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CHAPTER 1 VEGETATION TYPES OF VARIOUS WETLAND AREAS IN THE ZAMBEZI BASIN

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1.1 INTRODUCTION

Vegetation, or communities of plants, form structural units – habitats – which, in many cases, determine what other organisms can live or feed in an area. Vegetation, through its species composition as well as structure, also provides an excellent integration of environmental factors in that it reflects the climatic, physiographic, edaphic and biotic features pertaining to the land where it grows (Timberlake *et al.* 1993). From this it can be seen that an understanding of the vegetation of an area – its composition, structure and distribution – is fundamental in assessing biodiversity.

The two main vegetation maps covering the Zambezi Basin as a whole are that by Frank White (1983) covering all of Africa, and that by Wild and Barbosa (1968) covering the Flora Zambesiaca area. The former was presented at a scale of 1:5 million while the latter was at 1:2.5 million. In both cases the scale is too coarse to be of much value in differentiating wetland vegetation types within the basin. For this, scales around 1:250,000 or finer are required.

Wetland vegetation is particularly difficult to map. The main reason is inaccessibility and the difficulty in moving through the area. In addition, the structure – often that of a tall grassland – does not differ enough to be used as much of an aid, as it does for example in woodland. Most wetland vegetation is characterised by a lack of woody species and a dominance of grasses (Poaceae) and sedges (Cyperaceae), groups which are very speciose and contain species that are not always easy to identify. The use of satellite imagery and airphotos assists in the mapping process, but it is still difficult to separate some units out.

The major determining factor for wetland vegetation types is, of course, water. But subtle differences in period, timing, regularity or persistence of inundation, features which are not often apparent from airphotos or fieldwork at only one time of year, can result in significant changes in species composition and vegetation types.

1.1.2 Mapping of basin vegetation

One of the difficulties in mapping wetland vegetation types is the lack of a clear common legend or a categorization that can be used across a wide area. In Section 1.2 an attempt has been made to provide such a common legend that will work at least across the Zambezi Basin. This draws heavily on that used by Pete Smith in describing the vegetation of the Okavango Swamps in Botswana (Smith 1976, 1991).

Not much work has been carried out on the mapping of wetland vegetation within the Zambezi Basin, hence this attempt to provide reconnaissance-scale maps for three of the four IUCN sub-project areas. It had been intended to carry out a specific vegetation survey of the Lower Shire wetlands using air photos, but funds were not forthcoming. The following three accounts draw as much as possible on existing maps, surveys and descriptions. A strong effort has been made to try and create comparability between areas, but owing to the diverse and subtly-changing nature of

wetland vegetation this has not always been possible. Only in the case of the Zambezi Delta (Section 1.5) has original survey work been carried out. The maps of the East Caprivi and Barotseland are revisions based on existing surveys.

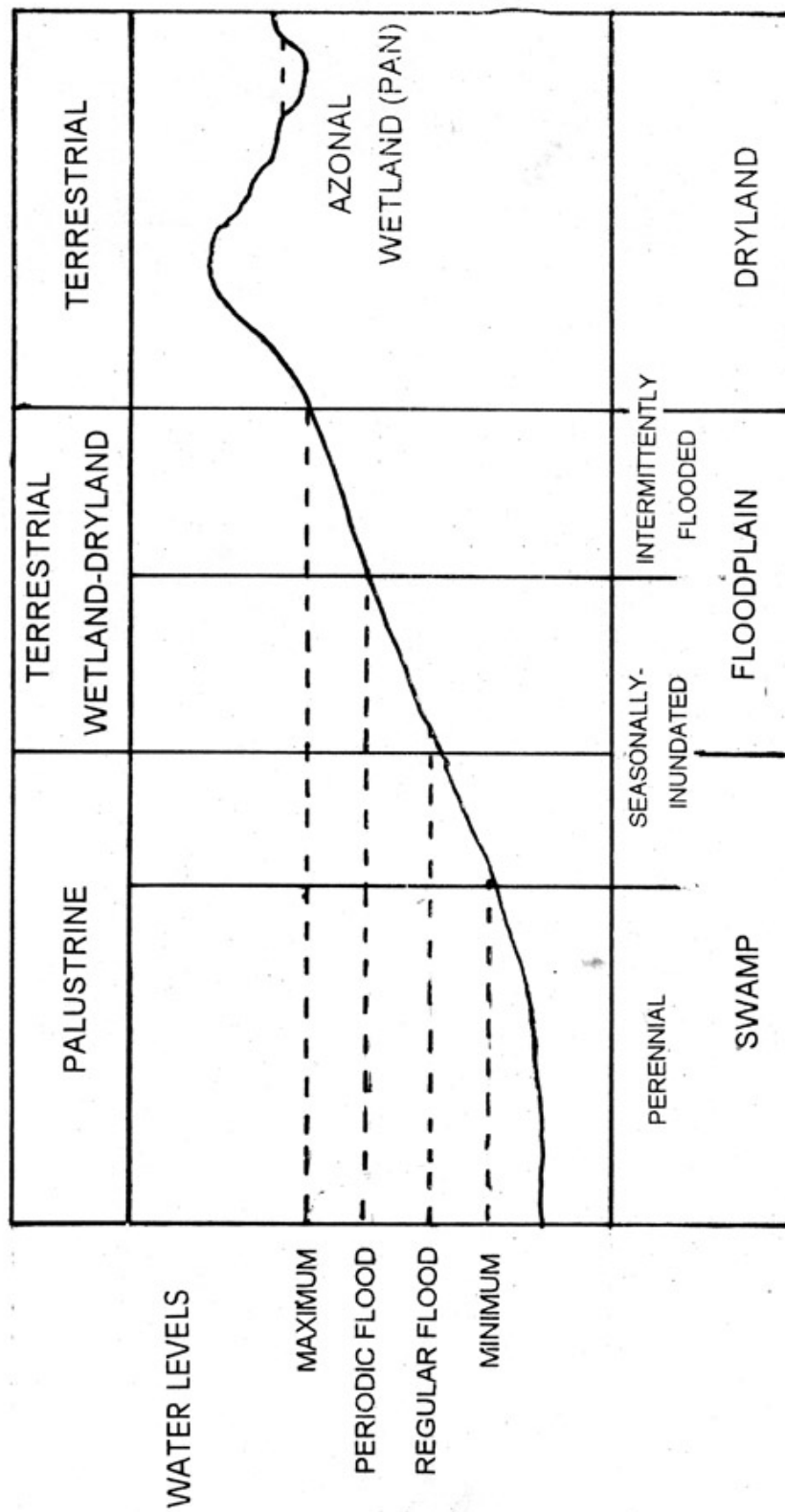
1.2 WETLAND VEGETATION AND HABITATS

1.2.1 Wetland habitats used in this study

As mentioned in the introduction, a common legend for wetland vegetation suitable for use across the basin is not available. An attempt is made here to provide this by describing ten wetland vegetation categories or classes, although there are many intermediates and it is often difficult to decide which group to put any particular wetland into. This legend is based on that produced by Pete Smith (1976, 1991) for use in the Okavango, and is presented diagrammatically in Figure 1.1. It should be recognised, however, that most wetlands consist of a variety of these habitats, some of limited extent and others predominant. It is the mosaic of habitats that gives diversity to the system.

- (a) Lakes – Large bodies of generally still or hardly-flowing water, shallow to a few metres deep. Shallow lakes with relatively clear water contain submerged and floating-leaved aquatics, but deep water or turbid water lakes only contain plants close to the shoreline. Man-made lakes and dams are often poorly vegetated (unless very shallow) due to unstable water levels.
 - (b) Channels – Here this refers to perennial rivers and smaller channels running through swamps. Water is flowing, usually fast in mid-stream of rivers, but much slower near the banks, and very slow in swamp channels. Plants found rooted in the substrate depend primarily on the speed of the current and turbidity of the water.
 - (c) Perennial swamps – Areas which are perennially wet (not just moist) and are usually well vegetated. Water moves through them, but at a slow rate. Papyrus (*Cyperus papyrus*) is often the dominant species.
 - (d) Seasonal swamps – Areas which are perennially moist and inundated for a large portion of the year, although not all of it. Obligate wetland species cannot survive year-round as growing individuals, but survive as seed or as underground storage organs. The grasses *Miscanthus* and *Phragmites* are typical.
 - (e) Floodplains – Extensive areas bordering a perennial river which are inundated with water for a significant part of the year, but usually less than six months. The high water table and poor drainage also preclude most trees and shrubs except on elevated ground such as termitaria. Grasses and herbs are the main life form, with some bulbiferous herbs. *Cynodon dactylon* is a common grass.
 - (f) Sandbanks – Banks of coarse sand in the middle or at the edge of perennial rivers. They are usually recently formed and repeatedly washed over by floodwaters. Plants found here are mostly "weeds" and adventives with short life cycles, although on more established sandbanks the reed *Phragmites* and the tree *Faidherbia albida* can form consolidating colonies.
 - (g) Riverbanks – These are the dry ground somewhat elevated above perennial rivers (riverbanks of seasonal rivers do not generally show a very different flora from the surrounding dryland).
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Figure 1.1 Diagram produced by Pete Smith (1976, 1991) for use in the Okavango, and used in this report as the basis for a legend describing ten broad wetland vegetation categories or classes across the Zambezi Basin.



Moisture is available to deeper-rooted plants at a depth of 1 to 5 m year-round. Vegetation often comprises trees and a dense shrub layer on the more elevated banks, with dense tall grass on the steep slopes or on banks regularly exposed to flowing water.

- (h) Dambos – Broad valleys, principally up on the Central African Plateau, that are waterlogged for some months during the wet season. The high water table, with little lateral movement, causes anaerobic conditions in the subsoil, thus precluding most woody species (except geoxylic suffrutices). The vegetation is grassland with scattered termitaria.
- (i) Pans – Depressions in dry ground (occasionally on floodplains) that fill up with water for part of the year, usually with rainwater but sometimes from a high water table. The water is still and fluctuates widely in temperature, and the substrate often muddy. Various small plant species are adapted to pan edges and can grow and reproduce rapidly there.
- (j) Seeps – Seasonal or perennial outflows of water, generally from a very limited area (few square metres) on sloping dryland underlain by rock. The ground is marshy and smaller plants that need moist or wet conditions replace those from the surrounding areas. Trees and shrubs are generally absent.

1.2.2 Alternate categories of wetland habitat

Although the wetland habitats used in this review and in the vegetation maps are those given in Section 1.2.1, there have been other, different, ways of categorizing wetland vegetation. One, described below, has been articulated by Bob Drummond (pers. comm., 1999) and incorporates the full range of riparian and wetland vegetation found in the Zambezi Basin.

A. Wetlands dominated by trees that can withstand flooding

- A1 - Swamp Forest: Most highly developed in the *mushitus* of the Zambezi headwaters area in Zambia and Angola.
- A2 - Riverine Forest: Often dominated by flood-tolerant species of *Syzygium* in the higher reaches, and *Aeschynomene elaphroxylon* and *Mimosa pigra* at lower altitudes.
- A3 - Wooded Riparian: Where rocks and shallow soil are present *Nuxia oppositifolia* and *Rhus quartiniana* are among the common species, along with the herbs *Pluchea discorides*, *Kanahia* and Podostemaceae.

B. Grasslands

The most extensive are floodplain and valley grasslands and dambos in the headwaters.

- B1 - Dambos.
- B2 - Riverine and Floodplain Grassland.
- B3 - Swamp Grassland: the Chobe, Okavango, Bangweulu, Lukanga and Busanga swamps are the main ones; silted dams and sewage ponds may become swamps.
- B4 - Pans.
- B5 - Seepage and Soak Zones: These are generally found overlying rock.

C. Aquatic Plants

Open water habitats, flowing or still, populated by submerged, floating-leaved or emergent aquatics.

1.3 EAST CAPRIVI, NAMIBIA

1.3.1 Introduction

Until recently the only vegetation map covering the East Caprivi strip of Namibia was that by White (1983), covering all of Africa. He shows the Kwando-Linyanti area as herbaceous freshwater swamp and aquatic vegetation (unit 75) and the Zambezi floodplain as edaphic grassland mosaic with semi-aquatic vegetation (unit 64). The map of South West Africa by Giess (1971) does not cover the Caprivi at all, nor did the map by Wild & Barbosa (1967) of the Flora Zambesiaca area, although the latter does show various types of swamp vegetation in the Kwando-Linyanti area and *Loudetia* grassland on the Zambezi floodplain. Various vegetation surveys cover adjacent parts of the Chobe (e.g. Weare & Yalala 1971, Coulson 1992, Simpson 1975), while Curson (1947) gives a good account of Caprivi vegetation but without a map. Recently, however, as part of the environmental profile of the Caprivi (Mendelsohn & Roberts 1997), a detailed vegetation map of the whole Caprivi was prepared using aerial photographs, Landsat TM imagery and fieldwork (Hines 1997).

In order to provide a simple map of the extent of wetlands in the East Caprivi that can be used for biodiversity assessment, two further maps were prepared – a map derived from the existing one by Hines (1997), and one produced directly from satellite imagery. Both draw heavily on this earlier work and are not supported in themselves by any fieldwork. The second, satellite image-based map, in particular, must be considered as just an hypothesis.

DERIVED MAP

1.3.2 Methods

Vegetation units considered to be wetland types, or to incorporate a significant wetland component, were listed using Hines' descriptions (Appendix in Mendelsohn & Roberts 1997). These were allocated to the wetland vegetation units given in Section 1.2 above, as shown in Table 1.1. Some vegetation units presented by Hines appear to be combinations of different wetland types, so it is not possible to trace directly from the boundaries given. Best judgement, coupled with a study of the same satellite images used in that mapping exercise, was used to revise boundaries or lump categories where thought necessary.

Only the more extensive wetland vegetation types listed in Section 1.2 were mapped, namely open water, perennial swamp, seasonal swamp, floodplains and river banks.

1.3.3 Results and discussion

The resulting map (Figure 1.2 - see page 19) shows the extent of what are here considered to be wetland vegetation types in the East Caprivi. The difference between perennial and seasonal swamp was difficult to determine, thus in effect unit 2 should be considered a combination of the two. Unit 4 (floodplains) also incorporates many small, unmappable (at this scale) patches of seasonal swamp. The riparian woodland along much of the Chobe is too narrow to be mapped, and along the Kwando it is all grouped under floodplain.

Floodplains here are taken to be those areas regularly inundated by floodwaters, not those only flooded every few years. It is the regularly flooded floodplains that support wetland biodiversity on a year-by-year basis. As would be expected, floodplains are the most extensive wetland type, but only occupy around 15% of the East Caprivi area. The total proportion occupied by wetland vegetation (as defined here) ranges from 18.6% of the total area (derived map) to 24.4% (Landsat map).

Table 1.1. Comparison of vegetation types for the Eastern Caprivi.

Map unit	Wetland type (section 1.2)	Vegetation type (Hines 1997)
1	Channels	Open water
2	Perennial Swamp	(Chobe wetland) (Zambezi floodplain channels)
3	Seasonal Swamp	(Maningimanzi channels) (Chobe wetland) (Okavango-Kwando grassland) Zambezi floodplain channels
4	Floodplains	Wet Mamili grassland (Bukalo-Liambezi grassland) Chobe swamp grassland (Chobe wetland) Kwando-Linyanti grassland Okavango-Kwando grassland Zambezi floodplain grassland
5	Riverbanks	(Maningamanzi channels) (Okavango-Kwando valley woodland) (Impalila woodlands) (Zambezi woodland)

Note: Vegetation types in brackets indicate only partial coverage.

LANDSAT MAP

1.3.4 Methods

Using 1:150,000 scale geometrically-corrected, false-colour Landsat TM images (dating from June/July 1994), the same images that were used for preparation of the various maps presented in Mendelsohn & Roberts (1997), a rapid interpretation was carried out to determine extent of some of the wetland vegetation types listed in Section 1.2 (above). The interpretation was not supported by fieldwork, or any great knowledge of the area. The descriptions give by Hines (1997) were drawn upon for clarification in places. The image did not cover the far eastern tip of the Caprivi.

1.3.5 Results and discussion

The wetland vegetation map is given as Figure 1.3 (see page 21). Only four units – open water, permanent/seasonal swamp, regularly flooded floodplains, Kwando floodplain/riparian woodland – were mapped. Open water was of limited extent, although there were many small channels too

small to be mapped at the given scale. As with the previous map, it was not possible to confidently separate permanent and seasonal swamp, thus they were combined. Regularly flooded floodplain was taken to be extensive grassland areas with little evidence of woody cover or cultivation/settlement. The vegetation along the Kwando is stated by Hines (1999) to be a combination of floodplain, limited swamp and riparian woodland. It was not possible to separate them at the mapping scale.

As with the previous map, floodplains were the most extensive wetland vegetation type, and cover a significant part of the eastern end of the East Caprivi, effectively the Zambezi floodplain but also extending some way up the Chobe. A large area along the Linyanti is also mapped as floodplain, although it does not appear as such on Hines' (1997) map. Extent of the various wetland types is given in Table 1.2.

Table 1.2. Comparison of extents of wetland vegetation types in East Caprivi.

Map unit	Wetland Type (section 1.2)	Extent (km ²)	
		Derived map (from Hines 1997)	Landsat map
1	Open Water	-	6
2/3	Perennial/Seasonal Swamp	268	1037
4	Floodplain	1873	1670
4/5	Kwando floodplain/woodland	21	124
TOTALS		2162	2837

1.3.6 Conclusions

The wetland vegetation types of the East Caprivi mostly comprise floodplains and permanent and seasonal swamps. Other wetland categories are limited in extent and not mappable at a landscape scale.

The major wetland area is the Zambezi floodplain downstream of Katima Mulilo, joining up with the lower Chobe floodplain. There appears to be a significant area of permanent swamp here. Other important areas are along the Kwando, Linyanti and Chobe rivers, especially the lower Kwando/upper Linyanti confluence.

The approximate extent of permanent/seasonal swamp is from over 250 to over 1000 km², depending on the map used, while floodplains cover from 1670 to 1870 km². Clearly there are major discrepancies.

Much detailed fieldwork will be required to clarify the given boundaries and determine differences between permanent and seasonal swamp and the extent of regularly flooded floodplains (which will have to be defined more carefully, perhaps using biological criteria).

1.4 BAROTSE FLOODPLAIN, WESTERN ZAMBIA

1.4.1 Introduction

The Barotse floodplain is here defined as the plains and tributary rivers or drainage lines associated with the Zambezi River in the Western Province of Zambia. Wetland areas to the north, in North Western Province, have not been included. Four vegetation maps cover the Barotse floodplain area, those by Edmonds (1976), Jeanes & Baars (1991), White (1983) and Wild & Barbosa (1967). There are also a number of vegetation surveys of the area or parts of it, e.g. Fanshawe (1969a, 1969b, 1969c, 1973), Jeanes (1985), Trapnell & Clothier (1937), Trapnell, Martin & Allan (1962), Verboom (1965) and Verboom & Brunt (1970), all carried out for agricultural, land evaluation or forestry purposes. The most detailed survey is the recent one by Jeanes & Baars (1991; see also Baars 1996) carried out for rangeland purposes. This study utilized a hierarchical Land Systems approach, Landsat MSS imagery, aerial photographs and extensive fieldwork, and especially concentrated on grasses.

However, one of the limitations of the Jeanes & Baars study from the perspective of wetland biodiversity assessment, is that it maps the main floodplain area as one undescribed unit ("unsurveyed flood plain grasslands (Bulozi floodplain)") and not much attention was paid to separating out the various wetland types as they were of limited rangeland significance.

1.4.2 Methods

Contrary to the approach adopted with the Caprivi wetland vegetation map (Section 1.2, above), only one map was prepared. The vegetation/land units shown by Jeanes & Baars (1991) are very detailed in their separation of dryland and wetland types, but additional interpretation of satellite imagery was necessary to (a) delineate and combine the various floodplain vegetation types, and (b) provide detail for the unmapped Bulozi floodplain.

Vegetation units considered to be wetland types, or to incorporate a significant wetland component, were listed using Jeanes & Baars' (1991) descriptions. These were allocated to the wetland vegetation units given in Section 1.2, as shown in Table 1.3. Many of their floodplain grasslands units had to be combined, as were some of the pan grasslands units. Best judgement, coupled with the use of two 1:250,000 scale geo-referenced, false-colour Landsat TM images dated 12 July 1996, was used to revise boundaries or combine mapped units. The interpretation was not supported by fieldwork, or any great knowledge of the area.

Only the more extensive wetland vegetation types were mapped, namely perennial swamp, seasonal swamp, floodplains inundated for a significant period every year, floodplains inundated for a shorter period of time, dambos and pans. In the woodlands on Kalahari sands on both East and West banks, there are a number of seasonal pans and dambos (or seasonally waterlogged drainage lines). Some of these have been separated out on the map, but generally they are indicated as also occurring within the terrestrial unit.

1.4.3 Results and discussion

The resulting map (Figure 1.4 - see page 23) shows the extent of what are here considered to be wetland vegetation types of the general Barotse floodplain area. Areas are given in Table 1.4. Perennial swamp, characterised by papyrus, is only found along the Luanginga River above Kalabo, while seasonal swamp appears in a matrix with longer-inundated floodplains flanking the Zambezi River on the Bulozi Plain, and also on some sections of the Lui River. In general, swamp vegetation is not as extensive on the Barotse floodplain as it is in East Caprivi or in the Zambezi Delta.

Table 1.3. Comparison of vegetation types for the Barotse floodplain.

Map unit	Wetland type (section 1.2)	Vegetation type (Jeanes & Baars 1991)
2	Perennial Swamp	R1 Lower drainage valleys - papyrus
3	Seasonal Swamp	F1 Floodplain grasslands - channel complex (F2 Floodplain grasslands - low plains & floodways) (R1 Lower drainage valleys - papyrus) (unsurveyed flood plain grasslands)
4.1	Floodplains (long duration)	F2 Floodplain grasslands - low plains & floodways (F3 Floodplain grasslands - low plains) (unsurveyed flood plain grasslands) (R3 Lower drainage valleys - dry riverplains)
4.2	Floodplains (shorter duration)	F3 Floodplain grasslands - low plains F4 Floodplain grasslands - low plains (R3 Lower drainage valleys - dry riverplains)
6	Dambos	(F2 Floodplain grasslands - low plains & floodways) (R1 Lower drainage valleys - papyrus) (R2 Lower drainage valleys - wet riverplains) (R3 Lower drainage valleys - dry riverplains)
7	Pans	P1 Pan grasslands - wet pans

Note: Vegetation types in brackets indicate only partial coverage.

It was difficult to consistently separate floodplains inundated for a significant period each year from those inundated for a shorter period (1-2 months?), but this was attempted using geomorphology and occurrence of still actively-growing vegetation in July. These areas lie closer to perennial rivers or drainage lines. Jeanes & Baars (1991) mention that the Bulozzi Plain has been subdivided by others into a broad upper level and older floodplain called *Saana*, which is principally found east of the Zambezi from Libanda south to around Namushakakende, and a larger area of more recent floodplain mostly west of the Zambezi. They emphasize that the Bulozzi Plain is such a complex mixture of pools, swamps, ox-bows, old and recent channels that is difficult to map or make generalizations about it.

There are a number of near-circular pans up on the Kalahari sands woodland plateau on the east bank, many of them associated with the upper reaches of drainage lines. A few are also present on the plateau fringes on the west bank. Also on the west bank, and north of the Luanginga River approaching the Liuwa Plains National Park, are many open grassy areas similar in appearance to

dambos. Again, these are not mapped individually and only a few are likely to support typical wetland vegetation. Most, however, are seasonally waterlogged and dominated by species typical of dambos.

Riverbank vegetation is not present (or very localized) on the Barotse floodplain as the Zambezi floodwaters are present for too long a period to allow woody vegetation to survive there. Such vegetation is common, however, downstream of Senanga where the floodplain is narrower and well-developed banks are present. The map of Jeanes & Baars (1991) shows swamp forest vegetation close to the Zambezi in the Lukulu area in the north of Western Province, but this was not surveyed by them and no further details are available. It is not clearly discernable on the satellite images.

Table 1.4. Extent of different vegetation types on the Barotse floodplain.

Map unit	Wetland Type (section 1.2)	Extent (km ²)
1	Open water	not mapped
2	Perennial/Seasonal swamp	38
3	Seasonal swamp	97
3/4.1	complex of swamp/floodplain	2273
4.1	Floodplain (long inundation)	2198
4.2	Floodplain (short inundation)	2817
5	Riverbanks	not mapped
6	Dambos	621
7	Pans	600
TOTAL		8644

1.4.4 Conclusions

The majority of the wetland areas of the Barotse floodplain area consists of floodplains inundated for shorter or longer periods each year. These are not clearly separable and are a complex of old and new channels, swamps and pools as well as extensive grassy plains. Approximate total extent is probably over 7200 km².

There is very little extent of permanent swamp characterised by papyrus. This is principally found along the lower reaches of the Luangingwa River, but also along part of the Lui and probably in places on the Bulozzi Plain. The approximate extent of perennial/seasonal swamp is 135 km², with a probable addition of 50-80 km² on the Bulozzi Plain.

Additional work, including fieldwork, is required to differentiate and map the categories of floodplain as reflected in vegetation composition and ecology. Also, the extent and distribution of permanent/seasonal swamp is not yet known. The distribution of pans and dambos that can be considered to support a wetland flora need to be investigated further.

1.5 ZAMBEZI DELTA, MOZAMBIQUE

1.5.1 Introduction

In terms of vegetation mapping, the Zambezi Delta was the least well covered of the four major Zambezi wetland areas. For this reason a reconnaissance-level vegetation map supported by fieldwork was carried out under this project. The area is extensive covering over 14,000 km², 12,800 km² of which is the delta proper on alluvium. For the purposes of this report the delta is defined as the low-lying area downstream of Mopeia extending to the Indian Ocean, including the mangroves. The western limit is the eastern extent of woodland on the Cheringoma Plateau, and the northern limit is the southern extent of woodland on the Campo Plateau, roughly following the Rio Cuacua. On its coastal margin the delta extends 70 km from Quelimane in the north to Isle Nhamatarara in the south.

White (1983) shows all the area as being mixed vegetation of the East African coastal mosaic (unit 16a), a unit which he describes as being mostly forest or woodland in structure. Wild & Barbosa (1968), much more accurately, describe it as formations on alluvium (unit 54). This type ranges from aquatic vegetation through swamps to riverine fringing forest and tree/shrub savanna with *Acacia polyacantha*. They also show areas within this of mangrove (14a) and coastal thicket (14b). The alluvial formations are flanked by moist lowland forest (unit 9) with *Pteleopsis myrtifolia*, *Erythrophleum suaveolens* and *Brachystegia spiciformis*. Barbosa (1952) in his vegetation descriptions of Zambezia Province, lumps all the delta area together as "hydrophilic grassland, with or without scattered trees, and forests on alluvium" (unit 14), a mosaic of poorly and better drained areas locally called *morrumbas* that also contains palm savanna. Mangroves and saline grassland (unit 18) are shown along tidal rivers. He states that species composition is primarily determined by drainage conditions. However, Barbosa's survey only covered the northern section of the delta and stopped at the Zambezi River. The adjacent woodland/forest (unit 3) is described as having *Pteleopsis myrtifolia*, *Millettia stuhlmannii* and *Brachystegia spiciformis*.

Recently, there has been a series of woody cover maps of Mozambique produced at a scale of 1:250,000 (CENACARTA 1998) based on satellite imagery. These show vegetation cover, but give no indication of species composition.

1.5.2 Methods

A landscape-guided phytosociological approach was taken to the present mapping. The units mapped are differentiated and described primarily on the basis of their constituent species, their position in the landscape and their structure. The map does not specifically reflect woody cover, nor does it set out to show vegetation structure and composition as it is today, but rather what it would naturally be.

The methodology follows that used in similar vegetation surveys carried out in Zimbabwe (Timberlake *et al.* 1993). Using a 1:250,000 scale geometrically-corrected, false colour Landsat TM image (166/073, dated 13 July 1996), an interpretation was carried out to delineate what appeared to be relatively homogeneous vegetation/ecological units, with particular reference to those considered to be wetlands or wetland-related. On the basis of this, a legend was constructed grouping similar units.

In September 1998 extensive aerial reconnaissance was flown over the study area, much of it at low level. At selected points (determined using a GPS) notes were made on broad vegetation type. In August/September 1999, ground-based fieldwork was carried out in accessible parts of the

Marromeu area (particularly Coutada 11 at the western margin of the Buffalo Reserve, and Malingapansi on the eastern margin). During this fieldwork 40 phytosociological samples were recorded following the method given in Timberlake *et al.* (1993). A full list of the plant species encountered within an area of about one hectare was noted and cover-abundance values allocated to each. Environmental notes on vegetation structure, soils, evidence of burning, etc. were also made. Species of uncertain identity were collected.

The ground-based fieldwork was augmented by extensive helicopter flights over the Marromeu Buffalo Reserve and adjacent palm savanna. A few landings were made in pre-determined areas in the grassland and phytosociological samples recorded. There was no helicopter or ground-based fieldwork in the northern sector of the delta.

On the basis of the field samples and extensive field observations, a further revision of the 1:250,000 scale interpretation was made. Some units in the original legend were amalgamated and boundaries were more critically drawn. The resulting 14 vegetation types were described in terms of their position in the landscape, structure and species composition, then grouped following a logical landscape and structural classification. The map was digitized and put onto a GIS, from which all area calculations were made. There were some significant inconsistencies between the previously-digitized basemap and the extent of some vegetation types as depicted on the satellite imagery, particularly on the lower reaches of major channels and along the coastline. However, this should not effect greatly the extents and general distribution, except that for mangrove and dune grassland.

1.5.3 Results and discussion

The 14 vegetation types, grouped into four landscape/structural classes, are described in detail in Appendix 1.1. The resulting map is given here as Figure 1.5 (see page 25), while Table 1.5 shows the individual extent of each type. The relation of these mapping units to wetland vegetation categories given in Section 1.2. is shown in Table 1.6. It should be noted that the great majority of the fieldwork was undertaken in types A1, A2, B1, C1 and C2; other types are inadequately described at present.

The vegetation of the Zambezi Delta falls fairly naturally into four classes. Of these, the forest and woodland types (class A) can not be considered as wetland types. The vegetation on alluvium consists primarily of savanna (class B) and grassland/swamp (class C), while mangroves and mud flats (types D1 and D2) occur on tidal reaches of various rivers with brackish or saline conditions. Dune grassland and beaches (D3) is a composite unit on recent coastal sand deposits, not always clearly separable at this scale, and found in narrow scattered bands fringing the ocean.

The forest and woodland vegetation types (A1 and A2) in practice define the delta boundary. They occur where the generally sandy soils start to rise away from the influence of regular flooding and/or seasonal inundation towards the Cheringoma plateau in the west and the Campo plateau in the north. This woodland is very species-rich with a forest-type understorey and verges into dry forest where the sand is deeper or has a lower groundwater level. Only the delta margins of these two types are mapped. What is of interest is that there is a difference in landscape, reflected in the composition and relative proportions of vegetation types, along the Rio Sessone on the west side of the Marromeu Reserve. This continues out into the savanna and grassland areas as the approximate boundary between palm savanna and wet grassland types. It is not clear if this reflects a difference in seasonal flooding regime (and groundwater levels) or a difference in age and/or substrate. Although these woodlands and forests have been heavily logged in the past, such that there are now

few individuals left of the most desired timber species and apparently poor regeneration, they are of major conservation interest in their own right as well as providing important habitat for birds, mammals and herpetofauna.

Table 1.5. Extent of different vegetation types in the Zambezi Delta.

Map unit	Wetland Type	Extent (km ²) ¹	Proportion of Delta area (%) ²
A1	Dry forest (<i>Pteleopsis/Millettia</i>)	161	-
A2	Dense miombo woodland (<i>Brachystegia</i>)	1145	-
B1	<i>Borassus</i> & <i>Hyphaene</i> palm savanna	2035	15.9
B2	<i>Acacia</i> savanna with <i>Hyphaene</i>	3500	27.4
B3	Old dunes (coconut/cultivation)	989	7.7
C1	Secondary grassland (fallow/cultivation)	1121	8.8
C2	Tussock grassland, seasonally wet	975	7.6
C3	Grassland & swamp, perennially wet	1417	11.1
C4	Papyrus swamp	746	5.8
C5	Open water (floating aquatics)	n/m ³	–
C6	Grassy or wetland pans	n/m ³	–
D1	Mangrove forests	1014	8.0
D2	Mud flats	578	4.5
D3	Dune grassland & beach	116	0.9
	River and sea inlets	295	2.3
Total		14,092	100.0

- Notes: 1. Figures derived from GIS printout; with mixed units proportions were allocated 70:30 or 50:50 after studying image
 2. Total area of delta proper is 12,786 km²
 3. n/m – not mapped separately

The most extensive vegetation types of the delta plain are the palm and *Acacia* savannas (types B1 and B2), which cover 5535 km² or 43% of the total delta (alluvium) area. On the south (or west) bank, *Borassus/Hyphaene* palm savanna (type B1) covers the upper reaches and grades abruptly, or with a lot of interdigitation depending on locality, into grassland and swamp (types C2 and C3). Along drainage lines in particular, various species of *Acacia* (*A. xanthophloea*, *A. sieberiana*, *A. polyacantha*) are common. At the furthest, southern reaches, the grassland becomes palm savanna again, presumably because of less inundated conditions. The extensive area covered by old fallow derived from past clearance for sugar plantations (type C1) is presumably derived from what was primarily palm savanna. North (or east) of the Zambezi, the palm savanna is mapped as a slightly different unit (type B2) with less *Borassus* and a higher proportion of *Acacia*. As ground-based fieldwork was not carried out in this area, it is not clear how distinct these two types are.

Table 1.6. Comparison of vegetation types for the Zambezi Delta.

Wetland type (section 1.2)	Vegetation type (section 1.5.3)
Channels	rivers, C5
Perennial Swamp	C4
Seasonal Swamp	C3
Floodplains (long duration)	C3, (C2)
Floodplains (short duration)	(C2), B1, B2 [also tidal D1, D2]
Riverbanks	not mapped
Dambos	not present (parts of C2 ?)
Pans	C6

Closer to the coast, and on what appears to be an undulating landscape with old sand dunes, another savanna type is found (type B3). This is really a longitudinally-orientated mosaic of thick woody vegetation on the dune crests with hydrophilic grassland in the hollows. However, the unit has been much modified in many places by human settlement – crops are planted in the hollows and coconuts on higher ground. It is often difficult to separate this unit from coconut plantations closer to Quelimane; here they have been mapped as one.

Other true wetland vegetation types, such as papyrus swamp, open water and pans (types C4, C5 and C6) are, in most instances, too small to map separately. However, papyrus swamp (type C4) is very common throughout the mapped unit C3, but is of limited extent. Likewise, open water (type C5) is scattered through the wet grassland areas. The large area of permanent swamp west of Quelimane shown on the map was not properly seen, even by air. It appears to be the most extensive wetland area within the Zambezi Delta and is probably fed primarily by runoff from the plateau to the north rather than by Zambezi flooding. This complex of pools, channels, permanent and seasonal swamp needs to be investigated further from both conservation and biodiversity perspectives.

Grassy or wetland pans (type C6) are found throughout much of the northwestern area of woodland/forest, and in the southwest the pans are replaced by extensive grassy swales (type C2) forming an intricate mosaic related to relative elevation and position in the landscape. It is this mix of vegetation that Barbosa (1952) terms *morrumbas*.

1.5.4 Conclusions

It must be recognized that this vegetation map is at a coarse, reconnaissance scale and is only preliminary. In particular, there was no fieldwork, and limited aerial reconnaissance, of the very extensive section north of the Zambezi River that covers almost three-fifths of the total delta area. The mangrove and coastal stretches also received inadequate attention. However, it is felt that in broad outline the survey gives an indication of the major vegetation types and their relative proportions and extents. In addition, the descriptions give a reasonable preliminary indication of environmental relationships across the delta.

The vegetation of the delta is seen to consist of palm and *Acacia* savanna in its upper reaches where seasonal inundation is limited, flanked by dense semi-evergreen woodland/forest as the land rises away from the delta plain. Even within the woodland, there are large areas of grassland or wetland in the form of pans or grassy swales. Towards the coast, and where the land is inundated for longer (perhaps in part from runoff from the surrounding plateaux), extensive grassland and swamp is found. Closer to the coast, vegetation on the old dune landscape, mangroves along tidal rivers, saline mud flats and vegetation on recent breach deposits predominate. The major determining factors for vegetation distribution are: (a) length of inundation by freshwater derived from flooding, runoff or incident rainfall, (b) substrate (sand, mud, etc.), and (c) influence of salinity derived from the ocean.

1.6 OVERALL ASSESSMENT AND CONCLUSIONS

Of the three wetland areas mapped – Eastern Caprivi, Barotse floodplains, Zambezi Delta – the most diverse in terms of habitat is probably the Zambezi Delta, principally because of the estuarine and marine influence. The Barotse area is also diverse, and becomes more so the further the area is extended upstream.

In two cases, Eastern Caprivi and the Zambezi Delta, wetlands form a mosaic with various woodland types on rather unstructured sandy substrates, while in the case of Barotse the floodplain area is clearly separated from the surrounding woodland on Kalahari sand by clearly-defined banks.

The distribution of the various wetland units generally takes the form of a mosaic of channels, permanent and seasonal swamp, and floodplains (both long and short duration flooding), depending on small differences in relative elevation as well as changes in river flow and flooding regimes. The types can be expected to move, slowly or in "jerks", across the landscape within the confines of geomorphology, as wetland systems are dynamic. As McCarthy and others have pointed out, wetlands are modified by exogenous factors such as changes in precipitation, drainage or flooding regime, and endogenous factors such as vegetation build-up and the carving of new channels (Ellery *et al.* 1989; McCarthy 1992; McCarthy, Ellery & Dangerfield 1998).

From a conservation perspective, the most important wetland area is the Zambezi Delta. This is due to its greater habitat diversity, its extensive area (ensuring a better chance of continuing ecological processes) and its less-impacted status compared to the other three wetland study sites. Because of its diversity of vegetation it probably also supports the widest range of large mammals and birds. Despite being possibly the least-impacted by human activities of the three wetland areas described, there have been marked changes in hydrology due to dam construction upstream (see Volume III, Chapter 2), extensive clearing for sugar plantations, heavy logging in the forests and tree cutting along the main river for many years, and regular extensive burning. These factors have significantly modified the vegetation in places and pose a continuing threat. Being at the downstream end of the Zambezi it is also the most vulnerable to pollutants, silt and changes in hydrology.

In conclusion, the vegetation of the Zambezi Delta is the most significant for conservation, yet in some ways potentially one of the most threatened. The vegetation of the broader Barotse area – not so much the actual wetlands or floodplains – is also of significant biodiversity interest, mostly through the communities in pans, dambos and surrounding woodlands. Wetland vegetation of the East Caprivi area is not of any particular intrinsic conservation interest from a regional vegetation

perspective, not least in that it has been heavily impacted and most of the communities are well-represented in the Okavango Delta.

