

## **An annotated plant species list for Mile 46 LDC and surrounding area in central Kavango, Namibia, with some notes on species diversity**

B.J. Strohbach & M.M. Strohbach \*

National Botanical Research Institute, Private Bag 13184, Windhoek, Namibia

### **Abstract**

*An annotated species list for the Mile 46 Livestock Development Center (LDC) and surrounding areas in central Kavango Region is presented. The list has been prepared from phytosociological data collected in the vicinity of the LDC as part of routine monitoring at the BIOTA observatories as well as the Vegetation Mapping Project. The species list has been augmented with information on habitat, relative abundance as well as growth and ecological characteristics.*

*A total of 334 species were observed in the study area, or 318 each in the Acacia Savannas and Kavango Woodlands. An attempt has been made to estimate the likely number of species occurring in the area using first order and second order Jackknife calculations as well as a species-area curve estimator LOGLIN. Both Jackknife procedures indicated that approximately 87 % of species were observed, whilst the LOGLIN procedure gave unrealistically high estimates of species richness.*

**Keywords:** Kavango, Namibia; Raunkiaer life forms, species abundance, species diversity, species richness

### **Introduction**

In order to comply with, and benefit from, the Convention on Biological Diversity, a need exists for each country to know its biological resources. In terms of vascular plants, some basic information is available (Merxmüller 1966-72; Maggs *et al.* 1994; Maggs *et al.* 1998; Craven 1999). Yet, when discussing diversity trends, Craven (2001) declined to put any numbers to a species diversity map (Map 13), rather indicating these units in seven classes ranging from “lowest” to “highest”. Mendelsohn *et al.* (2002) translated these classes into estimated numbers. It is also understandable why Craven declined to put such figures to her map as in many cases, insufficient supporting herbarium collections were made (Map 11 in Craven 2001).

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\* Contact Address: P.O. Box 1669, Swakopmund

In terms of vegetation (i.e. the combination of species in a certain area, depending on a particular habitat) even less is known. Giess (1971) published a vegetation map of Namibia, describing his vegetation types with photographs and only a short narrative. Little indication is given on species diversity. Various smaller-scale studies have since been made on specific areas (see Burke & Strohbach 2000 for an overview). Recently published work for the Kavango include Burke (2002) and Mendelsohn & el Obeid (2003) (based on Burke 2002). In both cases a good description of the (vegetative) landscapes is provided, yet no data on species composition and/or species diversity are given. From similar maps, Mendelsohn *et al.* (2002) compiled a new vegetation map of Namibia, again without much information on species composition and/or diversity.

The BIOTA Southern Africa project is being undertaken to study the diversity of species across the major climatic gradient, i.e. rainfall, in southern Africa (BIOTA 2000). In order to establish a standard biodiversity observation tool / observation strategy, the concept of “biodiversity observatories” was developed and established at the study sites along the main rainfall gradient from south to north. A “biodiversity observatory” consists of 1 km<sup>2</sup>, subdivided into 100 one-ha squares. These squares are grouped according to habitat. The squares are assigned a random ranking, however biased towards the habitat, in such a way that each habitat is represented in the top-ranking one-ha squares. According to this ranking, the plots are sampled by each participating biotic discipline. Sampling intensity depends on the capacity of each individual discipline; the 20 top-most ranking plots are sampled for botany. Within the one-ha squares each discipline samples as close as possible to the midpoint, according to a standard (discipline-specific) sampling scheme.

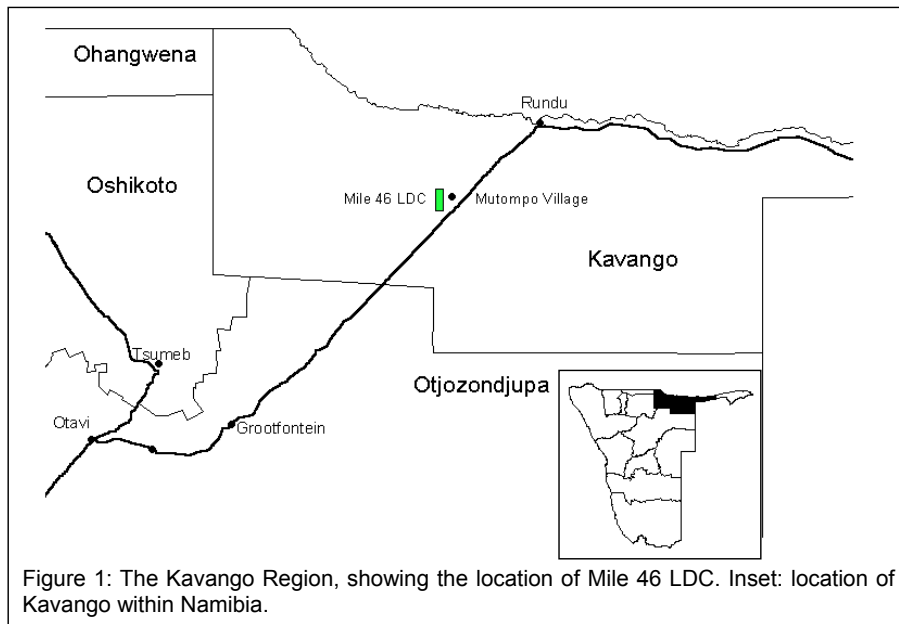
A further objective is to study the effect of land use on biological diversity, thus resulting in often paired observatories across a land-use gradient. The northernmost pair of observatories was established inside and outside the Mile 46 Livestock Development Centre (LDC) of the Directorate of Agricultural Research and Training; the outside observatory being located in the communal grazing area of the Mutompo community.

Due to lacking diversity information, it was decided to collect such data at the observatories as well as along the transect by way of vegetation mapping (BIOTA 2000). The species list presented here is a combination of species found at the Mile 46 and Mutompo observatories, augmented by species found at various sample sites for vegetation mapping purposes at and around the Mile 46 LDC.

### Study area

The Mile 46 LDC is situated in the central Kavango Region near the main road to Rundu (Figure 1). The two observatories were established at 18°18'07"S 19°14'50"E and 18°18'06"S 19°15'32"E (NW corners), respectively. The LDC is mostly situated in the 1819AC quarter-degree square (QDS), with only the eastern edge stretching

into the 1819AD QDS. The Mile 46 observatory also straddles the QDS border, with the biggest part however falling in the eastern (1819AD) QDS. The Mutompo observatory (as well as the Mutompo village and its grazing area) fall entirely into this QDS.



The entire Kavango Region forms part of the Kalahari Basin (Grove 1969; Mendelsohn *et al.* 2002). The study area forms part of the KAL3-3, defined as a sand drift plain with occasional pans (de Pauw *et al.* 1998/99). The growing period is described as 60 - 69 days long, with a dependability of 60 %. On average, 450 - 500 mm of rain falls in the area per annum (Pitman 1980; Mendelsohn *et al.* 2002).

Burke (2002) describes the vegetation as being part of the “northern Sandplains”, with a variety of associated deciduous woodland types: the *Pterocarpus angolensis* woodlands, *Schinziophyton rautanenii* woodlands, *Baikiaea plurijuga* woodlands and *Burkea africana* woodlands. These woodlands are dissected by *omirimbi* (shallow dry rivers), supporting *Acacia erioloba* shrublands, *Terminalia sericea* shrublands as well as *Terminalia sericea* - *Bauhinia petersiana* shrublands. According to Burke (2002), many of these *omirimbi* are transformed to support a mosaic of cultivated fields. From own observations (a detailed vegetation description is yet to be published), the vegetation can be divided into two broad physiognomic vegetation types. The *Acacia*-dominated shrublands, bushlands and thickets associated with the east-west oriented *omirimbi* that end up in the Mpuku *omuramba*, west of Mile 46 LDC, are collectively referred to as “Acacia Savannas”. At Mile 46 LDC, these cover an

estimated 20 % of the land surface. The matrix between these omirimbi is covered by typical broad-leafed woodlands and occasional shrublands (as described by Burke 2002). These are collectively referred to as the “Kavango Woodlands”.

### **Species richness**

A commonly used method to determine the number of species per specific area is by counting the number of species observed. This can either be done by doing a survey of a particular study site to list all species present, or by doing a study of historic records of species in literature and herbarium collections. These two approaches are often used in combination. A disadvantage of using historic records is that possible local extinctions as well as invasions are not observed. This can be avoided using present day surveys.

A common problem faced by direct observation of species is that as a rule, not all species are observed (Palmer 1990; Westfall *et al.* 1996). Thus the number of observed species always underestimates the total species richness of an area. Several estimators, both based on a species-area curve as well as non-parametric estimators, are available to calculate the species richness of an area. Palmer (1990; 1991) tested a number of these estimators, and found that the non-parametric Jackknife estimators (first and second order) performed best. Of the species-area curve-based estimators, “LOGLIN” (a linear regression based on the log of the accumulative area) performed best, yet constantly overestimated the species richness.

The first order Jackknife slightly underestimates the species richness, but is the least biased of all estimators (as determined by the Mean Deviation) and predicts species richness fairly precisely (Palmer 1990). In a revision of the second order Jackknife, Palmer (1991) found this to be even less biased than the first order Jackknife, but also less precise. Palmer (1990) warns also, that due to the calculus, the Jackknife procedures are not suited for larger areas, especially if less than half the total number of species have been observed.

It must be kept in mind that these calculation procedures are only estimators, and thus do not give an absolute number of species to be found at a particular area.

