<td>WD</td>
<td>Jul-Oct</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td>231</td>
<td><em>Solanum americanum</em> Mill.</td>
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<td>WD</td>
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<tr>
<td>232</td>
<td><em>Solanum virginianum</em> L.</td>
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<td>WD</td>
<td>Nov-Jun</td>
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### ASTERALES

#### Asteraceae

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<tr>
<th>No.</th>
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<th>Habitat</th>
<th>Prop.</th>
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</thead>
<tbody>
<tr>
<td>233</td>
<td><em>Acmella paniculata</em> (Wall. ex DC.) R.K.Jansen</td>
<td>Herb</td>
<td>WT</td>
<td>Jul-Oct</td>
<td>Abun</td>
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<td>234</td>
<td><em>Ageratum conyzoides</em> (L.) L.</td>
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<td>WD</td>
<td>Nov-Jun</td>
<td>Abun</td>
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<td>235</td>
<td><em>Artemisia capillaris</em> Thunb.</td>
<td>Herb</td>
<td>WT</td>
<td>Jul-Oct</td>
<td>Rare</td>
<td>NE</td>
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<tr>
<td>236</td>
<td><em>Blumea lacera</em> (Burm.f.) DC.</td>
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<td>WD</td>
<td>Mar-Jun</td>
<td>Abun</td>
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<td>237</td>
<td><em>Blumea membranacea</em> DC.</td>
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<td>WD</td>
<td>Mar-Jun</td>
<td>Abun</td>
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<td>238</td>
<td><em>Cirsium arvense</em> (L.) Scop.</td>
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<td>WD</td>
<td>Mar-Jun</td>
<td>Abun</td>
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<td>239</td>
<td><em>Cyanthillium cinereum</em> (L.) H.Rob.</td>
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<td>240</td>
<td><em>Ecliilla prostrata</em> (L.) L.</td>
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<td>GR</td>
<td>Throughout the year</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td>241</td>
<td><em>Erigeron bonariensis</em> L.</td>
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<td>WD</td>
<td>Mar-Oct</td>
<td>Abun</td>
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<td>242</td>
<td><em>Gnaphalium polycaulon</em> Pers.</td>
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<td>WD</td>
<td>Mar-Jun</td>
<td>Freq</td>
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<td>243</td>
<td><em>Grangea maderaspatana</em> (L.) Poir.</td>
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<td>Throughout the year</td>
<td>Occa</td>
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<tr>
<td>244</td>
<td><em>Helichrysum luteoalbum</em> (L.) Rchb.</td>
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<td>Mar-Jun</td>
<td>Freq</td>
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<td>245</td>
<td><em>Launaea procumbens</em> (Roxb.) Ramayya &amp; Rajagopal</td>
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<td>WD</td>
<td>Mar-Jun</td>
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<td>246</td>
<td><em>Parthenium hysterophorus</em> L.</td>
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<td>Abun</td>
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<tr>
<td>247</td>
<td><em>Soliva anthemifolia</em> (Juss.) Sweet</td>
<td>Herb</td>
<td>WT</td>
<td>Jul-Oct</td>
<td>Freq</td>
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<tr>
<td>248</td>
<td><em>Sonchus asper</em> (L.) Hill</td>
<td>Herb</td>
<td>WD</td>
<td>Mar-Jun</td>
<td>Freq</td>
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<tr>
<td>249</td>
<td><em>Sonchus oleraceus</em> (L.) L.</td>
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<td>WD</td>
<td>Mar-Jun</td>
<td>Abun</td>
<td>NE</td>
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<tr>
<td>250</td>
<td>†Sphagneticola trilobata* (L.) Pruski</td>
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<td>WD</td>
<td>Throughout the year</td>
<td>Occa</td>
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<tr>
<td>251</td>
<td><em>Tridax procumbens</em> (L.) L.</td>
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<tr>
<td>252</td>
<td><em>Xanthium strumarium</em> L.</td>
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#### Menyanthaceae

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<th>No.</th>
<th>Species</th>
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<th>WD</th>
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<th>Prop.</th>
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<tbody>
<tr>
<td>253</td>
<td><em>Nymphoides indica</em> (L.) Kuntze</td>
<td>Herb</td>
<td>WT</td>
<td>Jul-Oct</td>
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### APiales

#### Apiaceae

<table>
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<th>No.</th>
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<th>Habitat</th>
<th>Prop.</th>
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<tbody>
<tr>
<td>254</td>
<td><em>Centella asiatica</em> (L.) Urb.</td>
<td>Herb</td>
<td>GR</td>
<td>Nov-Feb</td>
<td>Freq</td>
<td>LC</td>
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</table>
EQUISETALES

Equisetaceae

255. *Equisetum ramosissimum* Desf. Herb WT, GR Mar-Jun Abun NE

SALVINIALES

Marsileaceae

256. *Marsilea quadrifolia* L. Herb WT Jul-Feb Abun LC

Salviaceae

257. *Azolla pinnata* R. Br. Herb WT Jul-Feb Abun LC

Footnote: Habitat: WT= Wetland, GR= Grassland, WD= Woodland; Flowering and Fruiting Season: March-June= summer, July-October=monsoon, November-February= winter; Abundance Status: Abun= Abundance, Freq= Frequent, Occa= Occasional; IUCN Status: VU= Vulnerable, LC= Least Concern, NE= Not Evaluated, DD= Data Deficient; *=Exotic/Invasive Species; †= Cultivated species.

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