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Fig 1.2: Wetland vegetation map, Caprivi Strip

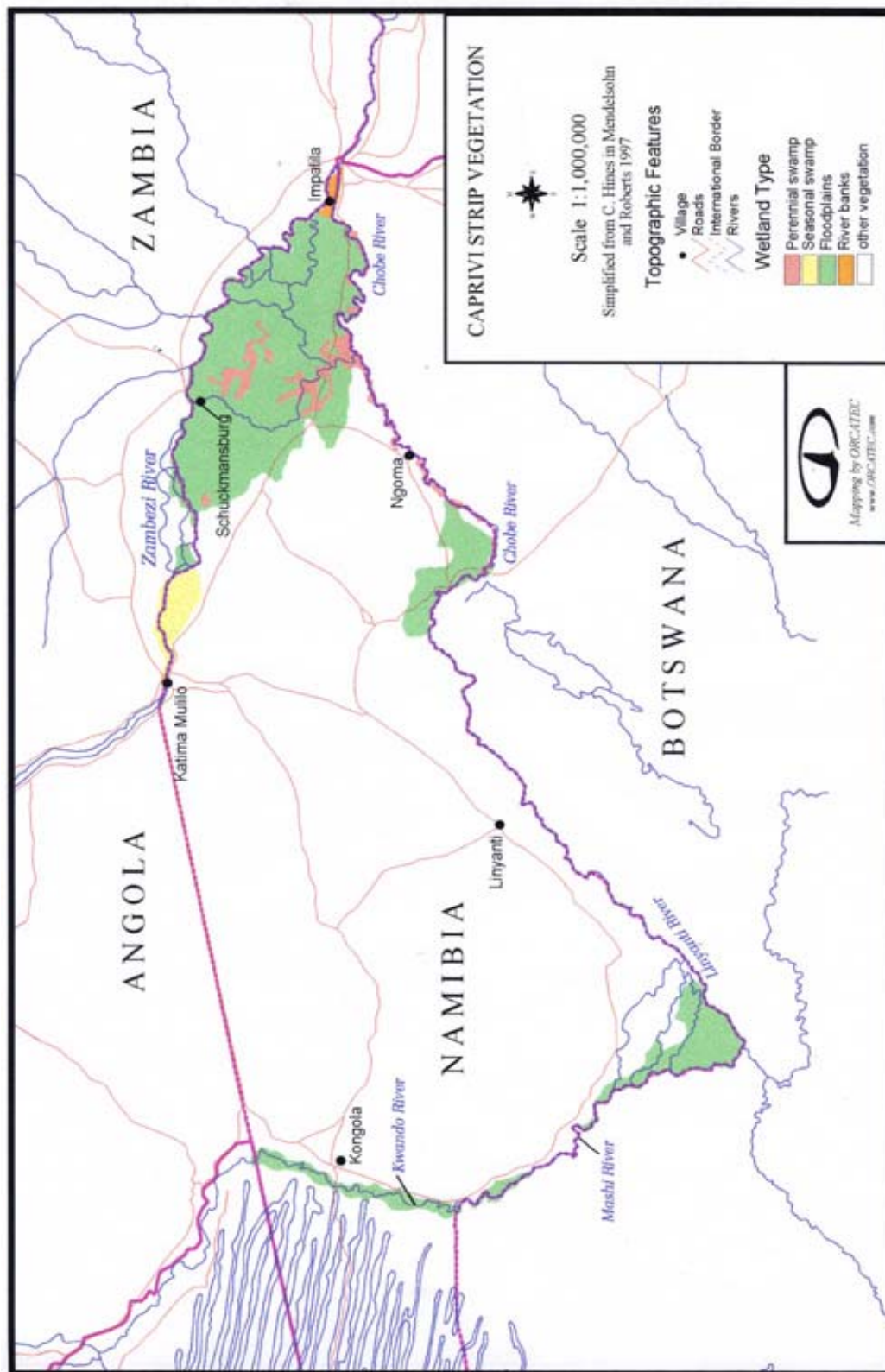


Fig 1.3: Wetland vegetation map, East Caprivi

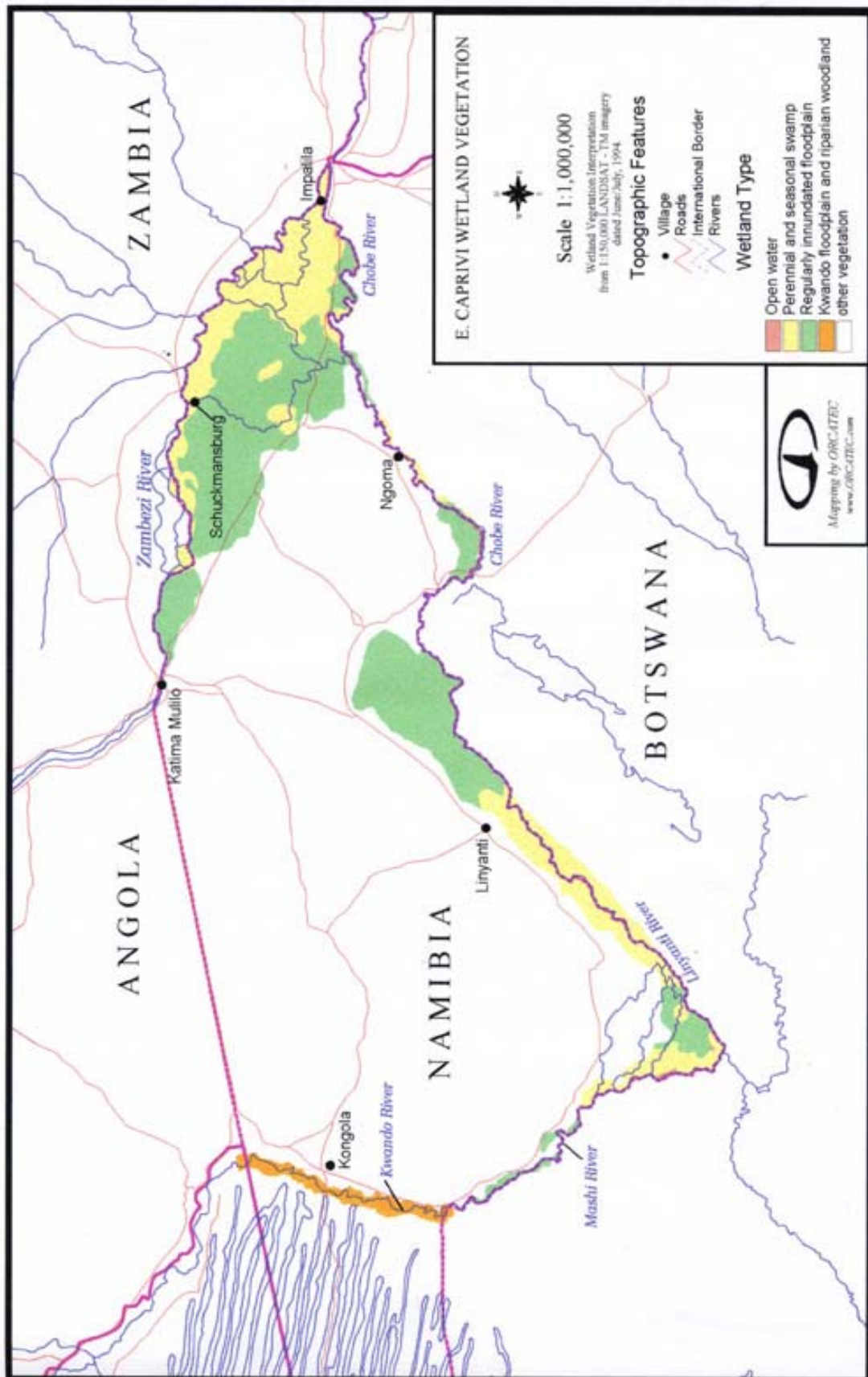


Fig 1.4: Wetland vegetation map, Barotse Floodplain

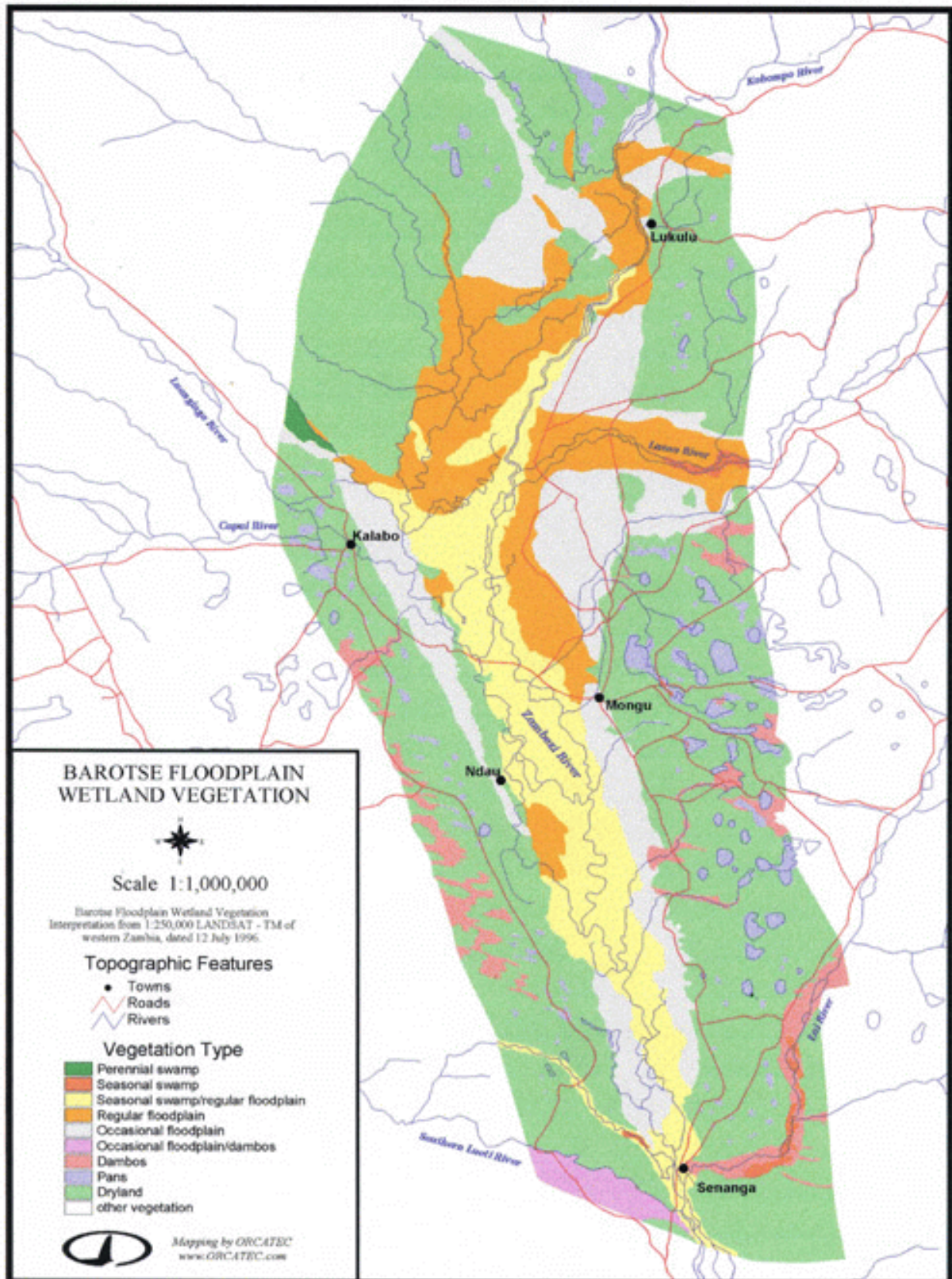
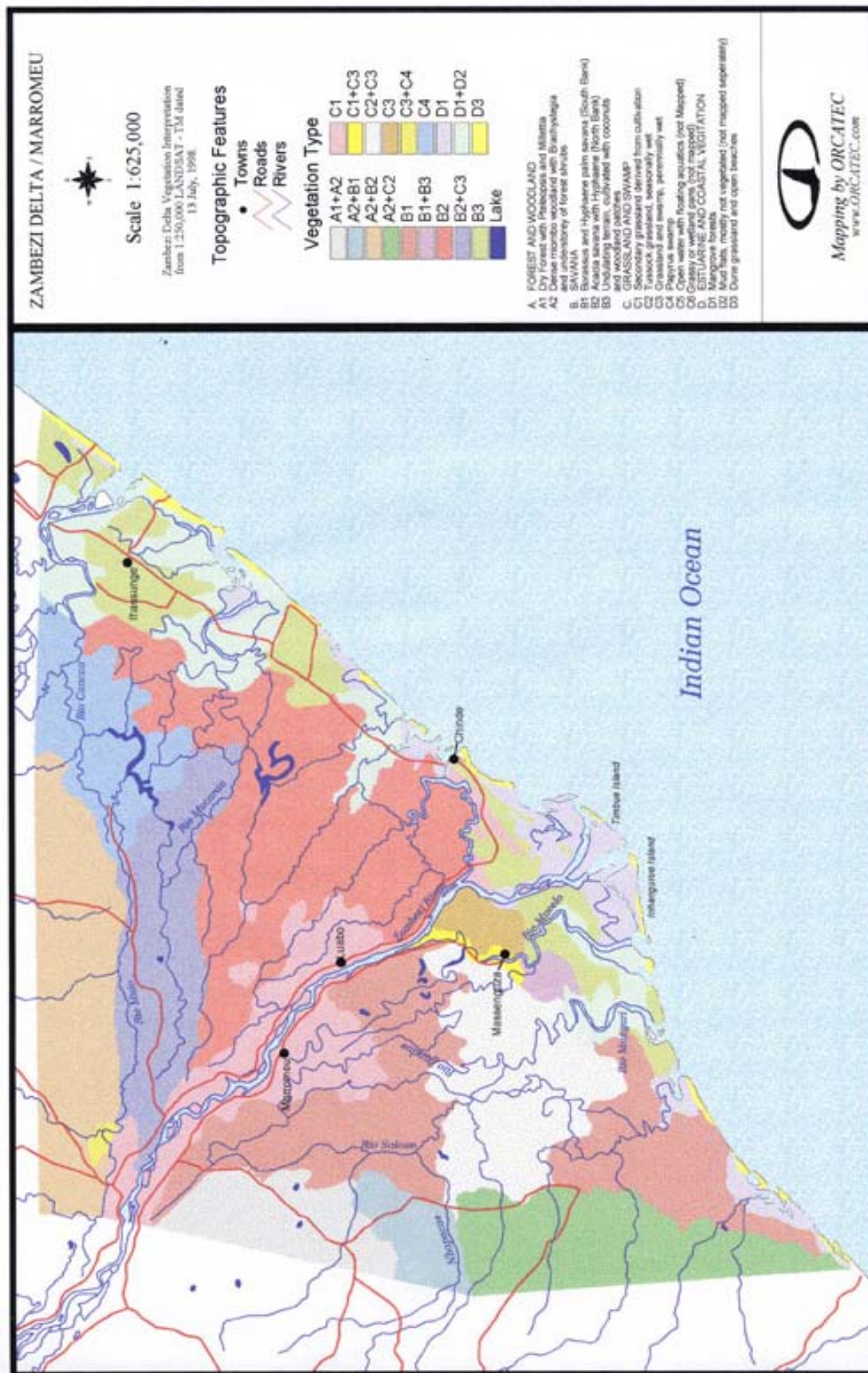


Fig 1.5: Wetland vegetation map, Zambezi Delta/Marromeu



CHAPTER 1 : APPENDIX 1 ZAMBEZI DELTA — VEGETATION TYPE DESCRIPTIONS

Jonathan Timberlake

A. FOREST AND WOODLAND

A1 Dry forest with *Pteleopsis* and *Millettia*

A tall dense forest, trees to 20-25 m tall, deciduous, only some partially evergreen. Main species are *Pteleopsis myrtifolia* and *Millettia stuhlmannii*, with occasional *Brachystegia spiciformis*. The understorey of smaller trees and shrubs comprises forest species. Grass cover is poor to absent. This type is found on sandy soils in the western part of the Marromeu area on the lower slopes of the Cheringoma Plateau. It often forms a mosaic with Type A2, but tends to be confined to slightly higher terrain. Circular pans are a feature in places, with a gradient from dry forest through *Brachystegia* woodland to grassland, sedges and occasionally open water.

A2 Dense miombo woodland with *Brachystegia* and understorey of forest shrubs

A dense woodland comprising spreading trees 20 to 30 m in height of *Brachystegia spiciformis*, with *Millettia stuhlmannii* and others common. Occasional emergent trees of *Inhambanella henriquesii*. Staghorn fern (*Platynerium alaicorne*) is not uncommon. The understorey comprises deciduous to semi-evergreen shrubs normally associated with evergreen forests. The grass cover is generally poor, but better developed in more open areas or at the ecotone.

This type, in one form or another, forms the northern and western boundaries of the delta where it abuts the gently rising sandy plateaux of Cheringoma and Campo. Owing to the gently undulating nature of the plateaux footslopes in these areas, and the low relief, the unit sometimes forms a woodland-grassland mosaic, as on the western boundary of Marromeu. Here the landscape comprises slightly higher ridges of sandy soils with miombo woodland separated from each other by wetland grassland or palm savanna in the swales, forming a striated pattern. It is probable the woodland areas are rarely, if ever, inundated, but groundwater must be available at a comparatively shallow depth so the woodland is only briefly deciduous.

In the north-western portion, relief is possibly a little more pronounced and miombo woodland forms a mosaic with dry deciduous forest (Type A1) on the more elevated, better-drained sandy ground and circular pans containing wetland vegetation in the lower areas fringed by palm savanna.

B. SAVANNA

B1 *Borassus* and *Hyphaene* palm savanna (South bank)

An open woodland to wooded grassland characterised by trees of *Borassus aethiopum* to 20 m and *Hyphaene coriacea* 4 to 8 m high. Closer to drainage lines the palms become closer and *Hyphaene* can almost form a low woodland. Various species of *Acacia*, such as *A. sieberiana*, *A. xanthophloea* and *A. polyacantha*, are also found closer to drainage lines. Occasional riverine trees can be found on the banks of these seasonal channels. The grasses are mostly of the tussock type, such as *Panicum* and *Sporobolus* spp. up to 1.5 m high, while *Hyparrhenia* spp. and *Hyperthelia dissoluta* can be locally common. The type is best considered as a mosaic of vegetation types in a gently undulating, low-relief landscape.

This is an extensive unit on sandy and silty soil found in the south bank of the Zambezi, extending from near the apex of the delta to halfway down (roughly a line from the Rio Sessone to where the Rio Micelo branches off the main Zambezi channel). Another extensive area of this unit is found in the southern part of the delta adjacent to the woodland/grassland area of the lower Cheringoma. Just north of the Rio Sessone there is a mapping unit that is a mosaic of miombo woodland and palm savanna, too intricate to bring out each unit separately. Woody vegetation is denser on the slightly higher ground and closer to drainage lines where drainage is better, while grasses predominate on the gentle slopes and in broad depressions, which often contain a limited extent of swamp vegetation.

The parts along the Zambezi that have been cleared for sand cultivated for sugar and other crops are mapped as Type C1.

B2 Acacia savanna with *Hyphaene* (North bank)

This vegetation type is thought to be rather similar to Type B1 but was not visited on the ground. It is here kept distinct as aerial reconnaissance revealed minor differences to Type B1, such as reduced presence of *Borassus* palm and a significantly higher presence of *Acacia* species (probably *A. sieberiana* and *A. polyacantha*) and other savanna tree species. The landscape also appears to have fewer channels and wetland areas than Type B1. Further fieldwork may suggest that the two units should be combined, but for the present they are kept separate.

This is another mosaic unit in a gently-undulating, low-relief landscape, perhaps more diverse than B1. It is only mapped as occurring on the north bank of the Zambezi, where it is very extensive, occurring from the delta apex virtually to the coast. Closer to the northern, wooded Campo plateau, a mosaic of palm savanna and wetland grassland is seen, of roughly equal proportion. It is not possible to consistently and clearly differentiate them at this scale, so they are treated here as a composite mapping unit.

B3 Undulating terrain, cultivated with coconuts and woodland patches

This vegetation type is a mixture of woody vegetation such as dune thicket, low woodland or planted coconuts with grassland. It is found on what appear to be stabilized dunes, with the woody vegetation on the better-drained dunes and grassland and cultivation in the dune slacks. It has a distinct striated appearance on the satellite imagery. As it was not visited on the ground, the vegetation composition is not clear and is derived from limited aerial reconnaissance.

The dunes comprising this type are generally found within 5-10 km of the coast and presumably date from the later Pleistocene period. It is these areas, along with the river banks, that seem to have been favoured for settlement, possibly as they allow refuge from flooding and also the cultivation of coconuts on the ridges and grain and starch crops in the moister slacks within close proximity. Much of this unit appears to have been cultivated, and it is likely the remaining dune vegetation is secondary.

The unit is found along the whole of the delta coastline, but is most extensive on Chinde Island and in the area south of Quelimane. Particularly here it is difficult to clearly separate this unit from commercial-scale coconut plantations, and the two have been mapped together.

C. GRASSLAND AND SWAMP

C1 Secondary grassland derived from cultivation

This type is a human-modified vegetation derived from fallows of various periods after clearance for cultivation, and includes present cultivation. It is mostly a tall grassland, 1 to 3 m in height, dominated by species such as *Pennisetum polystachion*, *Hyperthelia dissoluta* and *Hyparrhenia* spp. depending on underlying soil type. *P. polystachion* is more common on lighter sandy soils close to the main river, especially on the river side of the bund built to protect the sugar plantations. On heavier soils within the original irrigation scheme such species as *Setaria incrassata* predominate. Sand banks in the Zambezi and on its margins mostly support *Pennisetum* and *Phragmites*. The main crops are sugar cane, maize, cassava and sweet potato. Depending on soil type and age of fallow woody species may also be present, but are rarely dominant. The commonest species in this type are *Acacia polyacantha*, *A. sieberiana*, *Ficus sycomorus*. Rarely are these trees taller than 8 to 10 m, except along roadsides or in settlements.

This unit is confined the north bank of the Zambezi from Mopeia to Luabo, and on the south bank down to the Marromeu area. Here it is associated with the sugar plantations put in earlier this century. Here it is probably derived from what was palm savanna and a riparian strip on recent sandy alluvium that has been extensively cultivated or modified over hundred of years. Smaller areas are found on Chinde Island and along the upper reaches of the Rio Micelo. These appear to be derived from riparian vegetation on more recent alluvium.

C2 Tussock grassland, seasonally wet

A wetland vegetation type dominated by the tussock or mat-forming grasses up to 2 m high. The main grass and sedge species include *Panicum* sp., *Sporobolus pyramidalis*, *Brachiari humodicola* and *Lersia hexandra*. Trees and other woody plants are virtually absent; on slightly elevated ground and termitaria woody species such as *Phoenix reclinata*, *Ziziphus mucronata* and *Lannea schweinfurthii* can be found.

This type is not always clearly distinguishable from palm savanna (Type B1) and perennially wet swamp (Type C3) with which it generally forms a mosaic. The seasonally wet grassland lies on slightly more elevated ground than the perennially wet grassland or swamp. The principal area of seasonably wet grassland is in the Marromeu Buffalo Reserve in the south of the delta, south of a divide running from the Rio Sessone to the Zambezi/Rio Micelo junction. Here it forms a mosaic with perennially wet grassland or swamp, and it is not possible to differentiate them usefully or consistently at the present mapping scale. The other area of seasonally wet grassland where it forms a mosaic – which has a striated appearance on satellite images – with miombo woodland (Type A2) on the Cheringoma footslope on the south west margins of the delta.

Although this type is not mapped on the north bank of the Zambezi, it is undoubtedly present as a mosaic with palm savanna (Type B2) and perennially-wet grassland (Type C3).

This type of vegetation is clearly recognisable on the ground through its structure and composition, but it is very difficult to map as it invariably occurs in a mosaic with slightly drier and wetter vegetation types in a landscape with minimal relief.

C3 Grassland and swamp, perennially wet

A wetland vegetation type dominated by grasses and sedges from 0.5 to 3 m high. The main grass species include: *Phragmites mauritianus* and *Vossia cuspidata*, while the main sedges are *Cyperus papyrus* and *C. digitatus*. Other herbs include *Hibiscus diversifolius*, *Ludwigia* spp. and *Mimosa pigra*. Woody plants are almost entirely absent.

The substrate is perennially wet or even with standing water, and the soils are mostly peaty, formed from accumulated mats of dead and degrading plant matter.

This unit was not well sampled because of difficulties of access. It generally forms a mosaic with seasonally wet grassland (Type C2), the latter on slightly elevated and better-drained sites, more extensive areas of papyrus swamp (Type C4) and lagoons with floating aquatics (Type C5). these four grassland/swamp vegetation types form a catena across a large portion of the delta, and are not separately mappable in most instances.

This vegetation type forma sa mosaic with *Acacia*/palm savanna (Type B2) on the northern edge of the delta associated with drainage along the footslope of the Campo Plateau. To the east the swamp vegetation becomes sufficiently extensive and dominated bu papyrus to be mapped as such (Type C4). There is minimal difference between them.

C4 Papyrus swamp

A dense 'forest' of *Cyperus papyrus* up to 3 m in height with intermeshing root systems such that a "mat" is formed which it is almost possible to walk on. Generally papyrus stands have almost total dominance of *C. papyrus*, with only a few small plants of *Polygonum* and floating species such as *Azolla filiculoides* and *Wolfiella denticulata*. Towards to margins, or where the water is not so deep or perennial, other species can be found such as *Cyperus* spp. and *Phragmites*. This vegetation type also forms part of Type C3, but there the papyrus is confined to just the wetter parts of a mosaic.

The only major extent of this vegetation type is in the north of the study area near Quelimane along the Rio Cuacua. It would appear that areas to the south do not have any extensive perennially wet areas.

C5 Open water with floating aquatics [not mapped]

Open water areas are generally covered in the floating fern *Azolla* cf. *filiculoides*. Other species present include *Nymphaea*, and are fringed by papyrus. It was not possible to visit this vegetation type, which was only viewed from the air.

This unit comprises open freshwater lagoons set in a matrix of swamp (Type C3). Vegetation consists of free-floating and floating-leaved species such as *Azolla filiculoides* and *Nymphaea* spp. Its full species composition is not known as it was not visited on the ground and only seen from the air. It is fringed in most cases by papyrus and other wetland species.

This type, which is not mapped owing to its small size, is most common in the extensive wetland area to the west of Quelimane. Small scattered water bodies are also seen just north of Mopeia and in the Marromeu Buffalo Reserve. It is possible that such open lagoons or channels were more common in the past but are being slowly vegetated over owing to reduced hippo populations and lack of flooding.

C6 Grassy or wetland pans [not mapped]

This unit comprises circular or rounded pans with wetland vegetation consisting of swamp grasses or sedges in the middle surrounded by short grassland with occasional scattered woody plants. There is often a narrow band of bare, or partially bare, soil owing to soil compaction or salinity. Higher up the slope miombo woodland or dry forest (types A1 or A2) are found.

Pans range in size from a few hectares to a few hundred hectares. They are principally found in the miombo woodland just outside the northwestern margin of the delta. They are not mapped separately owing to their size (some are large enough to map at this scale while others are too small).

D. ESTUARINE AND COASTAL VEGETATION**D1 Mangrove forests**

A dense forest of species specially adapted to brackish water and regular inundation of their roots. The major species seems to be *Avicenna maritima*, which can grow up to 14 m high. *Avicenna* is also increasingly coming in on mud flats flanking major channels. The even-aged stands are quite conspicuous and the succession of stands can be seen from their varying size-structure. Other common species, although only locally dominant, are *Rhizophora mucronata*, *Xylocarpus granatum* and *Brugiera gymnorrhiza*. Where small areas of mangrove have been clear-felled, *Acrostachys maritima*, the mangrove fern, can form solid stands.

This unit is principally found within 10 km of the ocean, but can penetrate further inland along larger channels subject to tidal influence. Here, however, mangroves are generally restricted to within 1 to 3 kilometres of the channel.

D2 Mud flats, mostly not vegetated [not mapped separately]

Areas adjacent to mangrove forest, subject to periodic inundation by brackish water, are generally without much plant cover. In places scattered, stunted mangroves (mostly *Avicenna marina*) are found, along with low succulent shrubs or herbs of *Salicornia* sp. In some places, mangroves form a complex with mud flats owing to a high density of drainage channels, and perhaps a build up of salts.

D3 Dune grassland and open beaches

Within a kilometre or two of the ocean, a low grassland can be found on gently undulating unconsolidated sands derived from dunes. Grasses are generally wiry, but softer species are found in the dune slacks. Species of Cyperaceae are common. trailing herbs, especially Leguminosae are not uncommon. Closer to the sea such species as *Ipomoea pes-tigridis* are common. Woody plants are generally absent, although scattered *Hyphaene coriacea* palms and low trees of *Garcinia livingstonei* are seen. In saline depressions, and on the inshore margin, mud flats and mangroves take over.

CHAPTER 2

WETLAND PLANTS OF THE ZAMBEZI BASIN

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2.1 INTRODUCTION

The Zambezi Basin covers 1.3 million km² of south central Africa ranging from patches of what is virtually tropical rainforest at the headwaters, across the broad, gently undulating Central African Plateau covered with miombo and other woodlands interspersed with extensive grassy areas, to the hot dry reaches of the Zambezi Valley and the coastal plain. This large area supports many vascular plant species (that is pteridophytes and flowering plants, excluding mosses and algae) – perhaps 6-7000 (Timberlake 1999, G. Pope, pers. comm.) – only a proportion of which occur in wetlands. The number of taxa involved is vast, and the available knowledge on their distribution and ecology is still rather limited with large gaps.

The first major problem in attempting a review of knowledge on wetland plant species is in defining what is meant by a wetland and which wetland types are to be included. This is partly covered in Chapter 1. The present chapter will confine itself principally to plants found in lakes, channels, swamps and floodplains of the Zambezi Basin. Plants of sandbanks, riverbanks and seeps are not covered specifically. More importantly, dambos and pans are also not covered, although species found here are often of significant biological and conservation interest. The reason for these omissions is that their inclusion would make the review unmanageably large and unfocused given the information available. Hence it was decided to focus primarily on the obvious wetland habitats of swamps and regularly-inundated floodplains.

The second problem in a review of this nature is in deciding which species to include and which to exclude. Many species, for example, are able to survive under wetland conditions, but cannot be regarded as characteristic members of wetland communities – they are opportunists. Others are often found in wetlands such as floodplains, but just as commonly in dryland habitats. Another factor is that many species distributions are still incompletely known (especially herbs and grasses) and they may not have been formally recorded from wetlands, either in the literature or as herbarium specimens, although they might be suitably adapted for such a habitat. Alternatively, they may have been only recorded from wetlands yet commonly occur also in dryland habitats.

One area where a clearer concept has been developed of what a wetland species is northern Botswana, in particular the Okavango swamps. This is a culmination of almost 40 years of study and observation by Pete Smith based in Maun at the foot of the Okavango. Unfortunately he died recently before this could be written up and published. In essence, he said that species which were exclusively found in swamps, floodplains and rainwater pans were wetland species (P. Smith, pers. comm.), while excluding any which were found on islands and river edges, and those that also occur in dryland habitats. Hence very few woody species were included under his definition.

Major difficulties arise, however, when applying the definition developed in northern Botswana to extensive areas of low relief such as the Barotse floodplains and elsewhere in western Zambia. As Bingham points out (Appendix 2.2, section 2), the vegetation of the Bulozzi floodplain is seasonally inundated by floodwaters but, in most cases, plants are not specifically adapted to growing in water

or under perennially moist conditions. Instead, many species are adapted to flood avoidance. This is discussed further in Appendix 2.2.

There are many species found in wetlands of the Zambezi Basin that are not found in northern Botswana, thus Smith's list (Appendix 2.1) needs to be expanded significantly. The list of wetland plant species (Table 2.1 - see Page 53) presented here includes many others. Because of this, a modified definition of what comprises a wetland species was adopted: a wetland plant species is one which is almost exclusively found in what is generally termed a swamp, marsh, floodplain or similar wetland, or in open water. Riparian species that are also found elsewhere, species occurring in upland dambos on the higher parts of the central plateau in Angola, Zambia and Zimbabwe, and species found only in pans or seepages (many of which are ephemeral annuals or perennials adapted to a very short growing season), have been excluded. In addition, an attempt has been made to distinguish those species which are obligate wetland species (here termed 'true' or obligate wetland species), rooted in water, from others which can tolerate some degree of dryness.

This review firstly looks at what botanical work has been done on the wetlands of the Zambezi Basin, then goes on to provide a listing and discussion of the distribution of known wetland species from the basin. An analysis of what this indicates in biological and biogeographical terms is given, as well as a discussion of various species or groups of particular interest or concern. Conservation and the effects of dams and pollution are also briefly discussed.

2.2 PREVIOUS WORK

2.2.1 Vegetation and ecology

The major vegetation study of the Zambezi Basin, putting it in an African context, is that by Frank White (1983). This study maps out major wetland areas comprising the Barotse floodplains, Busango and Lukango swamps, Kafue Flats and Lake Chilwa as edaphic (i.e. soil-determined) grassland mosaics with semi-aquatic vegetation. The Okavango and Chobe/Linyanti are mapped as swamp and aquatic vegetation. All form part of the Zambezian phytochorion (a broad, evolutionary-linked plant species assemblage). The Zambezi Delta is mapped with coastal plant communities of the Zanzibar-Inhambane East African Coastal Mosaic – an error, even at the coarse scale of mapping. A basic floral division between plateau, savanna-type species and a low-altitude, moister coastal assemblage is suggested, a division which is also mirrored in other species groups and not just for wetlands. The other major vegetation map is that compiled by Wild & Barbosa (1967), which gives more detail but is not dissimilar in pattern.

Vegetation maps exist of individual countries (e.g. Barbosa 1970, Bekker & De Wit 1991, Edmonds 1976, Government of Malawi 1983, Pedro & Barbosa 1955, Rattray 1962, Weare & Yalala 1971), but often have no more detail than that given in the studies mentioned above. Surveys also exist for some areas including wetlands, e.g. Barotseland (Jeanes & Baars 1991, Verboom & Brunt 1970), Caprivi (Curson 1947, Hines 1997), Chobe (Blair-Rains & McKay 1968, Simpson 1975), much of the mid-Zambezi valley in Zimbabwe (Timberlake *et al.* 1993) and the northern Zambezi Delta (Barbosa 1952). However, there was no consistency in approach, methodology or map legend, thus comparisons between studies are difficult.

Vegetation or botanical studies of wetland areas have been carried out with varying degrees of detail and for varying purposes. They have often been of the general survey type for agricultural or development purposes, or have been done as an adjunct to other studies, e.g. impact assessments

or large mammal conservation. Some of the more important cover the Bangweulu Swamps (Verboom in Grimsdell & Bell 1975), Kavango River (Bethune 1991), Okavango Delta (Biggs 1976, Smith 1976, 1991, Tinley 1973), Kafue Flats (Douthwaite & Van Lavieren 1977), Kariba lakeshore (Magadza 1970, Skarpe 1997, Mhlanga & Mapaure, in press a,b), Mana floodplain (Dunham 1989, Müller & Pope 1982), Luangwa Valley (Astle *et al.* 1969, Smith 1997), Lake Chilwa (Howard-Williams & Walker 1974), Liwonde National Park (Dudley 1994), Lower and Middle Shire Valley (Blackmore *et al.* 1988), Lengwe National Park (Hall-Martin & Drummond 1980), Elephant Marsh (Howard-Williams 1973, Proctor 1980) and the extensive Gorongosa/Marromeu area (Tinley 1977). Cole (1963) places dambos in a useful geomorphological context, stressing the dynamic nature of wetland vegetation in a changing landscape.

Perhaps the major detailed plant ecological study of a Zambezi wetland is that by Ellenbroek (1987) for the Kafue Flats. This study looked at plant productivity as well as vegetation ecology, a topic otherwise only covered briefly by Thompson (1976) for the Okavango. Kalk *et al.* (1979) and Howard-Williams (1972, 1975a, 1975b, Howard-Williams & Walker 1974) provide perhaps the only other study on vegetation dynamics and ecological processes operating in wetlands, although this is of Lake Chilwa in Malawi, technically just outside the Zambezi Basin. Another detailed review of our knowledge of freshwater plants is that by Mitchell (1978), who covers both aquatic macrophytes and microphytes (i.e. algae and mosses) of the whole of southern Africa. In his book on ecology and management of wetland vegetation, Denny (1985) gives a scholarly treatment of vegetation ecology, dynamics, water plant biology, ecosystem structure and ecosystem functioning, as well as chapters on management, aquatic weeds and conservation. These treatments cover tropical Africa as a whole, not the Zambezi Basin in particular, although many of the examples are drawn from our area. In this book, Thompson *et al.* (1985) provide a very useful and comprehensive bibliography on African wetland plants and vegetation.

Gibbs-Russell (1975a) analysed the aquatic flora of Zimbabwe using herbarium specimens as source material. Her definition of an aquatic plant was broader than that used in this review as she incorporated species from pans, vleis (dambos) and "soak zones" (seasonally wet areas around water bodies). Out of a total of 491 species recorded, 155 were considered to be what are here termed 'true' aquatics (submerged or floating-leaved aquatics and emergent-leaved aquatics). Unfortunately the species involved are not listed. In her list of aquatic plants she gives 473 species but without localities (Gibbs-Russell 1977), so it has not been possible to incorporate these data into Table 2.1. Two main conclusions about aquatic plants were drawn from these studies: (a) their distribution is determined more by habitat than by geography, and (b) there are far more species in rivers than in pans, and these are generally found only in rivers and not in other habitats; the flora of man-made lakes is intermediate. As part of this research, she produced a comprehensive bibliography, also arranged by plant family, and a detailed key to the Zimbabwe species (Gibbs-Russell 1975b, 1977).

2.2.2 Plants

Studies on plant species are principally confined to checklists, some of which have been published but many of which probably sit in institutional archives or files. There are also large holdings of plant specimens collected from wetlands in regional and northern hemisphere herbaria, but data from these have not yet been compiled. Plant lists, with varying comprehensiveness of coverage, exist for parts of Barotseland (Bingham 1990, 1996, Appendix 2.2, Drummond & Cookson 1959, Fanshawe 1969a,b,c, Van Rensburg 1968, Verboom 1981, Verboom & Brunt 1970), Bangweulu (Verboom in Grimsdell & Bell 1975, Renvoize 1996), Okavango (Pete Smith 1976, 1984), Chobe (P. Smith, Appendix 2.1), Lake Kariba (Mhlanga & Mapaure, in press, a), Luangwa Valley (Astle *et al.* 1997, Smith 1997), Lake Chilwa (Howard-Williams 1977), the swamps of the Shire

(Blackmore *et al.* 1988) and part of the Marrromeu grasslands (Müller *et al.*, Appendix 2.4). Gibbs-Russell (1977) produced a list of wetland plants for Zimbabwe, but it is not possible to extract from this the species that occur in the Zambezi wetlands.

2.2.3 Gaps in knowledge

From a review of the literature it can be seen that there are major gaps in our knowledge of wetland plants. First and foremost, records of wetland plants are very scant from some major wetland areas within the basin; they are probably only reasonably comprehensive for the Okavango and Chobe/East Caprivi areas. Important areas that need to be investigated are the Busango swamps and the Zambezi Delta. This lack of data precludes a proper comparison of wetland areas across the basin. For example, it is not clear if the Okavango and Zambezi Delta are similar in the species and habitats present.

Another major gap in knowledge is in the ecological functioning and dynamics of wetland vegetation. Evidence is building up that within swamps channels come and go and the vegetation and drainage patterns can change fairly rapidly. This is partly in response to changes in water availability (minor tectonic movements or changes in rainfall), but also to changes brought about by vegetation itself, in particular papyrus (Smith 1976) and termitaria (McCarthy *et al.* 1997). The system is dynamic, which has important consequences in designing conservation actions, but we are not very clear how this operates, especially in areas other than the Okavango.

2.3 WETLAND HABITAT TYPES

Of these ten broad wetland habitat types, this review only covers plants from the first six. Riverbanks, dambos, pans and seeps are not fully covered in the discussion or in Table 2.1.

2.3.1 Swamps

Swamps are primarily formed by growth of swamp vegetation, especially papyrus. Plant growth reduces water flow and causes ponding-up, thus favouring an extension of itself (Debenham 1952). Swamp cannot exist in stagnant water and requires a perennial supply of water, or it will be replaced by grassland, adapted to periodic drought.

Perhaps the best descriptions of perennial and seasonal swamps within the basin are given by Smith (1976) in describing those of the Okavango, although swamp vegetation is similar elsewhere. The main swamp species is papyrus (*Cyperus papyrus*), a giant sedge which produces leafless stems to 4 m high from intertwined perennial rhizomes. Stands can be so dense that they effectively float, but they are rarely found in water deeper than 1 m. Papyrus beds occupy bands of varying width beside channels and can be so thick as to modify channel flow and direction. Other typical plants of papyrus beds are the grasses *Miscanthus junceus* and *Phragmites* spp., the bulrush *Typha*, the fern *Thelypteris*, and various herbs such as *Polygonum*, *Ipomoea* and species of Commelinaceae.

In the channels and pools of swamps the grass *Vossia cuspidata* is often seen floating out from the banks, and on the substrate are rooted water lilies (*Nymphaea*) and other aquatics. Free-floating species such as *Lemna* and *Wolffiella* are also present. It is these submerged or free-floating aquatics that show the greatest adaptations to an aquatic existence.

2.3.2 Floodplains

Floodplains are by far the most extensive wetland type in the Zambezi Basin (except perhaps for dambos). Some are only rarely flooded and support good tree growth (e.g. the Mana floodplain along the Zambezi in Zimbabwe), whereas others – which are more obviously wetlands – are inundated for some months every year (e.g. the Buluzi floodplain near Mongu in W. Zambia) and have no trees, except on termitaria. Floodplains are mostly grassland and can be quite rich in herbaceous species. Many plants avoid flooding by perennating as rootstocks (bulbs, etc.), whereas others are annuals. Unlike swamp species, floodplain plant species do not grow year-round.

The wetter types of floodplain consist of medium-short grasses such as *Echinochloa*, *Leersia*, *Oryza*, *Acroceras*, *Paspalum* and *Panicum repens*, with *Vossia cuspidata* in the wettest places. In less wet areas other short species, such as *Cynodon dactylon*, *Eragrostis* and *Chloris*, become dominant, with the taller and tussock grasses in the driest parts.

Floodplain plant diversity is greater than that of swamps, which are perennially flooded environments which require special adaptations possessed by only a few species. Species occurring on floodplains only need to overcome flooding for a few months of the year, so require less adaptation.

2.4 WETLAND SPECIES

In Table 2.1 a preliminary compiled list of all vascular wetland plant species recorded from the Zambezi Basin is given, which also shows their distribution across the major wetland areas. This forms the basis of the various analyses and discussion below. The table incorporates two major lists prepared under this project.

A detailed list of wetland species from the Chobe area of northern Botswana and adjacent parts of the Caprivi Strip (Kwando River and Linyanti swamps) was compiled by Pete Smith. Based on his own knowledge and herbarium material at the Okavango Research Station, this list is given as Appendix 2.1 and contains 361 species. Even though it was never finalized, it is the most comprehensive list available for any of the basin wetlands. An earlier list, produced for the whole of Botswana and with a somewhat more inclusive definition of a wetland species, gives 454 species (Smith 1984). Because of its comprehensiveness, Smith's Chobe list is here used as a basis for comparison with other, incomplete, data sets.

Another list was compiled by Mike Bingham for the wetland or wetland-related species of Western Zambia, and is given as Appendix 2.2. This list was compiled from records in Flora Zambesiaca, White 1962, various rangeland and land resource surveys (Jeanes & Baars 1991, Trapnell & Clothier 1996, Verboom & Brunt 1970), and from Bingham's own specimens and observations.

