This thesis is dedicated to Mashudu Phamphe, my parents and Lord, who gave me strength to succeed in life.

"Once you take a little trouble to become acquainted with grasses, their attraction and their glory grow on you, until at last you surrender completely to their charm."

Jan C. Smuts

"If we knew what it was we were doing it would not be a research".

Albert Einstein, Scientific American, September 2002.

Phytosociology of Transkei grasslands

by

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Abstract

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A plant ecological study was conducted in the grasslands of Transkei to develop a better understanding of the distribution, structure and composition of the plant communities found in the area. The agricultural sector in developed and rapidly developing areas of southern Africa is faced with problems like veld deterioration and the loss of natural areas that effectively contribute to the depopulation of rural areas. The Grassland Biome Project was initiated to address the problem of increased destruction of natural resources because the most suitable area for agriculture falls within the grasslands of South Africa. The aim of the Grassland Biome Project is to integrate knowledge, comprehension and expertise, which will enable scientists to forecast the results of the available options of grassland management programs. Vegetation of Transkei forms part of this project. The study area (Transkei) borders on the kingdom of Lesotho in the north and Indian Ocean in the southeast. In the northeast it borders on KwaZulu-Natal and in the northwest, and in the west on the eastern Cape Province. Relevés were compiled in 379 random sample plots and four major plant communities, namely: Bush and Grassland vegetation of drier areas, Wet and Disturbed grassland, Grassland of Undulating Areas, and Moist Grasslands on Flat Plains, were found. The vegetation was classified by means of TWINSPAN and Braun-Blanquet procedures were found. The vegetation was classified by means of TWINSPAN and Braun-Blanquet procedures.

Key words: TWINSPAN, Transkei, plant communities, grassland, phytosociology, old fields

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CHAPTER 1

Introduction

The Grassland Biome of South Africa covers about 27% (333 942 km^2) of the surface area of the country (Low & Rebelo 1996). Grassland areas are also the focus of the dairy, beef and wool production in South Africa (Rutherford & Westfall 1986). The Grassland Biome is the site of major urbanization centres of the country, including Gauteng, Bloemfontein and Pietermaritzburg (Perkins 1997). Intensive agricultural practices and the effect of urbanization and industrialization have had a profound negative influence on the condition and stability of grassland ecosystems (Mentis & Huntley 1982). The consequences of the rapidly deteriorating quality of grassland ecosystems have led to considerable concern amongst decision-makers.

South Africa is a country of contrasts, ranging from desert to humid coastal forests, including plains, mountains, valleys, and hills (Smit 1992). In the central part at the northern border of the Eastern Cape Province, lies an area where beauty of nature in all its diversity and intricacy can be experienced and studied (Bester 1998). The Eastern Cape is an area of transition, where the climate merges from winter to summer rainfall, and it is the juncture for most major biomes of South Africa (Hoare 1997). The vegetation provides fuel, medicines, and grazing for cattle and goats (Lubbe 1996).

The grasslands of Transkei face numerous threats from factors such as afforestation, agriculture and erosion and most of the areas are not conserved, which consequently will lead to species diversity loss (Perkins 1997).

Due to the increased demand that man places on the natural habitat for basic requirements of life, the natural resources are slowly but surely being depleted (Scheepers 1985). In other parts of South Africa, grasslands have been destroyed and are threatened by exotic afforestation (Cooper, 1991; Huntley, Siegfried & Sunter 1989). The disappearance of natural habitats and the danger of extinction of species are some of the consequences of mining, urbanization, industrialization and mismanagement and exploitation of natural resources (Germishuizen 1982).

Population pressures are increasing and people are depleting the available natural resources as they struggle to deal with poverty, and therefore proper action is required to preserve our green heritage.

Another threat to South African grassland is periodic drought, the effect of which is aggravated by the activities of man (Tainton 1981). The Transkei has large, impoverished, rural population, which depends heavily on wild botanical resources, which are sometimes exploited such that they are depleted, and as an example, people have to collect *Cymbopogon validus*, which is, now in short supply (Cawe & Ntloko 1997). The value of many grassland plant species in medicine and nutrition is becoming increasingly apparent worldwide (Chrispeels & Sadava 1994) and the value of many species is yet to be realized (Ledger 1991). However, in spite of all the impacts on grassland, grasses are well adapted to a changing environment and can tolerate a high degree of grazing, flooding, drought, and sometimes fire (Mader 2004), which may have an influence on the future existence of grassland plant communities.

In Transkei, where 95% of the human population of 3 million is rural, considerable data in the historical, sociological and economic fields have been collected (McKenzie 1984), and it is in Grassland Biome. Many people depend on plants and even animals to feed themselves, and they cut down trees to make firewood. Plants such as *Eucalyptus* spp. and some other exotics that are being cut down (example, *Acacia mearnsii*) are mainly used for firewood, as some cannot afford electricity. The limited amount of natural resources data that has been collected for various planning schemes is conspicuously devoid of baseline data on vegetation. The present general knowledge of the vegetation of this area is based on descriptions by Acocks (1988) and Low & Rebelo (1996). Two recent vegetation studies in Eastern Cape Grasslands surrounding the Transkei area are those conducted by Hoare (1997) and Bester (1998). The Grassland Biome Project therefore has been initiated to integrate efforts to develop the knowledge, understanding and expertise required to predict the outcome of available grassland management options (Mentis & Huntley, 1982).

People differ in the way they experience nature. Some see it as a place where they can relax and enjoy clean air and peace, while others see it as a resource that could be used to their benefit, and whichever way people see or experience nature, the fact

remains that man is directly or indirectly dependant on nature for food, water, energy, building materials and recreation, and as such people should take good care of nature.

Phytosociology is the science in which different vegetation types and plant communities are recognized and defined. A plant community can be defined as a collection of plant species growing together in a particular location that show a definite association or affinity with each other (Kent & Coker 1992).
Different communities of plants, derived from the classification of vegetation, provide information on ecological processes and consequently provide knowledge on variability, distribution and dynamics of vegetation, and hence, plant communities are generally treated as environmental management units (Bredenkamp & Brown 2001, Du Plessis 2001). The conservation and environmental management of an area can only be efficient if the vegetation and ecology of that area are well documented and understood (Bredenkamp & Theron 1978, 1980). In this sense, it is particularly important to know which plant communities and plant species are found in a particular area, which specific habitats they occupy and what the conservation status of these communities and species is. This study, therefore, is primarily aimed at obtaining knowledge on the vegetation of Transkei.

Little is known about the vegetation in the northeastern part of the Eastern Cape Province, the area formerly known as Transkei (Smits *et al.* 1999). For this reason a comprehensive phytosociological research project aimed at the grassland vegetation of this area was initiated. Grasslands of Transkei are of secondary nature, or they have resulted from vegetation regeneration of many old fields (abandoned, formerly cultivated field lots) (Smits *et al.* 1999).

Aims and objectives of the study were to

- identify and describe the plant communities of the Transkei and surrounding areas.
- study the relationships between plant communities and environmental factors, and
- compile a species checklist of all the species that occur in the study area.

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CHAPTER 2

Study area

2.1 Location

The Transkei is an area situated in the Eastern Cape Province, South Africa (Figure 2.1) between 30-33° S latitude and 26°45' E and 30°15' E longitude. In the former political era of South Africa, it used to be an 'independent' homeland for mainly Xhosa people. Transkei borders on the kingdom of Lesotho in the north and Indian Ocean in the southeast. In the northeast it borders on KwaZulu-Natal whereas in the northwest, and in the west it borders on the Eastern Cape Province. Since 1994, after the democracy elections, it has been part of the Eastern Cape Province. The study area also includes the parts of Elliot, Butterworth, Port st. Johns, Queenstown, Butterworth and Flagstaff (Figure 2.1).

The Grassland biome occupies grassy vegetation in the eastern portion of the country and Acocks (1975) suggested the three major subdivisions, which are: (i) Pure grassland, (ii) false grasslands seral to savanna and (iii) false grassland sereal to forest (Figure 2. 2).

Figure 2.1. Major towns in the study area and sample plots.

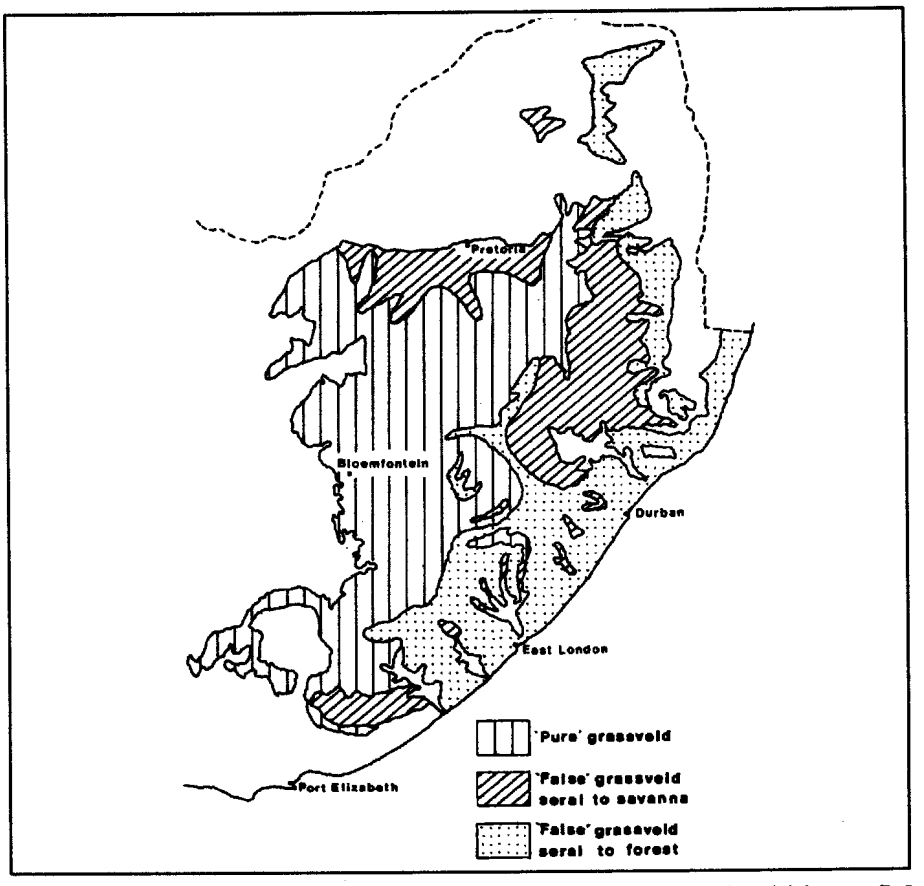


Figure 2.2. The major vegetational divisions of the grassland biome (Mentis & Huntley 1982).

2.2 Geology

Geology is one of the environmental variables affecting vegetation, physiography and ultimately the climate of the study area, and is directly related to soil types and plant communities that may occur in a specific area (Van Rooyen & Theron 1996). The dominant geological group in the study area is the Karoo Supergroup, a widespread group that underlines most of the Eastern Cape (Figure 2.3). The Karoo Supergroup comprises alternating bands of fine-grained sandstone, shale and mudstone that were deposited in the slowly subsiding 'Karoo Basin' (Visser 1984) (Table 1).

Table 2.1: Geological succession in the Eastern Cape (Visser 1984)

Geological Group/Formation	Geological epoch/period	Age in millions of years	Constituent elements
	Holocene	0.01 – 0	alluvium, sand, calcrete
Algoa Group:			
Grahamstown Silcrete Formation	Palaeocene	65 – 55	silcrete
Karoo Supergroup:	Jurassic	213 – 144	dolerite, gabbro, basalt, tuff, agglomerate
Drakensberg Group			
Clarens Formation	Triassic	248 – 213	very fine-grained sandstone, siltstone
Elliot Formation			mudstone, sandstone
Molteno Formation			grey mudstone, shale, gritty sandstone
Beaufort Group			
Ecca Group	Permian	286 – 248	mudstone, shale, sandstone
Dwyka Formation			shale, sandstone
			tillite, mudstone, sandstone, shale
Cape Supergroup:	Devonian	408 - 360	quartzilic sandstone, shale, diamictite
Witteberg Group			shale
Bokkeveld Group			

Transkei is mostly represented by the Karoo Supergroup geological formations. About 190 million years ago the Karoo sedimentation was ended by an extrusion of the volcanic basalt lavas of the Drakensberg Group, which today make up the highlands of Lesotho and the northern part of the Eastern Cape (Maud 1996). At the same time the Karoo sedimentatary rocks were extensively intruded by dykes, sills and inclined sheets of dolerite (Johnson & Keyser 1976). Geological formations present in the study area are as follows:

2.2.1 Clarens Formation

The Clarens Formation consists of fine-grained, aeolian sandstone. The thickness decreases to 200 m in the northwestern part of the Transkei (Visser 1984). Further towards the south the thickness usually varies from 300 to 700 m and in a few places, e.g. west of Elliot, it is wanting (Visser 1984). Topographically this unit forms the impressive cliffs, which are often undercut at the base and hallowed out to form shallow caves. Thickness generally varies between 20 to 80 m and more, to the north of Elliot.

The Clarens Formation is of late Triassic age. The upper boundary with the basalt of the overlaying Drakenberg Formation is generally either sharp or intertongued with a transition zone of up to 30 m or more (Visser 1984). In places the contact is uneven with sometimes deeply eroded surfaces. It represents an Aeolian deposit of which the material was transported by winds blowing from the west and was formed at the conclusion of a period of semi-aridity and drying up of the Karoo swamps.

2.2.2 Elliot Formation

The Elliot Formation in the Karoo basin follows conformably on the Molteno Formation. The Elliot Formation consists of alternating fine-grained sandstone and predominantly grayish-red mudstone lithosomes (Visser 1984). The boundary between the Elliot Formation and the overlaying Clarens Sandstone Formation may be sharp, gradational or intertongued, and a precise definition of this boundary seems to be very difficult.

In practice, most definitions attempt to locate the boundary at the base of a formation, which is largely or almost entirely composed of Aeolian sandstone or course siltstone. Thickness of the Elliot Formation ranges from 100 to 500 m. Calcareous concretions is common, particularly toward the top of the formation. Pertrified wood, even tree trunks are found in this formation, and fossils of Dinosauria were found in the Transkei (Visser 1984).

2.2.3 Molteno Formation

The Molteno Formation is composed of pale-grey to yellowish, glittering, fine-to course-grained, gritty and arkosic sandstone, which alternate with dark-grey to bluish, sandy shale, which weathers yellowish. (Visser 1984). The mudstone often grades into dark shale, while occasionally conglomerate and coal layers are also present. The Tarkastad Formations are overlaid by the Molteno Formation, which in turn is overlaid by the Elliot Formation (SACS 1980). The absence of red colouration in the mudrocks, as well as the presence of plant remains rather than reptile remains indicates that water, reducing conditions characterized the floodplains. The average sandstone of the Molteno Formation is fine to coarse-grained, moderately to well sorted and quartzose (Johnson 1984).

2.2.4 Dwyka Formation

The Dwyka Formation lies at the base of the Karoo sequence (Visser 1984) and is thought to be about 500 m thick (Mckenzie 1984). The fresh surfaces of the Dwyka rock are usually a greenish colour and are composed of small grains of sand embedded in a fine argillaceous matrix (McKenzie 1984). This formation is exposed in the north-eastern coastal districts north of Umzimvubu River mouth, forming a belt some 15 km wide, adjoining the Natal group (McKenzie 1984).

2.2.5 Ecca Group

The rocks, which belong to, this group crop out especially in the marginal areas of the main Karoo basin. Ecca group, which overlies the Dwyka Formation, was laid down

in large bodies of water in a cold temperate period (McKenzie 1984). This group is exposed just south of the Bashee River mouth and spreads as a broad belt some 30 km wide, turning northwards and inland near the mouth of the Umvimvubu River (McKenzie 1984).

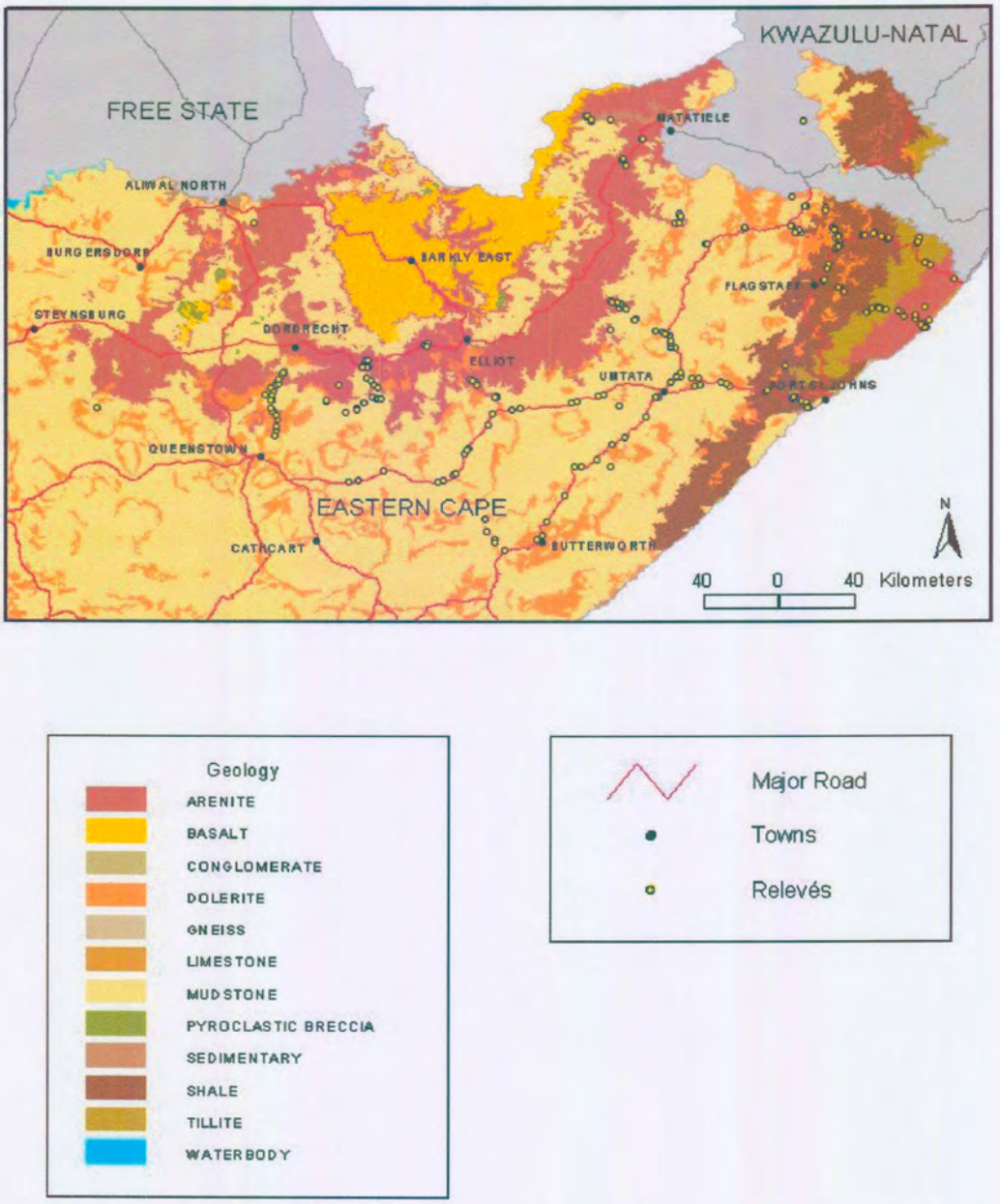


Figure 2.3 Geology of Eastern Cape (ENPAT 2001)

2.3 Climate

The climate of an area may be defined as the average weather pattern recorded over a number of years (Tyson 1986). The climate of an area describes the average conditions with respect to climatic factors such as precipitation, light, temperature, humidity and wind (Turner 1989). Factors influencing climate include latitude, the position of a site relative to the distribution of land masses and the sea, altitude, ocean currents, atmospheric pressure, physiography, precipitation, temperature, mist, frost, wind and solar radiation (Strahler & Strahler 1987; Tyson 1986). Climate can be considered as the source of moisture and temperature, whereas parent material influences the rate of weathering and mineral composition, and organisms of both flora and fauna are sources of nutrients and transport (White 1987).

The central thesis of plant ecology is that climate exerts the dominant control on the distribution of the major vegetation types of the world. Smaller-scale variations in distribution within a vegetation type may be controlled by smaller-scale features of the environment, such as soil types, and the activity of humans (Woodward 1986). Climatic conditions play a major role in determining whether a particular plant can or cannot exist in a specific area (Schulze & McGee 1978). The climatic factors of greatest importance in vegetation development are light, temperature and moisture, all of which vary subcontinentally as well as on a meso- and micro-scale (Schulze & McGee 1978).