## **Methods**

### **Field data collection**

For the present study, a total of 126 relevés were compiled during the peak growing period (February to April) in 2001, 2002 and 2003 at the two biodiversity observatories during regular monitoring activities. These were supplemented by a further 92 relevés within and around the Mile 46 LDC, as well as in the adjacent Mutompo communal grazing area. The relevés were compiled following standard

procedures described by Strohbach (2001). Any unknown species, as well as voucher specimens, were collected for later identification, following standard collection procedures. The voucher specimen number in the list (Appendix 1) refers to the collections by the senior author during field data collection.

No further searches were done through herbarium records, due to the low number of collections done previously as shown in Map 11 by Craven (2001) (four collections for QDS 1819AC, 15 collections for QDS 1819AD).

### Data analysis

These relevés (i.e. the data from each site) were data-based using TurboVeg (Hennekens 1996). This relevé database was then used to compile the list of species. Using the select and export facilities of TurboVeg, the species occurring in the 1819AC and 1819AD QDSs could be listed separately. Using a preliminary classification of relevés, the species occurring in the Acacia Savannas versus the Kavango Woodlands were separated. These two separate listings (1819AC vs AD; Acacia Savannas vs Kavango Woodlands) were combined into one species list given in Appendix 1.

The list of species/taxa was further corrected following Craven (1999), also referring back to the original species identification lists. This was necessary as TurboVeg stores data according to a species list derived from Arnold & de Wet (1993). Although this list has been updated in 2000, a number of species with their centre of origin in the Flora Zambesiaca region (rather than the Flora South Africa region) are not listed in this species list.

### *Species abundance and layer*

Species abundance was calculated in two ways:

Overall abundance relates to the frequency of occurrence in relevés, irrespectively of abundance in such relevés. The classes are defined as follows:

Rare:	present in <5 % of relevés
Occasional:	present in 5<20 % of relevés
Common:	present in 20<50 % of relevés
Abundant:	present in 50<75 % of relevés
Wide-spread:	present in >75 % of relevés

Local Abundance refers to the average abundance within the relevés in which it occurs, irrespectively of how often it occurs. The classes are defined as follows:

Rare:	0 < 0.1 % cover
Occasional:	0.1 < 1 % cover

Common:	1 < 10 % cover
Abundant:	10 < 50 % cover
Dominant:	50 < % cover

Local abundance was calculated separately for the Acacia Savannas and the Kavango Woodlands, in this way also indicating the general association of the species with these two vegetation types / habitat types. In some cases no value for local abundance could be calculated. These were species which were listed or collected separately within the study area, not at a specific relevé. Thus they could not be positively associated with a vegetation type.

The layer column indicates the structural layer to which the species normally belongs. The definitions follow Edwards (1983). The following conventions were adhered to:

Tree layer (T):	woody plants, single stemmed, >2m, or multi-stemmed, >5m
short Tree (T3):	(single stemmed), >2m <5m
low Tree (T2):	>5m <10m
high Tree (T1):	>10m <20m
Shrub layer (S):	woody plant, normally multi-stemmed
high Shrub (S1):	>1m <5m
low Shrub (S2):	<1m
Herb layer (hl):	all non-woody species, irrespective whether annual or perennial
Grasses:	species belonging to the family Poaceae, in many parts of the country constituting the main fodder resource for livestock keeping, are included in the herb layer, although highlighted as being grasses.

The layer information serves to give additional information on the growth form (especially differentiating between trees and shrubs, which all belong to the life form “phanerophytes” (see next columns on species-specific information).

#### *Species-specific information*

TurboVeg allows for the creation of an “Ecodatabase”, i.e. a database of ecological (and other) attributes for each species. These attributes can also be exported with the species, making further analysis possible (or as in this case, only a simple listing). For the species found along the BIOTA transect from the central Khomas Region up to the Kavango Region, such an ecodatabase has been created. The following information was included, as far as available from literature sources:

- Life form according to Raunkiaer (as described in Mueller-Dombois & Ellenberg 1974). Sources: Herbarium specimens, Merxmüller (1966-1972); Müller (1985); Gibbs-Russell *et al.*(1990)
- Periodicity (annual vs perennial) was included for easier recognition, even though this is implicitly included in the Raunkiaer life forms. Sources: Herbarium specimens, Merxmüller (1966-1972); Müller (1985); Gibbs-Russell *et al.*(1990)
- Information whether a species is indigenous (or even endemic) or alien to Namibia. Source: Craven (1999)
- Legal status of the species: Protected by the Nature Conservation Ordinance (Ordinance 4 of 1975) are indicated by a “P”; species protected by the Forest Act (Act 12 of 2001) (as previously declared under the Forestry Ordinance of 1952 and the Forestry Act No 72 of 1968) are indicated with an “F”, whilst species listed under CITES are indicated with a “C” and the respective list number. Source: Craven (1999)
- The general ecological status of species – weedy (Wd), climax (Cl), subclimax (SCI), pioneer (Pio) or rare species. For rare species, the IUCN Red Data categories are indicated. The following classes are relevant for the species found: Data deficient (DD), i.e. species of which too little is known to make a proper assessment; Low risk / not threatened (LRnt) and Vulnerable (VU). Sources: Müller (1985); Van Oudtshoorn (1999); Gibbs-Russell *et al.* (1990); Loots (2004); own observations.
- Indicator value: Mainly for grazing condition, following Van Oudtshoorn (1999), but also with local adaptations following Strohbach (1992; 2000a; 2000b). Further information on habitat indications have also been included if available. Sources: Müller 1985; Gibbs-Russell *et al.*(1990)
- Palability: Mainly for grazing species (Müller 1985; Van Oudtshoorn 1999; Gibbs-Russell *et al.*1990), but also for toxicity (Vahrmeijer 1981; Kellerman *et al.* 1988; van Wyk *et al.* 2002)
- Metabolism, focusing on photosynthetic metabolism, i.e. C3, C4 and/or CAM processes. Sources: Ellis *et al.* (1980); Gibbs-Russell *et al.*(1990)

#### *Number of species*

An estimation of the species richness was obtained by using the first- and second order Jackknife as well as the LOGLIN procedure.

The first order Jackknife was calculated as follows:

$$SR = SO + r(n-1)/n$$

where: SR is the estimated species richness  
SO are the number of observed species  
r is the number of species on a particular relevé.  
n is the number of relevés  
(Heltshé & Forrester 1983)

This calculation was done with the total number of species and relevés, as well as for the species listed on the relevés of the two QDSs as well as for the two different vegetation types. In each case, the calculation was repeated with *r* from each individual relevé, and an average calculated for the resulting SR.

The second order Jackknife was calculated as follows:

$$SR = SO + \{[r1(2n-3)/n] - [r2(n-2)^2/[n(n-1)]]\}$$

where: SR is the estimated species richness  
SO are the number of observed species  
*r1* and *r2* are the number of species on two separate relevés.  
*n* is the number of relevés  
(Burnham & Overton 1979)

Again this calculation was done with the total number of species and relevés, as well as for the species listed on the relevés of the two QDSs as well as for the two different vegetation types. In each case, the calculation was repeated with *r1* from each individual relevé and *r2* from the adjacent relevé, after the relevé sequence was randomised. An average was calculated for the resulting SR.

For the LOGLIN procedure (Gleason 1922), a species-area curve was constructed as follows:

The relevés were randomised and the accumulative number of species calculated. Each relevé was 0.1 ha in size – these were also accumulated. A linear regression was fitted with the logarithm of the accumulative area as independent variable and the accumulative number of species as dependent variable. The linear regression line can be expressed as follows:

$$SR = ax + b$$

where SR represents species richness  
*x* the log of the area  
*a* the slope of the line, and *b* the intercept of the line

This calculation was repeated also for the two QDSs, the two different vegetation types as well as the total sample. No absolute measure of the area covered by the two vegetation types is available yet; it is however estimated that the Acacia Savannas cover approximately 20 % of the area of the Mile 46 LDC. This was extrapolated to the QDSs to give an approximate area to use in the calculation of the estimate.



## Results and Discussion

The annotated species list is presented in Appendix 1. In total 334 species were observed, of which three are endemic and five are alien to Namibia. One species, *Micrococca mercurialis* (L.) Benth. (Strohbach 5639) is newly recorded for Namibia. Fourteen tree species are protected under the Forest Act (Act 12 of 2001), whilst four species are protected under the Nature Conservation Ordinance (Ordinance 4 of 1975). Two of these, both *Ceropegia* spp., are also listed on CITES II, meaning restricted for international trade.

A total of eight species are listed in the Red Data List for Namibia (Loots 2004) – four of these are noted as data deficient. One of these species, *Dioscorea quartiniana*, has been noted as occasionally occurring in the Acacia Savannas, whilst the other three species are all rare – *Kohautia amboensis* (one of the endemic species) in the Acacia Savannas, *Albucca cooperi* in the Acacia Savannas as well as the Kavango Woodlands, and *Cucumis humifructus* in the Kavango Woodlands. The rarity of *Albucca cooperi* could well be an artefact of sampling procedure. Sampling is generally done between February and April, and being a geophyte (which often flower very early in the season) it is likely to be ignored as it is difficult to identify without inflorescence or fruit. Likewise, *Cucumis humifructus*, being a rare annual species, does not occur on the same spot every year. Being annual means that the species germinates as soon as favourable conditions exist, not necessarily coinciding with the time of survey. Being also relatively short-lived as well as often grazed, even repeat observations during the same season might mean missing it.

