The Cuito catchment of the Okavango system: a vascular plant checklist for the Angolan headwaters

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Abstract
This paper aims to provide a baseline for conservation planning by documenting patterns of plant diversity and vegetation in the upper catchment of the Cuito River. 417 species are recorded from this region. Nine of these are species potentially new to science. Ten species are newly recorded from Angola, with an additional species only recorded previously within Angola from the northern enclave of Cabinda. The 108 new provincial records for Moxico clearly indicate the lack of collections from Angola’s largest province. We note the existence of extensive peat deposits in the Cuito river system for the first time and suggest that one of Barbosa’s vegetation types in the area needs to be reassessed.

Keywords
Angola, Botswana, Cuando Cubango, Moxico, peat deposits, Namibia

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Introduction

Internationally famous for its wildlife, the Okavango Delta wetland in northern Botswana was the 1000th World Heritage Site to be designated by UNESCO and is surrounded by desert. The hydrology and ecology of the Delta are dependent entirely on rainfall in the highlands of central Angola, and the flow of water south and east through the Okavango’s two principal tributaries, the Cuito and Cubango rivers. The Cubango system has been studied extensively in recent years (Oldeman et al. 2013), but little attention has been paid to biodiversity or conservation of the Cuito drainage.

Central and eastern Angola is overlain by deep Kalahari sands formed from uplifted and reworked deposits of an ancient palaeo-lake. The upper catchment of the Cuito and Cuanavale rivers falls mostly within Moxico Province where the plateau lies at an altitude of around 1500m, and the rivers have cut down to an elevation of around 1350 m. The landscape receives rainfall of approximately 1250 mm a year in the headwater lakes region, dropping to around 750 mm at the southern limits of the core study area which is marked by the Menongue – Longa – Cuito Cuanavale road in Cuando Cubango Province. The rainy season lasts from November to April and soils are highly leached. In consequence, they support very little agriculture (Diniz 1973).

Barbosa (1970) assigned the vegetation of the region stretching from just east of Camacupa [General Machado] to Luena [Luso] and south to Longa to vegetation type 17A. This he described as dense, high, mixed (Zambesian and Congolian) miombo woodland with “chanas” or geoxylic-rich grasslands. According to Barbosa, these woodlands comprise Brachystegia species (B. spiciformis Benth. and B. longifolia Benth.) and Julbernardia paniculata (Benth.) Troupin, with some Guibourtia species, Cryptosepalum species and Marquesia species. Around Longa, the vegetation transitions into Barbosa’s vegetation type 24, which he describes as a mosaic of savanna, woodland and dry forest with characteristic woody vegetation containing Brachystegia bakeriana Hutch. & Burtt Davy and Burkea africana Hook.

White (1977) drew attention to the high rainfall highly leached Kalahari sand system and its peculiar flora in a seminal paper on the underground forests of Africa, extrapolating from his knowledge of similar habitats in north-west Zambia. But detailed surveys of the flora of this region are lacking.

Angola is the least intensively inventoried country in southern Africa for plants (Goyder and Gonçalves in press) – this can be seen graphically in the paucity of plant distribution records for the country (Fig. 1) at the start of the National Geographic Okavango Wilderness Project series of expeditions in 2015. Not only is the whole country under-recorded in terms of plants, but the eastern half of the country has very little geo-referenced specimen data (Marshall et al. 2016, Stropp et al. 2016, Sosef et al. 2017). Early collectors such as the Austrian botanist Friedrich Welwitsch collected along the coast, and along routes into the interior as far as Malange Province in the north and the Huíla Plateau in the south, but no further east (Albuquerque 2008, Goyder and Gonçalves in press). Swiss botanist John Gossweiler collected in all of Angola’s provinces over the course of fifty years but spent very little time in central and
eastern parts of the country apart from surveys of the Dundo area, Lunda Norte, in 1946 and 1948 funded by the diamond concession DIAMANG (Cavaco 1959, Figueiredo and Smith 2008). In addition, many of Gossweiler’s collections are difficult to localise with outdated place names, and duplicates in herbaria accessible to the authors frequently omit locality data altogether. Slowly, as Angola has become more accessible following the end of the civil conflict in 2002, botanical surveys have resumed in areas of high endemism or conservation concern along the western escarpment (Hind and Goyder 2014, Gonçalves and Goyder 2016, Gonçalves et al. 2016), but the large eastern provinces of Moxico and Cuando Cubango remain poorly documented.

The only major expedition to study parts of the Cuito catchment botanically was the Kunene-Sambesi Expedition led by Pieter van der Kellen, and that covered only the area either side of the present-day Menongue – Longa – Cuito Cuanavale road. The expedition was in the Cuito system from 17th December 1899 to around 4th March 1900,

**Figure 1.** Plant distribution records for southern Africa. Raw data from GBIF (https://www.gbif.org). Note the absence of records for the Upper Cuito River.
and again between 4–18th April 1900. The botany of the expedition was written up by Warburg (1903) and summarised by Figueiredo et al. (2009) who included notes on the botanist Hugo Baum and on the itinerary. Collections which form the basis of the many species described by predominantly Berlin-based botanists in Warburg (1903) and by subsequent authors were made from the Longa, Cuiriri and Cuito rivers. The area was revisited by Mendes whose 1959–1960 expedition covered the area between Kuvango [Artur de Paiva], Menongue [Serpa Pinto] and Cuito Cuanavale. Prior to the start of the Okavango Wilderness Project many species were known only from this area, and the surveys offered the chance to see if they occurred more widely.

**Material and methods**

The core study area is located to the south of Munhango (Figs 2, 3), and fieldwork was centred initially around the source lakes of the Cuito and Cuanavale rivers (Fig. 4), with excursions radiating from these points to the area south of Tempue and to nearby headwater lakes of other river catchments. In addition, more southerly tributaries such as the Longa (Fig. 5), Luassingua and Cuiriri river valleys were accessed from the Menongue – Cuito Cuanavale road. The darker green area towards the top left of Fig. 2 corresponds with the elevated and dissected plateau covered with moist miombo woodland which formed our core study area.

Botanical surveys were conducted at four different seasons to maximise recording of plant diversity – May–June 2015 (dry season), February–March 2016 (height of the rainy season), October–November 2016 (early rainy season) and April 2018 (late rains/early dry season). DG took part in all four surveys and focussed principally on the higher rainfall zones of the catchment between the headwaters and the Menongue – Cuito Cuanavale road (Barbosa vegetation type 17A and its transition to vegetation type 24). FG participated in the third of these surveys, and AF focussed on the Longa and Cuiriri river valleys (transition zone between Barbosa 17A and 24 vegetation types), which were the core of Baum’s study in 1899 and 1900, and which had proved to be of particular botanical interest in earlier surveys. NB, SB and MJ surveyed the Longa area and the catchment south of the Menongue – Cuito Cuanavale road in June 2015.

Plant diversity was mostly assessed through walk-over surveys of each habitat in turn. But for grasses specifically, plots were set up in February-March 2016 following the methodology of Vorontsova et al. (2016) in order to feed into wider continental assessments of natural and anthropogenic grassland diversity. One plot was set up in undisturbed valley grassland near Tempue, a second in grassland possibly cleared from plateau woodland, but apparently long established, above the Cuito source lake, and the third plot was placed in open miombo woodland on the slope immediately adjacent to the Cuito source lake.

The major vegetation types generally form discrete, readily observable units in different parts of the landscape and were categorised informally.

Herbarium collections were made in sets of four where possible and deposited in two Angolan institutions (the National Biodiversity Institute of the Ministério do Am-
Figure 2. The Okavango Basin and its two principal tributaries the Cuito and Cubango rivers. The core study area is in the more elevated darker green zone of the upper Cuito river.

biente in Luanda and the Lubango Herbarium (LUBA) at ISCED-Huila), one in the UK (Royal Botanic Gardens, Kew (K)) and one in South Africa (the SANBI Herbarium in Pretoria (PRE)). Plants covered by CITES regulations (Aloe, succulent Euphorbia, Orchidaceae) were deposited only in Angolan institutions, and identified from photographs. Plants were dried on a frame over a gas burner, using aluminium corrugates to transmit heat and dry air through the press. Collections were identified principally by DG at Kew by reference to the unrivalled tropical African collections and literature held there. Expert opinion was sought from specialists in particular plant groups: Gill Challenger – Euphorbiaceae, Phyllanthaceae; Phillip Cribb – Orchidaceae; Iain Darbyshire – Acanthaceae, Linderniaceae, Orobanchaceae; Sebsebe Demissew – Asparagus; Peter Goldblatt – Gladiolus; Nicholas Hind – Compositae; Isabel Larridon – Cyperaceae; Gwylim Lewis – Leguminosae; Mike Lock – Xyridaceae, Zingiberaceae; Inger Nordal – Crinum; Jorge Paiva – Polygala; Alan Paton – Lamiaceae; Sylvia Phillips – Eriocaul-
Figure 3. Locations visited during 2015 and 2016 surveys.

Angiosperm classification and nomenclature follows APG IV (2016) at family level, and the African Plant Database (version 3.4.0) or the World Checklist of Selected Plant Families (WCSP 2016) in most cases at lower taxonomic levels. Fern and lycopod names follow Roux (2009). On occasion, accepted names diverge from these resources where expert opinion suggests otherwise. Where new country or provincial records are reported, Figueiredo and Smith (2008), recent taxonomic revisions, and searchable online herbarium catalogues (principally Kew (K), the Natural History Museum, London (BM) and the Tropical Institute, Lisbon (LISC)) have been used as the baselines for comparison.

Local usage of plants was documented on 5th and 9th March 2016 thanks to the inhabitants of Samenunga village (12°56'00"S, 018°48'54"E) who explained which plants had medicinal properties, and which were used to make items such as fish traps.
and beehives. Several cultural artefacts were purchased and deposited in the Economic Botany collections at Kew, where some have since been put on public display. Vouchers of the relevant plants were taken for verification at Kew.

**Results**

Approximately 1100 plant collections were made over the course of the four expeditions, with a further 40+ site-based observations recorded.

The principal vegetation types of the core study area are outlined below.

**Vegetation**

**Moist miombo woodlands**

Vast swathes of central and eastern Angola are covered in this vegetation. The most common trees we observed were *Brachystegia bakeriana*, *B. longifolia*, *Cryptosepalum exfoliatum*...
De Wild. subsp. *pseudotaxus* (Baker f.) P.A.Duvign. & Brenan, *Julbernardia paniculata*, with frequent *Pterocarpus angolensis* DC., *Erythrophleum africanum* (Welw. ex Benth.) Harms, *Baphia massaensis* Taub. subsp. *obovata* (Schinz) Brummitt var. *obovata*, *Bobgunnia madagascariensis* (Desv.) J.H. Kirkbr. & Wiersema, *Guibourtia coleosperma* (Benth.) J.Léonard, *Monotes dasyanthus* Gilg., *M. glaber* Sprague, and *Englerophytum magalismontanum* (Sond.) T.D.Penn. Shrubs include *Bauhinia mendoncae* Torre & Hillc., *Bauhinia urbaniana* Schinz and *Copaifera baumiana* Harms. Rainfall is generally between 750–1250 mm a year in the upper Cuito catchment. Where the rainfall drops below this, to the south (lower Longa valley and Cuito Cuanavale southwards), other elements such as *Baikiaea plurijuga* Harms come in, and by M’Pupo Falls, all elements of miombo are replaced by dry thorn-scrub.

*Isoberlinia angolensis* (Benth.) Hoyle & Brenan var. *lasiocalyx* Hoyle & Brenan and *B. spiciformis* are essentially absent from the Cuito catchment, occurring instead on richer substrate to the west. We only noted a single occurrence of *B. spiciformis* in plateau woodland in the Cuito system.