The climate of the Eastern Cape is typical of the high elevation summer rainfall areas of eastern South Africa (Perkins 1997). Winters are cold and dry with frequent frosts and snow on the mountains. Summers are warm, with regular thunderstorms bringing most of the high annual rainfall (Scott 1992).

Altitude has a strong influence on most climatic variables. Generally, an increase in altitude corresponds with a decrease in temperature and an increase in rainfall (Hoare 1997).

2.3.1 Temperature

Temperature is a controlling factor in the presence or absence of a species because plants can only function within a certain temperature range. Certain species also only grow at certain temperatures (Larcher 1975). Temperature affects the transpiration rate, evaporation rate and other physiological processes of plants (Daubenmire 1974). These processes affect rates of germination, growth, maturation and reproduction, and vigour of the plant in turn affects such aspects as its plant's ability to compete and resist diseases (Dauebenmire 1974, Schulze & McGee 1978). Temperature interacts with other climatic factors to create environmental conditions that may limit the distribution of a plant species. It is possible that the most important temperature effect is its influence on the water balance, and extremes of temperature are likely to have the greatest effect on plants (Turner 1989). Within plant communities or associations, the direct influence of temperature affects rates of growth, plant texture, seed germination, time of flowering (Schulze & McGee, 1978).

According to Scheepers (1978) and Schulze & McGee (1978), it is not the average annual temperature that has the greatest effect on vegetation, but the extremes of temperature that can gave a limiting factor on the plant and their distribution.

Available temperature data for the weather stations in the area are given in Table 1 (the mean monthly maximum and mean temperatures (°C) for relevant weather stations in the study area). Climatic information was obtained from the South African Weather Bureau.

Comparisons show that Elliot is the coldest town in the study area with minimum of 8.5 °C (Table 2.2), while it is evident that highest maximum temperature is attained at 38.0 °C at Queenstown. Temperature on its own is not a major determinant of the vegetation patterns, and in combination with annual rainfall and altitude, it however has a profound influence on vegetation, also evident in the grassland vegetation.

2.3.2 Rainfall

Rainfall is the primary force that influences the productivity of vegetation (Bredenkamp & Brown 1995). Schulze & McGee (1978) considered water to be the most important climatic parameter, which influences the gross features of vegetation differences on earth. Furthermore, the reservoir of soil water available for plant life is mainly derived in the form of rainfall, fog and snow, of which the first two are important in South Africa. Water serves as means of transport of materials throughout the plant whilst also regulating its temperature (Stern 1994). Table 2.3 below shows that Port St. Johns undoubtedly has a considerably higher mean annual rainfall, 119.85, than the other towns in the area. .Queenstown has the least mean monthly amount of rainfall, where it was recorded 21.267 mm.

Table 2.2. Mean maximum and minimum temperature for weather stations in the areas in 1997 (Weather Bureau) (Data information supplied via online).

	Umtata		Port St Johns		Barkly-East		Matatiele		Queenstown		Elliot	
	max	min	max	min	max	min	max	min	max	min	max	min
January	34.8	21.5	28.5	23.6	26.5	15.0	30.6	17.5	32.6	18.9	30.5	17.0
February	35.5	20.0	27.5	23.0	31.5	14.0	32.0	17.5	34.2	18.8	31.3	17.8
March	33.9	18.5	26.4	22.5	26.5	14.0	28.1	16.8	30.5	14.9	28.6	16.2
April	29.0	14.4	24.3	19.2	21.0	10.5	24.5	12.0	25.0	10.3	24.8	12.6
May	28.0	12.7	30.0	19.0	19.0	9.0	22.5	11.0	22.3	11.7	20.2	11.7
June	27.2	15.9	30.0	19.0	18.0	11.0	22.5	14.0	19.8	16.5	20.8	13.9
July	29.6	10.7	27.0	18.0	20.0	10.0	22.5	9.6	22.9	9.0	22.6	8.5
August	32.9	16.1	25.5	18.0	24.0	11.0	27.4	11.2	27.5	13.4	25.6	17.8
September	35.5	13.8	25.0	17.3	28.0	14.5	32.6	18.0	33.7	11.9	30.7	12.2
October	37.1	19.8	40.0	20.0	28.5	17.0	30.8	15.3	33.5	19.4	30.8	15.9
November	33.1	18.3	25.6	19.6	31.5	19.0	34.3	15.3	37.7	16.1	33.1	8.5
December	35.5	16.6	26.4	21.0	33.0	18.0	34.5	16.5	38.0	16.9	33.6	18.2

Table 2.3. Average annual rainfall data (in mm) for weather stations in the study area in 1997 (Weather Bureau) (Data information supplied via online).

1997	Umtata	Port St Johns	Barkly-East	Matatiele	Queenstown	Elliot	Mean Monthly
January	90.6	168.3	95	140.2	16.4	143.2	108.95
February	80.7	256.8	64.3	83.8	14	36.8	89.4
March	75.5	82.9	106.7	120.6	19.6	98.2	83.91
April	140	136.9	76.3	88.8	26.6	47.2	85.96
May	9.9	44.8	29.2	14.9	15.2	25.8	23.3
June	137.6	252.4	33	81.5	17.8	100.8	103.85
July	14.6	32.4	12	12.2	1.8	20.8	15.63
August	24.3	18.6	11	18.6	0	9	13.58
September	18.4	119	7.8	6.6	6	8.2	27.66
October	58.1	88.3	26.7	42.2	85	54.8	59.18
November	58.3	184.7	20	89.1	32.4	40.2	70.78
December	39.2	53.1	40.6	30	20.4	40.0	37.21
Mean Annual	62.26	119.85	43.55	60.70	21.26	52.08	59.95
Total	809.46	1558.05	566.15	726.3	276.46	677.08	779.36

Periods of low rainfall conditions and high temperatures (Tables 2.2 & 2.3 and Figure 2.4) have a definite effect on vegetation. Comparing the vegetation in Umtata and Port St. Johns, which is next to the Indian Ocean, one can suggest that there is higher species diversity in Port St. Johns as compare to Umtata where its very dry. Rainfall generally decreases with distance from the sea, but then increases at the highest altitude.

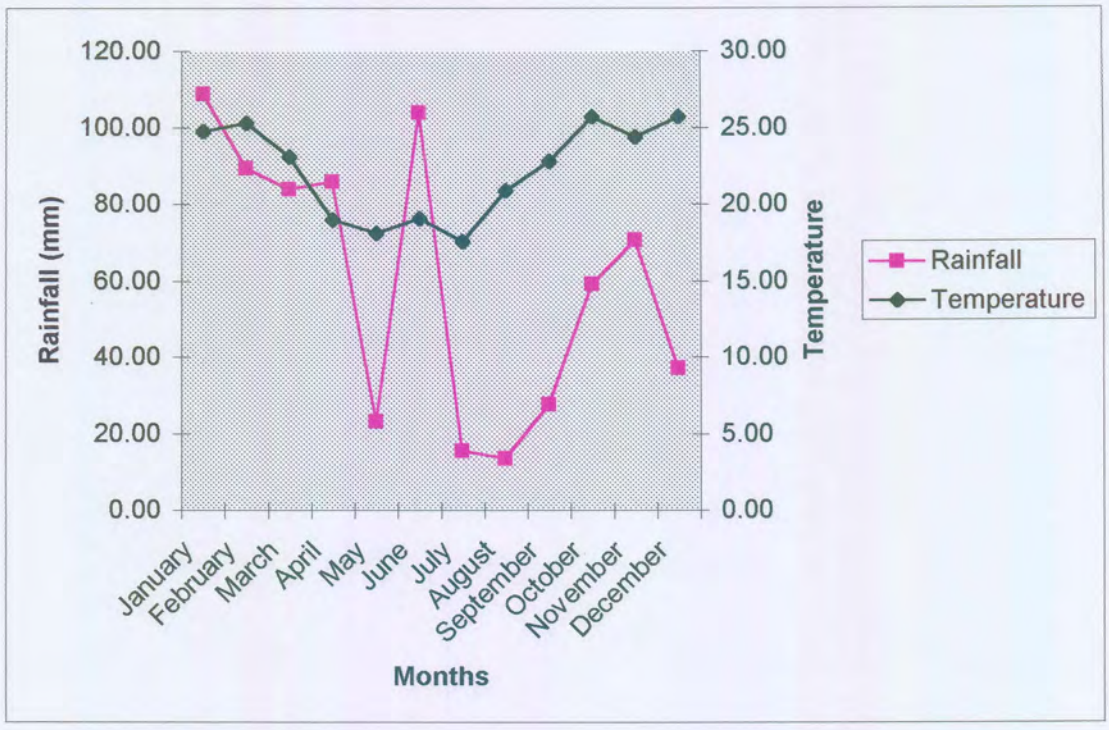


Figure 2.4. Average temperature and rainfall for weather stations in the study area.

2.3.3 Snow

Snow occurs sporadically, mainly on the higher mountain ranges. The ecological effects of snow in southern Africa are generally thought to be minimal (Schulze & McGee 1978). In the study area, snow is common during winter at altitudes above 1800 m.

2.3.4 Wind

Wind is important in that it is one of the main mechanisms of seed dispersal for plants as well as that grasses are pollinated by means of wind (Burgoyne 1995), and grasses are the dominant type of vegetation in this particular area. Wind influences water from the soil and strong winds can cause a water shortage in plants due to a high evapo-transpiration rate (Coupland 1979).

2.4 Soils

Soil is a distinct and important factor in plant ecology. Soils are complex biogeographically materials which form an integral part of any ecosystem, since they provide plants with support, water, nutrients and air for growth (Brown 1997). Soil is the common ground between the living and nonliving world (Barbour *et* al. 1980). The close relationship between soils and vegetation is a useful aid in studying ecosystems. Soil and its properties do not constitute an independent system, but are rather a part of the larger ecosystem, which includes vegetation, and its entire environment (Henning 2002).

Soils in Transkei are highly variable over short distances depending on relief, parent material, climate, time and the activities of living organisms, especially man (Cawe 1986). On steep slopes relief is important in that soils are eroded before they have fully developed, only shallow lithosols are found on such slopes, whereas in flat areas denudation is less severe and soils develop to a greater degree. Soils from different rock types tend to differ in both physical and chemical properties. For example, soils derived from dolerite tend to be richer in minerals than soils from Karoo sediments. The various Karoo sediments weather to different depth, e.g. Molteno sediments weather to greater depths (Cawe 1986). Very little data exist on soil types in the study area. Soil characteristics are dependant on landform and geology. The soils on the mountain areas are generally shallow and weakly developed consisting essentially of a topsoil horizon overlying rock or partially weathered rock (Harmann 1988).

2.5 Topography

The topography of Transkei ranges from 0-600 m at the coast, i.e. Port St. Johns, and up the mountainous areas such as Matatiele or Barkley East, where it reaches 2100-3000 m (Figure 2. 5). The study area is grassland with patches of exotic forest with deep ravines and steep cliffs in places and gently sloping plains in others. The terrain is fairly variable, ranging from the steepy craggy slopes of the Drakenberg Escarpment and foothills in the west to gently undulating slopes of the plateau to the south and east (Scott 1992) The topography of the study area was divided into five groups according to Scheepers (1985) as can be seen in Figure 2.6.

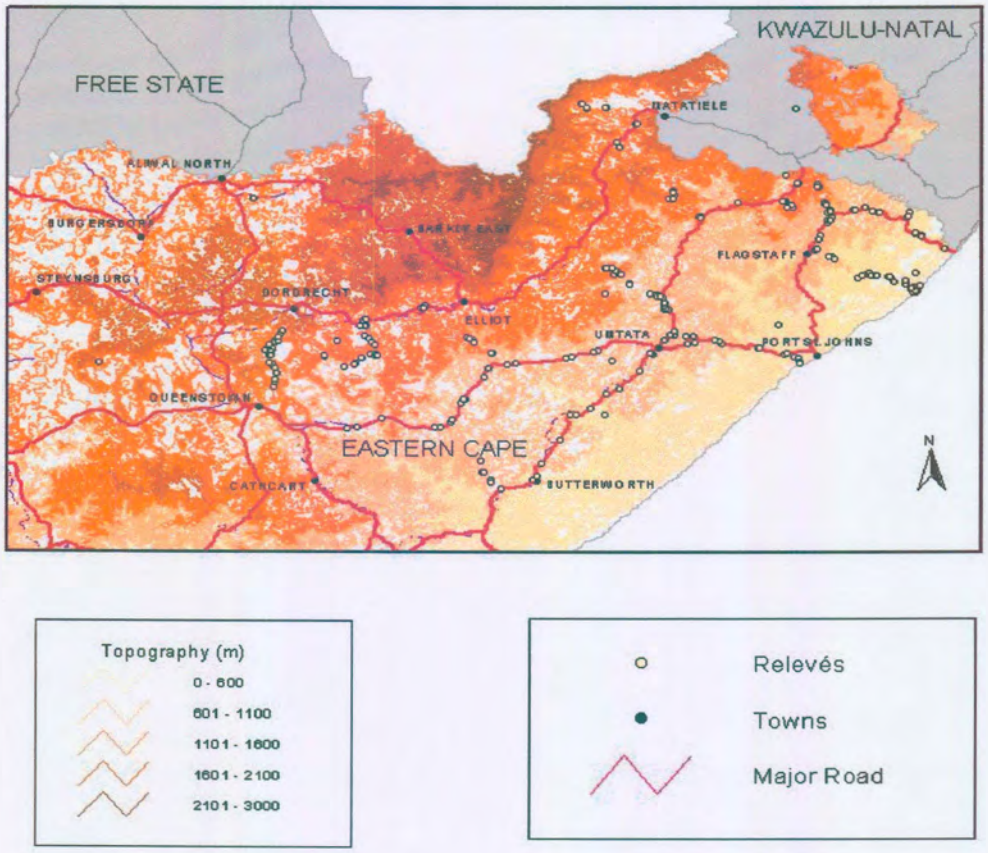


Figure 2.5 Topography of Transkei (ENPAT 2001)

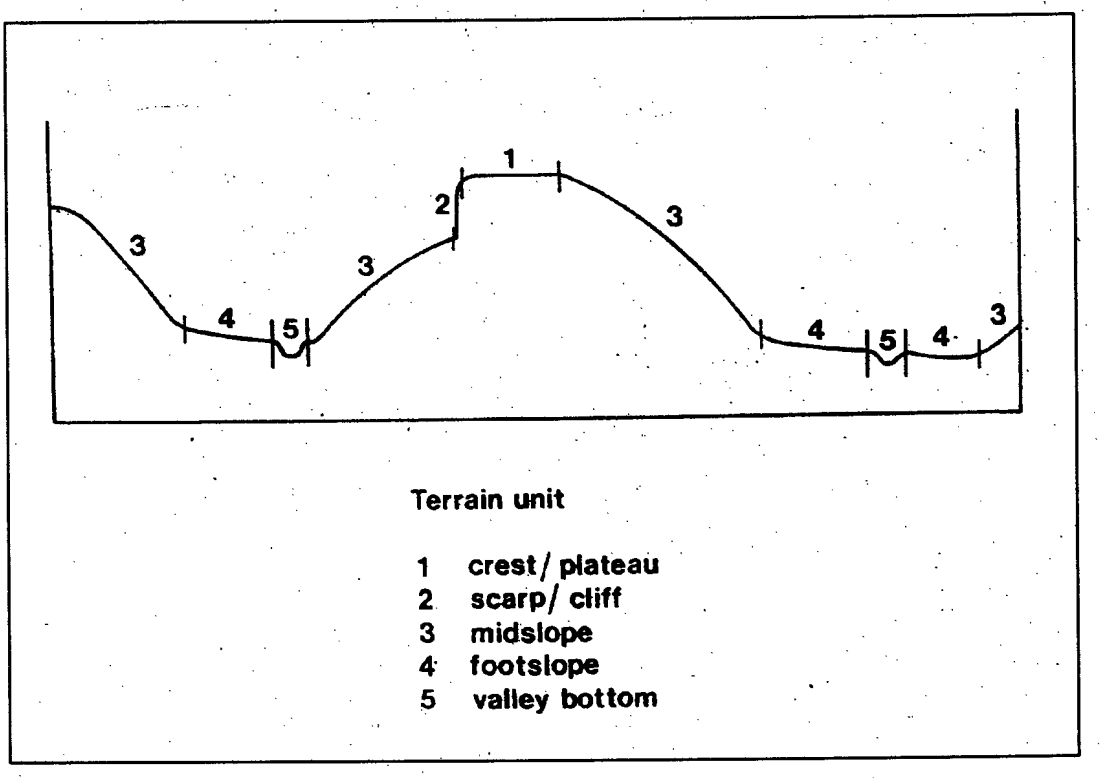


Figure 2.6 Sketch showing the principal terrain units in a landscape

2.6 Vegetation

The entire study area falls within the Grassland Biome (Figure 2.7) (Rutherford & Westfall 1986). According to Low & Rebelo (1996) in their classification of the vegetation of South Africa, Lesotho, and Swaziland, the vegetation types that occur within the study area are as follows: (i) Moist upland Grassland, (ii) South-eastern Mountain Grassland, (iii) Coastal Bushveld/Grassland, (iv) Moist Cold Highveld Grassland, (v) Valley Thicket, (vi) North-eastern Mountain Grassland, (vii) Subarid Thorn Bushveld, (viii) Alti Mountain Grassland, (ix) Dry Sandy Highveld Grassland, and (x) Coastal Forest. Acocks's descriptions of Veld Types in South Africa are based on agro-ecological units and are, therefore, fairly broad. Acocks 1988 defined veld type as a unit of vegetation whose range of variation is small enough to permit the whole of it to have the same farming potential. The environment includes many variable factors, such as grazing animals, birds and insects, light, heat and most important of al, water. He admits, "variation in the veld even over short distances are legion" (Acocks 1988). The following vegetation types occurs in the study area, according to Acocks 1988, and ENPAT 2001 (Figure 2.8) (a) Coastal Forest and Thornveld, (b) Ngongoni Veld, (c) Eastern Province Thornveld, (d) Highland Sourveld and Dohne Sourveld, (e) Highland Sourveld to Cymbopogon-Themeda Veld transition, and (f) Southern Tall Grassland. The descriptions are adequate for general purposes, but often incorporate structurally and floristically unrelated vegetation into a single Veld Type (Cowling 1984) thus making predictive research difficult. For managing the finer responses of vegetation a classification based on the full floristic composition is required (Taylor 1996).