Two protected timber tree species are listed as “low risk / not threatened” in the study area, *Pterocarpus angolensis* and *Baikiaea plurijuga*. Just how vulnerable these are, can be illustrated at the study area. Four trees of *Pterocarpus angolensis*, sought after for its wood for carving, were felled in the Mutompo observatory within a year after starting the project (Figure 2). Only a 3 m section of the trunk was removed, the remainder was left discarded. It could not be ascertained whether or not this felling was done legally or not; the community at Mutompo however complained that they are unable to control such fellings within their resource area (U. Schneiderrat, pers. com.). Likewise, *Baikiaea plurijuga* wood is sought after for construction wood. Whilst fencing the LDC in the 1980s, the labourers felled this species for fencing posts. Because of this, considerably less trees of this species are noted nearby the fences (including at the observatories, with furthest side about 1.2 km from the fence) as elsewhere in the landscape.

The information contained in this annotated species list may assist to clear up “Data Deficient” listings, and/or helps to assess the vulnerability of further species.

### Species richness

The results obtained for the estimated species richness is presented in Table 1 below.



Figure 2: A felled *Pterocarpus angolensis* tree at the Mutompo observatory. Note the brown leaves, indicating that the tree was green when felled.

Table 1: Species numbers observed and species numbers estimated to occur in different geographical areas in the study area.

	1918AC	1918AD	Acacia Savanna	Kavango Woodlands	Total
Area	72 857.75 ha	72 857.75 ha	±1150 ha (±20% of Mile 46)	±4590 ha (±80 % of Mile 46)	5740 ha (Mile 46 LDC only)
No of relevés	54	164	52	166	218
Average no of species per relevé	49	46	52	45	47
Range of species per relevé	29 – 70	26 – 80	35 – 80	26 – 70	26-80
Species observed	237	316	318	318	334
Species estimated: First order Jackknife	286	363	306	364	380
Species estimated: Second order Jackknife	287	364	369	364	380
Species estimated: LOGLIN	701	921	505 (656 for QDS)	694 (904 for QDS)	768 (999 for QDS)

The 1918AC QDS shows both the lowest number of species observed as well as the lowest number of species estimated. As the landscape features are in most cases linear, stretching from east to west (and with it the vegetation types), it is safe to assume that the same species diversity occurs in both QDSs. The low numbers observed can be attributed to the fact that the 1918AC QDS is undersampled (54 relevés) compared to the 1918AD QDS (164 relevés). The fact that all estimators indicate a lower number of species on the 1918AC QDS shows that they all are affected by the undersampling of this QDS.

The two Jackknife calculations give an astonishingly similar result. Only in the Acacia Savannas a significant difference in result occurs, indicating a possible undersampling of this vegetation type. Only 52 relevés were sampled versus the 166 relevés in the Kavango Woodlands. One has to remember, however, that this vegetation type is less extensive than the Kavango Woodlands. The denser nature of this vegetation type (many sample sites were thicket-like) means that more species occur on a smaller area (as indicated also by the average number of species per plot, as well as the range of species numbers). This also results in the similar number of species observed and estimated for this vegetation type.

All estimates by the two Jackknife procedures (with the exception of the First order Jackknife in the Acacia Savannas) indicated that between 86 and 88 % of species were observed. It is not clear whether this is an error of the calculus (which would be serious), or that during sampling in general about 87 % of species are observed.

The LOGLIN estimator, based on species-area curves, did not perform well at all by estimating totally unrealistic species numbers. It was also found problematic to apply to vegetation types if the exact (or near exact) area of these types were not known.

## **Conclusion**

Phytosociological studies of the vegetation of Namibia can greatly contribute to the collection of information on the distribution of species. Of essential value is the high intensity sampling and species observation in obtaining a good estimate of species richness. With such information, the diversity map prepared by Craven (2001) can be further improved.

The Jackknife estimators proved fairly simple to apply, yet are negatively influenced by low intensity sampling. The species-area curve-based LOGLIN estimator proved to be rather tedious to apply, and also gave unrealistically high estimates of species numbers. As the number of observed species can be used equally well to compare species richness between areas, it is thus questionable whether one should try to estimate the number of species for a given area, except if this is to be used as an incentive for further botanical collections in the area.

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Species list for Mile 46, Kavango Region

Appendix 1: Annotated list of vascular plant species observed in and around Mile 46 LDC.

	QDS	Overall abundance	Abundance in: Acacia Savannas	Kavango Woodlands	Layer	Life form	Periodicity	Alien/ Indigenous/ Endemic	Legal Status	Ecological status	Indicator	Palatability	Metabolism	Voucher
<b>PTERIDOPHYTA</b>														
Ophioglossaceae														
<i>Ophioglossum polyphyllum</i> A. Braun	AD	rare	rare		hl	Geo	Per	Ind						
<b>ANGIOSPERMAE</b>														
<b>Monocotyledonae</b>														
Poaceae														
<i>Eilonurus muticus</i> (Spreng.) Kunth	AD	rare	occasional	occasional	hl (grass)	Hemicr	Per	Ind		Cl	D	Unp	C4	5726
<i>Eilonurus trispicoides</i> Willd.	AC, AD	occasional	common	common	hl (grass)	Hemicr	Per	Ind		Cl			C4	5345
<i>Schizachyrium exile</i> (Hochst.) Pilg.	AC, AD	rare	rare	rare	hl (grass)	Ther	Ann	Ind					C4	
<i>Schizachyrium leffreyi</i> (Hack.) Stapf	AC, AD	rare	occasional	occasional	hl (grass)	Hemicr	Per	Ind						5200; 5722
<i>Schizachyrium sanguineum</i> (Retz.) Alston	AD	rare	occasional	occasional	hl (grass)	Hemicr	Per	Ind						5723
<i>Andropogon gayanus</i> Kunth var. <i>polycladus</i> (Hack.) Clayton	AC, AD	rare	occasional	occasional	hl (grass)	Hemicr	Per	Ind		Cl	D	Pal	C4	5705
<i>Andropogon schirensis</i> A. Rich.	AC, AD	rare	occasional	occasional	hl (grass)	Hemicr	Per	Ind						5704
<i>Monocymbium ceresiforme</i> (Nees) Stapf	AD	rare	occasional	occasional	hl (grass)	Hemicr	Per	Ind			Acid soils			5721
<i>Heteropogon contortus</i> (L.) Roem. & Schult.	AC	rare	common	common	hl (grass)	Hemicr	Per	Ind		SCI	1 2	Mp	C4	
<i>Heteropogon melanocarpus</i> (Elliott) Benth.	AC, AD	rare	common	common	hl (grass)	Ther	Ann	Ind				Mp	C4	5132
<i>Megaloptachne albescens</i> C.E.Hubb.	AC, AD	occasional	common	common	hl (grass)	Ther	Ann	Ind						
<i>Digitaria milanjiana</i> (Rendle) Stapf	AD	rare	common	rare	hl (grass)	Hemicr	Per	Ind		Cl		Pal	C4	5643
<i>Digitaria seriata</i> Stapf	AC, AD	wide-spread	common	common	hl (grass)	Hemicr	Per	Ind		Cl	D	Pal	C4	5346
<i>Brachiaria brizantha</i> (A. Rich.) Stapf	AC	rare	occasional	rare	hl (grass)	Hemicr	Per	Ind		Cl	D	Mp	C4	
<i>Brachiaria deflexa</i> (Schumach.) C.E.Hubb. ex Robyns	AC, AD	occasional	occasional	occasional	hl (grass)	Ther	Ann	Ind		Plo	1 2	Mp	C4	
<i>Brachiaria dura</i> Stapf	AD	rare	common	common	hl (grass)	Hemicr	Per	Ind						5715
<i>Brachiaria nigropedata</i> (Ficalho & Hiern) Stapf	AC, AD	common	occasional	common	hl (grass)	Hemicr	Per	Ind		Cl	D	Pal	C4	5348
<i>Brachiaria serrata</i> (Thunb.) Stapf	AC, AD	rare	occasional	occasional	hl (grass)	Hemicr	Per	Ind		Cl	D	Mp	C4	5703
<i>Urochloa brachyura</i> (Hack.) Stapf	AC, AD	abundant	common	common	hl (grass)	Ther	Ann	Ind		SCI	1 2	Pal	C4	5351
<i>Panicum kalaharensis</i> Mez	AC, AD	common	common	common	hl (grass)	Hemicr	Per	Ind		Cl		Mp		
<i>Panicum maximum</i> Jacq.	AC, AD	occasional	common	common	hl (grass)	Hemicr	Per	Ind		Cl	D	Pal		5187
<i>Setaria sphacelata</i> (Schumach.) Moss var. <i>sericea</i> (Stapf) Clayton	AC, AD	occasional	occasional	occasional	hl (grass)	Ther	Ann	Ind		Plo	1 2			
<i>Tricholaena monachne</i> (Trin.) Stapf & C.E.Hubb.	AC, AD	rare	occasional	occasional	hl (grass)	Hemicr	Per	Ind						5343
<i>Melinis repens</i> (Willd.) Zizka	AC, AD	occasional	occasional	occasional	hl (grass)	Ther	Ann	Ind		SCI	1 2	Mp	C4	
<i>Melinis kalimorpha</i> (Clayton) Zizka	AD	rare	occasional	occasional	hl (grass)	Ther	Ann	Ind						5653
<i>Melinis repens</i> (Willd.) Zizka ssp. <i>grandiflora</i> (Hochst.) Zizka	AC, AD	abundant	occasional	common	hl (grass)	Ther	Ann	Ind		Plo	1 2	Unp	C4	
<i>Melinis repens</i> (Willd.) Zizka ssp. <i>repens</i>	AC, AD	occasional	occasional	occasional	hl (grass)	Hemicr	Per	Ind		SCI	D	Unp	C4	5350
<i>Anthephora pubescens</i> Nees	AC, AD	rare	occasional	common	hl (grass)	Hemicr	Per	Ind		Cl	D	Pal	C4	
<i>Cenchrus biflorus</i> Roxb.	AC, AD	occasional	abundant	abundant	hl (grass)	Ther	Ann	Ali		Wd	1 3	Unp		5208
<i>Tristachya superba</i> (De Not.) Schweinf. & Asch.	AC, AD	common	occasional	common	hl (grass)	Hemicr	Per	Ind						5147
<i>Loudetia lanata</i> (Stent & J.M.Ratray) C.E.Hubb.	AC, AD	rare	occasional	occasional	hl (grass)	Hemicr	Per	Ind						5701
<i>Stipagrostis uniplumis</i> (Licht.) De Winter var. <i>uniplumis</i>	AC, AD	abundant	common	common	hl (grass)	Hemicr	Per	Ind		SCI	1 2	Mp	C4	5349
<i>Aristida adscensionis</i> L.	AC, AD	occasional	occasional	occasional	hl (grass)	Ther	Ann	Ind		Wd	1 3	Unp	C4	