*Brachystegia bakeriana* is most common near the outer margins of Cuito miombo woodland, and where the miombo patches are very small, as in the “fairy forests” near

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**Figure 5.** Upper Longa River valley at the southern end of the study area, Cuando Cubango Province. Moist miombo woodland on the plateau with a much broader valley containing more extensive peaty wetlands and fire-maintained grassland zones. The river is fast-flowing in deep sinuous channels with bare sandy bottoms. Photograph D. Goyder.
the Cuanavale source, these are dominated by this species. More extensive miombo is on the slopes is usually dominated by *Julbernardia paniculata*, and some plateau miombo (presumably with different soil composition) by *Cryptosepalum exfoliatum* subsp. *pseudotaxus*, which can form dense, closed canopy stands of miombo forest rather than woodland. Forest lacks the flammable grass layer that is present in woodland and under *Cryptosepalum* we frequently observed the presence of a hummock-forming moss not generally found elsewhere. *Julbernardia paniculata* was seen as the principle nectar source for honey bees during our 2016 surveys.

**Swamp forest**

We spent a short time in a small patch of swamp forest at the source of the Rio Cuiva (Kwanza drainage). Swamp forest appears to be rare and highly localised in Mexico, unlike in Lunda Norte where extensive formations occur along tributaries of the Kasai River (Congo drainage). The Cuiva swamp forest contained species of Guineo-Congoan affinity such as *Zanthoxylum gilletii* (De Wild.) P.G.Waterman and *Syzygium owariense* (P.Beauv.) Benth.

**Seasonally burned savannas**

These high rainfall grasslands receive 750–1250 mm of rain a year in the upper Cuito catchment, and are on highly leached Kalahari sand. Eastern Angola contains probably 80% of this habitat, which also extends into parts of NW Zambia and western parts of the DR Congo. This habitat is fire-adapted, and is dominated by grasses or by geoxylic suffrutices, plants with large underground woody biomass and seasonal above-ground shoots. Factors governing whether grasses dominated, or geoxylic suffrutices dominated these areas were not clear. Maurin et al. (2014) argue that across Africa, fire is the evolutionary driver of such lifeforms, whereas Finckh et al. (2016) provide convincing evidence that in upland central and eastern Angola, frost also plays a principal role, with cold air pooling in valley bottoms in the winter dry season and “burning” new shoots. Proximity to the water table limits growth of trees also.

The 2016 surveys took us to several sites with significant expanses of natural or little disturbed grasslands. They were particularly extensive near the confluence of the Cuito and Calua rivers downstream of the Cuito source lake, and the equivalent confluence downstream of the Cuanavale source lake. The third notable site was the Tempeué valley grasslands. Grassland diversity plots were placed at three sites – one on the plateau above the Cuito source lake, one in the nearby miombo, and one in the Tempeué valley grassland. *Loudetia* species dominated – *L. simplex* (Nees) C.E.Hubb. in open areas and *L. lanata* (Stent & J.M.Rattray) C.E.Hubb. in the woodland. Five to seven grass species were found in each plot. Total grass diversity in the upper Cuito-Cuanavale system was 27 species, the majority (18) occurring in open grassland. Grassland diversity appears significantly higher than in the lower altitude plateau grasslands of Lunda Norte, also dominated by *Loudetia simplex* (Darbyshire et al. 2011, 2014). *Polygala*
robusta Gürke seems to be associated with diverse natural grassland and could perhaps be considered an indicator of good quality habitat. Another rare species encountered in this environment was the Angolan endemic *Blepharis flava* Vollesen, known from just eight earlier collections. Both of these species are newly recorded from Moxico. A spectacular blue-flowered *Barleria* is new to science and was collected at the Cuito-Calua confluence. Also new to science is a geoxylic species of *Baphia* (Leguminosae), a genus of around 50 species of tree and shrub – the “underground forest” life form had not been recorded in *Baphia* before. This taxon was only seen in one area of the upper Lungué-Bungo catchment, in plains with a rich flora of geoxylic legume species.

*Burkea africana* was a common tree in savanna vegetation at the Cuanavale source lake. This was encountered much less frequently in the Cuito source region.

Further south, the upper Longa valley, despite large-scale conversion to rice cultivation, has extensive areas of burned savanna, with some extremely rare species. *Orthohanthera gossweileri* C.Norman was known only from the type, but we recollected it in the Longa valley in March 2016, and at the Cuanavale source in October 2016 extending its range some 200 km to the north.

**Wetland**

Wetlands tend not to be very diverse botanically, nor to have local endemics. They are however, poorly sampled in Angola.

The extensive peaty wetlands of the Cuito have a much more diverse flora than the rather limited equivalent on the Cubango, which is a much faster flowing river running through a rocky valley. Clump- or tussock-forming plants such as Eriocaulaceae and Xyridaceae are common, while plants such as Droseraceae and Lentibulariaceae are able to supplement the limited nutrients available to other plants by trapping and digesting insects or aquatic invertebrates. Sedges (Cyperaceae) are present but are not as common as preliminary palynological records might suggest (unpublished preliminary results).

The headwater lakes of the Cuito system support a wider range of open water aquatics (true water lilies (Nymphaeaceae) and other aquatics such as *Nymphoides* and *Brasenia*) than is present on the Cubango. One unusual aquatic plant encountered in the fast-flowing upper Longa river was *Mayaca baumii* Gürke (Mayacaceae), a near-endemic and the only old-world representative of this otherwise entirely neotropical family.

Conversely, rocky rapid specialists such as *Hydrostachys triaxialis* Engl. & Gilg (Hydrostachyaceae) and *Inversodicraea warmingiana* (Gilg) Engl. (Podostemaceae) which are present on suitable portions of the Cubango (Cheek et al. 2017) are completely absent from the Cuito.

Robust river-margin plants include *Gardenia imperialis* K.Schum. (Rubiaceae) are present throughout both river catchments, while plants such as *Tacaazza rosmarinifolia* Oliv. (Apocynaceae) with rheophytic adaptations and requiring a rocky footing are found only on the Cubango.
Many wetland species have their known distributions extended dramatically. *Genlisea angolensis* R.D.Good, for example, was formerly known in Angola from just Cuando Cubango and from one collection in the DR Congo – collections in both 2015 and 2016 demonstrate this species occurs throughout the catchment of the Cuito and Cuanavale rivers (Goyder 2016). Wetland species of *Polygala* and Eriocaulaceae show similar distributions. The photographic record of *Crinum binghamii* Nordal & Kwembeya from just N of Cuito Cuanavale demonstrates this also, as it was formerly known only from western Zambia (Nordal and Kwembeya 2004, Zimudzi et al. 2008). While extending the known distributions, the new limits reflect the high rainfall, low nutrient Kalahari sand ecology.

The source lakes generally have deep accumulations of unconsolidated peat at their margins. We measured these to a depth of at least five metres at the Cuito source lake. The valleys also have more consolidated peat deposits. Such deposits are rare in tropical Africa. Reiley and Page (2016), in a recent volume on tropical peatland, state that the only significant peat deposits in Angola are on the lower Cuanza River 50 km from Luanda. The upper Cuito and Cuanavale lakes and wetlands seem to have been overlooked, despite reference in the same volume to peaty deposits in the Okavango Delta in Botswana. Analysis of peat cores from these deposits in ongoing at the University of the Witwatersrand in South Africa – pollen trapped in different strata has the potential to shed light on changes in vegetation in the region over thousands of years.

Plant diversity

417 species of vascular plant were recorded from the core study area of the high-rainfall upper Cuito and Cuanavale drainage system. The Checklist was compiled principally from our own collections from the high-rainfall zone, but with some additional collection made by Hugo Baum in the transition zone to the south. The majority of Baum’s collections from the Cuito drainage system were, however, made in Barbosa’s drier vegetation type 24 even further to the south and are not included in this checklist. Note that Baum’s specimens citing Longa as the locality refer to the river, not to the village currently known as Longa, which is at the southern limit of our core study area, nor to Baixo Longa 100 km to the S, and outside the core study area. A further point of confusion is Warburg’s (1903) map showing the route of the Kunene-Sambesi Expedition places “Hadjon Longa” close to the confluence of the Longa and Cuito rivers even further south in the region of the present-day village of Nankova.

We report nine species from the core study area which are potentially new to science (Table 1). Ten species are newly recorded for Angola with an additional species which had only been recorded within Angola from the northerly enclave of Cabinda. *Orthochilus* is a new generic record for the country (Table 2). But it is the new provincial records that give the clearest indication of how poorly studied the core project area has been to date – we recorded ten new records for Bié Province, ten for Cuando Cubango, and 108 for Mexico – the largest province in Angola.
Table 1. Species potentially new to science.

| Family     | Species | Notes |
|------------|---------|-------|
| Acanthaceae| Barleria sp. nov. | Grassland at the Cuito-Calua confluence. Also in grasslands of upper Lfung-Bungo tributary |
| Compositae| Vernonia sp. nov. | Growing in the floating peaty mat at Cuanavale source lake |
| Euphorbiaceae| Acalpyha sp. not matched | Similar to A. angustissiima but dioecious. Pyrophytic grassland at head of Rio Cuanavale valley and N of Tempué |
| Gramineae| Loundetia sp. nov. | Closest to L. densipica. Grassland in Longa river valley |
| Lamiaceae| Endoitermon sp. nov. | Grassland at the Cuito-Calua confluence, Mexico province |
| Leguminosae| Baphia sp. nov. | Found at a single locality in upper Lfung-Bungo catchment |
| Linderniaceae| Crepidorhapalon sp. nov. | Open sand in upper Lfung-Bungo catchment |
| Orchidaceae| possibly sp. nov. | Same site as the Barleria sp. nov. A eulophioid orchid, but generic affinities uncertain |
| Orobancheaceae| Buchnena sp. not matched at Kew | May be undescribed, or a species from DR Congo. Awaiting comment from expert |

Table 2. Species newly recorded from Angola.

| Family     | Species | Notes |
|------------|---------|-------|
| Acanthaceae| Justicia subessilis Oliv. | Westerly range extension |
| Amaryllidaceae| Crinum binghamii Nordal & Kwembeya | Cuanavale River N of Cuito-Cuanavale. Known also from similar habitats in western Zambia |
| Apocynaceae| Landolphia cuneifolia Pichon | Known from NW Zambia and DR Congo |
| Apocynaceae| Secamone dewerei De Wild. subsp. elliptica Goyder | Only known previously from western Zambia |
| Cyperaceae| Cyperus unioloides R.Br. | Widely distributed across tropical and subtropical Africa |
| Gramineae| Schizachyrium claudopus (Chiov.) Chiov. | Known from Tanzania, DR Congo and Zambia |
| Loranthaceae| Englerina gabonensis (Engl.) Balle | Congolian element, near Cuanavale source. New record for Angola excluding Cabinda |
| Orchidaceae| Brachycorythis congomonis Kraenzl. | Marsh in the Longa and Cuiriri valleys |
| Orchidaceae| Balbophyllum josephi (Kuntze) Summerh. | Moist miombo woodland in Mexico |
| Orchidaceae| Orthochilus aurantiacus (Rolfe) Bytebier | New generic record for Angola |
| Rubiaceae| Gardenia resiniflua Hiern subsp. resiniflua | Suffrutescent form – Longa valley |

Botanically, the pyrophytic grassland zone between the marsh and the miombo woodland contains most of the new and interesting species. Over 40 underground forest species (whose nearest relatives are forest trees or shrubs) were recorded from this zone and as part of the ground flora of neighbouring miombo woodlands. They include Napoleonaea gossweileri Baker f. (Lecythidaceae), Trichilia quadrivalvis C.DC (Meliaceae), and an undescribed species of Baphia (Leguminosae). The Baphia was flowering profusely at ground level in the upper Lfung-Bungo catchment, where it occurred in an assemblage of other underground forest species. Baphia is a genus of 50 species of trees and shrubs in Africa and Madagascar – this is the first record of a pyrophytic underground forest species in the genus, and it appears to be a species new to science. The diversity of rubber-producing Apocynaceae species in the grassland zone was not-
ed – *Landolphia lanceolata* (K.Schum.) Pichon, *L. thollonii* Dewèvre, *Chamaeclitandra henriquesiana* (Hallier f.) Pichon, and *Raphionacme michelii* De Wild. were common elements and have been used as sources of natural rubber in earlier times. Other much rarer species of Apocynaceae were also recorded from this zone, including *Orthanthera gossweileri* C.Norman, which we found at the source of the Cuanavale river, 200 km north of its earlier known distribution. The new species of *Baphia* will be described separately, along with a more detailed discussion of the geoxylic suffrutex flora of the region.