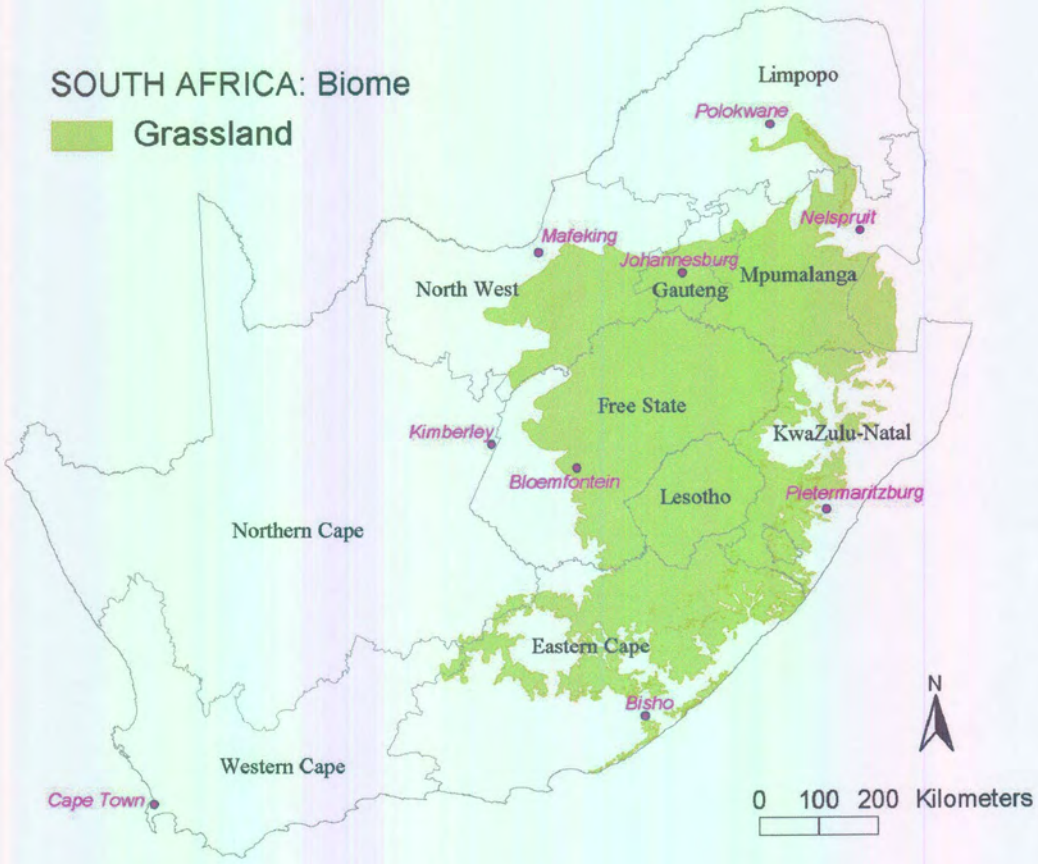
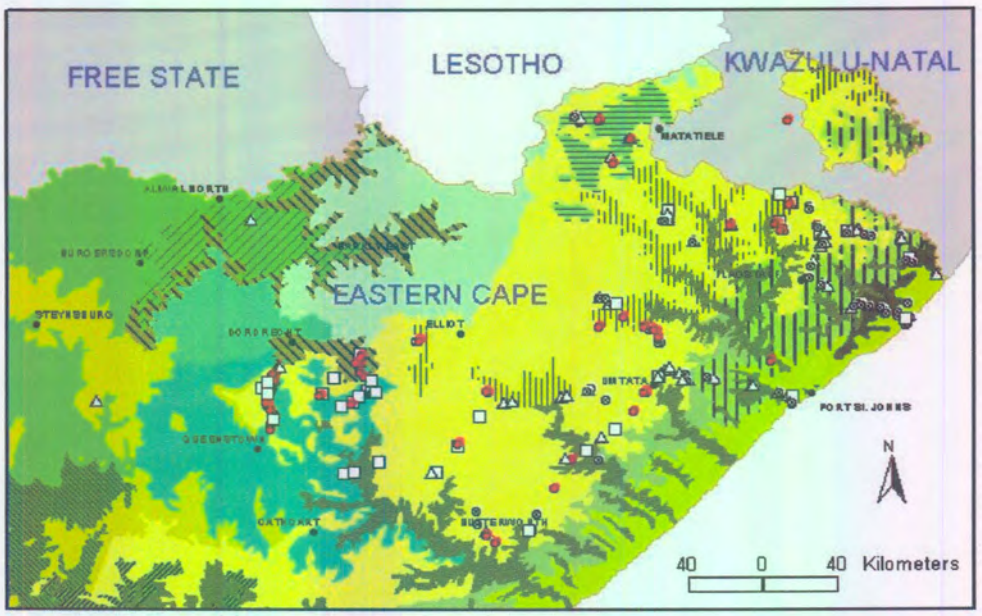


Figure 2.7 Grassland biome of South Africa (ENPAT 2001)



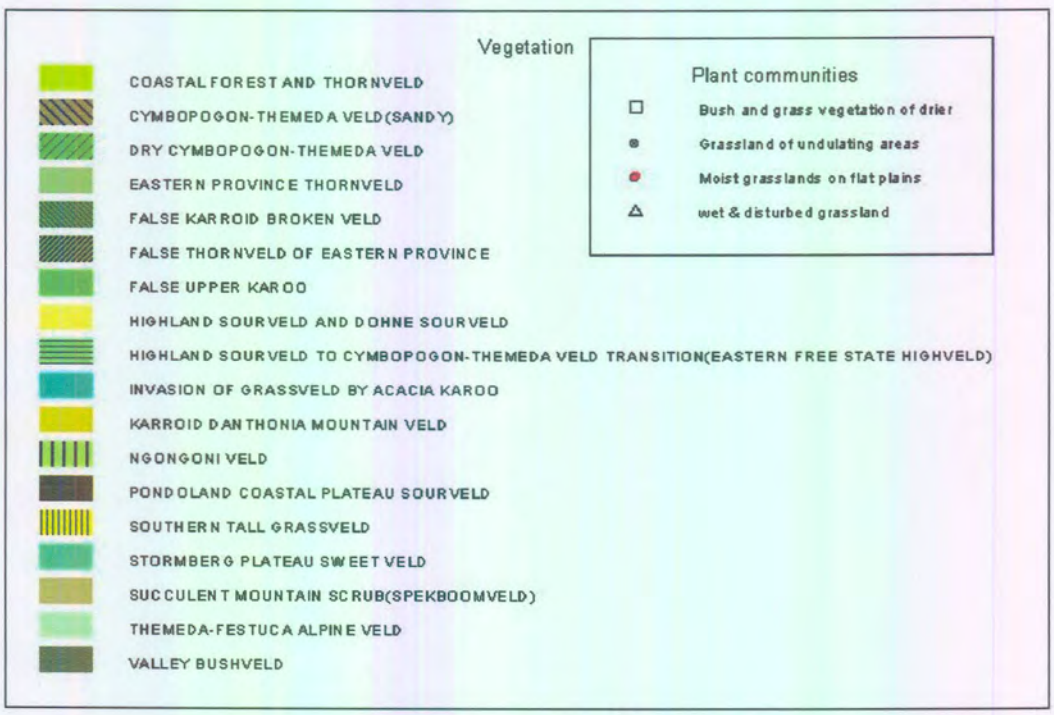


Figure 2.8. Vegetation of Transkei indicating major plant communities (ENPAT 2001)

The Moist Upland Grassland (Low & Rebelo #42) occurs at altitudes of 600 to 1 400 m above sea level, most commonly in the Drakensberg foothills of Eastern Cape and KwaZulu-Natal, and is found extensively over Transkei bordering on the afromontane forest in valley kloofs (Smits *et al.* 1999) The vegetation is dense, sour grassland with *Themeda triandra, Heteropogon contortus, Tristachya leucothrix, Eragrostis curvula* and *Elionurus muticus* as some of the dominant species. Often, in the north, *Hyparrhenia hirta* and *Sporobolus pyramidalis* become dominant. The most important herbaceous species include *Conyza obscura, Berkheya onopordifolia, Alysicarpus rugosus, Aster bakeramus, Corchorus confuses, Cucumis hirsutus, Gomphrena celosiodes, Helichrysum coriaceum, H. rugulosum, Kohautia cynachica, Richardia brasiliensis Walafrida densiflora, Spermacoce natalensis, Phyllanthus glaucophyllus* and *Tephrosia multijuga*. In places dominance of *Elionurus muticus* is another striking feature of this grassland (Low & Rebelo 1996).

Disturbed (ploughed, overgrazed, degraded) sites are often found within this region, indicating the secondary status of many of the representative plant communities (Smits *et al.* 1999). According to Acocks (1988) these Moist Upland Grasslands are High/Döhne Sourveld, Southern Tall Grassland and Highland Sourveld to *Cymbopogon-Themeda* Veld Transition.

The South-eastern Mountain Grassland (Low & Rebelo #44), a mixed grassland type, is found on the upland of the Karoo and inland margins of the Great Escarpment of Eastern Cape in the Barkley East-Steynsburg and Cradock-Middleburg areas, and the altitude varies from 1 350 to 2 150 m. In the northern regions (north of Queenstown) on volcanic soils of the Stormberg Plateau, the sweet grassland is dominated by *Themeda triandra, Pennisetum sphacelatum* and *Tetrachne dregei.*

The Moist Cold Highveld Grassland (Low & Rebel #40) occurs in the interior basins and plateaux of the northern and north-eastern parts of Eastern Cape north of Lady Grey, and the undulating plains immediately west of the high escarpment in the eastern Free State and western parts of Lesotho. A high altitude vegetation type from 1 350 to 2 000 m above sea level. It is moderately dense grassland dominated by *Cymbopogon plurinodis, Themeda triandra, Setaria sphacelata, Elionurus muticus* and *Eragrostis curvula*.

The North-eastern Mountain Grassland (Low & Rebelo #43) comprises the grasslands of the northern parts of the great escarpment mountains in Mpumalanga. It stretches northwards along these mountains into Northern Province (now known as Limpopo Province), and southwards through KwaZulu-Natal, reaching the northern parts of the Eastern Cape. Altitude ranges from 1 400 to 1 900 m. This grassland type contains many endemic plant species: 78 endemic or near endemic species occur on the Black reef quartzite (Low & Rebelo 1996).

The typical species that are always present include grasses *Eragrostis racemosa, Microchloa caffra, Alloteropsis semialata, Trachypogon spicatus, Aristida junciformis,* and forbs such as *Eriosema angustifolium and Helichrysum wilmsii.*

The Coastal Bushveld-Grassland (Low & Rebelo #23) occurs from just above sea level to about 300 m altitude. The terrain is more or less flat to gently undulating, but rises overall quite steeply towards the interior. The remaining forest patches are characterised by species such as *Drypetes gerrardii, Millettia grandis, Trichilia emetica and Celtis* spp. The vegetation is restricted to sandy soils of marine origin and is influenced by salt spray, fire and grazing (Acocks 1988).

The dominant species are *Trichilia emetica, V. lanceolata, Acacia robusta, A. nilotica* in forest patches, and the grassy matrix include species such as *Themeda triandra* and *Aristida junciformis.*

The Valley Thicket (Low & Rebelo #5) occurs in the river valleys of the eastern parts of the Western Cape, extending through Eastern Cape to KwaZulu-Natal. In the Eastern Cape, soil varies from sandy clays and lithosols of the Cape Supergroup and Dwyka and Ecca Formations, to deep solonetic soils derived from dolerites of the Beaufort Group. The evergreen species are dominant, rather than the succulent trees or shrubs, and includes *Cassine aethiopica.*

The Subarid Thorn Bushveld (Low & Rebelo #15) occurs in the relatively low-lying valleys in the drainage basin of the White and Black Kei Rivers in the Eastern Cape. Acocks (1988) considered the area to be Dry *Cymbopogon-Themeda* Veld, invaded by

sweet thorn *Acacia karroo* (Low & Rebelo 1996). The most prominent grass species include *Themeda triandra, Heteropogon contortus, Digitaria eriantha* (Acocks 1988).

The Alti Mountain Grassland (Low & Rebelo #46) occurs on the steep, treeless, alpine Upper Mountain Region of Lesotho and the adjacent KwaZulu-Natal Drakensberg, 2 500 to 3 480 m above sea level. Extremely high altitudes with associated low temperatures and snow determine the area of this grassland type during winter. The diagnostic species include the grasses *Harpochloa falx, Eragrostis caesia* and the forbs *Helichrysum flanagannii* and *H. cephaloideum.*

The Dry Sandy Highveld Grassland (Low & Rebelo # 37) is a grassland with the Sweet Thorn *Acacia karroo* trees occurring only occasionally along watercourses. Diagnostic grasses include the grasses *Eragrostis lehmanniana, E. obtusa, Panicum coloratum* and *Stipagrostis uniplumis,* and the forbs present are *Solanum panduriforme, Anthospermum hispidulum,* and dwarf shrubs such as *Walafrida densiflora.*

The Coastal Forest (Low & Rebelo # 1) is confined to a narrow belt of the high dunes with Dune Forest, and this type is best developed in the Alexandria region and locally in protected areas, such as Kei Mouth and in the Eastern Cape. Common species include *Euclea natalensis* and *Combretum kraussi.*

In addition to the naturally occurring species found in this area there are a number of alien species that are found in the study area. They include *Eucalyptus* spp. for plantation and *Acacia mearnsii.* Other considerable plant species are *Stoebe vulgaris* and *Pennisetum villosum*, which have spread into the natural grassland. There is also a problem with black wattle (*Acacia mearnsii*) in the wetter areas of the study areas, and fortunately there seems to be a program in place to eradicate these species. The removal of these trees is vital to the recovery of the natural vegetation around the rivers (Mueller Dombois & Ellenberg 1974), however, the seed bank of seeds still remains viable for along while after the trees have been removed. Other naturally occurring trees will be able to establish themselves after the removal of the black wattles (*Acacia mearnsii*).

2.7 Erosion

The movement of stock animals from to and from watering points in these areas contribute a lot to the formation of the dongas (Figure 2.9). There is lot of run-off taking place in these areas and as such infertile soils are found. The roads that are built on steep slopes also contribute to soil erosion, and can also lead to the formation of dongas.

Figure 2.9 Formation of dongas due to erosion

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CHAPTER 3

Materials and Methods

3.1 Introduction

In this study the classification of the vegetation is done on the basis of the floristic-sociological approach with the essential viewpoint that plant communities are units of classification based primarily on species composition (Coetzee 1993). The specific locality of the study area was demarcated on 1:250 000 scale topographic base maps. The methods applied in this dissertation include extensive literature survey. Fieldwork comprised excursions to the Transkei.

In order to obtain a sound background knowledge of the study area, all the obtainable publications on the vegetation and physical environment of the study area were studied: on vegetation, Low & Rebelo (1996); Perkins (1997); Hoare (1997); on geology, Visser (1984), ENPAT 2001; on climate, Schulze & McGee (1978), Tyson (1986), Weather Bureau data; on soils, Hartmann (1988). The analysis of the data has been done recently since the person who was supposed to do this research decided not to proceed with it.

3.2 Vegetation Survey

3.2.1 Terrain reconnaissance

All the relevant environmental, vegetation and floristic information of the area that were available were obtained. They were based on the geology, topography and rainfall of that area, and using the maps of 1: 250 000 and 1: 50 000 to enable a sound stratification of the study area for efficient sampling of the representative vegetation types.

The study area was traversed in order to get a basic idea of the variation in vegetation types, land use and species composition. Using this information as basis, the area was

stratified into relatively homogenous units, using topography, physiognomy and dominant plant species as major attributes to delimit stratification units.

3.2.2 Number, size and distribution of sample plots

The number of plots within a given region should depend on the heterogeneity (variation) of the area, the scale of the study area, and the accuracy required for the classification (Bredenkamp 1982). Due to species diversity and uneven topography, a sample plots size of 5 m x 5 m for grassland vegetation (Bredenkamp 1975) was chosen. The shape of these sample plots were generally square and was only adapted to circumstances where it was necessary, e.g. in ravines or along watercourses (Matthews 1991). In the present study, area size was taken as the basis for the number of sample plots per stratification unit. In order to give clear reflection of the variation of the vegetation, sample plots were, as far as possible, equally distributed within the different stratification units, and one relevé was compiled in each plot. Stratification was based primarily on physiographic regions proposed by Turner (1967), and modified by Schulze (1982).

The exact position of each sample plot within the relevant stratification unit was chosen subjectively according to the methodology of the Zurich-Montpellier approach of phytosociology (Braun-Blanquet 1964). It has been successfully applied in other phytosociological studies in South African grasslands (*e.g.* Bezuidenhoudt 1988, Behr & Bredenkamp 1988, Bezuidenhoudt & Bredenkamp 1990, Bredenkamp & Bezuidenhoudt 1990, Bredenkamp *et al.* 1991, Kooij *et al.* 1990) and also in many other vegetation types.

Previous phytosociological research in South African grasslands has shown that a sample plot size of 25 m^2 is adequate to sample the diversity of vegetation (Eckhardt 1993), and this size was therefore used in the present study. Sampling was carried out during 1997, and a total number of 379 sample plots (Appendix 2) were surveyed (Figure 4.1), and two relevés were omitted because their coordinates were incorrect. Most of the sampling was done in areas along the roads where plots were easy to reach, although always more than 200 m from the road itself.

3.2.3 Sampling method

The Braun-Blanquet (BB) method (Mueller-Dombois & Ellenberg 1974) was used as the sampling technique in this study, as it is a standardized and widely used technique in South Africa (Bredenkamp 1982). The BB method has been successfully used within various biomes in South Africa (Du Preez 1991) since 1969. The method has been widely accepted because it meets three most important requirements for a vegetation ecology study, namely (i) it is scientifically sound, (ii) it fulfills the necessity of classification at an appropriate level, and (iii) it is the most efficient and versatile amongst comparable approaches (Werger 1973). Because of the above-mentioned reasons and also because the BB method is easy to use and produces a reliable classification of the vegetation of an area (Bredenkamp 1975), it was decided to use this method for the classification of the vegetation of the Transkei grasslands.

A comprehensive floristic and habitat survey was done in each of the sample plots. Taxon names conform to those of Arnold & De Wet (1993), though some names were updated in accordance with the species list contained in the Turboveg database at the University of Pretoria, Botany Department. The use of this technique permits the incorporation of the data into Turboveg (Hennekens 1996a) data bank of the Grassland Biome Project.

3.2.4 Floristic analysis

The floristic survey included a listing of all plant species present in a sample plot, and the allocation of a value of the BB cover-abundance scale (Mueller-Dombois & Ellenberg 1974), according to the cover and abundance of each species. However, scale-unit 2 was separated as suggested by Werger (1974).

The following cover-abundance scale table (Table 3.1) was therefore used:

Table 3.1 Braun-Blanquet cover abundance scale

Symbol	Qualitative Braun-Blanquet scale
r	one or few individual (rare) with less than 1% of total sample plot area.
+	occasional and less than 1% of total sample plot area.
1	abundant and with very low cover or less abundant, but with higher cover, 1–5% cover of total sample plot area
2a	covering 5–12% of the sample plot area, irrespective of the number of individuals
2b	covering 12–25% of the sample plot area, irrespective of the number of individuals
3	>25–50% cover of total sample plot area, irrespective of the number of individuals
4	>50–75% cover of the total sample plot area, irrespective of the number of individuals.
5	>75% cover of the total sample plot area, irrespective of the number of individuals.

Collections of herbarium specimens were made in order to identify plants that could not be identified in the field, and the identification was done at the National Herbarium (PRE) and H.G.W.J. Schweikerdt (PRU), University of Pretoria and also through consultation with other botanists.

3.2.5 Habitat analysis

According to Daubenmire (1968), the distribution of plant communities is mainly determined by environmental factors. The physical environment plays an important role in the ecological interpretation of the floristic data (Bezuidenhout 1988). Detailed habitat information is recommended by Morris (1973) and implemented by Bredenkamp (1982). The physical habitat or environment is made up of a complex of

many interacting factors, which result in the distribution of plant communities (Bredenkamp 1982).

Data recorded included the locality, date of collection, altitude, substrate (*e.g.* Sand), latitude, longitude, geology, topography, topographical position, quadrat size, aspect, slope, soil color & texture, land utilization, biotic influences and any notes considered to be of importance.

The details of the habitat factors investigated in this study area were the following:

(i) Geographical position

Latitude and longitude positions for each relevé were obtained from a Global Positioning System (GPS) (Ensign from Trimble Navigation) in the field. A GPS can record positional data directly in the field and when linked with GIS can be used to compile and generate maps and other data sets (Lass & Callihan 1993).

(ii) Geology

The geology of an area usually influences the soil found in that area (Mac Vicar *et al.* 1991). Information about the geology (Figure 2.3) was obtained from the Environmental Potential Atlas (ENPAT 2001) database on the Arc View package for Geographical Information System (GIS) work. The 1: 250 000 geological survey maps (Department of Mineral and Energy Affairs 1984) of the study area, were used as a guideline for the identification of the geological types.

The following geological types were identified

-Clarens Formation

-Elliot Formation

-Molteno Formation

-Dwyka Formation

-Ecca Group

(iii) Topography

The following topographical positions were distinguished for each sample plot: midslopes, footslopes, crests, scarps, valley bottoms, floodplains and coastal plains. Altitude, slope and aspect were determined for each sample plot. The altitudes were ascertained by means of a hand-held GPS device, or from the topographical maps. Aspect was determined with a compass, and slope was determined with a gradient estimator.

(iv) Rock cover

The percentage of the sample plot area covered by surface rock was estimated, as well as the size of surface rocks.

(v) Soil depth

The soil depth was subjectively estimated as deep or shallow.

(vi) General observations and notes

The extent of disturbance, in the form of erosion, trampling, utilization, as well as signs of fire, were noted at each sampling site. These factors can seriously influence the state of the vegetation (Tainton 1981). It was recorded whether the vegetation was little, moderately, or heavily grazed (utilized), or whether the vegetation was disturbed, such as abandoned ploughed fields, edges of recently ploughed fields, gate entrances or the effect of any other development.

3.3 Data input, processing and analysis

A list of observations of a sample plot with all its floristic and associated environmental data is called a relevé (Eckhardt 1993). A relevé was compiled for each sample plot. Data were imported into a database using the program Turboveg (Hennekens 1996b). The floristic data, which consist of 379 relevés, were subjected to the **T**wo-**W**ay **In**dicator **Spe**cies **An**alysis technique (TWINSPAN) (Hill 1979b) on two levels of division in the MEGATAB program (Hennekens 1996b). Results from the TWINSPAN indicated a first approximation of the major vegetation units in the study area. A phytosociological table was created after which a synoptic table of the major vegetation types was created (Figure 4.1). This synoptic table summarized and

confirmed the vegetation types. Each major vegetation unit (Figure 4.1) was separately subjected to further analyses by TWINSPAN and afterwards refined by means of Braun-Blanquet procedures within MEGATAB to determine the plant communities within the major vegetation types. Four major vegetation types were identified. 364 grassland relevés (Figure 4.2) were classified and the azonal relevés were omitted.