2.4.1 Methodology

A compilation was made of vascular plant species found in open water, swamps, marshes and floodplains in what were considered to be the major wetlands of the Zambezi Basin. Lists produced under the project by Smith for the Chobe/Linyanti area, by Bingham for Western Zambia, and by Müller, Mapaura & Drummond for the Zambezi Delta were the major data sources. Other important lists were Blackmore *et al.* (1988) for the Middle and Lower Shire, Hall-Martin & Drummond (1980) for Lengwe National Park in the Lower Shire, Proctor (1980) for part of the Lower Shire, Howard-Williams & Walker (1974) and Howard-Williams (1977) for Lake Chilwa in southern

Malawi, Magadza (1970, 1977) and Mhlanga & Mapaure (in press, a, b) for Lake Kariba, Renvoize (1996) and Verboom (in Grimsdell & Bell 1975) for the Bangweulu swamps, and Smith (1984) for the Okavango Delta. Additional records from the literature were also incorporated, including from *Flora Zambesiaca* (1960, continuing), the major taxonomic work for the area. This initial list of over 1000 species was checked for redundant and incorrect names by Bob Drummond, who also reduced it to the present 755 species by removing those which did not really fulfil the definition of a wetland species used here. For example, semi-dryland species, species exclusively from dambos, and species from various types of pan were removed. Where species were known to be present in various wetlands, although not formally recorded, they were also included. Nomenclature follows that in current use by the National Herbarium in Harare (R.B. Drummond, pers. comm.).

Broad distribution patterns were derived principally from *Flora Zambesiaca* (and from the *Flora of Tropical East Africa* or *Flora of Southern Africa* where not covered in *Flora Zambesiaca*), and are given as one of three categories. Restricted distribution refers to species or subspecies which are confined to a smaller part of the Zambezi Basin (here taken to be the palaeo-basin, i.e. including parts of the DRC and northern Zambia) such as a province, sub-catchment or smaller area. Southern African distribution refers to species which are found over a large part of the basin, even into South Africa or southern Tanzania, but which are not found elsewhere on the continent. The last category, widespread distribution, refers to species which are also found outside of southern Africa, and includes those with distributions covering East Africa, tropical West Africa, Afrotropical, pantropical, or even (in a few cases) worldwide.

Perhaps a tighter definition of a wetland plant is those that are obligate wetland species, that is they can only survive under permanently wet conditions such as in swamps or marshes. In order to more clearly separate out obligate wetland species, various life form categories were used. These are an amalgamation of those used by Pete Smith in his various lists, reduced to two categories – species with submerged or floating leaves (rooted in a substrate or free-floating, **sa**), and those rooted in a substrate but with leaves emerging above the water (**ea**). These two groups can be considered swamp or marsh species. They do not include floodplain species (i.e. those species only seasonally inundated) or riverine species (i.e. those from mesic environments with access to moisture at depth year-round). In Table 2.1 allocation of categories follows Smith (1984 and Appendix 2.1), with additions where necessary. An additional group mentioned is woody plants, shown as tree or shrub.

2.4.2 Analysis

Table 2.1 lists 736 wetland species, which is around 12% of the total flora for the basin. The listing must be considered only preliminary as undoubtedly others will be added and perhaps some removed. Indicated distribution across the basin in the various wetlands is also incomplete, and some areas seem particularly poorly covered.

Geographical Distribution

What is most noticeable is the very few listed wetland species that can be considered of restricted, or even only southern African, distribution. Of the taxa with known distributions (last column, Table 2.1), the majority (77%) are eastern and southern African, Afrotropical, pantropical or worldwide in their distribution, and only 4% show restricted (i.e. sub-basin) distribution. The proportion of widely distributed taxa is much higher than would be the case in an equivalent analysis of plants from other habitats such as dry forest, rainforest, montane grassland or miombo woodland, and is more comparable to a figure that might be obtained from an analysis of the flora of fallow fields (that is a weed flora). The widespread distribution of wetland species is clearly demonstrated, and this proportion is even higher (86%) when only obligate aquatics are looked at, compared to 2%

with restricted distribution. For woody wetland taxa, 57% have widespread distribution compared to 10% with restricted distribution.

There is obviously a large difference between numbers of species found in each of the wetland areas, but this principally reflects differences in recording and our knowledge of each area. However, a comparison is possible between the comparatively well-recorded Okavango and the Chobe/Caprivi areas. The Okavango contains 423 taxa compared to the 394 taxa from Chobe, which Smith (pers. comm.) ascribes to greater habitat diversity in the Okavango rather than to differences in recording intensity. The number of taxa found in the Middle Zambezi (303) and Lower Zambezi (327) is significantly lower than the number found in the wetlands of the Upper Zambezi (662). Although partly reflecting differential recording, it is probably also a reflection of the greater wetland habitat diversity upstream.

Taxonomic group

The total number of wetland species in each taxonomic group (Pteridophytes, monocotyledons, dicotyledons, Cyperaceae, Poaceae) across the basin is shown in Table 2.2. From this it can be seen that the relative proportions of each group are similar to those seen for the more complete Chobe data set (Appendix 2.1), except that in the full basin list woody species are slightly better represented (7.3% vs. 3.9%). However, this may be a result of a more rigorous definition of wetland species used for the Chobe list. Proportions of the various taxonomic groups in the Upper Zambezi wetlands and wetlands of the basin as a whole are very similar, but this possibly reflects the preponderance of data from Upper Zambezi areas.

The sedge (Cyperaceae) and grass (Poaceae) families are the two largest wetland families by far, accounting for almost half of the total listed species (43%), much higher than their relative species abundance in the regional flora. Of the dicotyledon families, the composites (Asteraceae) and legumes (Fabaceae) are the largest (6.7% and 5.4% of total wetland flora, respectively). There is also a marked preponderance of monocotyledon over dicotyledon taxa (52.5% vs. 45.1%, respectively) compared to the regional flora. The wetland flora of the basin, at a family and higher taxonomic level, is therefore not representative of the flora of the region. It can be surmised that certain families and higher groups have either evolved in conjunction with this environment, or are more able to adapt to wetland conditions.

The plant families which are particularly well-represented as obligate aquatics are: Alismataceae, Commelinaceae, Cyperaceae, Hydrocharitaceae, Lemnaceae, Pontederiaceae, Potamogetonaceae and Xyridaceae among the monocotyledons, and Asteraceae, Droseraceae, Fabaceae: Papilionoideae, Lentibulariaceae, Lythraceae, Menyanthaceae, Nymphaeaceae, Onagraceae, Polygonaceae and Scrophulariaceae among the dicotyledons. The main submerged or floating-leaved aquatic families are: Aponogetaceae, Hydrocharitaceae, Lemnaceae, Najadaceae, Pontederiaceae, Potamogetonaceae, Ceratophyllaceae, Lentibulariaceae, Menyanthaceae, Nymphaeaceae, Onagraceae and Scrophulariaceae.

Life form

Comparison of the groups of obligate aquatic species across the basin (Table 2.3), shows that there are generally twice as many emergent aquatics as submerged or free-floating aquatics. The total number of obligates is 227, about 31% of the total species listed. A high proportion of pteridophytes (56%) are obligate aquatics, but there are relatively low proportions of sedges and grasses (25% and 15%, respectively). It is interesting to note that of the grasses, which comprise a quarter of all wetland species and which are so dominant and characteristic of floodplains, only a low number

Table 2.2. Comparison of numbers of wetland taxa by taxonomic groups or life form from various parts of the Zambezi Basin.

group	Chobe/Caprivi ¹		Upper Zambezi ²		Middle Zambezi ²		Lower Zambezi ²		Zambezi Basin ²	
	no.	%	no.	%	no.	%	no.	%	no.	%
Pteridophytes	10	2.8	14	2.1	4	1.3	11	3.4	18	2.4
Monocotyledons	187	51.8	346	52.3	142	46.9	160	48.9	386	52.5
Dicotyledons	164	45.4	302	45.6	157	51.8	156	47.7	332	45.1
TOTAL	361	100	662	100.0	303	100.0	327	100.0	736	100.0
Cyperaceae (sedges)	77	21.3	123	18.6	17	5.6	49	15.0	136	18.5
Poaceae (grasses)	78	21.6	164	24.8	109	36.0	80	24.5	177	24.0
submerged aquatics (sa)	45	12.5	64	9.7	21	6.9	41	12.5	73	9.9
emergent aquatics (ea)	98	27.1	148	22.4	52	17.2	68	21.0	154	20.9
woody species (T/S)	15	3.9	43	6.5	30	9.9	34	10.4	54	7.3

Sources: 1. From unpublished list by Pete Smith (Appendix 2.1)

2. From all relevant records in Table 2.1. Some species listed by Smith are not included in this table (e.g. species exclusively in pans).

Table 2.3. Distribution of obligate aquatic species amongst plant taxonomic groups.

Group	submerged aquatics(sa)	emergent aquatics(ea)	obligate wetland species (% group total)	woody species (T/S)
Pteridophyta	6	4	10 (55.6)	-
Monocotyledons	30	77	105 (27.2)	5
Cyperaceae	2	32	34 (25.0)	-
Poaceae	1	26	27 (15.3)	-
Dicotyledons	39	73	112 (33.5)	49
TOTALS (% of all taxa)	76 (10.3)	212 (28.8)	227 (30.8)	54 (7.3)

(27 species) can be considered obligate aquatics. And of these, only one (*Vossia cuspidata*) is a submerged aquatic, although it is often referred to as only an emergent aquatic. The other major wetland group, sedges, contains only two submerged species (*Eleocharis naumanniana* and *Websteria confervoides*).

Comparison of the proportion of obligate aquatics in the comprehensive Chobe list (Appendix 2.1) and the basinwide list, shows more species in the Chobe area (12.5% vs. 27.1% for submerged and emergent aquatics, respectively, compared with 10.3% and 28.8% in the basinwide list). This may represent a greater concentration of obligate aquatics in the Chobe swamps as many of the other basin wetlands are floodplains, or it may be a result of under-recording of aquatics elsewhere.

2.4.3 Distribution

As noted earlier, most wetland species, especially the obligate aquatics, are found right across the basin. Unlike other wetland groups, such as Odonata, fish, freshwater molluscs and reptiles, aquatic plants do not show a geographical separation into Upper, Middle and Lower Zambezi species. There are some species which appear to be confined to the palaeo-Upper Zambezi, but these are all essentially dryland species which have secondarily adapted to a moister environment, or species of upper floodplains and dambos (such as the geoxylic suffrutices mentioned below). These habitats were even more extensive in the geomorphological past under wetter climatic conditions than they are today.

The widespread distribution of most wetland species, extending in many cases outside the Zambezi Basin to South Africa and the Afrotropics, is probably a result of species specialization to a particular, and often unstable, environment. Such environments require an opportunistic life history, such as rapid growth to reproduction, or wide dissemination of seed or propagules. Species may be dispersed by small seeds held in mud adhering to the feet of waterfowl moving over comparatively large distances, and seed is also distributed widely downstream by water currents.

2.5 AQUATIC WEEDS

The main aquatic weeds of concern in the wetlands of the basin are the floating species *Salvinia molesta* (Pteridophyta: Salviniaceae), *Pistia stratiotes* (Araceae), *Eichhornia crassipes* (Pontederiaceae) and the fern *Azolla filiculoides* (Azollaceae). Because they float and are not rooted in the substrate, all can move rapidly over water bodies or up and downstream, and all reproduce asexually and explosively under good conditions. The problems they cause are that they: (a) clog up waterways hindering navigation, power plants and water extraction, (b) cut out light so that submerged plants die out, (c) greatly increase the biological oxygen demand of waters when they die and decompose, and (d) modify the aquatic environment so that various indigenous plants and animals (especially fish) cannot survive. All the aquatic weeds described are exotic and originate from tropical America.

2.5.1 *Salvinia molesta*

The floating fern *Salvinia molesta*, generally called Kariba weed, has created the most concern, whether on Lake Kariba (Almeida 1972, Balinsky & James 1960, Boughey 1963, Schelpe 1961), Lake Cabora Bassa (Bond & Roberts 1978, Jackson & Davies 1976) or in the Chobe/Caprivi area (Edwards 1972, Edwards & Thomas 1977, Koch & Schlettwein 1983, Mitchell 1967, Smith 1993). The species showed an explosive invasion of the newly-formed Lake Kariba starting in the late 1950s, probably as a result of the greatly increased water nutrient levels resulting from flooding. There were also small invasions in the Okavango, but these were soon controlled (Smith 1993).

In the Chobe, biological control has been successful using an introduced weevil, *Cyrtobagous singularis* (Bethune 1996, Proctor 1983, Schlettwein & Bethune 1992), and on Lake Kariba weed populations have declined as water nutrient levels diminished (Marshall & Junor 1981, Mitchell & Rose 1979). Although the species must now be considered a permanent fixture in the waterways and swamps of the Chobe area, and elsewhere, it is only present in small numbers and does not now have any obvious deleterious effect.

2.5.2 *Azolla* species

Another genus of floating aquatic ferns is *Azolla*, the Water fern. There are three species found in the basin (*A. nilotica*, *A. pinnata* and the introduced *A. filiculoides*), but owing to their similarity they have often been confused when it comes to distribution. *A. filiculoides* shows a strong reddish tinge, particularly in winter, and although within the basin it was only reported from the Harare area some 10 years ago, it now appears to be widespread. Recently it has been noted to cover large areas in the swamps and lagoons of the southern Zambezi Delta. *A. filiculoides*, however, does not seem to have such a deleterious effect as other water weeds.

2.5.3 *Pistia stratiotes*

Pistia stratiotes, often called Nile cabbage or Water lettuce, is a much larger plant. Although it has been recorded from the Chobe River, as well as the Middle and Lower Shire, it is nowhere considered a major problem. Individual plants are often seen floating down the main channel of the Zambezi, but it does not seem to build up in numbers. A biological control agent (the beetle *Neohydronomus affinis*) has been introduced and is now well-established.

2.5.4 *Eichhornia crassipes*

The last aquatic weed considered is the rather beautiful *Eichhornia crassipes* or Water hyacinth. Although this species has been present in the Zambezi Basin for some time (in the middle and lower parts, plus the Kafue River), until now it was only considered a problem locally in eutrophic lakes

such as Lake Chivero (Jarvis *et al.* 1982), Lake Cabora Bassa and in the Lower Shire (Anon. n.d., Blackmore *et al.* 1988). However, it has now also become a problem in parts of Lake Malawi and the Shire (Dudley 1996). Over the last few years *Eichhornia* has shown explosive growth on Lake Kariba giving rise to much concern over difficulties with boat access and possible effects on the kapenta fishery (Marshall 1997). As with other aquatic weeds, herbicides and physical control measures have had little or no success on anything other than small water bodies. But on Lake Chivero a biological control agent (the weevil *Neochetina eichhorniae*) was released in the early 1990s. This seems to have brought the heavy infestation under control, although the plant is, and will probably remain, a permanent part of the ecology of the lake.

2.6 SITES AND SPECIES OF INTEREST

The major problem in identifying sites and species of interest is our uneven knowledge on distribution. Collecting and survey work has not been systematically carried out across the basin. What may now be regarded as a rare or threatened species may turn out to be much more common than supposed. In a similar way, some species may be a lot less widely distributed than believed, and new taxonomic concepts on what comprises a species may result in some taxa, such as subspecies of very limited distribution, being raised to specific status.

Our uneven knowledge poses a similar problem with identifying sites of interest. Knowledge of the whole basin (or at least a substantial portion of it) is needed in order to identify any site as being of particular interest. It is a comparative process, not normally an absolute one.

2.6.1 Species of interest

There are two categories of species of conservation interest, although the two groups should not be mutually exclusive. One group is endemic species, and the other is Red Data or threatened species.

Endemics

For the reasons given above, it has not been possible to provide a full list of species endemic to the basin, or a portion of it. Of the obligate aquatic species or subspecies, only six can be considered endemic to the basin wetlands and not found outside. These are the orchid *Habenaria pasmithii* (Orchidaceae; Mwinilunga and Okavango), the small herb *Rotala longistyla* (Lythraceae; Upper Zambezi and Zimbabwe highveld), and four woody species – *Pandanus petersii* (Pandanaceae), *Acacia hebeclada* subsp. *chobiensis* (Fabaceae: Mimosoideae), *Ficus pygmaea* (Moraceae), and *Syzygium guineense* subsp. *barotsense* (Myrtaceae). Very little appears to be known about the screwpine *Pandanus*, except that it has only been recorded from the wetlands of the Zambezi Delta. It may well prove to be the same as the more widespread *P. livingstonianus*. *Ficus pygmaea* is widely distributed along streams in the Kalahari sands areas of the Upper Zambezi. Both *Acacia* and *Syzygium* subspecies are also endemic to the western parts of the palaeo-Upper Zambezi plains, growing on stream banks and often trailing branches in the water, although *S. g.* subsp. *barotsense* is also found at slightly lower altitudes in the Zimbabwe highveld.

All the other 19 endemic, or near-endemic, taxa are not restricted to permanently wet situations. Two grasses, however, are of particular interest – *Eragrostis punctiglandulosa*, which is endemic to the Kafue Flats, and *Microchloa annua*, endemic to the Mongu area.

Red Data Species

The only comprehensive sources of data on threatened species are the IUCN *Red List of Threatened Plants* (Walter & Gillett 1998) and the WCMC *World List of Threatened Trees* (Oldfield *et al.* 1998). The former is a compilation of existing information from sources of greatly varying dates and quality, while the latter is more rigorous and went through a peer-review process.

The full list of Red Data species for the Zambezi Basin countries (Angola, Botswana, Malawi, Namibia, Mozambique, Zambia, Zimbabwe) is 273, of which 30 are considered particularly threatened (categories Vulnerable or Endangered). If only species/subspecies known to occur within the Zambezi Basin itself are included (excluding areas with many endemics, such as Mulanje, Nyika, Chimanmani and the Great Dyke), there are 43 threatened taxa in the IUCN study area, but only six of these are wetland-related. The WCMC threatened trees list shows 34 threatened taxa within the Zambezi Basin (compared to 134 taxa from all basin states, excluding Tanzania), but only three of these can be considered river or wetland-related.

The nine taxa that are considered wetland or riverine on the basis of their published habitat data are given in Table 2.4, although some are not featured in Table 2.1 as they do not fulfill the criteria used here for a wetland species. Five of them are woody and three are more aptly termed riverine rather than wetland species. The leguminous tree *Bussea xylocarpa* is only found in one small area downstream of Tete along the Zambezi, while *Acacia purpurea* was only found once over 100 years ago near Chupanga on the Lower Zambezi, and is probably not a good species but an aberrant specimen (which has since been lost so its identity cannot be checked). *Mimosa mossambicensis*, a riverine climber, is only recorded from the Zambezi banks from Tete downstream to Mutarara. Interestingly, in the review process of the WCMC study *Acacia hebeclada* subsp. *chobiensis* was downgraded from Threatened to Lower Risk, something which may occur with some other species when better knowledge is available. Only *Pandanus petersii* can be considered a truly wetland woody plant, but it is difficult to get any further information on it. Of the four herbaceous species, one (*Isoetes rhodesiana*) is from a pan in W Zimbabwe, and is thus excluded from the definition of a wetland plant used here, one is a grass (*Nematopoa longipes*) of wet areas in the highveld, one a herb found on sandbanks of the Lower Zambezi (*Vahlia capensis* subsp. *macrantha*), and the last is a bulbous herb recently discovered on the edges of termitaria on the Bulози Plain (*Gloriosa sessiliflora*). Under the definitions used here, only four of these can be considered as being from wetlands: *Acacia hebeclada*, *Pandanus petersii*, *Nematopoa longipes* and *Vahlia capensis*. However, with improved knowledge on endemics (see section above on endemics, in particular endemic grasses which were not included in the original IUCN list) this number will probably rise.

The oil palm, *Elaeis guineensis*, was recently recorded from a small area next to the Marromeu Reserve. If this proves to be the wild form it will be the only record south of southern Kenya (G. Pope, pers. comm.). But it may be naturalised specimens of the cultivated form, which have only been recorded as far south as northern Lake Malawi. It is a species of particular interest, and is also greatly desired as a source of good quality palm wine.

A fairly obvious conclusion from these lists is that there appears to be an under-representation of threatened plants from the Zambezi wetlands, certainly when compared to other limited and specialised habitats such as dry forests, montane grasslands, rainforests, etc. Given that wetland species listed are around 12% of the regional flora, and using the IUCN list of 43 threatened taxa from the basin, around five Red Data species should be expected instead of the present one or two. This is unlikely to be due solely to poor collecting or knowledge, and is more likely to be a result of the much wider distribution of wetland species.

Table 2.4. Red Data book plant species associated with wetlands of the Zambezi Basin.

Species	status	country	source	remarks
PTERIDOPHYTES				
Isoetaceae				
<i>Isoetes rhodesiana</i> <i>Alston</i>	R	Zim W	1	Nyamandhlovu; pans
DICOTYLEDONS				
Fabaceae: Caesalpinioideae				
<i>Bussea xylocarpa</i> (<i>Sprague</i>) <i>Sprague & Craib</i>	V	Moz Z	1, 2	small area of woodland along Zambezi R.
Fabaceae: Mimosoideae				
<i>Acacia hebeclada</i> <i>DC.</i>	R	Zam, Zim, Bot N	1	NW Zimbabwe, SW Zambia, Caprivi
<i>ssp. chobiensis</i> (<i>O.B.Miller</i>) <i>A.Schreiber</i>				
<i>Acacia purpurea</i> <i>Bolle</i>	VU D2	Moz C	2	Possibly not a good species. Riverine plains of S Zambezi R.
<i>Mimosa mossambicensis</i> <i>Brenan</i>	R	Moz T	1	Mutarara, Tete; riverside
MONOCOTYLEDONS				
Colchicaceae				
<i>Gloriosa sessiliflora</i> <i>Nordal & Bingham</i>	R?	Zam B		pers.comm. mounds near Lealui, Barotseland
Pandanaceae				
<i>Pandanus petersii</i>	VU D2	Moz MS	2	Zambezi Delta & N. Swampy places
Poaceae				
<i>Nematopoa longipes</i> (<i>Stapf & Hubb.</i>) <i>Hubb.</i>	R	Zim N,C	1	Endemic. Wet places.
Vahliaceae				
<i>Vahlia capensis</i> (<i>L.f.</i>) <i>Thumb.</i>	R	Moz MS	1	Zambezi river banks; sand
<i>ssp. macrantha</i> (<i>Klotzsch</i>) <i>Bridson</i>				

Sources: (1) IUCN Red List of Threatened Plants (1997); (2) World List of Threatened Trees (1998).

Threat categories:

Ex Extinct (taxa definitely not located in wild for 50 years)

E Endangered (taxa in danger of extinction and whose survival is unlikely if causal factors continue operating)

V Vulnerable (taxa liable to move into Endangered category in near future if causal factors continue operating; all populations decreasing)

R Rare (taxa with small world populations that are not at present Endangered or Vulnerable; usually found in restricted geographical areas or habitats)

I Indeterminate (taxa that are known to be Endangered, Vulnerable or Rare but where there is not enough information to categorise further)

2.6.2 Geoxylic Suffrutices

Another very important group of species of interest within the Zambezi Basin are the geoxylic suffrutices, or "underground trees" as Frank White (1976) so aptly called them. These are woody plants where the above-ground and flowering shoots die back leaving only the lower parts to survive unfavourable seasons or conditions such as fire, frost or drought. The species concerned have developed large woody rootstocks which can spread laterally for some distance.

However, this specialized group, consisting of many unrelated genera which contain closely-related tree species, is predominantly a group growing in seasonally anaerobic grasslands or upland dambos on Kalahari sands. As such they fall outside the definition of a wetland plant used here and can not be considered as 'true' wetland species.

There are around 82 species recorded from the palaeo-Zambezi Basin (White 1976), of which 68 are found in the broadly-defined Upper Zambezi Basin (i.e. including adjacent parts of the DRC and northeast Zambia), and 24 of these appear provisionally to be endemic to that area.

This group of wetland-related plants is not only of intrinsic biological interest in their repeated adaptation to a stressed environment, but show better than most the biogeographical and evolutionary links over the Upper Zambezi Basin. It is likely they evolved from closely-related tree species, independently of one another, in response to increasing waterlogged and dambo-like conditions present on the broad, gently-undulating Central African Plateau. These events perhaps took place a lot earlier than the Pleistocene climatic changes, but such events "merely sharpened the edges of taxa which began their differentiation a very long time before" (White 1976). This pattern of evolution indicates, as with the Reduncine antelope (see Chapter 3), the importance of this large area of woodland/grassland/wetland over the last few million years as a cradle of speciation.

2.6.3 Sites/areas of interest

Of major significance in terms of Zambezi Basin biodiversity are the *mushitus* and associated vegetation of Mwinilunga area at the Zambezi headwaters. Where many species of Congolian or more tropical affinity are found. However, although the area is of particular interest from the viewpoint of Zambezi Basin plant diversity, the species and habitats (only some of which could be termed wetland anyway) are more widespread in the Congo Basin and, in some cases, into West Africa.

The Barotse floodplains are very extensive and contain some species that are not found downstream. The extensive and stable seasonally-flooded grasslands of the broad Upper Zambezi have resulted in evolution of many species with bulbs or rhizomes, such as *Gloriosa sessiliflora*, related to more widespread species (vicariant evolution), while the associated dambos of the plateaux above have been the site of evolution of many geoxylic suffrutices. It is important to keep this extensive habitat functioning as an evolutionary "cradle", as well as a refuge for these highly-adapted species.

The Okavango Delta is probably the best minimally-disturbed wetland ecosystem and extensive area of swamps within the palaeo-basin. Here, floodplain habitats are much more limited and there is a high diversity of micro-habitat owing to seasonal flooding and the shifting of channels (P. Smith, pers. comm.).

Although the Bangweulu Swamps are, strictly speaking, also outside the present Zambezi Basin, they are probably also an area of plant biodiversity interest (Debenham 1952, Grimsdell & Bell

1975). With the exception of a recent plant collecting trip focussing on grasses and sedges (Renvoize 1996), there appears to be little information available on the plants.

The Zambezi Delta, in particular the southern portion in and around the Marromeu Reserve, is an area of major significance for wetland biodiversity with an extensive area of papyrus, lagoons, aquatic grassland and mangroves. Whereas the Okavango shows high habitat diversity with many wooded islands, the Zambezi Delta contains very few woody plants except for the mangroves closer to the coast and along creeks under tidal influence, the dense miombo woodland to the south where the land begins to rise to the Cheringoma plateau, and the very open palm savanna to the north west.

A very extensive (c.30 km²) area of pure-stand papyrus was noted from the air in the northwestern sector of the Zambezi Delta in Mozambique centred on the Rio Lulua/Rio Cuacua area, 40 km west of Quelimane (17°55'S, 36°30'E). This is unusually large extent of uniform papyrus swamp and may be of particular interest from a conservation perspective, although it hasn't been possible to visit it on the ground or by boat.

2.7 CONSERVATION

2.7.1 Wetland species

Most aquatic species are widely distributed, not just across the Zambezi Basin but also across tropical Africa. So although permanent wetlands are often considered threatened habitats, their constituent plant communities and species are usually widely spread.

A large swamp area, such as the Okavango or parts of the Zambezi Delta, has a multitude of habitats each shifting its composition and locality as channels move. Small areas of swamp, however, are much more likely to dry up periodically, contain fewer habitats, and through the natural process of plant succession may change their ecology more readily. The dynamic mosaic of communities found in the extensive wetland systems, and the healthy functioning of "wetland processes", is what most needs to be conserved. Conservation managers must try also not to confine or fossilize what is where. Perennial wetlands are very dynamic, more so than woodlands or forests, and must be managed as such.

Floodplains are less dynamic than swamps but contain more species of restricted distribution. The most restricted species, however, are those of dambos and pans. It is these that are perhaps of most conservation interest in the sense that it is within the broad Zambezi Basin (particularly the Upper Zambezi) that they must be conserved as many species are only found here.

2.7.2 Threats

Very little work has been done on the threats posed to wetland plants by such interventions as dams or from pollution. The vegetation of the Kafue Flats has changed since the construction of Itezhi-Tezhi dam, but it is not clear if any plant species have disappeared or been greatly reduced in numbers or extent. To determine this one needs monitoring plots, recorded before the intervention and after. But such plots do not appear to exist. On the Bulozzi floodplain, Bingham (Appendix 2.2) raises concerns on the loss of legume species due to localized intensive grazing by cattle. It is also possible that reduction in hippo numbers has caused channels to close, thus reducing the number of habitats. This has also been suggested as an important factor in the Zambezi Delta (see Volume III, Chapter 2).

Some of the biggest concerns have been raised over the effects of Kariba and Cabora Bassa dams on the floodplains and swamps of the Zambezi Delta. The lack of regular flooding is said to have reduced the effective wetland area, particularly at Marromeu, and allowed more frequent burning and also encroachment of woody species (see Volume III, Chapter 2). This is not obviously apparent, and without baseline data will remain a point of discussion and belief. There certainly does not seem to be a risk of any plant species being threatened, although the vegetation patterns and relative species proportions may shift subtly.

Other threats are posed by pollution. As can be seen from Lake Chivero near Harare, excessive pollution – in this case primarily of nutrients such as nitrate and phosphate – causes a radical change in species composition with algal blooms and a proliferation of weeds on the shoreline. The Okavango swamps are very nutrient poor. If large quantities of plant nutrients were released into the Okavango River upstream, it is likely there would be a significant change in both vegetation and plant species, with those species able to compete better under high nutrient conditions predominating. Many of the submerged and floating-leaved aquatics might become rare. The same would occur with other major pollutants such as pesticides or heavy metals.

2.8 CONCLUSIONS

The wetlands of the Zambezi Basin are rich in species number, mostly because of the large area of floodplains which are more species-rich than swamps. These floodplains also contain more restricted-distribution species than swamps. Most swamp species, or obligate aquatics, of the basin are found in similar habitats over much of southern or tropical Africa. There are very few wetland species endemic to the basin. However, one of the major gaps in our knowledge of wetland plants is on their distribution – it is not clear how widely distributed the various species are within the basin.

What is clear is that the Okavango Delta and Zambezi Delta are the most important wetland conservation areas for swamp vegetation within the broadly-defined Zambezi Basin, while the Barotse floodplains (and perhaps those of the Kafue) are the most important floodplain systems. The Zambezi headwaters area in northwest Zambia and northeastern Angola is exceptionally species-rich and important from a basinwide perspective, although the grasslands and forests here have not been categorized as wetlands in this review. The same applies to the plants of the upland dambos of the Upper Zambezi. If the existing ecological and hydrological processes in all these areas continue to operate, and land clearance and disturbance is properly managed, then the full complement of wetland plants will continue to exist.

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Family	Species/authority	L/F	Upper Zambezi						Middle Zambezi			Lower Zambezi			Dist.
			Barot	Okav	Ch/Cap	Kafue	other	MZV	Cabora	other	L. Shir	Delta	other		
Najadaceae	<i>Najas horrida</i> A.Br.	sa			X							X			S
Najadaceae	<i>Najas marina</i> L. ssp. <i>armata</i> (Lindb.f.) Horn (N. <i>pectinata</i> (Pari.) Magnus)	sa		X	X							X			A
Orchidaceae	<i>Eulophia alta</i> (L.) Fawcett & Rendle	ea	X												?
Orchidaceae	<i>Eulophia angolensis</i> (Reichb.f.) Summerh.	ea	X	X											?
Orchidaceae	<i>Eulophia pyrophila</i> (Reichb.f.) Summerh.	ea	X		X										?
Orchidaceae	<i>Eulophia walleri</i> (Reichb.f.) Kraenzl	ea	X		X										?
Orchidaceae	<i>Habenaria filicornis</i> (Lindl.) H.Bol. (H. <i>chlorotica</i> Reichb.f.)	ea		X	X							X			A
Orchidaceae	<i>Habenaria</i> sp.aff. <i>H. galpinii</i> Bolus	ea		X								X			?R
Orchidaceae	<i>Habenaria pasmithii</i> G.Will.	ea		X											R
Orchidaceae	<i>Habenaria schimperiana</i> A.Rich.	ea	X	X				X				X			A
Orchidaceae	<i>Satyrium trinerve</i> Lindl. (S. <i>atherstonei</i> Reichb.f.)	ea	X	X								X			A
Orchidaceae	<i>Zeuxine africana</i> Reichb.f.	T		X											A
Pandanaceae	<i>Pandanus petersii</i>	ea		X	X							X			R
Poaceae	<i>Acroceras macrum</i> Stapf	ea	X	X					X			X			A
Poaceae	<i>Acrocerus zizanioides</i> (Kunth) Dandy	ea		X								X			A
Poaceae	<i>Alloteropsis cimicina</i> (L.) Stapf	ea	X		X				X						A
Poaceae	<i>Andropogon brazzae</i> Franch.	ea	X	X	X				X						S
Poaceae	<i>Andropogon eucomus</i> Nees	ea	X	X	X				X						A
Poaceae	<i>Andropogon huillensis</i> Rendle	ea	X	X	X				X						S
Poaceae	<i>Andropogon laxatus</i> Stapf	ea	X	X	X				X						A
Poaceae	<i>Andropogon perligulatus</i> Stapf	ea	X	X	X				X						A
Poaceae	<i>Aristida cumingiana</i> Trin. & Rupr.	ea	X	X	X				X						A
Poaceae	<i>Aristida denudata</i> Pilg.	ea	X	X	X				X						S
Poaceae	<i>Aristida junciformis</i> Trin. & Rupr. ssp. <i>welwitschii</i> (Rendle) Melderis	ea	X	X	X				X						S
Poaceae	<i>Aristida pilgeri</i> Henard	ea	X	X	X				X						S
Poaceae	<i>Aristida stipitata</i> Hack.	ea	X	X	X				X						S

Family	Species/authority	L/F	Upper Zambezi						Middle Zambezi		Lower Zambezi			Dist.
			Barot	Okav	Ch/Cap	Kafue	other	MZV	Cabora	other	L. Shir	Delta	other	
Poaceae	<i>Bothriochloa bladhii</i> (Retz.) S.T.Blake (<i>B. glabra</i> (Roxb.) A. Camus)		X	X	X			X				X	A	
Poaceae	<i>Brachiaria arrecta</i> (T.Dur. & Schinz) Stent		X	X			X		X				A	
Poaceae	<i>Brachiaria bovonei</i> (Chiov.) Robyns		X					X					A	
Poaceae	<i>Brachiaria eruciformis</i> (Sm.) Griseb.		X	X				X					A	
Poaceae	<i>Brachiaria humicola</i> (Rendle) Schweick.		X	X			X		X				A	
Poaceae	<i>Brachiaria jubata</i> (Fig. & De Not.) Stapf		X				X						S	
Poaceae	<i>Brachiaria oligobrachiata</i> (Pilg.) Henr.		X	X			X						A	
Poaceae	<i>Brachiaria rugulosa</i> Stapf		X						X				A	
Poaceae	<i>Chasmodonium purpurascens</i> (Robyns) Jaq.-Fél.		X										?	
Poaceae	<i>Chloris gayana</i> Kunth		X	X				X				X	A	
Poaceae	<i>Chloris virgata</i> Sw.		X	X			X					X	A	
Poaceae	<i>Cleistachne sorghoides</i> Benth.		X	X								X	?	
Poaceae	<i>Cynodon dactylon</i> (L.) Pers.		X	X			X		X			X	A	
Poaceae	<i>Dactyloctenium giganteum</i> B.S.Fisher & Schweick.		X	X						X		X	A	
Poaceae	<i>Dichanthium annulatum</i> (Forssk.) Stapf var. <i>papillosum</i> (A.Rich.) de Wet & Harlan		X	X			X					X	A	
Poaceae	<i>Digitaria acuminatissima</i> Stapf		X				X						A	
Poaceae	<i>Digitaria brazzae</i> (Franch.) Stapf		X						X				A	
Poaceae	<i>Digitaria comifera</i> Pilg.		X						X				A	
Poaceae	<i>Digitaria debilis</i> (Desf.) Willd.		X						X				A	
Poaceae	<i>Digitaria diagonalis</i> (Nees) Stapf		X						X				S	
Poaceae	<i>Digitaria eriantha</i> Steud.		X						X				S	
Poaceae	<i>Digitaria eylesii</i> C.E.Hubb.		X						X				S	
Poaceae	<i>Digitaria maniculata</i> Stapf		X						X				S	
Poaceae	<i>Digitaria monodactyla</i> (Nees) Stapf		X						X				S	
Poaceae	<i>Digitaria perrottetii</i> (Kunth) Stapf		X						X				A	
Poaceae	<i>Digitaria remotigluma</i> (De Winter) Clayton		X						X				S	
Poaceae	<i>Digitaria scalarum</i> (Schweinf.) Chiov.		X						X				A	
Poaceae	<i>Diheteropogon grandiflorus</i> (Hack.) Stapf		X						X				A	

Family	Species/authority	L/F	Upper Zambezi					Middle Zambezi			Lower Zambezi				Dist.
			Barot	Okav	Ch/Cap	Kafue	other	MZV	Cabora	other	L. Shir	Delta	other		
Poaceae	<i>Dinebra retroflexa</i> (Vahl) Panz.				X	X			X						A
Poaceae	var. <i>condensata</i> S.M. Phillips														A
Poaceae	<i>Echinochloa colona</i> (L.) Link		X	X				X					X		A
Poaceae	<i>Echinochloa haploclada</i> (Stapf) Stapf		X	X				X					X		S
Poaceae	<i>Echinochloa jubata</i> Stapf		X	X				X					X		A
Poaceae	<i>Echinochloa pyramidalis</i> (Lam.) Hitchc. & Chase (E. <i>holubii</i> (Stapf) Stapf)	ea	X	X				X					X		A
Poaceae	<i>Echinochloa stagnina</i> (Retz.) Beauv.		X	X				X					X		A
Poaceae	<i>Entolasia imbricata</i> Stapf		X	X				X					X		A
Poaceae	<i>Eragrostis aethiopica</i> Chiov.		X	X				X					X		A
Poaceae	<i>Eragrostis arenicola</i> C.E. Hubb.		X	X				X					X		A
Poaceae	<i>Eragrostis atrovirens</i> (Desf.) Steud.		X	X				X					X		A
Poaceae	<i>Eragrostis botryodes</i> Clayton		X	X				X					X		A
Poaceae	<i>Eragrostis chapelieri</i> (Kunth) Nees		X	X				X					X		A
Poaceae	<i>Eragrostis ciliaris</i> (L.) R.Br.		X	X				X					X		A
Poaceae	<i>Eragrostis curvula</i> (Schrad.) Nees		X	X				X					X		A
Poaceae	<i>Eragrostis cylindrifolia</i> Hochst.		X	X				X					X		A
Poaceae	(E. <i>rigidior</i> Pilg.; E. <i>trichophora</i> Coss. & Dur.)		X	X				X					X		A
Poaceae	<i>Eragrostis friesii</i> Pilg.														S
Poaceae	<i>Eragrostis gangetica</i> (Roxb.) Steud.		X	X				X					X		A
Poaceae	<i>Eragrostis habrantha</i> Rendle		X	X				X					X		S
Poaceae	<i>Eragrostis heteromera</i> Stapf		X	X				X					X		A
Poaceae	<i>Eragrostis hiermiana</i> Rendle		X	X				X					X		A
Poaceae	<i>Eragrostis hispida</i> K.Schum.		X	X				X					X		A
Poaceae	<i>Eragrostis inamoena</i> K.Schum.		X	X				X					X		A
Poaceae	<i>Eragrostis japonica</i> (Thunb.) Trin.	ea	X	X				X					X		A
Poaceae	(<i>Diandrochloa namaquensis</i> (Nees) De Winter)		X	X				X					X		A
Poaceae	<i>Eragrostis lappula</i> Nees		X	X				X					X		A
Poaceae	<i>Eragrostis membranacea</i> Schinz		X	X				X					X		R
Poaceae	<i>Eragrostis mildbraedii</i> Pilg.		X	X				X					X		A
Poaceae	<i>Eragrostis pallens</i> Hack.		X	X				X					X		S
Poaceae	<i>Eragrostis pilosa</i> (L.) P.Beauv.		X	X				X					X		A