Thirty-nine legume species were recorded from the upper catchment of the Cuito Cuanavale system and were found in both open and woodland habitats. Most of the miombo trees belong to this family, but there were many herbs also. Other significant elements of the flora include Rubiaceae (26 spp.), Apocynaceae (19 spp.), Lamiaceae (20 spp.) and the genus *Polygala* (Polygalaceae) with 14 species recorded – each habitat had its own suite of *Polygala* species. Monocot diversity was also substantial, with 31 grass species recorded, 17 orchids – mostly in the marsh and grassland zones – and seven species of *Gladiolus* (Iridaceae).

A flame lily species, *Gloriosa sessiliflora* Nordal & M.G.Bingham, was recorded from Angola for the second and third times ever, by the headwater team and the Longa/Cuiriri team respectively. It was described from similar marshland habitats in western Zambia in 1998.

**Discussion**

Miombo woodland is generally regarded as Zambesian floristically. Nevertheless, we encountered a small but significant element of moist-miombo species with Guineo-Congolian affinities. These include several species of Apocynaceae, *Uvaria angolensis* Welw. ex Oliv. in the Annonaceae, *Paropsis brazzaeana* Baill. in the Passifloraceae and *Englerina gabonensis* (Engl.) Balle in the Loranthaceae. The small patch of swamp forest at the head of the Río Cuiva is also Guineo-Congolian in affinity with *Syzygium owariense* (Myrtaceae) and *Zanthoxylum gilletii* (Rutaceae) widely distributed in the Congo Basin and West Africa. Phylogenetically, *Crinum binghamii* (Amaryllidaceae), a wetland species, is closer to Congolian members of the genus than to Zambesian species (Nordal and Kwembeya 2004).

Cape elements in the flora were restricted to savanna or grassland habitats, sometimes where rocky substrate was encountered locally. *Protea*, *Cliffortia* and *Erica* are three genera with predominantly Cape affinities and species radiations.

Floristic links outside of Africa are demonstrated by a couple of wetland taxa. *Mayaca baumii* (Mayacaceae) is the only African species of an otherwise entirely neotropical genus and family. *Mesanthemum glabrum* Kimpouni (Eriocaulaceae) is allied phylogenetically to a species from Ecuador (Larridon pers. comm., unpublished work in progress). These distributions probably reflect historic transatlantic dispersal events involving birds.

Human population in the region is low, and the few villages we passed are far apart. The low-nutrient landscape does not support much agriculture. Nevertheless, one or two
villages grew a diverse range of crops, and neighbouring miombo woodland was cleared for shifting maize and cassava cultivation. Habitat conversion is local but increasing in what is otherwise a remarkably intact ecosystem. Major human impact on the vegetation of the Cuito-Cuanavale system was only really apparent around the town of Cuito Cuanavale, and the section of the Longa valley affected by the large-scale rice project, although many of the grasslands are burned more frequently that they would be without human presence. Also, timber in the upper Lungué-Bungo valley is increasingly targeted as this area is closer to the provincial capital Luena than the rest of the core project area.

Many native plant species are used as medicines or for construction. It is mostly the most common species that are used.

The most frequent miombo tree, *Julbernardia paniculata*, is not only the principle source of nectar for honey bees but is also the preferred tree for the construction of beehives (Fig. 6). A cylinder of bark is removed from the tree (killing the individual), stapled together with stakes made from another legume timber (*Bobgunnia madagascariensis*), and tied together with stringy underbark from a third (*Julbernardia paniculata*, *Brachystegia bakeriana* or *Cryptosepalum exfoliatum subsp. pseudotaxus*). Internal bracing hoops come from flexible young shoots of either *Diplorhynchus condylocarpon* (Müll.Arg.) Pichon or *Baphia massaensis* subsp. *obovata*, the permanent wooden cap at one end is made from *Parinari curatellifolia* Planch. ex Benth., while the removable cap at the other end is of woodland grasses, mostly *Loudetia* spp. Such traditional methods of construction are destructive but sustainable when population levels are low. However, harvesting of honey and production of beehives is becoming an industry, with some villages boasting of 300+ hives in active use.

Large fish traps were constructed from saplings of *Englerophytum magalismontanum*, tied together with fine bark string as above. The small fishtrap was constructed from the grass *Loudetia densispica* (Rendle) C.E.Hubb.

Locally made bark canoes were present in most lakes and major watercourses we visited (Fig. 7). These were generally made from bark of the legume tree *Erythrophleum africanum* and stitched together as above with strips of stringy underbark from *Brachystegia* or *Cryptosepalum* spp.

It was noted that local people have a detailed understanding of plants with active biological properties in their immediate environment and know how to use these to treat a variety of conditions in the absence of accessible western medicine.

**Conclusions**

Over 1100 plant collections were made during the course of the National Geographic Okavango Wilderness Project, the majority from the core project area of the upper Cuito and Cuanavale river catchments. These form the basis of what is undoubtedly the most detailed specimen-based assessment of the vegetation and plant diversity of this region.

The flora of the upper Cuito and Cuanavale system is diverse and endemism is high, although the latter has not been analysed in detail for this study. New records extend the known geographic range of many species 200 km to the north, to the
headwaters of the Cuito and Cuanavale rivers. They also underline the need for further surveys in Moxico Province where 108 new provincial records were reported, and provide evidence that the absence of plant records for eastern Angola revealed on the GBIF data map of southern Africa is real, and not a data artefact. All four Protea species collected in Moxico had never been recorded there before.

Barbosa (1970)’s vegetation type 17A needs to be critically reconsidered in the light of our findings in this area – we observed a fundamental change in composition of the miombo woodlands east of Cuemba once we moved onto the deep white sands, where several woody species drop out – no Isoberlinia angolensis (Benth.) Hoyle & Brenan was seen east of this point, and Brachystegia spiciformis occurred exceptionally rarely. Both Burkea africana and Brachystegia bakeriana are significant elements of the landscape in the headwater lakes region, not just in the transition zone around Longa. We saw no Marquesia species in the headwaters zone, but Monotes is common. Baphia massaiensis subsp. obovata, more commonly associated with dry Baikiaea-dominated woodland, was a common element of the miombo right up into the headwater region.

We also highlight the existence of extensive peat deposits in the Cuito river system. These are not as extensive as those recently reported from the Congo Basin (Dargie et al. 2017), but must be significant in terms of carbon storage nevertheless.
Figure 7. Bark canoe (foreground) made from *Erythrophleum africanum* (Leguminosae) alongside a fibre-glass “dugout” brought in by the National Geographic Okavango Wilderness Project from the Okavango Delta. Cuito source lake. Photograph D. Goyder.

### Checklist

An annotated checklist of the upper Cuito & Cuanavale drainage system – the flora of high rainfall (annual precipitation more than c. 750 mm), highly leached Kalahari sand deposits from the headwaters to c. 15°S, based principally on 2015, 2016 and 2018 field surveys (Barbosa vegetation type 17A and transition to vegetation type 24).