The four major vegetation types are described from the synoptic table (Chapter 4) while each of the major types are described in a separate Chapter from detailed phytosociological tables.

3.4 Ordination

The ordination technique, Detrended Correspondence Analysis (DECORANA) (Hill 1979a) was performed on the four major plant communities in the study area, namely: (i) Bush and grassland vegetation in drier areas, (ii) Wet and disturbed grassland, (iii) Grassland of Undulating areas, and (iv) Moist grasslands of flat plains, in order to determine the relationship between the vegetation and environmental factors. Results of the ordination are presented in a scatter diagram (Figure 4.3). This program was designed primarily for ecologists who have collected data on the occurrence of a set of species in a set of samples (Bonyongo 1999). Its main purpose is to make ordination by the method of detrended correspondence analysis. By using this ordination technique, floristic relationships between the various plant communities as well as habitat gradients can be detected (Bezuidenhout 1993, Greig-Smith 1983).

An ordination of data could be one small graph showing points spread out in space. Each point represents a stand, and the distance between points represents their degree of similarity or difference. At a glance, one can see if there are any patterns of relatedness: whether points are clustered together or form a continuous progression from one extreme to the other (Barbour *et al.* 1980). The objective of ordination is not to draw lines around similar stands and label them as an association; rather, it is to show a pattern of continuous relationships (Barbour *et al.* 1980).

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CHAPTER 4

RESULTS: IDENTIFICATION OF MAJOR VEGETATION TYPES OF THE TRANSKEI GRASSLAND VEGETATION

1 Initial classification

The aim of this chapter is to record the classification of the grassland vegetation of the Transkei into recognizable major vegetation units and to relate these to broad environmental parameters.

The first approximation by TWINSPAN (Hill 1979b), revealed four major vegetation types (Figure 4.1). Although some of these types are under-sampled, this classification gives an indication of the major vegetation types within the grassland and associated vegetation in the Transkei.

The following four main types were identified (Figure 4.1):

♦Wetland vegetation

A single relevé represents this wetland, which is an azonal type and it is not described as a community, and therefore, further detailed sampling is needed in similar vegetation. The dominant species in this relevé are *Juncus capensis, Scillia kraussi, Zaluzianskya africana* and *Plantago caffra.*

♦Grassland

Relevés from this major vegetation type represent typical grassland, which occurs widely over the entire study area.

♦Sandy saline vegetation

Relevés from this major vegetation type represent vegetation of sandy, saline habitats. This group does not represent typical grassland, but an azonal type, and future sampling is needed. This type is dominated by species such as *Sporobolus virginicus, Tetragonia decumbens, Galenia fruticosa, Senecio elegans, Cyperus obtusiflorus,* and *Gazania rigens.*

♦Rivine

This azonal type is dominated by species such as *Stipagrostis zeyheri, Euclea racemosa* and *Schotia afra.* This is forest-like vegetation.

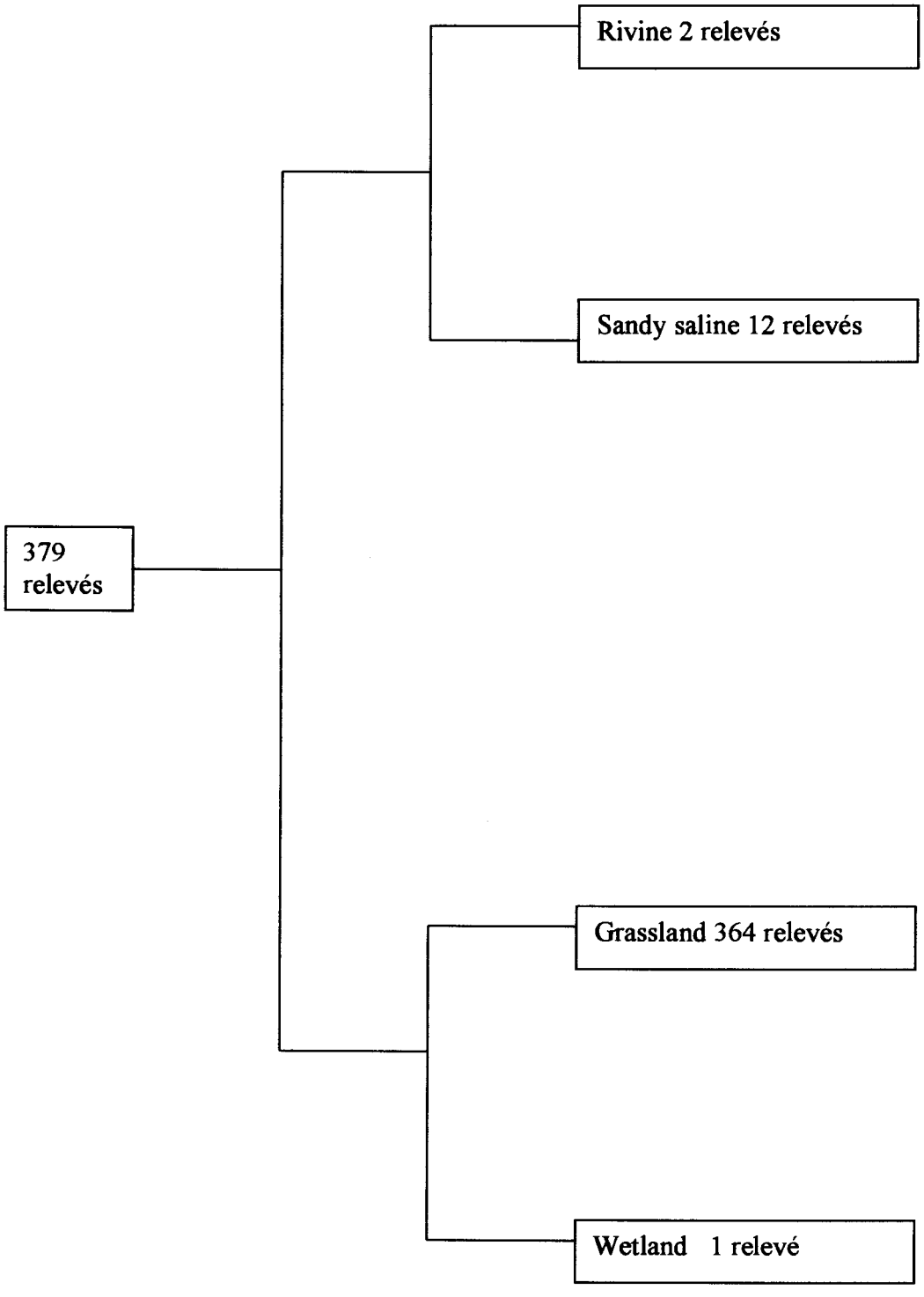


Figure 4.1 Simplified dendrogram showing the four major vegetation types from the first approximation of TWINSPAN classification.

This study, however, focused on the grassland types, and the relevés representing the three other types (i.e. wetland, sandy saline and rivine) were omitted from the Transkei grasslands vegetation database, as they represent azonal types, which were not adequately sampled.

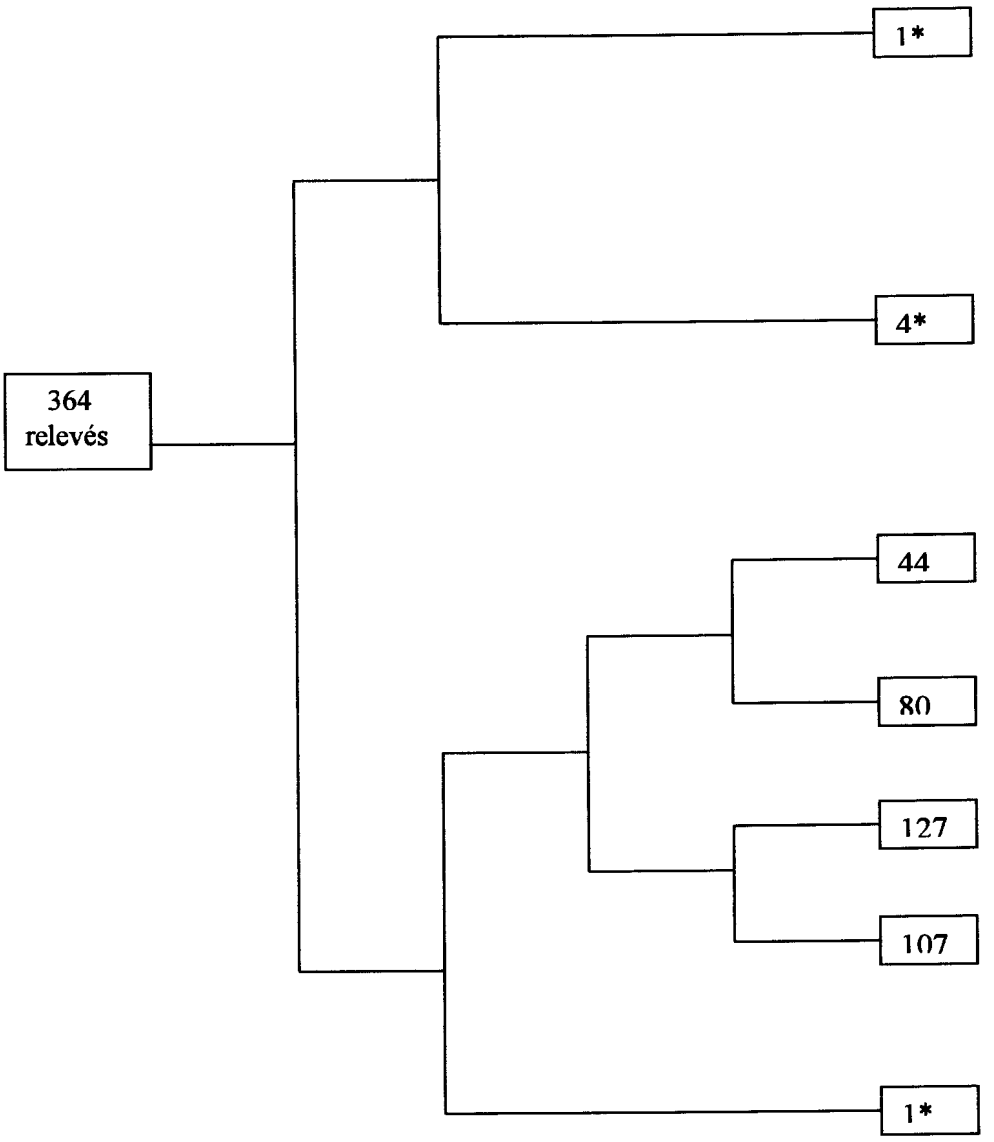
2 Analysis of the grasslands

The 364 relevés that represent the grassland vegetation of Transkei (Figure 4.1) were subjected to TWINSPAN (Hill 1979b), which resulted in the following hierarchical classification (Figure 4.2). After the application of DECORANA (Hill 1979a) a scatter diagram was produced (Figure 4.3) in which the Transkei grassland communities are represented in A (Figure 4.3).

Six relevés were omitted from the database as they do not represent typical grassland types or they represent types that were not well sampled, and would require further sampling. The four major grassland plant communities include the following:

- Bush and Grassland vegetation of drier areas (44 relevés)
- Wet and Disturbed grassland (80 relevés)
- Grassland of Undulating areas (127 relevés)
- Moist Grassland on Flat Plains (107 relevés)

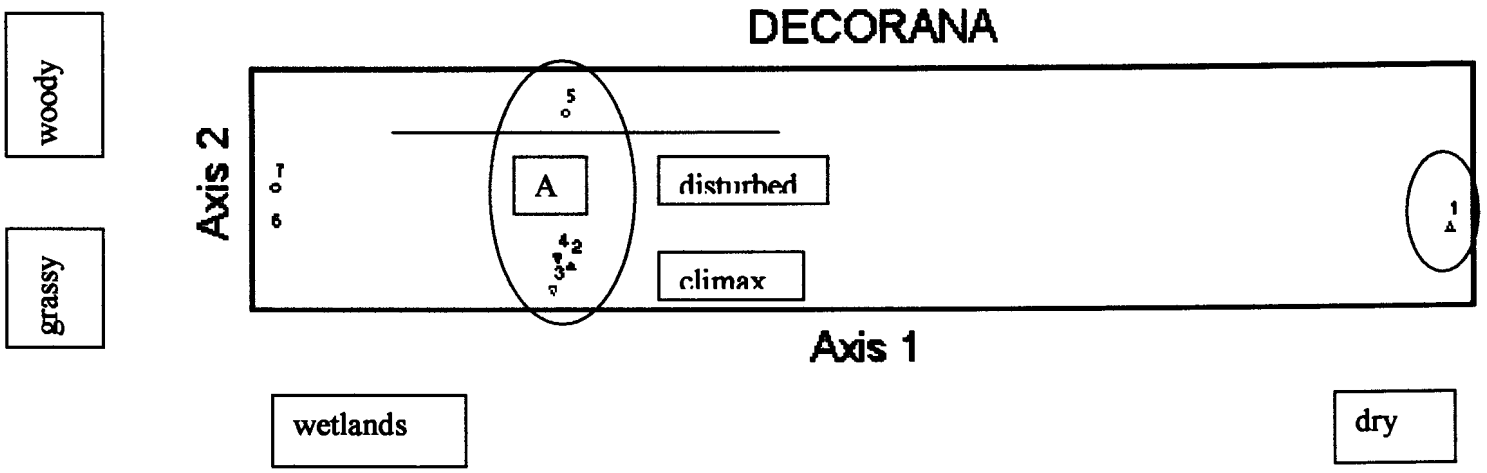
An abbreviated synoptic table of the Transkei grasslands (Table 4.1) was compiled on the four major vegetation types.



Legend

107. Moist grasslands on flat plains
127. Grassland of Undulating Areas
80. Wet and Disturbed Grassland
44. Bush and Grassland vegetation of drier areas
*. Undersampled communities

Figure 4.2 Simplified dendrogram showing the four major communities derived from the first approximation of TWINSPAN classification



Legend

1. Outliers eliminated
2. Moist Grasslands on Flat Plains
3. Grassland of Undulating Areas
4. Wet and Disturbed grassland
5. Bush and Grassland vegetation of drier areas
6. Outliers eliminated
7. Outliers eliminated

A. Four main plant communities

Figure 4.3 Ordination of the four major plant communities

Table 4.1 Synoptic table of the Transkei grasslands data set

Layer	Vegetation type	1	2	3	4
	Number of relevés	44	80	127	107
	Spies Group A	%	%	%	%
pioneer grass	*Aristida congesta* subsp. *barbicollis*	41	1	.	11
karoo shrub	*Felicia muricata*	41	1	.	24
annual weed	*Tagetes minuta*	41	3	2	6
tree	*Acacia karroo*	39	5	0.8	5
pioneer grass	*Eragrostis lehmanniana*	34	1	0.8	6
annual weed	*Schkuhria pinnata*	23	.	2	0.9
pioneer grass	*Eragrostis obtusa*	21	.	.	.
pioneer grass	*Urochloa panicoides*	18	.	.	.
shrub	*Hermannia depressa*	18	3	.	15
herb	*Teucrium trifidum*	18	.	.	0.9
pioneer grass	*Aristida congesta* subsp. *congesta*	16	4	.	7
karoo shrub	*Walafrida densiflora*	14	.	0.8	7
herb	*Oxalis obliquifolia*	11	.	5	8
perennial weed	*Solanum elaeagnifolium*	11	1	.	.
annual weed	*Verbena brasiliensis*	9	4	.	2
annual weed	*Gomphrena celosioides*	9	3	.	2
perennial weed	*Solanum incanum*	9	1	.	0.9
annual weed	*Lepidium africanum*	9	.	.	0.9
herb	*Monsonia angustifolia*	9	.	.	0.9
annual weed	*Xanthium strumarium*	9	1	.	.
herb	*Gamochaeta coarctata*	7	1	.	.
herb	*Blepharis integrifolia*	9	.	.	.
karoo shrub	*Lycium cinereum*	7	.	.	.
shrub	*Diospyros lycioides*	7	.	2	3
climax grass	*Panicum natalense*	7	.	2	6
perennial weed	*Sida dregei*	7	.	2	3
perennial weed	*Gomphocarpus fruticosus*	7	.	0.8	.
herb	*Crepis* species	5	.	0.8	.
herb	*Wahlenbergia juncea*	5	.	.	.
karoo shrub	*Euryops floribundus*	5	.	.	.
shrub	*Asparagus suaveolens*	5	.	.	.
karoo shrub	*Chrysocoma oblongifolia*	5	.	.	.
pioneer grass	*Bothriochloa bladhii*	5	.	.	.
herb	*Abutilon* species	5	.	.	.
karoo shrub	*Lycium villosum*	2	.	.	.
herb	*Agrimonia procera*	2	.	.	.
tree	*Ziziphus mucronata*	2	.	.	.
shrub	*Eriosema psoraleoides*	2	.	.	.
annual weed	*Portulaca oleracea*	2	.	.	.
pioneer grass	*Tragus koelerioides*	2	.	.	.
herb	*Hermannia althaeifolia*	2	.	.	.
geophyte	*Dipcadi viride*	2	.	.	.
pioneer grass	*Sporobolus* species	2	.	.	.
grass	*Drimia elata*	2	.	.	.
annual weed	*Bidens bipinnata*	2	.	.	.
climax grass	*Coccinia* species	2	.	.	.
climax grass	*Miscanthus capensis*	2	.	.	.
grass	*Lachenalia capensis*	2	.	.	.
karoo shrub	*Felicia linifolia*	2	.	.	.
grass	*Bulbine* species	2	.	.	.
herb	*Trigonella* species	2	.	.	.
pioneer grass	*Tragus* species	2	.	.	.
woody shrub	*Medicago* species	2	.	.	.
karoo shrub	*Lycium* species	2	.	.	.
succulent herb	*Crassula* species	2	.	.	.

grass	*Brunsvigia* species	2	.	.	.
karoo shrub	*Aster squamatus*	2	.	.	.
karoo shrub	*Asparagus laricinus*	2	.	.	.
herb	*Verbena* species	2	.	.	.
herb	*Nemesia saccata*	2	.	.	.
karoo shrub	*Metalasia brevifolia*	2	.	.	.
herb	*Gnaphalium vestitum*	2	.	.	.
annual weed	*Chenopodium* species	2	.	.	.
herb	*Lamium* species	2	.	.	.
annual weed	*Galinsoga parviflora*	2	.	.	.
climax grass	*Setaria sphacelata*	2	.	.	.
herb	*Hermannia bicolor*	2	.	.	.
herb	*Helichrysum album*	2	.	.	.
karoo shrub	*Felicia muricata*	2	.	.	.
tree	*Cussonia natalensis*	2	.	.	.
herb	*Vaccaria* species	2	.	.	.
annual weed	*Taraxacum brachyglossum*	2	.	.	.
herb	*Helichrysum obtusum*	2	.	.	.
shrub	*Psoralea cordata*	2	.	.	.
herb	*Oxalis convexula*	2	.	.	.
herb	*Millettia* species	2	.	.	.
herb	*Lamium amplexicaule*	2	.	.	.
climax grass	*Digitaria angolensis*	2	.	.	.
herb	*Centella fusca*	2	.	.	.
perennial grass	*Brachiaria eruciformis*	2	.	.	.
herb	*Anemone* species	2	.	.	.
herb	*Sida chrysantha*	2	.	.	.
herb	*Lotononis laxa*	2	.	.	.
herb	*Pelargonium senecioides*	2	.	.	.
annual weed	*Tribulus terrestris*	2	.	.	.
karoo shrub	*Walafrida geniculata*	2	.	.	.
annual weed	*Xanthium spinosum*	2	.	.	.
annual weed	*Guilleminea* species	2	.	.	.
herb	*Indigofera sessilifolia*	2	.	.	.
shrub	*Argyrolobium parviflorum*	2	.	.	.
karoo shrub	*Felicia microcephala*	2	.	.	.
pioneer grass	*Bothriochloa insculpta*	2	.	.	.
annual weed	*Solanum nigrum*	2	.	.	.
shrub	*Calpurnia aurea*	2	.	.	.
succulent herb	*Talinum caffrum*	2	.	.	.
shrub	*Grewia flava*	2	.	.	.
	Species Group B				
pioneer grass	*Melinis repens*	.	11	4	6
annual weed	*Verbena bonariensis*	.	6	.	0.9
annual weed	*Senecio inaequidens*	2	5	0.8	.
herb	*Ranunculus multifidus*	.	8	.	0.9
sedge	*Cyperus* species	.	8	0.8	0.9
pioneer grass	*Cynodon hirsutus*	.	8	.	2
grass	*Leersia hexandra*	.	4	.	.
sedge	*Juncus oxycarpus*	.	4	.	.
grass	*Paspalum urvillei*	2	3	.	.
weed	*Solanum* species	2	3	.	.
sedge	*Typha capensis*	.	3	.	.
reed	*Phragmites australis*	.	3	.	.
herb	*Ifloga glomerata*	.	3	.	.
herb	*Senecio inornatus*	.	3	.	.

