Bothalia 34,1: 61–71 (2004)

Grass assemblages and diversity of conservation areas on the coastal plain south of Maputo Bay, Mozambique

S.J. SIEBERT*, L. FISH**, M.M. URAS*** and S.A. IZIDINE†

Keywords: dunes, forest, grasses, grassland, Maputaland, Mozambique, Poaceae, woodland

ABSTRACT

A floristic analysis of the grass species assemblages of the Licuati Forest and Maputo Elephant Reserves south of Maputo Bay, Mozambique, is presented. Sampling of grass data was undertaken in six previously described, major vegetation types. TWINSPAN divisions distinguished grass assemblages that are characteristic for these major vegetation types of the study area. The results were supported by an Indirect Gradient Analysis. Further TWINSPAN divisions of a larger Maputaland data set indicated a floristic relationship between grass assemblages of similar major vegetation types in the study area and South Africa. This relationship was supported by high similarity values (> 65%), obtained with Sorenson's Coefficient. The coefficient also indicated varying degrees of similarity between grass assemblages of different major vegetation types within the study area. A rich diversity of 115 grass species and infraspecific taxa was recorded for the study area. The Chloridoideae and Panicoideae dominate the grass diversity and the genera with the most species include *Eragrostis*, *Panicum* and *Digitaria*. Most grass species in the study area are perennials and have a tufted growth form, but this varies considerably between vegetation types.

INTRODUCTION

Despite the importance of the Poaceae to both subsistence and commercial agriculture (Myre 1971; Tainton *et al.* 1976) and the continued documentation of the rich diversity of this family in southern Africa (Gibbs Russell *et al.* 1990; Kobisi & Kose 2003), some areas still remain poorly studied and documented. One particular area is the coastal plain of Mozambique south of Maputo Bay. Although Myre (1964) and De Boer *et al.* (2000) provided a comprehensive account of the vegetation south of Maputo Bay in Mozambique, the descriptions of the grass layer contained limited taxonomic and floristic information.

In this paper the grass diversity of the coastal plain south of Maputo Bay is revisited to investigate the following hypotheses based on current knowledge: 1, different grass assemblages characterize the major vegetation types of the study area; 2, a floristic relationship exists between grass assemblages of different major vegetation types within the study area; 3, there is a floristic relationship between grass assemblages of the study area and similar vegetation types in South Africa; 4, species that form the grass assemblage for a major vegetation type are characterized by certain life/growth forms; 5, dominance of different Poaceae subfamilies in the study area correspond with predictions made previously; and 6, there is a rich diversity of grasses in the study area.

STUDY AREA

The study area comprises the Maputo Elephant Reserve and Licuati Forest Reserve on the Maputaland coastal plain, south of Maputo Bay in Mozambique (Figure 1). Maputaland is an important centre of plant endemism and diversity of Mozambique, South Africa and Swaziland (Van Wyk & Smith 2001), defined as the biogeographical area bounded by the Inkomati-Limpopo River in the north, Indian Ocean in the east, foothills of the Lebombo Mountains in the west and St Lucia estuary in the south.

The topography comprises high, linear, north-south oriented dune cordons along the inland margin of the coast. The youngest of these dunes are probably 10 000–30 000 years old, making them in geological terms some of the youngest formations in southern Africa (Botha 1997). These high dune cordons mark a succession of marine regressions that deposited these sediments. Marine siltstone underlies these sediment deposits and in turn, the sediment deposits underlie the dune sand deposits currently defining the surface relief in this area.

Maputaland lies within a transitional zone between the tropics and subtropical coastal conditions to the south (Bruton & Cooper 1980), with warm to hot summers (mean of 27°C in January) and cool to warm winters with no frost (mean of 16°C in July). Mean relative air humidity is high along the coast, namely 55% in August and 90% in February. Summers are wetter than winters, although rain is received throughout the year. Mean annual rainfall is higher along the coast (1 100 mm/year) and declines progressively inland (600 mm/year). Morning mist is common in the dry season.

The study area comprises the major terrestrial vegetation types recognized and defined for this floristic region by Myre (1964), De Boer *et al.* (2000) and Matthews *et al.* (1999, 2001), namely Coastal Woodland, Dune Forest, Licuati (Sand) Forest, Primary Dunes, Reed Beds and Woody Grassland.

* Department of Botany, University of Zululand, Private Bag X1001, 3886 KwaDlangezwa.
** National Botanical Institute, Private Bag X101, 0001 Pretoria.
*** National Botanical Research Institute, Private Bag X13184, Windhoek, Namibia.
† National Institute for Agronomic Research, P.O. Box 3658, Mavalane, Maputo, Mozambique.
MS. received: 2003-03-14.

FIGURE 1.—Locality of the Maputo Elephant and Licuati Forest Reserves in Mozambique and the Tembe Elephant Park and Sileza Nature Reserve in South Africa.

METHODS

Sampling sites were randomly selected using topographic maps and aerial photographs. Plots were placed in vegetation types conforming to the descriptions of Matthews *et al.* (1999, 2001), avoiding the edges of these and refraining from sampling in disturbed areas. Presence/absence of diagnostic woody species was used to identify vegetation types in the field. A vegetation type is a composition of species that recurs in a region as a result of specific combinations of environmental factors (Barbour *et al.* 1999). Reed Beds could not be sampled adequately due to high water tables. However, wetlands that feed into the Reed Beds were sampled, and these are referred to as Hygrophilous Grassland for the purpose of this study.

Twenty-one sites were sampled at the beginning of summer 2001, the peak flowering season for grasses. At each site all the grass species in a 20×20 m grid were collected and identified. Scientific names conform to Fish (2003). Voucher specimens are listed in a checklist (Appendix 1) and housed at the Maputo Herbarium (LMA), with duplicates in the Luanda Herbarium (LUAI), Natal Herbarium (NH), Pretoria National Herbarium (PRE) and University of Zambia Herbarium (UZL). The LMA collection was consulted to identify sterile specimens and to locate fertile voucher specimens for these species. If none were found, sterile specimens were provisionally identified, but listed without voucher specimens in the checklist.

A floristic classification of grass data for the Licuati Forest and Maputo Elephant Reserves was obtained by the application of Two-Way Indicator Species Analysis (TWINSPAN) (Hill 1979a). The multivariate analysis divided the data set, comprising all collected grass species and their presence/absence data per plot, into nodes. In MEGATAB (Hennekens 1996) the resultant classification was summarized in a synoptic table to reflect percentage occurrence of each species per node (major vegetation type) and refined with Braun-Blanquet procedures to group species in assemblages. Detrended Correspondence Analysis (DECORANA) (Hill 1979b) was applied to the data set to illustrate vegetation gradients and floristic relationships.

A second data set containing grass species presence/absence data from the study area was merged with data from studies conducted in Sileza Nature Reserve (Matthews *et al.* 1999) and Tembe Elephant Park (Matthews *et al.* 2001). Vegetation types from these conservancies in South Africa were chosen for comparison because of their similar grass flora, status as pristine environments, proximity to the study area, and formal classification and description as representative of northern Maputaland. The TWINSPAN divisions depicting the floristic relationship are illustrated in a dendrogram (Figure 2).