	QDS	Overall abundance	Abundance in: Acacia Savannas	Kavango Woodlands	Layer	Life form	Periodicity	Alien/ Indigenous/ Endemic	Legal Status	Ecological status	Indicator	Palatability	Metabolism	Voucher
<i>Aristida congesta</i> Roem. & Schult. ssp. <i>congesta</i>	AD	rare	occasional		hl (grass)	Hemicr	Per	Ind		Wld	I 2	Unp	C4	
<i>Aristida meridionalis</i> Henrard	AC, AD	occasional	common	common	hl (grass)	Hemicr	Per	Ind		SCI	I 2	Unp	C4	
<i>Aristida pilgeri</i> Henrard	AC, AD	occasional	common	common	hl (grass)	Hemicr	Per	Ind		CI	D	Mp	C4	
<i>Aristida stipitata</i> Hack.	AC, AD	common	common	common	hl (grass)	Hemicr	Per	Ind		SCI	I 2	Unp	C4	5148
<i>Sartidia angoleris</i> (C.E.Hubb.) De Winter	AC, AD	rare	occasional	occasional	hl (grass)	Hemicr	Per	Ind		Hemicr			C3	5702
<i>Tragus berteronianus</i> Schult.	AD	occasional	common	common	hl (grass)	Ther	Ann	Ind		Plo	I 2	Unp	C4	
<i>Perotis leptopus</i> Pilg.	AC, AD	occasional		common	hl (grass)	Ther	Ann	Ind						5199
<i>Perotis patens</i> Gand.	AC, AD	occasional		occasional	hl (grass)	Ther	Ann	Ind						5131
<i>Sporobolus fimbriatus</i> (Trin.) Nees	AC, AD	occasional	common	occasional	hl (grass)	Hemicr	Per	Ind		CI	D	Pal	C4	
<i>Sporobolus panicoides</i> A.Rich.	AC, AD	occasional	common	occasional	hl (grass)	Hemicr	Per	Ind			I 2	Unp	C4	
<i>Eragrostis annulata</i> Rendle ex Scott-Elliott	AC	rare	occasional	rate	hl (grass)	Ther	Ann	Ind		Plo	I 3	Unp	C4	
<i>Eragrostis cimbicina</i> Launert	AC, AD	occasional		occasional	hl (grass)	Hemicr	Per	Ind						5345
<i>Eragrostis dirteri</i> Stapf	AC, AD	common	occasional	common	hl (grass)	Ther	Ann	Ind		SCI	I 2	Mp	C4	
<i>Eragrostis lehmanniana</i> Nees	AD	rare	occasional	occasional	hl (grass)	Hemicr	Per	Ind		SCI		Mp	C4	
<i>Eragrostis nirdensis</i> Ficalho & Hiern	AD	rare	rate	rate	hl (grass)	Hemicr	Per	Ind		CI	I 2	Mp	C4	
<i>Eragrostis pallens</i> Hack.	AC, AD	abundant	common	common	hl (grass)	Hemicr	Per	Ind				Unp	C4	
<i>Eragrostis rigidior</i> Pilg.	AC, AD	common	common	common	hl (grass)	Hemicr	Per	Ind		Wld	I 2	Mp	C4	
<i>Eragrostis trichophora</i> Coss. & Durieu	AC, AD	occasional	common	occasional	hl (grass)	Hemicr	Per	Ind		SCI	I 2	Mp	C4	
<i>Microchloa caffra</i> Nees	AC, AD	rare	occasional	occasional	hl (grass)	Hemicr	Per	Ind						
<i>Cynodon dactylon</i> (L.) Pers.	AD	rare	common	common	hl (grass)	Hemicr	Per	Ind		Plo	I 3	Pal	C4	
<i>Craspedorhachis rhodesiana</i> Rendle	AC, AD	rate	rate	occasional	hl (grass)	Hemicr	Per	Ind						5699
<i>Dactyloctenium giganteum</i> Fisher & Schweick.	AC, AD	rate	common	rate	hl (grass)	Ther	Ann	Ind		Wld	I 3	Pal	C4	
<i>Pogonarthria fleckii</i> (Hack.) Hack.	AC, AD	common	common	common	hl (grass)	Ther	Ann	Ind		Plo	I 3	Unp	C4	
<i>Pogonarthria squarrosa</i> (Roem. & Schult.) Pilg.	AC, AD	occasional		common	hl (grass)	Hemicr	Per	Ind		Plo	I 2	Unp	C4	
<i>Triplaphis purpurea</i> Hack.	AC, AD	rare		occasional	hl (grass)	Ther	Ann	Ind			I 3	Unp	C4	
<i>Triplaphis schinzii</i> Hack.	AC, AD	common	occasional	occasional	hl (grass)	Hemicr	Per	Ind		CI	D	Pal	C4	
<i>Erneapogon cenchroides</i> (Roem. & Schult.) C.E.Hubb.	AC, AD	rare	occasional	occasional	hl (grass)	Ther	Ann	Ind		Plo	I 3	Mp	C4	
<i>Schmidtia pappophoroides</i> Steud.	AC, AD	wide-spread	common	common	hl (grass)	Hemicr	Per	Ind		CI	D	Pal	C4	5347
Cyperaceae														
<i>Cyperus amabilis</i> Vahl	AC, AD	occasional	occasional	occasional	hl	Ther	Ann	Ind						5190; 5679
<i>Cyperus esculentus</i> L.	AC, AD	occasional	occasional	occasional	hl	Geo	Per	Ind						5267
<i>Cyperus margaritaceus</i> Vahl	AC, AD	abundant	occasional	occasional	hl	Geo	Per	Ind						5282
<i>Manisca chersinus</i> N.E.Br.	AC, AD	occasional	occasional	occasional	hl	Hemicr	Per	Ind						5153
<i>Kyllinga alba</i> Nees	AD	rate	occasional	occasional	hl	Hemicr	Per	Ind						5283
<i>Bulbostylis hispidula</i> (Vahl) R.W.Haines	AC, AD	abundant	common	occasional	hl	Hemicr	Per	Ind						5135; 5270
<i>Scleria species</i>	AD	rate	occasional	occasional	hl	Hemicr	Per	Ind						5713
Commelinaceae														
<i>Commelina africana</i> L. var. <i>krebsiana</i> (Kunth) C.B.Clarke	AC, AD	abundant	occasional	occasional	hl	Ther	Ann	Ind						5126; 5271
<i>Commelina aspera</i> Benth.	AD	rate	rate	rate	hl	Ther	Ann	Ind						5207
<i>Commelina berghalensis</i> L.	AC, AD	occasional	occasional	occasional	hl	Ther	Ann	Ind						5626
<i>Commelina erecta</i> L.	AC, AD	occasional	occasional	occasional	hl	Ther	Ann	Ind						5178; 5284
<i>Commelina livingstonii</i> C.B.Clarke	AD	rate	rate	rate	hl	Ther	Ann	Ind						
Colchicaceae														
<i>Gloriosa superba</i> L.	AC, AD	common	occasional	occasional	hl	Geo	Per	Ind						
<i>Ornithoglossum vulgare</i> B.Nord.	AC	rare	common	common	hl	Geo	Per	Ind						