### Table Checklist

| Family            | Species                                                                 | Habitat | Vouchers       | New Records |
|-------------------|-------------------------------------------------------------------------|---------|----------------|--------------|
| Lycopodiaceae     | *Lycopodiella affinis* (Bory) Pic.Serm.                                 | Wetland | Frisby 3027; Goyder 8261 |              |
|                   | *Lycopodiella cernua* (L.) Pic.Serm.                                    | Wetland | sight record 38 |              |
|                   | *Lycopodiella sarcocaulon* (A.Braun & Welw. ex Kuhn) Pic.Serm.          | Wetland | Goyder 8298     |              |
| Pteridophyta       |                                                                         |         |                |              |
| Aspleniacae       | *Asplenium aethiopicum* (Burm.f.) Bech.                                 | Humid Forest | Goyder 8329 |              |
| Gleicheniacae     | *Dicranopteris linearis* (Burm.f.) Underw.                              | Wetland | Goyder 8396     |              |
| Thelyperidaceae   | *Cyclosorus interruptus* (Willd.) H.İtô                                | Wetland | Goyder 8317     | Mexico       |
|                   | *Thelypteris confluens* (Thunb.) Morton                                 | Wetland | Barker et al. 139 |              |
| Family                      | Species                           | Habitat   | Vouchers                                      | New Records       |
|-----------------------------|-----------------------------------|-----------|-----------------------------------------------|-------------------|
| **ANGIOSPERMAE: MAGNOLIIDS**|                                   |           |                                               |                   |
| Annonaceae                  | Annona stenophylla Engl. & Diels  | Grassland | Goyder & Maiato 8759; Goyder & Maiato 8843    |                   |
|                            | subsp. nana (Exell) N. Robson     |           |                                               |                   |
|                            | Artabotrys antunesii Engl. & Diels| Woodland  | Goyder 8436                                   | Mozico            |
|                            | Uvaria angolensis Welw. ex Oliv.  | Woodland  | Goyder 8034; Goyder 8414; Goyder 8438         |                   |
|                            | Xylopia odoratissima Welw. ex Oliv.| Woodland  | Frisky 3067; Goyder & Maiato 8806             | Bié               |
|                            | Xylopia tomentosa Exell           | Woodland  | Barker et al. 50; Frisky 3057; Goyder 8027;  |                   |
|                            |                                   |           | Goyder 8048; Goyder 8096; Goyder 8288; Goyder |                   |
|                            |                                   |           | 8918                                          |                   |
| Cabombaceae                 | Brasenia schreberi J.F Gmel.      | Wetland   | Goyder 8295                                   | Mozico            |
| Lauraceae                   | Cassytha pondoensis Engl. var.    | Woodland  | Goyder 8104                                   |                   |
|                            | pondoensis                        |           |                                               |                   |
| Nymphaeaceae                | Nymphaea beudelotii Planch.       | Wetland   | Barker et al. 44; Goyder 8259                 |                   |
|                            | Nymphaea nouchali Burm.f. var.    | Wetland   | Frisky 4013; Goyder 8296; Goyder 8376         |                   |
|                            | caerulea (Savigny) Verdc.         |           |                                               |                   |
|                            | Nymphaea sulphurea Gilg.          | Wetland   | Baum 657; Frisky 3050; Frisky 3064; Frisky    |                   |
|                            |                                   |           | 3072; Goyder 8097; Goyder 8297; Goyder 8393   |                   |
| **ANGIOSPERMAE: MONOCOTS**  |                                   |           |                                               |                   |
| Alismataceae                | Limnoblyton angolense Buchenau     | Wetland   | Frisky 3093; Goyder 8375; sight record 15     | Moxico            |
| Amaryllidaceae              | Boophone disticha (L.f.) Herb.    | Grassland | Goyder & Maiato 8829                          |                   |
|                            | Crinum kibinganii Nordal & Kwembeya| Wetland  | sight record 42                               |                   |
|                            | Cryptostephanus densiflorus Welw.  | Woodland  | Goyder 8258                                   | Mozico            |
|                            | ex Baker                          |           |                                               |                   |
|                            | Cyrtanthus welwitschii Hiern ex Baker| Wetland  | Frisky 4023                                   | Cuando Cubango    |
| Asparagaceae                | Asparagus africanus Lam. var.     | Grassland | Goyder 8439                                   |                   |
|                            | puberulus (Baker) Sebsebe          |           |                                               |                   |
|                            | Chlorophyllum colubrinum (Baker)  | Grassland | Baum 611                                      |                   |
|                            | Engl.                             |           |                                               |                   |
|                            | Chlorophyllum fasciculatum (Baker)| Grassland | Baum 683; Goyder 9495                         |                   |
|                            | Kativu                            |           |                                               |                   |
|                            | Chlorophyllum sp.                 | Grassland | Goyder 9495a                                  |                   |
|                            | Dipcadi viride (L.) Moench        | Wetland   | Goyder & Maiato 8801                          |                   |
|                            | Sansevieria aubrytiana Carrière   | Woodland  | Goyder & Maiato 8838                          | Mozico            |
|                            | Schizocarphus nervosus (Burch.)   | Grassland | Goyder & Maiato 8779                          | Mozico            |
|                            | Van der Merwe                     |           |                                               |                   |
| Asphodelaceae               | Aloe nutii Baker                  | Grassland | Baum 698                                      |                   |
|                            | Aloe zebrina Baker                | Woodland  | Goyder 8255                                   |                   |
|                            | Trachyandra arvensis (Schinz)     | Grassland | Frisky 3062; Goyder 8494; Goyder & Maiato 8816| Cuando Cubango;   |
|                            | Oberm.                            |           |                                               | Mozico            |
| Colchicaceae                | Gloriosa sessiliflora Nordal & M.G.| Wetland  | Frisky 4035; Goyder & Maiato 8822             |                   |
|                            | Bingham                          |           |                                               |                   |
|                            | Gloriosa simplex L.               | Woodland  | Goyder 8425                                   | Mozico            |
| Commelinaceae               | Aniselmia plagiocarpa K. Schum.    | Woodland  | Barker et al. 82; Baum 716; Goyder 8244       | Mozico            |
|                            | Commelina africana L. var.        | Woodland  | Goyder 8245                                   | Mozico            |
|                            | lanceispata C.B Clarke            |           |                                               | Mozico            |
|                            | Commelina sphaerorhizoma Faden &  | Woodland  | Goyder 8243                                   | Mozico            |
|                            | Layton                            |           |                                               | Mozico            |
| Family | Species | Habitat | Vouchers | New Records |
|--------|---------|---------|----------|-------------|
| Commelinaceae | *Commelina welwitschii* C.B.Clarke | Grassland | Baum 814 |  |
| | *Cynotis longifolia* Benth. | Grassland | Goyder & Maiato 8832 | Mexico |
| Costaceae | *Costus spectabilis* (Fenzl) K.Schum. | Grassland | Goyder 8947 |  |
| Cyperaceae | *Abildgaardia ovata* (Burm.f.) Kral | Wetland | Frisby 3041 |  |
| | *Bulboctylis lanceps* C.B.Clarke ex T.Durand & Schinz | Grassland | Goyder 8290 | Mexico |
| | *Cyperus chrysocephalus* (K.Schum.) Kük. | Wetland | Frisby 3071 |  |
| | *Cyperus denudatus* L.f. | Wetland | Goyder 8931 |  |
| | *Cyperus erinaceus* (Ridl.) Kük. | Grassland | Goyder 8334 |  |
| | *Cyperus henii* T.Durand & Schinz | Wetland | Frisby 3081 |  |
| | *Cyperus kipasensis* Chern. | Wetland | Goyder 8939 |  |
| | *Cyperus margaritaceus* Vahl | Grassland | Goyder 8335; Goyder & Maiato 8831; Goyder 8925 |  |
| | *Cyperus pectinatus* Vahl | Wetland | Goyder 8294 |  |
| | *Cyperus proteus* (Welw.) Bauters | Wetland | Barker et al. 63; Baum 627; Baum 628; Frisby 3009; Goyder 8005; Goyder 8365 |  |
| | *Cyperus proteus* (Welw.) Bauters var. bellidiflora Welw. | Wetland | Goyder 8936 |  |
| | *Cyperus rhynchosporoides* Kuk. | Grassland | Goyder & Maiato 8830 |  |
| | *Cyperus subtrigonus* (C.B.Clarke) Kük. | Wetland | Goyder 8940 |  |
| | *Cyperus unioloides* R.Br. | Wetland | Goyder 8941 | Angola |
| | *Fimbristylis dichotoma* (L.) Vahl var. dichotoma | Wetland | Barker et al. 71; Barker et al. 111 |  |
| | *Fimbristylis dichotoma* (L.) Vahl var. dichotoma | Wetland | Goyder 8945 |  |
| | *Fuirena umbellata* Rottb. | Grassland | Barker et al. 136; Goyder 8924 |  |
| | *Lipocarpha chinensis* (Osbeck) J.Kern. | Wetland | Goyder 8938 |  |
| | *Rhynchospora candida* (Nees) Boeck. | Wetland | Barker et al. 62; Goyder 8302; Goyder 8368 |  |
| | *Rhynchospora rugosa* (Vahl) Gale subsp. brownii (Roem. & Schult.) T.Koyama | Grassland | Barker et al. 65 |  |
| | *Scleria erythropoidea* Ridl. | Wetland | Barker et al. 57; Goyder 8933 |  |
| | *Scleria gregisfolia* (Ridl.) C.B.Clarke | Wetland | Goyder 8239; Goyder 8360; sight record 41 |  |
| Eriocaulaceae | *Eriocaulon lanatum* H.E.Hess | Wetland | Goyder 8202; Goyder 8369 | Mexico |
| | *Eriocaulon teuczaii* Engl. & Ruhland | Wetland | Goyder 8099; Goyder 8364 | Mexico |
| | *Meesanthemum glabrum* Kimpouni | Wetland | Baum 645; Frisby 3065; Goyder 8004; Goyder 8201; Goyder 8238; Goyder 8358 | Mexico |
| | *Meesanthemum reductum* H.E.Hess | Wetland | Barker et al. 115 |  |
| | *Syngonanthus angolensis* H.E.Hess | Wetland | Goyder 8237; Goyder 8359 | Mexico |
| | *Syngonanthus wahlbergii* (Wikstr. ex Körn.) Ruhland | Wetland | Goyder 8100 |  |
| Gramineae | *Aristida nemorivaga* Henrard | Woodland | Barker et al. 108 |  |
| | *Brachiaria dura* Stapf | Grassland | Barker et al. 59; Goyder 8289 | Cuando Cubango |
| | *Ctenium newtonii* Hack. | Grassland | Barker et al. 54 | Cuando Cubango |
| | *Digitaria milanjiana* (Rendle) Stapf | Woodland | Goyder 8306 |  |
| Family                      | Species                                      | Habitat          | Vouchers                      | New Records |
|-----------------------------|----------------------------------------------|-------------------|-------------------------------|-------------|
| Gramineae                   | **Diheteropogon amplexens** (Nees) Clayton var. amplexens | Grassland; Woodland | Goyder 8274; Goyder 8285     | Moxico      |
|                             | **Diheteropogon filifolius** (Nees) Clayton | Grassland         | Barker et al. 60; Goyder 8407 | Cuando Cubango |
|                             | **Eleusine coracana** (L.) Gaertn.           | Wetland           | Baum 693                      |             |
|                             | **Elymandra grallata** (Stapf) Clayton      | Grassland         | Barker et al. 98; Barker et al. 105 | Cuando Cubango |
|                             | **Eragrostis brayii** (Stent) Lauert         | Woodland          | Goyder 8268; Goyder 8282     |             |
|                             | **Eragrostis thollonii** Franch.             | Woodland          | Goyder 8284                   | Moxico      |
|                             | **Heteropogon contortus** (L.) P.Beauv.      | Grassland         | Goyder 8272; Goyder 8404     |             |
|                             | **Hyparrhenia newtonii** (Hack.) Stapf       | Grassland         | Goyder 8042; Goyder 8923     | Bié         |
|                             | **Leersia hexandra** Sw.                     | Wetland           | Goyder 8930                   |             |
|                             | **Loudetia angolensis** C.E.Hubb.            | Wetland           | Goyder 8264                   | Moxico      |
|                             | **Loudetia densispica** (Rendle) C.E.Hubb.  | Grassland         | Barker et al. 109; Goyder 8273; Goyder 8442 | Moxico |
|                             | **Loudetia lanata** (Stent & J.M.Rattray) C.E.Hubb. | Woodland         | Goyder 8281                   | Moxico      |