	Species Group C				
forb	*Spermacoce natalensis*	.	18	35	0.9
grass	*Trachypogon spicatus*	.	.	22	5
forb	*Anthospermum herbaceum*	.	3	20	8
grass	*Panicum aequinerve*	.	1	15	2
grass	*Cymbopogon validus*	7	1	14	.
forb	*Zornia capensis*	.	4	14	8
forb	*Pentanisia angustifolia*	.	4	13	5
grass	*Diheteropogon amplectens*	.	.	12	2
forb	*Berkheya speciosa*	.	3	10	8
shrub	*Rhus dentata*	.	.	8	5
forb	*Thunbergia atriplicifolia*	.	.	9	4
fern	*Pteridium aquilinum*	.	.	7	2
forb	*Eriosema salignum*	.	.	7	0.9
grass	*Loudetia simplex*	.	.	6	.
grass	*Eragrostis superba*	.	.	6	.
forb	*Hydrocotyle* species	.	1	6	.
forb	*Sebaea leiostyla*	.	1	5	.
forb	*Phyllanthus parvulus*	.	3	6	.
forb	*Thunbergia neglecta*	.	.	4	.
forb	*Acalypha ambigua*	.	.	3	.
grass	*Eulalia villosa*	.	.	3	.
forb	*Athrixia elata*	.	.	2	.
forb	*Zornia* species	.	.	2	.
forb	*Aster peglerae*	.	.	2	.
tree	*Ficus thonningii*	.	.	2	.
forb	*Senecio harvelanus*	.	.	2	.
forb	*Plectranthus spicatus*	.	.	2	.
sedge	*Mariscus* species	.	.	2	.
forb	*Thunbergia* species	.	.	2	.
forb	*Senecio bipinnatus*	.	.	2	.
forb	*Senecio juniperinus*	.	.	2	.
grass	*Andropogon schirensis*	.	.	2	.
forb	*Aspidoglossum lamellatum*	.	.	2	.
forb	*Rhynchosia reptabunda*	.	.	2	.
shrub	*Aspalathus lamarckiana*	.	.	2	.
succulent	*Crassula spathulata*	.	.	2	.
shrub	*Asparagus* species	.	.	2	.
geophyte	*Moraea* species	.	.	2	.
grass	*Agrostis* species	.	.	2	.
forb	*Alepidea* species	.	.	2	.
forb	*Euphorbia* species	.	.	2	.
forb	*Helichrysum ammitophilum*	.	.	2	.
tree	*Leucosidea sericea*	.	.	2	.
grass	*Diheteropogo filifolius*	.	.	2	.
grass	*Panicum schinzii*	.	.	2	.
	Species Group D				
forb	*Vernonia natalensis*	2	.	8	21
grass	*Harpochloa falx*	.	1	6	20
forb	*Turbina oblongata*	.	.	.	19
forb	*Haplocarpha scaposa*	.	3	9	17
grass	*Cymbopogon plurinodis*	9	.	2	15
grass	*Andropogon appendiculatus*	.	1	6	12
geophyte	*Ledebouria ovalifolia*	.	1	6	12
geophyte	*Boophane disticha*	.	.	0.8	11
geophyte	*Ledebouria ovatifolia*	2	.	2	10
forb	*Euphorbia striata*	2	.	0.8	9
forb	*Gnidia kraussiana*	2	.	0.8	9
forb	*Hibiscus pusillus*	2	.	0.8	8
grass	*Eustachys paspaloides*	2	.	0.8	7

	Species Group E				
forb	*Scabiosa columbaria*	.	.	13	32
grass	*Alloteropsis semialata*	.	1	20	13
forb	*Helichrysum nudifolium*	.	3	13	12
forb	*Acalypha punctata*	.	1	11	11
sedge	*Cyperus obtusiflorus*	.	.	13	10
forb	*Helichrysum pilosellum*	.	.	17	22
forb	*Zornia linearis*	5	.	10	11
forb	*Kohautia amatymbica*	.	.	4	5
sedge	*Bulbostylis schoenoides*	.	.	6	3
forb	*Gerbera piloselloides*	.	.	6	2
forb	*Aster bakeranus*	.	.	3	4
forb	*Senecio bulbinifolius*	.	.	3	4
forb	*Acalypha angustata*	.	.	3	3
forb	*Crabbea hirsuta*	.	.	3	3
forb	*Eriosema cordatum*	.	.	4	2
forb	*Polygala hottentotta*	.	.	2	8
shrub	*Elephantorrhiza elephantina*	.	.	2	8
geophyte	*Scilla nervosa*	.	.	2	7
forb	*Schoenoxiphium sparteum*	.	.	2	4
forb	*Acalypha schinzii*	.	.	2	3
forb	*Crabbea acaulis*	.	.	2	2
forb	*Senecio oxyrilifolius*	.	.	2	2
grass	*Alloteropsis semialata*	.	.	2	3
forb	*Hypericum lalandii*	.	.	2	2
geophyte	*Gladiolus species*	.	.	2	2
forb	*Artemisia afra*	.	.	2	2
forb	*Senecio isatideus*	.	.	2	2
	Species Group F				
geophyte	*Tritonia lineata*		1	20	0.9
forb	*Cynoglossum hispidum*	.	5	6	5
forb	*Monopsis decipiens*	.	8	8	2
geophyte	*Sporobolus pyramidalis*	.	3	8	2
forb	*Pentanisia prunelloides*	.	4	8	4
geophyte	*Hypoxis acuminata*	.	1	6	6
sedge	*Mariscus congestus*	.	8	4	3
sedge	*Coleochloa setifera*	.	5	6	3
dwarf shrub	*Stoebe vulgaris*	.	1	2	9
forb	*Senecio erubescens*	.	1	6	4
forb	*Berkheya setifera*	.	1	6	4
geophyte	*Hypoxis iridifolia*	.	3	4	5
forb	*Helichrysum appendiculatum*	.	3	3	4
forb	*Polygala amatymbica*	.	3	4	3
forb	*Hypericum aethiopicum*	.	4	5	2
geophyte	*Hypoxis rigidula*	.	1	2	6
forb	*Helichrysum cephaloideum*	.	1	4	3
forb	*Sphenostylis angustifolia*	.	1	2	4
forb	*Rhynchosia adenodes*	.	1	2	3
forb	*Cucumis zeyheri*	.	1	0.8	4
forb	*Helichrysum callicomum*	.	1	0.8	3
forb	*Pentanisia* species	.	3	2	0.9
forb	*Dianthus moolensis*	.	1	0.8	2
forb	*Polygala* species	.	1	0.8	2
forb	*Zaluzianskya katharina*	.	1	0.8	2
dwarf shrub	*Lippia javanica*	.	1	2	0.9
forb	*Schistostephium heptalobum*	.	1	2	0.9
forb	*Denekia capensis*	.	1	0.8	0.9
geophyte	*Paspalum notatum*	.	1	0.8	0.9

forb	*Indigofera spicata*	.	1	4	0.9
annual weed	*Taraxacum officinale*	.	3	0.8	0.9
geophyte	*Zantedeschia albomaculata*	.	5	2	0.9
sedge	*Fuirena pubescens*	.	1	2	0.9
grass	*Digitaria monodactyla*	.	1	0.8	4
forb	*Monopsis scabra*	.	1	2	0.9
	Species Group G				
forb	*Anthospermum rigidum*	16	.	4	16
grass	*Eragrostis chloromelas*	14	.	0.8	13
forb	*Hibiscus aethiopicus*	11	.	8	20
forb	*Oxalis corniculata*	9	.	3	5
geophyte	*Hypoxis hemerocallidea*	2	.	5	8
grass	*Melinis nerviglumis*	7	.	3	10
forb	*Helichrysum miconiifolium*	5	.	6	10
forb	*Graderia scabra*	2	.	4	2
grass	*Digitaria tricholaenoides*	5	.	0.8	9
	Species Group H				
succulent herb	*Aloe ferox*	9	.	.	7
forb	*Hermannia coccocarpa*	5	.	.	5
fern	*Pellaea calomelanos*	2	.	.	7
forb	*Tephrosia capensis*	5	.	.	6
forb	*Geigeria filifolia*	5	.	.	4
geophyte	*Ledebouria cooperi*	5	.	.	5
	Species Group I				
grass	*Eragrostis plana*	43	81	65	46
grass	*Cynodon dactylon*	82	43	5	22
grass	*Themeda triandra*	7	14	59	74
grass	*Heteropogon contortus*	7	1	41	68
grass	*Eragrostis capensis*	18	6	35	61
grass	*Digitaria eriantha*	30	5	10	9
forb	*Commelina africana*	27	20	22	39
annual weed	*Richardia brasiliensis*	23	53	41	26
grass	*Sporobolus africanus*	32	48	43	31
forb	*Polygala ohlendorfiana*	18	10	2	13
forb	*Felicia filifolia*	16	13	5	28
grass	*Microchloa caffra*	23	9	10	48
grass	*Hyparrhenia hirta*	30	26	43	33
forb	*Helichrysum rugulosum*	25	10	4	32
forb	*Senecio bupleuroides*	11	6	8	41
grass	*Eragrostis curvula*	16	29	29	44
forb	*Helichrysum aureonitens*	11	10	24	17
forb	*Diclis reptans*	16	14	6	8
forb	*Lactuca inermis*	11	3	0.8	6
forb	*Teucrium kraussii*	14	4	2	6
grass	*Paspalum scrobiculatum*	7	30	25	5
forb	*Centella asiatica*	2	35	23	10
grass	*Paspalum dilatatum*	9	36	15	3
forb	*Hypochaeris radicata*	7	24	15	11
grass	*Helictotrichon turgidulum*	5	13	11	11
sedge	*Kyllinga alba*	9	20	17	11
sedge	*Cyperus esculentus*	2	10	6	2
forb	*Senecio burchellii*	9	11	8	2
sedge	*Kyllinga alata*	7	15	3	5
annual weed	*Cirsium vulgare*	2	15	2	2
grass	*Setaria sphacelata*	9	21	29	20
geophyte	*Hypoxis argentea*	7	13	20	20
forb	*Lobelia erinus*	7	11	17	18

sedge	*Abildgaardia ovata*	9	15	28	26
grass	*Aristida junciformis*	2	11	40	14
forb	*Rhynchosia totta*	2	6	18	23
forb	*Gerbera ambigua*	2	3	11	11
grass	*Cymbopogon excavatus*	5	5	10	10
grass	*Eragrostis racemosa*	7	3	21	45
grass	*Brachiaria serrata*	7	4	6	31
annual herb	*Chamaecrista mimosoides*	5	1	17	8
grass	*Aristida diffusa*	2	5	2	15
forb	*Senecio retrorsus*	5	6	3	11
forb	*Sonchus wilmsii*	9	1	3	10
forb	*Cyanotis speciosa*	7	1	4	17
grass	*Elionurus muticus*	2	3	6	52
forb	*Chaetacanthus setiger*	5	1	5	12
forb	*Bulbostylis burchellii*	5	1	8	6
grass	*Aristida bipartita*	5	4	2	7
forb	*Cotula hispida*	5	3	3	4
forb	*Crabbea nana*	2	5	6	7
forb	*Chamaecrista comosa*	5	1	3	2
forb	*Crepis hypochoeridea*	5	1	6	5
forb	*Conyza podocephala*	5	5	4	6
forb	*Helichrysum glomeratum*	2	3	7	2
forb	*Berkheya radula*	9	3	8	2
forb	*Senecio venosus*	2	5	9	6
grass	*Koeleria capensis*	2	1	6	6
forb	*Chaetacanthus costatus*	2	3	9	6
forb	*Berkheya rhapontica*	2	1	7	6
forb	*Senecio speciosus*	2	3	6	3
forb	*Helichrysum acrophilum*	5	1	6	4
grass	*Setaria nigrirostris*	2	3	4	9
annual weed	*Conyza bonariensis*	16	14	3	0.9
forb	*Sida rhombifolia*	5	13	0.8	0.9
annual weed	*Bidens pilosa*	16	5	6	0.9
forb	*Oenothera rosea*	5	5	0.8	2
forb	*Arctotis arctotoides*	9	1	0.8	3

From this synoptic table the following can be derived:

3 Description of the major grassland types

3.1 Bush and Grassland vegetation of drier areas

This major vegetation type is widely distributed over the Transkei area, though it is restricted to the drier ecosystems, that include areas of lower rainfall or areas where the topography or soil causes relatively drier condition (Figure 5.1). The vegetation can vary according to specific plant communities within this vegetation type, from open to dense *Acacia karroo* bush, to dry mountain slopes covered with *Aloe ferox*-dominated shrubland, to a short dry shrubland dominated by shrubs such as *Diospyros lycioides, Lycium cinereum, Euryops floribundus, Asparagus suaveolens, Chrysocoma oblongifolia, Ziziphus mucronata* to a dry grassland with very few woody species.

From the synoptic table (Table 4.1) Species Group A indicates the diagnostic species for this vegetation type. Although only 14 diagnostic species attain a high frequency, there are many species basically restricted to this vegetation type, as shown by Species Group A. Many of the species are indicators of dry conditions, for example the karoo bushes, including species such as *Felicia muricata, Walafrida densiflora, Euryops floribundus* and *Lycium villosum*, and also some of the pioneer grasses, for example *Aristida congesta,* which also indicate a certain degree of degradation. This is also emphasized by the presence of various weedy annual species, for example *Tagetes minuta, Schkuhria pinnata, Verbena brasiliensis, Gomphrena celosioides Lepidium africanum* and *Xanthium strumarium.* Some grass species that are diagnostic include *Aristida congesta* subsp. *congesta, Aristida congesta* subsp. *barbicollis, Eragrostis lehmanniana, E. obtusa, Urochloa panicoides, Panicum natalense, Bothriochloa bladhii* and *Tragus koelerioides* (Table 4.1 Species Group A).

Grasses represent the dominant plant type in the herbaceous layer. Most of these grasses are dominant and widespread over the entire region of the Transkei, as shown

in Species Group I (Table 4.1). These include species such as *Eragrostis plana, Cynodon dactylon, Digitaria eriantha, Hyparrhenia hirta* and *Microchloa caffra.*

3.2 Wet and Disturbed grassland

Wet and disturbed grasslands mostly occur in bottomland areas or in areas that were intensively utilized during a long period of human settlement. These areas occur widespread over the Transkei area (Figure 6.1). The wet grasslands are not true wetlands, though they may often occur on the plains adjacent to floodplains. These areas are often over utilized by man.

The vegetation is mostly quite short, often grazed and trampled and often represents old fields that were abandoned and the pioneer vegetation had already become established. In the case of the moister sites, merging into wetland areas, sedges or reeds (*Phragmites australis*) may be present.

Species Group B (Table 4.1) contains the diagnostic species for this vegetation type. The wet habitat is indicated by the hygrophilous species in this Species Group, including the reed *Phragmites australis,* sedges such as *Cyperus* spp., *Juncus oxycarpus* and *Typha capensis,* but also hygrophilous herbaceous pioneer plants for example *Verbena bonariensis* and *Senecio inaequidens.* The hygrophilous forbs *Ranunculus multifidus, Ifloga glomerata* and *Senecio inornatus* and grasses *Leersia hexandra* and *Paspalum urvillei* are also diagnostic for this vegetation type.

Species from other species groups that indicate the wet habitat conditions include *Monopsis decipiens, Mariscus congestus* (Species Group F), *Centella asiatica, Paspalum dilatatum, P. scrobiculatum,* and *Hypochaeris radicata* (Species Group I).

The most dominant and most frequently present species are the grasses *Eragrostis plana, Cynodon dactylon, Sporobolus africanus, Hyparrhenia hirta, Eragrostis curvula* and the weedy forb *Richardia brasiliensis* (Species Group I).

3.3 Grassland of Undulating Areas

Although also widespread over the Transkei area, this vegetation type is more prominent in the northern and western areas at higher altitudes where the landscape is transitional to the mountain area (Figure 7.1).

The vegetation is dominated by tall grasses, which are typical of the higher altitude mountain areas along the eastern escarpment of southern Africa, including *Trachypogon spicatus, Panicum aequinerve, Cymbopogon validus* and *Diheteropogon amplectens* Species Group C (Table 4.1). On rocky outcrops woody bushclumps occur, which include woody species of the wetter Drakensberg area for example *Ficus thonningii, Rhus dentata, Artemisia afra* and *Leucosidea sericea.*

The diagnostic species are listed in Species Group C (Table 4.1). Other diagnostic grasses and forbs, typically found on the slopes in the Drakensberg area, also on hill and ridges in the Bankenveld (Acocks 1988, Bredenkamp & Brown 2003) include the grasses *Trachypogon spicatus, Cymbopogon validus, Diheteropogon amplectens, Loudetia simplex, Eragrostis superba, Eulalia villosa* and *Andropogon schirensis*, and the forbs *Spermacoce natalensis, Anthospermum herbaceum, Zornia capensis, Pentanisia angustifolia, Berkheya speciosa, Thunbergia atriplicifolia, Eriosema salignum, Sebaea leiostyla, Thunbergia neglecta, , Athrixia elata,* and *Aster peglerae* and the fern *Pteridium aquilinum.*

Other species that are conspicuously present are the grass *Alloteropsis semialata,* the sedge *Cyperus obtusiflorus* and the forbs *Scabiosa columbaria, Helichrysum nudifolium, H. pilosellum* and *Acalypha punctata* (Species Group E) and the geophyte *Tritonia lineata* (Species Group F).

As typical for most of the Transkei, the dominant species are listed in Species Group I, and include the grasses *Eragrostis plana, Themeda triandra, Hetereopogon contortus, Eragrostis capensis, E. curvula, Sporobolus africanus, Hyparrhenia hirta, Setaria sphacelata, Aristida junciformis* and the forbs *Richardia brasiliensis* and *Helichrysum aureonitens.*

3.4 Moist Grasslands on Flat Plains

These grasslands are situated on the flat plains of Transkei, which occur widespread over the region, although they are the most prominent in the central parts, in the region of Umtata (Figure 8.1). The vegetation is often short, grazed grassland with scattered old fields and moister wetlands, as shown in Figure 8.1.

The diagnostic species found in this vegetation type are listed in Species Group D (Table 4.1), and include the grasses *Harpochloa falx, Cymbopogon plurinodis, Andropogon appendiculatus* and *Eustachys paspaloides,* the forbs *Vernonia natalensis, Turbina oblongata, Haplocarpha scaposa, Euphorbia striata, Gnidia kraussiana* and *Hibiscus pusillus,* while the geophytes *Ledebouria ovatifolia, L. ovalifolia* and *Boophane disticha* are diagnostically present.

Other conspicuous species include the forbs *Scabiosa columbaria* and *Helichrysum pilosellum* (Species Group E), *Hibiscus aethiopicus* (Species Group G), and the widespread and often dominant grass species listed in Species Group I, including *Eragrostis plana, Cynodon dactylon, Themeda triandra, Heteropogon contortus, Eragrostis capensis, Sporobolus africanus, Microchloa caffra, Hyparrhenia hirta, Eragrostis curvula, Setaria sphacelata, Eragrostis racemosa, Brachiaria serrata,* and *Elionurus muticus.* Forbs that are often encountered in this grassland are *Commelina africana, Richardia brasiliensis, Felicia filifolia, Helichrysum rugulosum, Senecio bupleuroides, Abildgaardia ovata* and *Rhynchosia totta.*

4 Discussion

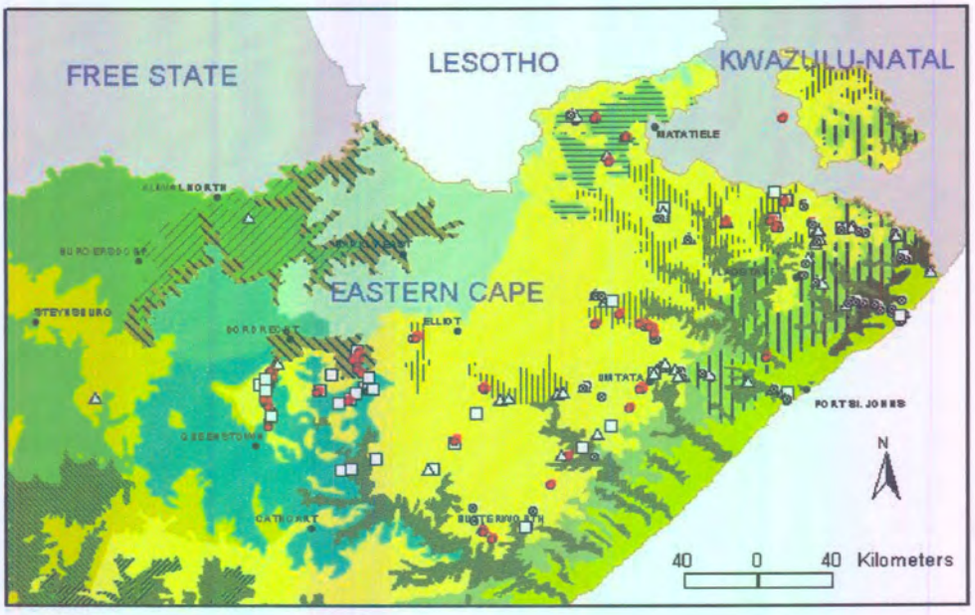
Although some woody vegetation types could be recognized, the larger portion of the data shows that grasslands predominate in the Transkei region. Local inhabitants utilized these grasslands over a long period of time (Cawe 1986, McKenzie 1984). This resulted in some degree of disturbance over large parts of the grassland, as also indicated by the presence, and often abundance of weedy species. This is particularly conspicuous in areas where fields for cultivation of crops have been abandoned and natural vegetation had time to establish and recover (Smits *et al.* 1999). In spite of this utilization some areas still contain grassland in a close to climax condition, indicated

by the prominence of *Themeda triandra*. It also appears that, when degraded the *Themeda triandra*-dominated grassland may change to an *Eragrostis plana*-dominated grassland, with a high cover of the weed *Richardia brasiliensis*. Recovery of these degraded sites may lead to the establishment of *Hyparrhenia hirta*. Once established, *Hyparrhenia hirta* tends to become dominant and the vegetation remains *Hyparrhenia hirta*-dominated for a long time, preventing *Themeda triandra* to become established (Moll 1965; Bredenkamp & Brown 2003). For this reason Bredenkamp & Brown (2003) consider *Hyparrhenia hirta*-dominated grassland as being anthropogenic in origin. However, sites were observed where the grassland was protected from utilization for a few years by fences, and here *Themeda triandra* took over dominance. It therefore seems that recovery towards *Themeda triandra*-dominated grassland is possible with specific management actions.