Species list for Mile 46, Kavango Region

	QDS	Overall abundance	Abundance in: Acacia Savannas	Kavango Woodlands	Layer	Life form	Periodicity	Alien/ Indigenous/ Endemic	Legal Status	Ecological status	Indicator	Palatability	Metabolism	Voucher
<b>Anthericaceae</b>														
<i>Chlorophytum galpinii</i> (Baker) Kativu var.	AC, AD	rate		occasional	hl	Hemicr	Per	Ind						5158; 5641
<i>metabelense</i> (Baker) Kativu														
<b>Asphodelaceae</b>														
<i>Trachyandra arvensis</i> (Schinz) Oberm.	AC, AD	rate		occasional	hl	Geo	Per	Ind						5642
<b>Hyacinthaceae</b>														
<i>Albica cooperi</i> Baker	AC	rate	rate	rate	hl	Geo	Per	Ind		DD				5688
<i>Dipcadi longifolium</i> (Lindl.) Baker	AD	rate	occasional	occasional	hl	Geo	Per	Ind				Tox		5644; 5725
<i>Dipcadi</i> species	AD	rate	occasional	rate	hl	Geo	Per	Ind				Tox		
<b>Eriopsmaceae</b>														
<i>Eriopserum abyssinicum</i> Baker	AD	rate	rate	rate	hl	Geo	Per	Ind						
<b>Dracaenaceae</b>														
<i>Sansevieria aethiopica</i> Thunb.	AC, AD	occasional	common	occasional	hl	Hemicr	Per	Ind						5710
<b>Asparagaceae</b>														
<i>Asparagus africanus</i> Lam.	AD	rate	rate	rate	s2	Hemicr	Per	Ind						5205
<i>Asparagus aspergillus</i> Jessop	AD	rate	common	occasional	s2	Cham	Per	Ind						
<i>Asparagus cooperi</i> Baker	AC, AD	common	occasional	rate	s2	Cham	Per	Ind						5311; 5342
<i>Asparagus exuvialis</i> Burch.	AD	rate	rate	rate	s2	Cham	Per	Ind						
<i>Asparagus nelsii</i> Schinz	AC, AD	common	common	occasional	s2	Cham	Per	Ind						5301
<b>Amaryllidaceae</b>														
<i>Crinum</i> species	AC, AD	occasional	occasional	occasional	hl	Geo	Per	Ind						
<b>Tecophilaeaceae</b>														
<i>Walleria nultans</i> J.Kirk	AC, AD	occasional	rate	occasional	hl	Geo	Per	Ind						5294; 5337
<b>Dioscoreaceae</b>														
<i>Dioscorea quaritiana</i> A.Rich.	AC, AD	occasional	occasional	occasional	hl	Geo	Per	Ind		DD				5181; 5312
<b>Iridaceae</b>														
<i>Gladiolus magnificus</i> (Harms) Goldblatt	AC, AD	rate	rate	occasional	hl	Geo	Per	Ind		Lrnt				
<i>Lapeirousia bainesii</i> Baker	AD	rate	occasional	rate	hl	Geo	Per	Ind						5655
<i>Lapeirousia odoratissima</i> Baker	AD	rate	rate	rate	hl	Geo	Per	Ind						5629
<b>Orchidaceae</b>														
<i>Eulophia</i> species	AD	rate	rate	rate	hl	Geo	Per	Ind	P					
<b>Dicotyledonae</b>														
<b>Loranthaceae</b>														
<i>Agelanthus terminaliae</i> (Engl. & Gilg) Polhill & Wiens	AC	rate	rate	common		Semi-par	Per	Ind						5201
<i>Eranthemum dregei</i> (Eckl. & Zeyh.) Tiegh.	AD	occasional	occasional	occasional		Semi-par	Per	Ind						5306
<i>Tapinanthus oleifolius</i> (J.C.Wendl.) Danser	AC, AD	rate	common	occasional		Semi-par	Per	Ind						
<b>Oleaceae</b>														
<i>Ximera americana</i> L.	AC, AD	common	common	common	s2	Phan	Per	Ind						
<i>Ximera caffra</i> Sond.	AC, AD	occasional	common	common	s1	Phan	Per	Ind						
<b>Hydnoraceae</b>														
<i>Hydnora abyssinica</i> A.Braun ex Schweinf.	AD	rate	rate	rate	hl	Par	Per	Ind						5635
<b>Polygonaceae</b>														
<i>Oxygonum alatum</i> Burch.	AC, AD	abundant	occasional	occasional	hl	Ther	Ann	Ind						5281
<b>Chenopodiaceae</b>														
<i>Lophocarpus tenuissimus</i> Hook.f.	AC, AD	common	occasional	occasional	hl	Ther	Ann	Ind						5121; 5266
<b>Amaranthaceae</b>														
<i>Herbsttaectia argenteiformis</i> Schinz	AC, AD	rate	common	rate	hl	Ther	Ann	Ind						5698
<i>Herbsttaectia scabra</i> Schinz	AD	rate	rate	rate	hl	Ther	Ann	Ind						5204
<i>Amaranthus</i> species	AD	occasional	common	occasional	hl	Ther	Ann	Ind						
<i>Kyphocarpa angustifolia</i> (Moq.) Lopr.	AC, AD	rate	occasional	rate	hl	Hemicr	Ann	Ind						

	QDS	Overall abundance	Abundance in: Acacia Savannas Woodlands	Layer	Life form	Periodicity	Alien/ Indigenous/ Endemic	Legal Status	Ecological status	Indicator	Palatability	Metabolism	Voucher
<i>Pupalia lappacea</i> (L.) A.Juss.	AC, AD	rare	occasional	hi	Cham	Per	Ali		Wd				
<i>Achyranthes aspera</i> L. var. <i>sicula</i> L.	AD	rare		hi	Ther	Ann	Ali		Wd				
Gisekiaceae													
<i>Gisekia africana</i> (Lour.) Kuntze var. <i>africana</i>	AC, AD	abundant	occasional	hi	Ther	Ann	Ind						5162; 5278
Molluginaceae													
<i>Limeum fenestratum</i> (Fenzl) Heimerl var.	AC, AD	abundant	occasional	hi	Ther	Ann	Ind						
<i>fenestratum</i>	AC, AD	occasional	occasional	hi	Ther	Ann	Ind						5138; 5288
<i>Limeum sulcatum</i> (Klotzsch) Hutch.	AC, AD	occasional	occasional	hi	Ther	Ann	Ind						5353; 5632
<i>Limeum viscosum</i> (J.Gay) Fenzl ssp. <i>viscosum</i>	AD	rare	occasional	hi	Ther	Ann	Ind						5636
var. <i>viscosum</i>													
Portulacaceae													
<i>Talinum tenuissimum</i> Dinter	AC, AD	common	occasional	hi	Geo	Per	Ind						5300
Caryophyllaceae													
<i>Polycarpaea corymbosa</i> (L.) Lam.	AC, AD	occasional	occasional	hi	Ther	Ann	Ind						5154
Illecebraceae													
<i>Pollichia campestris</i> Aiton	AD	rare	occasional	hi	Cham	Per	Ind						
Ranunculaceae													
<i>Clematis villosa</i> (DC.) Hutch. ssp. <i>stanleyi</i>	AD	rare		hi	Ther	Ann	Ind						5714
(Hook.) J. Raynal & Brummit													
Menispermaceae													
<i>Cissampelos mucronata</i> A.Rich.	AD	rare	common	hi	Lian	Per	Ind						5677
Annonaceae													
<i>Annona stenophylla</i> Engl. & Diels ssp. <i>nana</i>	AC, AD	rare	common	hi	Hemicr	Per	Ind						5707
(Exell) N. Robson													
Capparaceae													
<i>Cleome rubella</i> Burch.	AC, AD	common	occasional	hi	Ther	Ann	Ind						5268
<i>Boscia albitrunca</i> (Burch.) Gilg & Glig-Ben.	AC, AD	occasional	occasional	t3	Phan	Per	Ind	F					
Crassulaceae													
<i>Kalanchoe brachyloba</i> Welw. ex Britten	AC, AD	rare	occasional	hi	Cham	Ann	Ind						
Fabaceae													
Subfamily Mimosoideae													
<i>Acacia ataxacantha</i> DC.	AC, AD	common	common	s2	Phan	Per	Ind						
<i>Acacia erioloba</i> E.Mey.	AC, AD	common	common	t3	Phan	Per	Ind	F					
<i>Acacia fleckii</i> Schinz	AC, AD	common	common	s2	Phan	Per	Ind						
<i>Acacia hebeclada</i> DC. ssp. <i>hebeclada</i>	AD	rare	occasional	s2	Phan	Per	Ind						
<i>Acacia luederitzii</i> Engl. var. <i>luederitzii</i>	AC, AD	common	common	t3	Phan	Per	Ind						5188
<i>Acacia mellifera</i> (Vahl) Benth. ssp. <i>delinens</i>	AC, AD	occasional	common	s2	Phan	Per	Ind		Wd				
(Burch.) Brenan													
<i>Dichrostachys cinerea</i> (L.) Wight & Arn.	AC, AD	common	common	t3	Phan	Per	Ind		Wd				
<i>Eritada arenaria</i> Schinz	AC, AD	occasional	occasional	s2	Phan	Per	Ind						5712
Subfamily Caesalpinioideae													
<i>Burkea africana</i> Hook.	AC, AD	wide-spread	occasional	t3	Phan	Per	Ind	F					5341
<i>Guibourtia coleosperma</i> (Benth.) J. Léonard	AC, AD	common	common	t3	Phan	Per	Ind	F					5134
<i>Baikiaea plurijuga</i> Harms	AC, AD	occasional	common	t2	Phan	Per	Ind	F	Lrnt				
<i>Bauhinia petersiana</i> Bolle ssp. <i>macrantha</i>	AC, AD	wide-spread	abundant	s2	Phan	Per	Ind						5325
(Oliv.) Brummit & J.H. Ross													5116; 5287
<i>Dialium englerianum</i> Henriq.	AD	rare	occasional	s1	Cham	Per	Ind						5622; 5334
<i>Chamaecrista absus</i> (L.) Irwin & Barneby	AC, AD	common	common	hi	Cham	Per	Ind						5136; 5275
<i>Chamaecrista biensis</i> (Steyvaert) Lock	AC, AD	common	occasional	hi	Ther	Ann	Ind						
<i>Chamaecrista mimosoides</i> (L.) Greene	AC, AD	occasional	common	hi	Ther	Ann	Ind						