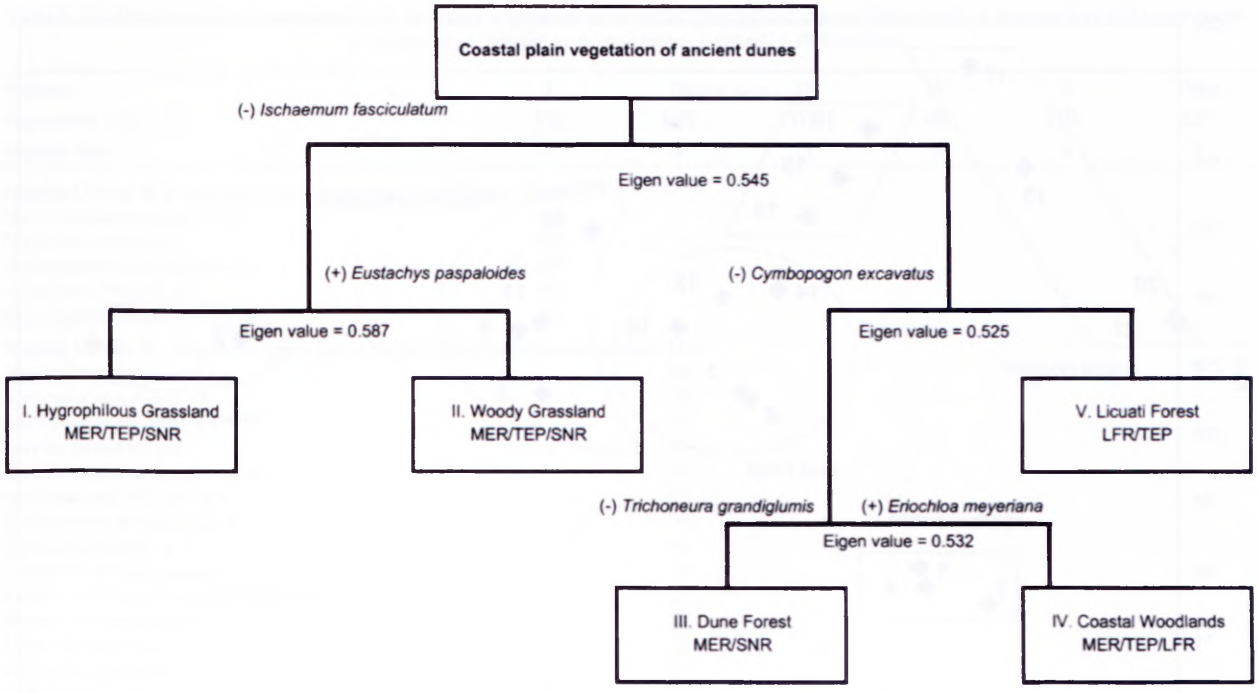

FIGURE 2.—Dendrogram of a TWINSPAN division depicting the floristic relationships between the grass assemblages of the major vegetation types of four protected areas of the Maputaland coastal plain in Mozambique and South Africa. LFR, Licuati Forest Reserve; MER, Maputo Elephant Reserve; SNR, Sileza Nature Reserve; TEP, Tembe Elephant Park.

The species richness of grasses was calculated as the number of species per major vegetation type (homogeneous unit) in the study area (Whittaker 1978). Rare and threatened species were identified as either endemic (Van Wyk 1996) and/or Red Data List (Izidine & Bandeira 2002). Character species were defined as species that are relatively restricted to specific vegetation types (Westhoff & Van der Maarel 1978). Recognition as an introduced alien species was based on Fish (2003). Life cycles (annual or perennial) and growth form (tufted, rhizomatous and/or stoloniferous) of each species followed Gibbs Russell *et al.* (1990). Sorenson's Index (Mueller-Dombois & Ellenberg 1974) was used to determine the beta diversity between the vegetation types of the study area and between different reserves in Maputaland.

Floristic diversity of the Poaceae subfamilies/tribes, and the distribution of these taxonomic units within the different vegetation types were presented in tables to interpret and compare current patterns of grass diversity with what was previously predicted for southern Africa (Gibbs Russell 1986, 1988).

RESULTS AND DISCUSSION

The resultant hierarchical division of the sample plots from the TWINSPAN analysis (Table 1) resulted in the classification of distinct grass assemblages associated with six major terrestrial vegetation types of the Maputaland coastal plain in Mozambique, namely Coastal Woodland, Dune Forest, Hygrophilous Grassland, Licuati Forest, Primary Dunes and Woody Grassland. The ordination clusters (Figure 3) obtained for the first and second axes tended to substantiate the groups identified in the TWINSPAN classification. A TWINSPAN division of the Mozambican grass data merged with sample plots from South Africa resulted in a hierarchy of assemblages that confirms that a floristic link exists between these different parts of Maputaland (Figure 2).

Grass assemblages

1. *Grass assemblage of Primary Dunes*
Locality: Maputo Elephant Reserve

This assemblage is restricted to the upper reaches of beaches, bordering on the seaward side of primary dunes. Grasses are mostly pioneers and are not only associated with the unstable seashore dunes, but also occur further inland along freshwater and saline marshes, and in disturbed places such as road reserves. Grasses of the assemblage prefer light shade, but tolerate full sun.

Character species for this grass assemblage are given in species group A (Table 1). The assemblage is species poor and although predominantly characterized by perennials, has the highest proportion of annuals (36%) in the study area. It also has the highest proportion of grass species with a stoloniferous growth form (35%). One naturalized alien grass, *Cenchrus brownii*, was recorded. Taxonomically the vegetation type is unique in that it is not characterized by the Paniceae (Panicoideae) as in the grass assemblages of the other vegetation types (Table 2), but is dominated by the Eragrostideae (Chloridoideae). The community is floristically most related to Hygrophilous Grassland (Sorenson Coefficient = 15%; Table 1) (Figure 3).

2. *Grass assemblage of Hygrophilous Grassland*
Locality: Maputo Elephant Reserve

Hygrophilous Grassland represents a vegetation type of open grassland on seasonally wet, sandy or clay soils. These seasonally wet areas may occur as inter-dune