|                             | **Loudetia simplex** (Nees) C.E.Hubb.       | Grassland         | Goyder 8228; Goyder 8269; Goyder 8403 | Bié; Moxico |
|                             | **Loudetia sp. nov. aff. L. densispica**    | Grassland         | Barker et al. 55              |             |
|                             | **Miscanthus junceus** Pilg.                 | Wetland           | Goyder 8299                   | Moxico      |
|                             | **Monocymbium cereiforne** (Nees) Stapf      | Grassland         | Goyder 8275; Goyder 8405     | Moxico      |
|                             | **Panicum natalense** Hochst.                | Grassland         | Goyder 8271; Goyder 8409     | Moxico      |
|                             | **Pennisetum polystachion** (L.) Schult.    | Ruderal           | Goyder 8043                   | Bié         |
|                             | **Phragmites mauritianus** Kunth             | Wetland           | Goyder 8935                   |             |
|                             | **Pogonarthria squarrosa** (Roem. & Schult.) Pilg. | Grassland      | Barker et al. 97              |             |
|                             | **Rhystachne robusta** Stapf                 | Woodland          | Goyder 8283                   |             |
|                             | **Schizachyrium claudopus** (Chiov.) Chiov. | Grassland         | Barker et al. 58              |             |
|                             | **Sporobolus welwitschii** Rendle            | Grassland         | Goyder 8291                   |             |
|                             | **Trachypogon spicatus** (L.f.) Kuntze      | Grassland         | Goyder 8913                   |             |
|                             | **Tristachya hubbardiana** Conert           | Grassland         | Goyder 8408                   | Moxico      |
|                             | **Tristachya nidiglumis** K.Schum.          | Grassland         | Barker et al. 72              |             |
|                             | **Tristachya rhambanii** Hack.               | Grassland         | Goyder 8270; Goyder 8406     |             |
|                             | **Blyxa radicans** Ridl.                    | Wetland           | Baum 827                      |             |
|                             | **Ottelia muricata** (C.H.Wright) Dandy     | Wetland           | Barker et al. 118             |             |
|                             | **Ottelia ulvifolia** (Planch.) Walp.       | Wetland           | Goyder 8929                   |             |
| Hydrocharitaceae            | **Blyxa radicans** Ridl.                    | Wetland           | Baum 827                      |             |
| Hypoxidaceae                | **Blyxa radicans** Ridl.                    | Wetland           | Baum 827                      |             |
|                             | **Ottelia muricata** (C.H.Wright) Dandy     | Wetland           | Barker et al. 118             |             |
|                             | **Ottelia ulvifolia** (Planch.) Walp.       | Wetland           | Goyder 8929                   |             |
| Iridaceae                   | **Ferraria welwitschii** Baker               | Grassland         | Goyder & Maiato 8790          |             |
|                             | **Gladiolus atropurpureus** Baker           | Grassland         | Goyder 8496; Goyder & Maiato 8768 | Moxico      |
|                             | **Gladiolus benguellensis** Baker           | Grassland         | Goyder 8498                   | Cuando Cubango |
|                             | **Gladiolus dalenii** Van Geel subsp. dalenii | Wetland         | Frisy 3029; Goyder 8461       | Moxico      |
|                             | **Gladiolus gregarius** Welw. ex Baker      | Woodland          | Goyder 8401                   |             |
|                             | **Gladiolus gregarius** Welw. ex Baker – anomalous form with filiform leaves and green flowers | Grassland         | Goyder 8499                   |             |
|                             | **Gladiolus laxiflorus** Baker              | Wetland           | Frisy 3010; Frisy 3066; Goyder & Maiato 8793 |             |
|                             | **Gladiolus magnificus** (Harms) Goldblatt  | Grassland         | Baum 651; Goyder 8947         |             |
| Family          | Species                      | Habitat         | Vouchers                              | New Records       |
|-----------------|------------------------------|-----------------|---------------------------------------|-------------------|
| Iridaceae       | Gladiolus unguiculatus Baker | Grassland       | Frisby 3025; Frisby 3038; Goyder & Maiato 8777; Goyder & Maiato 8778 |                   |
| Mayacaceae      | Mayaca baumii Gürke          | Wetland         | Barker et al. 117; Baum 811           |                   |
| Orchidaceae     | Brachycorythis congoensis Kraenzl. | Wetland      | Frisby 3068                           |                   |
|                 | Bulbophyllum josephi (Kuntze) | Summerhayes    | Goyder 8419                           |                   |
|                 | Disia caffra Bolus            | Wetland         | Goyder & Maiato 8791                  |                   |
|                 | Disia ochrostachya Rchb.f.    | Wetland         | Frisby 4005; Goyder & Maiato 8763; Goyder & Maiato 8796 |                   |
|                 | Disia bicornis Rchb.f.        | Wetland         | Frisby 3075                           |                   |
|                 | Disia welwitschii Rchb.f.     | Wetland         | Frisby 3063                           |                   |
|                 | Eulophia angolenisis (Rchb.f.) Summerh. | Wetland       | Frisby 3032                           |                   |
|                 | Eulophia bornfallii (Bateman) Summerh. | Wetland       | Goyder & Maiato 8792                  | Mexico            |
|                 | Eulophia longisepala Rendle  | Grassland       | Goyder & Maiato 8753                  | Mexico            |
|                 | Eulophia rolfiana Kraenzl.    | Grassland       | Frisby 3095; Goyder & Maiato 8755    | Mexico            |
|                 | Eulophia speciosa (R. Br. ex Lindl.) Bolus | Grassland       | Goyder & Maiato 8774                  | Mexico            |
|                 | Habenaria retinervis Summerh. | Woodland         | Goyder 8220                           |                   |
|                 | Orthochilus aurantiacu (Rolfe) Bytebier | Grassland       | Frisby 4002; Goyder & Maiato 8752; Goyder & Maiato 8796 | Cuando Cubango    |
|                 | Phaius occidentalis Schltr.   | Wetland         | Goyder & Maiato 8761                  | Mexico            |
|                 | Polyctchyla concrata (Jacq.) Garay & H.R.Sweet | Woodland       | Goyder 8225                           |                   |
|                 | Satyrium trinerve Lindl.      | Wetland         | Frisby 3080; Frisby 4001              |                   |
|                 | possibly sp. nov.             | Grassland       | Goyder 8351                           |                   |
| Smilacaceae     | Smilax anceps Willd.          | Ruderal         | sight record 16                       |                   |
| Xyridaceae      | Xyris capensis Thunb.         | Wetland         | Goyder 8373                           |                   |
|                 | Xyris congensis Büttner       | Wetland         | Barker et al. 64; Goyder 8322         |                   |
|                 | Xyris foliolata L.A.Nilsson   | Wetland         | Barker et al. 128                     |                   |
|                 | Xyris friezi Malme            | Wetland         | Goyder & Maiato 8800                  | Mexico            |
|                 | Xyris imitatrix Malme         | Wetland         | Goyder 8332                           |                   |
| Zingiberaceae   | Aframomum albiovaleaceum (Ridl.) K.Schum. | Ruderal       | sight record 17                       |                   |
|                 | Siphonochilus aethiopicus (Schweinf.) B.L.Burtt | Grassland Woodland | Frisby 3089; Goyder & Maiato 8769    |                   |
|                 | Siphonochilus punticulatus (Gagnep.) Lock | Grassland Woodland | Frisby 3076; Goyder & Maiato 8770    |                   |
| ANGIOSPERMAE: EUDICOTS |                  |                 |                                       |                   |
| Acanthaceae     | Barleria crassa C.B.Clarke subsp. crassa | Woodland        | Goyder 8028                           |                   |
|                 | Barleria sp. nov.             | Grassland       | Goyder 8343; Goyder 8952              |                   |
|                 | Blepharis flavus Vollesen     | Grassland       | Goyder 8277                           | Mexico            |
|                 | Blepharis glaucaea S.Moore   | Grassland       | Goyder 8909                           |                   |
|                 | Justicia subserisil Oliv.     | Grassland       | Barker et al. 89                      |                   |
|                 | Lepidagathis macrochila Lindau | Woodland        | Baum 779; Goyder 8040; Goyder 8415    | Mexico            |
|                 | Srothlantopsis linifolia (T.Anderson ex C.B.Clarke) Milne-Redh. | Woodland | Barker et al. 107; Goyder 8026        | Mexico            |
|                 | Thunbergia guswelleri S.Moore | Woodland         | Goyder 8241                           | Mexico            |
| Amaranthaceae   | Mechowia grandiflora Schinz   | Grassland       | Frisby 4010; Goyder 8112; Goyder 8385 | Mexico            |
| Family              | Species                                      | Habitat | Vouchers                        | New Records |
|---------------------|----------------------------------------------|---------|---------------------------------|-------------|
| Anacardiaceae       | *Lannea gossweileri* Exell & Mendonça subsp. gossweileri | Grassland | Goyder & Maiato 8834            |             |
|                     | *Ozoroa stenophylla* (Engl. & Gilg) R.Fern. & A.Fern. | Grassland | Baum 662; Frisby 3012; Goyder 8310 | Mexico      |
|                     | *Ozoroa verticillata* (Engl.) R.Fern. & A.Fern. | Grassland | Goyder 8287                     | Mexico      |
|                     | *Rhus gracilipes* Exell                      | Woodland | Goyder 8254                    | Mexico      |
|                     | *Rhus kirkii* Oliv.                          | Grassland | Goyder 8344; Goyder 8911        |             |
| Anisophylleaceae    | *Anisophyllea Boehmii* Engl.                 | Woodland | Goyder 8232                    |             |
|                     | *Anisophyllea fruticulosa* Engl. & Gilg       | Grassland | Barker et al. 46; Baum 8081; Gossweiler 2856; Goyder 8106; Goyder & Maiato 8765 |             |
| Apocynaceae         | *Chamaecitandra henriquesiana* (Hallier f.) Pichon | Grassland | Barker et al. 81; Goyder & Maiato 8766; Goyder & Maiato 8807 | Mexico      |
|                     | *Ceropegia racemosa* N.E.Br.                  | Woodland | Goyder 8402                    | Mexico      |
|                     | *Cryptolepis oblongifolia* (Meisn.) Schltr.   | Woodland | Barker et al. 78; Barker et al. 112; Frisby 3037; Goyder 8118; Goyder 8124; Goyder 8300 |             |
|                     | *Diplorhynchus condylocarpon* (Müll.Arg.) Pichon | Grassland | Barker et al. 52A; Frisby 3058; Frisby 3061; Goyder 8213; Goyder 8381; Goyder 8445; sight record 1; sight record 8; sight record 36 |             |
|                     | *Glossostelma ceciliae* (N.E.Br.) Goyder     | Grassland | Frisby 4033; Goyder & Maiato 8789 |             |
|                     | *Campocarpus semiamplexatus* K.Schum.        | Woodland | Barker et al. 121              |             |
|                     | *Landolphia campotoloba* (K.Schum.) Pichon    | Woodland | Barker et al. 49; Barker et al. 122; Baum 669; Frisby 4004; Goyder 8025; Goyder 8400 |             |
|                     | *Landolphia cuneifolia* Pichon                | Woodland | Goyder 8331                    |             |
|                     | *Landolphia lanceolata* (K.Schum.) Pichon     | Grassland | Barker et al. 79; Goyder 8019; Goyder 8266; Goyder & Maiato 8803 |             |
|                     | *Landolphia thollonii* Dewèvre               | Grassland | Goyder 8431; Goyder & Maiato 8825 [photographic record] | Mexico      |
|                     | *Orthanthera gossweileri* C.Norman            | Grassland | Frisby 3051; Goyder 8500; Goyder & Maiato 8827 | Mexico      |
|                     | *Raphionacme globosa* K.Schum.               | Grassland | Goyder & Maiato 8797            | Mexico      |
|                     | *Raphionacme linearii* K.Schum.              | Wetland  | Frisby 3020; Frisby 3035; Frisby 3039; Frisby 3078; Goyder & Maiato 8776; Goyder & Maiato 8856 | Mexico      |
|                     | *Raphionacme michelii* De Wild.              | Grassland | Frisby 3026; Goyder & Maiato 8788; Goyder & Maiato 8809; Goyder & Maiato 8771 | Mexico      |
|                     | *Secamone brevipes* (Benth.) Pichon          | Woodland | Goyder 8330                    | Mexico      |
|                     | *Secamone dewevei De Wild. subsp. elliptica* Goyder | Woodland | Goyder 8041; Goyder 8223        |             |
|                     | *Strophanthus welwitschii* (Baill.) K.Schum. | Woodland | Goyder & Maiato 8837            |             |