Species list for Mile 46, Kavango Region

	QDS	Overall abundance	Abundance in: Acacia Savannas	Kavango Woodlands	Layer	Life form	Periodicity	Alien/ Indigenous/ Endemic	Legal Status	Ecological status	Indicator	Palatability	Metabolism	Voucher
<i>Hoffmannseggia burchellii</i> (DC.) Benth. ex Oliv.	AC, AD	occasional	common	occasional	hl	Cham	Per	Ind						
<i>Peltophorum africanum</i> Sond.	AC, AD	common	common	common	t3	Phan	Per	Ind	F					
Subfamily Papilionoideae														
<i>Bobgunnia madagascariensis</i> (Desv.) J.H.Kirkbr. & Wierssema	AD	rare		common	t3	Phan	Per	Ind						5327
<i>Baphia massariensis</i> Taub. ssp. <i>obovata</i> (Schinz) Brummitt var. <i>obovata</i>	AC, AD	abundant		occasional	s2	Phan	Per	Ind						
<i>Crotalaria barbae</i> Schweinf.	AD	rare	occasional		hl	Ther	Ann	Ind						
<i>Crotalaria heidmannii</i> Schinz	AC, AD	occasional	occasional	occasional	hl	Ther	Ann	Ind						5318
<i>Crotalaria piscicarpa</i> Welw. ex Baker	AD	rare	occasional		hl	Hemicr	Ann	Ind						5193
<i>Crotalaria platysepala</i> Harv.	AD	rare	occasional		hl	Ther	Ann	Ind						5171; 5646
<i>Crotalaria podocarpa</i> DC.	AC, AD	rare	common		hl	Ther	Ann	Ind						
<i>Crotalaria sphaerocarpa</i> Perr. ex DC.	AD	rare	occasional		hl	Ther	Ann	Ind						
<i>Indigofera baumiana</i> Harms	AC, AD	common		common	s2	Ther	Ann	Ind						5273
<i>Indigofera charlieriana</i> Schinz var. <i>charlieriana</i>	AC, AD	occasional	occasional	occasional	hl	Ther	Ann	Ind						5169; 5274
<i>Indigofera daleoides</i> Benth. ex Harv. var.	AC, AD	common	common	occasional	hl	Ther	Ann	Ind						5160; 5651
<i>Indigofera filipes</i> Benth. ex Harv.	AC, AD	common	occasional	occasional	hl	Ther	Ann	Ind						5117; 5295
<i>Indigofera flavicans</i> Baker	AC, AD	common	occasional	common	hl	Ther	Ann	Ind						5156; 5291
<i>Indigofera inhambanensis</i> Klotzsch	AD	occasional		occasional	s2	Cham	Per	Ind						5279
<i>Indigofera trita</i> L. f. ssp. <i>subulata</i> (Vahl ex Poir.) Ali	AC, AD	common	occasional		s2	Ther	Ann	Ind						5297
<i>Tephrosia cephalantha</i> Welw. ex Baker	AD	rare	occasional	occasional	s2	Cham	Per	Ind						5716
<i>Tephrosia lupinifolia</i> DC.	AC, AD	common	occasional	occasional	hl	Hemicr	Per	Ind						5152
<i>Tephrosia oxygona</i> Welw. ex Baker ssp. <i>oxygona</i>	AD	rare		occasional	s2	Cham	Per	Ind						5717
<i>Tephrosia purpurea</i> (L.) Pers. ssp. <i>leptostachya</i> (DC.) Brummitt var. <i>leptostachya</i>	AC, AD	common	occasional	occasional	hl	Ther	Ann	Ind						5176; 5313
<i>Mundulea sericea</i> (Willd.) A.Chev.	AC, AD	occasional	common	common	s2	Phan	Per	Ind			Tox			
<i>Stylosanthes fruticosa</i> (Retz.) Alston	AC, AD	occasional	common	occasional	S2	Ther	Ann	Ind						5144; 5298
<i>Zornia glochidiata</i> DC.	AD	rare	occasional		hl	Ther	Ann	Ind						5195
<i>Pterocarpus angolensis</i> DC.	AC, AD	abundant		common	t1	Phan	Per	Ind	F	LRnt				
<i>Lonchocarpus neisii</i> (Schinz) Heering & Grimme	AC, AD	common	common	common	t3	Phan	Per	Ind	F					
<i>Rhynchosia minima</i> (L.) DC. var. <i>minima</i>	AC, AD	occasional	occasional	occasional	hl	Cham	Per	Ind						5321
<i>Rhynchosia totta</i> (Thunb.) DC. var. <i>totta</i>	AC, AD	rare	occasional	occasional	hl	Cham	Per	Ind						5166; 5172
<i>Rhynchosia venulosa</i> (Hiem) K.Schum.	AC, AD	common	occasional	occasional	hl	Cham	Per	Ind						5299; 5309
<i>Vigna lobatifolia</i> Baker	AC, AD	occasional	common	occasional	hl	Geo	Per	Ind						5696
<i>Vigna unguiculata</i> (L.) Walp. ssp. <i>dekindtiana</i> (Harms) Verdc. var. <i>hullensis</i> (Welw. Ex Baker) B.J. Plenaar	AD	occasional	occasional	occasional	hl	Geo	Per	Ind						5654
<i>Vigna frutescens</i> A. Rich.	AD	rare			hl	Geo	Per	Ind						5137
<i>Oloptera burchellii</i> DC.	AD	rare		common	hl	Cham	Per	Ind						
Zygophyllaceae														
<i>Tribulus terrestris</i> L.	AD	rare	common		hl	Ther	Ann	Ind		Wd		Tox		
<i>Tribulus zeyheri</i> Sond.	AD	rare	occasional		hl	Hemicr	Ann	Ind		Wd		Tox		
Burseraceae														
<i>Commiphora africana</i> (A.Rich.) Engl.	AC, AD	common	common	common	s2	Phan	Per	Ind						
<i>Commiphora angolensis</i> Engl.	AC, AD	common	common	common	s2	Phan	Per	Ind						

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<i>Commiphora glandulosa</i> Schinz	AC, AD	occasional	occasional	s2	Phan	Per	Ind						
Malpighiaceae													
<i>Sphedamnocarpus pruriens</i> (Juss.) Szyszyl. ssp. <i>pruriens</i>	AD	rare	occasional	hl	Ther	Ann	Ind						5198
Polygalaceae													
<i>Polygala albida</i> Schinz	AC, AD	rare	rare	hl	Ther	Ann	Ind						5886
<i>Polygala schinziana</i> Chodat	AC, AD	common	occasional	hl	Hemicr	Ann	Ind						5202; 5320
<i>Securidaca longepedunculata</i> Fresen.	AD, AC	occasional	occasional	t2	Phan	Per	Ind	F					5344
Dichapetalaceae													
<i>Dichapetalum cymosum</i> (Hook.) Engl.	AC, AD	rare	common	hl	Hemicr	Per	Ind		Wd		Tox		5708
<i>Dichapetalum rhodesicum</i> Sprague & Hutch.	AD	rare	common	hl	Hemicr	Per	Ind						5161
Euphorbiaceae													
<i>Phyllanthus maderaspatensis</i> L.	AC, AD	rare	occasional	hl	Cham	Per	Ind						
<i>Phyllanthus omahakensis</i> Dinter & Pax	AC, AD	common	occasional	hl	Hemicr	Ann	Ind						5280; 5624
<i>Phyllanthus pentandrus</i> Schumacher & Thonn.	AC, AD	abundant	occasional	hl	Ther	Ann	Ind						5119; 5269
<i>Croton gratissimus</i> Burch. var. <i>gratissimus</i>	AC, AD	common	common	s1	Phan	Per	Ind						
<i>Erythrococca menyharthii</i> (Pax) Prain	AD	rare	occasional	s2	Phan	Per	Ind						5197; 5647
<i>Seidelia firmula</i> (Prain) Pax & K. Hoffm.	AD	rare	common	hl	Ther	Ann	Ind						5209
<i>Acalypha segetalis</i> Müll.Arg.	AC, AD	rare	occasional	hl	Ther	Ann	Ind						
<i>Acalypha villicaulis</i> Hochst. ex A. Rich.	AC, AD	occasional	common	s2	Cham	Per	Ind						5191; 5323
<i>Micrococca mercurialis</i> (L.) Benth.	AD	rare	occasional	hl	Ther	Per	Ind						5639
<i>Tregia okanyua</i> Pax	AC, AD	common	occasional	hl	Cham	Per	Ind						5302
<i>Tragia dioica</i> Sond.	AD	rare		hl	Ther	Ann	Ind						5184
<i>Cephalocroton mollis</i> Klotzsch	AC, AD	rare	common	s2	Cham	Per	Ind						
<i>Schinziophyton rautanenii</i> (Schinz) Raddl.-Sm.	AC, AD	occasional		t2	Phan	Per	Ind	F					
<i>Euphorbia forskalii</i> J. Gay in Webb & Berthel.	AC, AD	rare	common	hl	Ther	Ann	Ind						5210
<i>Euphorbia inaequilatera</i> (Sond.) Soják	AD	rare	occasional	hl	Ther	Ann	Ind						
<i>Euphorbia neopolycnemoides</i> Pax & K. Hoffm.	AD	occasional	occasional	hl	Ther	Ann	Ind						5123; 5272
Anacardiaceae													
<i>Lannea gossweileri</i> Exell & Mendonça ssp. <i>gossweileri</i>	AC, AD	common	common	s2	Cham	Per	Ind						5631
<i>Ozoroa paniculosa</i> (Sond.) R. & A. Fern.	AD	rare	occasional	s1	Phan	Per	Ind						
<i>Ozoroa schinzii</i> (Engl.) R. & A. Fern.	AC, AD	common	common	s2	Phan	Per	Ind						5125
<i>Rhus tenuinervis</i> Engl.	AC, AD	common	common	s2	Phan	Per	Ind						5124
Celastraceae													
<i>Gymnosporia senegalensis</i> (Lam.) Loes.	AC, AD	rare	common	s2	Phan	Per	Ind						
<i>Reissantia parviflora</i> (N.E.Br.) N. Halle	AC, AD	occasional	occasional	s2	Phan	Per	Ind						5310; 5711
<i>Salacia luebbertii</i> Loes.	AC, AD	rare	occasional	s2	Phan	Per	Ind						
Rhamnaceae													
<i>Ziziphus mucronata</i> Willd.	AC, AD	occasional	common	s1	Phan	Per	Ind						
<i>Helinus integrifolius</i> (Lam.) Kuntze	AC, AD	occasional	common	s2	Cham	Per	Ind						
<i>Helinus spartioides</i> (Engl.) Schinz ex Engl.	AC, AD	rare	common	s2	Cham	Per	Ind						
Vitaceae													
<i>Cyphostemma cirrhosum</i> (Thunb.) Desc. ex Wild & R.B. Drumm.	AD	rare	occasional	hl	Geo	Per	Ind						
<i>Cyphostemma sandersonii</i> (Harv.) Desc.	AD	rare	rare	hl	Geo	Per	Ind		L/Rnt				5307
Tiliaceae													
<i>Corchorus tridens</i> L.	AC, AD	rare	occasional	hl	Ther	Ann	Ind						5170
<i>Grewia avellana</i> Hiern	AC, AD	occasional	common	s2	Cham	Per	Ind						
<i>Grewia bicolor</i> Juss.	AC, AD	common	common	s2	Phan	Per	Ind						