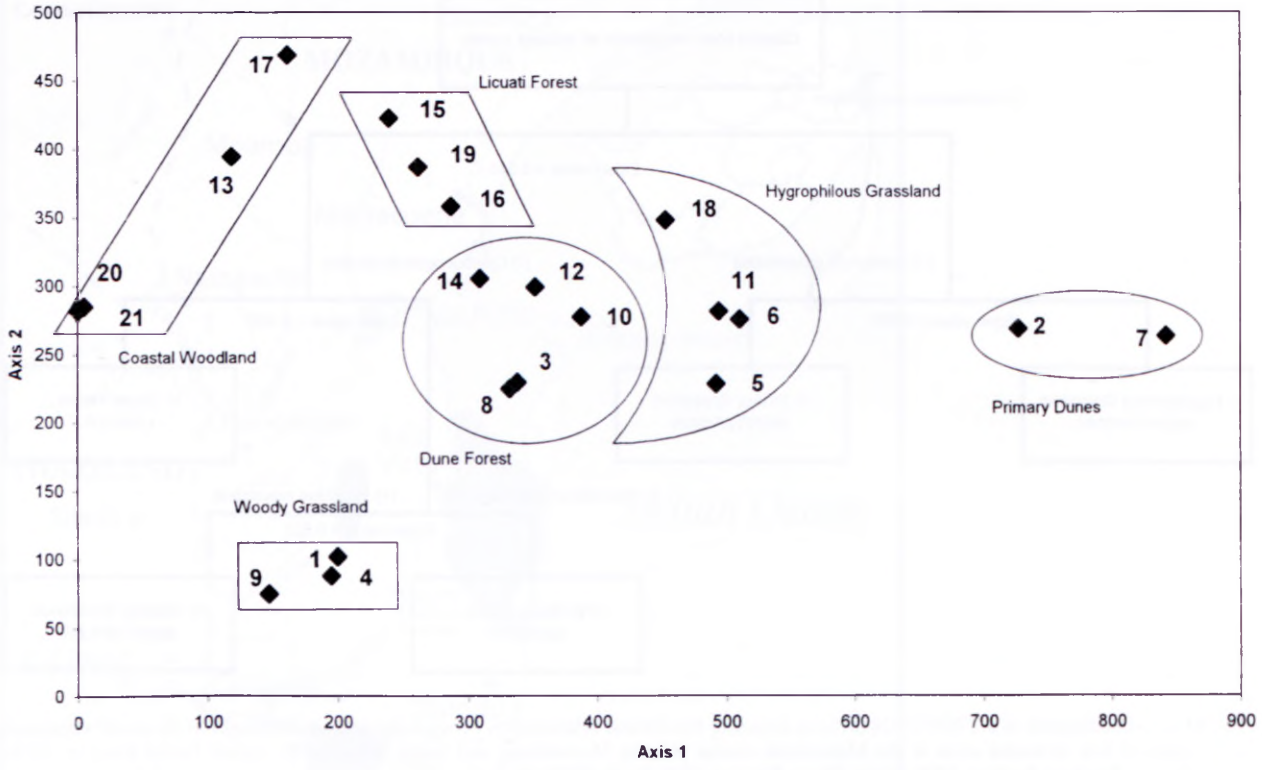

FIGURE 3.—Relative positions of sampling plots along the first and second ordination axes. Numbers refer to plots; polygons group the plots into grass assemblages.

depressions, pans, lake seepages, riverbanks and floodplains, and are characterized by high levels of organic matter and a water table of less than one metre below the soil surface. Soils are also less sandy and with a higher clay content. The biomass of the hygrophilous grass component is the highest due to dense growth under constant wet conditions.

Character species for the grass assemblage are given in species group B (Table 1). This grass assemblage is species rich (56 taxa) and tufted perennials dominate. It also has the highest proportion of rhizomatous taxa (36%). There are 15 character grass species, which is the most for any of the major vegetation types. This is the only grass assemblage in the study area characterized by representatives from the Arundineae, Aveneae and Oryzeae (Table 2). Floristically this assemblage is most related to Woody Grassland and Dune Forest (Sorenson Coefficient = 56% and 57% respectively; Table 1) (Figure 3). It also shows a high similarity in grass species composition when compared with plots from Maputaland Hygrophilous Grassland in South Africa (Sorenson Coefficient = 76%; Table 3) (Figure 2).

3. *Grass assemblage of Woody Grassland*
Locality: Maputo Elephant Reserve

Extensive grasslands occur along the coast south of Maputo Bay and is characterized by deep, well-drained sandy to loam soils and an undulating topography (dunes and floodplains). This grassland type is endemic to Maputaland and is dominated by geoxylic suffrutices which are dwarf woody plants with annual or short-lived shoots sprouting from woody, perennial underground axes. Woody Grassland is not as rich in grass species as the Hygrophilous Grassland.

Character species of the grass assemblage are given in species group D (Table 1). A low number of four character species were recorded, because grassland represents a transition between other major vegetation types. This assemblage is characterized by tufted, perennial species. The Andropogoneae (Panicoideae) dominate the assemblage (Table 2). One rare grass species, namely the Maputaland endemic *Trichoneura schlechteri*, was recorded. Floristically it is most related to Dune Forest, Coastal Woodland and Hygrophilous Grassland (Sorenson Coefficient = 62%, 58% and 56% respectively; Table 1) (Figure 3). Of all the grass assemblages in the study area, it has the lowest similarity in grass species composition when compared with similar vegetation further south in South Africa (Sorenson Coefficient = 63%; Table 3) (Figure 2).

4. *Grass assemblage of Dune Forest*
Locality: Maputo Elephant Reserve

Forests mainly occur on well-established secondary dunes and further inland. Soils are moist, deep and sandy. Forest trees have a higher diversity of creepers and understorey vegetation than the vegetation of surrounding areas. Grass species of Dune Forest prefer semi-shade and are especially common along forest margins, riverbanks, and partially disturbed and overgrazed areas.

Seven character species for this grass assemblage are given in species group F (Table 1). This grass assemblage is the most species rich (57 taxa). It is characterized by tufted perennials, has the highest number of recorded rare grass species (5) and taxonomically it is dominated by the Panicoideae, although the Eragrostideae, a tribe of the Chloridoideae, supports the highest diversity (Table 2). Along the coast, Dune Forest tends to

TABLE 1.—Diagnostic grass assemblages of the major vegetation types of the Maputaland coastal plain south of Maputo Bay in Mozambique. p, perennial; a, annual; s, stoloniferous; t, tufted; r, rhizomatous

Nodum	**I**	**II**	**III**	**IV**	**V**	**VI**
Vegetation type	**PD**	**HG**	**WG**	**DF**	**CW**	**LF**
Sample sites	**2**	**4**	**3**	**5**	**4**	**3**
Species Group A: Diagnostic grass assemblage of Primary Dunes (PD)						
Dactyloctenium australe p s	100	.	.	.	.	.
Digitaria ciliaris a t	100	.	.	.	.	.
Stenotaphrum dimidiatum p s	100	.	.	.	.	.
**Cenchrus brownii* a t	50	.	.	.	.	.
Dactyloctenium aegyptium a t s	50	.	.	.	.	.
Species Group B: Diagnostic grass assemblage of Hygrophilous Grassland (HG)						
Hemarthria altissima p r s	.	100	.	.	.	.
Acroceras macrum p r t	.	75	.	.	.	.
Andropogon eucomus p t	.	50	.	.	.	.
Leersia hexandra p r	.	50	.	.	.	.
Monocymbium ceresiiforme p r t	.	50	.	.	.	.
Andropogon huillensis p t	.	50	.	.	.	.
Echinochloa pyramidalis p r s	.	50	.	.	.	.
Panicum infestum p r t	.	50	.	.	.	.
Paspalum scrobiculatum p r s	.	50	.	.	.	.
Agrostis lachnantha var. *lachnantha* p t	.	25	.	.	.	.
Brachiaria humidicola p s	.	25	.	.	.	.
Digitaria debilis a t	.	25	.	.	.	.
Digitaria gymnostachys p t	.	25	.	.	.	.
Phragmites australis p r	.	25	.	.	.	.
Phragmites mauritianus p r	.	25	.	.	.	.
Species Group C						
Sporobolus virginicus p s r	50	50	.	.	.	.
Hyparrhenia dichroa p r t	50	25	.	.	.	.
Species Group D: Diagnostic grass assemblage of Woody Grassland (WG)						
Eragrostis sclerantha p t	.	.	70	.	.	.
Heteropogon contortus p r	.	.	30	.	.	.
Hyparrhenia filipendula var. *filipendula* p r t	.	.	30	.	.	.
Triraphis andropogonoides p r	.	.	30	.	.	.
Species Group E						
Eragrostis inamoena p t r	.	100	70	.	.	.
Ischaemum fasciculatum p r	.	100	30	.	.	.
Panicum genuflexum p t	.	75	30	.	.	.
Sorghastrum stipoides p t	.	75	30	.	.	.
Eragrostis capensis p t	.	50	30	.	.	.
Echinochloa colona a s t	.	25	30	.	.	.
Species Group F: Diagnostic grass assemblage of Dune Forest (DF)						
Digitaria argyrothricha p t r	.	.	.	80	.	.
***Panicum pleianthum* p t	.	.	.	60	.	.
Triraphis schinzii p r t	.	.	.	60	.	.
Setaria megaphylla p r t	.	.	.	40	.	.
Bothriochloa insculpta p s	.	.	.	20	.	.
Brachiaria deflexa a t	.	.	.	20	.	.
***Brachychloa schiemanniana* p s	.	.	.	20	.	.
Species Group G						
Cynodon dactylon p r s	100	75	.	20	.	.
Dactyloctenium geminatum p r s	50	75	.	60	.	.
Sporobolus africanus p r t	50	50	.	20	.	.
Species Group H						
Imperata cylindrica p r	.	75	.	20	.	.
Eragrostis ciliaris a t	.	50	.	20	.	.
Brachiaria nigropedata p t r	.	25	.	20	.	.
Dactyloctenium giganteum a t	.	25	.	20	.	.
Dinebra retroflexa var. *condensata* a t	.	25	.	20	.	.
Eragrostis species p t	.	25	.	20	.	.
Species Group I						
Eragrostis lappula p r t	.	100	70	80	.	.
Sporobolus subtilis p r t	.	75	30	60	.	.
Aristida congesta subsp. *barbicollis* p t	.	50	30	20	.	.
Elionurus muticus p t	.	50	70	40	.	.
Digitaria natalensis p t r	.	25	70	60	.	.
Sporobolus subulatus p t r	.	25	30	20	.	.
Species Group J: Diagnostic grass assemblage of Coastal Woodland (CW)						
**Coix lacryma-jobi* a t	.	.	.	.	25	.
Cenchrus ciliaris p t	.	.	.	.	25	.
Chloris virgata a t	.	.	.	.	25	.
Enneapogon scoparius p t	.	.	.	.	25	.
Eragrostis sarmentosa p r t	.	.	.	.	25	.