|                     | *Tabernanthe iboga* Baill.                   | Woodland | Goyder 8226; sight record 18    |             |
|                     | *Xysonelobium bolubii* Scott Elliot          | Wetland  | Baum 715; Frisby 3034; Goyder & Maiato 8785; Goyder & Maiato 8853 | Mexico      |
| Campanulaceae       | *Lobelia* sp.                                | Grassland | Barker et al. 116              |             |
|                     | *Wahlenbergia collomistes* (A.DC.) Thulin    | Grassland | Goyder 8906                    |             |
|                     | *Wahlenbergia possibly sp. B of Thulin* (1975) | Grassland | Barker et al. 94               |             |
| Family          | Species                          | Habitat  | Vouchers                                                                 | New Records |
|-----------------|----------------------------------|----------|--------------------------------------------------------------------------|-------------|
| Caryophyllaceae | *Polycarpaea corymbosa* (L.) Lam. | Grassland| Barker et al. 132; Baum 818; Goyder 8457                                 |             |
| Celastraceae    | *Gymnosporia senegalensis* (Lam.) Loes. | Wetland  | Goyder 8934                                                              |             |
|                 | *Salacia bussii* Loes.            | Grassland| Goyder 8292; Goyder & Maiato 8810                                        | Moxico      |
| Chrysobalanaceae| *Parinari capensis* Harv.         | Grassland| Barker et al. 130; Goyder 8256                                           |             |
|                 | *Parinari curatellifolia* Planch. ex Benth. | Woodland| Goyder 8444                                                              |             |
| Combretaceae    | *Combretum dumetorum* Exell       | Woodland | Goyder 8426                                                              | Moxico      |
|                 | *Combretum gusweileri* Exell      | Woodland | Goyder 8023                                                              |             |
|                 | *Combretum platypetalum* Welw. ex M.A.Lawson | Grassland| Frisby 3036; Goyder 8121                                                  |             |
|                 | *Combretum psidioides* Welw. subsp. psidioides | Grassland| Frisby 3053; Goyder 8345                                                  |             |
|                 | *Combretum sp. not matched 1*     | Woodland | Goyder 8307                                                              |             |
|                 | *Combretum sp. not matched 2*     | Grassland| Goyder 8346                                                              |             |
|                 | *Prelopsis anisoptera* (Welw. ex M.A.Lawson) Engl. & Diels | Woodland | Goyder 8418                                                              |             |
|                 | *Terminalia brachystemma* Welw. ex Hiern | Woodland| Frisby 3011; Goyder 8378                                                  |             |
| Compositae      | *Anisopappus chinensis* Hook. & Arn. | Grassland| Goyder 8908                                                              |             |
|                 | *Bidens crocea* Welw. ex O.Hoffm. | Woodland | Goyder 8253                                                              |             |
|                 | *Blumea axillaris* (Lam.) DC.     | Grassland| Barker et al. 134                                                        |             |
|                 | *Crassocephalum* sp. not matched  | Woodland | Goyder 8305                                                              |             |
|                 | *Dicoma schinzii* O.Hoffm.        | Grassland| Barker et al. 85                                                         |             |
|                 | *Emilia baumii* (O.Hoffm.) S.Moore | Woodland | Baum 707; Goyder 8252; Goyder 8910                                       | Moxico      |
|                 | *Erlangia miura* (Oliv. & Hiern) S.Moore | Woodland | Barker et al. 125                                                        |             |
|                 | *Hypericophyllum gusweileri* S.Moore | Grassland| Goyder 8948                                                              | Angola       |
|                 | *Mikania sagittifera* B.L.Robb.   | Grassland| Barker et al. 104; Baum 679                                               |             |
|                 | *Nidorella resedifolia* DC.       | Grassland| Barker et al. 126                                                        |             |
|                 | *Paucicardia baumii* O.Hoffm.     | Grassland| Frisby 3013; Goyder 8111                                                 |             |
|                 | *Pleiotaxis linearifolia* O. Hoffm. | Grassland| Barker et al. 69; Barker et al. 120                                       |             |
|                 | *Pleiotaxis rugosa* O.Hoffm.      | Woodland | Barker et al. 75                                                         |             |
|                 | *Pleiotaxis subcaposa* C.Jeffrey   | Grassland| Goyder 8279; Goyder 8456                                                 | Moxico      |
|                 | *Pseudognaphalium latealbum* (L.) Hilliard & B.L.Burtt | Grassland| Barker et al. 70; Frisby 3019                                             |             |
|                 | *Senecio strictifolius* Hiern     | Wetland  | Barker et al. 110; Barker et al. 127; Goyder 8915                        |             |
|                 | *Vernonia sp. nov.*               | Wetland  | Goyder 8357                                                              |             |
|                 | *Vernonia* sp.                    | Grassland| Goyder 8459                                                              |             |
|                 | *Vernonia gerberiformis* Oliv. & Hiern subsp. gerberiformis var. gerberiformis | Grassland| Goyder 8109                                                              |             |
|                 | *Vernonia ornata* S.Moore         | Wetland  | Frisby 3091                                                              |             |
|                 | *Vernonia poskeana* Vatke & Hildebr. subsp. poskeana | Woodland| Barker et al. 84                                                         |             |
|                 | *Vernonia subplumosa* O.Hoffm.    | Woodland | Baum 703; Goyder 8286                                                    | Moxico      |
|                 | *Vernonia turbinella* S.Moore     | Woodland | Goyder 8017                                                              |             |
| Convolvulaceae  | *Ipomoea welwitschii* Vatke ex Hallier f. | Grassland| Goyder & Maiato 8828                                                   | Moxico      |
| Cucurbitaceae   | *Acanthosicyos naudinianus* (Sond.) C. Jeffrey | Ruderal; Grassland| Barker et al. 119; Goyder 8086                                           |             |
| Dilleniaceae    | *Tetracera poggei* Gilg           | Woodland | Goyder 8021; Goyder 8214                                                 | Bié; Moxico |
| Dipterocarpaceae| *Monotes dasyanthus* Gilg         | Woodland | Goyder 8039; sight record 34                                              |             |
| Family          | Species                              | Habitat     | Vouchers                      | New Records   |
|-----------------|--------------------------------------|-------------|-------------------------------|---------------|
| Dipterocarpaceae| *Monotes glaber* Sprague             | Woodland    | Goyder 8014; Goyder 8122;     |               |
|                 | *Monotes gossweileri* De Wild.       | Grassland   | Goyder 8338; Goyder 8951      |               |
| Droseraceae     | *Drosena affinis* Welw. ex Oliv.     | Wetland     | Baum 687; Goyder 8260; Goyder|               |
|                 | *Drosena burkeana* Planch.           | Wetland     | Goyder & Maiato 8794          |               |
|                 | *Drosena madagascariensis* DC.       | Wetland     | Frisy 4011; Goyder 8003; Goyder|               |
|                 |                                       |             | 8006; Goyder 8372; sight record|               |
|                 |                                       |             | 40; Goyder & Maiato 8786      |               |
| Ebenaceae       | *Diospyros batocana* Hiern           | Woodland    | Barker et al. 142; Goyder 8029|               |
|                 | *Diospyros chamaethamnus* Dinter ex  | Grassland   | Goyder 8901                   |               |
|                 | Mildbr.                              |             |                               |               |
|                 | *Diospyros pseudomespilus* Mildbr. subsp. | Woodland    | Goyder 8032; sight record 32  |               |
|                 | *Diospyros virgata* (Gürke) Brenan   | Woodland    | Goyder 8015                   |               |
| Ericaceae       | *Erica benguelensis* (Welw. ex Engl.)| Grassland   | Goyder 8352                   |               |
|                 | *E.G.H.Oliv. var. benguelensis*      |             |                               |               |
| Euphorbiaceae   | *Acalypha* sp. not matched           | Grassland   | Goyder & Maiato 8802; Goyder  |               |
|                 | *Maprounia africana* Müll.Arg. pyrophytic | Grassland    | Goyder & Maiato 8814          |               |
|                 | *Pyrophea oblongifolia* (Müll.Arg.)* | Grassland   | Goyder 8314; Goyder & Maiato  |               |
|                 | *Kruit & Roebers*                    |             | 8844                          |               |
| Gentianaceae    | *Farot salutaris* Welw.              | Wetland;    | Barker et al. 53; Frisy 4000; |               |
|                 | *Neurobea congolana* De Wild. & T.Durand | Grassland    | Goyder 8216                   |               |
|                 | *Pycnophaea buchananii* (Baker) N.E.Br. | Wetland     | Goyder 8234; Goyder 8354      | Mexico        |
|                 | *Schinzella tetragona* (Schinz) Gilg | Grassland   | Goyder 8462                   |               |
|                 | *Haumaniastrum katangense* (S.Moore) | Grassland   | Goyder 8333; Goyder 8355      |               |
|                 | *Haumaniastrum prealtum* (Briq.)     | Grassland   | Goyder 8949                   |               |
| Gisekiaceae     | *Gisekia africana* (Lour.) Kuntze    | Grassland   | Barker et al. 124; Goyder 8233;|               |
|                 | *Haumaniastrum katangense* (S.Moore) | Grassland   | Goyder 8949                   |               |
| Hypericaceae    | *Hypericum oligandrum* Milne-Redh.   | Wetland     | Frisy 4026                    |               |
|                 | *Porporpermum baumii* Engl.          | Woodland    | Frisy 4003; Goyder 8221       | Bié           |
| Ixonanthaceae   | *Ochthocosmus lemaireanui* T.Durand & | Woodland    | Barker et al. 48; Barker et al.|               |
|                 | *H. Durand*                          |             | 74; Baum 712; Goyder 8095; Goyder|               |
|                 |                                       |             | 8311; Goyder 8313; sight record|               |
|                 |                                       |             | 27                            | Mexico        |
| Lamiaceae       | *Alvesia rosmarinifolia* Welw.       | Woodland    | Barker et al. 45; Baum 676;   |               |
|                 | *Clerodendrum baumii* Gürke          | Grassland   | Goyder 8036                   |               |
|                 | *Clerodendrum buchneri* Gürke        | Grassland   | Goyder 8262                   |               |
|                 | *Clerodendrum formicarum* Gürke      | Grassland   | Goyder & Maiato 8798          |               |
|                 | *Endostemon sp. nov.*                | Grassland   | Goyder & Maiato 8762          |               |
|                 | *Haumaniastrum prealtum* (Briq.)     | Grassland   | Goyder 8341; Goyder 8454      | Mexico        |
|                 | *Haumaniastrum prealtum* (Briq.)     | Grassland   | Goyder 8341; Goyder 8454      | Mexico        |
|                 | *Haumaniastrum prealtum* (Briq.)     | Grassland   | Goyder 8440                   |               |
|                 | *Kalabaria uncinata* (Schinz) Moldenke | Grassland    | Goyder & Maiato 8782          |               |
|                 | *Leonotis nepetifolia* (L.) R.Br. var.| Ruderal     | Baum 822                      |               |
|                 | *nepetifolia*                        |             |                               |               |
| Family       | Species                                          | Habitat            | Vouchers                                      | New Records       |
|--------------|--------------------------------------------------|--------------------|-----------------------------------------------|-------------------|
| **Lamiaceae**|                                                  |                    |                                               |                   |
|              | *Ocimum obovatum* E.Mey. ex Benth. var. obovatum| Grassland          | Goyder & Maiato 8787                          |                   |
|              | *Plectranthus betonicifolius* Baker              | Wetland            | Goyder 8463                                   | Mexico            |