Family	Species/authority	L/F	Upper Zambezi					Middle Zambezi		Lower Zambezi			Dist.	
			Barot	Okav	Ch/Cap	Kafue	other	MZY	Cabora	other	L. Shir	Delta		other
Poaceae	<i>Eragrostis plana</i> Nees							X						S
Poaceae	<i>Eragrostis punctiglandulosa</i> Cope						X							R
Poaceae	<i>Eragrostis pusilla</i> Hack.							X						S
Poaceae	<i>Eragrostis rotifer</i> Rendle		X	X								X		S
Poaceae	<i>Eragrostis sarmentosa</i> (Thunb.) Trin.		X	X				X						S
Poaceae	<i>Eragrostis tremula</i> (Lam.) Steud.		X	X				X						A
Poaceae	<i>Eragrostis turgida</i> (Schumacher) De Wild.		X											A
Poaceae	<i>Eriochloa fatmensis</i> (Hochst. & Steud.) Clayton							X						A
Poaceae	<i>Eriochloa macclounii</i> Stapf				X			X			X			S
Poaceae	<i>Eriochloa meyeriana</i> (Nees) Pilg.							X			X			A
Poaceae	<i>Eriochloa procera</i> (Retz.) C.E.Hubb.										X			A
Poaceae	<i>Eriochloa stapfiana</i> Clayton (<i>E. borumensis</i> Stapf)										X			A
Poaceae	<i>Eriochrysis pallida</i> Munro	ea	X	X										S
Poaceae	<i>Eulalia aurea</i> (Bory) Kunth		X	X				X						A
Poaceae	<i>Harporchloa pseudoharpechloa</i> (Chiov.) Clayton		X											R
Poaceae	<i>Hemarthria altissima</i> (Poir.) Stapf & C.E.Hubb. (<i>Rendlia pseudoharpechloa</i> Chiov.)		X	X							X			A
Poaceae	<i>Hemarthria natans</i> Stapf				X									A
Poaceae	<i>Heteranthoecia guineensis</i> (Franch.) Robyns		X											A
Poaceae	<i>Hyparrhenia bracteata</i> (Willd.) Stapf		X									X		A
Poaceae	<i>Hyparrhenia filipendula</i> (Hochst.) Stapf		X					X						A
Poaceae	<i>Hyparrhenia rufa</i> (Nees) Stapf		X	X				X			X			A
Poaceae	<i>Hyperthelia dissoluta</i> (Steud.) W.D. Clayton		X	X				X				X		A
Poaceae	<i>Imperata cylindrica</i> (L.) Raeuschel		X	X							X			A
Poaceae	<i>Ischaemum afrum</i> (J.F. Gmel.) Dandy		X	X							X			A
Poaceae	<i>Ischaemum fasciculatum</i> Brongn.		X	X										A
Poaceae	<i>Leersia denudata</i> Launert	ea	X	X				X						A
Poaceae	<i>Leersia friesii</i> Melderis	ea	X	X			X							S
Poaceae	<i>Leersia hexandra</i> Sw.	ea	X	X				X			X			A
Poaceae	<i>Leptocarydion vulpiastrum</i> (De Not.) Stapf		X	X				X			X			A

Family	Species/authority	L/F	Upper Zambezi						Middle Zambezi			Lower Zambezi			Dist.	
			Barot	Okav	Ch/Cap	Kafue	other	MZV	Cabora	other	L. Shir	Delta	other			
Poaceae	<i>Setaria incrassata (Hochst.) Hack.</i>		X		X			X				X				A
Poaceae	<i>Setaria longiseta P.Beauv.</i>		X			X		X								A
Poaceae	<i>Setaria pseudaristata (Peter) Pilg.</i>				X											S
Poaceae	<i>Setaria pumila (Poir.) Roem. & Schult.</i>		X		X			X								A
Poaceae	<i>Setaria sphacelata (Schumacher) M.B.Moss (S. palustris Stapf)</i>		X		X			X								A
Poaceae	<i>Setaria verticillata (L.) P.Beauv.</i>		X					X								A
Poaceae	<i>Sorghastrum nudipes Nash</i>		X		X											S
Poaceae	<i>Sorghastrum stipoides (Kunth) Nash</i>													X		A
Poaceae	<i>Sorghum bicolor (L.) Moench</i>		X		X									X		A
Poaceae	<i>ssp. arundinaceum (Desv.) De Wet & Harlan (S. verticilliflorum (Steud.) Stapf)</i>															A
Poaceae	<i>Sorghum versicolor Andersson.</i>				X									X		A
Poaceae	<i>Sporobolus acinifolius Stapf (S. tenellus (Spreng.) Kunth)</i>		X		X			X								S
Poaceae	<i>Sporobolus africanus (Poir.) Robyns & Tournay</i>				X			X								A
Poaceae	<i>Sporobolus consimilis Fresen.</i>															A
Poaceae	<i>Sporobolus ioclados (Trin.) Nees (S. rangei Pilg.)</i>		X		X											A
Poaceae	<i>Sporobolus macranthelus Chiov.</i>		X		X											S
Poaceae	<i>Sporobolus natalensis (Steud.) Dur. & Schinz</i>													X		A
Poaceae	<i>Sporobolus nitens Stent</i>		X											X		S
Poaceae	<i>Sporobolus pyramidalis P.Beauv.</i>		X		X			X						X		A
Poaceae	<i>Sporobolus spicatus (Vahl) Kunth</i>		X		X			X						X		A
Poaceae	<i>Sporobolus subtilis Kunth</i>		X					X								A
Poaceae	<i>Triaraphis schinzii Hack.</i>		X					X								A
Poaceae	<i>Tristachya leucothrix Nees</i>		X													S
Poaceae	<i>Tristachya lualabaensis (De Wild.) J.B.Phipps</i>		X		X			X								S
Poaceae	<i>Tristachya rehmannii Hack.</i>		X		X			X								S
Poaceae	<i>Urochloa trichopus (Hochst.) Stapf</i>		X		X									X		A
Poaceae	<i>Vetiveria nigriflora (Benth.) Stapf</i>		X		X									X		A
Poaceae	<i>Vossia cuspidata (Roxb.) Griff.</i>	sa	X		X			X						X		A

Family	Species/authority	L/F	Upper Zambezi				Middle Zambezi			Lower Zambezi			Dist.	
			Barot	Okav	Ch/Cap	Kafue	other	MZV	Cabora	other	L. Shiri	Delta		other
Pontederiaceae	<i>Eichhornia crassipes (Mart.) Solms !!</i>	sa				X		X	X		X			A
Pontederiaceae	<i>Eichhornia natans (Beauv.) Solms.</i>	sa	X	X	X	X								A
Pontederiaceae	<i>Heteranthera callifolia Kunth</i>	ea		X	X									A
Pontederiaceae	<i>Monochoria africana (Solms) N.E.Br.</i>	ea										X		A
Potamogetonaceae	<i>Potamogeton octandrus Poir.</i>	sa	X	X	X									A
Potamogetonaceae	<i>Potamogeton pectinatus L.</i>	sa										X		A
Potamogetonaceae	<i>Potamogeton schweinfurthii A. W. Benn.</i>	sa	X	X	X									A
Potamogetonaceae	<i>Potamogeton thunbergii Cham. & Schltdl.</i>	sa	X	X	X							X		A
Potamogetonaceae	<i>Potamogeton trichoides Cham. & Schltdl.</i>	sa	X	X	X									A
Typhaceae	<i>Typha capensis (Rohrb.) N.E.Br.</i> (<i>T. latifolia L. ssp. capensis Rohrb.</i>)	ea												S
Typhaceae	<i>Typha domingensis Pers.</i>	ea		X	X						X		X	?
Xyridaceae	<i>Xyris capensis Thumb.</i>	ea	X	X				X						A
Xyridaceae	<i>Xyris congoensis Büttner.</i> (<i>X. hildebrandtii Nilss.</i>)	ea	X						X					A
Xyridaceae	<i>Xyris straminea Nilss.</i>	ea	X											A
DICOTYLEDONS														
Acanthaceae	<i>Asystasia gangetica (L.) T. Anders.</i>		X	X	X						X		X	?
Acanthaceae	<i>Blepharis maderaspatensis (L.) Roth</i>										X		X	?
Acanthaceae	<i>Barleria spinulosa Klotzsch</i>										X		X	?
Acanthaceae	<i>Dyschoriste radicans (A. Rich.) Nees</i>					X								?
Acanthaceae	<i>Dicliptera spinulosa Balkwill</i> (<i>D. verticillata (Forssk.) C.B. Clarke</i>)		X	X										?
Acanthaceae	<i>Duosperma quadrangulare (Klotzsch) C.B. Clarke</i>										X			?
Acanthaceae	<i>Hygrophila abyssinica (Nees) T. Anders.</i> (<i>H. prunellodes (S. Moore) Heine</i>)	sa	X	X	X									?
Acanthaceae	<i>Hygrophila auriculata (Schumacher) Heine</i>	sa										X	X	?
Acanthaceae	<i>Hygrophila pilosa Burkhill</i>	ea	X											?
Acanthaceae	<i>Hygrophila pobegumii Benoist</i>	ea		X										?
Acanthaceae	<i>Hygrophila sp. (PAS 3820)</i>	ea			X									?
Acanthaceae	<i>Isoglossa floribunda C.B. Clarke</i>										X			?

Family	Species/authority	L/F	Upper Zambezi					Middle Zambezi		Lower Zambezi			Dist.	
			Barot	Okav	Ch/Cap	Kafue	other	MZV	Cabora	other	L. Shir	Delta		other
Boraginaceae	<i>Heliotropium baclei</i> DC. var. <i>rostratum</i> I.M.Johnst.		X		X	X	X		X					A
Boraginaceae	<i>Heliotropium indicum</i> L.				X			X						A
Boraginaceae	<i>Heliotropium ovalifolium</i> Forssk.		X		X		X							A
Brassicaceae	<i>Rorippa micrantha</i> (Roth) Jonsell				X			X						A
Cabombaceae	<i>Brasenia schreberi</i> J.F. Gmel.	ea	X		X		X							A
Campanulaceae	<i>Gunillaea rhodesica</i> (Adamson) Thulin		X		X		X							S
Campanulaceae	<i>Wahlenbergia banksiana</i> A.DC.		X		X		X		X					S
Campanulaceae	<i>Wahlenbergia ramosissima</i> (Hemsl.) Thulin ssp. <i>lateralis</i> (Brehmer) Thulin		X		X		X							R
Campanulaceae	<i>Wahlenbergia undulata</i> (L.f.) A.DC.		X		X		X							A
Caryophyllaceae	<i>Polycarpon prostratum</i> (Forssk.) Aschers. & Schweinf.		X		X		X							A
Ceratophyllaceae	<i>Ceratophyllum demersum</i> L. var. <i>demersum</i>	sa	X		X		X		X				X	A
Ceratophyllaceae	<i>Ceratophyllum submersum</i> L.	sa			X								X	?
Chenopodiaceae	<i>Chenopodium ambrosioides</i> L.		X		X		X		X					A
Clusiaceae	<i>Garcinia livingstonei</i> T.Anders.	T	X		X		X		X					A
Combretaceae	<i>Combretum erythrophyllum</i> (Burch.) Sond.	T	X		X		X		X					S
Combretaceae	<i>Combretum imberbe</i> Wawra	T	X		X		X		X					S
Combretaceae	<i>Combretum microphyllum</i> Klotzsch	T	X		X		X		X					S
Combretaceae	<i>Combretum mossambicense</i> (Klotzsch) Engl.	T	X		X		X		X					S
Combretaceae	<i>Combretum padoides</i> Engl. & Diels	T	X		X		X		X					S
Connaraceae	<i>Rourea orientalis</i> Baill. (<i>Byrsocarpus orientalis</i> (Baill.) Bak.)	T			X				X					A
Convolvulaceae	<i>Falkia oblonga</i> Krauss var. <i>oblonga</i>	sa			X		X							A
Convolvulaceae	<i>Ipomoea aquatica</i> Forssk.		X		X				X					A
Convolvulaceae	<i>Ipomoea eriocarpa</i> R.Br.	ea	X		X		X		X					A
Convolvulaceae	<i>Ipomoea rubens</i> Choisy		X		X		X		X					A
Convolvulaceae	<i>Ipomoea sinensis</i> (Desr.) Choisy ssp. <i>sinensis</i>				X		X		X					A
Cucurbitaceae	<i>Cucumis metuliferus</i> Naud.		X						X					A

Family	Species/authority	L/F	Upper Zambezi				Middle Zambezi			Lower Zambezi			Dist.	
			Barot	Okav	Ch/Cap	Kafue	other	MZV	Cabora	other	L. Shir	Delta		other
Cucurbitaceae	<i>Mukia maderaspatana (L.) M.J.Roem.</i>		X		X				X		X		X	A
Cucurbitaceae	<i>Zehneria</i> sp. (SRGH No.1, PAS 1162)	ea			X									?
Droseraceae	<i>Aldrovanda vesiculosa L.</i>	sa		X	X									A
Droseraceae	<i>Drosera burkeana Planch.</i>	ea	X						X					A
Droseraceae	<i>Drosera madagascariensis DC.</i>	ea	X	X	X				X					A
Elatinaceae	<i>Bergia ammannioides Roth</i>		X	X	X				X					A
Elatinaceae	<i>Bergia glutinosa Dinter & Schulze-Menz</i>		X	X					X					S
Elatinaceae	<i>Bergia penteriana Keissl.</i> (<i>B. prostrata Schinz</i>)		X	X					X					S
Elatinaceae	<i>Elatine triandra Schkuhr</i>	sa		X	X									A
Euphorbiaceae	<i>Acalypha ornata A.Rich.</i>	S	X	X	X				X				X	A
Euphorbiaceae	<i>Acalypha pubiflora Bail.</i>	S									X			S
Euphorbiaceae	<i>Antidesma rufescens Tul.</i>	S	X								X			A
Euphorbiaceae	<i>Antidesma venosum Tul.</i>	S	X	X	X				X					A
Euphorbiaceae	<i>Caperonia fistulosa Beille</i>	ea	X	X	X				X					A
Euphorbiaceae	<i>Croton leuconeurus Pax</i> ssp. <i>leuconeurus</i>	T	X		X									A
Euphorbiaceae	<i>Croton megalobotrys Müll.Arg.</i>	T	X	X	X				X					S
Euphorbiaceae	<i>Phyllanthus reticulatus Poir.</i>	S	X	X	X				X		X			A
Fab: Caesalpinoideae	<i>Chamaecrista mimosoides (L.) Greene</i>		X	X	X				X		X		X	A
Fab: Caesalpinoideae	<i>Cordyla africana Lour.</i>	T	X						X					A
Fab: Caesalpinoideae	<i>Senna obtusifolia (L.) Irwin & Barneby !!</i>		X		X									A
Fab: Caesalpinoideae	<i>Senna occidentalis (L.) Link !!</i>		X	X	X				X					A
Fab: Mimosoideae	<i>Acacia hebeclada DC.</i> ssp. <i>chobiensis (O.B.Mill.) A.Schreib.</i>	S	X		X				X					A
Fab: Mimosoideae	<i>Acacia kirkii Oliv.</i> ssp. <i>kirkii</i>	T			X						X			A
Fab: Mimosoideae	<i>Acacia montigena Brenan & Exell</i>	S	X											A
Fab: Mimosoideae	<i>Acacia pilispina Pic.Serm.</i>	S	X		X				X					A
Fab: Mimosoideae	<i>Acacia tortilis (Forssk.) Hayne</i> ssp. <i>spirocarpa (A.Rich.) Brenan</i>	T		X	X				X			X		A
Fab: Mimosoideae	<i>Acacia xanthophloea Benth.</i>	T									X		X	A

Family	Species/authority	L/F	Upper Zambezi					Middle Zambezi		Lower Zambezi			Dist.	
			Barot	Okav	Ch/Cap	Kafue	other	MZV	Cabora	other	L. Shir	Delta		other
Fab: Mimosoideae	<i>Faidherbia albida</i> (Delile) A.Chev.	T	X	X	X	X		X	X	X				A
Fab: Mimosoideae	<i>Mimosa pigra</i> L.	sa	X	X	X	X		X	X					A
Fab: Mimosoideae	<i>Neptunia oleracea</i> Lour.	ea	X	X	X	X								A
Fab: Papilionoideae	<i>Aeschynomene afraspera</i> J.Léonard	ea												?
Fab: Papilionoideae	<i>Aeschynomene cristata</i> Vatke var. <i>crisitata</i>	ea	X	X	X			X	X					A
Fab: Papilionoideae	<i>Aeschynomene elaphroxylon</i> (Guill. & Perr.) Taub.	ea	X	X	X	X		X	X					A
Fab: Papilionoideae	<i>Aeschynomene fluitans</i> Peter	sa	X	X	X	X		X	X					S
Fab: Papilionoideae	<i>Aeschynomene indica</i> L.	ea	X	X	X					X				A
Fab: Papilionoideae	<i>Aeschynomene nilotica</i> Taub.	ea	X	X							X			A
Fab: Papilionoideae	<i>Aeschynomene pfundii</i> Taub.	ea									X			A
Fab: Papilionoideae	<i>Aeschynomene schimperii</i> A.Rich.	ea									X			A
Fab: Papilionoideae	<i>Aeschynomene uniflora</i> E.Mey.	ea	X											A
Fab: Papilionoideae	<i>Crotalaria ochroleuca</i> G.Don	ea	X	X				X			X			A
Fab: Papilionoideae	<i>Desmodium salicifolium</i> (Poir.) DC. var. <i>salicifolium</i>	ea	X	X	X						X			A
Fab: Papilionoideae	<i>Indigofera tinctoria</i> L. var. <i>arcuata</i> J.B.Gillett		X					X						A
Fab: Papilionoideae	<i>Lablab purpureus</i> (L.) Sweet ssp. <i>uncinatus</i> Verdc.		X							X				A
Fab: Papilionoideae	<i>Lonchocarpus capassa</i> Rolfe	T	X	X	X			X			X			S
Fab: Papilionoideae	<i>Psophocarpus scandens</i> (Endl.) Verdc.													A
Fab: Papilionoideae	<i>Sesbania bispinosa</i> (Jacq.) W.F.Wight	ea	X	X	X			X			X			A
Fab: Papilionoideae	<i>Sesbania brevipedunculata</i> J.B.Gillett	ea	X	X	X									A
Fab: Papilionoideae	<i>Sesbania cinerascens</i> Bak.	ea												S
Fab: Papilionoideae	<i>Sesbania coerulescens</i> Harms	ea	X									X		A
Fab: Papilionoideae	<i>Sesbania goetzei</i> Harms ssp. <i>goetzei</i>	ea												A
Fab: Papilionoideae	<i>Sesbania microphylla</i> E.Phillips & Hutch.	ea	X	X	X							X		A
Fab: Papilionoideae	<i>Sesbania rostrata</i> Bremek. & Oberm.	ea	X	X	X						X			A
Fab: Papilionoideae	<i>Sesbania sesban</i> (L.) Merr. var. <i>nubica</i> Chiov.	ea	X	X	X							X		A
Fab: Papilionoideae	<i>Sesbania tetraptera</i> Bak. ssp. <i>rogersii</i> (E.Phillips & Hutch.) G.P.Lewis		X								X			S

Family	Species/authority	L/F	Upper Zambezi					Middle Zambezi			Lower Zambezi			Dist.
			Barot	Okav	Ch/Cap	Kafue	other	MZV	Cabora	other	L. Shir	Delta	other	
Fab: Papilionoideae	<i>Vigna luteola</i> (Jacq.) Benth.	ea	X	X	X	X	X	X				X		A
Fab: Papilionoideae	<i>Vigna vexillata</i> (L.) A.Rich.		X								X			A
Fab: Papilionoideae	<i>Xanthocercis zambeziaca</i> (Baker) Dumaz-le-Grand	T			X				X					S
Gentianaceae	<i>Chironia palustris</i> Burch.				X						X			S
Gentianaceae	ssp. <i>transvaalensis</i> (Gilg.) I. Verd.													
Gentianaceae	<i>Exacum oldenlandioides</i> (S.Moore) Klack.		X		X						X			A
Gentianaceae	<i>Pychnosphaera buchananii</i> (Baker) N.E.Br.	ea	X	X										A
Gentianaceae	<i>Sebaea pentandra</i> E.Mey. var. <i>burchellii</i> (Gilg) Marais													S
Gentianaceae	<i>Sebaea</i> sp. (PAS 4630)				X									?
Haloragaceae	<i>Laurembergia repens</i> Berg.	ea	X	X	X					X				A
Haloragaceae	ssp. <i>brachypoda</i> (Hiern) Oberm. (L. <i>tetrandra</i> (Schott) Kanitz)													
Haloragaceae	<i>Myriophyllum spicatum</i> L.	sa	X		X						X	?		A
Lamiaceae	<i>Hyptis pectinata</i> (L.) Poit.		X	X	X									?
Lamiaceae	<i>Hyptis spicigera</i> Lam.		X	X										?
Lamiaceae	<i>Mentha aquatica</i> L.	ea			X									?
Lamiaceae	<i>Neohyptis paniculata</i> (Baker) J.K.Morton		X											?
Lamiaceae	<i>Ocimum americanum</i> L. (O. <i>canum</i> Sims)		X							X				?
Lamiaceae	<i>Plectranthus mirabilis</i> (Briq.) Launert		X											?
Lamiaceae	<i>Pycnostachys coerulea</i> Hook.	ea		X										?
Lamiaceae	<i>Pycnostachys schliebenii</i> Mildbr.													?
Lauraceae	<i>Cassytha filiformis</i> L.		X	X	X							X		A
Lauraceae	<i>Cassytha pondoensis</i> Engl. var. <i>pondoensis</i>		X											S
Lentibulariaceae	<i>Utricularia australis</i> R.Br. (U. <i>vulgaris</i> L.)	sa			X									A
Lentibulariaceae	<i>Utricularia benjaminiana</i> Oliv.	sa	X	X										A
Lentibulariaceae	<i>Utricularia cymbantha</i> Oliv.	sa	X	X										A
Lentibulariaceae	<i>Utricularia foliosa</i> L.	sa	X	X	X									A
Lentibulariaceae	<i>Utricularia gibba</i> L.	sa	X	X	X						X			A

Family	Species/authority	L/F	Upper Zambezi				Middle Zambezi		Lower Zambezi			Dist.	
			Barot	Okav	Ch/Cap	Kafue	other	MZV	Cabora	other	L. Shir		Delta
Lentibulariaceae	<i>Utricularia inflexa</i> Forssk.	sa	X	X	X	X	X	X	X			X	A
Lentibulariaceae	<i>Utricularia reflexa</i> Oliv.	sa	X	X	X	X		X				X	A
Lentibulariaceae	<i>Utricularia scandens</i> Benj.		X	X	X	X							A
Lentibulariaceae	<i>Utricularia stellaris</i> L.f.	sa	X	X	X	X		X					A
Lentibulariaceae	<i>Utricularia subulata</i> L.		X	X	X	X		X					A
Lentibulariaceae	<i>Utricularia tortilis</i> Oliv.	sa	X	X	X	X		X					A
Lobeliaceae	<i>Lobelia angolensis</i> Engl. & Diels		X	X	X	X		X					A
Lobeliaceae	<i>Lobelia erinus</i> L.		X	X	X	X		X					A
Lobeliaceae	<i>Lobelia fervens</i> Thunb. ssp. fervens		X	X	X	X		X			X		A
Loganiaceae	<i>Anthocleista liebrechtsiana</i> De Wild. & T. Dur.	T	X	X	X	X		X					A
Loganiaceae	<i>Gomphostigma virgatum</i> (L.f.) Baill.		X	X	X	X		X					S
Lythraceae	<i>Ammannia auriculata</i> Willd.		X	X	X	X	X	X					A
Lythraceae	(<i>Nesaea dinteri</i> Koehne ssp. <i>elata</i> A. Fern.)		X	X	X	X		X					A
Lythraceae	<i>Ammannia baccifera</i> L. ssp. <i>baccifera</i>		X	X	X	X		X					A
Lythraceae	<i>Ammannia plicuriana</i> Guill. & Perr.		X	X	X	X		X					A
Lythraceae	<i>Ammannia senegalensis</i> Lam.		X	X	X	X		X					S
Lythraceae	var. <i>odongana</i> (Koehne) Verdc.		X	X	X	X		X					A
Lythraceae	(<i>Nesaea odongana</i> Koehne ssp. <i>odongana</i>)		X	X	X	X		X					A
Lythraceae	<i>Nesaea cordata</i> Hiern		X	X	X	X		X					A
Lythraceae	<i>Nesaea crassicaulis</i> (Guill. & Perr.) Koehne		X	X	X	X		X					A
Lythraceae	<i>Nesaea drummondii</i> A. Fern.	sa	X	X	X	X	X	X					S
Lythraceae	<i>Nesaea erecta</i> Guill. & Perr.		X	X	X	X		X					A
Lythraceae	<i>Nesaea linearis</i> Hiern		X	X	X	X		X					A
Lythraceae	<i>Nesaea minima</i> Immelman		X	X	X	X		X					R
Lythraceae	<i>Nesaea radicans</i> Guill. & Perr.		X	X	X	X		X					?
Lythraceae	var. <i>floribunda</i> (Sond.) A. Fernandes		X	X	X	X		X					A
Lythraceae	<i>Nesaea radicans</i> Guill. & Perr. var. <i>radicans</i>		X	X	X	X		X					A
Lythraceae	<i>Nesaea rautanemii</i> Koehne		X	X	X	X		X					R
Lythraceae	<i>Nesaea rigidula</i> (Sond.) Koehne		X	X	X	X		X					S

Family	Species/authority	L/F	Upper Zambezi						Middle Zambezi			Lower Zambezi			Dist.	
			Barot	Okav	Ch/Cap	Kafue	other	MZV	Cabora	other	L. Shir	Delta	other			
Lythraceae	<i>Nesaea schinzii</i> Koehne var. <i>schinzii</i>		X		X											A
Lythraceae	<i>Nesaea</i> sp. (Mavi 118, FHH 274)			X												?
Lythraceae	<i>Rotala filiformis</i> (Bellardi) Hiern (<i>R. heterophylla</i> A.Fern. & Diniz; <i>R. heteropetala</i> Koehne)	ea	X	X	X			X			X					A
Lythraceae	<i>Rotala fluitans</i> Pohnert		X		X			X								S
Lythraceae	<i>Rotala longistyla</i> Gibbs	sa	X	X				X			X					R
Lythraceae	<i>Rotala myriophylloides</i> Hiern	sa		X				X			X					S
Lythraceae	<i>Rotala serpiculoides</i> Hiern		X		X			X			X					A
Lythraceae	<i>Rotala tenella</i> (Guill. & Perr.) Hiern (<i>R. submersa</i> Pohnert)		X	X	X			X			X					S
Malvaceae	<i>Hibiscus diversifolius</i> Jacq.	ea	X	X	X			X			X					A
Malvaceae	spp. <i>rivularis</i> (Bremek. & Oberm.) Exell		X	X				X								A
Malvaceae	<i>Kosteletzkya buettneri</i> Gürke	ea	X	X	X			X								A
Malvaceae	<i>Wissadula rostrata</i> (Schumach.) Hook.f.		X	X				X			X					A
Melastomataceae	<i>Antherotoma naudinii</i> Hook.f.		X					X								A
Melastomataceae	<i>Dissotis falcipila</i> Gilg		X					X								R
Melastomataceae	<i>Dissotis gracilis</i> Cogn.		X					X								R
Melastomataceae	<i>Dissotis princeps</i> (Kunth) Triana		X					X								A
Melastomataceae	<i>Melastomastrum segregatum</i> (Benth.) A. & R. Fern.	ea	X		X			X								A
Meliaceae	<i>Trichilia emetica</i> Vahl	T	X	X	X			X			X					A
Meliaceae	<i>Turraea zambesica</i> Sprague & Hutch.	T	X		X			X			X					A
Menyanthaceae	<i>Nymphoides brevipedicellata</i> (Vatke) A. Raynal	sa	X	X	X			X			X					S
Menyanthaceae	<i>Nymphoides forbesiana</i> (Griseb.) Kuntze	sa	X		X			X								A
Menyanthaceae	<i>Nymphoides indica</i> (L.) Kuntze ssp. <i>occidentalis</i> A. Raynal	sa	X	X	X			X			X					A
Menyanthaceae	<i>Nymphoides rautanenii</i> (N.E.Br.) A. Raynal	sa	X	X	X			X								S
Menyanthaceae	<i>Nymphoides thunbergiana</i> (Griseb.) Kuntze	sa	X	X	X			X								S
Molluginaceae	<i>Corrigiola litoralis</i> L.		X	X	X			X								A
Molluginaceae	<i>Glinus lotooides</i> L. var. <i>lotooides</i>		X	X	X			X			X					A

Family	Species/authority	L/F	Upper Zambezi						Middle Zambezi			Lower Zambezi			Dist.
			Barot	Okav	Ch/Cap	Kafue	other	MZV	Cabora	other	L. Shir	Delta	other		
Scrophulariaceae	<i>Walafrida paniculata</i> (Thunb.) Rolfe (<i>W. saxatilis</i> (E.Mey.) Rolfe)			X					X						S
Sphenocleaceae	<i>Sphenoclea zeylanica</i> Gaertn.	ea		X					X				X		A
Sterculiaceae	<i>Melochia corchorifolia</i> L.		X	X				X					X		A
Thymelaeaceae	<i>Gnidia chrysantha</i> (Schweinf) Gilg		X												?
Tiliaceae	<i>Corehorus fascicularis</i> Lam.		X										X		A
Tiliaceae	<i>Corehorus olitorius</i> L.		X						X						A
Tiliaceae	<i>Corehorus trilocularis</i> L.		X	X											A
Tiliaceae	<i>Grewia flavescens</i> Juss. var. <i>olukondae</i> (Schinz) Wild	S	X						X				X		S
Tiliaceae	<i>Grewia inaequilatera</i> Garcke (<i>G. cyclopetala</i> Wawra)	S							X				X		S
Tiliaceae	<i>Grewia schinzii</i> K.Schum.	S	X	X					X						R
Tiliaceae	<i>Triumfetta pentandra</i> A.Rich.	sa	X	X					X				X		A
Trapaceae	<i>Trapa natans</i> L. var. <i>bispinosa</i> (Roxb.) Makina		X	X					X				X		A
Vahliaceae	<i>Vahlia capensis</i> (L.f.) Thunb. ssp. <i>macrantha</i> (Klotzsch) Bridson														R
Vahliaceae	<i>Vahlia capensis</i> (L.f.) Thunb. ssp. <i>vulgaris</i> Bridson		X	X					X						S
Verbenaceae	<i>Phyla nodiflora</i> (L.) Greene	ea		X									X		A
Verbenaceae	<i>Premna senensis</i> Klotzsch	S		X									X		?
Vitaceae	<i>Cissus grisea</i> (Bak.) Planch.			X									X		S
TOTALS		736 taxa	402	420	392	72	249		133	16	217		177	138	168

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CHAPTER 2 : APPENDIX 1
LIST OF AQUATIC AND WETLAND PLANTS FROM THE CHOBE AND
EAST CAPRIVI WETLANDS OF NAMIBIA/BOTSWANA

Pete Smith

!!	introduced species	aq.	aquatic status
sa	submerged or floating aquatic	L/F	life form
ea	emergent aquatic		
Life form categories:			
P	perennial	H	herb
A	annual	Cl	climber
T	tree	other groups unclear	
S	shrub		

Species/authority	aq.	L/F	habitat
PTERIDOPHYTA			
Adiantaceae			
<i>Adiantum capillus-veneris L.</i>			Kwando, riverbanks
Azollaceae			
<i>Azolla pinnata R.Br.</i>	sa		Linyanti; Shaile; Kwando
Equisetaceae			
<i>Equisetum ramosissimum Desf.</i>			Sibuyu, banks; Lesomo, spring
Marsiliaceae			
<i>Marsilea macrocarpa Presl.</i>			Seronga road, pans
<i>Marsilea nubica A.Br.</i>			Zwenya, pans
Salvinaceae			
<i>Salvinia molesta D.S.Mitchell !!</i>	sa		
Pteridaceae			
<i>Pteris vittata L.</i>			Kwando; Lesomo
Thelypteridaceae			
<i>Ampelopteris prolifera (Retz.) Copel.</i>			Kwando, riverbanks/levees
<i>Thelypteris confluens (Thunb.) Morton</i>	ea		riverbanks, swamps
<i>Thelypteris totta (Thunb.) Schelpe</i> (<i>T. interrupta (Willd.) K.Iwats</i>)	ea		riversides, swamps, rapids
MONOCOTYLEDONS			
Alismataceae			
<i>Burnatia enneandra P.Micheli</i>	ea	PH	swamps, floodplains
<i>Caldesia reniformis (D.Don) Makino</i>	sa	H	swamps
<i>Limnophyton obtusifolium (L.) Miq.</i>	ea	H	pans
Araceae			
<i>Pistia stratiotes L.</i>	sa	AHr	rivers, lakes, pools
Arecaceae			
<i>Phoenix reclinata Jacq.</i>	ea	T	riverbanks, swamps

Species/authority	aq.	L/F	habitat
Colchicaceae			
<i>Androcymbium gramineum</i> (Cav.) Macbride		Hc	floodplains
Commelinaceae			
<i>Commelina diffusa</i> Burm.f. ssp. <i>diffusa</i>	ea	A/PH	riverbanks
<i>Commelina diffusa</i> Burm.f. ssp. <i>scandens</i> (C.B. Clarke) Oberm.	ea	A/PH	riverbanks, swamps
<i>Commelina subulata</i> Roth		AH	pans
<i>Floscopa flavida</i> C.B. Clarke	ea	AH	rapids
<i>Floscopa glomerata</i> (Schult. & Schult.f.) Hassk.	ea	PH	riverbanks, swamps
Cyperaceae			
<i>Ascolepis pusilla</i> Ridl. var. <i>microcuspis</i> K.Lye			
<i>Bolboschoenus maritimus</i> (L.) Palla (<i>Scirpus maritimus</i> (L.) Lye)			
<i>Carex cognata</i> Kunth var. <i>cognata</i>			
<i>Cladium mariscus</i> (L.) Pohl ssp. <i>jamaicense</i> (Crantz) Kük.	ea		
<i>Courtoisina cyperoides</i> (Roxb.) Sojak			
<i>Cyperus alopecuroides</i> Rottb.	ea		
<i>Cyperus alternifolius</i> L. ssp. <i>flabelliformis</i> Kük.			
<i>Cyperus articulatus</i> L.	ea		
<i>Cyperus clavinox</i> C.B. Clarke			
<i>Cyperus compressus</i> L.			
<i>Cyperus denudatus</i> L.f.	ea		
<i>Cyperus digitatus</i> Roxb. ssp. <i>auricomus</i> (Spreng.) Kük.	ea		
<i>Cyperus dives</i> Del.	ea		
<i>Cyperus esculentus</i> L.			
<i>Cyperus imbricatus</i> Retz. (<i>C. radiatus</i> Vahl)			
<i>Cyperus laevigatus</i> L.			
<i>Cyperus latifolius</i> Poir.			
<i>Cyperus longus</i> L.			
<i>Cyperus maculatus</i> Boeck.			
<i>Cyperus mwiniungensis</i> Podlech			
<i>Cyperus palmatus</i> Vorster ms.			
<i>Cyperus papyrus</i> L.	ea		
<i>Cyperus pectinatus</i> Vahl	ea		
<i>Cyperus schinzii</i> Boeck.			
<i>Cyperus sphaerospermus</i> Schrad.			
<i>Cyperus tenuispica</i> Steud.			
<i>Eleocharis acutangula</i> (Roxb.) Schult.	ea		
<i>Eleocharis atropurpurea</i> (Retz.) Presl			
<i>Eleocharis brainii</i> Svenson			
<i>Eleocharis caduca</i> (Delile) Schult.			
<i>Eleocharis marginulata</i> Steud.			
<i>Eleocharis naumanniana</i> Boeck. var. <i>naumanniana</i>	sa		
<i>Eleocharis setifolia</i> (A. Rich.) J. Raynal			
<i>Fimbristylis bisumbellata</i> (Forssk.) Bub.			
<i>Fimbristylis complanata</i> (Retz.) Link			
<i>Fimbristylis dichotoma</i> (L.) Vahl			

Species/authority	aq.	L/F	habitat
<i>Fimbristylis ferruginea</i> (L.) Vahl			
<i>Fimbristylis obtusifolia</i> (Lam.) Kunth			
<i>Fimbristylis squarrosa</i> (Poir.) Vahl			
<i>Fuirena ciliaris</i> (L.) Roxb. var. <i>ciliaris</i>			
<i>Fuirena coerulescens</i> Steud.			
<i>Fuirena pubescens</i> (Poir.) Kunth			
<i>Fuirena umbellata</i> Rottb.	ea		
<i>Kyllinga bulbosa</i> P.Beauv.			
<i>Kyllinga erecta</i> Schumach. ssp. <i>erecta</i>			
<i>Kyllingiella microcephala</i> (Steud.) R.W.Haines			
<i>Lipocarpha hemisphaerica</i> (Roth) Goetgh.	ea		
<i>Lipocarpha rehmannii</i> (Ridl.) Goetgh.			
<i>Mariscus dregeanus</i> Kunth			
<i>Mariscus hamulosus</i> (M.Bieb.) Hooper			
<i>Mariscus squarrosus</i> (L.) C.B. Clarke			
<i>Oxycaryum cubense</i> (Popp.&Kunth) Lye	ea		
<i>Pycreus flavescens</i> (L.) Rchb.			
<i>Pycreus macranthus</i> (Boeck.) C.B. Clarke.			
<i>Pycreus mundii</i> Nees	ea		
<i>Pycreus nitidus</i> (Lam.) J.Raynal	ea		
<i>Pycreus okavangensis</i> Podlech			
<i>Pycreus pelophilus</i> (Ridl.) C.B.Cl.			
<i>Pycreus polystachyos</i> (Rottb.) Beauv.			
<i>Rhynchospora brevirostris</i> Griseb.			
<i>Rhynchospora corymbosa</i> (L.) Britton	ea		
<i>Rhynchospora holoschoenoides</i> (Rich.) Herter	ea		
<i>Schoenoplectus articulatus</i> (L.) Palla (Scirpus <i>articulatus</i> L.)			
<i>Schoenoplectus corymbosus</i> (Roem.& Schult.) J.Raynal	ea		
<i>Schoenoplectus erectus</i> (Poir.) J.Raynal ssp. <i>raynalii</i> (Schuyler) Lye			
<i>Schoenoplectus microglumis</i> Lye			
<i>Schoenoplectus muricinux</i> (C.B. Clarke) J.Raynal (Scirpus <i>muricinux</i>)			
<i>Schoenoplectus roylei</i> (Nees) Ovcz.& Czukav.			
<i>Schoenoplectus senegalensis</i> (Steud.) J.Raynal			
<i>Schoenoplectus</i> SRGH sp. no.			
<i>Scleria bulbifera</i> A.Rich.			
<i>Scleria distans</i> Poir.	ea		
<i>Scleria dregeana</i> Kunth	ea		
<i>Scleria foliosa</i> A.Rich.	ea		
<i>Scleria melanomphala</i> Kunth	ea		
<i>Scleria schimperiana</i> Boeck.			
<i>Scleria woodii</i> C.B. Clarke			
Hyacinthaceae			
<i>Litanthus pusillus</i> Harv.		Hb	pans
Hydrocharitaceae			
<i>Lagarosiphon cordofanus</i> Caspary (L. <i>crispus</i> Rendle)	sa	H	pans
<i>Lagarosiphon ilicifolius</i> Oberm.	sa	Hr	ivers, lakes, pools

Species/authority	aq.	L/F	habitat
Lagarosiphon muscoides Harv.	sa	H	pans
Ottelia muricata (C.H.Wright) Dandy	sa	PH	rivers
Ottelia ulvifolia (Planch.) Walp.	sa	PH	rivers, lake, pools, swamps, pans
Vallisneria spiralis L.	sa	PHs	rivers, lakes, pools
Juncaceae			
Juncus rigidus Desf.		PHr	floodplains
Lemnaceae			
Lemna aequinoctialis Welw.	sa	AH	open water
Spirodela polyrrhiza (L.) Schleid.	sa	AH	open water
Wolffia arrhiza (L.) Wimm.	sa	AH	open water
Wolffiella welwitschii (Hegelm.) Monod	sa	AH	open water
Limnocharitaceae			
Butomopsis latifolia (D.Don) Kunth		AH	pans
Najadaceae			
Najas horrida A.Br.	sa	A/PH	rivers, lakes, pools
Orchidaceae			
Habenaria filicornis (Lindl.) H.Bol. (H.chlorotica Rchb.f.)		Ht	floodplains
Poaceae			
Acroceras macrum Stapf	ea		
Andropogon brazzae Franch.	ea		
Andropogon eucomus Nees			
Andropogon huillensis Rendle			
Andropogon laxatus Stapf			
Aristida pilgeri Henrard			
Bothriochloa bladhii (Retz.) S.T.Blake (B. glabra (Roxb.) A.Camus)			
Bothriochloa insculpta (A.Rich.) A.Camus			
Brachiaria arrecta (T.Dur.& Schinz) Stent			
Brachiaria dura Stapf			
Brachiaria eruciformis (Sm.) Griseb.			
Brachiaria grossa Stapf			
Brachiaria humidicola (Rendle) Schweick.			
Brachiaria jubata (Fig.& De Not.) Stapf			
Brachyachne patentiflora (Stent & J.M.Ratray) C.E.Hubb.			
Chloris gayana Kunth			
Chloris virgata Sw.			
Cymbopogon caesius (Nees) Stapf			
Cymbopogon giganteus Chiov.			
Dichanthium annulatum (Forssk.) Stapf var. papillosum (A.Rich.) de Wet & Harlan			
Digitaria debilis (Desf.) Willd.			
Digitaria maniculata Stapf			
Digitaria scalarum (Schweinf.) Chiov.			
Dinebra retroflexa (Vahl) Panz. var. condensata S.M.Phillips			
Echinochloa colona (L.) Link			
Echinochloa crus-pavonis (Kunth) Schult.	ea		
Echinochloa jubata Stapf			

Species/authority	aq.	L/F	habitat
<i>Echinochloa pyramidalis</i> (Lam.) Hitchc. & Chase (<i>E. holubii</i> (Stapf) Stapf)	ea		
<i>Elytrophorus globularis</i> Hack.			
<i>Elytrophorus spicatus</i> (Willd.) A. Camus			
<i>Eragrostis gangetica</i> (Roxb.) Steud.			
<i>Eragrostis habrantha</i> Rendle			
<i>Eragrostis inamoena</i> K. Schum.	ea		
<i>Eragrostis lappula</i> Nees			
<i>Eragrostis rotifer</i> Rendle			
<i>Eragrostis sarmentosa</i> (Thunb.) Trin.			
<i>Eragrostis stapfii</i> De Winter			
<i>Eriochloa macclounii</i> Stapf			
<i>Eriochloa stapfiana</i> W.D. Clayton			
<i>Eulalia aurea</i> (Bory) Kunth			
<i>Hemarthria altissima</i> (Poir.) Stapf & C.E. Hubb.			
<i>Hemarthria natans</i> Stapf			
<i>Hyparrhenia dichroa</i> (Steud.) Stapf			
<i>Hyparrhenia rudis</i> Stapf			
<i>Hyparrhenia rufa</i> (Nees) Stapf			
<i>Hyperthelia dissoluta</i> (Steud.) W.D. Clayton			
<i>Imperata cylindrica</i> (L.) Raeuschel			
<i>Ischaemum fasciculatum</i> Brongn.			
<i>Leersia hexandra</i> Sw.	ea		
<i>Leptochloa fusca</i> (L.) Kunth	ea		
<i>Miscanthus junceus</i> (Stapf) Pilg.	ea		
<i>Oryza barthii</i> A. Chev. (<i>O. breviligulata</i> A. Chev. & Roehr.)	ea		
<i>Oryza longistaminata</i> A. Chev. & Roehr.	ea		
<i>Oryzidium barnardii</i> C.E. Hubbard & Schweick.			
<i>Oryzidium</i> sp. nov.			
<i>Panicum coloratum</i> L. var. <i>coloratum</i>			
<i>Panicum gilvum</i> Launert			
<i>Panicum graniflorum</i> Stapf			
<i>Panicum repens</i> L.	ea		
<i>Panicum subalbidum</i> Kunth	ea		
<i>Panicum trichonode</i> Launert & Renvoize			
<i>Paspalidium obtusifolium</i> (Delile) Simpson			
<i>Pennisetum macrourum</i> Trin.	ea		
<i>Phragmites australis</i> (Cav.) Steud.	ea		
<i>Phragmites mauritanus</i> Kunth	ea		
<i>Sacciolepis interrupta</i> (Willd.) Stapf	ea		
<i>Sacciolepis typhura</i> (Stapf) Stapf	ea		
<i>Setaria incrassata</i> (Hochst.) Hack.			
<i>Setaria sphacelata</i> (Schumach.) M.B. Moss (<i>S. palustris</i> Stapf)			
<i>Sorghastrum nudipes</i> Nash			
<i>Sporobolus spicatus</i> (Vahl) Kunth			
<i>Themeda triandra</i> Forssk.			