TABLE 1.—Diagnostic grass assemblages of the major vegetation types of the Maputaland coastal plain south of Maputo Bay in Mozambique. p, perennial; a, annual; s, stoloniferous; t, tufted; r, rhizomatous (cont.)

Nodum	**I**	**II**	**III**	**IV**	**V**	**VI**
Vegetation type	**PD**	**HG**	**WG**	**DF**	**CW**	**LF**
Sample sites	**2**	**4**	**3**	**5**	**4**	**3**
Species Group J (cont.)						
Eriochloa meyeriana subsp. *meyeriana* p t	.	.	.	.	25	.
Panicum coloratum var. *coloratum* p t	.	.	.	.	25	.
Setaria incrassata p r t	.	.	.	.	25	.
Sorghum bicolor subsp. *arundinaceum* p t	.	.	.	.	25	.
Species Group K						
Trichoneura grandiglumis p t	.	.	100	40	50	.
Eustachys paspaloides p r t	.	.	70	80	75	.
Sporobolus sanguineus p t r	.	.	70	40	25	.
Andropogon schirensis p t	.	.	30	40	25	.
Cymbopogon excavatus p t	.	.	30	80	25	.
Cymbopogon nardus p t	.	.	30	60	75	.
Melinis repens subsp. *repens* a t	.	.	30	20	25	.
Species Group L						
Eragrostis heteromera p t	.	75	.	40	25	.
Diheteropogon amplectens p r	.	75	100	40	100	.
Themeda triandra p t r	.	50	100	20	75	.
Setaria sphacelata var. *sericea* p r t	.	50	70	20	50	.
Bewsia biflora p r t	.	50	30	40	25	.
Pogonarthria squarrosa p t r	.	25	100	40	50	.
Trachypogon spicatus p r t	.	25	70	40	75	.
Sacciolepis curvata p t r	.	25	70	40	100	.
Urelytrum agropyroides p t	.	25	30	20	50	.
Urochloa mosambicensis p s t	.	25	30	20	50	.
Hyperthelia dissoluta p t	.	25	30	20	25	.
Andropogon gayanus var. *polycladus* p t	.	25	.	60	25	.
Chloris gayana p s t	.	25	.	.	25	.
Species Group M: Diagnostic grass assemblage of Licuati Forest (LF)						
Megastachya mucronata p s	.	.	.	.	.	70
Digitaria longiflora p s t	.	.	.	.	.	30
Ehrharta erecta var. *natalensis* p t	.	.	.	.	.	30
Eragrostis gummiflua p t	.	.	.	.	.	30
Oplismenus hirtellus p t	.	.	.	.	.	30
Tristachya nodiglumis p t	.	.	.	.	.	30
Melinis repens subsp. *grandiflora* a t	.	.	.	.	.	30
Species Group N						
Eragrostis superba p t	.	.	.	.	75	30
Eragrostis pallens p t	.	.	.	.	25	30
Species Group O						
Panicum deustum p r t	.	.	.	80	50	100
Sporobolus fimbriatus p t r	.	.	.	80	50	30
Brachiaria chusqueoides a t	.	.	.	80	.	70
***Eragrostis moggii* var. *moggii* p t s	.	.	.	80	.	30
Panicum heterostachyum a t	.	.	.	40	25	30
***Alloteropsis papillosa* p t	.	.	.	20	50	70
Panicum laticomum a t s	.	.	.	20	25	100
Eleusine coracana subsp. *africana* a t	50	.	.	20	.	30
Eleusine indica a s t	.	.	.	20	.	30
Species Group P						
Aristida stipitata subsp. *graciliflora* p t	.	.	100	80	75	70
***Trichoneura schlechteri* p t	.	.	30	20	25	30
Species Group Q						
Panicum maximum p t	.	50	70	80	100	30
Aristida congesta subsp. *congesta* p t	.	50	30	20	25	30
Perotis patens p t	.	50	100	40	100	30
Digitaria eriantha p s t	.	25	70	20	100	30
Panicum kalaharense p r t	.	25	30	40	25	30
Percentage perennial/annual	64 / 36	91 / 9	95 / 5	82 / 18	88 / 12	76 / 24
Percentage tufted/rhizomatous/stoloniferous	35 / 30 / 35	51 / 36 / 13	63 / 32 / 5	60 / 29 / 11	70 / 23 / 7	73 / 9 / 18
Total no. species	**11**	**56**	**40**	**57**	**43**	**25**
Restricted to community (character species)	6	15	4	7	9	7
***No. naturalized aliens**	3	0	0	0	1	0
****No. rare and threatened species**	0	0	1	5	2	3
Sorensen Coefficient (%):						
PD	*100*	15	0	9	0	0
HG	15	*100*	56	57	36	12
WG	0	56	*100*	62	58	22
DF	9	57	62	*100*	62	39
CW	0	36	58	62	*100*	41
LF	0	12	22	39	41	*100*

TABLE 2.—Numbers of species of Poaceae subfamilies/tribes recorded within major vegetation types of Maputaland, south of Maputo Bay

Subfamily/Tribe	Vegetation types*					
	PD	HG	WG	DF	CW	LF
Bambusoideae	**0**	**1**	**0**	**0**	**0**	**1**
Oryzeae	-	1	-	-	-	-
Ehrharteae	-	-	-	-	-	1
Pooideae	**0**	**1**	**0**	**0**	**0**	**0**
Aveneae	-	1	-	-	-	-
Centothecoideae	**0**	**0**	**0**	**0**	**0**	**1**
Centotheceae	-	-	-	-	-	1
Arundinoideae	**0**	**4**	**3**	**3**	**2**	**2**
Arundineae	-	2	-	-	-	-
Aristideae	-	2	3	3	2	2
Chloridoideae	**7**	**18**	**14**	**24**	**15**	**9**
Pappophoreae	-	-	-	-	1	-
Eragrostideae	6	15	12	21	10	8
Cynodonteae	1	3	2	3	4	1
Panicoideae	**4**	**32**	**23**	**30**	**26**	**12**
Paniceae	3	17	10	18	15	11
Arundinelleae	-	-	-	-	-	1
Andropogoneae	1	15	13	12	11	-
TOTAL	11	56	40	57	43	25

* CW, Coastal Woodland; DF, Dune Forest; HG, Hygrophilous Grassland; LF, Licuati Forest; PD, Primary Dunes; WG, Woody Grassland

be continuous, but inland it forms a mosaic with other vegetation types. Its grass assemblage therefore shows a strong floristic link with Woody Grassland, Coastal Woodland, Hygrophilous Grassland, and to a lesser extent Licuati Forest (Sorenson Coefficient = 62%, 62%, 57% and 39% respectively; Table 1) (Figure 3). It also shows a high similarity in grass species composition when compared with plots from Maputaland Dune Forest in South Africa (Sorenson Coefficient = 71%; Table 3) (Figure 2).