Areas where woody vegetation predominates were not ploughed, though cattle and goats grazed these areas. Most of these woody plant communities occur on rocky hills or steep slopes. These areas are drier and the grass layer is not as well developed, as is the case in the grassland communities. Various woodland communities were found, though those dominated by *Acacia karroo* or *Aloe ferox* are the most conspicuous. These plant communities also often have a unique plant species composition, and may also act as special habitats for particular animal species, especially bird species. In some cases the *Acacia karroo* may become very dense, due to bush encroachment (Friedel 1987), a phenomenon associated with overgrazing and disturbance of these ecosystems.

During the analysis of the data it became clear that each of the four major vegetation types described here contains several plant communities. The species group shows the typical dominant and widespread species of the Transkei grasslands. The vegetation is dominated by grasses such as *Eragrostis plana, Cynodon dactylon*, *Themeda triandra*, and the presence of some of the species indicate that the vegetation of this area is highly disturbed, or was heavily utilized in the past. The herbs are the perennial *Helichrysum rugulosum, H. aureonitens* and *Commelina africana,* the branched shrub *Felicia filifolia,* the geophyte *Hypoxis argentea,* the weed *Bidens pilosa* the soft shrublet *Teucrium krausii.*

Therefore the relevés representing each of these types (Figure 4.4) were analyzed separately to identify these plant communities. The description of the plant communities for each major vegetation type is given in Chapters 5-8.



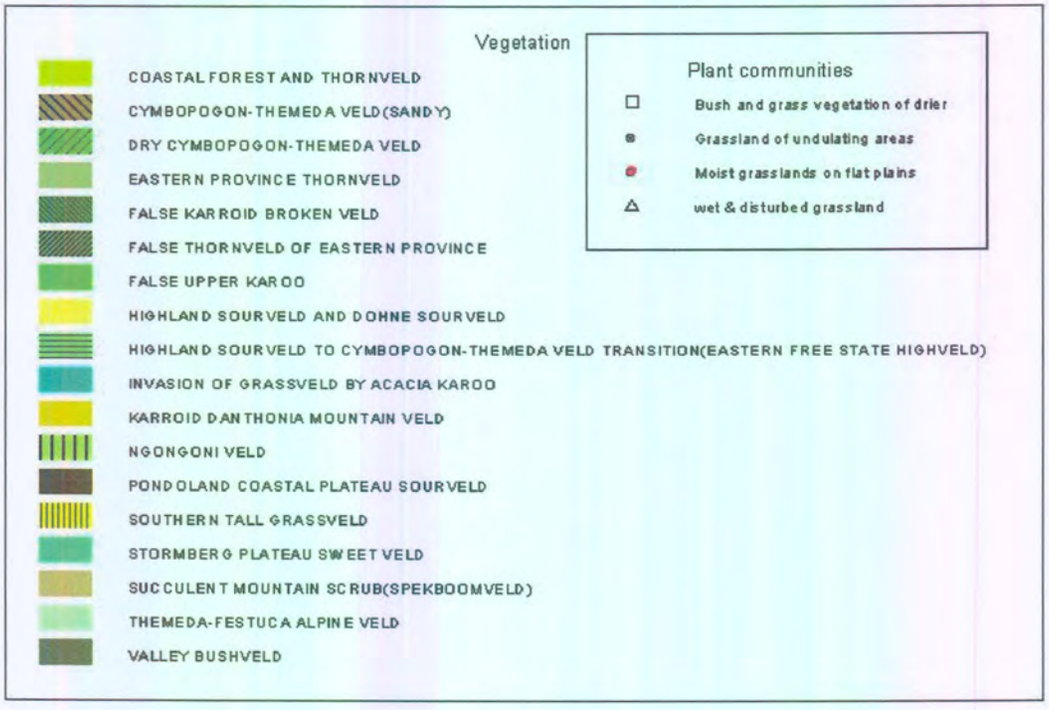


Figure 4.4 Locality of the four major plant communities

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CHAPTER 5

RESULTS: BUSH AND GRASSLAND VEGETATION OF DRIER AREAS

1 Introduction

The initial classification of the floristic data from the Transkei vegetation survey (See Chapter 4) revealed in the identification of, amongst others, the Bush and Grassland vegetation of drier areas. It was indicated that this vegetation type is unique within the Transkei, with a large number of diagnostic species listed under Species Group A in the synoptic table (Table 4.1). Many of the species present are indicators of dry conditions, for example the karoo bushes, including species such as *Felicia muricata, Walafrida densiflora, Euryops floribundus* and *Lycium villosum*, and also some of the pioneer grasses, for example *Aristida congesta,* which also indicate a certain degree of degradation. This is also emphasized by the presence of various weedy annual species, for example *Tagetes minuta, Schkuhria pinnata, Verbena brasiliensis, Gomphrena celosioides, Lepidium africanum* and *Xanthium strumarium.* Some of the grass species that are diagnostic include *Aristida congesta* subsp. *congesta, Aristida congesta* subsp. *barbicollis, Eragrostis lehmanniana, E. obtusa, Urochloa panicoides, Panicum natalense, Bothriochloa bladhii* and *Tragus koelerioides* (Table 4.1).

This major vegetation type occurs widely distributed over the Transkei area, though it is restricted to the drier ecosystems, that include areas of lower rainfall or areas where the topography or soil causes relatively drier condition. The vegetation can vary according to specific plant communities within this vegetation type, from open to dense *Acacia karroo* bush, to dry mountain slopes covered with *Aloe ferox*–dominated shrubland (Species Group H), to a short dry shrubland dominated by shrubs such as *Diospyros lycioides, Lycium cinereum, Euryops floribundus, Asparagus suaveolens, Chrysocoma oblongifolia, Ziziphus mucronata* to a dry grassland with very few woody species.

In most areas within this type, grasses form the dominant vegetation layer. Most of these grasses are dominant and widespread over the entire region of the Transkei, as

shown in Species Group I (Table 4.1). These include species such as *Eragrostis plana, Cynodon dactylon, Digitaria eriantha, Hyparrhenia hirta* and *Microchloa caffra.*

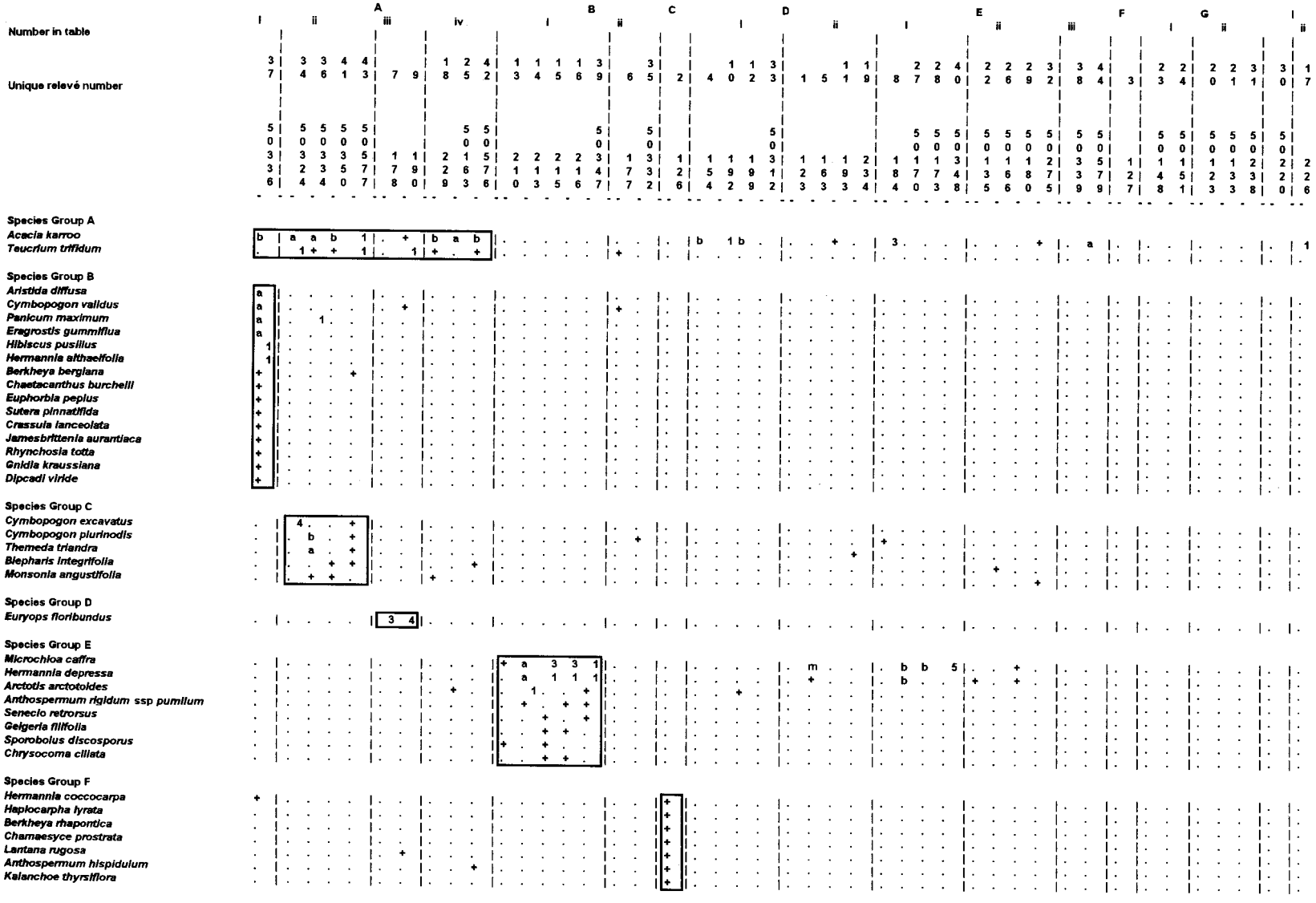
In this Chapter the various plant communities that are found within the Bush and Grassland Vegetation Type are classified, described and interpreted in terms of their habitat.

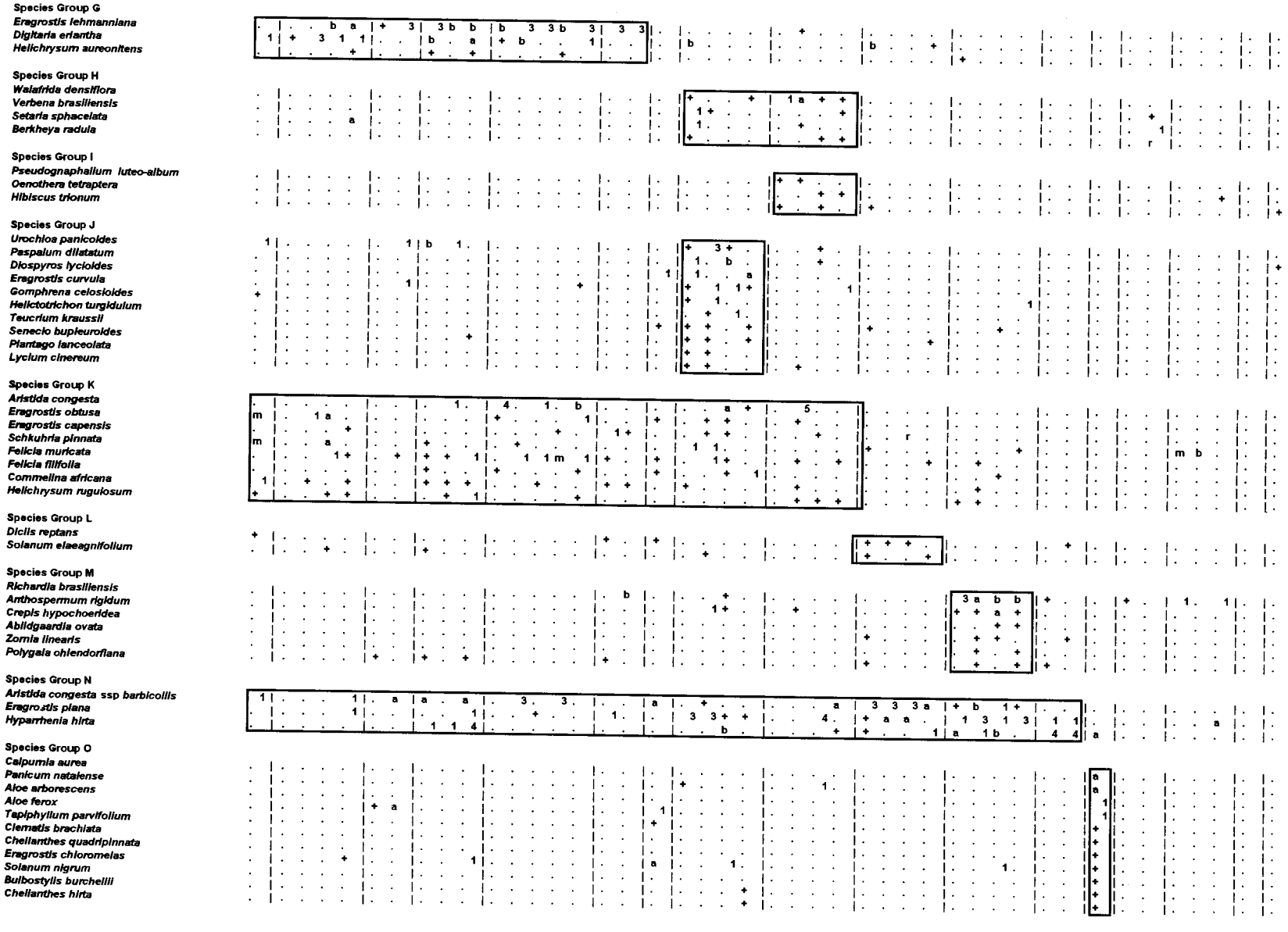
2 Results and discussion

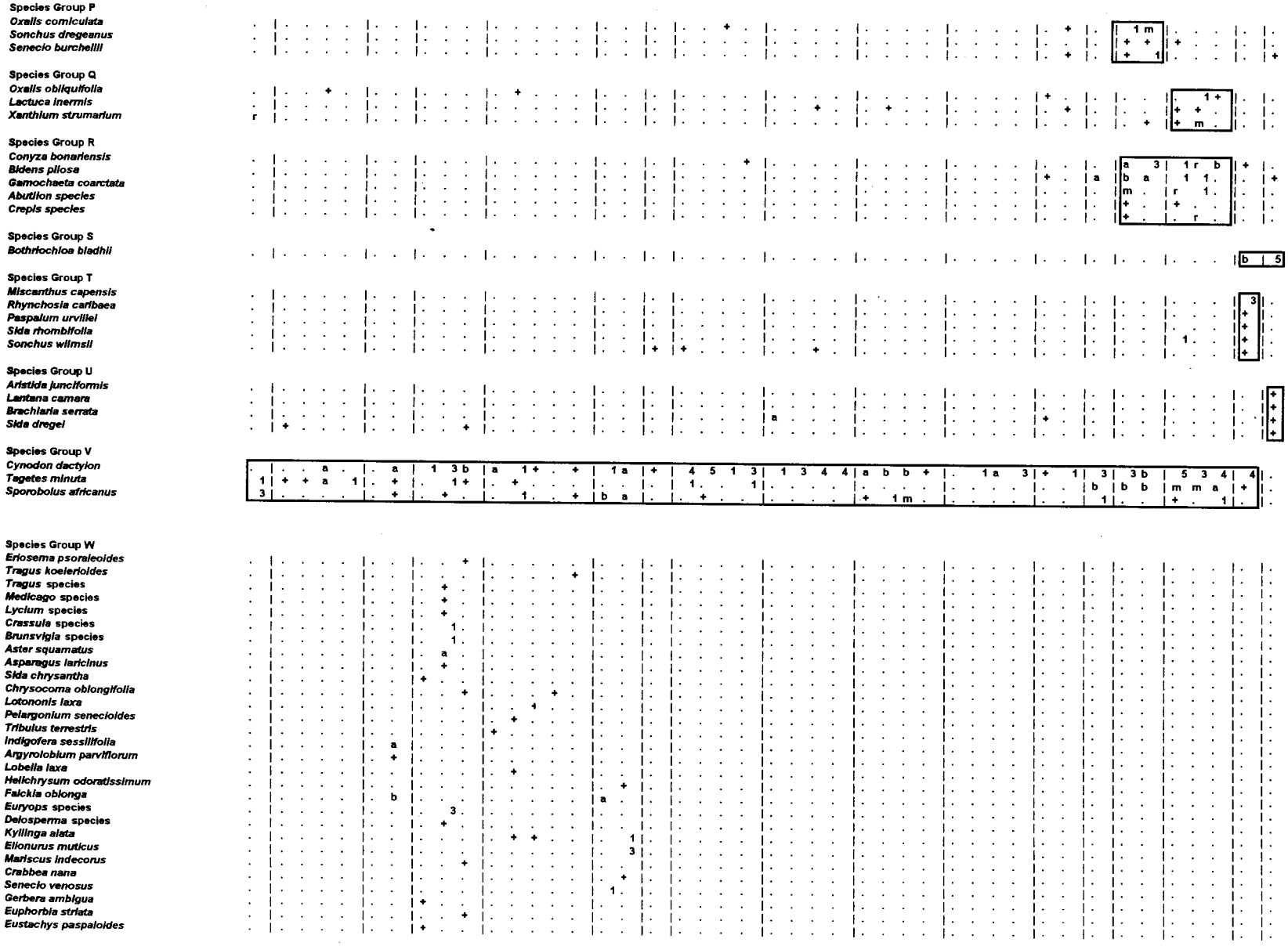
2.1 Classification of plant communities

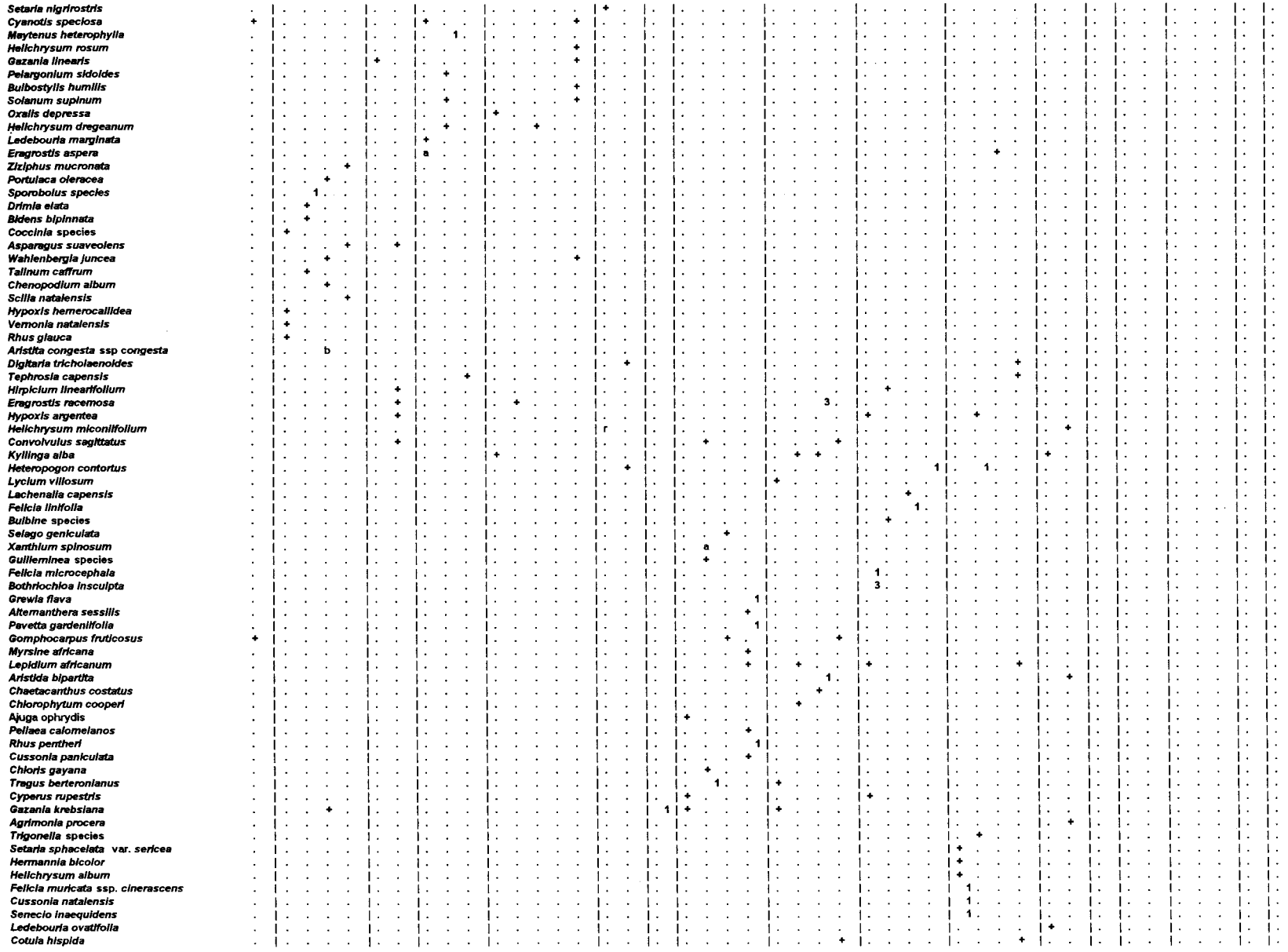
Data collected in the 44 relevés sampled in Bush and grassland vegetation of drier areas were collated in a phytosociological table. This table was further refined, using the computer program MEGATAB, to produce Table 5.1