Species/authority	aq.	L/F	habitat
<i>Trachypogon spicatus</i> (L.f.) Kuntze			
<i>Tristachya lualabensis</i> (De Wild.) J.B.Phipps			
<i>Tristachya nodiglumis</i> K.Schum.			
<i>Vetiveria nigriflora</i> (Benth.) Stapf			
<i>Vossia cuspidata</i> (Roxb.) Griff.	sa		
<i>Willkomnia sarmentosa</i> Hack.			
Pontederiaceae			
<i>Eichhornia natans</i> (Beauv.) Solms.	sa	H	rivers, lakes, pans
<i>Heteranthera callifolia</i> Kunth	ea	CrH	pans
Potamogetonaceae			
<i>Potamogeton octandrus</i> Poir.	sa	PH	rivers, lakes, pools
<i>Potamogeton schweinfurthii</i> A.W.Benn.	sa	PH	rivers, lakes, pools
<i>Potamogeton thunbergii</i> Cham. & Schldl.	sa	PH	rivers, lakes, pools, sandbanks
Typhaceae			
<i>Typha capensis</i> (Rohrb.) N.E.Br.	ea	PHcr	rivers, lakes, pools
DICOTYLEDONS			
Acanthaceae			
<i>Hygrophila pilosa</i> Burkill		PH	pans, floodplains
<i>Hygrophila prunelloides</i> (S. Moore) Heine	sa	PH	riverbanks, floodplains
<i>Hygrophila pumiloides</i>		PH	rapids
<i>Hygrophila</i> sp. (PAS 3820)		H	pan
<i>Justicia anselliana</i> (Nees) T.Anders.		PH	floodplain edge
<i>Nelsonia canescens</i> (Lam.) Spreng.		PH	floodplain/island edge
Amaranthaceae			
<i>Alternanthera nodiflora</i> R.Br. !!		A/PH	pan edge, floodplains
<i>Alternanthera sessilis</i> (L.) DC.	ea	A/PH	river edges, swamps
Anacardiaceae			
<i>Rhus quartiniana</i> A.Rich.	ea	S/T	riverbanks, island edges
Apiaceae			
<i>Centella asiatica</i> (L.) Urb.		CrHS	floodplains
<i>Hydrocotyle ranunculoides</i> L.f.	ea	CrH	floodplains
<i>Hydrocotyle verticillata</i> L.	ea	CrH	floodplains
Asclepiadaceae			
<i>Asclepias rostrata</i> N.E.Br. (<i>Gomphocarpus rostratus</i>)		S/PH	floodplain/pan edges
<i>Periglossum mossambicense</i> Schltr.		Ht	floodplain
<i>Tacazzea apiculata</i> Oliv.	ea	CIS	riverbanks, floodplains
Asteraceae			
<i>Adenostemma cafferum</i> DC.	ea	PH	riverbanks, swamps
<i>Ambrosia maritima</i> L.		AH	floodplains, islands
<i>Artemisiopsis villosa</i> (O.Hoffm.) Schweick.		AH	pans
<i>Blumea solidaginoides</i> (Poir.) DC.		AH	edges of islands, riverbanks
<i>Blumea viscosa</i> (Mill.) Badillo		H	riverbanks
<i>Crassocephalum x picridifolium</i> (DC.) S.Moore	ea	A/PH	riverbanks, swamps
<i>Eclipta prostrata</i> (L.) L. (<i>E. alba</i>)	ea	AH	pans, floodplains
<i>Emilia ambifaria</i> (S.Moore) C.Jeffrey		H	pan fringes

Species/authority	aq.	L/F	habitat
<i>Ethulia conyzoides</i> L.f. ssp. <i>conyzoides</i>	ea	AH	riverbanks, floodplains
<i>Gnaphalium polycaulon</i> Pers.		AH	pans
<i>Grangea anthemoides</i> O.Hoffm.		AH	pans
<i>Grangea maderaspatana</i> (L.) Poir.		AH	floodplains, river
<i>Melanthera scandens</i> (Schumach. & Thonn.) Roberty ssp. <i>madagascariensis</i> (Baker) Wild	ea	PH?	riverbanks, swamps
<i>Mikania natalensis</i> DC.	ea	PHCl	riverbanks, swamps
<i>Mikania sagittifera</i> B.L.Rob.			??
<i>Nicolasia costata</i> (Klatt) Thell.		PH	floodplains
<i>Nicolasia pedunculata</i> S.Moore		PH	floodplains
<i>Nicolasia stenoptera</i> (O.Hoffm.) Merxm. ssp. <i>makarikariensis</i> (Bremek. & Oberm.) Merxm.		PH	floodplains
<i>Nolletia zambesica</i> R.E.Fr.		PH	floodplains
<i>Pluchea dioscoridis</i> (L.) DC		S/PH	floodplains
<i>Pseudognaphalium luteo-album</i> (L.) Hilliard & B.L.Burt		AH	floodplains
<i>Pseudognaphalium oligandrum</i> (DC.) Hilliard & B.L.Burt		AH	floodplains
<i>Pulicaria scabra</i> (Thunb.) Druce		AH	floodplains
<i>Sonchus asper</i> (L.) Hill !!		A/PH	riverbanks
<i>Sphaeranthus flexuosus</i> O.Hoffm.		A/PH	pans
<i>Sphaeranthus peduncularis</i> DC. ssp. <i>rogersii</i> (N.E.Br.) Wild ssp. <i>peduncularis</i>		A/PH A/PH	pans pans
<i>Sphaeranthus</i> sp. (PAS 319) (=S. <i>similis</i> Ker?)		H	pan
<i>Vernonia adoensis</i> Walp. ssp. <i>kotschyana</i> (Walp.) G.V.Pope		S/PH	spring
<i>Vernonia amygdalina</i> Delile		S(T)	riverbanks, islands, floodplains
<i>Vernonia glabra</i> (Steetz) Vatke		PH	floodplains
<i>Vernonia rosenii</i> R.E.Fr.		PH	pan
Boraginaceae			
<i>Heliotropium baclei</i> DC. var. <i>rostratum</i> I.M.Johnst.		PH	floodplains
<i>Heliotropium indicum</i> L.		A/PH	floodplains
<i>Heliotropium ovalifolium</i> Forssk.		A/PH	floodplains
<i>Heliotropium supinum</i> L.		AH	pans
Cabombaceae			
<i>Brasenia schreberi</i> J.F.Gmel.	sa	CrHs	ivers, lakes, open water
Campanulaceae			
<i>Gunillaea rhodesica</i> (Adamson) Thulin		AH	riverbanks
<i>Wahlenbergia banksiana</i> A.DC.		PH	floodplains
<i>Wahlenbergia ramosissima</i> (Hemsl.) Thulin ssp. <i>lateralis</i> (Brehmer) Thulin		AH	floodplains, pans
Caryophyllaceae			
<i>Polycarpon prostratum</i> (Forssk.) Aschers. & Schweinf.		AH	riverbanks
Ceratophyllaceae			
<i>Ceratophyllum demersum</i> L. var. <i>demersum</i>	sa	H	ivers, lakes, pools
Chenopodiaceae			
<i>Suaeda merxmuelleri</i> Aellen		HS	saline hot spring

Species/authority	aq.	L/F	habitat
Convolvulaceae			
<i>Falkia oblonga</i> Krauss var. <i>oblonga</i>		PCrH	floodplains, pans
<i>Ipomoea aquatica</i> Forssk.	sa	PCrH	pans
<i>Ipomoea rubens</i> Choisy	ea	PCIH	riverbanks, swamps
Cucurbitaceae			
<i>Mukia maderaspatana</i> (L.) M.J.Roem.		CIH	riverbanks, floodplains
<i>Zehneria</i> sp. (SRGH No.1, PAS 1162)	ea	CIH	riverbanks
Droseraceae			
<i>Aldrovanda vesiculosa</i> L.	sa	H	ivers, lakes, pools
Elatinaceae			
<i>Bergia capensis</i> L.		AH	pans
<i>Bergia penteriana</i> Keissl. (B. <i>prostrata</i> Schinz)		PH	pans, floodplains
<i>Elatine triandra</i> Schkuhr	sa	CrAH	pans
Euphorbiaceae			
<i>Caperonia fistulosa</i> Beille	ea	AH	riverbanks, rapids
<i>Croton leuconeurus</i> Pax		T	islets in rapids
Fabaceae: Mimosoideae			
<i>Mimosa pigra</i> L.		S	riverbanks
<i>Neptunia oleracea</i> Lour.	sa	PCrH	pans
Fabaceae: Papilionoideae			
<i>Aeschynomene cristata</i> Vatke var. <i>cristata</i>	ea	SH	floodplains, pans
<i>Desmodium salicifolium</i> (Poir.) DC. var. <i>salicifolium</i>	ea	PHS	island edges
<i>Lotononis listii</i> Polhill		PCrH	floodplains, pans
<i>Sesbania brevipedunculata</i> J.B.Gillett	ea	AH	riverbanks
<i>Sesbania cinerascens</i> Bak.	ea	SPH	riverbanks
<i>Sesbania microphylla</i> E.Phillips & Hutch.	ea	AH	floodplains
<i>Sesbania sesban</i> (L.) Merr. ssp. <i>sesban</i>	ea	S	riverbanks
<i>Vigna luteola</i> (Jacq.) Benth.	ea	PCIH	riverbanks
Gentianaceae			
<i>Exacum oldenlandioides</i> (S.Moore) Klack.		AH	pans
<i>Sebaea</i> sp. (PAS 4630)		AH	floodplains
Haloragaceae			
<i>Laurembergia repens</i> Berg. ssp. <i>brachypoda</i> (Hiern) Oberm.	ea	Hwr	floodplains
<i>Myriophyllum spicatum</i> L.	sa	Hwr	ivers
Lamiaceae			
<i>Hyptis pectinata</i> (L.) Poit.		A/PH	riverbanks
<i>Mentha aquatica</i> L.	ea	PH	riverbanks
Lentibulariaceae			
<i>Utricularia arenaria</i> A.DC.		H	sandbanks
<i>Utricularia australis</i> R.Br.	sa	H	ivers
<i>Utricularia foliosa</i> L.	sa	H	lakes, rivers
<i>Utricularia gibba</i> L.	sa	H	floodplains, lake edge, sudd
<i>Utricularia inflexa</i> Forssk.	sa	H	ivers
<i>Utricularia reflexa</i> Oliv.	sa	H	ivers
<i>Utricularia scandens</i> Benj.		H	sandbanks
<i>Utricularia stellaris</i> L.f.	sa	H	pans, rivers

Species/authority	aq.	L/F	habitat
Lobeliaceae			
<i>Lobelia angolensis</i> Engl. & Diels		AHwr	pans
<i>Lobelia erinus</i> L.		AH	riverbanks, swamp edges
Lythraceae			
<i>Ammannia auriculata</i> Willd. (<i>Nesaea dinteri</i> Koehne ssp. <i>elata</i> A.Fern.)		AH	pans, river edge
<i>Ammannia baccifera</i> L. ssp. <i>baccifera</i>		AH	pans, riverbanks
<i>Ammannia prieuriana</i> Guill. & Perr.		AH	spring, riverbanks
<i>Ammannia senegalensis</i> Lam. var. <i>odongana</i> (Koehne) Verdc. (<i>Nesaea odongana</i> Koehne ssp. <i>odongana</i>)		AH	swamp edge
<i>Nesaea crassicaulis</i> (Guill. & Perr.) Koehne	sa	ACrH	riverbeds
<i>Nesaea minima</i> Immelman		AH	floodplains
<i>Nesaea radicans</i> Guill. & Perr. var. <i>radicans</i>		PH	spring
var. <i>floribunda</i> (Sond.) A.Fern.		PH	floodplains
<i>Nesaea rigidula</i> (Sond.) Koehne		SS	floodplains
<i>Nesaea schinzii</i> Koehne var. <i>schinzii</i>		SS	floodplains
<i>Nesaea</i> sp. (Mavi 118, FHH 274)		?	pan, floodplains
<i>Rotala filiformis</i> (Bellardi) Hiern (<i>R. heterophylla</i> A.Fern. & Diniz)	ea	AH	pan
<i>Rotala fluitans</i> Pohnert		ACrH	sandbank
<i>Rotala serpiculoides</i> Hiern		AH	pans, floodplains
<i>Rotala tenella</i> (Guill. & Perr.) Hiern (<i>R. submersa</i> Pohnert)		AH	pans
Malvaceae			
<i>Hibiscus diversifolius</i> Jacq. ssp. <i>rivularis</i> (<i>Bremek. & Oberm.</i>) Exell	ea	SPH	riverbanks
<i>Kosteletzkya buettneri</i> Gürke	ea	A/PH	riverbanks
Melastomataceae			
<i>Dissotis debilis</i> (Sond.) Triana var. <i>debilis</i>		PH	floodplains
<i>Melastomastrum segregatum</i> (Benth.) A. & R.Fern.	ea	S	islets in rapids
Menyanthaceae			
<i>Nymphoides brevipedicellata</i> (Vatke) A.Raynal	sa	PH	pans
<i>Nymphoides forbesiana</i> (Griseb.) Kuntze	sa	PH	pans
<i>Nymphoides indica</i> (L.) Kuntze ssp. <i>occidentalis</i> A.Raynal	sa	PH	ivers, lakes, pools, pans
Moraceae			
<i>Ficus capreifolia</i> Delile	ea	S	islets in rapids
<i>Ficus pygmaea</i> Hiern	ea	S	riverbanks
<i>Ficus verruculosa</i> Warb.	ea	S	spring
Myricaceae			
<i>Morella serrata</i> (Lam.) Killick (<i>Myrica serrata</i> Lam.)	ea	S	floodplains
Myrtaceae			
<i>Syzygium cordatum</i> Hochst.	ea	T	riverbank
<i>Syzygium guineense</i> (Willd.) DC. ssp. <i>barotsense</i> F.White	ea	T	riverbank
Nymphaeaceae			
<i>Nymphaea nouchali</i> Burm.f. var. <i>caerulea</i> (Savigny) Verdc.	sa	Hwtr	ivers, lakes, pools

Species/authority	aq.	L/F	habitat
Onagraceae			
<i>Ludwigia leptocarpa</i> (Nutt.) Hara	ea	SH	sudd, riverbanks
<i>Ludwigia octovalvis</i> (Jacq.) Raven ssp. <i>brevisepala</i> (Brenan) Raven		H	riverbanks
<i>Ludwigia senegalensis</i> (DC.) Troch.	sa	CrH	sandbanks, shallow water
<i>Ludwigia stolonifera</i> (Guill. & Perr.) Raven	sa	H	pools, riversides
Pedaliaceae			
<i>Sesamum calycinum</i> Welw. ssp. <i>baumii</i> (Stapf) Seidenst.		A/PH	riverbanks
Podostemaceae			
<i>Ledermanniella tenax</i> (C.H. Wright) C. Cusset	ea	H	rapids
Polygonaceae			
<i>Persicaria attenuata</i> (R.Br.) Sojak ssp. <i>africana</i> K.L. Wilson	ea	PH	riverbanks, swamps
<i>Persicaria limbata</i> (Meisn.) Hara	ea	PH	lakes, pools, riverbanks
<i>Persicaria senegalensis</i> (Meisn.) Sojak	ea	PH	riverbanks, lakes, pools
<i>Persicaria serrulata</i> (Lag.) Webb & Moq.	ea	AH	riverbanks, sudd, springs
<i>Polygonum meisnerianum</i> Cham. & Schtdl.	ea	H	riverbanks
Ranunculaceae			
<i>Ranunculus multifidus</i> Forssk.	ea	H	springs
Rosaceae			
<i>Rubus apetalus</i> Poir.	ea	S	riverbanks, swamps
Rubiaceae			
<i>Kohautia caespitosa</i> Schnizl. ssp. <i>brachyloba</i> (Sond.) Mantell		A/PH	floodplains
<i>Kohautia cuspidata</i> (K. Schum.) Bremek.		A/PH	pans
<i>Kohautia virgata</i> (Willd.) Bremek.		A/PH	pans
<i>Oldenlandia corymbosa</i> L.			
var. <i>caespitosa</i> (Benth.) Verdc.		AH	floodplains, riverbanks
var. <i>linearis</i> (DC.) Verdc.		AH	pans
<i>Oldenlandia goreensis</i> (DC.) Summerh.		AH	floodplains
<i>Oldenlandia lancifolia</i> (Schumach.) DC.	ea	PH	swamps, riverbanks
<i>Pentodon pentandrus</i> (Schumach. & Thonn.) Vatke	ea	AH	sudd, riverbanks
<i>Spermacoce arvensis</i> (Hiern) Good		AH	floodplains, pans
Salicaceae			
<i>Salix mucronata</i> Thunb. ssp. <i>mucronata</i> (S. <i>subserrata</i> Willd.)	ea	S/T	islets in rapids
Scrophulariaceae			
<i>Bacopa floribunda</i> (R.Br.) Wettst.		AH	pans
<i>Buchnera randii</i> S. Moore		AH	pans
<i>Cycnium filicalyx</i> (E.A. Bruce) O.J. Hansen		AH	pans
<i>Cycnium tubulosum</i> (L.f.) Engl.	ea	PH	riverbanks, floodplains
<i>Dopatrium junceum</i> Benth.		AH	pans
<i>Limnophila bangweolensis</i> (R.E. Fries) Verdc.	sa	AH	riversides
<i>Limnophila ceratophylloides</i> (Hiern) Skan	sa	PH	pans
<i>Lindernia parviflora</i> (Roxb.) R.W. Haines		AH	pans
<i>Sopubia mannii</i> Skan var. <i>tenuifolia</i> (Engl. & Gilg) Hepper		PH	floodplains
<i>Torenia thouarsii</i> (Cham & Schtdl.) Kuntze	ea	A/PH	riverbanks

Species/authority	aq.	L/F	habitat
Sphenocleaceae			
<i>Sphenoclea zeylanica Gaertn.</i>	ea	AH	pans
Tiliaceae			
<i>Corchorus olitorius L.</i>		AH	pans
<i>Corchorus trilocularis L.</i>		AH	edges of rivers & swamps
<i>Triumfetta pilosa Roth var. effusa (Harv.) Wild</i>		H	islets in rapids
Trapaceae			
<i>Trapa natans L. var. bispinosa (Roxb.) Makina</i>	sa	AH	lakes, pools
Vahliaceae			
<i>Vahlia capensis (L.f.) Thunb. ssp. vulgaris Bridson</i>		A/PH	floodplains
Verbenaceae			
<i>Phyla nodiflora (L.) Greene</i>	ea	A/PCr	riverbanks, floodplain edges

Total number of taxa	361
Total number ea taxa	98
Total number sa taxa	45
Total number T/S taxa	15

CHAPTER 2 : APPENDIX 2
WETLAND PLANT COMMUNITIES OF THE BAROTSELAND AREA
OF WESTERN ZAMBIA, WITH A LIST OF SPECIES

Mike Bingham

1. INTRODUCTION

As part of the review of wetland plants being carried out by the BFA/Zambezi Society for the IUCN Zambezi Basin Wetlands Project, a listing of wetland plant species for Barotseland was required. The chief sources from which this list was compiled (*Flora Zambesiaca*, White 1962 and various papers in the journal *Kirkia*) give one citation per botanical province. The Barotse botanical province includes the whole of what is now called Western Province (but not what was known as Western Province prior to the signing of the Barotseland Agreement) plus Zambezi (previously Balovale) and Kabompo Districts. The two latter districts are now included in Northwestern Province. Therefore, the list is more correctly of the major part of Western Zambia, rather than of the Zambezi wetlands as such.

The list is preceded by an account of the main wetland or floodplain habitats, while the list itself indicates the life form, principal habitat, and the relative abundance of each species, where this is known. The list is by no means complete, being principally based on literature records and the author's own collections, but it can at least be considered indicative.

2. HABITATS

Trapnell & Clothier (1996) describe the ecology and traditional agricultural systems of Western Province, while Jeanes & Baars (1991) and Verboom & Brunt (1970) list the grass associations. Most published sources do not indicate the habitat of the cited herbarium specimens, but give a brief listing of habitats for the species. In her introduction Gibbs Russell (1977) lists the major aquatic habitats as "Rivers", "Streams", "Dams", "Pans" and "Vleis". However, in her species descriptions she also uses the terms "marginal", "emergent" and "soak zone", frequently applying all three to a species. The latter are unfortunately not defined.

The reason for the introduction of these terms is simply explained – "rivers", "pans" and "vleis" are not habitats, they are wetland systems, each comprising a range of different habitats. Herbarium labels, however, frequently only refer to the easily described features. Unambiguous wetland features include *floodplain*, *swamp*, *seepage* and *dambo*. Unambiguous dryland includes *teak forest*, *woodland* and *savanna*. Almost any other habitat type is ambiguous – *river bank*, *termite mound*, *bushgroup*, *grassland* and even *forest* may include both wetland and dryland species. While there can be no argument about the status of a swamp forest, riverine fringing forests are a doubtful case, since the critical requirement of many of the species growing in them is good drainage rather than access to surface water. A fringing forest may have all the characteristics of a swamp forest at the lower end of the catena, and of a dry thicket on the upper end. Yet the description of the habitat is likely to given simply as "riparian forest". An example of the unreliability of published sources is provided by a habitat description of *Grewia retinervis*: "Open woodland, common on Kalahari Sand formations". This description is correct, but incomplete, since this shrub also occurs on sand bars on the Buluzi Plain where it withstands complete inundation.

Taxonomists are generally dependent on labels of herbarium material for descriptions of habitats. In mosaics of microhabitats wetland and dryland species may be found within a few metres of one another. For example, typical annual wetland associations may occur in slight, indurated depressions in miombo woodland. One collector may describe the habitat as a pan (wetland), while another might simply call it a depression in woodland, implying dryland. Many weeds and ruderals occur both in wetland and dryland areas. Of the species which are most characteristic of the floodplain, many are weeds of cultivation or grazing areas. Pantropical pasture weeds occurring on the Buluzi Plain include *Lantana camara*, *Senna occidentalis* and *Tribulus terrestris*.

In the floras a common habitat is "wet grassland", a term which is difficult to interpret. All edaphic grasslands are subject to flooding, even if only shallowly and briefly, and even woodland areas may occasionally be flooded. The only permanently wet soils are the seeps where groundwater emerges, and the banks of river channels. This accounts for the fact that floodplain species are either annuals, or have underground storage organs. In fact many are described as "annual or perennial" frequently with "?". These species are adapted to survive for more than one year when conditions are favourable, but are able to cut their losses in unfavourable years.

Although all collectors have collected grasses, and this is the most thoroughly collected family, there are many obvious omissions. *Panicum maximum* and *Melinis repens* for example, two of the commonest and most familiar grasses, have no citations for the Province in Flora Zambesiaca, nor has any species of *Urochloa*. The tendency has been to collect the unfamiliar, while the well known grasses have been neglected. Not only does this give a false impression of the floodplain flora, it may also result in important local varieties being overlooked.

In general, plants can be ranged along a spectrum from those that are specialised aquatics to those which do not tolerate any flooding. Some species show a much wider range of tolerance than others, and may be found both on well-drained sand as well as on floodplains, where they may be inundated for several months.

2.1 Habitat specificity

From the foregoing it will be appreciated that the selection of species for this list is based largely on descriptions of the habitats. In the case of species where the habitat is not clearly indicated, or where they may be expected to occur in wetlands, it is prefixed by "!"; more often the species has been excluded from the list. In the checklist only one habitat is generally shown, this being the one which is most characteristic of the species, or where the species is most commonly found. F3 includes all grassland or semi-dambo types where floods are shallow and short-lived. Many, probably most, species listed in this category will be found also in woodland.

Attempts to classify floodplains and dambos as "wet" or "dry" lead to problems. The wetness or dryness fluctuates not only with the annual cycle but also with periods of higher and lower rainfall. The presence of peat indicates permanent wetness over a long period. Yet obviously, wetness or dryness is a major determining factor of species distribution. At this early stage of our knowledge and understanding of the ecology of the Upper Zambezi wetlands it is probably best to define plant communities as accurately as possible. Key indicator species or associations need to be identified.

Highest plant diversity is found in the nutrient rich seeps, concentrated along the floodplain and dambo margins, but also occurring locally on the plains. In such areas peat deposits commonly occur.

3. HABITAT DESCRIPTIONS

3.1 Trees of the plains

The tree most commonly seen on the Bulozzi Plain, apart from the mango (*Mangifera indica*), is *Faidherbia albida*, which grows mostly on elevated sites and is usually somewhat stunted. All other indigenous species are occasional to rare. They include *Syzygium cordatum*, *Borassus aethiopum*, and the shrubs *Acacia hebeclada* subsp. *chobiensis*, *Rhus quartinianus*, *Grewia retinervis* and *Keetia venosa*. Large flood-season islands, such as Lealui, have a greater variety of species than small islands. Seepages at the plain edge have typical secondary riverine species such as *Bridelia micrantha*, *Ficus sur*, *Kigelia africana* and *Syzygium cordatum*, although the number of species is small.

Small patches of swamp forest occur at Namushakende and Sinungu. These have a typical swamp forest flora, including *Syzygium owariense* (sinungu), *S. cordatum*, *Ficus verruculosa* and *Gardenia imperialis*. The climbing fern *Lygodium microphyllum* occurs in both these forests and the royal fern, *Osmunda regalis*, occurs at Namushakende.

The stable banks of the Luanginga River have fringing *Syzygium guineense* subsp. *barotsense*, a very characteristic tree overhanging flowing water and bearing large, pulpy fruits which float on the water surface. These mature in February, much later than the other species and subspecies, and are dispersed by flood water. This subspecies, which also appears along the banks of the Zambezi below Senanga, is absent from the Buluzi Plain. The banks of the main channel of the Zambezi on the plain are too unstable for trees to take root, and the fruits are probably unable to reach the stable banks of the side channels. Associated with *S. guineense* subsp. *barotsense* are occasional *Anthocleista liebrechtsiana* on the Lueti River west of Kalabo, mostly small but up to 15 m high.

Sand bars thrown up by the Zambezi and the larger tributaries are invaded by *Acacia hebeclada* subsp. *chobiensis*, *Grewia retinervis* and *Rhus quartiniana*, which form thickets capable of surviving complete submergence. According to the local residents, the fruits of *G. retinervis* are retained during the flood, and ripen after the flood has receded.

3.2 Trees of the dambos and pans

The dry heads of dambos and the pan margins are invaded by pioneer woodland species. The wind-dispersed species *Burkea africana*, *Erythrophleum africanum* and *Terminalia sericea* are the first to arrive, followed by *Parinari curatellifolia* with fleshy fruits.

Semi-dambos, with enough free drainage to support small trees, may have a vegetation type known as "orchard bush", where small trees predominate, notably *Syzygium guineense* subsp. *guineense* (the woodland form), *Oldfieldia dactylophylla* and *Maprounea africana*.

3.3 Floodplain grasslands

The floodplain grassland has two distinct floras, one of dryland species which tolerate inundation, and the other a truly aquatic flora. The dryland flora consists of tufted perennial grasses, such as *Setaria sphacelata*, *Bewsia biflora* and *Sporobolus africanus*, which flower and set seed before the arrival of the flood in a normal year. Although they are not killed by the flood, they remain dormant while the flooding lasts.

The aquatic component consists of the grasses *Acroceras macrum*, *Brachiaria arrecta*, *Digitaria* sp. (?*D. sanguinalis*), *Echinochloa pyramidalis*, the late-flowering *Hemarthria altissima*, *Leersia hexandra*, *Panicum subalbidum*, *Robynsiocloa purpurascens*, *Sacciolepis typhura* and, dominating large areas, *Oryza longistaminata*. They occur mostly in mixed swards, but can be dominant locally. Most are creeping perennials, rooting at the nodes and with the culms floating vertically with the leafy tips held 30-50 cm above the surface. They principally flower in February. When the water recedes the grasses form a thick mulch on the soil surface, which is burnt off in most years.

Sedges associated with the grasses are *Cyperus* sp.(11884) and *Eleocharis dulcis*. Dicotyledonous plants include the legumes *Sesbania microphylla* (leafless during the flood period) and, remarkably, *Chamaecrista mimosoides*, normally a dryland plant but which thrives in floodwater, growing to over 1 m in height and continuing to flower and fruit. *Commelina fluviatilis* (Commelinaceae), *Caperonia fistulosa* (Euphorbiaceae), *Persicaria serrulata* (Polygonaceae), *Alternanthera sessilis* (Amaranthaceae), *Cycnium tubulosum* (Scrophulariaceae) and *Emilia protracta* (Asteraceae) have a similar habit to the aquatic grasses, the stems elongating to keep pace with the rising floodwater. Plants with stems or leaves floating horizontally at the surface include *Aeschynomene fluitans* (Fabaceae: Papilionoideae), waterlilies (*Nymphaea* spp., Nymphaeaceae), *Nymphoides indica* (Menyanthaceae) and *Trapa natans* (Trapaceae). Patches of submerged gelatinous material (mang'ululuya) are probably an alga or cyanobacterium.

3.4 Channel banks

The banks of the deeper channels and lagoons support a more rank aquatic vegetation, 2-3 m in height above the water surface. The most abundant species is the reed *Phragmites mauritianus*. Others occurring in local stands include *Cyperus papyrus* (Cyperaceae), *Hibiscus diversifolius* and *Urena lobata* (Malvaceae), *Persicaria senegalensis* (Polygonaceae), *Aeschynomene uniflora* (Fabaceae: Papilionoideae) and the swamp grasses *Echinochloa pyramidalis*, *E. stagnina* and *Vossia cuspidata*.

Associated with the reeds and papyrus are two creepers, *Vigna luteola* (Fabaceae: Papilionoideae) and *Ipomoea rubens* (Convolvulaceae), two sedges (*Cyperus* sp. and *Pycreus mundtii*), *Limnophyton angolense* (Alismataceae), *Thalia welwitschii* (Marantaceae) and the fern *Ampelopteris prolifera* (Thelypteridaceae). Floating in the deeper channels are *Nymphaea* spp. (Nymphaeaceae), *Trapa natans* (Trapaceae), *Aeschynomene fluitans* (Papilionoideae), *Ipomoea aquatica* (Convolvulaceae), the fern *Salvinia molesta* (Salviniaceae), and the submerged herbs *Lagarosiphon major* and *Ottelia ulvifolia* (Hydrocharitaceae).

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5. LIST OF WETLAND PLANTS FROM BAROTSELAND

Symbols:

[] = validity of name doubtful
 ! = not normally a wetland species
 * = introduced
 - = no information available

Habit:

T = large tree
 t = small tree
 S = shrub
 s = subshrub
 h = annual or perennial herb
 ha = annual herb
 hp = perennial herb
 cl = climber
 qf = floating aquatic
 qr = rooted aquatic

Grasses:

a = annual
 p = perennial
 t = tufted
 c = creeping

Habitat: Only habitats which qualify as wetlands are listed.

Floodwater habitats (plain, dambo, pan), nutrient poor:

- F1 = swamp, permanently wet channel, lagoon *milapo*. Includes reedbeds.
- F2 = lower level ("deep water") *liwatata*. Comprises deeply flooding plains with extensive *Oryza longistaminata* and *Ipomoea aquatica*.
- F3 = higher level ("shallow water") *litongo*. Includes the *saana* terrace, suffrutex plains and the seasonally dry margins of dambos.
- F4 = mounds and levees; banks of seasonal channels *lizulu*. Includes *Mimosa pigra* at the lower end and bushgroup vegetation at the upper.
- F5 = rainwater pools.

Spring water habitats (peaty, nutrient rich):

- Wf = swamp forest, permanently wet seep. Includes the peaty seepages and sponges. Much of this is cultivated, hence many weeds occur.
- Wg = swamp grassland *sishanjo*

Other habitats:

- Kd = dambo (transitional Kalahari sand, Kaoma)
- Na = salt pans
- P = parasite (no particular habitat)

Usually only one habitat is indicated for each species, which is an oversimplification. The choice, in the absence of quantitative data, is based on subjective criteria.

Frequency:	d = dominant	l = local
	a = abundant	o = occasional
	c = common	r = rare
	w = widespread	

	Habit	Habitat	Freq.
FERNS AND FERN ALLIES			
Azollaceae			
Azolla sp.	qf	WfWg	la
Equisetaceae			
Equisetum ramosissimum <i>Desf.</i>	hp	Wg	o
Lycopodiaceae			
Lycopodium carolinianum <i>L.</i>	hp	Wg	r
Lycopodium cernuum <i>L.</i>	hp	Wg	r
Osmundaceae			
Osmunda regalis <i>L.</i>	s	Wf	r
Salviniaceae			
*Salvinia molesta <i>D.S.Mitchell</i>	qf	WfWg	
Schizaeaceae			
Lygodium kerstenii <i>Kuhn</i>	cl	WfWg	r
Lygodium microphyllum (<i>Cav.</i>) <i>R.Br.</i>	cl	Wf	r
Thelypteridaceae			
Cyclosorus interruptus (<i>Willd.</i>) <i>H.Itô</i>	hp	WgF1	c
Thelypteris confluens (<i>Thunb.</i>) <i>Morton</i>	hp	WgWf	lc
Thelypteris interrupta (<i>Willd.</i>) <i>K.Iwats</i>	h	WgWf	lo
MONOCOTYLEDONS			
Alismataceae			
Burnatia enneandra <i>P.Micheli</i>	hp	F1	lc
Caldesia parnassifolia	h	F1	-
Limnophyton angolense <i>Buchenau</i>	hp	F1	c
Ranalisma humile (<i>Kunth</i>) <i>Hutch.</i>	-	-	-
Amaryllidaceae			
Ammocharis tinneana (<i>Kotschy & Peyr.</i>) <i>Milne-Redh. & Schweick.</i>	hp	F3	lc
Crinum macowanii <i>Baker</i>	hp	F3	o
Crinum rautanenianum <i>Schinz</i>	hp	F3	o
Pancratium trianthum (<i>L.f.</i>) <i>Herb.</i>	hp	F3	-
Anthericaceae, Kirkia 15(1)			
Chlorophytum affine <i>Baker</i> var. <i>curvicapum</i> (<i>Poelln.</i>) <i>Hanid</i>	hp	Kd	o
!Chlorophytum blepharophyllum <i>Baker</i>	hp	-	-
Chlorophytum galpinii (<i>Bak.</i>) <i>Kativu</i>			
var. <i>matabelense</i> (<i>Bak.</i>) <i>Kativu</i>	hp	Kd	o
var. <i>norlindhii</i> (<i>H.Weim.</i>) <i>Kativu</i>	hp	-	-
Chlorophytum longifolium (<i>Bak.</i>) <i>Kativu</i>	hp	Kd	o
Chlorophytum pauper <i>Poelln.</i>	hp	-	-

	Habit	Habitat	Freq.
<i>Chlorophytum psammophilum</i> Engl. & Gilg	hp	-	-
<i>Chlorophytum pubiflorum</i> Baker	hp	-	-
Aponogetonaceae			
<i>Aponogeton spathaceum</i> Hook.f.	qf	F2	-
Arecaceae (sight records only)			
<i>Borassus aethiopum</i> Mart.	T	F4	o
<i>Hyphaene petersiana</i> Klotzsch	T	F3	o
<i>Phoenix reclinata</i> Jacq.	S	F4	c
<i>Raphia farinifera</i> (Gaertn.) Hylander	T	Wg	r
Asphodelaceae , <i>Kirkia</i> 16(1)			
<i>Bulbine abyssinica</i> A.Rich.	hp	F3	lo
<i>Trachyandra arvensis</i> (Schinz) Oberm.		F3	-
<i>Trachyandra laxa</i> (N.E.Br.) var. <i>rigida</i> (Suesseng.) Roessl.	hp	F3	lo
<i>Trachyandra saltii</i> (Baker) Oberm.	-	F3	-
Colchicaceae			
<i>Gloriosa sessiliflora</i> Nordal & Bingham	hp	F3	lc
Commelinaceae			
<i>Aneilema nicholsonii</i> C.B.Cl.	hp	Wg	o
<i>Commelina fluviatilis</i> Brenan	hp	F2	o
<i>Cyanotis longifolia</i> Benth.	hp	Kd	-
<i>Floscopa glomerata</i> (Schult. & Schult.f.) Hassk.	hp	Wg	o
Cyperaceae			
<i>Ascolepis capensis</i> (Kunth) Ridley	hp	Wg	-
<i>Ascolepis elata</i> Welw.	-	Kd	-
<i>Ascolepis protea</i> Welw. prob. subsp. <i>rhizomatosa</i> K.Lye	hp	Kd	c
<i>Ascolepis pusilla</i> Ridley ?var. <i>microcuspis</i> K.Lye	ha	Kd	-
<i>Bulbostylis</i> prob. <i>B. cinnamomea</i> (Boeck.) C.B. Clarke [? <i>B. schoenoides</i> (Kunth) C.B. Clarke]	-	Kd	-
<i>Bulbostylis hispidula</i> (Vahl) R.Haines	-	F3	-
<i>Bulbostylis</i> ? <i>laniceps</i> C.B. Clarke	-	?	-
<i>Bulbostylis macra</i> (Ridl.) C.B. Clarke	-	Kd	-
<i>Bulbostylis megastachys</i> (Ridl.) C.B. Clarke	-	Kd	-
<i>Bulbostylis</i> sp. = Robinson 2041	-	Wg	-
<i>Courtoisina cyperoides</i> (Roxb.) Sojak	ha	Kd	-
! <i>Cyperus angolensis</i> Boeck.	hp	Kd	-
<i>Cyperus articulatus</i> L.	hp	F2	lc
<i>Cyperus bolbosus</i> Vahl	-	Na	-
<i>Cyperus compressus</i> L.	ha	F2	c
<i>Cyperus</i> sp.nr. <i>C. dereilema</i> Steudel	-	Kd	-
<i>Cyperus digitatus</i> Roxb. subsp. <i>auricomus</i> (Spreng.) Kükenth.	hp	Wg	-
<i>Cyperus esculenta</i> L.	hp	Wg	-
<i>Cyperus flavescens</i> L. subsp. <i>flavescens</i>	ha	Kd	-
<i>Cyperus nudicaulis</i> Poir. [<i>C. pectinatus</i> ? Vahl]	-	F1	-
<i>Cyperus papyrus</i> L.	hp	F1	ld
<i>Cyperus pelophilus</i> Ridley [<i>Pycrus pelophilus</i> (Ridl.) C.B. Clarke]	ha	Kd	-
<i>Cyperus tenuispica</i> Steudel	ha	Kd	-