5. *Grass assemblage of Coastal Woodland*
Locality: Maputo Elephant Reserve and Licuati Forest Reserve

Savanna covers extensive areas along the coast south of Maputo Bay and stretches westwards to the foothills of the Lebombo Mountains. The vegetation type occurs on sandy soils in drier habitats with a deeper water table. The grass assemblage forms a dense herbaceous layer and is associated with light shade or full sunlight and occurs in a wide range of habitats including floodplains, dune crests, drainage lines, transition zones and disturbed areas.

Nine character species were recorded for this assemblage and are given in species group J (Table 1). Tufted perennials typically dominate this grass assemblage. Two rare species were recorded and one naturalized alien grass, *Coix lacryma-jobi*, has colonized this assemblage. This is the only grass assemblage that contains a member of the Pappophoreae and is dominated by the Panicoideae (Table 2). Dune Forest forms localized patches within Coastal Woodland, and in turn, Coastal Woodland within Woody Grassland. Hence, its grass assemblage shows a strong floristic link with Dune Forest and Woody Grassland, and to a lesser extent with Licuati Forest on which it borders (Sorenson Coefficient = 62%, 58% and 41% respectively; Table 1) (Figure 3). The assemblage is similar to that of corresponding Maputaland woodlands in South Africa (Sorenson Coefficient = 67%; Table 3) (Figure 2).

6. *Grass assemblage of Licuati Forest*
Locality: Licuati Forest Reserve

This vegetation type is endemic to Maputaland and has many rare plant species. It is restricted to the ancient coastal dunes of Maputaland, and drier (600 mm per annum) conditions than most of the other coastal forest types in southern Africa. This grass assemblage prefers moister habitats in shady places and is common along forest margins. Based on vegetation structure and species composition the forests of ancient dunes in Maputaland can be divided into Licuati Forest and Licuati Thicket (Izidine *et al.* 2003).

Character species of the grass assemblage are given in species group M (Table 1). Although it is a forest system and tufted perennials dominate the grass assemblage, this vegetation type has a high proportion (24%) of annual species. The assemblage is species poor, but a high proportion of three rare species are recorded for the assemblage. This is the only vegetation type in the study area with representatives from the Arundinelleae, Centotheceae and Ehrharteae, and the only one without a representative of the Andropogoneae (Table 2). This grass assemblage is related to Coastal Woodland and Dune Forest as a result of similar microhabitats (Sorenson Coefficient = 41% and 39% respectively; Table 1) (Figure 3). It also shows a high similarity in grass species composition when compared with plots from Maputaland sand forest in South Africa (Sorenson Coefficient = 71%; Table 3) (Figure 2).

TABLE 3.—Similarity indices of grass assemblages shared between major Maputaland vegetation types in Mozambique (Moz) and South Africa (RSA)

Vegetation type*	Total species (Moz)	Total species (RSA)	Shared between Moz and RSA	Sorenson Index (Ss)%
HG	37	37	28	76
WG	22	32	17	63
DF	42	34	26	71
CW	31	32	21	67
LF	26	19	16	71

* CW, Coastal Woodland; DF, Dune Forest; HG, Hygrophilous Grassland; LF, Licuati Forest; WG, Woody Grassland

Floristic analysis

In a provisional checklist compiled from available literature for the two Maputaland reserves in Mozambique, the Poaceae numbered 52 species/infraspecific taxa and 36 genera. Currently, with 95% of the collected specimens identified, the updated checklist (Appendix 1) contains 115 species/infraspecific taxa and 56 genera. However, 15 species previously recorded were not collected again. Most of these taxa are either locally rare (e.g. *Panicum genuflexum* and *Triraphis andropogonoides*) or wetland species (e.g. *Leersia hexandra* and

TABLE 4.—Floristic analysis of subfamilies and tribes recorded for Maputo Elephant and Licuati Forest Reserves

Tribe/**Subfamily**	Major associated vegetation types*	Rare species	Alien species	Tribes	Genera	Species	Species/infra-specific taxa	Percentage of subfamily
Oryzeae	HG	-	-	-	1	1	1	-
Ehrharteae	LF	-	-	-	1	1	1	-
Bambusoideae	**LF, HG**	**0**	**0**	**2**	**2**	**2**	**2**	**15%**
Aveneae	HG	-	-	-	1	1	1	-
Pooideae	HG	0	0	1	1	1	1	1%
Centotheceae	LF	-	-	-	1	1	1	-
Centothecoideae	**LF**	**0**	**0**	**1**	**1**	**1**	**1**	**?**
Arundineae	HG	-	-	-	1	2	2	-
Aristideae	DF, LF	-	-	-	1	2	4	-
Arundinoideae	**DF, LF**	**0**	**0**	**2**	**2**	**4**	**6**	**2%**
Pappophoreae	CW	-	-	-	1	2	2	-
Eragrostideae	DF, HG	3	-	-	10	32	32	-
Cynodonteae	CW, DF	-	-	-	4	5	5	-
Chloridoideae	**DF, CW, HG**	**3**	**0**	**3**	**15**	**39**	**39**	**17%**
Paniceae	DF, HG, LF	2	2	-	16	40	41	-
Arundinelleae	LF	-	-	-	1	1	1	-
Andropogoneae	HG, WG, DF	-	1	-	18	24	24	-
Panicoideae	**DF, HG**	**2**	**3**	**3**	**35**	**65**	**66**	**19%**
TOTAL		5	3	12	56	112	115	

*CW, Coastal Woodland; DF, Dune Forest; HG, Hygrophilous Grassland; LF, Licuati Forest; WG, Woody Grassland

Dinebra retroflexa var. *condensata*), for which high water tables made their localized habitats inaccessible.

In the study area the most commonly represented subfamilies are the Panicoideae with 66 species/infraspecific taxa (accounting for 57% of the total checklist) and Chloridoideae with 39 taxa (34%) (Table 4). Together they account for 91% of the species in the checklist. The tribes with the most species are the Paniceae (41 taxa), Eragrostideae (32 taxa) and Andropogoneae (24 taxa) (Table 4). The genera with the most species are *Eragrostis* (12), *Panicum* (10), *Digitaria* (8) and *Sporobolus* (6). *Andropogon*, *Brachiaria* and *Dactyloctenium* are represented by four species each.