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<i>Grewia flava</i> DC.	AC, AD	common	common	s2	Phan	Per	Ind						5115
<i>Grewia flavescens</i> Juss. var. <i>flavescens</i>	AC, AD	occasional	occasional	s2	Phan	Per	Ind						5296
<i>Grewia flavescens</i> Juss. var. <i>olukondae</i> (Schinz) Wild	AC, AD	occasional	occasional	s2	Phan	Per	Ind						5150
<i>Grewia falcistipulata</i> K. Schum.	AD	rate	occasional	s2	Phan	Per	Ind						
Malvaceae													
<i>Sida cordifolia</i> L.	AD	rate	occasional	s2	Hemicr	Ann	Ind		Wd				
<i>Sida ovata</i> Forssk.	AC, AD	occasional	common	s2	Cham	Per	Ind						5118
<i>Pavonia burchellii</i> (DC.) R.A.Dyer	AC, AD	occasional	occasional	hl	.....	Per	Ind						
<i>Pavonia clathrata</i> Mast.	AC, AD	common	occasional	hl	Cham	Per	Ind						5168; 5305
<i>Hibiscus caesioides</i> Garkke	AC, AD	occasional	occasional	hl	Cham	Per	Ind						
<i>Hibiscus calyphyllus</i> Cav.	AC, AD	occasional	common	s2	Cham	Per	Ind						5634
<i>Hibiscus mastersianus</i> Hiern	AC, AD	occasional	occasional	s2	Cham	Per	Ind						5164; 5648
<i>Hibiscus palmatus</i> Forssk.	AD	rate	rare	hl	Hemicr	Ann	Ind						
<i>Hibiscus sififormis</i> Baill.	AC, AD	rate	rate	hl	Ther	Ann	Ind						5332
Sterculiaceae													
<i>Melania acuminata</i> Mast.	AC, AD	occasional	occasional	s2	Cham	Per	Ind						
<i>Melania forbesii</i> Planch. ex Mast.	AC, AD	occasional	common	s2	Cham	Per	Ind						5179
<i>Hermannia guerkeana</i> K.Schum.	AC, AD	occasional	occasional	s2	Cham	Per	Ind						5336
<i>Hermannia tomentosa</i> (Turcz.) Schinz ex Engl.	AC, AD	common	occasional	hl	Cham	Per	Ind						5140; 5329
<i>Waltheria indica</i> L.	AC, AD	occasional	common	hl	Hemicr	Per	Ind						
Ochnaceae													
<i>Ochna cinnabarina</i> Engl. & Gilg	AC, AD	occasional	common	s2	Cham	Per	Ind						
<i>Ochna pulchra</i> Hook.	AC, AD	wide-spread	occasional	t3	Phan	Per	Ind	F					
Passifloraceae													
<i>Basaninthe pedata</i> (Baker f.) W.J.de Wilde	AC, AD	occasional	occasional	hl	Ther	Ann	Ind						5127; 5285
<i>Adenia repanda</i> (Burch.) Engl.	AD	rate	rare	hl	Geo	Per	Ind						
Combretaceae													
<i>Combretum collinum</i> Fresen.	AC, AD	wide-spread	common	t2, t3, s1	Phan	Per	Ind						
<i>Combretum engleri</i> Schinz	AC, AD	occasional	common	s1	Phan	Per	Ind						
<i>Combretum hereroense</i> Schinz	AC, AD	occasional	common	s1	Phan	Per	Ind						
<i>Combretum imberbe</i> Wawira	AC	rate	common	t2	Phan	Per	Ind	F					
<i>Combretum psidioides</i> Welw.	AC, AD	common	common	t3, s1	Phan	Per	Ind						
<i>Combretum zeyheri</i> Sond.	AC, AD	common	common	s1	Phan	Per	Ind						
<i>Terminalia sericea</i> Burch. ex DC.	AC, AD	wide-spread	occasional	t2, t3, s1	Phan	Per	Ind		Wd				
Apiaceae													
<i>Steganotaenia araliacea</i> Hochst.	AC, AD	rate	common	s1	Phan	Per	Ind						
Ebenaceae													
<i>Diospyros chamaethamnus</i> Mildbr.	AC, AD	common	common	s2	Cham	Per	Ind						5114; 5706
<i>Diospyros lycioides</i> Desf.	AD	rate		s2	Phan	Per	Ind						
Loganiaceae													
<i>Strychnos cocculoides</i> Baker	AC, AD	occasional	common	t3	Phan	Per	Ind	F					5163
<i>Strychnos pungens</i> Soler.	AC, AD	common	common	t3	Phan	Per	Ind	F					
Apocynaceae													
<i>Diplorhynchus condylocarpon</i> (Mull.Arg.) Pichon	AC, AD	abundant	common	t3	Phan	Per	Ind						5304
<i>Baisea wulfhorstii</i> Schinz	AC, AD	occasional	common	hl	Lian	Per	Ind						
Periplocaceae													
<i>Cryptolepis oblongifolia</i> (Meisn.) Schltr.	AC, AD	occasional	occasional	s2	Cham	Per	Ind						5718
<i>Raphionacme velutina</i> Schltr.	AC, AD	abundant	occasional	hl	Geo	Per	Ind						5146; 5277

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Asclepiadaceae														
<i>Sarcostemma viminale</i> (L.) R.Br. ssp. <i>thunbergii</i> (Don) Liede & Meve	AC, AD	rate	common	common	s2	Cham	Per	Ind				Tox		5695
<i>Orthanthera jasminiflora</i> (Decne.) Schinz	AD	rate	occasional		hl	Geo	Per	Ind						
<i>Ceropegia lugardae</i> N.E.Br.	AD	rate	rate		hl	Geo	Per	Ind	P_C2					5700
<i>Ceropegia nilotica</i> Kotschy	AD	rate	occasional	rate	hl	Geo	Per	Ind	P_C2					5324
<i>Orbeopsis lutea</i> (N.E.Br.) L.C.Leach	AC	rate	rate	rate	hl	Hemicr	Per	Ind	P					
<i>Marsdenia sylvestris</i> (Retz.) P.I.Forst.	AD	rate	rate	rate	s1	Phan	Per	Ind						5633
Convolvulaceae														
<i>Evolvulus alsinoides</i> (L.) L.	AC, AD	common	occasional	occasional	hl	Hemicr	Per	Ind						
<i>Jacquemontia tammifolia</i> (L.) Griseb.	AC, AD	occasional	occasional	common	hl	Ther	Ann	Ind						
<i>Merremia pinnata</i> (Hochst. ex Choisy) Hallier f.	AD	rate	rate	rate	hl	Ther	Ann	Ind						
<i>Merremia verecunda</i> Rendle	AD	rate	occasional	occasional	hl	Ther	Ann	Ind						
<i>Xenostegia tridentata</i> (L.) D.F.Austin & Staples	AD, AD	common	occasional	occasional	hl	Ther	Ann	Ind						5328
ssp. <i>angustifolia</i> (Jacq.) A.Meeuse	AC	rate	rate	rate	hl	Hemicr	Per	End						
<i>Astipomoea rotundata</i> (Plig.) A.Meeuse	AC, AD	occasional	occasional	occasional	hl	Geo	Per	Ind						
<i>Ipomoea bolusiana</i> Schinz	AC, AD	occasional	occasional	occasional	hl	Ther	Ann	Ind						5142
<i>Ipomoea chloroneura</i> Hallier f.	AC, AD	occasional	occasional	occasional	hl	Ther	Ann	Ind						
<i>Ipomoea coptica</i> (L.) Roth ex Roem. & Schult.	AD	rate	occasional	occasional	hl	Geo	Per	Ind						5645
<i>Ipomoea hacketiana</i> (Schinz) Hallier f.	AC, AD	rate	occasional	common	hl	Ther	Ann	Ind						
<i>Ipomoea magnusiana</i> Schinz	AD	rate	occasional	occasional	hl	Geo	Per	Ind						
<i>Ipomoea obscura</i> (L.) Ker Gawl. var. <i>obscura</i>	AD	occasional	occasional	occasional	hl	Ther	Ann	Ind						
<i>Ipomoea sinensis</i> (Desr.) Choisy	AC, AD	occasional	occasional	common	hl	Ther	Ann	Ind						
<i>Ipomoea suffruticosa</i> Burch.	AD	rate	occasional	occasional	hl	Geo	Per	Ind						5720
<i>Ipomoea verbascoidea</i> Choisy	AD	rate	rate	occasional	hl	Geo	Per	Ind						5339
Boraginaceae														
<i>Ehretia rigida</i> (Thunb.) Druce	AC, AD	occasional	occasional	occasional	s2	Phan	Per	Ind						
<i>Heliotropium</i> species	AD	rate	rate	occasional	hl									
Verbenaceae														
<i>Lantana angolensis</i> Moldenke	AC, AD	occasional	occasional	occasional	s2	Cham	Per	Ind						
Lamiaceae														
<i>Clerodendrum dekindtii</i> Gürke	AC, AD	occasional	occasional	occasional	s2	Phan	Per	Ind						
<i>Clerodendrum tematum</i> Schinz	AC, AD	abundant	common	occasional	hl	Cham	Per	Ind						
<i>Clerodendrum uncinatum</i> Schinz	AC, AD	rate	common	occasional	hl	Hemicr	Per	Ind						
<i>Tinnea enocalyx</i> Welw.	AC	rate	rate	occasional	s2	Hemicr	Per	Ind						5689
<i>Acrotome angustifolia</i> G. Taylor	AC, AD	common	occasional	occasional	hl	Ther	Ann	Ind						5139; 5286
<i>Tetradenia riparia</i> (Hochst.) Codd	AC, AD	rate	common	common	s2	Cham	Per	Ind						
<i>Hemizygia bracteosa</i> (Benth.) Briq.	AC, AD	common	occasional	occasional	hl	Ther	Ann	Ind						
<i>Ocimum americanum</i> L. var. <i>americanum</i>	AC, AD	rate	occasional	occasional	hl	Ther	Ann	Ind						
Solanaceae														
<i>Solanum catombelense</i> Peyr.	AD	rate	common	common	s2	Cham	Per	Ind						5308
<i>Solanum delagoense</i> Dunal	AC, AD	rate	occasional	occasional	s2	Cham	Per	Ind						5185; 5649
Scrophulariaceae														
<i>Alectra orobanchioides</i> Benth.	AC	rate	rate	common	hl	Para	Ann	Ind						5683
<i>Striga asiatica</i> (L.) Kuntze	AC, AD	occasional	occasional	occasional	hl	Semi-par	Ann	Ind						5143; 5691
<i>Striga gesnerioides</i> (Willd.) Vatke ex Engl.	AC, AD	rate	rate	rate	hl	Para	Ann	Ind						
Bignoniaceae														
<i>Rhigozum brevispinosum</i> Kuntze	AD	rate	common	common	s2	Phan	Per	Ind						