	Habit	Habitat	Freq.
<i>Diplacrum africanum</i> C.B.Clarke	ha	Kd	-
<i>Eleocharis acutangula</i> (Roxb.) Schult.	hp	F1	-
<i>Eleocharis dulcis</i> Herschel.	hp	F2	a
<i>Fimbristylis complanata</i> (Retz.) Link.	-	Wg	-
<i>Fimbristylis dichotoma</i> (L.) Vahl	ha/p	F3	-
<i>Fimbristylis squarrosa</i> Vahl	ha	F3	-
<i>Fuirena leptostachya</i> Oliv. var. <i>nudiflora</i> C.B.Clarke	ha	Kd	-
<i>Fuirena stricta</i> Steud.	ha/p	Wg	-
<i>Fuirena pubescens</i> (Poir.) Kunth [F. <i>welwitschii</i> Ridley]	ha	F3	-
<i>Fuirena umbellata</i> Rottb.	hp	Wg	-
<i>Kyllinga brevifolia</i> Rottb.	ha	Kd	-
<i>Lipocarpha atra</i> Ridley	-	Kd	-
<i>Lipocarpha chinensis</i> (Osbeck) Kern	hp	Wg	-
<i>Lipocarpha nana</i> (A.Rich.) Cherm.	ha	Kd	-
<i>Lipocarpha senegalensis</i> (Lam.) Th. & H.Durand	-	-	-
<i>Mariscus deciduous</i> (Baeck.) C.B.Clarke	-	-	-
<i>Mariscus dubius</i> (Rottb.) Hutch.	hp	F3	-
<i>Pycreus aethiops</i> Ridl.	-	-	-
<i>Pycreus flavescens</i> (L.) Reichenbach	ha	F3	-
<i>Pycreus mundii</i> Nees	hp	F1	a
<i>Pycreus ?nigricans</i> (Steud.) C.B.Clarke	-	-	-
<i>Pycreus nitidus</i> (Lam.) J.Raynal	hp	F2	-
<i>Rhynchospora brevirostris</i> Griseb.	ha	Kd	-
<i>Rhynchospora candida</i> (Nees) C.B.Clarke	hp	Wg	c
<i>Rhynchospora corymbosa</i> (L.) Britt.	hp	Wg	-
<i>Rhynchospora holoschoenoides</i> (L.C.Rich.) Herter	hp	Wg	d
<i>Schoenoplectus corymbosus</i> (Roem. & Schult.) J.Raynal	hp	F1	-
<i>Schoenoplectus senegalensis</i> (Steud.) J.Raynal	ha	Kd	-
<i>Scleria aterrima</i> (Ridl.) Napper	hp	F1	-
<i>Scleria bambariensis</i> Cherm.	hp?	Kd	-
<i>Scleria erythrorrhiza</i> Ridley	-	-	-
<i>Scleria greigifolia</i> (Ridl.) C.B.Clarke [Acriulus <i>greigifolius</i> Ridl.]	hp	Sg	-
<i>Scleria hirtella</i> Swartz	-	-	-
<i>Scleria lagoënsis</i> Boeck.	hp	Wg	-
<i>Scleria ?striatonux</i> C.B.Clarke	-	-	-
Eriocaulaceae			
<i>Eriocaulon lacteum</i> Rendle	-	Sg	-
<i>Mesanthemum</i> sp.	-	Sg	-
<i>Syngonanthus</i> sp.	-	Sg	-
Eriospermaceae			
<i>Eriospermum abyssinicum</i> Baker	hp	F3	o
<i>Eriospermum</i> sp.	hp	F3	o
Hyacinthaceae			
<i>Dipcadi longifolium</i> (Lindl.) Baker	hp	F3	la
<i>Dipcadi virida</i> (L.) Moench.	hp	Kd	-
<i>Drimia altissima</i> (L.f.) Ker Gawl.	hp	F3	lc

	Habit	Habitat	Freq.
<i>Drimia</i> [Urginea] <i>nyasae</i> Rendle	hp	-	-
<i>Ledebouria</i> <i>benguellensis</i>	hp	F3	-
<i>Scilla</i> <i>rigidifolia</i> Kunth	hp	F3	-
<i>Thuranthos</i> <i>zambesiicum</i> (Baker) Kativu	hp	-	-
Hydrocharitaceae			
<i>Lagarosiphon</i> <i>major</i> (Ridl.) Moss	qf	F2	-
<i>Ottelia</i> <i>kunensis</i> (Gürke) Dandy	qr	F1	c
<i>Ottelia</i> <i>muricata</i> (C.H.Wright) Dandy	qr	F1	-
<i>Ottelia</i> <i>ulvifolia</i> (Planch.) Walp.	qr	F1	c
Hypoxidaceae , <i>Kirkia</i> 16(1)			
<i>Hypoxis</i> <i>goetzei</i> Harms	hp	F3	-
<i>Hypoxis</i> <i>villosa</i> L.f.	hp	F3	-
Iridaceae , FZ 12			
<i>Gladiolus</i> <i>dalenii</i> Van Geel subsp. <i>dalenii</i>	hp	F3	lc
<i>Gladiolus</i> <i>laxiflorus</i> Baker	hp	Kd	-
<i>Gladiolus</i> <i>unguiculatus</i> Baker	hp	Kd	-
<i>Hesperantha</i> <i>longicollis</i> Baker	hp	F3	-
<i>Lapeirousia</i> <i>littoralis</i> Baker subsp. <i>caudata</i> (Schinz) Goldblatt	hp	F3	r
! <i>Lapeirousia</i> <i>odoratissima</i> Baker	hp	F3	-
<i>Lapeirousia</i> <i>rivularis</i> Wanntorp	hp	F3	-
<i>Lapeirousia</i> <i>schimperi</i> (Asch. & Klatt) Milne-Redhead	hp	F3	-
<i>Lapeirousia</i> <i>zambeziaca</i> Goldblatt	hp	F3	-
Marantaceae			
<i>Thalia</i> <i>geniculata</i> L.	hp	F2	c
Orchidaceae			
<i>Eulophia</i> <i>alta</i> (L.) Fawcett & Rendle	hp	Wg	-
<i>Eulophia</i> <i>angolensis</i> (Rchb.f.) Summerh.	-	Wg	-
! <i>Eulophia</i> <i>cucullata</i> (Sw. & Pers.) Steud	hp	F3	-
<i>Eulophia</i> <i>flavopurpurea</i> (Rchb.f.) Rolfe	hp	F3	o
<i>Eulophia</i> <i>latilabris</i> Summerh.	hp	Wg	o
<i>Eulophia</i> <i>parvula</i> (Rendle) Summerh.	hp	F3	o
<i>Eulophia</i> <i>stolzii</i> Schltr.	hp	-	-
<i>Eulophia</i> <i>walleri</i> (Rchb.f.) Kraenzl.	hp	F3	o
<i>Habenaria</i> <i>schimperiana</i> A.Rich.	hp	F3	o
<i>Platycoryne</i> <i>buchananiana</i> (Kraenzl.) Rolfe	hp	Wg	o
<i>Satyrium</i> <i>atherstonei</i> Rchb.f.	hp	Wg	-
Poaceae , FZ 10(1), (3)			
<i>Acroceras</i> <i>macrum</i> Stapf	cp	F2	-
<i>Alloteropsis</i> <i>cimicina</i> Stapf	ta	F3	c
<i>Alloteropsis</i> <i>semialata</i> (R.Br.) Hitch. subsp. <i>semialata</i>	c/tp	F3	-
<i>Anadelphia</i> sp.	a	-	-
<i>Andropogon</i> <i>brazzae</i> Franch.	tp	F3	o
! <i>Andropogon</i> <i>chinensis</i> (Nees) Merr.	tp	F3	o
<i>Andropogon</i> <i>eucomis</i> Nees	tp	Wg	c
<i>Andropogon</i> <i>huillensis</i> Rendle	tp	Wg	c
<i>Andropogon</i> <i>perligulatus</i> Stapf	tp	Wg	lc

	Habit	Habitat	Freq.
<i>Andropogon schirensis</i> A.Rich.	tp	F3	c
<i>Andropogon textilis</i> Welw.	-	-	-
<i>Aristida canescens</i> Henr.	tp	F3	-
<i>Aristida cumingiana</i> Trin.& Rupr.	ta	Sw	-
<i>Aristida denudata</i> Pilg.	tp	F3	c
<i>Aristida junciformis</i> Trin.& Rupr. subsp. <i>welwitschii</i> (Rendle) Melderis	tp	Wg	c
<i>Aristida leucophaea</i> Henrard	tp	F3	-
<i>Aristida meridionalis</i> (Stapf) Henr.	tp	F3	lc
<i>Aristida perlingulatus</i> Stapf	-	-	-
<i>Aristida pilgeri</i> Henrard	tp	F3	-
<i>Aristida stipitata</i> Hack. subsp. <i>stipitata</i>	tp	F3	c
<i>Aristida transvaalensis</i> Henr.	tp	F3	-
<i>Bothriochloa bladhii</i> (Retz.) S.T.Blake	cp	F3	c
<i>Bothriochloa radicans</i> (Lehm.) A.Camus	cp	Na	r
<i>Brachiaria arrecta</i> (Hack.) Stent	c/tp	F2	c
<i>Brachiaria bovonei</i> (Chiov.) Robyns	tp	Sg	-
<i>Brachiaria brevispica</i> (Rendle) Stapf	a	Sw	-
<i>Brachiaria brizantha</i> (A.Rich.) Stapf	tp	F4	-
! <i>Brachiaria dura</i> Stapf	tp	F3	c
<i>Brachiaria humidicola</i> (Rendle) Schweick.	cp	F3	c
<i>Brachiaria nigropedata</i> (Hiern) Stapf	tp	F3	o
<i>Brachiaria oligobrachiata</i> (Pilger) Henr.	a	F1	-
<i>Brachiaria pungipes</i> Clayton	tp	F3	-
<i>Brachiaria rugulosa</i> Stapf	tp	Wg	-
<i>Chasmopodium purpurascens</i> (Robyns) Jac.-Fel.	p	Wg	-
<i>Chloris gayana</i> Kunth	cp	F4	o
<i>Chloris virgata</i> Sw.	ta	F3	-
<i>Craspedorrhachis rhodesiana</i> Rendle	c/tp	F3	o
<i>Cymbopogon caesius</i> (Nees) Stapf	tp	F3	o
<i>Cymbopogon nardus</i> (L.) Rendle	tp	-	-
<i>Cynodon dactylon</i> (L.) Pers.	cp	F4	lc
<i>Dactyloctenium giganteum</i> B.S.Fisher & Schweick.	ta	F3	a
<i>Dichanthium annulatum</i> (Forsk.) Stapf var. <i>papillosum</i> (A.Rich.) De Wet & Harlam	tp	F3	-
<i>Digitaria abyssinica</i> (A.Rich.) Stapf	cp	Sw	-
<i>Digitaria acuminatissima</i> Stapf	ca	Wg	-
<i>Digitaria brazzae</i> (Franch.) Stapf	tp	F3	-
<i>Digitaria debilis</i> (Desf.) Willd.	p	Wg	-
<i>Digitaria diagonalis</i> (Nees) Stapf	tp	F3	-
<i>Digitaria eriantha</i> Steud.	c/tp	F3	-
<i>Digitaria maniculata</i> Stapf	ca	F3	-
<i>Digitaria monodactyla</i> (Nees) Stapf	tp	Wg	-
<i>Digitaria perrottetii</i> (Kunth) Stapf	ta	F3	-
<i>Digitaria remotigluma</i> (De Winter) Clayton	c/ta	F3	-
<i>Digitaria sanguinalis</i> (L.) Scop.	a	F3	-

	Habit	Habitat	Freq.
<i>Digitaria scalarum</i> (Schweinf.) Chiov.	cp	Wg	lc
<i>Digitaria velutina</i> (Forssk.) P.Beauv.	ca	F3	-
<i>Diheteropogon grandiflorus</i> (Hack.) Stapf	tp	F3	-
<i>Diplachne fusca</i> (L.) Stapf	tp	Na	-
<i>Echinochloa colona</i> (L.) Link	ta	F5	-
<i>Echinochloa haploclada</i> (Stapf) Stapf	tp	F3	-
<i>Echinochloa jubata</i> Stapf	a	F1	-
<i>Echinochloa pyramidalis</i> (Lam.) Hitchc. & Chase	cp	F1	c
<i>Echinochloa stagnina</i> (Retz.) Beauv.	ca/p	F1	d
<i>Elionurus muticus</i> (Spreng.) Kuntze	tp	-	-
<i>Elionurus platypus</i> (Trin.) Hack.	tp	-	-
<i>Elymandra grallata</i> (Stapf) Clayton	tp	F3	-
<i>Elytrophorus globularis</i> Hack.	ta	F5	o
<i>Entolasia imbricata</i> Stapf	tp	F2	-
<i>Eragrostis arenicola</i> C.E.Hubbard	ta	F3	c
<i>Eragrostis brainii</i> (Stent) Launert	c/tp	-	-
<i>Eragrostis capensis</i> (Thunb.) Trin.	tp	Wg	c
<i>Eragrostis cimicina</i> Launert	tp	-	-
<i>Eragrostis congesta</i> Oliv.	tp	F3	c
<i>Eragrostis gangetica</i> (Roxb.) Steud.	a	Wg	-
<i>Eragrostis heteromera</i> Stapf	tp	F5	-
<i>Eragrostis hispidula</i> K.Schum.	tp	Kd	-
<i>Eragrostis inamoena</i> K.Schum.	cp	Wg	c
<i>Eragrostis japonica</i> (Thunb.) Trin.	ta	F5	o
[<i>E. namaquensis</i> Schrad. var. <i>diplachnoides</i> (Steud.) Clayton]			
<i>Eragrostis lappula</i> Nees	c/tp	F5	c
<i>Eragrostis mildbraedii</i> Pilg.	cp	Wg	d
<i>Eragrostis nindensis</i> Ficalho & Hiern	tp	-	-
<i>Eragrostis pallens</i> Hack.	tp	F5	-
<i>Eragrostis patens</i> Oliv.	ta	F3	c
<i>Eragrostis rotifer</i> Rendle	tp	-	-
<i>Eragrostis stapfii</i> De Winter	tp	-	-
<i>Eragrostis</i> sp.cf. <i>E. tenuifolia</i> (A.Rich.) Steud	ta	F5	-
<i>Eragrostis turgida</i> (Schumach.) De Wild.	-	-	-
<i>Eragrostis viscosa</i>	ta	Wg	-
<i>Eragrostis welwitschii</i> Rendle	a	Kd	-
<i>Eriochrysis pallida</i> Munro	tp	Wg	-
<i>Eulalia aurea</i> (Bory) Kunth	cp	Kd	-
<i>Hemarthria altissima</i> (Poir.) Stapf & C.E.Hubb.	cp	Wg	-
<i>Heteranthoecia guineensis</i> (Franch.) Robyns	cp	Wg	-
<i>Heteropogon contortus</i> (L.) Roem. & Schult.	tp	Na	c
<i>Hyparrhenia anamesa</i> W.D.Clayton	tp	Kd	-
<i>Hyparrhenia bracteata</i> (Willd.) Stapf	tp	F3	-
<i>Hyparrhenia filipendula</i> (Hochst.) Stapf	tp	F3	-
<i>Hyparrhenia gazensis</i> (Rendle) Stapf	tp	-	-
<i>Hyparrhenia hirta</i> (L.) Stapf [H. <i>anamesa</i> ?]	tp	-	-

	Habit	Habitat	Freq.
<i>Hyparrhenia newtonii</i> (Hack.) Stapf	tp	F3	o
<i>Hyparrhenia rufa</i> (Nees) Stapf	tp	F3	o
<i>Hyperthelia dissoluta</i> (Steud.) W.D.Clayton	tp	F3	o
<i>Ischaemum afrum</i> (Gmel.) Dandy	cp	-	-
<i>Leersia denudata</i> Launert	tp	Wg	-
<i>Leersia hexandra</i> Sw.	cp	Wg	d
<i>Loudetia angolensis</i> C.E.Hubbard	tp	Wg	-
<i>Loudetia lanata</i> (Stent & Rattray) C.E.Hubb.	tp	F3	-
<i>Loudetia simplex</i> (Nees) C.E.Hubb.	tp	F3	d
<i>Miscanthus junceus</i> (Stapf) Pilg.	tp	Wg	c
<i>Monocymbium ceresiiforme</i> (Nees) Stapf	tp	Kd	c
<i>Oryza barthii</i> A.Chev.	a	F5	r
<i>Oryza longistaminata</i> A.Chev. & Roehr.	p	F2	d
<i>Panicum coloratum</i> L. var. <i>coloratum</i>	tp	F3	o
<i>Panicum dregeanum</i> Nees	tp	Wg	-
<i>Panicum fluviicola</i> Steud.	tp	F3	-
<i>Panicum graniflorum</i> Stapf	tp	Wg	-
<i>Panicum kalaharensis</i> Mez	tp	F3	-
<i>Panicum madipirensis</i> Mez	a	F5	-
<i>Panicum maximum</i> Jacq.	ta/p	F4	-
<i>Panicum natalense</i> Hochst.	tp	F3	-
<i>Panicum parvifolium</i> Lam.	cp	Wg	c
<i>Panicum repens</i> L.	cp	Wg	d
<i>Panicum schinzii</i> Hack.	a	F3	-
<i>Panicum subalbidum</i> Kunth	a/p	F2	a
<i>Panicum trichonode</i> Launert & Renvoize	tp	Wg	-
<i>Paratheria prostrata</i> Griseb.	t/cp	Wg	o
<i>Paspalidium geminatum</i> (Forssk.) Stapf	cp	F2	-
<i>Paspalidium obtusifolium</i> (Del.) N.D.Simpson	cp	F2	-
<i>Paspalum scrobiculatum</i> L.	cp	Wg	c
<i>Pennisetum macrourum</i> Trin.	cp	F1	r
<i>Perotis vaginata</i> Hack.	ta	F3	o
<i>Phragmites australis</i> (Cav.) Steud.	cp	Wg	r
<i>Phragmites mauritianus</i> Kunth	cp	F1	d
<i>Phyllorhachis sagittata</i> Trimen	tp	F4	r
<i>Rendlia altera</i> (Rendle) Chiov.	tp	-	-
<i>Rendlia pseudoharpechloa</i> Chiov.	tp	F3	o
<i>Rhytachne rottboellioides</i> Desv.	tp	F3	r
<i>Sacciolepis africana</i> C.E.Hubb. & Snowden	cp	Wg	-
<i>Sacciolepis chevalieri</i> Stapf	p	-	-
<i>Sacciolepis indica</i> (L.) Chase	a	Kd	-
<i>Sacciolepis typhura</i> (Stapf) Stapf	cp	Wg	c
<i>Setaria incrassata</i> (Hochst.) Hack.	c/tp	-	-
<i>Setaria longiaristata</i> Beauv.	tp	F4	-
<i>Setaria sphacelata</i> (Schumach.) Moss	tp	F3	lc
<i>Setaria verticillata</i> (L.) Beauv.	a	F4	-

	Habit	Habitat	Freq.
<i>Sorghastrum nudipes</i> Nash	tp	F3	o
<i>Sorghum arundinaceum</i> (Desv.) Stapf	p	F3	c
<i>Sporobolus macrantelus</i> Chiov.	cp	-	-
<i>Sporobolus myrianthus</i> Benth.	tp	-	-
<i>Sporobolus pyramidalis</i> Beauv.	tp	F3	o
<i>Sporobolus subtilis</i> Kunth	tp	Wg	o
<i>Sporobolus welwitschii</i> Rendle	tp	Wg	d
<i>Themeda triandra</i> Forssk.	tp	F4	o
<i>Trachypogon spicatus</i> (L.f.) Kuntze	tp	F3	-
<i>Tricholaena monachne</i> (Trin.) Stapf & Hubbard	a/p	F4	c
<i>Trichopteryx dregeana</i> Nees	tp	-	-
<i>Triraphis schinzii</i> Hack.	tp	F4	-
<i>Tristachya hubbardiana</i> Conert	tp	-	-
<i>Tristachya leucothrix</i> Nees	tp	Kd	-
<i>Tristachya lualabensis</i> (De Wild.) J.B.Phipps	tp	F3	-
<i>Tristachya nodiglumis</i> K.Schum.	tp	F3	c
<i>Tristachya rehmannii</i> Hack.	tp	F3	-
<i>Tristachya superba</i> (De Not.) Schweinf. & Aschers.	tp	F3	o
<i>Urochloa trichopus</i> (Hochst.) Stapf	ta	F3	-
<i>Vetiveria nigritana</i> (Benth.) Stapf	tp	F3	c
<i>Vossia cuspidata</i> (Roxb.) Griff.	cp	F1	d
<i>Willkommia sarmentosa</i> Hack.	ca/p	F5	r
Pontederiaceae Kirkia 16(1)			
<i>Eichhornia natans</i> (P.Beauv.) Solms	qf	-	-
Potamogetonaceae			
<i>Potamogeton octandrus</i> Poir.	qr	-	-
<i>Potamogeton richardii</i> Solms	qr	-	-
Xyridaceae			
<i>Xyris capensis</i> Thunb.	h	Wg	-
<i>Xyris hildebrandtii</i> Nills.	h	Wg	-
<i>Xyris ?straminea</i> Nills.	h	Wg	-
DICOTYLEDONS			
Acanthaceae			
<i>Hygrophila abyssinica</i> (Nees) T.Anders.	ha	F3	lc
<i>Hygrophila linearis</i> Burkill	ha	Kd	r
<i>Hygrophila pilosa</i> Burkill	ha	F3	lc
<i>Justicia</i> sp.	hp	Wg	r
<i>Nelsonia gracilis</i> Vollesen	hp	F3	lc
Aizoaceae , FZ 4			
<i>Sesuvium hydaspicum</i> (Edgew) M.L.Gonçalves	h	Na	r
Amaranthaceae , FZ 9(1)			
<i>Alternanthera sessilis</i> (L.) DC.	hp	Wg F2	-
* <i>Gomphrena celosioides</i> Mart.	ha	F3	lc
<i>Hermibstaedtia angolensis</i> C.B.Clarke	ha	F3	-
<i>Pandiaka carsonii</i> (Baker) Clarke var. <i>linearifolia</i> Hauman	hp	F3	-

	Habit	Habitat	Freq.
Anacardiaceae , FZ 2(2)			
<i>Rhus quartiniana</i> <i>A.Rich.</i>	t/S	F4	lc
Annonaceae , FZ 1(1)			
<i>Annona stenophylla</i> <i>Engl. & Diels</i> subsp. <i>nana</i> (<i>Exell</i>) <i>N.Robson</i>	s	F3	la
Apiaceae , FZ 4			
<i>Centella asiatica</i> (<i>L.</i>) <i>Urb.</i>	hp	Wg	lc
<i>Hydrocotyle verticillata</i> <i>Thunb.</i>	hp	Wg	lc
<i>Pimpinella neglecta</i> <i>Norman</i>	hp	Kd	-
<i>Steganotaenia hockii</i> (<i>Norman</i>) <i>Norman</i>	hp	F3	-
Apocynaceae			
<i>Carissa edulis</i> (<i>Forssk.</i>) <i>Vahl</i>	S	F4	o
Asclepiadaceae			
<i>Pachycarpus lineolatus</i> (<i>Decne</i>) <i>Bullock</i>	hp	F3	o
<i>Tacazzea apiculata</i> <i>Oliv.</i>	scl	F3	c
Asteraceae , FZ 6(1)			
<i>Adenostemma mauritianum</i> <i>DC.</i>	ha	Wf	lc
* <i>Ageratum conyzoides</i> <i>L.</i>	ha	Wg	c
<i>Ambrosia maritima</i> <i>L.</i>	ha	F3	r
<i>Blumea lacera</i> (<i>Burm.f.</i>) <i>Wight</i>	ha	?	-
<i>Blumea viscosa</i> (<i>Mill.</i>) <i>Badillo</i>	ha	F3	-
<i>Calostephane angolensis</i> (<i>O.Hoffm.</i>) <i>A.Anderb.</i>	ha	K3	o
<i>Conyza aegyptiaca</i> (<i>L.</i>) <i>Ait.</i>	ha	Kd	lc
<i>Conyza stricta</i> <i>Willd.</i>	ha	?	-
<i>Conyza welwitschii</i> (<i>S.Moore</i>) <i>Wild</i>	hp	Wg	c
<i>Cotula anthemoides</i> <i>L.</i>	ha	F3	lc
<i>Crassocephalum picridifolium</i> (<i>DC.</i>) <i>S.Moore</i>	ha/p	Wg	o
<i>Crassocephalum rubens</i> (<i>Jacq.</i>) <i>S.Moore</i>	ha	Wg	o
<i>Denekia capensis</i> <i>Thunb.</i>	ha	Na	o
<i>Eclipta alba</i> (<i>L.</i>) <i>Hassk.</i>	ha	Wg	lc
<i>Emilia protracta</i> <i>S.Moore</i>	ha/p	F2	lc
<i>Emiliella drummondii</i> <i>Torre</i>			
var. <i>drummondii</i>	ha	Wg	o
var. <i>moxicoensis</i> <i>Torre</i>	ha	Wg	
<i>Ethulia conyzoides</i> <i>L.</i>	ha	Wf	o
<i>Ethulia rhizomata</i> <i>M.G.Gilbert & C.Jeffrey</i>	ha	?Wf	-
<i>Grangea maderaspatana</i> (<i>L.</i>) <i>Poir.</i>	ha	F4	c
<i>Melanthera albinervia</i> <i>O.Hoffm.</i> subsp. <i>albinervia</i>	ha	F4	o
<i>Nicolaisia nitens</i> (<i>O.Hoffm.</i>) <i>Eyles</i>	ha	F3	o
<i>Nidorella resedifolia</i> <i>DC.</i>	ha	Wg	lc
<i>Nolletia zambesica</i> <i>R.E.Fr.</i>	hp	F4	lc
<i>Pseudognaphalium luteo-album</i> (<i>L.</i>) <i>Hilliard & Burt</i>	ha	Wg	lc
<i>Senecio</i> sp. aff. <i>hochstetteri</i>	ha/p	Wg	c
<i>Sphaeranthus humilis</i> <i>O.Hoffm.</i>	ha	F3	-
<i>Vernonia gerberiformis</i> <i>Oliv. & Hiern</i>			
subsp. <i>macrocyanus</i> (<i>O.Hoffm.</i>) <i>C.Jeffrey</i>	hp	F3	r
<i>Vernonia glabra</i> (<i>Steetz</i>) <i>Vatke</i>	hp	F3	c

	Habit	Habitat	Freq.
Bignoniaceae , FZ 8(3)			
<i>Kigelia africana</i> (Lam.) Benth.	T	F4	r
Boraginaceae , FZ 7(4)			
<i>Heliotropium baclei</i> DC. var. <i>rostratum</i> Johnston	hp	F3	a
Campanulaceae , FZ 7(1)			
<i>Gunillaea emirnensis</i> (A.DC.) Thulin	ha	Kd	c
<i>Wahlenbergia banksiana</i> A.DC.	hp	F3	-
<i>Wahlenbergia campanuloides</i> (Delile) Vatke	ha	F3	-
<i>Wahlenbergia hirsuta</i> (Edgew.) Tuyn	ha	Kd	o
<i>Wahlenbergia undulata</i> (L.f.) A.DC.	ha/hp	F3	c
Capparaceae , FZ 1			
? <i>Cleome rubella</i> Burch.	ha	-	-
Caryophyllaceae (incl. Illecebraceae), FZ 1(2)			
<i>Corrigiola litoralis</i> L.	ha	?	-
[<i>Corrigiola paniculata</i> Peter]	-	-	-
<i>Polycarpon prostratum</i> (Forssk.) Aschers. & Schweinf.	ha	F3	lc
Chenopodiaceae , FZ 9(1)			
<i>Atriplex amboensis</i> Schinz	ha/p	Na	r
<i>Chenopodium ambrosioides</i> L.	ha	F3	-
<i>Sueda</i> sp.aff. <i>S. merxmuelleri</i> Allen	s	Na	r
Chrysobalanaceae , FZ 4			
<i>Magnistipula sapinii</i> De Wild.	s	F3	c
<i>Parinari capensis</i> Harv.	s	F3	a
<i>Parinari excelsa</i> Sabine	T	Wf	-
Clusiaceae (Guttiferae incl. Hypericaceae), FZ 1(2)			
<i>Garcinia livingstonei</i> T.Anders.	T	F4	o
<i>Garcinia smeathmannii</i> (Planch. & Triana) Oliv.	S	Wf	c
<i>Harungana madagascariensis</i> Poir.	t/S	Wf	lo
<i>Hypericum oligandrum</i> Milne-Redh.	hp	Wg	o
Combretaceae , FZ 4			
<i>Combretum sericeum</i> G.Don	s	F3	a
Convolvulaceae , FZ 8(1)			
<i>Ipomoea aquatica</i> Forssk.	hp	F2	a
<i>Ipomoea optica</i> (L.) Roem. & Schult.	ha	F4	lc
<i>Ipomoea rubens</i> Choisy	cl	F1	lc
Cruciferae , FZ 1(1)			
<i>Coronopus integrifolius</i> (DC.) Spreng.	hp	-	r
Cucurbitaceae , FZ 4			
<i>Ctenolepis cerasiformis</i> (Stocks) Hook.f.	hp	F4	-
<i>Cucumis metuliferus</i> Naud.	ha	F4	o
<i>Kedrostis foetidissima</i> (Jacq.) Cogn.	hp	F4	o
<i>Momordica balsamina</i> L.	hp	F4	c
<i>Momordica charantia</i> L.	hp	F4	-
<i>Mukia maderaspatana</i> (L.) M.J.Roem.	hp	F4	-
<i>Zehneria marlothii</i> (Cogn.) R. & A.Fern.	cl	F4	c

	Habit	Habitat	Freq.
Dichapetalaceae, FZ 2(1)			
!Dichapetalum rhodesicum <i>Sprague & Hutch.</i>	s	F3	o
Droseraceae, FZ 4			
Drosera affinis <i>Oliv.</i>	hp	Wg	-
Drosera bequaertii <i>Taton</i>	hp	Wg	-
Drosera burkeana <i>Planch.</i>	hp	Wg	-
Drosera madagascariensis <i>DC.</i>	hp	Wg	-
Ebenaceae, FZ 7(1)			
Diospyros chamaethamnus <i>Mildbr.</i>	s	F3	-
Elatinaceae, FZ 1(2)			
Bergia ammanioides <i>Roth.</i>	ha	Wg	-
Bergia glutinosa <i>Dinter & Schulze-Menz</i>	hp	Wg	-
Bergia prostrata <i>Schinz</i>	hp	Wg	-
Euphorbiaceae, FZ 9(4)			
Acalypha allenii <i>Hutch.</i>	s	F3	-
Acalypha ciliata <i>Forssk.</i>	ha	F3	-
Acalypha indica <i>L.</i>	ha	F3	-
!Acalypha ornata <i>A.Rich.</i>	S	F4	-
Acalypha villicaulis <i>Hochst.</i>	s	F3	c
!Antidesma rufescens <i>Tul.</i>	t/S	F4	o
Antidesma venosum <i>Tul.</i>	t/S	F4	o
Bridelia micrantha (<i>Hochst.</i>) <i>Baill.</i>	T	F4	c
Caperonia fistulosa <i>Beille</i>	ha	F2	c
Chrozophora plicata (<i>Vahl</i>) <i>Spreng.</i>	ha/p	F3	c
Croton leuconeurus <i>Pax</i> subsp. leuconeurus	t	F4	o
Croton megalobotrys <i>Müll.Arg.</i>	t/S	F4	o
Euphorbia oatesii <i>Rolfe</i>	hp	F3	-
Jatropha baumii <i>Pax</i>	ph	F3	-
Micrococca mercurialis (<i>L.</i>) <i>Benth.</i>	ha	F3	-
Phyllanthus maderaspatensis <i>L.</i>	ha	F3	-
Phyllanthus nummulariifolius <i>Poir.</i>	ha/p	F3	-
Phyllanthus pentandrus <i>Schumach. & Thonn.</i>	ha	F3	-
Phyllanthus reticulatus <i>Poir.</i>	S	F4	lc
Fabaceae: Caesalpinioideae			
Chamaecrista mimosoides (<i>L.</i>) <i>Greene</i>	ha	F3	c
Chamaecrista polytricha (<i>Brenan</i>) <i>Lock</i>	ha	F4	c
Senna obtusifolia (<i>L.</i>) <i>Irwin & Barneby</i>	S	F4	lc
Senna occidentalis (<i>L.</i>) <i>Link</i>	S	F4	lc
Fabaceae: Mimosoideae			
Acacia hebeclada <i>DC.</i> subsp. chobiensis (<i>O.Miller</i>) <i>A.Schreib.</i>	S	F4	ld
Acacia montigena <i>Brenan & Exell</i>	S	F4	r
Entada arenaria <i>Schinz</i> subsp. arenaria	s	F3	o
Faidherbia albida (<i>Del.</i>) <i>A.Chev.</i>	T	F2	o
Mimosa pigra <i>L.</i>	S	F4	la
Neptunia oleracea <i>Lour.</i>	h/qr	F2	lc

	Habit	Habitat	Freq.
Fabaceae: Papilionoideae			
<i>Aeschynomene cristata</i> <i>Vatke</i>	s/h	?F2	-
<i>Aeschynomene fluitans</i> <i>Peter</i>	h,qf	F1	lc
<i>Aeschynomene indica</i> <i>L.</i>	s/h	Wg	lc
<i>Aeschynomene nilotica</i> <i>Taubert</i>	s/h	Wg	-
<i>Aeschynomene uniflora</i> <i>E.Mey.</i>	s/h	F1	lc
<i>Crotalaria flavicarinata</i> <i>Baker f.</i>	s/h	?	-
<i>Crotalaria germainii</i> <i>Wilezek</i>	ha	F3	r
<i>Desmodium dregeanum</i> <i>Benth.</i>	s	F3	o
<i>Desmodium salicifolium</i> (<i>Poir.</i>) <i>DC.</i>	s	F3	o
<i>Dolichos trinervatus</i> <i>Baker</i>	s	K2	o
<i>Eriosema psoraleoides</i> (<i>Lam.</i>) <i>G.Don</i>	S	F4	c
<i>Indigofera arenophila</i> <i>Schinz</i>	hp	F3	r
<i>Indigofera astragalina</i> <i>DC.</i>	ha	F3	c
<i>Indigofera capitata</i> <i>Kotschy</i>	s/h	F3	r
<i>Indigofera flavicans</i> <i>Baker</i>	h	F3	c
<i>Indigofera gairdnerae</i> <i>Baker f.</i>	h	F3	r
<i>Indigofera microcalyx</i> <i>Baker</i>	s	F3	-
<i>Indigofera numulariifolia</i> (<i>L.</i>) <i>Alston</i>	ha	F3	c
<i>Sesbania coerulescens</i> <i>Harms</i>	S	Wg	o
<i>Sesbania microphylla</i> <i>E.Phillips & Hutch.</i>	s/h	F2	c
<i>Sesbania sesban</i> (<i>L.</i>) <i>Merr.</i>	t/S	?	lc
<i>Tephrosia cephalantha</i> <i>Baker</i> var. <i>decumbens</i> <i>Baker</i>	s	F3	lc
<i>Tephrosia lupinifolia</i> <i>DC.</i>	hp	F3	o
<i>Vigna luteola</i> (<i>Jacq.</i>) <i>Benth.</i>	ha	Wg	lc
<i>Zornia milneana</i> <i>Mohl.</i>	hp	F3	o
Flacourtiaceae, FZ 1			
<i>Caloncoba suffruticosa</i> (<i>Milne-Redh.</i>) <i>Exell & Sleumer</i>	s	F3	o
<i>Homalium abdessammadii</i> <i>Asch. & Schweinf.</i> subsp. <i>wildemanianum</i> (<i>Gilg</i>) <i>Wild</i>	T	F4	lc
Gentianaceae, FZ 7(2)			
<i>Pycnosphaera buchananii</i> (<i>Baker</i>) <i>N.E.Br.</i>	ha/p	K2	r
<i>Swertia welwitschii</i> <i>Engl.</i>	ha	K2	r
Haloragidaceae, FZ 4			
<i>Laurembergia tetrandra</i> (<i>Schott</i>) <i>Kanitz</i> subsp. <i>brachypoda</i> (<i>Hiern</i>) <i>A.Raynal</i>	hp	?Wg	-
<i>Myriophyllum spicatum</i> <i>L.</i>	qs	F1	-
Lamiaceae			
<i>Englerastrum schweinfurthii</i> <i>Briq.</i>	ha/p	Wg	c
<i>Hyptis spicigera</i> <i>Lam.</i>	ha/p	Wg	o
<i>Neohyptis paniculata</i> (<i>Baker</i>) <i>J.K.Morton</i>	ha	Wg	p
<i>Ocimum americanum</i> <i>L.</i>	ha	Wg	lc
<i>Plectranthus mirabilis</i> (<i>Briq.</i>) <i>Launert</i>	s	Wg	lc
Lauraceae, Kirkia 16(1)			
<i>Cassytha pondoensis</i> <i>Engl.</i>	hp	P	lc

	Habit	Habitat	Freq.
Lecythidaceae, FZ 4			
!Napoleonaea gossweileri <i>Baker f.</i>	s	F3	c
Lentibulariaceae, FZ 8(3)			
Utricularia benjaminiana <i>Oliver</i>	h	Wg	-
Utricularia firmula <i>Oliver</i>	h	Wg	-
Utricularia foliosa <i>L.</i>	h	Wg	-
Utricularia gibba <i>L.</i>	h	Wg	-
Utricularia reflexa <i>Oliver</i>	h	Wg	-
Utricularia scandens <i>Benj.</i>	h	Wg	-
Utricularia stellaris <i>L.f.</i>	h	Wg	-
Utricularia subulata <i>L.</i>	h	Wg	-
Utricularia tortilis <i>Oliver</i>	h	Wg	-
Utricularia welwitschii <i>Oliver</i>	h	Wg	-
Lobeliaceae, FZ 7(1)			
Lobelia angolensis <i>Engl. & Diels</i>	h	Wg	-
Lobelia erinus <i>L.</i>	h	Wg	-
Lobelia livingstoniana <i>R.E.Fr.</i>	h	Wg	-
Monopsis zeyheri (<i>Sonder</i>) <i>Thulin</i>	h	Wg	-
Loganiaceae, FZ 7(1)			
Anthocleista liebrechtsiana <i>De Wild. & T.Dur.</i>	T	F4	o
Lythraceae, FZ 4			
Ammannia prieruriana <i>Guill. & Perr.</i>	ha	Wg	-
Nesaea caudata <i>Hiern</i>	ha	Wg	-
Nesaea crassicaulis (<i>Guill. & Perr.</i>) <i>Koehne</i>	ha	Wg	-
Nesaea ondongana <i>Koehne</i> subsp. <i>ondongana</i>	ha	Wg	lc
Nesaea radicans <i>Guill. & Perr.</i>	ha/p	Wg	lc
Nesaea rautanenii <i>Koehne</i>	ha	Wg	-
Nesaea rigidula (<i>Sond.</i>) <i>Koehne</i>	s	Wg	-
Nesaea schinzii <i>Koehne</i>	s	Wg	-
Rotala fluitans <i>Pohnert</i>	ha	F4	-
Rotala heteropetala <i>Koehne</i>	ha	Wg	-
Rotala heterophylla <i>Fernandes & Diniz</i>	ha	Wg	-
Rotala longistyla <i>Gibbs</i>	hp	Wg	-
Rotala submersa <i>Pohnert</i>	ha	Wg	-
Malvaceae, FZ 1(2)			
Hibiscus diversifolius <i>Jacq.</i> subsp. <i>rivularis</i> (<i>Bremek. & Oberm.</i>) <i>Exell</i>	S	F1	o
Kosteletzkya buettneri <i>Gürke</i>	hp	Wg	-
Urena lobata <i>L.</i>	hp	F1	c
Wissadula rostrata (<i>Schumach.</i>) <i>Hook.f.</i>	s	F4	-
Melastomataceae, FZ 4			
Antherotoma naudinii <i>Hook.</i>	ha	Wg	lc
Dissotis debilis (<i>Sond.</i>) <i>Triana</i>	s	Wg	lc
Dissotis falcipila <i>Gilg</i>	s/hp	Wg	-
Dissotis gracilis <i>Cogn.</i>	hp	Wg	-
Dissotis princeps (<i>Kunth</i>) <i>Triana</i>	S	Wg	c
Melastomastrum segregatum (<i>Benth.</i>) <i>A. & R.Fern.</i>	S	Wg	-