Interesting species were recorded, such as *Panicum kalaharense* (usually associated with much drier areas on Kalahari sands) and *Monocymbium ceresiiforme* (usually associated with much higher altitudes on mountains). Many grass species of direct significance for conservation initiatives, reserve management and sustainable utilization were also recorded:

1, three Maputaland endemic grasses belonging to the Eragrostidae (Van Wyk 1996). *Brachychloa schiemanniana* occurs in Dune Forest, *Eragrostis moggii* var. *moggii* is associated with Licuati Forest and Dune Forest, and *Trichoneura schlechteri* is found in Coastal Woodlands, Dune Forest, Licuati Forest and Woody Grassland. *Brachychloa fragilis* was not recorded, although it is a typical endemic associated with deep sands in South Africa;

2, three alien grasses belonging to the Panicoideae. As is the case in many Centres of Endemism in the world (Stohlgren *et al.* 1999), alien taxa have also invaded Maputaland. *Cenchrus brownii* has invaded vegetation of Primary Dunes and *Coix lacryma-jobi* and *Digitaria didactyla* occurs in Coastal Woodland in the vicinity of villages;

3, two Red Data List grass species: *Panicum pleianthum* from Dune Forest which is assessed as Low Risk (Izidine & Bandeira 2002), and *Alloteropsis papillosa* from Dune Forest, Coastal Woodland and Licuati Forest which is assessed as Insufficiently Known (Hilton-Taylor 1996). Both species are locally common and known to occur as far north as Kenya and Tanzania;

4, eight grasses that are important for rural livelihoods. Some species are used as important components to build huts: *Phragmites australis* for the walls and *Cymbopogon excavatus*, *Imperata cylindrica* and *Hyperthelia dissoluta* to thatch the roof (Mangue 1999). *Dactyloctenium giganteum*, *Eleusine coracana* subsp. *africana*, *Echinochloa pyramidalis* and *Sorghum bicolor* subsp. *arundinaceum* are used as indigenous grass cereals (Scudder 1971).

Correlation analyses of the floristic data did not reveal any meaningful relationships. The only significant positive correlation ($n = 6$; $r = 0.827$; $P = 0.04$) was obtained between the number of rare/endemic grass species and the number of annual grass species per vegetation type. Forests/woodlands have higher numbers of rare/endemic and annual grass species than grasslands.

Distribution patterns

All known distributions of the six grass subfamilies extend into southern Mozambique. The diversity of the Chloridoideae and the Panicoideae in the study area was expected and subsequently were the best represented in the major vegetation types. The dominance of the Panicoideae (both C_3 and C_4 grasses) in the terrestrial vegetation types coincides with the centre of diversity of the subfamily in mesic summer rainfall regions (Gibbs Russell 1986). However, its diversity was much lower than would be expected (19% instead of the predicted 46–60%) (Table 4). The diversity of species of the Chloridoideae (mainly C_4 aspartate producers) was within the expected range of 16–30% (17% of the subfamily's species was recorded) (Table 4), as this subfamily's centre of diversity is mainly situated further north in arid summer rainfall regions (Gibbs Russell 1986). Chloridoideae dominated the grass assemblage of the Primary Dunes. The species diversity of the other four subfamilies was as predicted by Gibbs Russell (1988). Arundi-

noideae is dominant in Hygrophilous Grassland and the remaining three subfamilies are associated mainly with Hygrophilous Grassland and Licuati Forest.

The tribes, Eragrostideae (C_4 aspartate), Paniceae (both C_3 and C_4) and Andropogoneae (C_4 malate) dominate the grass assemblages of the major vegetation types, probably due to specific regional climatic conditions, such as high temperatures at the local scale, which favour these C_4 groups to successfully colonize specific habitats. Eragrostideae dominate the grass assemblages of Dune Forest and Primary Dunes, the Paniceae dominate in Coastal Woodland, Hygrophilous Grassland and Licuati Forest, and the Andropogoneae in Woody Grassland (Table 2). The Aristideae and Cynodonteae are found in nearly all the vegetation types, but are restricted to a maximum of four species per vegetation type. This is low when compared to the maximum of 21, 18 and 15 species respectively recorded for the three dominant tribes. The remaining seven tribes are restricted to single vegetation types. Three of these tribes are associated with Licuati Forest, two with Hygrophilous Grassland and one with Coastal Woodland.

CONCLUSIONS

It is evident from the analysis of the grass diversity on the coastal plain of southern Mozambique that a specific grass flora is present and that six species assemblages are associated with and characteristic of certain major vegetation types of the coastal plain.

The grass assemblage of Dune Forest was qualitatively the most similar and central to the grass assemblages of the other vegetation types south of Maputo Bay. Primary Dunes have the most floristically unrelated grass assemblage to other vegetation types.

Similarity in grass assemblage composition was more than 60% for each vegetation type shared between reserves in Mozambique and South Africa. This relationship with areas further south links the grass assemblages to the Maputaland floristic region.

Grasses of the study area are mostly perennial. Woody Grassland has the highest proportion of perennial species and Primary Dunes the highest proportion of annuals. Tufted grasses are the most common growth form with the highest proportions in Licuati Forest and Coastal Woodland.

Chloridoideae and Panicoideae dominate the grass composition in the study area. The tribes Paniceae, Eragrostideae and Andropogoneae are represented most and *Eragrostis*, *Panicum* and *Digitaria* are the largest genera of this part of Maputaland.

The coastal plain south of Maputo Bay has a grass diversity of 115 species and infraspecific taxa. Dune Forest and Hygrophilous Grassland have the richest grass diversity. Dune Forest has the most rare and endemic grass species and Hygrophilous Grassland the most character species.

ACKNOWLEDGEMENTS

The authors thank Ms Teresa Martins (LUAI, Angola) and Ms Florence Nyirenda (UZL, Zambia) for their grass collections and identifications. Mr Calane da Silva (LMA, Mozambique) is thanked for hosting the SABONET Mozambique Expedition. The Global Environment Facility (GEF)/United Nations Development Programme (UNDP), through the National Botanical Institute of South Africa, financially supported this research as part of the capacity building Southern African Botanical Diversity Network (SABONET) Project.

REFERENCES

BARBOUR, M.G., BURK, J.H., PITTS, W.D., GILLIAM, F.S. & SCHWARTZ, M.W. 1999. *Terrestrial plant ecology*. Addison Wesley Longman, Menlo Park, California.

BOTHA, G.A. 1997. *Maputaland: focus on the Quaternary evolution of the South-East African coastal plain, field guide and abstracts*: 21–26. Council for Geoscience, Pretoria.

BRUMMITT, R.K. & POWELL, C.E. 1992. *Authors of plant names*. Royal Botanic Gardens, Kew, London.

BRUTON, M.N. & COOPER, K.H. (eds). 1980. *Studies on the ecology of Maputaland*. Rhodes University and Wildlife Society of South Africa, Grahamstown & Durban.

CLAYTON, W.D. & RENVOIZE, S.A. 1986. Genera Graminum: grasses of the world. *Kew Bulletin Additional Series* No. 13. HMSO, London.

DE BOER, F., HAANDRIKMAN, V., VRIESENDORP, B. & MARIA, F. 2000. Vegetation map of the Maputo Elephant Reserve. Eduardo Mondlane University, Maputo.

FISH, L. 2003. Poaceae. In G. Germishuizen & N.L. Meyer, Plants of southern Africa: an annotated checklist. *Strelitzia* 14: 1152–1194. National Botanical Institute, Pretoria.

GIBBS RUSSELL, G.E. 1986. Significance of different centres of diversity in subfamilies of Poaceae in southern Africa. *Palaeoecology of Africa* 17: 183–192.

GIBBS RUSSELL, G.E. 1988. Distribution of subfamilies and tribes of Poaceae in southern Africa. *Monographs in Systematic Botany* 25: 555–566.

GIBBS RUSSELL, G.E., WATSON, L., KOEKEMOER, M., SMOOK, L., BARKER, N.P., ANDERSON, H.M. & DALLWITZ, M.J. 1990. Grasses of southern Africa. *Memoirs of the Botanical Survey of South Africa* No. 58. Botanical Research Institute, Pretoria.