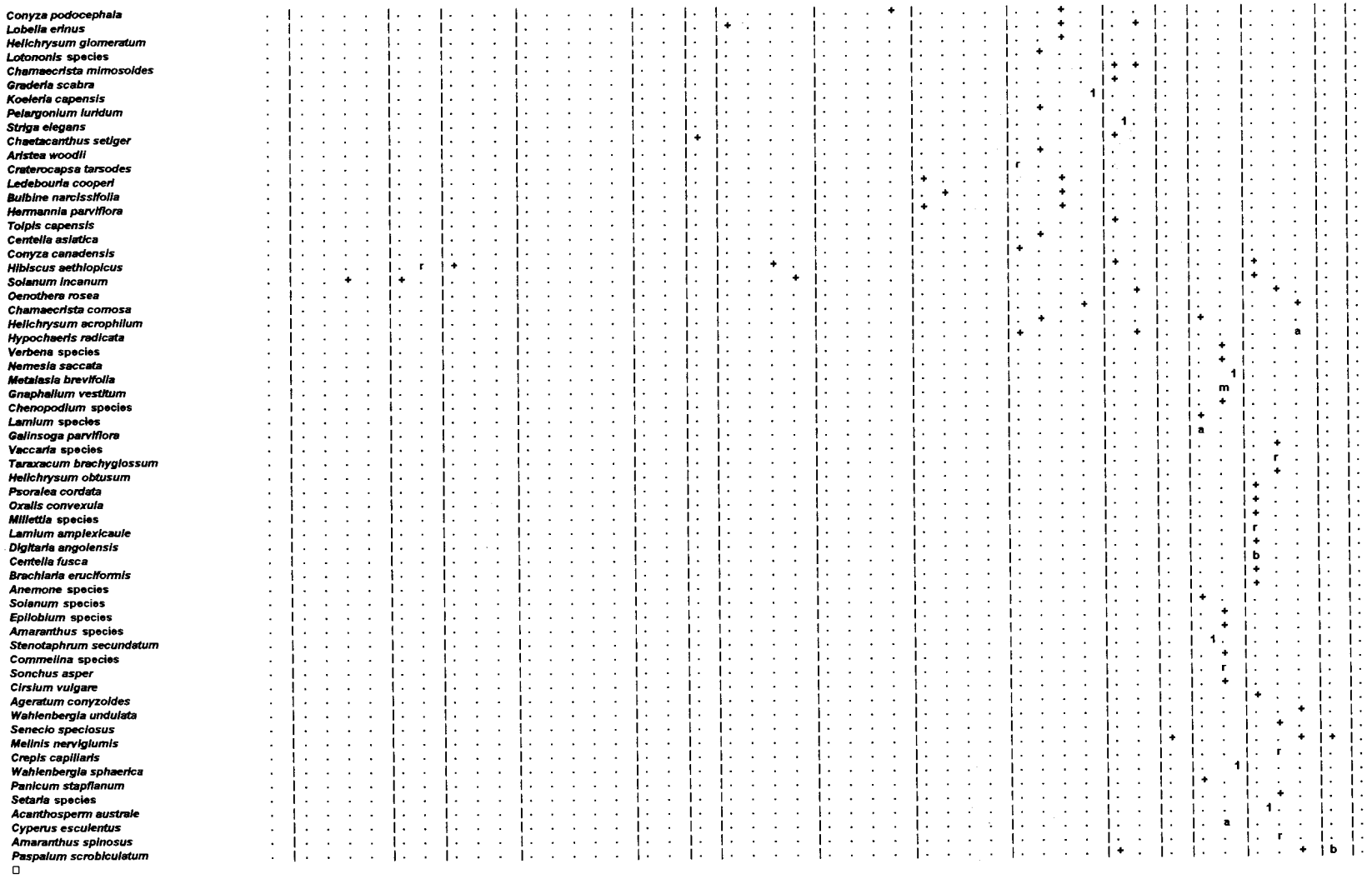
Table 5.1. Phytosociological table of Bush and Grassland vegetation of drier areas




Species Group G
Eragrostis lehmanniana
Digitaria eriantha
Helichrysum aureonitens
Species Group H
Walafrida densiflora
Verbena brasiliensis
Setaria sphacelata
Berkheya radula
Species Group I
Pseudognaphalium luteo-album
Oenothera tetraptera
Hibiscus trionum
Species Group J
Urochloa panicoides
Paspalum dilatatum
Diospyros lycioides
Eragrostis curvula
Gomphrena celosioides
Heliotrichon turgidulum
Teucrium kraussii
Senecio bupleuroides
Plantago lanceolata
Lycium cinereum
Species Group K
Aristida congesta
Eragrostis obtusa
Eragrostis capensis
Schkuhria pinnata
Felicia muricata
Felicia filifolia
Commelina africana
Helichrysum rugulosum
Species Group L
Dicliptera
Solanum elaeagnifolium
Species Group M
Richardia brasiliensis
Anthospermum rigidum
Crepis hypochoeridea
Abildgaardia ovata
Zornia linearis
Polygala ohlendorfiana
Species Group N
Aristida congesta ssp barbicollis
Eragrostis plana
Hyparrhenia hirta
Species Group O
Calpurnia aurea
Panicum natalense
Aloe arborescens
Aloe ferox
Tapiphyllum parvifolium
Clematis brachiata
Chellanthes quadripinnata
Eragrostis chloromelas
Solanum nigrum
Bulbostylis burchellii
Chellanthes hirta






Conyza podocephala
Lobelia erinus
Helichrysum glomeratum
Lotononis species
Chamaecrista mimosoides
Graderia scabra
Koeleria capensis
Pelargonium luridum
Striga elegans
Chaetacanthus setiger
Aristea woodii
Craterocapsa tarsodes
Ledebouria cooperi
Bulbine narcissifolia
Hermannia parviflora
Tolpis capensis
Centella asiatica
Conyza canadensis
Hibiscus aethiopicus
Solanum incanum
Oenothera rosea
Chamaecrista comosa
Helichrysum acrophilum
Hypochaeris radicata
Verbena species
Nemesia saccata
Metalasia brevifolia
Gnaphalium vestitum
Chenopodium species
Lamium species
Galinsoga parviflora
Vaccaria species
Taraxacum brachyglossum
Helichrysum obtusum
Psoralea cordata
Oxalis convexula
Millettia species
Lamium amplexicaule
Digitaria angolensis
Centella fusca
Brachiaria eruciformis
Anemone species
Solanum species
Epilobium species
Amaranthus species
Stenotaphrum secundatum
Commelina species
Sonchus asper
Cirsium vulgare
Ageratum conyzoides
Wahlenbergia undulata
Senecio speciosus
Melinis nerviglumis
Crepis capillaris
Wahlenbergia sphaerica
Panicum stapfianum
Setaria species
Acanthosperm australe
Cyperus esculentus
Amaranthus spinosus
Paspalum scrobiculatum

The positions of the samples plots representing the Bush and Grassland vegetation of drier areas are also shown in Figure 5.1. This vegetation type is very often found on dolorite, but may also occur on arenite and mudstone, and sometimes on shale and sedimentary rocks.

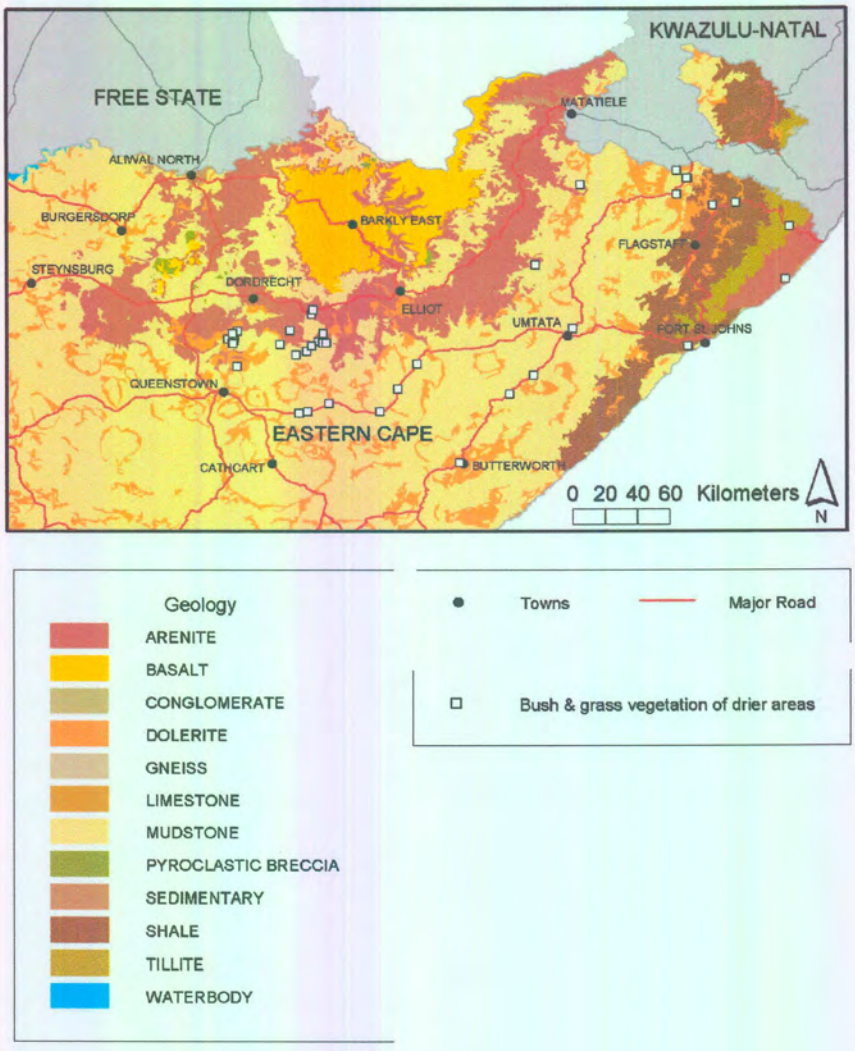


Figure 5.1 A Geological map of Transkei with the position of the sample plots representing Bush and Grassland vegetation of drier areas community with geology.

The classification revealed 8 communities and 15 Sub–communities. These are:

A. *Teucrium trifidum–Acacia karroo* Thornveld
   (i) *Aristida diffusa* Sub-community
   (ii) *Cymbopogon excavatus* Sub–community
   (iii) *Euryops floribundus* Sub–community
   (iv) *Eragrostis lehmanniana* Sub–community
B. *Eragrostis lehmannia* Grassland
   (i) *Microchloa caffra* Sub–community
   (ii) Typical Sub–community
C. *Hermannia coccocarpa–Diospyros lycioides* Shrubveld
D. *Cynodon dactylon–Walafrida densiflora* Shrubby grassland
   (i) *Eragrostis curvula* Sub–community
   (ii) *Pseudognaphalium luteo-album* Sub–community
E. *Eragrostis plana-Aristida congesta* Grassland
   (i) *Sporobolus africanus* Sub–community
   (ii) *Richardia brasiliensis* Sub–community
   (iii) *Hyparrhenia hirta* Sub–community
F. *Aloe ferox-Calpurnia aurea* Shrubland
G. *Bidens pilosa-Conyza bonariensis* Weedland (Disturbed land)
   (i) *Senecio burchellii* Sub–community
   (ii) *Xanthium strumarium* Sub–community
H. *Bothriochloa bladhii* Moist grassland
   (i) *Miscanthus capensis* Sub–community
   (ii) *Acacia karroo* Sub–community

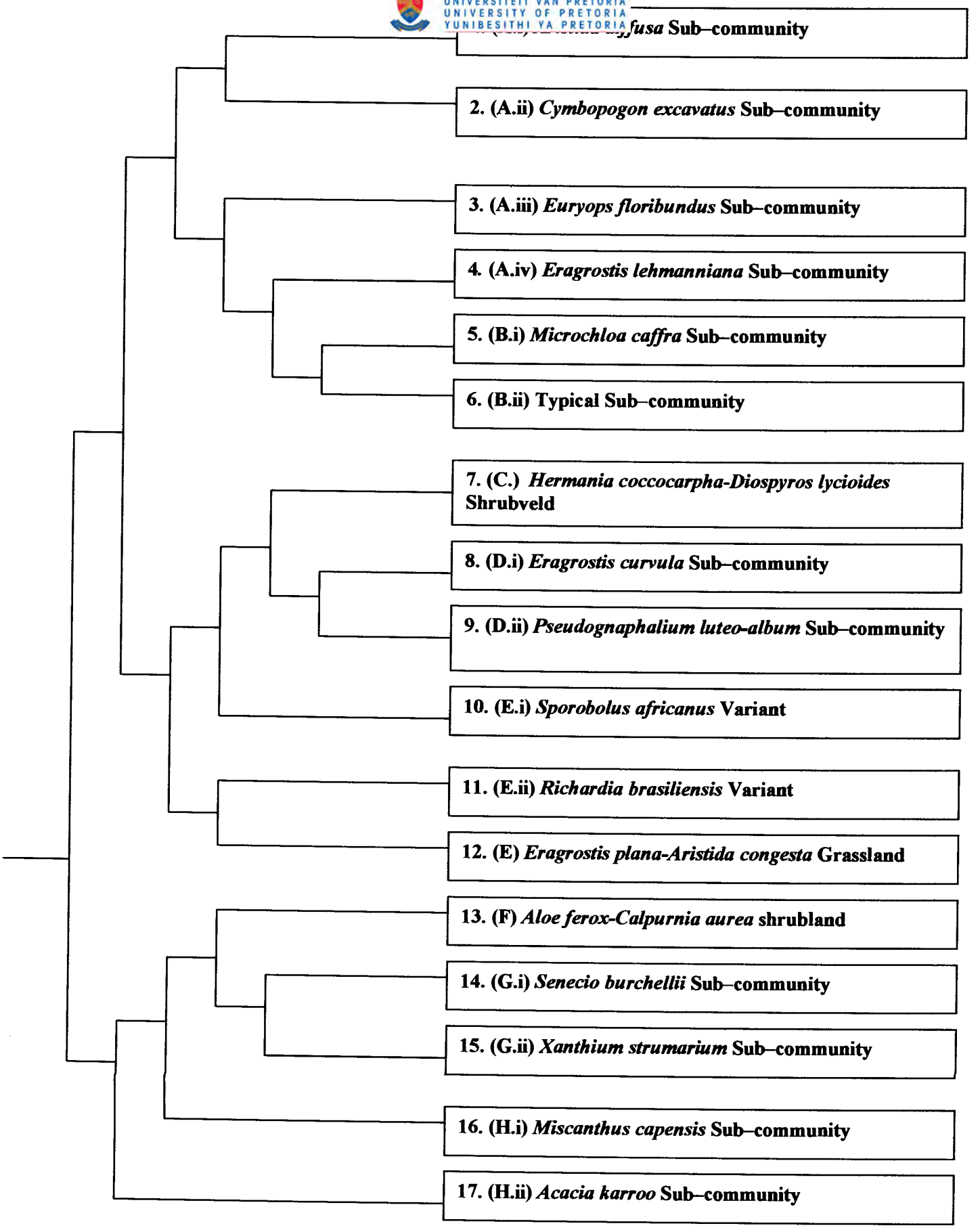


Figure 5.2 Dendrogram representing Bush and Grassland vegetation of drier areas.

2.2 Description of plant communities

A. *Teucrium trifidum – Acacia karroo* Thornveld

This thornveld is situated in an area that is highly disturbed and overgrazed and there is an invasion of *Acacia karroo.* The soil is reddish brown, sandy-to-sandy loam.
Cattle and goats heavily graze the vegetation. The total vegetation cover is 75%, in average, with the tree cover 10%, on average. The herbaceous layer is 0.7m tall and covers 70% on average.

This thornveld is characterized by Species Group A (Table 5.1), and the diagnostic species are the tree *Acacia karroo* and the soft shrublet *Teucrium trifidum*.

The prominent species in the grass layer are *Cymbopogon excavatus,* (Species Group C), *Digitaria eriantha, Eragrostis lehmanniana* (Species Group G), *Aristida congesta* subsp. *barbicollis* (Species Group N), *Sporobolus africanus* and *Cynodon dactylon* (Species Group V). The herbaceous layer is dominated by the soft shrublet *Teucrium trifidum* (Species Group A), the perennials *Commelina africana* (Species Group K), *Felicia muricata* (Species Group K), the annual *Schkuhria pinnata* (Species Group K), perennial *Helichrysum rugulosum*, (Species Group K) and the annual weed *Tagetes minuta* (Species Group V) and the tree layer is dominated by *Acacia karroo* shrubs and trees (average height of 2 m) tall.

The community is further sub-divided into four Sub–communities.

(i) *Aristida diffusa* Sub–community

This Sub–community is situated in bottomlands, which has a slight slope (2°) towards the north east on the broad alluvium of the White Kei River. The soils are red sandy loam, without any rocks on the surface. There are termitaria in the area and cattle and goats graze the vegetation.

The total cover of the vegetation is almost 80% with the wood layer on average 2.2 m tall, covering 25% whereas the herbaceous layer is on average tall (0.7 m), with a 70% cover.

This Sub–community is characterized by Species Group B (Table 5.1) and the diagnostic species include the grasses *Panicum maximum, Eragrostis gummiflua, Aristida diffusa, Cymbopogon validus,* and herbaceous low-growing *Hibiscus pusillus* and *Hermannia althaeifolia.*
The prominent species include among others the grasses *Digitaria eriantha* (Species Group G), *Urochloa panicoides* (Species Group J), *Aristida congesta* subsp. *barbicollis* (Species Group N), *Sporobolus africanus* (Species Group V), while the herbaceous layer is dominated by perennial *Commelina africana* (Species Group K), *Xanthium strumarium* (Species Group Q), annual weed *Tagetes minuta* (Species Group V), and the tree layer is dominated by *Acacia karroo* (Species Group A).

(ii) *Cymbopogon excavatus* Sub–community

This Sub–community is situated on flat plains or at south–facing footslopes (2°), on very deep (> 1 m deep) red to reddish brown sandy loam soils. At one locality (relevé 50350) the soil was 20 m deep, as indicated by a 20 m deep donga.
The average cover of the vegetation is 76%, with the woody layer on average 3 m tall, covering 15%, while the herbaceous layer is on average 0.75 m tall. Although the vegetation has a relatively high cover, it is often overgrazed and in a poor condition, with erosion evident.