	Habit	Habitat	Freq.
Meliaceae, FZ 2(1)			
<i>Ekebergia capensis</i> <i>Sparrm.</i>	T	F4	o
<i>Trichilia emetica</i> <i>Vahl</i>	T	F4	c
<i>Turraea zambesica</i> <i>Hutch.</i>	t/S	F4	-
Menispermaceae, FZ 1(1)			
<i>Cissampelos mucronata</i> <i>A.Rich.</i>	cl	F4	o
<i>Cocculus hirsutus</i> (<i>L.</i>) <i>Diels</i>	cl	F4	o
Menyanthaceae, FZ 2(2)			
<i>Nymphoides indica</i> (<i>L.</i>) <i>Kuntze</i>	qf	F2	c
Molluginaceae, FZ 4			
<i>Glinus lotoides</i> <i>L.</i>	ha	F4	a
<i>Glinus oppositifolius</i> (<i>L.</i>) <i>DC.</i> var. <i>lanatus</i> <i>Hauman</i>	ha	F4	a
<i>Limeum fenestratum</i> (<i>Fenzl</i>) <i>Heimerl</i>	ha	F4	o
! <i>Limeum viscosum</i> (<i>J.Gay</i>) <i>Fenzl.</i>	hp	F4	-
<i>Mollugo cerviana</i> (<i>L.</i>) <i>Ser.</i>	ha	F4	-
Moraceae, FZ 9(6)			
<i>Ficus capreifolia</i> <i>Del.</i>	S	F4	c
<i>Ficus pygmaea</i> <i>Hiern</i>	s	F3	c
<i>Ficus sur</i> <i>Forssk.</i>	T	F4	c
<i>Ficus verruculosa</i> <i>Warb.</i>	S	Wg	o
Myricaceae			
<i>Myrica serrata</i> <i>Lam.</i>	s	Wg	lo
Myrsinaceae, FZ 7(1)			
<i>Embelia schimperi</i> <i>Vatke</i>	cl	F4	r
Myrtaceae, FZ 4			
<i>Eugenia capensis</i> (<i>Eckl. & Zeyh.</i>) <i>Sond.</i>			
subsp. <i>nyassensis</i> (<i>Engl.</i>) <i>F.White</i>	s	F3	-
<i>Eugenia malangensis</i> (<i>O.Hoffm.</i>) <i>Nieden zu</i>	s	F3	-
<i>Syzygium cordatum</i> <i>Krauss</i>	T	Wf	ld
<i>Syzygium guineense</i> (<i>Willd.</i>) <i>DC.</i>			
subsp. <i>barotsense</i> <i>F.White</i>	T	F4	ld
subsp. <i>guineense</i>	T/t	F3	c
subsp. <i>huillense</i> (<i>Hiern</i>) <i>F.White</i>	s	F3	c
<i>Syzygium owariense</i> (<i>Beauv.</i>) <i>Benth.</i>	T	Wf	ld
Nyctaginaceae, FZ 9(1)			
! <i>Commicarpus plumbagineus</i> (<i>Cav.</i>) <i>Standley</i>	hp	F4	-
Nymphaeaceae, FZ 1(1)			
<i>Nymphaea caerulea</i> <i>Savigny</i>	qf	F1	a
<i>Nymphaea</i> sp.aff. <i>N. maculata</i> <i>Schumach</i>	qf	F1	a
Ochnaceae, FZ 2(1)			
<i>Brackenridgea arenaria</i> (<i>De Wild. & Dur.</i>) <i>N.Robson</i>	s	F3	lc
<i>Ochna cinnabarina</i> <i>Engl. & Gilg</i>	s	F4	-
! <i>Ochna leptoclada</i> <i>Oliv.</i>	s	F3	-
<i>Ochna manikensis</i> <i>De Wild.</i>	s	F3	-
<i>Ochna pygmaea</i> <i>Hiern</i>	s	F3	-
<i>Vausagesia africana</i> <i>Baill.</i>	hp	Wg	-

	Habit	Habitat	Freq.
Oleaceae, FZ 7(1)			
<i>Jasminum fluminense Vell.</i>	cl	F4	o
Onagraceae, FZ 4			
<i>Ludwigia abyssinica A.Rich.</i>	h	Wg	-
<i>Ludwigia leptocarpa (Nutt.) Hara</i>	h	Wg	-
<i>Ludwigia octovalvis (Jacq.) Raven</i>	h	Wg	c
*? <i>Ludwigia palustris (L.) Ell.</i>	h	Wg	r
<i>Ludwigia senegalensis (DC.) Troch.</i>	h	Wg	-
<i>Ludwigia stolonifera (Guill.& Perr.) Raven</i>	qf	F1	-
Passifloraceae, FZ 4			
<i>Adenia digitata (Harv.) Engl.</i>	cl	F4	-
<i>Adenia repanda (Burch.) Engl.</i>	cl	F4	-
<i>Adenia rumicifolia Engl.& Harms</i>	cl	Wf	o
Pedaliaceae, FZ 8(3)			
<i>Ceratotheca sesamoides Endl.</i>	h	F3	o
<i>Dicerocaryum eriocarpum (Decne.) Abels</i>	hp	F3	o
<i>Harpagophytum zeyheri Decne.</i>			
subsp. <i>sublobatum (Engl.) Ihlenf & Hartm.</i>	hp	F3	o
<i>Sesamum alatum Thonn.</i>	hp	F3	c
<i>Sesamum calycinum Welw. subsp. baumii (Stapf) Seidenst.</i>	hp	F3	o
Phytolaccaceae, FZ 9(1)			
! <i>Lophiocarpus tenuissimus Hook.f.</i>	h	F3	o
<i>Phytolacca dodecandra L'Herit.</i>	cl	F4	-
Polygalaceae, FZ 1(1)			
<i>Polygala africana Chod.</i>	ha	Wg	-
<i>Polygala arenicola Gürke</i>	ha/p	Wg	-
<i>Polygala kalaxariensis Schinz</i>	s/hp	Wg	-
<i>Polygala nambalensis Gürke</i>	ha	Wg	-
<i>Polygala pygmaea Gürke</i>	ha	F3	-
<i>Polygala schinziana Chod.</i>	hp	-	-
<i>Polygala spicata Chod.</i>	ha	Wg	-
Polygonaceae			
<i>Oxygonum dregeanum Meisn.</i>	ha	F4	c
<i>Polygonum (Persicaria) senegalense Meisn.</i>	hp	F1	c
<i>Polygonum tomentosum Willd.</i>	hp	-	-
Primulaceae, FZ 7(1)			
<i>Anagallis barbata (P.Taylor) Kupicha</i>	ha	Wg	o
Proteaceae			
<i>Protea welwitschii Engl.</i>	t/S	P3	r
Rhizophoraceae, FZ 4			
<i>Anisophyllea quangensis Henriques</i>	s	F3	-
<i>Cassipourea malosana (Baker) Alston</i>	t/S	F4	-
Rosaceae, FZ 4			
<i>Rubus rigidus J.E.Sm.</i>	cl	F4	-

	Habit	Habitat	Freq.
Rubiaceae , FZ 5(1), 1989; 5(2), 1998			
<i>Ancylanthos rubiginosus</i> Desf.	s	F3	c
<i>Fadogia gossweileri</i> Robyns	s	F3	-
<i>Fadogia stenophylla</i> Hiern subsp. <i>odorata</i> (Krause) Verdc.	s	F3	-
<i>Gardenia imperialis</i> K.Schum.	T	Wf	lo
<i>Keetia zanzibarica</i> (Klotzsch) Bridson			
subsp. <i>cornelioides</i> (De Wild.) Bridson	S	F4	o
<i>Keetia venosa</i> (Oliv.) Bridson	S	F4	o
<i>Kohautia caespitosa</i> Schnizl.			
subsp. <i>brachyloba</i> (Sonder) D.Mantell	hp	F3	c
<i>Kohautia cuspidata</i> (K.Schum.) Bremek.	ha/p	F3	c
<i>Kohautia longifolia</i> Klotzsch	ha/p	-	-
<i>Kohautia virgata</i> (Willd.) Bremek.	ha/p	-	-
<i>Mitrasacmopsis quadrivalvis</i> Jovet	ha	F4	-
<i>Oldenlandia angolensis</i> K.Schum. var. <i>angolensis</i>	ha/p	Wg	o
<i>Oldenlandia capensis</i> L.f.	ha	F3	-
<i>Oldenlandia corymbosa</i> L. var. <i>linearis</i> (DC.) Verdc.	ha	F4	-
<i>Oldenlandia goreensis</i> (DC.) Summerh. var. <i>goreensis</i> Bremek.	ha	-	-
<i>Oldenlandia herbacea</i> (L.) Roxb. var. <i>herbacea</i>	ha	F3	-
<i>Oldenlandia lancifolia</i> (Schumach.) DC. var. <i>scabridula</i> Bremek.	hp	F3	-
<i>Pachystigma albosetulosum</i> Verdc.	s	F3	-
<i>Paederia bojeriana</i> (A.Rich.) Drake subsp. <i>foetens</i> (Hiern) Verdc.	cl	F4	-
<i>Pentodon pentandrus</i> (Schmach. & Thonn.) Vatke var. <i>pentandrus</i>	ha/p	Wg	-
<i>Psychotria butayei</i> De Wild. var. <i>butayei</i>	S	F4	-
<i>Psychotria djumaensis</i> De Wild. var. <i>zambesiaca</i> Petit	tS	Wf	-
<i>Psychotria peduncularis</i> (Salis.) Steyerm. var. <i>rufonyassana</i> Verdc.	Ss	F4	-
<i>Pygmaeothamnus zeyheri</i> (Sond.) Robyns			
var. <i>rogersii</i> Robyns	s	F3	a
var. <i>zeyheri</i>	s	F3	a
<i>Sabicea</i> sp.	cl	Wf	c
<i>Spermacoce pusilla</i> Wall.	ha	F4	-
<i>Spermacoce quadrisulcata</i> (Bremek.) Verdc.	ha	Wg	-
<i>Spermacoce senensis</i> (Klotzsch) Hiern	ha	F3	c
<i>Tapiphyllum discolor</i> (De Wild.) Robyns	s	F3	o
<i>Vangueria proschii</i> Briq.	S	F4	-
Salicaceae			
<i>Salix subserrata</i> Willd.	tS	F4	o
Santalaceae			
<i>Thesium</i> sp.	ha/p	F3	o
<i>Thesium</i> sp.	ha/p	F3	o
Sapindaceae , FZ 2(2)			
<i>Allophylus africanus</i> Beauv.	tS	F4	o
<i>Cardiospermum corindum</i> L.	cl	F4	-
<i>Cardiospermum halicacabum</i> L.	cl	F4	c
<i>Paullinia pinnata</i> L.	cl	F4	c

	Habit	Habitat	Freq.
Scrophulariaceae, FZ 8(2)			
<i>Alectra picta</i> (Hiern) Hemsl.	ha	F4	-
<i>Alectra sessiliflora</i> (Vahl) Kuntze			
var. <i>monticola</i> (Engl.) Melch.	ha	F3	-
var. <i>senegalensis</i> (Benth.) Hepper	ha	F3	-
var. <i>sessiliflora</i>	ha	F3	-
<i>Aptosimum decumbens</i> Schinz	s	F3	-
<i>Bacopa floribunda</i> (R.Br.) Wettst.	ha	F3	-
<i>Buchnera henriquesii</i> Engl.	ha	F3	-
<i>Buchnera humpatensis</i> Hiern	ha	F3	-
<i>Buchnera longispica</i> Schinz	ha	F3	-
<i>Buchnera prorepens</i> Engl. & Gilg	ha	F3	-
<i>Buchnera randii</i> S.Moore	ha	F3	-
<i>Cycnium tubulosum</i> (L.f.) Engl.	ha/p	F2	c
<i>Diclis ovata</i> Benth.	ha	F4	-
<i>Hebenstretia holubii</i> Rolfe	ha	F3	lo
<i>Limnophila barteri</i> Skan	ha	F5	-
<i>Limnophila indica</i> (L.) Druce	hp	F2	-
<i>Lindernia parviflora</i> (Roxb.) Haines	ha	F5	-
<i>Mimulus gracilis</i> R.Br.	hp	F4	-
<i>Rhamphicarpa brevipedicellata</i> O.J.Hansen	ha	F5	-
<i>Scoparia dulcis</i> L.	s	F3	o
<i>Selago</i> sp. prob. <i>S. welwitschii</i> Rolfe	h/s	F3	o
<i>Sopubia mannii</i> Skan			
var. <i>mannii</i>	hp	F3	-
var. <i>tenuifolia</i> (Engl. & Gilg) Hepper	hp	F3	-
<i>Sopubia ramosa</i> (Hochst.) Hochst.	hp	F3	o
<i>Sopubia simplex</i> Hochst.	hp	F3	o
<i>Striga elegans</i> Benth.	ha	F3	o
<i>Sutera elegantissima</i> (Schinz) Skan	hp	F4	-
<i>Torenia spicata</i> Engl.	ha	F3	-
<i>Torenia thouarsii</i> (Cham. & Schlecht.) Kuntze	ha	F3	-
<i>Walafriida angolensis</i> (Rolfe) Rolfe	hp	F3	-
Sterculiaceae, FZ 1(2)			
<i>Hermannia angolensis</i> K.Schum.	hp	F3	-
<i>Hermannia glanduligera</i> K.Schum.	hp	F3	o
<i>Hermannia quartiniana</i> A.Rich.	hp	F3	-
<i>Melochia corchorifolia</i> L.	ha	F4	c
<i>Waltheria americana</i> L.	hp	F3	-
Thymelaeaceae			
<i>Gnidia chrysantha</i> (Schweinf.) Gilg	hp	F3	-
Tiliaceae, FZ 2(1)			
<i>Corchorus aestuans</i> L.	ha	Wg	c
<i>Corchorus fascicularis</i> Lam.	ha	Wg	-
<i>Corchorus tridens</i> L.	ha	Wg	c
<i>Corchorus trilocularis</i> L.	ha	Wg	c

	Habit	Habitat	Freq.
<i>Grewia retinervis</i> Burret	S	F4	c
<i>Grewia schinzii</i> K.Schum	tS	F4	-
<i>Triumfetta annua</i> L.	ha	F3	c
<i>Triumfetta pentandra</i> A.Rich.	ha	F3	o
Trapaceae, FZ 4			
<i>Trapa natans</i> L.	qr	F1	o
Turneraceae, FZ 4			
<i>Tricliceras lobatum</i> (Urb.) R.Fern.	ha	Wg	o
<i>Tricliceras longepedunculatum</i> (Mast.) A.Fern.	hp	F3	o
Vahliaceae, FZ 4			
<i>Vahlia capensis</i> (L.f.) Thunb. subsp. <i>vulgaris</i> Bridson	hp	F3	o
Vitaceae, FZ 2(2)			
<i>Cissus integrifolia</i> (Baker) Planch	cl	F4	o
<i>Cyphostemma bororense</i> (Klotsch) Descoings	cl	F4	-
<i>Cyphostemma congestum</i> (Baker) Descoings	cl	F4	-
<i>Cyphostemma kaessneri</i> (Gilg & Brandt) Descoings	cl	F4	-
<i>Cyphostemma lynesii</i> (Dewit) Descoings	cl	F4	-
Zygophyllaceae, FZ 2(1)			
<i>Tribulus terrestris</i> L.	ha	F3	c
TOTAL 662 taxa (76 taxa trees/shrubs)			

CHAPTER 2 : APPENDIX 3 BULOZI PLAIN WETLAND PLANT SURVEY

Mike Bingham

1. INTRODUCTION

There have been a number of plant collections from the Bulozhi Floodplain over the years, in particular Drummond and Cookson (1959), Verboom (1964), Robinson (1962-1966), Jeanes (1987) and Bingham (1989-1995). A comprehensive list derived from these collections is given in Appendix 2.2. As the collections have generally not focussed on wetland plants, and have often taken place at other times of year, it was thought useful to carry out some systematic plant collecting in the area in February 1999 under the Zambezi Society/BFA Zambezi Basin Wetlands Biodiversity Assessment Project. This survey was undertaken by M.G. Bingham and Ben Luwiika.

Areas selected for the survey were: (a) the Bulozhi floodplain flanking the Zambezi River near Mongu, (b) the Luena Flats some 50 km north of Mongu, (c) the wetlands along the Luanginga River northwest of Kalabo, and (d) the area around Ndau School 25 km southwest of Mongu on the west bank. The Ndau School area was selected as it is of particular interest to IUCN being the study site for a community-based biodiversity monitoring project. The other sites were chosen as being representative of the range of wetland habitats accessible from Mongu.

One of the three areas that it was intended to survey – the Luena Flats – was inaccessible in February, but the east bank floodplain area has been well collected during several visits since 1990. The area north west of Kalabo on the Luanginga River was collected during February 1999, and collections were also made along the Lueti River, a tributary of the Luanginga, in October 1990. These two collections, made respectively before and after the rains, complement one another. During three days spent at the Ndau study area, the wetland species of the floodplain and Kabumu Lagoon were collected and recorded. At this time most of the smaller plants were submerged, but a collection was made at the water's edge. In addition to these areas a few other areas were briefly surveyed, including three sand bars.

Wherever possible, vernacular names and uses were recorded. The community at Ndau, and especially the ADCC Chairperson, Mr Inambao Ilubala, provided most of the information.

A total of 236 species in 62 families were collected or recorded during the survey. No attempt has been made to include species collected or recorded by others. Unless stated otherwise, all identifications are those of the author and should be regarded as tentative pending confirmation. Some of the specimens have been sent to the Kew Herbarium in London (K) and the Zimbabwe National Herbarium in Harare (SRGH) for identification. A complete set of specimens has been deposited at Mount Makulu herbarium (MRSC) outside Lusaka.

2. COLLECTING LOCALITIES

2.1 Bulozhi Floodplain flanking the Zambezi near Mongu

The east bank area from Mongu to Namushakende is the most intensively surveyed wetland area of the Province, having been collected both by the author and other collectors.

The area between the eastern sand scarp and channel of the Zambezi is occupied by a raised terrace (*saana*), which is less seriously affected by the annual flooding of the Zambezi than lower-lying areas of the Bulozhi Plain. Numerous mounds, built and maintained by termites, are a conspicuous feature of the Saana. The larger mounds are occupied by family abodes, the people moving to dryland areas during high floods. The plain edge is ecologically distinct, being strongly influenced by seeps.

Included in the list are plants collected in the Sefula dambo, a strongly flowing perennial stream draining onto the Bulozhi Plain at the Sefula Mission, about 15 km south of Mongu. The dambo is channelled for most of its length. The channel is kept cleared by the local community in order to keep the soil from becoming

waterlogged and to ensure improved cultivation. Since previous collections were made a weir has been built near the mouth of the dambo to store water for a Japanese funded rice project.

Wetland collecting localities:

Mongu south – 15°15'S / 23°06'E, 1000 m altitude; 18-21 Dec 1993, 7 Dec 1995. Seepage zone at floodplain margin.

Sefula, Mutungi village – 15°21.4'S / 23°10.1'E, 1000 m altitude; 11 Feb 1999. Seepage zone at floodplain margin with *Imperata*.

Sefula Mission – 15°07'S / 23°10'E, 1050 m altitude; 5 July 1991, 21-22 Dec 1993. Dambo and plain edge; heavily grazed.

Sefula Dambo, Kasuka Village – 15°22'S / 23°13'E, 1050 m altitude; 14-15 Oct 1993. Channelled dambo with grazing and patch cultivation.

Namushakende – 15°25'S / 23°13'E, 1000 m altitude; 19 Feb 1999. Seepage zone at floodplain margin with *Syzygium cordatum* swamp forest.

Limalunga to Libonda (3 km) – 23 Oct 1990. Saana.

Libonda Ferry, banks of the Zambezi – 23 Oct 1990. River bank.

Lealui West (2 km) – 15°12.8'S / 22°59.8'E, 1000 m altitude; 9 Dec 1995, 21 Feb 1999. Termite mound and deeply flooded surrounding plain.

Ferns

Azollaceae

Azolla sp. drainage ditches of gardens

Osmundaceae

Osmunda regalis L. seep forest; rare

Salviniaceae

Salvinia molesta D.S.Mitchell ditch drains of gardens

Schizaeaceae

Lygodium microphyllum (Cav.) R.Br. climbing shrub in seep forest

Thelypteridaceae

Cyclosorus interruptus (Willd.) H.Itô rhizomatous perennial, occasional in peaty seeps

Thelypteris confluens (Thunb.) Morton rhizomatous perennial; common in peaty seeps

Monocotyledons

Alismataceae

Burnatia enneandra P.Micheli floodplain mounds

Limnophyton angolense Buchenau perennial herb

Amaryllidaceae

Crinum sp.

Anthericaceae

Chlorophytum sp. culms to 3 m

Colchicaceae

Gloriosa sessiliflora Nordal & Bingham mounds and sand banks

Commelinaceae

Aneilema nicholsonii C.B.Cl.

Commelina africana L.

Commelina benghalensis L. perennial weed

Commelina fluviatilis Brenan

Commelina sp. yellow flower

Cyperaceae

Bulbostylis abortiva (Steud) C.B.Clarke.

Cyperus amabilis Vahl annual weed

Cyperus digitatus Roxb. large coarse sedge

Cyperus esculenta L.

Fuirena umbellata Rottb. seep forest and grassland

<i>Lipocarpa chinensis</i> (Osbeck) Kern	
<i>Pycreus mundtii</i> Nees	
<i>Rhynchospora corymbosa</i> (L.) Britton	
<i>Scleria melanomphala</i> Kunth	
Hyacinthaceae	
<i>Dipcadi longifolium</i> (Lindl.) Baker	
<i>Drimia zombensis</i> Baker	floodplain mound
<i>Ledebouria</i> sp.	floodplain mound
Hydrocharitaceae	
<i>Lagarosiphon</i> sp.	
<i>Ottelia kunensis</i> (Gürke) Dandy	submerged aquatic in deeper channels
<i>Ottelia ulvifolia</i> (Planch.) Walp.	submerged aquatic in deeper channels
Iridaceae	
<i>Gladiolus dalenii</i> Van Geel	locally common on plain & near mounds
Marantaceae	
<i>Thalia geniculata</i> L.	
Orchidaceae	
<i>Eulophia alta</i> (L.) Fawcett & Rendle	
<i>Habenaria schimperiana</i> A.Rich.	
<i>Platycoryne buchananii</i> (Kraenzl.) Rolfe	
Poaceae	
<i>Acroceras macrum</i> Stapf	creeping perennial
<i>Andropogon eucomus</i> Nees	
<i>Andropogon huillensis</i> Rendle	
<i>Andropogon perligulatus</i> Stapf	
<i>Cenchrus biflorus</i> Roxb.	sand banks
<i>Cynodon dactylon</i> (L.) Pers.	mostly on old village sites
<i>Digitaria acuminatissima</i> Stapf	
<i>Digitaria scalarum</i> (Schweinf.) Chiov.	rhizomatous perennial weed
<i>Digitaria velutina</i> (Forssk.) P.Beauv.	annual weed
<i>Echinochloa stagnina</i> (Retz.) Beauv.	lining deep channels
<i>Eleusine corocana</i> (L.) Gaertn.	annual weed
<i>Eragrostis arenicola</i> C.E.Hubbard	
<i>Eragrostis capensis</i> (Thunb.) Trin.	tufted perennial of sandy dambos
<i>Eragrostis gangetica</i> (Roxb.) Steud.	
<i>Eragrostis mildbraedii</i> Pilg.	
<i>Eragrostis tremula</i> (Lam.) Steud.	
<i>Eragrostis viscosa</i> (Retz.) Trin.	
<i>Eulalia aurea</i> (Bory) Kunth	creeping perennial; floodplain mounds
<i>Hemarthria altissima</i> (Poir.) Stapf & C.E.Hubbard	creeping perennial; permanently wet ground
<i>Heteranthoecia guineensis</i> (Franch.) Robyns	
<i>Hyparrhenia newtonii</i> (Hack.) Stapf	
<i>Hyperthelia dissoluta</i> (Steud.) W.D.Clayton	
<i>Imperata cylindrica</i> (L.) Beauv.	rhizomatous perennial
<i>Leersia hexandra</i> Sw.	
<i>Miscanthus junceus</i> (Stapf) Pilg.	
<i>Oryza longistaminata</i> A.Chev.& Roehr.	widespread & dominant on Bulozzi Plain
<i>Panicum coloratum</i> L.	tufted perennial
<i>Panicum fluviicola</i> Steud.	tufted perennial
<i>Panicum parvifolium</i> Lam	creeping perennial; peaty seeps
<i>Panicum repens</i> L.	creeping perennial
<i>Paspalum scrobiculatum</i> L.	
<i>Phragmites mauritanus</i> Kunth	lining deep channels; locally dominant
<i>Rottboellia cochichinensis</i> (Lour.) W.D.Clayton	annual weed

<i>Setaria sphacelata</i> (Schumach.) Moss	tufted perennial
<i>Sorghastrum nudipes</i> Nash	
<i>Sporobolus ioclados</i> (Trin.) Nees	floodplain termite mound
<i>Sporobolus subtilis</i> Kunth	
<i>Sporobolus welwitschii</i> Rendle	tufted perennial
<i>Themeda triandra</i> Forssk.	floodplain mounds
<i>Tristachya superba</i> (De Not.) Schweinf. & Aschers.	saana
<i>Vossia cuspidata</i> (Roxb.) Griff.	fringing deep channels
Dicotyledons	
Apiaceae	
<i>Centella asiatica</i> (L.) Urb.	weedy perennial
Asclepiadaceae	
<i>Taccazea apiculata</i> Oliv.	shrub on banks & mounds; common
Asteraceae	
<i>Ambrosia maritima</i> L.	
<i>Aspilia kotschyi</i> (Hochst.) Oliv.	annual weed
<i>Bidens pilosa</i> L.	
<i>Conyza welwitschii</i> (S.Moore) Wild	perennial
<i>Conyza</i> sp.	weed
<i>Cotula anthemoides</i> L.	
<i>Crassocephalum picridifolium</i> (DC.) S.Moore	
<i>Crassocephalum rubens</i> (Jacq.) S.Moore	annual weed
<i>Emilia protracta</i> S.Moore	annual(?) in wild rice zone
<i>Emiliella drummondii</i> Torre var. <i>drummondii</i>	
<i>Erlangea misera</i> (Oliv. & Hiern) S.Moore	
<i>Ethulia conyzoides</i> L.	seep forest margin
<i>Grangea maderaspatana</i> (L.) Poir.	
<i>Pseudognaphalium oligandrum</i> (DC.) Hilliard & Burt	
<i>Senecio chlorocephalus</i> Poir.	
<i>Senecio</i> sp. aff. <i>S. hochstetteri</i> A.Rich.	sandy dambo
Boraginaceae	
<i>Heliotropium baclei</i> DC. var. <i>rostratum</i> I.M.Johst.	
Campanulaceae	
<i>Gunillaea rhodesica</i> (Adamson) Thulin	
Capparaceae	
<i>Cleome hirta</i> (Klotzsch) Oliv.	annual weed
Caryophyllaceae	
<i>Polycarpon prostratum</i> (Forssk.) Aschers. & Schweinf.	
Clusiaceae	
<i>Hypericum oligandrum</i> Milne-Redh.	
Convolvulaceae	
<i>Ipomoea aquatica</i> Forssk.	
<i>Ipomoea coptica</i> (L.) Roem. & Schult.	
<i>Xenostegia tridentata</i>	
Euphorbiaceae	
<i>Caperonia stuhlmannii</i> Pax	
<i>Euphorbia hirta</i> L.	annual weed
Fabaceae: Caesalpinioideae	
<i>Chamaecrista absus</i> (L.) Irwin & Barneby	annual weed
Fabaceae: Mimosoideae	
<i>Faidherbia albida</i> (Del.) A.Chev.	most common tree of the Bulozzi Plain
<i>Mimosa pigra</i> L.	spiny shrub on channel banks

Fabaceae: Papilionoideae

<i>Aeschynomene indica</i> L.	annual
<i>Aeschynomene nilotica</i> Taubert	annual
<i>Crotalaria kapiiriensis</i> De Wild.	spiny annual; floodplain mounds
<i>Crotalaria ochroleuca</i> G.Don	annual
<i>Crotalaria glauca</i> Willd.	erect annual; glaucous, unifoliolate
<i>Desmodium dregeanum</i> Benth.	subshrub of seeps
<i>Eriosema psoraleoides</i> (Lam.) G.Don	weedy shrub
<i>Flemingia grahamiana</i> Wight & Arn.	shrub; short lived perennial
<i>Indigofera arrecta</i> A.Rich.	short-lived perennial shrub; weedy
<i>Indigofera spicata</i> Forssk.	floodplain mound
<i>Indigofera gairdneriae</i> Baker f.	
<i>Indigofera</i> sp.	9-foliolate
<i>Sesbania microphylla</i> E.Phillips & Hutch.	annual
<i>Vigna luteola</i> (Jacq.) Benth.	seeps, reedbeds & floodplain mounds

Lamiaceae

<i>Englerastrum schweinfurthii</i> Briq.	
<i>Neohyptis paniculata</i> (Baker) J.K.Morton	seep forest
<i>Plectranthus mirabilis</i> (Briq.) Launert	perennial shrub

Lentibulariaceae

Utricularia sp.

Lobeliaceae

<i>Lobelia erinus</i> L.	sandy dambo
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Lythraceae

Lauremberguia tetrandra (Schott) Kanitz
ssp. *brachypoda* (Hiern) A.Raynal

Malvaceae

<i>Hibiscus mechowii</i> Garcke	
<i>Hibiscus meeusei</i> Exell	annual weed
<i>Urena lobata</i> L.	

Melastomataceae

<i>Dissotis gracilis</i> Cogn.	
<i>Dissotis princeps</i> (Kunth) Triana	perennial shrub

Menispermaceae

<i>Cissampelos mucronata</i> A.Rich.	climbing shrub, floodplain mounds
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Molluginaceae

<i>Gisekia pharnaceoides</i> L. var. <i>pharnaceoides</i>	annual weed
<i>Glinus lotoides</i> L.	floodplain termite mound, overgrazed areas
<i>Glinus oppositifolius</i> (L.) DC.	floodplain termite mound, overgrazed areas

Moraceae

<i>Ficus verruculosa</i> Warb.	shrub; seep at floodplain edge
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Myrtaceae

<i>Syzygium cordatum</i> Krauss	tree, mostly small
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Nymphaeaceae

<i>Nymphaea heudelotii</i> Planch.	
<i>Nymphaea nouchali</i> Burm.f. var. <i>caerulea</i> (Savigny) Verdc.	edge of channel on floodplain

Onagraceae

<i>Ludwigia leptocarpa</i> (Nutt.) Hara	
<i>Ludwigia octovalvis</i> (Jacq.) Raven	weed

Polygalaceae

Polygala capillaris Harv.

Polygonaceae

<i>Oxygonum dregeanum</i> Meisn.	sand bars
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Rubiaceae

<i>Kohautia cuspidata</i> (K.Schum.) Bremek.	
<i>Oldenlandia angolensis</i> K.Schum.	peaty seeps
<i>Oldenlandia capensis</i> L.f.	peaty seeps
<i>Oldenlandia herbacea</i> (L.) Roxb.	sandy dambo
<i>Spermacoce quadrisulcata</i> (Bremek.) Verdc.	
<i>Spermacoce</i> sp.	

Scrophulariaceae

<i>Alectra</i> sp.	
<i>Hebenstretia holubii</i> Rolfe	
<i>Lindernia parviflora</i> (Roxb.) Haines	dambo grassland
Scrophulariaceae, uniden.	succulent aquatic herb
<i>Selago welwitschii</i> Rolfe	
<i>Sopubia mannii</i> Skan	
var. <i>tenuifolia</i> (Engl. & Gilg) Hepper	

Sterculiaceae

Melochia corchorifolia L.

Turneraceae

Tricliceras lobatum (Urb.) R.Fern. annual

Verbenaceae

Lantana camara L. scandent in seep thicket

Zygophyllaceae

Tribulus terrestris L.

2.2 Wetlands along the Lunginga River Northwest of Kalabo

Wetland collecting localities:

Sitapa School, 14 km SW of Ngombe – 23 Oct 1990. Dambo.

Ngombe, E of Kalabo, 15 km S of Lueti River – 24 Oct 1990. Dambo including a gravel quarry.

Lueti River crossing, 5 km E of Sikongo – 24 Oct 1990. Riverine fringing forest; riverine grassland.

Mukoma canal, NW of Kalabo – 14°58.3'S / 22°39.0'E; 22 Feb 1999. Floodplain and canal bank.

Mukoma canal, c.15 km NW of Kalabo – 14°55.1'S / 22°34.0'E; 22 Feb 1999. Sand bar with *Syzygium cordatum* forest, thicket and sparse grassland.

Ferns and fern allies

<i>Equisetum ramosissimum</i> Desf.	seep
<i>Thelypteris confluens</i> (Thunb.) Morton	dambo seep
<i>Thelypteris interrupta</i> (Willd.) K.Iwats	dambo seep

Monocotyledons

Alismataceae

Burnatia enneandra P.Micheli sand bar; bulb

Limnophyton angolense Buchenau

Amaryllidaceae

Crinum macowanii Baker flooded plain

Anthericaceae

Trachyandra arvensis (Schinz) Oberm. sand bar

Colchicaceae

Gloriosa sessiliflora Nordal & Bingham sand bar; under *Syzygium cordatum*

Commelinaceae

Commelina fluviatilis Brenan flooded plain

Commelina nigriflora Benth. sand bar

Cyperaceae

Eleocharis sp. dambo seep

Rhynchospora candida (Nees) C.B. Clarke	dambo seep
Rhynchospora holoschoenoides (L.C.Rich.) Herter	dambo seep
Scleria melanomphala Kunth	flooded plain
Eriocaulaceae	
Eriocaulon sp.	dambo seep
Hyacinthaceae	
Scilla nervosa (Burch.) Jessop	plain
Marantaceae	
Thalia geniculata L.	dambo seep & flooded plain
Orchidaceae	
Eulophia latilabris Summerh.	fallow sweet-potato mounds
Eulophia parvula (Rendle) Summerh.	
Poaceae	
Acroceras macrum Stapf	dambo seep
Andropogon huillensis Rendle	dambo seep
Aristida denudata Pilg.	dambo seep; middle slope dominant
Eragrostis capensis (Thunb.) Trin.	Ngombe; dambo seep
Eragrostis pallens Hack.	Ngombe quarry; seep
Eriochrysis pallida Munro	
Hyparrhenia rufa (Nees) Stapf	plain
Paspalidium obtusifolium (Delile) N.D. Simpson	flooded plain
Harpochloa pseudoharpochloa (Chiov.) Clayton	sand bar
Rhytachne rottboellioides Desv.	Ngombe quarry; seep
Sacciolepis typhura (Stapf) Stapf	flooded plain
Sacciolepis sp.	flooded plain; rhizomatous perennial
Setaria sphacelata (Schumach.) Moss	Ngombe quarry; seep
<u>Dicotyledons</u>	
Anacardiaceae	
Lannea edulis (Sond.) Engl.	suffrutex on plain
Rhus quartiniana A.Rich.	shrub or small tree; occasional on river bank
Asteraceae	
Pseudognaphalium luteo-album (L.) Hilliard & Burt	dambo seeps
Pseudognaphalium oligandrum (DC.) Hilliard & Burt	
Senecio sp. aff. S. hochstetteri A.Rich.	
Campanulaceae	
Wahlenbergia banksiana A.DC.	suffrutex on sand bar; uncommon
Celastraceae	
Gymnosporia buchananii Loes.	suffrutex on sand bar
Combretaceae	
Combretum sericeum G.Don.	dambo margin
Convolvulaceae	
Cuscuta australis R.Br.	parasitic creeper; on <i>Indigofera gairdneriae</i>
Euphorbiaceae	
Antidesma rufescens Tul.	shrub or small tree; riverine forest
Antidesma venosum Tul.	shrub on small tree in riverine forest
Fabaceae: Papilionoideae	
Aeschynomene fluitans Peter	shrub with floating stems, in backwaters
Crotalaria pallida Ait. var. obovata (G.Don) Polhill	erect annual at forest margin
Indigofera gairdneriae Baker f.	annual herb on sand bars
Tephrosia purpurea (L.) Pers. ssp. purpurea	annual herb on sand bars
Vigna vexillata (L.) Benth. var. vexillata	canal bank; creeping herb

Gentianaceae	
Selago sp.	pioneer on sand bars
Lamiaceae	
Neohyptis paniculata (Baker) J.K.Morton	dambo seeps
Loganiaceae	
Anthocleista liebrechtsiana De Wild. & T.Dur.	Lueti riverine forest
Melastomataceae	
Melastomastrum segregatum (Benth.) A. & R.Fern.	canal bank
Moraceae	
Ficus pygmaea Hiern	subshrub; canal bank, mounds and dambo seeps
Malvaceae	
Hibiscus mechowii Garcke	annual herb; sand bar
Kosteletzkyia buettneri Gürke	canal bank
Nymphaeaceae	
Nymphaea nouchali Burm.f. var. caerulea (Savigny) Verdc.	flooded plain
Polygonaceae	
Persicaria attenuata (R.Br.) Soják ssp. africana K.L.Wilson	canal bank
Rubiaceae	
Keetia venosa (Oliv.) Bridson	shrub or small tree; riverine forest
Pavetta sp.	Lueti riverine shrub
Psychotria sp.	riverine forest on sand bars
Scrophulariaceae	
Alectra sp.	dambo seep
Cycnium tubulosum (L.f.) Engl.	floodplain
Sebaea grandis (E.Mey.) Steud	sand bar
Striga sp.	sand bar
Tiliaceae	
Triumfetta angolensis Sprague & Hutch.	occasional on sand bars; short-lived perennial shrub

2.3 Floodplain near Ndau School

Collecting locality:

Kabumu Lagoon & flooded plain at Ndau School – 15°23.5'S / 22°58.7'E; 12-14 Feb 1999. Lagoon, flooded plain and plain margin (grassland); mounds and high banks.

Ferns & fern allies

Cyclosorus interruptus (Willd.) H.Itô	lagoon
Azolla sp.	lagoon
Salvinia molesta D.S.Mitchell	lagoon

Monocotyledons

Amaryllidaceae

Crinum macowanii Baker	flooded plain
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Commelinaceae

Commelina diffusa Burm.f.	flooded plain
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Cyperaceae

Cyperus compressus L.	flooded plain, plain edge; weed in maize
Cyperus digitatus Roxb.	flooded plain
Cyperus papyrus L.	lagoon
Cyperus sp.	lagoon; erect

<i>Pycnus macrostachyus</i> (Lam.) J.Raynal	flooded plain
<i>Pycnus mundtii</i> Nees	lagoon; stoloniferous
Iridaceae	
<i>Gladiolus dalenii</i> Van Geel	flooded plain
Poaceae	
<i>Bewisia biflora</i> (Hack.) Goosens	flooded plain
<i>Brachiaria arrecta</i> (Hack.) Stent	flooded plain
<i>Chasmopodium purpurascens</i> (Robyns) Jac.-Fel.	flooded plain
<i>Digitaria</i> sp. cf. <i>D. sanguinalis</i> (L.) Scop.	flooded plain; co-dominant in deep water
<i>Echinochloa pyramidalis</i> (Lam.) Hitch.& Chase	flooded plain
<i>Echinochloa stagnina</i> (Retz) Beauv.	lagoon
<i>Leersia hexandra</i> Sw.	flooded plain
<i>Oryza longistaminata</i> A.Chev.& Roehr.	flooded plain
<i>Panicum subalbidum</i> Kunth	flooded plain
<i>Phragmites mauritianus</i> Kunth	lagoon & canals
<i>Sacciolepis typhura</i> (Stapf) Stapf	flooded plain
<i>Sporobolus africanus</i> (Poir.) Robyns & Tourn.	flooded plain
<i>Trachypogon spicatus</i> (L.f.) Kuntze	flooded plain
<i>Vetiveria nigriflora</i> (Benth.) Stapf	flooded plain
<i>Vossia cuspidata</i> (Roxb.) Griff.	lagoon
Typhaceae	
<i>Typha</i> sp.	lagoon
<u>Dicotyledons</u>	
Amaranthaceae	
<i>Alternanthera sessilis</i> (L.) DC.	flooded plain
Asclepiadaceae	
<i>Taccaea apiculata</i> Oliv.	mounds and banks
Asteraceae	
<i>Acanthospermum hispidum</i> DC.	plain edge
<i>Ambrosia maritima</i> L.	plain edge
Ceratophyllaceae	
<i>Ceratophyllum demersum</i> L.	lagoon
Euphorbiaceae	
<i>Caperonia stuhlmannii</i> Pax	flooded plain
Fabaceae: Caesalpiinoideae	
<i>Senna obtusifolia</i> (L.) Irwin & Barneby	mounds
Fabaceae: Mimosoideae	
<i>Chamaecrista absus</i> (L.) Irwin & Barneby	plain edge
<i>Chamaecrista mimosoides</i> (L.) Greene	plain edge & flooded plain
<i>Chamaecrista polytricha</i> (Brenan) Lock	plain edge
<i>Mimosa pigra</i> L.	mounds & banks
Fabaceae: Papilionoideae	
<i>Aeschynomene fluitans</i> Peter	lagoon
<i>Aeschynomene cristata</i> Vatke var. <i>cristata</i>	canal & lagoon banks
<i>Sesbania microphylla</i> E.Phillips & Hutch.	flooded plain
Lentibulariaceae	
<i>Utricularia stellaris</i> L.f.	flooded plain
Malvaceae	
<i>Hibiscus diversifolius</i> Jacq.	lagoon
Menyanthaceae	
<i>Nymphoides indica</i> (L.) Kuntze	flooded plain

Nymphaeaceae	
Nymphaea nouchali <i>Burm.f.</i>	lagoon
var. petersiana (<i>Klotzsch</i>) <i>Verdc.</i>	
Nymphaea sp.	lagoon
Polygonaceae	
Persicaria senegalensis (<i>Meisn.</i>) <i>Soják</i>	lagoon
Scrophulariaceae	
Cycnium tubulosum (<i>L.f.</i>) <i>Engl.</i>	flooded plain
Trapaceae	
Trapa natans <i>L.</i> var. bispinosa (<i>Roxb.</i>) <i>Makino</i>	lagoon

2.4 Sand Bars on the Zambezi and Major Channels

Thrown up in the backwaters on the inside curve of the channels during the flood periods, these sand bars are colonised by pioneer species. The climax community is a thicket of *Acacia hebeclada* subsp. *chobiensis*.

Three sandbars in the Bulози Plain were surveyed:

Malebo Gauging Station – 15°17.0'S / 23°04.2'E, 12 Feb 1999.

Near Ndaу School – (coordinates unknown) 14 Feb 1999.

Zambezi River – (coordinates unknown) 14 Feb 1999.