HENNEKENS, S. 1996. *MEGATAB: a visual editor for phytosociological tables*. User's guide. Giesen & Geurts, Ulft.

HILTON-TAYLOR, C. 1996. Red Data List of southern African plants. *Strelitzia* 4. National Botanical Institute, Pretoria.

HILL, M.O. 1979a. *TWINSPAN: a FORTRAN program for arranging multivariate data in an ordered two way table by classification of individuals and attributes*. Cornell University, Ithaca, New York.

HILL, M.O. 1979b. *DECORANA: a FORTRAN program for detrended correspondence analysis and reciprocal averaging*. Cornell University, Ithaca, New York.

IZIDINE, S.A. & BANDEIRA, S.O. 2002. Mozambique. In J.S. Golding, *Southern African plant Red Data Lists*. Southern African Botanical Diversity Network Report No. 14: 43–60. SABONET, Pretoria.

IZIDINE, S.A., SIEBERT, S.J. & VAN WYK, A.E. 2003. Maputaland's Licuati forest and thicket: botanical exploration of the coastal plain south of Maputo Bay. Veld & Flora 89: 56–61.

KOBISI, K. & KOSE, L.E. 2003. *A checklist of Lesotho grasses*. Southern African Botanical Diversity Network Report No. 17: 1–22. SABONET, Pretoria.

MANGUE, P. 1999. Community use and management of Licuati Forest Reserve and surrounding areas. In P.V. Desanker & L. Santos, *Integrated analysis and management of renewable natural resources in Mozambique*. www.mozambique.gecp.virginia.edu/publications/book_project/mangue.pdf.

MATTHEWS, W.S., VAN WYK, A.E. & VAN ROOYEN, N. 1999. Vegetation of the Sileza Nature Reserve and neighbouring areas, South Africa, and its importance in conserving woody grasslands of the Maputaland Centre of Endemism. *Bothalia* 29: 151–167.

MATTHEWS, W.S., VAN WYK, A.E., VAN ROOYEN, N. & BOTHA, G.A. 2001. Vegetation of the Tembe Elephant Park, Maputaland, South Africa. *South African Journal of Botany* 67: 573–594.

MUELLER-DOMBOIS, D. & ELLENBERG, H. 1974. *Aims and methods of vegetation ecology*. Wiley, New York.

MYRE, M. 1964. *A vegetação do extremo sul da província de Moçambique: inclui um estudo especial fitossociológico dos principais tipos e subtipos de pastagens da região*. Junta de Investigações do Ultramar, Lisbon.
MYRE, M. 1971. As pastagens da regio do Maputo. *Memórias Instituto de Investigaço Agronómica de Moçambique* 3: 1–181.
SCUDDER, T. 1971. Gathering among woodland savanna cultivars: a case study of the Gwembe Tonga. *Zambian Papers* 5. University Press, Manchester.
STOHLGREN, T.J., BINKLEY, D. & CHONG, G.W. 1999. Exotic plant species invade hot spots of native plant diversity. *Ecological Monographs* 69: 25–46.
TAINTON, N.M., BRANSBY, D.I. & BOOYSEN, P. DE V. 1976. *Common veld and pasture grasses of Natal*. Department of Pasture Science, University of Natal. Shuter & Shooter, Pietermaritzburg.
VAN WYK, A.E. 1996. Biodiversity of the Maputaland Centre. In L.J.G. van der Maesen, X.M. van der Burgt & J.M. van Medenbach de Rooy, *The biodiversity of African plants*: 198–207. Kluwer Academic Publishers, Dordrecht.
VAN WYK, A.E. & SMITH, G.F. 2001. *Regions of floristic endemism in southern Africa: a review with emphasis on succulents*. Umdaus Press, Pretoria.
WESTHOFF, V. & VAN DER MAAREL, E. 1978. The Braun-Blanquet approach. In R.H. Whittaker, *Classification of plant communities*: 287–399. Junk, The Hague.
WHITTAKER, R.H. 1978. Evolution of species diversity in land communities. *Evolutionary Biology* 10: 1–67.

APPENDIX 1.—Checklist of grasses recorded for the major vegetation types of the Maputo Elephant and Licuati Forest Reserves

Arrangement and classification follow Clayton & Renvoize (1986) and author citations follow Brummitt & Powell (1992). Species names follow Fish (2003) and general practice at Maputo Herbarium (LMA). All specimens are housed at LMA, with duplicates specified for the herbaria of Luanda (LUAI), Natal (NH), Pretoria (PRE) and University of Zambia (UZL). Naturalized alien species are marked with an asterisk*, Maputaland endemic species with **, and Red Data List species with ***. Abbreviations for collectors' names: *B*, Balsinhas; *DHN*, De Koning, Hiemstra & Nuvunga; *G*, Greenwood; *H*, Hornby; *Ma*, Martins; *MB*, Myre & Balsinhas; *MC*, Myre & Carvalho; *MD*, Myre & Duarte; *My*, Myre; *N*, Nyirenda; *P*, Pedro; *PP*, Pedro & Pedrogao; *S*, Siebert; *U*, Uiras; *V*, Viana; *Z*, field observations of sterile specimens.

BAMBUSOIDEAE

ORYZEAE
Leersia hexandra *Sw., Z 14*

EHRHARTEAE
Ehrharta erecta *Lam.* var. natalensis *Stapf, Z 1*

POOIDEAE

AVENEAE
Agrostis lachnantha *Nees* var. lachnantha, *Ma 101* (LUAI), *H 133*

CENTOTHECOIDEAE

CENTOTHECEAE
Megastachya mucronata *(Poir.) P.Beauv., S 2180* (PRE), *U 99* (NH)

ARUNDINOIDEAE

ARUNDINEAE
Phragmites
australis *(Cav.) Steud., H 123*
mauritianus *Kunth, DHN 8846*

ARISTIDEAE
Aristida congesta *Roem. & Schult.*
subsp. barbicollis *(Trin & Rupr.) De Winter, S 2137* (PRE), *U 65* (NH)
subsp. congesta, *P 3933*
Aristida stipitata *Hack.*
subsp. graciliflora *(Pilg.) Melderis, S 2161* (PRE), *U 106* (NH)
subsp. ramifera *(Pilg.) Melderis, S 2188* (PRE)

CHLORIDOIDEAE

PAPPOPHOREAE
Enneapogon
cenchroides *(Roem. & Schult.) C.E.Hubb., MB 349*
scoparius *Stapf, Z 2*