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Pedaliaceae														
<i>Harpagophytum zeyheri</i> Decne.	AC, AD	occasional	common	common	hl	Geo	Per	Ind						5335
<i>Sesamum alatum</i> Thonn.	AC, AD	common	occasional	occasional	hl	Ther	Ann	Ind						5159; 5276
<i>Dicerocaryum eriocarpum</i> (Decne.) Abels		rate		occasional	hl	Hemicr	Per	Ind						5155; 5331
Acanthaceae														
<i>Thunbergia aurea</i> N.E.Br.	AD	rate	rare		hl	Ther	Ann	Ind						
<i>Ruellia</i> sp. nova 1 M.-J. Cadman	AC, AD	occasional	occasional	occasional	s2	Cham	Per	Ind						5333; 5637
<i>Barleria albi-pilosa</i> Hainz	AC, AD	occasional	common	common	hl	Cham	Per	Ind						5650
<i>Barleria macrostegia</i> Nees	AC, AD	rate	common	common	hl	Cham	Per	Ind						5685
<i>Blepharis integrifolia</i> (L.f.) E.Mey. ex Schinz var. <i>integrifolia</i>	AC, AD	rate		common	hl	Ther	Ann	Ind						
<i>Blepharis maderaspatensis</i> (L.) B. Heyne ex Roth ssp. <i>rubifolia</i> (Schumach.) Napper	AC, AD	rate	occasional	common	hl	Ther	Ann	Ind						5314; 5694
<i>Blepharis obmitrata</i> C.B. Clarke	AC, AD	occasional	common	occasional	hl	Cham	Ann	Ind						
<i>Asystasia gangetica</i> (L.) T. Anderson	AC	rate		rate	hl	Ther	Ann	Ind						
<i>Hypoestes forskoolii</i> (Vahl) R.Br.	AC, AD	occasional		occasional	hl	Cham	Per	Ind						5122; 5326
<i>Justicia betonica</i> L.	AD	rate	occasional		hl	Ther	Ann	Ind						5196; 5317
<i>Justicia odorata</i> (Forssk.) Nees	AD	rate			s2	Hemicr	Per	Ind						5183
<i>Monechma debile</i> (Forssk.) Nees	AD	rate		occasional	hl	Ther	Ann	Ind						5143; 5623
<i>Monechma spartioides</i> (T. Anderson) C.B. Clarke	AC, AD	rate	common	occasional	s2	Cham	Per	Ind						
Rubiaceae														
<i>Kohautia amboensis</i> (Schinz) Bremek.		rate	rare		hl	Ther	Ann	End		DD				5194
<i>Kohautia azurea</i> (Dinter & K. Krause) Bremek.	AC, AD	rate	occasional	common	hl	Ther	Ann	End						5315
<i>Kohautia caespitosa</i> Schinzl. ssp. <i>brachyloba</i> (Sond.) D. Mantell	AC, AD	occasional	occasional	occasional	hl	Ther	Ann	Ind						5303
<i>Kohautia virgata</i> (Willd.) Bremek.	AD	rate		common	hl	Ther	Ann	Ind						5192
<i>Oldenlandia herbacea</i> (L.) Roxb. var. <i>herbacea</i>	AD	rate			hl	Ther	Ann	Ind						5697
<i>Gardenia brachyhammus</i> (K. Schum.) Launert	AC, AD	common	common	occasional	s2	Cham	Per	Ind						5151
<i>Gardenia ternifolia</i> Schumach. & Thonn.	AD	rate			hl	Hemicr	Per	Ind						
<i>Vangueria infausta</i> Burch.	AD	rate	rate	common	s1	Phan	Per	Ind						
<i>Fadogia thaminus</i> K. Schum.	AC, AD	rate		occasional	hl	Hemicr	Per	Ind						5709
<i>Fadogia tomentosa</i> De Wild. ssp. <i>clavescens</i> (Verdc.) Verdc.	AC, AD	occasional		occasional	s2	Cham	Per	Ind						5638
<i>Pavetta zeyheri</i> Sond.	AC, AD	rate	common	common	s2	Phan	Per	Ind						
<i>Spermacoce senensis</i> (Klotzsch) Hiern	AD	occasional	occasional	occasional	hl	Ther	Ann	Ind						5157; 5628
Cucurbitaceae														
<i>Zehneria marlothii</i> (Cogn.) R. & A. Fern.	AC, AD	rate	occasional	occasional	hl	Ther	Ann	Ind						5682
<i>Acanthosicyos naudinianus</i> (Sond.) C. Jeffrey	AC, AD	abundant	occasional	occasional	hl	Geo	Per	Ind						
<i>Momordica balsamina</i> L.	AC, AD	rate	rate	rate	hl	Ther	Ann	Ind						5693
<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai	AC, AD	rate	rate	occasional	hl	Ther	Ann	Ind						5625
<i>Cucumis africanus</i> L.f.	AC, AD	rate	rate	occasional	hl	Hemicr	Ann	Ind			Tox			
<i>Cucumis humifructus</i> Stent	AC, AD	rate	rate	rate	hl	Ther	Ann	Ind		DD				5630
<i>Cucumis kalahariensis</i> A. Meeuse	AD	rate		occasional	hl	Geo	Per	Ind						5690
Asteraceae														
<i>Eriangea misera</i> (Oliv. & Hiern) S. Moore	AC	rate		common	hl	Ther	Ann	Ind						5680
<i>Vernonia fastigiata</i> Oliv. & Hiern		rate			hl	Ther	Ann	Ind						5212

	QDS	Overall abundance	Abundance in: Acacia Savannas	Kavango Woodlands	Layer	Life form	Periodicity	Alien/ Indigenous/ Endemic	Legal Status	Ecological status	Indicator	Palatability	Metabolism	Voucher
<i>Vernonia poskeana</i> Vatke & Hildebr. ssp. <i>botswanaica</i> G.V.Pope	AC, AD	abundant	occasional	common	hl	Ther	Ann	Ind						
<i>Vernonia poskeana</i> Vatke & Hildebr. white form	AD	occasional	occasional	common	hl	Ther	Ann	Ind						5129; 5687
<i>Melanthera marlothiana</i> O. Hoffm.	AC, AD	occasional	occasional	common	s2	Ther	Ann	Ind						5175; 5322
<i>Bidens bifurcata</i> (Lour.) Mierl. & Sherff	AC, AD	occasional		common	hl	Ther	Ann	Ali		Wd				
<i>Bidens pilosa</i> L.	AC, AD	occasional		occasional	hl	Ther	Ann	Ali		Wd				5203
<i>Bidens schimperii</i> Sch.Bip. ex Walp.	AC, AD	occasional		occasional	hl	Ther	Ann	Ind						5145
<i>Plectaxis antunesii</i> O.Hoffm.	AD	rare		occasional	hl	Hemicr	Per	Ind						5719
<i>Dicoma schinzii</i> O.Hoffm.	AC, AD	occasional		occasional	hl	Hemicr	Per	Ind						5189