|              | *Plectranthus gracillens* (T.C.E.Fr.) Hutch. & Dandy | Grassland         | Goyder 8902                                   |                   |
|              | *Plectranthus guerki* Briq.                     | Grassland          | Barker et al. 86                              |                   |
|              | *Plectranthus mirabilis* (Briq.) Launert         | Wetland            | Barker et al. 140; Baum 794; Goyder 8007; Goyder 8928 |                   |
|              | *Pycnostachys gracilis* R.D.Good                 | Woodland           | Goyder 8441                                   |                   |
|              | *Tinnea eriocalpa* Welw.                        | Grassland          | Goyder 8250                                   |                   |
|              | *Tinnea fuscoluteola* Gücke                     | Grassland          | Baum 697; Goyder 8458                         | Mexico            |
|              | *Vitex madiensis* Oliv. subsp. milanjensis*(Britten) E.White | Woodland         | Frisby 3023; Frisby 3046; Goyder 8044; Goyder 8416; Goyder 8428 |                   |
| **Lecythidaceae**|                                                  |                    |                                               |                   |
|              | *Napoleonaea gosweileri* Baker f.               | Grassland          | Goyder 8107; Goyder & Maiato 8812             | Mexico            |
| **Leguminosae**|                                                  |                    |                                               |                   |
|              | *Aeschynomene dimidiata* Welw. ex Baker          | Woodland           | Goyder 8392                                   | Mexico            |
|              | *Aeschynomene glabrescens* Welw. ex Baker        | Wetland            | Goyder & Maiato 8784                          |                   |
|              | *Albizia adianthifolia* (Schumach.) W.Gight     | Woodland           | Goyder 8212                                   |                   |
|              | *Baphia massiensis* Taub. subsp. obovata*(Schinz) Brummitt var. obovata | Woodland         | Frisby 3024; Goyder 8092; Goyder 8449; sight record 7; sight record 31; Goyder & Maiato 8780 |                   |
|              | *Baphia sp. nov.*                               | Grassland          | Goyder & Maiato 8772                          |                   |
|              | *Bauninia mendoncaea* Torre & Hillc.             | Woodland           | Barker et al. 76; Goyder 8030; Goyder 8391    |                   |
|              | *Bauninia petersonia* Bolle subsp. macrantha*(Oliv.) Brummitt & J.H. Ross | Woodland         | Frisby 4017                                   |                   |
|              | *Bolgonia madagascariensis* (Desv.) J.H. Kirkbr. & Wiersema | Woodland         | Goyder 8031; Goyder 8384; Goyder 8429; Goyder 8450 |                   |
|              | *Brachystegia bakertiana* Hutch. & Burtt Davy   | Woodland           | Barker et al. 100; Frisby 3014; Goyder 8020; Goyder 8090; Goyder 8116; Goyder 8386; Goyder 8430; Goyder 8432; Goyder 8448; sight record 10 |                   |
|              | *Brachystegia longifolia* Benth.                | Grassland; Woodland| Goyder 8011; Goyder 8328; Goyder 8921         |                   |
|              | *Brachystegia spiciformis* Benth.               | Woodland           | Goyder 8038                                   |                   |
|              | *Burkea africana* Hook.                         | Grassland          | Goyder 8379; sight record 37; sight record 43  |                   |
|              | *Chaetecrista mimonoides* (L.) Greene sens. lat. | Woodland          | Barker et al. 83                              |                   |
|              | *Clitoria baesneri* Harms – depauperate form    | Grassland          | Goyder & Maiato 8758                          |                   |
|              | *Copaifera baumiana* Harms                      | Grassland; Woodland| Goyder 8018; Goyder 8113; Goyder 8224; Goyder 8388; sight record 3; Goyder & Maiato 8847; Goyder 8919 |                   |
|              | *Crotalaria abscondita* Welw. ex Baker          | Grassland          | Goyder 8465                                   | Mexico            |
|              | *Crotalaria angulicarpa* Harms                   | Grassland          | Goyder 8452                                   | Mexico            |
|              | *Crotalaria annua* Milne-Redh.                  | Grassland          | Goyder 8900                                   |                   |
|              | *Crotalaria kambolensis* Baker f.               | Woodland           | Goyder 8424                                   |                   |
|              | *Crotalaria leptocladia* Harms                  | Grassland          | Baum 829                                     |                   |
|              | *Crotalaria mendoncae* Torre                     | Woodland           | Goyder 8016; Goyder 8103; sight record 26     | Cuando Cubango    |
| Family               | Species                                      | Habitat                      | Vouchers                          | New Records |
|---------------------|----------------------------------------------|------------------------------|-----------------------------------|-------------|
| **Leguminosae**     | **Crotalaria stenoptera** Welw. ex Baker     | Grassland; Wetland; Woodland | Barker et al. 146; Baum 677; Goyder 8093; Goyder 8257 |             |
|                     | **Crotalaria youngii** Baker f.              | Grassland; Woodland          | Goyder 8218                       |             |
|                     | **Crotalaria cf. youngii** Baker f.          | Grassland; Woodland          | Barker et al. 144; Goyder 8944    |             |
|                     | **Cryptosepalum esfoliatum** De Wild. subsp. pseudotaxus (Baker f.) P.A.Duvign. & Brenan | Woodland                      | Goyder 8022; Goyder 8323; Goyder 8446; sight record 4; sight record 12; sight record 24 |             |
|                     | **Cryptosepalum miniosoides** Welw. ex Oliv. | Grassland                    | Goyder 8372; Goyder & Maiato 8751 | Mexico      |
|                     | **Desmodium barbatum** (L.) Benth. var. dimorphum (Welw. ex Baker) B.G.Schub. | Grassland                          | Baum 685; Goyder 8502              |             |
|                     | **Dialium engleriunanum** Henriq.            | Woodland                     | Goyder & Maiato 8805              |             |
|                     | **Entada arenaria** Schinz subsp. arenaria | Grassland; Woodland          | Goyder 8390; Goyder & Maiato 8836 | Mexico      |
|                     | **Erythrophleum africanum** (Welw. ex Benth.) Harms | Woodland                          | Goyder 8010; Goyder 8380; Goyder 8389; sight record 29; Goyder 8922 |             |
|                     | **Erythrina baumii** Harms                   | Grassland                    | Frisby 4034; Goyder & Maiato 8767 |             |
|                     | **Guibouria colorasperma** (Benth.) J.Léonard | Woodland                          | Goyder 8035; Goyder 8377; sight record 2; sight record 13; sight record 23; sight record 30; sight record 35 |             |
|                     | **Indigofera baumiana** Harms                | Grassland                    | Baum 819; Goyder & Maiato 8818   |             |
|                     | **Indigofera sutherlandioides** Baker        | Woodland                     | Goyder 8046; Goyder 8955          |             |
|                     | **Kotschya strobilantha** (Welw. ex Baker) Dewit & P.A.Duvign. | Grassland                          | Barker et al. 56; Goyder 8091; Goyder 8943 |             |
|                     | **Julbernardia paniculata** (Benth.) Troupin | Woodland                          | Goyder 8012; Goyder 8089; Goyder 8123; Goyder 8308; Goyder 8443; sight record 11; sight record 19 |             |
|                     | **Macrotyloma rupestre** (Welw. ex Baker) Verdc. | Woodland                          | Goyder 8247                      | Mexico      |
|                     | **Pterocarpus angolensis** DC.               | Woodland                     | Barker et al. 52B; Goyder 8009; Goyder 8382; sight record 6; sight record 22; sight record 28 |             |
|                     | **Rhynchosia procurrens** (Hiern) K.Schum. | Woodland              | Barker et al. 77                  |             |
|                     | **Sphenostylis erecta** (Baker E) Hutch. ex Baker f. subsp. obtusifolia (Harms) Porter & Doyle  | Woodland                          | Goyder 8248; Goyder 8950          | Mexico      |
| **Lentibulariaceae** | **Genlisea angolensis** R.D.Good              | Wetland                      | Frisby 3073; Goyder 8120; Goyder 8315; Goyder 8371 | Mexico      |
|                     | **Utricularia gibba** L.                      | Wetland                      | Barker et al. 44a; Goyder 8098    |             |
|                     | **Utricularia spiralis** Sm.                  | Wetland                      | Frisby 3094; Goyder 8114          |             |
|                     | **Utricularia subulata** L.                   | Wetland                      | Baum 691; Goyder 8370             |             |
|                     | **Utricularia stellaris** L.f.                | Wetland                      | Frisby 3088                       |             |
| ** Limeaceae**      | **Limeum fenestratum** (Fenzl) Heimerl        | Grassland                    | Barker et al. 80; Baum 688        |             |
| ** Linderniaceae**  | **Crepiderhopalan** ?sp. nov.                | Grassland                    | Goyder 8917                       |             |
| ** Loranthaceae**   | **Englerina gabonensis** (Engl.) Balle        | Woodland                      | Goyder 8413                       |             |
|                     | **Tapinanthus dependens** (Engl.) Danser      | Woodland                      | Barker et al. 137                 |             |
| ** Lythraceae**     | **Rotala myriophylloides** Welw. ex Hiern    | Wetland                      | Barker et al. 68                  |             |
| ** Malvaceae**      | **Grewia falcitipula** K.Schum.              | Woodland                      | Frisby 3022                       |             |
|                     | **Grewia sp.**                                | Ruderal                      | Goyder & Maiato 8819             |             |
|                     | **Triumfetta dekindiana** Engl.               | Woodland                      | Barker et al. 133                 |             |
| Family             | Species                                                                 | Habitat | Vouchers                                      | New Records  |
|--------------------|--------------------------------------------------------------------------|---------|----------------------------------------------|--------------|
| Melastomataceae    | Antherotoma debilis (Sond.) Jacq.-Fél.                                   | Wetland | Barker et al. 47; Frisby 4031; Goyder 8094   |              |
|                    | Disotis brazzae Cogn.                                                    | Grassland | Goyder 8927                                   |              |
|                    | Disotis rhinanthifolia (Brenan) A.Fern. & R.Fern. var. rhinanthifolia     | Wetland | Goyder & Maiato 8823                          |              |
|                    | Disotis welwitschii Cogn.                                                | Wetland | Goyder 8240                                   | Mexico       |
|                    | Memecylon huillense A.Fern. & R.Fern.                                     | Woodland | Goyder 8399                                  | Mexico       |
| Meliaceae          | Trichilia quadridentatais C.D.C.                                         | Woodland | Frisby 3070; Goyder & Maiato 8839             | Mexico       |
| Menyanthaceae      | Nymphoides forbesiana (Griseb.) Kuntze                                  | Wetland | Goyder & Maiato 8824                          | Mexico       |
|                    | Nymphoides indica (L.) Kuntze subsp. occidentalis A.Raynal               | Wetland | Barker et al. 113                             |              |
| Moraceae           | Ficus pygmaea Welw. ex Hiern                                             | Wetland | Barker et al. 141                             |              |
|                    | Ficus verruculosa Warb.                                                  | Wetland | Goyder 8320                                   |              |
| Myricaceae         | Morella serrata (Lam.) Killick                                          | Wetland | Goyder 8914                                   |              |
| Myrtaceae          | Syzygium cordatum Hochst. ex Krauss subsp. cordatum                     | Wetland | Barker et al. 145; Goyder 8319                |              |
|                    | Syzygium guineense (Wild.) DC. subsp. huillense (Hiern) E.White          | Grassland | Barker et al. 67; Frisby 3045; Goyder 8339; Goyder 8309 |              |
|                    | Syzygium ovariense (P.Beauv.) Benth.                                    | Humid Forest | Goyder 8326                                  | Mexico       |
| Ochnaceae          | Brackenridgea arenaria (De Wild. & T.Durand) N.Robson                   | Grassland | Frisby 3015; Frisby 3016; Frisby 3060; Goyder & Maiato 8781; Goyder & Maiato 8804 |              |