ERAGROSTIDEAE
Bewsia biflora *(Hack.) Gooss., S 2128* (PRE), *N 506* (UZL)
**Brachychloa schiemanniana *(Schweick.) S.M.Phillips, S 2141* (PRE), *U 60* (NH)
Dactyloctenium
aegyptium *(L.) Willd., N 350* (UZL)
australe *Steud., My 3743*
geminatum *Hack., S 2158* (PRE), *U 79* (NH)
giganteum *Fisher & Schweick., U 94* (NH)
Dinebra retroflexa *(Vahl) Panz.* var. condensata *S.M.Phillips, Z 3*
Eleusine
coracana *(L.) Gaertn.* subsp. africana *(Kenn.-O'Byrne) Hilu & De Wet, S 2130* (PRE)
indica *(L.) Gaertn., U 98* (PRE)
Eragrostis
capensis *(Thunb.) Trin., S 2122* (PRE), *U 20* (NH)
ciliaris *(L.) R.Br., S 2189* (PRE), *U 27* (NH)
gummiflua *Nees, U 104* (NH)
heteromera *Stapf, S 2185* (PRE), *U 97* (NH)
inamoena *K.Schum., S 2125* (PRE)
lappula *Nees, S 2144* (PRE), *U 58* (NH)
**moggii *De Winter* var. moggii, *S 2151* (PRE), *N 372* (UZL)
pallens *Hack., S 2174* (PRE), *U 85* (NH)
sarmentosa *(Thunb.) Trin., S 2164* (PRE)
sclerantha *Nees* subsp. sclerantha, *Z 13*
sp., *U 61* (NH)
superba *Peyr., N 362* (UZL), *U 101* (NH)
Pogonarthria squarrosa *(Roem. & Schult.) Pilg., S 2173* (PRE), *U 53* (NH)
Sporobolus
africanus *(Poir.) Robyns & Tournay, S 2140* (PRE), *U 63* (NH)
fimbriatus *(Trin.) Nees, S 2176* (PRE), *U 89* (NH)
sanguineus *Rendle, S 2186* (PRE), *U 100* (NH)
subtilis *Kunth, N 354* (UZL), *U 81* (NH)
subulatus *Hack., S 2123* (PRE)
virginicus *(L.) Kunth, S 2106* (PRE), *U 59* (NH)
Trichoneura
grandiglumis *(Nees) Ekman, S 2136* (PRE), *U 67* (NH)
**schlechteri *Ekman, S 2170* (PRE), *U 86* (NH)
Triraphis
andropogonoides *(Steud.) E.Phillips, Z 4*
schinzii *Hack., S 2154* (PRE), *U 57* (NH)

CYNODONTEAE
Chloris
gayana *Kunth, S 2196* (PRE), *U 115* (NH)
virgata *Sw., S 2187* (PRE)
Cynodon dactylon *(L.) Pers., S 2149* (PRE), *U 29* (NH)
Eustachys paspaloides *(Vahl) Lanza & Mattei, S 2133* (PRE), *U 42* (NH)
Perotis patens *Gand., S 2169* (PRE), *U 32* (NH)

PANICOIDEAE

PANICEAE
Acroceras macrum *Stapf, B 1708*
***Alloteropsis papillosa *Clayton, S 2166* (PRE), *U 109* (NH)
Brachiaria
chusqueoides *(Hack.) Clayton, S 2147* (PRE), *U 55* (NH)
deflexa *(Schumach.) C.E.Hubb. ex Robyns, Ma 102* (LUAI), *H 3047*
humidicola *(Rendle) Schweick., S 2157* (PRE)
nigropedata *(Ficalho & Hiern) Stapf, S 2182* (PRE), *U 95* (NH)

Cenchrus
*brownii *Roem. & Schult., S 2129* (PRE)
ciliaris *L., S 2199* (PRE), *U 111* (NH)
Digitaria
argyrothricha *(Andersson) Chiov., S 2163* (PRE), *U 50* (NH)
ciliaris *(Retz.) Koeler, MB 541*
debilis *(Desf.) Willd., Ma 103* (LUAI), *My 1088*
*didactyla *Willd., Z 11*
eriantha *Steud., S 2126* (PRE), *U 107* (NH)
gymnostachys *Pilg., U 112* (NH)
longiflora *(Retz.) Pers., S 2181* (PRE)
natalensis *Stent, U 21* (NH)
Echinochloa
colona *(L.) Link, S 2195* (PRE), *U 118* (NH)
holubii *(Stapf) Stapf, Z 12*
pyramidalis *(Lam.) Hitchc. & Chase, H 3057*
Eriochloa meyeriana *(Nees) Pilg.* subsp. meyeriana, *N 382* (UZL), *U 116* (NH)
Melinis repens *(Willd.) Zizka*
subsp. grandiflora *(Hochst.) Zizka, U 90* (NH)
subsp. repens, *S 2198* (PRE), *U 52* (NH)
Oplismenus hirtellus *(L.) P.Beauv., Z 5*
Panicum
coloratum *L.* var. coloratum, *N 385* (UZL)
deustum *Thunb., S 2139* (PRE), *U 108* (NH)
genuflexum *Stapf, Z 15*
glandulopaniculatum *Renvoize, B 1196*
heterostachyum *Hack., Z 6*
infestum *Peters, Z 9*
kalaharense *Mez, S 2184* (PRE)
laticomum *Nees, Z 8*
maximum *Jacq., S 2179* (PRE), *U 92* (NH)
*** pleianthum *Peters, S 2143* (PRE), *U 49* (NH)
Paspalum scrobiculatum *L., V 38*
Sacciolepis curvata *(L.) Chase, S 2150* (PRE), *U 64* (NH)
Setaria
incrassata *(Hochst.) Hack., S 2194* (PRE), *U 114* (NH)
megaphylla *(Steud.) T.Durand & Schinz, S 2160* (PRE)
sphacelata *(Schumach.) Moss* var. sericea *(Stapf) Clayton, S 2132* (PRE), *U 73* (NH)
Stenotaphrum dimidiatum *(L.) Brongn., S 2108* (PRE)
Tricholaena monachne *(Trin.) Stapf & C.E.Hubb., Z 10*
Urochloa mosambicensis *(Hack.) Dandy, S 2138* (PRE), *U 96* (NH)

ARUNDINELLEAE
Tristachya nodiglumis *K.Schum., S 2193* (PRE), *U 105* (NH)

ANDROPOGONEAE
Andropogon
eucomus *Nees, S 2155* (PRE), *U 72* (NH)
gayanus *Kunth* var. polycladus *(Hack.) Clayton, S 2168* (PRE), *U 84* (NH)
huillensis *Rendle, Ma 104* (LUAI), *G 1*
schirensis *A.Rich., MC 1138*
Bothriochloa insculpta *(A.Rich.) A.Camus., Z 7*
*Coix lacryma-jobi *L., My 1235*
Cymbopogon
excavatus *(Hochst) Stapf ex Burtt Davy, S 2138* (PRE), *U 62* (NH)
nardus *(L.) Rendle, S 2197* (PRE), *U 117* (NH)
pospischilii *(K.Schum.) C.E. Hubb., PP 1068*
Diheteropogon amplectens *(Nees) Clayton, MD 3942*
Elionurus muticus *(Spreng.) Kuntze, S 2191* (PRE), *U 102* (NH)
Hemarthria altissima *(Poir.) Stapf & C.E.Hubb., MC 1163*
Heteropogon contortus *(L.) Roem. & Schult., MB 348*
Hyparrhenia
dichroa *(Steud.) Stapf, MB 632*
filipendula *(Hochst.) Stapf* var. filipendula, *S 2134* (PRE), *U 43* (NH)
Hyperthelia dissoluta *(Nees ex Steud.) Clayton, S 2118* (PRE), *U 41* (NH)
Imperata cylindrica *(L.) Raeusch., S 2117* (PRE), *U 16* (NH)
Ischaemum fasciculatum *Brongn., S 2121* (PRE), *U 78* (NH)
Monocymbium ceresiiforme *(Nees) Stapf, MC 1161*
Sorghastrum stipoides *(Kunth) Nash, B 1579*
Sorghum bicolor *(L.) Moench* subsp. arundinaceum *(Desv.) De Wet & Harlan, S 2198* (PRE), *U 113* (NH)
Themeda triandra *Forssk., S 2135* (PRE), *U 39* (NH)
Trachypogon spicatus *(L.f.) Kuntze, S 2165* (PRE), *U 44* (NH)
Urelytrum agropyroides *(Hack.) Hack., S 2167* (PRE), *U 37* (NH)