Monocotyledons

Alismataceae

Burnatia enneandra *P.Micheli*

Cyperaceae

Cyperus compressus *L.*

Poaceae

Aristida meridionalis (*Stapf*) *Henr.*

Digitaria sanguinalis (*L.*) *Scop.*

Tricholaena monachne (*Trin.*) *Stapf & Hubbard*

Dicotyledons

Anacardiaceae

Rhus quartiniana *A.Rich.* shrub

Cucurbitaceae

Zehneria marlothii (*Cogn.*) *R. & A.Fern.* herbaceous climber on *A. hebeclada*

Fabaceae: Mimosoideae

Acacia hebeclada *DC.* thicket-forming shrub
 subsp. chobiensis (*O.Miller*) *A.Schreib.*

Fabaceae: Papilionoideae

Crotalaria lanceolata *E.Mey.* ssp. prognatha *Polhill*

Molluginaceae

Limeum viscosum (*J.Gay*) *Fenzl.* semi-succulent annual herb

Polygonaceae

Oxygonum dregeanum *Meisn.*

 var. canescens (*Sond.*) *R.Grah.*

Rubiaceae

Spermacoce senensis (*Klotzsch*) *Hiern*

Tiliaceae

Grewia retinervis *Burret* shrub

Vitaceae

Cyphostemma sp. climber in thickets

3. DISCUSSION

The field survey was undertaken at a time when many of the wetland plant species are in flower. The exceptionally early flood provided a useful opportunity to observe the dynamics of the wetland flora on the floodplain. Some of the early-flowering species had already seeded, while most of those adapted to deep-flooding were either flowering or had not yet started.

A total of 164 collections were made, of which about 120 have been identified to species and a further 30 to genus. Most of these identifications are being confirmed. These figures have little significance as regards species composition. Some familiar species were not collected, and in other cases more than one collections was made of a species.

Very little ethnobotanical work has been done on the wetland flora. A survey of indigenous knowledge is needed to identify the exploited and indicator species.

One aspect of botanical interest is the peat soil areas. Wetland cultivation is concentrated on the more fertile peaty soils. This is particularly the case with rice, which is cultivated during the rains and where crop residues are burnt. Decades of intensive cultivation of the peaty soils along the floodplain margin between Mongu and Namushakende, do not appear to have destroyed the peat or reduced the fertility of the soil. Indeed the richness of the flora would appear to be partly a result of anthropogenic eutrophication.

The outlying plains, particularly those which are known to be rich in woody suffrutices, were excluded from the study, yet we need to be able to compare the vegetation of the different levels. The plains of Liuwa Plains National Park, in particular, need special attention. The more detailed studies to date have been confined to cattle areas.

4. SITES AND SPECIES OF INTEREST

There are very few unique sites in floodplain systems, as there are no topographic fixtures. The biota therefore is primarily adapted to change. However, certain sites can be mentioned.

The small patches of swamp forest at Namushakende on the east bank, and at Sinungu on the west bank are noteworthy. The presence of royal fern, *Osmunda regalis*, is a significant record, but the forest itself is disturbed, invaded by mango and guava, and underplanted with pineapples. There are also small forest patches at Sinungu, not visited during the field survey, which are so far undisturbed. The presence of *Syzygium owariense*, a swamp forest dominant, is of interest, and probably represents a considerable extension of the known range of this species. Herbarium material has not been collected to verify the field identification.

Isolated trees of *Syzygium cordatum*, or sparse stands of juveniles, occur at the floodplain margin at Sefula and elsewhere. Prolonged dry weather probably favours the trees, but periodic high floods would set them back. Swamp and riverine forest also occurs along the more stable channels of the west bank tributaries, a characteristic species being *Anthocleista liebrechtsiana*. The number of woody species in these riparian forests is very small.

More attention needs to be given to the sandbars flanking the Luanginga and other west bank tributaries, and possibly to the mounds of the *saana*. These are relatively undisturbed and likely to contain species not found elsewhere.

5. ACKNOWLEDGEMENTS

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CHAPTER 2 : APPENDIX 4 ZAMBEZI DELTA WETLAND PLANT SURVEY

Tom Müller, Anthony Mapaura and Bob Drummond

1. INTRODUCTION

A botanical expedition was made to the Zambezi River Delta from 22 July to 12 August 1999 as part of a multidisciplinary team carrying out biodiversity inventory of the area. Approximately eight days were used up in travelling to the Zambezi Delta and to the base camps, and about 14 days were spent working in the field. Fieldwork was carried out from three base camps and during a 19-hour boat trip from Malingapanse to the Zambezi River mouth. The base camps were at Marromeu (4 days), a temporary hunting camp in Coutada 11 in the vicinity of the southern edge of the delta (18°33'11"S / 36°06'02"E, 6 days) and at the village of Malingapanse (18°39'13"S / 36°06'02"E, 4 days). The objectives of the botanical team were to make a preliminary vegetation classification of the Zambezi Delta area, and also to make a comprehensive collection of herbarium specimens.

2. FIELD WORK AND RESULTS

The vegetation survey is described in Chapter 1. Approximately 430 voucher specimens were collected during this work, some of which were interesting records and will be kept as herbarium specimens.

The herbarium wetland plant collection made comprises 196 numbers. Where possible three to four duplicates of each number were collected. Collecting essentially took place in the wetlands, the adjacent seasonally wet grasslands, the palm savanna, the *Acacia* savanna, in the dry forest on slightly higher ground, in river fringing vegetation and in former sugar cane fields. A little collecting was also carried out in mangrove swamps and dune grasslands. A complete set of specimens has been deposited with the Eduardo Mondlane University collection (LMU) in Maputo.

A total of 445 vascular plant taxa (species and subspecies) were recorded, belonging to 93 different families. Table 1 lists these under family in alphabetical order with an indication of the broad habitat types in which they were found. The forest and savanna habitats were by far the most rich in terms of species, which is to be expected, while the mangroves were the most species-poor. However, collecting intensity was not equal across the habitats and the figures can not be used as a guide.

3. COMMENTS ON THE COLLECTIONS

3.1 Timing of expedition

Working and living conditions as well as access by road are extremely bad in the Zambezi Delta during the rainy season. Thus this preliminary and exploratory expedition was made during the dry season. However, for most of the vegetation types this is the least rewarding time of the year if obtaining good fertile plant material is intended. This is probably the main reason why the interest content of the collection remained some what below expectations.

3.2 Collecting in permanently wet areas

The wetlands were one of the main target areas for collecting and access to them was often particularly difficult. Some wetlands of interest could not be investigated because it was not possible to land sufficiently close by them when working with a helicopter. Once in a wetland, it was difficult and time-consuming to move around to investigate and collect plants. Hence it was not possible, in the time available, to investigate as wide a selection of wetlands as would be necessary for a comprehensive inventory. However, from the experience gained during the work, it is suspected that the wetlands of the Zambezi Delta are not particularly diverse and may be fairly uniform throughout. It is possible that they might not harbour many species of special interest. The main botanical interest of the delta may well lay in the areas adjacent and beyond the wetlands.

4. NEW RECORDS

Five of the species collected were new records for Mozambique. They are *Ipomoea coptica* var. *acuta* (Convolvulaceae), a twiner of riverine vegetation; *Physalis lagascae* (Solanaceae), an introduced weed of riverbanks; *Mikania sagittifera* (Asteraceae), a twiner on water plants; *Dichapetalum bangii* (Dichapetalaceae), a woody species in dry forest; and *Elaeis guineense* (Arecaceae), the small-fruited wild form of the oil palm. This wild type of *Elaeis* occurs naturally in degenerated coastal forest between Mombasa and the Tanzania border and could be expected to extend to the delta. The palms were mainly seen along stream banks where their occurrence looked natural. To confirm that it is a major southern range extension of the wild form, and not a naturalized form of the cultivated oil palm (known from northern Malawi), further investigations are necessary.

The following were new records for the Manica e Sofala province: *Acalypha nyasica* (Euphorbiaceae), *Aneilema dregeanum* subsp. *mossambicense* (Commelinaceae), *Bacopa floribunda* and *Stemodia serrata* (both Scrophulariaceae). All four are herbs found in wet places. A further new record was *Pisonia aculeata* (Nyctaginaceae), a climber growing on dunes and related to *Bougainvillea*.

5. PLANTS OF SPECIAL INTEREST

A species of *Habenaria* (Orchidaceae) was collected on the fringes of a wetland near Malingapanse. This species was once before recorded from near Chinde (Bond 512). This specimen could not be matched in the herbarium and perhaps is a new species.

A species of *Leptactina* (Rubiaceae) found in dry forest and closely related to *L. delagoensis*, but with a smaller corolla, is possibly a new taxa. Other interesting records were: *Vahlia capensis* subsp. *macrantha* (Vahliaceae), endemic to the delta; *Operculina turpethum* (Convolvulaceae), only known from one previous collection, is a climber only collected in Mozambique before in 1887; *Wolffiella denticulata* (Lemnaceae) is a minute floating water plant and a new record to the Zambezi Basin; and *Nesaea linearis* and *N. racemosa* (Lythraceae) are water plants endemic to the delta. The two sedges *Anlinula paradoxa*, and *Fimbristylis longiculmis*, and *Vigna parkeri* subsp. *aculifolia* (Fabaceae: Papilionoidae), are all rare plants of which few herbarium specimens exist.

Azolla filiculoides (Azollaceae) a water fern from America, which has invaded most of the waters of southern Africa over the last 20 years, was recorded and observed to cover most of the smaller channels in the delta.

Appendix 2.4: Table 1. List of plant species seen or collected in the Zambezi Delta study area, July-August 1999.

For.	Forest/Woodland	Gra.	Grassland	Man.	Mangrove
Sav.	Savanna/Palm savanna	Wet.	Wetland	Dun.	Dunes/beach
Fall.	Fallow fields				

Species	Habitat						Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	
PTERIDOPHYTA							
Adiantaceae							
<i>Acrostichum aureum</i> L.							X
Azollaceae							
<i>Azolla filiculoides</i> Lam.				X			
Dennstaedtiaceae							
<i>Pteridium aquilinum</i> (L.) Kuhn subsp. <i>aquilinum</i>		X					
Polypodiaceae							
<i>Platynerium alcinorne</i> Desv.		X					

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
Thelypteridaceae								
<i>Cyclosorus interruptus</i> (Willd.) H.Itô				X				
MONOCOTYLEDONS								
Araceae								
<i>Pistia stratiotes</i> L.				X				
<i>Stylochaeton puberulus</i> N.E.Br.	X							
Arecaceae								
<i>Borassus aethiopum</i> Mart.		X	X					
<i>Elaeis guineensis</i> Jacq.	X	X						
<i>Hyphaene coriacea</i> Gaertn.	X	X	X			X		
<i>Phoenix reclinata</i> Jacq.	X	X	X	X			X	
Asparagaceae								
<i>Asparagus africanus</i> Lam. or related sp.			X					
<i>Asparagus plumosus</i> Baker or related sp.		X						
Commelinaceae								
<i>Aneilema aequinoctiale</i> (P.Beauv.) Kunth	X							
<i>Aneilema dregeanum</i> Kunth subsp. <i>mossambicense</i> Faden	X						new to MS	
<i>Commelina diffusa</i> Burm.f. subsp. <i>diffusa</i>				X				
<i>Commelina diffusa</i> Burm.f. subsp. <i>scandens</i> (C.B. Clarke) Oberm.				X				
<i>Commelina erecta</i> L.	X						X	
<i>Commelina subulata</i> Roth		X	X	X				
<i>Murdannia simplex</i> (Vahl) Brenan		X	X					
Cyperaceae								
<i>Alinula paradoxa</i> (Cherm.) Goetgh. & Vorster			X					
<i>Bulbostylis</i> sp.				X				
<i>Bulbostylis</i> sp.						X		
<i>Bulbostylis</i> sp.		X						
<i>Cyperus crassipes</i> Vahl						X		
<i>Cyperus digitatus</i> Roxb. subsp. <i>auricomus</i> (Spreng.) Kük.		X	X	X				
<i>Cyperus papyrus</i> L.				X				
<i>Cyperus prolifer</i> Lam.				X				
<i>Cyperus rabrotinctus</i> Cherm.				X				
<i>Cyperus</i> sp = 6/2, 9/5, 23/7		X						
<i>Cyperus tenuispica</i> Steud			X					
<i>Eleocharis acutangula</i> (Roxb.) Schult.		X						
<i>Fimbristylis dichotoma</i> (L.) Vahl.		X						
<i>Fimbristylis longiculmis</i> Steud.			X			X		
<i>Fuirena ciliaris</i> (L.) Roxb.		X						
<i>Fuirena umbellata</i> Rottb.			X	X				
<i>Kyllinga alba</i> Nees		X		X				
<i>Pycnus macrostachyos</i> (Lam.) J.Raynal			X	X				

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
<i>Pycreus polystachyos</i> (Rottb.) P.Beauv.		X		X				
<i>Pycreus pumilis</i> (L.) Nees subsp. <i>patens</i> (Vahl) Podlech				X				
<i>Rhynchospora corymbosa</i> (L.) Britton		X	X	X				
<i>Schoenoplectus lateriflorus</i> (Gmel.) Lye				X				
<i>Scleria bambariensis</i> Cherm.		X						
Flagellariaceae								
<i>Flagellaria guineensis</i> Schumach.								
Hyacinthaceae								
<i>Ornithogalum</i> sp.							X	
Hydrocharitaceae								
<i>Ottelia exserta</i> (Ridl.) Dandy				X				
Lemnaceae								
<i>Wolfiella denticulata</i> (Hegelm.) Hegelm.				X				
Orchidaceae								
<i>Habenaria</i> sp. aff. <i>H. galpinii</i> Bolus				X				=Bond 512 from Chinde
Poaceae								
<i>Acroceras zizanioides</i> (Kunth) Dandy				X				
<i>Brachiaria humidicola</i> (Rendle) Schweick.				X	X			
<i>Chloris gayana</i> Kunth				X				
<i>Chloris</i> sp.		X	X					
<i>Cymbopogon</i> sp.		X						
<i>Cynodon dactylon</i> (L.) Pers.				X			X	
<i>Dactyloctenium</i> sp.				X				
<i>Digitaria</i> sp.		X						
<i>Diheteropogon amplexans</i> (Nees) Clayton		X						
<i>Echinochloa haploclada</i> (Stapf) Stapf				X	X		X	
<i>Echinochloa jubata</i> Stapf				X				
<i>Eleusine</i> sp.							X	
<i>Elionurus tripsacoides</i> Willd.				X				
<i>Eragrostis arenicola</i> C.E.Hubb.							X	
<i>Eragrostis atrovirens</i> (Desv.) Steud.				X				
<i>Eragrostis chapelieri</i> (Kunth) Nees		X						
<i>Eragrostis</i> sp.							X	
<i>Eriochloa macclounii</i> Stapf				X				
<i>Eriochloa stapfiana</i> Clayton				X				
<i>Heteropogon contortus</i> (L.) Roem.& Schult.				X				
<i>Heteropogon melanocarpus</i> (Ell.) Benth.		X						
<i>Hyparrhenia</i> sp.		X	X					
<i>Hyparrhenia</i> sp.								X
<i>Hyperthelia dissoluta</i> (Steud) W.D.Clayton		X	X					X
<i>Imperata cylindrica</i> (L.) Raeusch.				X			X	
<i>Leersia hexandra</i> Sw.		X	X	X				
<i>Loudetia simplex</i> (Nees) C.E.Hubb.		X	X					

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
<i>Glinus oppositifolius</i> (L.) DC. var. <i>oppositifolius</i>				X				
<i>Sesuvium portulacastrum</i> (L.) L.					X	X		
<i>Zaleya pentandra</i> (L.) C.Jeffrey							X	
Amaranthaceae								
<i>Achyranthes aspera</i> L. var. <i>sicula</i> L.	X							
<i>Achyranthes aspera</i> L. var. <i>pubescens</i> (Moq.) C.C.Towns.		X						
<i>Aerva lanata</i> (L.) Schult.							X	
<i>Alternanthera sessilis</i> (L.) DC.	X							
<i>Celosia schweinfurthiana</i> Schinz.							X	
<i>Celosia trigyna</i> L.	X							
<i>Cyathula natalensis</i> Sond.	X							
<i>Cyathula prostrata</i> (L.) Blume var. <i>pedicellata</i> (C.B.Clarke) Cavaço	X							
<i>Psilotrichum scleranthum</i> Thwaites	X							
Anacardiaceae								
<i>Lannea schweinfurthii</i> (Engl.) Engl. var. <i>stuhlmannii</i> (Engl.) Kokwaro	X	X						X
<i>Ozoroa obovata</i> (Oliv.) R. & A.Fern.	X	X		X				
<i>Rhus gueinzii</i> Sond. var. <i>spinescens</i> (Diels) R. & A.Fern		X						
<i>Sclerocarya birrea</i> (A.Rich.) Hochst. subsp. <i>caffra</i> (Sond.) Kokwaro		X	X					X
Annonaceae								
<i>Annona senegalensis</i> Pers.		X						
<i>Artabotrys brachypetalus</i> Benth.	X							
<i>Cleistochlamys kirkii</i> (Benth.) Oliv.		X						
<i>Melodorum gracile</i> (Engl. & Diels) Verdc. subsp. <i>gracile</i>	X							
<i>Monanthes buchananii</i> (Engl.) Verdc.	X							
<i>Monodora junodii</i> Engl. & Diels.	X							
<i>Xylopia parviflora</i> (A.Rich.) Benth.	X							
Apiaceae								
<i>Centella asiatica</i> (L.) Urb.		X						
Apocynaceae								
<i>Alafia caudata</i> Stapf.	X							
<i>Ancylobothrys petersiana</i> (Klotzsch) Pierre							X	
<i>Diplorhynchus condylocarpon</i> (Müll.Arg.) Pichon	X							
<i>Landophia kirkii</i> T.-Dyer	X							
<i>Mascarenhasia arborescens</i> A.DC.	X							
<i>Pleiocarpa pycnantha</i> (K.Schum.) Stapf	X							
<i>Saba comorensis</i> (Boj.) Pichon	X							
<i>Strophanthus courmontii</i> Franch.	X							
<i>Tabernaemontana elegans</i> Stapf	X							

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
<i>Voacanga schweinfurthii Stapf</i>	X							
Asclepiadaceae								
<i>Cryptolepis obtusa N.E.Br.</i>		X	X	X				
<i>Cynanchum schistoglossum Schltr.</i>		X						
<i>Pergularia daemia (Forssk.) Chiov.</i>								X
<i>Tylophora sp.</i>	X							
Asteraceae								
<i>Ageratum conyzoides L.</i>	X			X				X
<i>Blumea axillaris (Lam.) DC.</i>			X					X
<i>Crassocephalum picridifolium (DC.) S.Moore</i>				X				
<i>Crassocephalum rubens (Jacq.) S.Moore</i>	X		X					
<i>Eclipta prostrata (L.) L.</i>				X				X
<i>Ethulia conyzoides L.f.</i> subsp. <i>conyzoides</i>								X
<i>Gnaphalium polycaulon Pers.</i>				X				
<i>Launaea cornuta (Oliv. & Hiern) C.Jeffrey</i>								X
<i>Launaea sarmentosa (Willd.) Kuntze</i>						X		
<i>Melanthera scandens (Schumacher & Thonn.) Roberty</i> subsp. <i>madagascariensis (Baker) Wild</i>		X		X				
<i>Mikania capensis DC.</i>		X						
<i>Mikania sagittifera C.B.Rob.</i>				X				new to Moz.
<i>Nidorella microcephala Steetz</i>								X
<i>Pluchea dioscoridis (L.) DC</i>					X			X
<i>Pseudognaphalium luteo-album (L.) Hilliard & B.L.Burt</i>	X							
<i>Sphaeranthus angolensis O.Hoffm.</i>			X					
<i>Sphaeranthus gazaensis Bremek.</i>								X
<i>Vernonia colorata (Willd.) Drake</i>								X
<i>Vernonia glabra (Steetz) Vatke</i>			X					X
<i>Vernonia kirkii Oliv. & Hiern.</i>			X					
Bignoniaceae								
<i>Kigelia africana (Lam.) Benth.</i>		X						
<i>Markhamia obtusifolia (Baker) Sprague</i>	X							
Boraginaceae								
<i>Cordia africana Lam.</i>			X					
<i>Cordia goetzei Gürke</i>		X						
Brassicaceae								
<i>Rorippa micrantha (Roth) Jonsell</i>								X
Cactaceae								
<i>Rhipsalis sp.</i>	X							
Capparaceae								
<i>Boscia salicifolia Oliv.</i>		X						
<i>Capparis sepiaria L.</i> var. <i>subglabra (Oliv.) De Wild.</i>	X	X						
<i>Cleome bororensis (Klotzsch) Oliv.</i>	X							

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
Celastraceae								
<i>Gymnosporia mossambicensis</i> (Klotzsch) Loes.	X							
<i>Gymnosporia senegalensis</i> (Lam.) Loes.		X						
<i>Maytenus heterophylla</i> (Eckl. & Zeyh.) N.K.Robson	X	X						
<i>Reissantia indica</i> (Willd.) N.Halle	X							
<i>Salacia kraussii</i> (Harv.) Harv.			X					
<i>Salacia madagascariensis</i> (Lam.) DC.	X							
Chenopodiaceae								
<i>Salicornia perrierii</i> A.Chev.					X			
Chrysobalanaceae								
<i>Hirtella zanzibarica</i> Oliv. subsp. zanzibarica	X		X					
<i>Parinari curatellifolia</i> Benth.	X	X						
Clusiaceae								
<i>Garcinia livingstonei</i> T.Anders.	X		X			X		
<i>Psorospermum febrifugum</i> Spach	X	X						
Combretaceae								
<i>Combretum collinum</i> Fresen	X							
<i>Combretum imberbe</i> Wawra		X						
<i>Combretum</i> sp.		X						
<i>Pteleopsis myrtifolia</i> (M.A.Laws.) Engl. & Diels	X							
Connaraceae								
<i>Rourea orientalis</i> Baill.	X							
Convolvulaceae								
<i>Astripomoea malvacea</i> (Klotzsch) A.Meeuse var. malvacea		X						
<i>Hewitta scandens</i> (Milne) Mabb.	X							
<i>Ipomoea aquatica</i> Forssk.				X				
<i>Ipomoea coptica</i> (L.) Roem. & Schult. var. acuta Choisy		X						new to Moz.
<i>Ipomoea mauritiana</i> Jacq.							X	
<i>Ipomoea pes-caprae</i> (L.) R.Br. subsp. brasiliensis (L.) Ooststr.						X		
<i>Ipomoea pileata</i> Roxb.		X						
<i>Ipomoea rubens</i> Choisy				X				
<i>Jacquemontia tamnifolia</i> (L.) Griseb.			X					
<i>Merremia tridentata</i> (L.) Hall.f. subsp. angustifolia (Jacq.) Ooststr.					X			
<i>Operculina turpethum</i> (L.) J.Silva Manso							X	first collection since 1887
Cucurbitaceae								
<i>Lagenaria breviflora</i> (Benth.) Roberty				X				
<i>Mukia maderaspatana</i> (L.) M.Roem.		X	X					
<i>Zehneria thwaitesii</i> (Schweinf.) C.Jeffrey		X						

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
Dichapetalaceae								
<i>Dichapetalum bangii</i> (<i>Didr.</i>) <i>Engl.</i>	X	X						new to Moz.
<i>Pteleopsis myrtifolia</i> (<i>M.A.Laws.</i>) <i>Engl. & Diels</i>	X							
<i>Tapura fischeri</i> <i>Engl.</i> var. <i>pubescens</i> <i>Verdc. & Torre</i>	X							
Droseraceae								
<i>Drosera indica</i> <i>L.</i>			X					
Ebenaceae								
<i>Diospyros</i> sp.	X							
<i>Diospyros mespiliformis</i> <i>A.DC.</i>	X	X						
<i>Diospyros senensis</i> <i>Klotzsch</i>		X						
<i>Diospyros usambarensis</i> <i>F.White</i> subsp. <i>usambarensis</i>	X							
<i>Euclea racemosa</i> <i>Murr.</i> subsp. <i>schimperii</i> (<i>A.DC.</i>) <i>F.White</i>		X						
Elatinaceae								
<i>Bergia salaria</i> <i>Bremek.</i>		X						
Erythroxylaceae								
<i>Erythroxylon emarginatum</i> <i>Thonn.</i>	X	X						
Euphorbiaceae								
<i>Acalypha nyasica</i> <i>Hutch.</i>			X					new to MS
<i>Alchornea laxiflora</i> (<i>Benth.</i>) <i>Pax & K.Hoffm.</i>	X							
<i>Antidesma rufescens</i> <i>Tul.</i>							X	
<i>Antidesma venosum</i> <i>Tul.</i>		X	X					
<i>Bridelia cathartica</i> <i>G.Bertol.</i> subsp. <i>cathartica</i>		X						
<i>Cleistanthus</i> sp.	X							
<i>Drypetes natalensis</i> (<i>Harv.</i>) <i>Hutch.</i> var. <i>natalensis</i>	X							
<i>Euphorbia indica</i> <i>Lam.</i>							X	
<i>Flueggea virosa</i> (<i>Willd.</i>) <i>Baillon</i>		X						
<i>Hymenocardia acida</i> <i>Tul.</i>	X							
<i>Maprounea africana</i> <i>Müll.Arg.</i>	X	X						
<i>Phyllanthus</i> sp.		X	X	X			X	
<i>Phyllanthus reticulatus</i> <i>Poir.</i>		X	X					
<i>Suregada zanzibariensis</i> <i>Baill.</i>	X							
<i>Tragia</i> sp.	X							
<i>Uapaca nitida</i> <i>Müll.Arg.</i>	X	X						
<i>Uapaca sansibarica</i> <i>Pax</i>	X							
Fab: Caesalpinioideae								
<i>Afzelia quanzensis</i> <i>Welw.</i>	X	X						
<i>Brachystegia spiciformis</i> <i>Benth.</i>	X							
<i>Cassia abbreviata</i> <i>Oliver</i>		X						
<i>Chamaecrista absus</i> (<i>L.</i>) <i>Irwin & Barneby</i>		X						
<i>Chamaecrista mimosoides</i> (<i>L.</i>) <i>Greene</i>		X						
<i>Chamaecrista</i> sp.		X	X	X			X	

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
<i>Dialium schlechteri</i> Harms						X		
<i>Erythrophleum suaveolens</i> (Guill.& Perr.) Brenan	X							
<i>Piliostigma thonningii</i> (Schumach.) Milne-Redh.		X					X	
<i>Senna singueana</i> Del.		X						
Fab: Mimosoideae								
<i>Acacia ataxacantha</i> DC.		X						
<i>Acacia</i> cf. <i>grandicornuta</i> Gerstner		X						
<i>Acacia karroo</i> Hayne						X		
<i>Acacia nilotica</i> (L.) Delile		X					X	
<i>Acacia polyacantha</i> Willd.		X	X				X	
<i>Acacia robusta</i> Burch. subsp. <i>clavigera</i> (Burch.) Brenan		X						
<i>Acacia schweinfurthii</i> Brenan & Exell	X							
<i>Acacia sieberiana</i> DC.		X					X	
<i>Acacia xanthophloea</i> Benth.		X						
<i>Albizia adianthifolia</i> (Schumach.) W.F.Wight	X							
<i>Albizia versicolor</i> Oliver			X					
<i>Albizia</i> sp.			X					
<i>Dichrostachys cinerea</i> (L.) Wight & Arn.		X						
<i>Entada abyssinica</i> A.Rich.			X					
<i>Mimosa pigra</i> L.			X				X	
Fab: Papilionoideae								
<i>Abrus precatorius</i> L. subsp. <i>africanus</i> Verdc.		X					X	
<i>Aeschynomene afraspera</i> J.Léonard				X				
<i>Aeschynomene cristata</i> Vatke var. <i>cristata</i>				X				
<i>Alysicarpus rugosus</i> (Willd.) DC. subsp. <i>perennirufus</i> J.Léonard			X				X	
<i>Alysicarpus vaginalis</i> (L.) DC. var. <i>vaginalis</i>		X						
<i>Canavalia rosea</i> (Sw.) DC.						X		
<i>Crotalaria goreensis</i> Guill.& Perr.				X				
<i>Crotalaria laburnoides</i> Klotzsch		X						
<i>Crotalaria lanceolata</i> E.Mey. subsp. <i>lanceolata</i>		X					X	
<i>Crotalaria ochroleuca</i> G.Don							X	
<i>Crotalaria polysperma</i> Kotschy							X	
<i>Crotalaria</i> sp.		X						
<i>Crotalaria virgulata</i> Klotzsch subsp. <i>forbesii</i> (Baker) Polhill	X							
<i>Dalbergia lactea</i> Vatke.	X							
<i>Derris</i> sp.	X							
<i>Desmodium barbatum</i> (L.) Benth. var. <i>dimorphum</i> (Baker) Schubert		X						
<i>Desmodium salicifolium</i> (Poir.) DC.		X						

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
<i>Dolichos junodii</i> (Harms) Verdc.		X		X				
<i>Eriosema parviflora</i> E.Mey. var. <i>parviflorum</i>				X				
<i>Eriosema psoraleoides</i> (Lam.) G.Don		X					X	
<i>Erythrina livingstoniana</i> Baker				X				
<i>Flemingia grahamiana</i> Wight & Arn.							X	
<i>Indigofera arrecta</i> A.Rich.							X	
<i>Indigofera hendecaphylla</i> Jacq.				X				
<i>Indigofera hirsuta</i> L.		X						
<i>Indigofera inhambanensis</i> J.B.Gillett		X						
<i>Indigofera laziracemosa</i> Baker f.						X		
<i>Lonchocarpus capassa</i> Rolfe	X	X						
<i>Macrotyloma africanum</i> (Wilczek) Verdc.						X		
<i>Microcharis latifolia</i> Benth.		X						
<i>Millettia stuhlmannii</i> Taub.	X							
<i>Millettia usaramensis</i> Taub.	X							
<i>Mucuna coriacea</i> Baker subsp. <i>irritans</i> (Burt Davy) Verdc.							X	
<i>Pericopsis angolensis</i> (Baker) Meeuwen		X						
<i>Pterocarpus angolensis</i> DC.		X						
<i>Rhynchosia sublobata</i> (Schumach.) Meikle			X				X	
<i>Sesbania bispinosa</i> (Jacq.) W.F.Wight var. <i>bispinosa</i>				X		X		
<i>Sesbania</i> sp.				X				
<i>Tephrosia linearis</i> (Willd.) Pers.		X						
<i>Teramnus labialis</i> (L.f.) Spreng. subsp. <i>arabicus</i> Verdc.		X	X					
<i>Vigna parkeri</i> Baker subsp. <i>acutifolia</i> Verdc.	X							
<i>Vigna unguiculata</i> (L.) Walp.			X					
<i>Vigna vexillata</i> (L.) Benth. var. <i>angustifolia</i> (Schumach.& Thonn.) Baker				X				
<i>Xeroderris stuhlmannii</i> (Taub.) Mend.& E.P.Sousa		X						
Flacourtiaceae								
<i>Dovyalis</i> sp.	X							
<i>Xylothea tettensis</i> (Klotzsch) var. <i>macrophylla</i> (Klotzsch) Wild	X	X						
Gentianaceae								
<i>Enicostema axillare</i> (Lam.) Raynal		X						
<i>Exacum oldenlandioides</i> (S.Moore) Klack.		X						
Haloragidaceae								
<i>Myriophyllum</i> sp.				X				
Lamiaceae								
<i>Basilicum polystachyon</i> (L.) Moench			X					
<i>Englerastrum gracillimum</i> T.C.E.Fries		X						
<i>Hoslundia opposita</i> Vahl.		X					X	

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
<i>Leucas milanjana</i> Gürke		X	X					
Lauraceae								
<i>Cassytha filiformis</i> L.							X	
Lecythidaceae								
<i>Barringtonia racemosa</i> (L.) Roxb.	X							
Linaceae								
<i>Hugonia orientalis</i> Engl.	X							
Lobeliaceae								
<i>Lobelia fervens</i> Thunb. subsp. <i>fervens</i>		X		X				
Loganiaceae								
<i>Anthocleista grandiflora</i> Gilg.	X							
<i>Strychnos mitis</i> S.Moore	X							
<i>Strychnos spinosa</i> Lam.	X							
Lythraceae								
<i>Ammannia prieriana</i> Guill.& Perr								X
<i>Nesaea erecta</i> Guill.& Perr.		X						
<i>Nesaea linearis</i> Hiern		X	X					X
<i>Nesaea ramosa</i> A.Fern.		X						
Malvaceae								
<i>Abutilon guineense</i> (Schumach.) Heine			X					
<i>Abutilon lauraster</i> Hochr.	X							
<i>Abutilon mauritianum</i> (Jacq.) Medic.		X		X				
<i>Hibiscus cannabinus</i> L.		X	X	X				
<i>Hibiscus diversifolius</i> Jacq. subsp. <i>rivularis</i> (Bremek.& Oberm.) Exell				X				
<i>Hibiscus physaloides</i> Guill.& Perr.	X							
<i>Hibiscus surattensis</i> L.	X	X						
<i>Hibiscus tiliaceus</i> L.						X		
<i>Sida cordifolia</i> L.	X							
<i>Thespesia populnea</i> (L.) Correa						X		
<i>Urena lobata</i> L.	X							
Melastomataceae								
<i>Dissotis phaeotricha</i> (Hochst.) Hook.f. var. <i>phaeotricha</i>		X						
<i>Memecylon sansibaricum</i> Taub. var. <i>buchanii</i> (Gilg.) A.& R.Fern.	X							
Meliaceae								
<i>Trichilia emetica</i> Vahl	X	X						X
<i>Xylocarpus granatum</i> J.König						X		
Menispermaceae								
<i>Anisocycla blepharosepala</i> Diels cf. <i>Epinetrum delagoense</i> (N.E.Br.) Diels	X	X						
<i>Cissampelos mucronata</i> A.Rich.								X
<i>Tiliacora funifera</i> (Miers) Oliv.	X							

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
Moraceae								
<i>Ficus natalensis</i> Hochst. subsp. natalensis		X		X				
<i>Ficus sycomorus</i> L.		X					X	
<i>Maclura africana</i> (Bureau) Corner		X		X				
<i>Treculia africana</i> Decne. subsp. africana var. africana	X							
Mysinaceae								
<i>Embelia</i> sp.	X							
Myrtaceae								
<i>Syzygium guineense</i> (Willd.) DC.	X	X		X				
Nyctaginaceae								
<i>Pisonia aculeata</i> L.		X						new to MS
Nymphaeaceae								
<i>Nymphaea lotus</i> L.				X				
<i>Nymphaea nouchali</i> Burm.f. var. caerulea (Savigny) Verd.				X				
Ochnaceae								
<i>Ochna atropurpurea</i> DC.	X							
<i>Ochna</i> sp.		X						
Oleaceae								
<i>Jasminum fluminense</i> Vell.		X		X				
Onagraceae								
<i>Ludwigia abyssinica</i> A.Rich.			X				X	
<i>Ludwigia leptocarpa</i> (Nutt.) Hara				X				
<i>Ludwigia octovalvis</i> (Jacq.) Raven var. octovalvis				X				
<i>Ludwigia</i> sp.	X			X				
Passifloraceae								
<i>Adenia</i> sp.								
<i>Passiflora foetida</i> L.							X	
Pedaliaceae								
<i>Dicerocaryum senecioides</i> (Klotzsch) Abels		X	X			X		
Polygalaceae								
<i>Carpolobia conradsiana</i> Engl.	X							
Polygonaceae								
<i>Persicaria attenuata</i> (R.Br.) Sojak subsp. africana K.L.Wilson		X		X				
<i>Persicaria senegalensis</i> (Meisn.) Soják				X				
Rhamnaceae								
<i>Berchemia discolor</i> (Klotzsch) Hemsley		X						
<i>Ziziphus mucronata</i> Willd.		X						
Rhizophoraceae								
<i>Bruguiera gymnorrhiza</i> (L.) Lam.						X		
<i>Ceriops tagal</i> (Perr.) C.B.Rob.						X		
<i>Rhizophora mucronata</i> Lam.						X		

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
Rosaceae								
<i>Pyrenacantha kirkii</i> Baill.	X							
Rubiaceae								
<i>Aidia micrantha</i> (K.Schum.) F.White	X							
<i>Catunaregam spinosa</i> (Thunb.) Tirveng. subsp. <i>spinosa</i>	X							
<i>Chazaliella abrupta</i> (Hiern) E.M.A.Petit & Verdc. var. <i>abrupta</i>	X							
<i>Coffea racemosa</i> Lour.	X							
<i>Coffea zanguebariae</i> Lour.	X	X						
<i>Craterispermum schweinfurthii</i> Hiern.	X							
<i>Crossopteryx febrifuga</i> (G.Don) Benth.	X	X						
<i>Geophila obvallata</i> (Schumach.) F.Didr. subsp. <i>ioides</i> (K.Schum.) Verdc.		X						
<i>Keetia gueinzii</i> (Sond.) Bridson	X							
<i>Keetia venosa</i> (Oliv.) Bridson	X	X						
<i>Keetia zanzibarica</i> (Klotzsch) Bridson subsp. <i>zanzibarica</i>		X	X					
<i>Kohautia longifolia</i> Klotzsch			X					
<i>Leptactina delagoensis</i> K.Schum. subsp. <i>delagoensis</i>	X	X						
<i>Oldenlandia affinis</i> (Roem. & Schult.) DC. subsp. <i>fugax</i> (Vatke) Verdc.	X							
<i>Oldenlandia capensis</i> L.f. var. <i>capensis</i>		X						
<i>Oldenlandia goreensis</i> (DC.) Summerh. var. <i>trichocaula</i> Bremek.		X						
<i>Oxyanthus latifolius</i> Sond.	X							
<i>Pavetta decumbens</i> K.Schum. & K.Krause	X							
<i>Pavetta klotzschiana</i> K.Schum.	X							
<i>Pentodon pentandrus</i> (Schumach. & Thonn.) Vatke			X	X				
<i>Polysphaeria lanceolata</i> Hiern subsp. <i>lanceolata</i> var. <i>pedata</i> Brenan	X							
<i>Psychotria capensis</i> (Eckl.) Vatke subsp. <i>riparia</i> (K.Schum. & K.Krause) Verdc.	X	X						
<i>Rytigynia sparsifolia</i> (S.Moore) Robyns	X							
<i>Tarenna zygoon</i> Bridson	X							
<i>Tarenna junodii</i> (Schinz) Bremek.	X	X						
<i>Tricalysia delagoensis</i> Schinz	X							
<i>Tricalysia jasminiflora</i> (Klotzsch) Hiern var. <i>jasminiflora</i>	X	X						
<i>Vangueria infausta</i> Burch.		X						
Rutaceae								
<i>Zanthoxylum</i> sp.								
Sapindaceae								
<i>Allophylus alnifolius</i> (Baker) Rendle		X	X					
<i>Blighia unijugata</i> Baker	X	X						

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
<i>Deinbollia xanthocarpa</i> (Klotzsch.) Radlk.	X	X						
<i>Paullinia pinnata</i> L.		X						
Sapotaceae								
<i>Inhambanella henriquesii</i> (Engl. & Warb.) Dubard	X							
<i>Manilkara discolor</i> (Sond.) J.H.Hemsl.	X							
<i>Synsepalum brevipes</i> (Baker) T.D.Penn.	X							
Scrophulariaceae								
<i>Bacopa floribunda</i> (R.Br.) Wettst.		X						new to MS
<i>Buchnera hispida</i> D.Don		X						
<i>Craterispermum schweinfurthii</i> Hiern.	X							
<i>Cycnium tubulosum</i> (L.f.) Engl.		X	X					
<i>Stemodia serrata</i> Benth.							X	new to MS
<i>Striga asiatica</i> (L.) Kuntze		X						
<i>Torenia thouarsii</i> (Cham. & Schltdl.) Kuntze	X							
Solanaceae								
<i>Physalis lagascae</i> Roem. & Schult.							X	new to Moz.
<i>Solanum incanum</i> L.							X	
Sterculiaceae								
<i>Heritiera littoralis</i> Ait.					X			
<i>Melochia melissifolia</i> Benth.				X				
<i>Sterculia appendiculata</i> K.Schum.		X						
<i>Waltheria indica</i> L.		X						
Thymelaeaceae								
<i>Synaptolepis alternifolia</i> Oliv.	X							
Tiliaceae								
<i>Corchorus fascicularis</i> Lam.			X					
<i>Corchorus tridens</i> L.							X	
<i>Grewia bicolor</i> Juss.	X							
<i>Grewia caffra</i> Meisn.		X						
<i>Grewia sulcata</i> Mast.	X	X	X					
<i>Grewia transzambesica</i> Wild	X	X						
<i>Triumfetta rhomboidea</i> Jacq.	X		X					new to Moz.
Ulmaceae								
<i>Chaetachme aristata</i> Planch.	X							
Vahliaceae								
<i>Vahlia capensis</i> (L.f.) Thunb. subsp. <i>macrantha</i> (Klotzsch) Bridson		X						
Verbenaceae								
<i>Avicennia marina</i> (Forssk.) Vierh.					X			
<i>Clerodendrum robustum</i> Klotzsch	X	X						
<i>Lippia javanica</i> (Burm.f.) Spreng.		X		X				
<i>Vitex doniana</i> Sweet	X	X					X	
<i>Vitex payos</i> (Lour.) Merr.	X	X						
<i>Vitex petersiana</i> Klotzsch	X							
Vitaceae								

Species	Habitat							Notes
	For.	Sav.	Gra.	Wet.	Man.	Dun.	Fall.	
<i>Cissus integrifolia</i> (Baker) Planch.	X	X						
<i>Cyphostemma paucidentatum</i> (Klotzsch) Wild & R.B.Drumm.		X						
<i>Cyphostemma subciliatum</i> (Baker) Wild & R.B.Drumm.				X				
<i>Rhoicissus revoilii</i> Planch.		X						
<i>Rhoicissus tridentata</i> (L.f.) Wild & R.B.Drumm. <i>sensu lato</i>	X							
TOTALS	445 taxa	151	175	79	84	16	21	65