|                    | Ochna katangensis De Wild.                                              | Grassland | Goyder & Maiato 8754A                          |              |
|                    | Ochna manikensis De Wild.                                               | Grassland | Frisby 3031; Goyder 8108; Goyder 8309         | Mexico       |
|                    | Ochna pulchra Hook.                                                     | Woodland | Goyder 8013; Goyder 8383; sight record 21     | Mexico       |
|                    | Ochna pygmaea Hiern                                                      | Grassland | Frisby 3059; Goyder & Maiato 8754B            | Mexico       |
| Olacaceae          | Olax gossweileri Exell & Mendonça                                         | Woodland | Goyder & Maiato 8846                          | Mexico       |
| Oleaceae           | Olea capensis L. subsp. macrocarpa (C.H.Wright) I.Verd.                 | Woodland | Goyder 8437                                   |              |
| Onagraceae         | Ludwigia octovalvis (Jacq.) P.H.Raven                                   | Wetland | Barker et al. 138                             |              |
| Orohbanccae        | Buchnera prorepeni Engl. & Gilg                                          | Grassland | Goyder 8349; Goyder 8451                      | Mexico       |
|                    | Buchnera attenuata Skan                                                  | Wetland | Frisby 3086; Frisby 4021                      |              |
|                    | Buchnera sp. not matched at K                                            | Grassland | Goyder 8276                                  |              |
|                    | Buchnera welwitschii Engl.                                               | Grassland | Barker et al. 93                              |              |
|                    | Cynium tubulosum (L.f.) Engl. subsp. tubulosum                           | Grassland | Frisby 4019                                  |              |
|                    | Gerardiina angolensis Engl.                                              | Wetland | Goyder 8101                                   |              |
|                    | Gerardiina angolensis Engl. – unusual form with branched inflorescence | Wetland | Goyder 8293                                   |              |
|                    | Melasma calycinum (Hiern) Hemsl.                                         | Wetland | Frisby 4018; Goyder & Maiato 8760             |              |
|                    | Micranteriella aphylla R.E.Fr.                                           | Wetland | Goyder & Maiato 8783                          | Mexico       |
|                    | Supertia simplex (Hochst.) Hochst.                                       | Wetland | Frisby 3083; Frisby 4024; Goyder & Maiato 8821 | Mexico       |
|                    | Striga angolensis K.I.Mohamed & Musselman                                | Wetland | Goyder 8336                                  |              |
|                    | Striga bilabiata (Thunb.) Kuntze                                         | Wetland | Frisby 4028; Goyder & Maiato 8795             | Mexico       |
| Passifloraceae     | Basananthe bauonai (Harms) W.J. de Wilde var. caeruleus (A.Fern. & R.Fern.) W.J. de Wilde | Grassland | Goyder & Maiato 8826                          |              |
| Passifloraceae     | Patopsis brazzaeanana Baill.                                             | Woodland | Barker et al. 101; Goyder 8024; sight record 25; Goyder 8920 |              |
| Pedaliaceae        | Sesamum calycinum Welv.                                                  | Grassland | Frisby 4022                                   |              |
| Family          | Species                          | Habitat         | Vouchers               | New Records |
|-----------------|----------------------------------|-----------------|------------------------|-------------|
| Peraceae        | *Clutia benguelensis* Müll.Arg.  | Grassland       | Goyder 8455            | Moxico      |
| Phrymaceae      | *Mimulus gracilis* R.Br.         | Wetland         | Barker et al. 135      |             |
| Phyllanthaceae  | *Bridelia davagneaudii* J.Léonard| Woodland        | Goyder 8423            | Moxico      |
|                 | *Hymenocardia acida* Tul.        | Woodland        | Goyder 8231            |             |
|                 | *Uapaca nitida* Müll.Arg.        | Woodland        | Goyder 8047; Goyder 8427|             |
|                 | *Uapaca nitida* Müll.Arg. – pyrophytic form | Grassland | Goyder 8217 |             |
| Picodendraceae  | *Oldfieldia dactylophylla* (Welw. ex Oliv.) | Grassland | Goyder 8267; Goyder 8421|             |
| Plantaginaceae  | *Limnophylla ceratophylloides* (Hiern) Skan | Wetland | Goyder 8318 | Moxico      |
| Polygalaceae    | *Polygala africana* Chodat       | Wetland         | Frisby 4027            |             |
|                 | *Polygala arenicola* Gürke       | Woodland        | Barker et al. 123; Goyder 8229|             |
|                 | *Polygala dewevrei* Exell        | Wetland         | Goyder 8361 (blue fls); Goyder 8362 (white fls); Goyder & Maiato 8849; Goyder 8926 | Bié        |
|                 | *Polygala gomesiana* Welw. ex Oliv. | Wetland | Goyder 8374 | Cuando Cubango |
|                 | *Polygala balacaritensis* Schinz | Grassland       | Barker et al. 96       |             |
|                 | *Polygala mendocae* E.M.A.Petit  | Woodland        | Goyder 8037; Goyder 8417|             |
|                 | *Polygala nambatensis* Gürke     | Grassland       | Goyder 8453            | Moxico      |
|                 | *Polygala nematophylla* Exell    | Grassland       | Goyder 8366            | Moxico      |
|                 | *Polygala paludicola* Gürke      | Wetland         | Barker et al. 92; Frisby 3040; Frisby 3085; Goyder 8119; Goyder 8926 | Moxico     |
|                 | *Polygala pogei* Gürke           | Grassland       | Goyder 8278            | Moxico      |
|                 | *Polygala rivularis* Gürke       | Grassland       | Barker et al. 90       |             |
|                 | *Polygala robusta* Gürke         | Grassland       | Baum 704; Frisby 3047; Goyder 8085; Goyder 8280; Goyder 8303; Goyder 8411 | Moxico     |
|                 | *Polygala spicata* Chodat        | Wetland         | Frisby 3084; Goyder 8235; Goyder 8363 |             |
|                 | *Polygala welwitchii* Chodat subsp. pygmaea (Gürke) Paiva | Grassland | Goyder 8350; Goyder 8916 | Moxico      |
|                 | *Securidaca longipedunculata* Fresen. | Woodland | sight record 44 |             |
| Polygonaceae    | *Oxygonum annuum* S.Ortíz & Paiva | Grassland | Goyder 8348 | Moxico      |
|                 | *Oxygonum fruticosum* Dammer ex Milne-Redh. | Woodland | Goyder 8008; Goyder 8105; Goyder 8954 |             |
|                 | *Oxygonum pachybasis* Milne-Redh. | Grassland | Frisby 3090; Goyder & Maiato 8799 | Moxico      |
| Proteaceae      | *Faurea delevoyi* De Wild.       | Wetland; Woodland | Goyder 8398 |             |
|                 | *Faurea saligna* Harv.           | Woodland        | Barker et al. 102      |             |
|                 | *Protea angolensis* Welw. var. angolensis | Grassland | Goyder 8410 | Moxico      |
|                 | *Protea baumii* Engl. & Gilg subsp. baumii | Grassland | Barker et al. 106 |             |
|                 | *Protea petiolaris* (Hiern) Baker & C.H.Wright subsp. petiolaris | Grassland | Goyder 8412 | Moxico      |
|                 | *Protea pogei* Engl. subsp. haemantha Chisumpa & Brummitt | Woodland | Baum 709; Goyder 8215; sight record 14; Goyder 8956 | Bié; Moxico |
|                 | *Protea welwitchii* Engl.         | Grassland       | Goyder 8117; Goyder 8353; Goyder 8397; Goyder 8460 | Moxico      |
| Ranunculaceae   | *Clematis villosa* DC.           | Grassland       | Goyder 8912            |             |
| Rosaceae        | *Cliffortia nitidula* R.E.Fr. & T.C.E.Fr. var. angolensis* (Weim.) Brenan | Grassland | Barker et al. 103; Baum 650; Goyder 8395; Goyder & Maiato 8855; Goyder 8932 |             |
| Rubiaceae       | *Ancylanthos rubiginosus* Desf.  | Grassland       | Frisby 3056; Goyder 8115; Goyder & Maiato 8775; Goyder & Maiato 8848 |             |
| Family          | Species                                      | Habitat         | Vouchers                  | New Records |
|-----------------|----------------------------------------------|-----------------|---------------------------|-------------|
| Rubiaceae       | Bertiera sp.                                | Humid Forest    | Goyder 8325               |             |
|                 | Diodia flavescens Hiern                    | Grassland       | Barker et al. 99          |             |
|                 | Fadogia cienkowski Schweinf.                | Grassland       | Frisby 3018; Goyder 8501  |             |
|                 | Fadogia fuchsiaides Oliv.                   | Grassland       | Goyder 8340               |             |
|                 | Fadogia gosweileri Robyns                  | Woodland        | Frisby 4032               |             |
|                 | Fadogia tomentosa De Wild. var. flaviflora (Robyns) Verde. | Woodland | Goyder 8246               |             |
|                 | Gangueula gosweileri (S.Moore) Robbr.      | Grassland       | Goyder & Maiato 8815      |             |
|                 | Gardenia imperialis K.Schum.               | Wetland         | Goyder 8321; Goyder 8394; sight record 39 |             |
|                 | Gardenia resiniflua Hiern subsp. resiniflua | Woodland       | Barker et al. 143         |             |
|                 | Gardenia resiniflua Hiern subsp. resiniflua – suffrutescent form | Woodland | Barker et al. 51; Frisby 4007 |             |
|                 | Leptactina benguelensis (Benth. & Hook.f.)R.D.Good | Woodland | Frisby 4029; Goyder & Maiato 8842 |             |
|                 | Morinda angolensis (R.D.Good) F.White       | Grassland       | Goyder & Maiato 8756; Goyder & Maiato 8851 | Mexico |
|                 | Pavetta nitidula Hiern                     | Woodland        | Goyder & Maiato 8840      |             |
|                 | Pavetta sp. 1                              | Woodland        | Goyder 8242               |             |
|                 | Pavetta sp. 2                              | Woodland        | Goyder 8249               |             |
|                 | Pavetta sp. 3                              | Grassland       | Goyder 8301               |             |
|                 | Psychotria sp.                             | Humid Forest    | Goyder 8324               |             |
|                 | Psydrax gilletii (De Wild.) Bridson        | Woodland        | Goyder 8434               |             |
|                 | Psydrax sp.                                | Woodland        | Goyder 8433               |             |
|                 | Pygmaeothamnus zeyheri (Sond.) Robyns      | Grassland       | Goyder & Maiato 8808; Goyder & Maiato 8811 |             |
|                 | Rothmannia engleriana (K.Schum.) Keay var. engleriana | Woodland | Goyder 8420               |             |
|                 | Rytignia orbicularis (K.Schum.) Robyns     | Woodland        | Goyder 8227               |             |
|                 | Triclaysia angolensis A.Rich. ex DC.       | Woodland        | Barker et al. 73          |             |
|                 | Triclaysia sp.                             | Woodland        | Goyder 8435               |             |
|                 | Vangueria sp. not matched at K             | Woodland        | Goyder 8265               |             |
|                 | Vangueriopsis cf. lanciflora (Hiern) Robyns | Woodland       | Goyder 8422               |             |
| Rutaceae        | Zanthoxylum gilletii (De Wild.) P.G.Waterman | Humid Forest    | Goyder 8327               | Mexico      |
| Santalaceae     | Theismus atrum A.W.Hill                    | Grassland       | Goyder 8342; Goyder & Maiato 8813 | Mexico      |
|                 | Theismus subaphyllum Engl.                 | Grassland       | Barker et al. 91; Goyder 8347; Goyder 8937 |             |
| Sapotaceae      | Chryophyllum bangwelense R.E.Fr.            | Woodland        | Goyder & Maiato 8841      |             |
|                 | Englerophyllum magalismontanum (Sond.) T.D.Penn. | Woodland | Goyder 8033; Goyder 8387; Goyder 8447; sight record 5 |             |
|                 | Englerophyllum magalismontanum (Sond.) T.D.Penn. – pyrophytic form | Grassland | Goyder & Maiato 8854 |             |
| Simaroubaceae   | Hannoa chlorantha Engl. & Gilg             | Woodland        | Barker et al. 66; Barker et al. 129; Baum 674; Goyder 8946 | Mexico      |
| Thymelaeaceae   | Craterosiphon quarrei Staner               | Woodland        | Goyder 8219; Goyder & Maiato 8845 | Mexico      |
|                 | Gnidia gosweileri (S.Moore) B.Peterson subsp. gosweileri | Wetland; Grassland | Barker et al. 88 |             |
|                 | Gnidia kraussiana Meisn.                   | Grassland       | Goyder 8110; Goyder & Maiato 8817 |             |
| Umbelliferae    | Afrocarum imbricatum (Schinz) Rauschert    | Wetland         | Goyder 8957               |             |
|                 | Pseudoseminum angolense (C.Norman)         | Grassland; Woodland | Goyder 8045; Goyder 8251; Goyder 8953 | Bié; Mexico |
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