This Sub–community (Figure 5.3) is characterized by Species Group C (Table 5.1). Diagnostic species include grasses such as the tall growing *Cymbopogon excavatus, Themeda triandra* and *Cymbopogon plurinodis.*

Prominent species include grasses such as *Digitaria eriantha* (Species Group G), *Eragrostis obtusa* (Species Group K), *Eragrostis plana* (Species Group N) and *Aristida congesta* subsp. *barbicollis* (Species Group N). The herbaceous layer is dominated by the weedy annual *Tagetes minuta* (Species Group V), the geophyte

Hypoxis hemerocallidea (Species Group W), the perennial shrublet *Solanum incanum* (Species Group W), the perennial *Helichrysum rugulosum*, (Species Group K) and the tree layer is dominated by *Acacia karroo* (Species Group A).

Figure 5.3 *Cymbopogon excavatus* Sub–community

(iii) *Euryops floribundus* Sub–community

This Sub–community occurs on the midslopes of east or southeast– facing hills, on slopes of about 15°. The hills are mostly dolerite, but may also be Karoo sediments. The soils are light brown to red, with a 10% cover of stones (up to 50 cm diameter). The soils are mainly sandy.

The total vegetation cover is 70% with the tree layer up to 1.8 m tall, covering on average 55% whereas the shrub layer (karoo-bushes) of up to 0.7 m tall, cover on average 50%. The karoo bushes are prominent. The herbaceous layer is 0.5 m tall, but covers only 1–5%. The area is heavily overgrazed and termite activity was observed.

This Sub–community (Figure 5.4) is characterized by Species Group D (Table 5.1), and the diagnostic species is *Euryops floribundus*.

The prominent species include grasses such as *Eragrostis lehmanniana*, (Species Group G), *Urochloa panicoides* (Species Group J), *Aristida congesta* subsp. *barbicollis* (Species Group N), *Cynodon dactylon* (Species Group V). The herbaceous layer is dominated by *Indigofera sessilifolia* (Species Group W), *Falckia oblonga* (Species Group W) and the tree layer is dominated by *Acacia karroo* (Species Group A) and *Aloe ferox* (Species Group O).

Figure 5.4 *Euryops floribundus* Sub–community

(iv) *Eragrostis lehmanniana* Sub–community

This Sub–community is a typical *Acacia karroo* dominated bushveld that occurs on the flat or bottomland situations within the slightly undulating plains of the Transkei. The soils are mostly >1 m in depth, light brown to reddish, and mostly a clay loam. The vegetation is heavily grazed, sheet and gully erosion is evident and in some cases the topsoil layers have been completely removed by erosion.

The total vegetation cover is 72% on average, with the tree layer height 2.6 m on average and tree cover 12% on average. The herbaceous layer cover is high despite the high degree of disturbance (on average 65%), but it is only about 8–10 cm tall.

There are no diagnostic species that characterize this Sub–community, but it is differentiated by the presence of Species Group A and the absence of Species Groups B, C and D. This Sub–community is characterized by dominant species such as *Eragrostis lehmanniana, Digitaria eriantha,* (Species Group G), *Urochloa panicoides (*Species Group J), *Hyparrhenia hirta* (Species Group N), *Aristida congesta* subsp. *barbicollis* (Species Group N), *Cynodon dactylon* (Species Group V) in the grass layer. The herbaceous layer is dominated by bushy dwarf shrubs *Euryops floribundus* (Species Group D) and *Felicia muricata,* (Species Group K) as well as the perennial herbs *Commelina africana* (Species Group K). The tree layer is dominated by *Acacia karroo* (Species Group A).

B. *Eragrostis lehmanniana* Grassland

This is a very dry grassland mostly situated towards the drier south western parts of the Transkei. This grassland community (Figure 5.5) is characterized by Species Group G (Table 5.1), which includes diagnostic species such as the grasses *Eragrostis lehmanniana* and *Digitaria eriantha*, and the forb *Helichrysum aureonitens*.

The dominant species in grass layer are *Microchloa caffra*, *Sporobolus discosporus* (Species Group E), *Aristida congesta, (*Species Group K*), Urochloa*

panicoides (Species Group J), *Eragrostis plana* (Species Group N) and *Cynodon dactylon* (Species Group V). In the herbaceous layer, the prostrate *Hermannia depressa* (Species Group E), the dwarf shrub *Felicia muricata* (Species Group K) and the forb *Helichrysum aureonitens* (Species Group G) are prominent while in the shrub layer *Anthospermum rigidum* subsp. *pumilum* (Species Group E) is the prominent species. The tree species is dominated by *Acacia karroo* (Species Group A).

Figure 5.5 *Eragrostis lehmanniana* Grassland

The major community is further divided into two Sub–communities, namely:

(i) *Microchloa caffra* Sub–community

This dry grassland Sub–community is situated on footslopes of up to 2° steep. Often south or east–facing slopes or on flat plains within the undulating grassland landscape. The soils are light brown-to-brown, sandy-to-sandy loam, up to 1 m deep, and are mostly without rocks on the surface, though small stones (5–10 cm diameter) may cover 1–5% of the soil surface.
Cattle and goats graze the area, and termitaria or annual diggings do occur in this area. The total cover of the vegetation (herbaceous layer) is quite high, on average 78%. Trees are rare and only found in exceptional cases. The herbaceous layer is on average only 14 cm tall.

This Sub–community is characterized by Species Group E (Table 5.1). Diagnostic species include the grass *Microchloa caffra* and in the herbaceous layer *Anthospermum rigidum* subsp. *pumilum* and *Hermannia depressa* are diagnostic.

The prominent species in the grass layer are *Eragrostis lehmanniana* (Species Group G), *Digitaria eriantha* (Species Group G), *Aristida congesta* subsp. *barbicollis* (Species Group N), *Cynodon dactylon* (Species Group V) and *Sporobolus africanus* (Species Group V), while the herbaceous layer is dominated by the karroid dwarf shrubs *Felicia muricata* (Species Group K) and *Felicia filifolia* (Species Group K).

(ii) Typical Sub–community

This grassland is situated at the footslops of hills in the undulating grassland landscape. The habitat is quite similar to Sub–community B (i) though the slopes are steeper (5°), facing southeast to southwest.
The soils are light brown sands, without any rock cover on the soils surface. The vegetation is grazed and both sites are burnt the previous winter. No trees are present. The herbaceous layer is on average 35 cm tall and cover 72%.

This Sub–community is characterized by the presence of Species Group G, and absence of Species Groups A–E are absent (Table 5.1).

This Sub–community is characterized by dominant species such as *Eragrostis lehmanniana* (Species Group G), *Eragrostis capenis* (Species Group K), *Eragrostis plana* (Species Group N), *Sporobolus africanus* (Species Group V), *Cynodon dactylon* (Species Group V) and *Elionurus muticus* (Species Group W) in the grass layer, the herbaceous layer is dominated by the perennial forb *Commelina africana* (Species Group K) and the weedy *Richardia brasiliensis* (Species Group M).

C. *Hermannia coccocarpa – Diospyros lycioides* shrubveld

Some of the hills in the undulating grassland landscape are rocky, with boulders > 1 m in diameter, covering up to 45% of the soil surface. These rocky hillslopes are the habitat for this shrubveld. The soils are shallow, < 10 cm deep, brown and sandy. The shrubs are 0.5 m tall and cover 5% and the herbaceous layer is 5 cm tall, covering 50%.

This shrubveld community (Figure 5.6) is characterized by Species Group F (Table 5.1). The diagnostic species include species such as the much branched, aromatic shrub *Lantana rugosa,* as well as *Anthospermum hispidulum*.

The prominent species in the grass layer are *Aristida congesta* subsp. *barbicollis* (Species Group N) and *Eragrostis chloromelas* (Species Group O), the shrub layer is dominated by *Diospyros lycioides* (Species Group J) and the succulent *Aloe ferox* (Species Group O) is conspicuously present in the herbaceous layer.

Figure 5.6 *Hermannia coccocarpa – Diospyros lycioides* shrubveld

D. *Cynodon dactylon – Walafrida densiflora* Shrubby grassland

This grassland/shrubland occurs on footslopes or valley bottoms where the herbaceous layer is severely degraded, and either encroached by *Acacia karroo,* or becoming dominated by weedy annual plants. This shrubby grassland community is characterized by Species Group H (Table 5.1). The diagnostic species are *Walafrida densiflora* and *Berkheya radula.*

The prominent grass species include *Urochloa panicoides, Eragrostis curvula* (Species Group J), *Aristida congesta, Eragrostis obtusa* (Species Group K), *Aristida cogesta* ssp. *Barbicollis, Eragrostis plana, Hyparrhenia hirta* (Species Group N). The herbaceous layer is dominated by *Anthospermum rigidum* (Species Group E) the annual weed *Tagetes minuta* (Species Group V). T the tree layer is dominated *Acacia karroo* (Species Group A).
This community is further divided into two Sub–communities, namely:

(i) *Eragrostis curvula* Sub–community

This shrubby grassland, often with *Acacia karroo,* is situated on slopes of hills or mountains, often adjacent to denser *Acacia karroo* vegetation. Although there are mostly no rocks on the soil surface, rocks may occur locally, covering up to 40%. The soil is mostly < 1 m deep, brown and sandy loam or clay loam. The area is heavily grazed, consequently the herbaceous layer is degraded often with weedy, pioneer species and is seems *Acacia karroo* is encroaching into the degraded grassland areas.
The woody layer is 2 m tall, on average, and covers 14%. The herbaceous layer is mostly only 5–10 cm tall and covers 57 % on average, though at local overgrazed sites it can be as low as 35 %.
This Sub–community is characterized by Species Group I (Table 5.1), with diagnostic species such as *Eragrostis curvula, Urochloa panicoides,* and *Paspalum dilatatum* in grass layer and *Diospyros lycioides* in the shrub layer.

The prominent species in the grass layer are *Aristida congesta* (Species Group K), *Eragrostis plana* (Species Group N), *Cynodon dactylon* (Species Group V). The

herbaceous layer is dominated by the karroid dwarf shrub *Felicia muricata,* (Species Group K), the perennial forb *Commelina africana* (Species Group K), and the annual weed *Schkuhria pinnata* (Species Group K), while the tree layer is dominated by *Acacia karroo* (Species Group A).

(ii) *Pseudognaphalium luteo-album* Sub–community

This Sub–community is mostly situated in broad valleys, in the bottomlands, often on black clays. The soils are deep, (> 1 m), mostly without rocks on the surface. The area is heavily grazed and the vegetation is degraded, often weedy. No trees are found in this vegetation, the herbaceous layer is mostly shortly grazed, and is mostly only 3–5 cm tall, and covers on average 41%.

This Sub–community is characterized by Species Group J (Table 5.1), which have diagnostic species such as the weedy herbaceous *Pseudognaphalium luteo-album* (Species Group I), *Hibiscus trionum* (Species Group I), *Walafrida densiflora* (Species Group H) and *Verbena brasiliensis* (Species Group H).

The herbaceous layer is dominated by bushy karroid dwarf shrub *Felicia muricata* (Species Group K) and the perennial forb *Helichrysum rugulosum* (Species Group K).

E. *Eragrostis plana* – *Aristida congesta* Grassland

This grassland represents vegetation that has been degraded by overgrazing or old-field, and is presently still degraded or is in a recovery phase. *Acacia karroo* or karoo-bush encroachment maybe observed, while weedy species or *Hyparrhenia hirta* predominate.

This grassland is characterized by Species Group N (Table 5.1). The diagnostic species include grasses such as *Eragrostis plana, Aristida congesta* subsp. *barbicollis* and *Hyparrhenia hirta*.

The species such as *Microchoa caffra* (Species Group E), *Cynodon dactylon* (Species Group V) are prominent in the grass layer, the herbaceous layer is dominated the sedge *Abildgaardia ovata* (Species Group M), the tree layer is dominated by *Acacia karroo* (Species Group A).

This major community is further divided into three Sub–communities, namely:

(i) *Sporobolus africanus* Sub–community

This is very dry grassland, becoming karoo-hills towards the south–western part of the Transkei. The habitat is dry midslopes (2–16°) or footslopes, almost flat, with shallow (20 cm) to deep (1 m) light brown sabdy loam soils, often covered up to 5% with small stones (up t 10 cm diameter). Termitaria are present. The vegetation is lightly degraded, due to overgrazing, and may even represent very cold, recovery maize fields. The tree layer is only exceptionally present, with *Acacia karroo.* The herbaceous layer is on average 15 cm tall, and covers, on average, 60%.

This grassland Sub–community is characterized by Species Group L (Table 5.1). The diagnostic species are including herbs such as *Diclis reptans* and *Solanum elaeagnifolium*.

The prominent species in grass layer include *Microchloa caffra* (Species Group E), *Eragrostis plana* (Species Group N), *Hyparrhenia hirta* (Species Group N), *Aristida congesta* subsp. *barbicollis* (Species Group N), *Sporobolus africanus* (Species Group V), *Cynodon dactylon* (Species Group V. The herbaceous layer is dominated by sprawling, mat-forming *Diclis reptans* (Species Group L), and *Hermannia depressa* (Species Group E).

(ii) *Richardia brasiliensis* Sub–community

This grassland occurs on slopes in the undulating grassland landscape. The slopes are often 3–5°, mostly west or northwest facing. The soils are brownish yellow, loamy, deep, with 12 % cover of small stones or rocks. The vegetation seems to

represent a late recovery phase of abandoned old fields (with *Hyparrhenia hirta*), or alternatively severely overgrazed sites. No trees occur in this Sub–community, the herbaceous layer is 3–25 cm tall, covering 62% on average.

This Sub–community is characterized by Species Group M (Table 5.1), and has diagnostic species such as the weedy herbs *Richardia brasiliensis* and *Anthospermum rigidum*.

The prominent species in grass layer are *Hyparrhenia hirta*, *Eragrostis plana* (Species Group N), *Aristida congesta* subsp. *barbicollis* (Species Group N), *Cynodon dactylon* (Species Group V).
The herbaceous layer is dominated by the prostrate *Hermannia depressa* (Species Group E). The tree layer is dominated by *Acacia karroo* (Species Group A).

(iii) *Hyparrhenia hirta* Sub–community

This tall, *Hyparrhenia hirta* –dominated grassland occurs on the slopes (8–15°) of hills, on sandstone, on all aspects. The soil is yellow–brown, shallow, about 30 cm deep, and have clay–loam texture. Rocks on various sizes, up to 1 m in diameter, cover 5% of the soil surface. The occasional *Acacia karroo* tree occurs here, and this species might be invading this grassland.

The vegetation was previously heavily grazed, and it seems that *Hyparrhenia hirta* has become dominant during the recovery phase. The herbaceous layer covers, on average, 65%, and is 0.8 m tall.

This grassland Sub–community is characterized by Species Group N (Table 5.1). The dominats species include the grasses *Hyparrhenia hirta, Eragrostis plana* and *Aristida congesta.* subsp. *barbicollis.*

The prominent species in the grass layer is *Cynodon dactylon* (Species Group V), while tree layer is dominated by *Acacia karroo (*Species Group A).

F. *Aloe ferox – Calpurnia aurea* Shrubveld

This shrubveld is restricted to the steep slopes (about 20°) of rocky hills within the undulating landscape. These hills are covered by large rocks (40 %). The soils are shallow, 30 cm deep, dark brown in colour, and clayey. Shrubs are 1.5 m tall, cover 20 % of the area, while the herbaceous layer covers 60%, and is 20 cm tall. On Figure 5.7 this community seems to be eroded.
This shrubveld (Figure 5.7) is characterized by Species Group O (Table 5.1) and the diagnostic species include the grass *Panicum natalense*, shrubs such as the succulents *Aloe ferox* and *A. arborescens* and also *Calpurnia aurea.*

The prominent species in the grass layer are *Hyparrhenia hirta* (Species Group N), *Sporobolus africanus* (Species Group V) and *Cynodon dactylon* (Species Group V). The herbaceous layer is dominated by widespread weed *Bidens pilosa* (Species Group R) and the strongly scented annual weed *Tagetes minuta* (Species Group V).

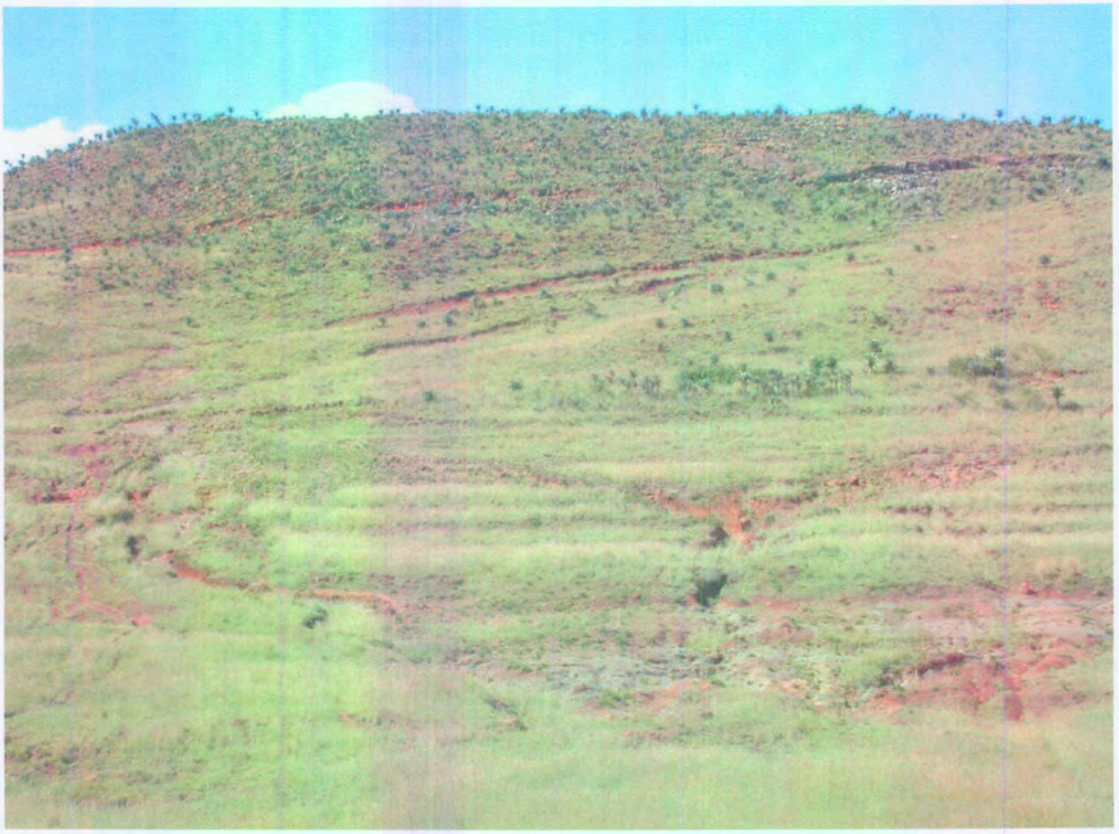


Figure 5.7 *Aloe ferox – Calpurnia aurea* Shrubveld

G. *Bidens pilosa – Conyza bonariensis* Weedland

This Weedland occurs nearly throughout the area, but represent well developed vegetation often the agriculture has been abandoned.

This weedland is characterized by Species Group R (Table 5.1) and the diagnostic species include the annual weeds *Bidens pilosa* and *Conyza bonariensis* and also *Gamochaeta coarctata.*

Prominent species in grass layer is *Cynodon dactylon* (Species Group V), while the dominant species in herbaceous layer are the weedy perennial *Richardia brasiliensis* (Species Group M) and the annual weeds *Schkuhria pinnata* (Species Group K), and strongly scented *Tagetes minuta* (Species Group V).

This major community is further divided into two Sub–communities, namely:

(i) *Senecio burchellii* Sub–community

This old fields vegetation is found on slopes of 10°, south or east–facing slopes, in undulating landscape. The soils are light–brown and loamy.The herbaceous layer is 10–15 cm tall and cover 80%, indicating an advanced stage of succession. The vegetation has recovered to much a degree that it is not classified under degraded.

This weedland Sub–community is characterized by Species Group P (Table 5.1) and the diagnostic species include forbs such as *Sonchus dregeanus* and *Senecio burchellii.*

The grass layer is dominated by species such as *Sporobolus africanus* (Species Group H), *Cynodon dactylon (*Species Group V), and the herbaceous layer is dominated by the annual weeds *Conyza bonariensis* (Species Group R), *Bidens pilosa* (Species Group R) and *Tagetes minuta* (Species Group V).

(ii) *Xanthium strumarium* Sub–community

These old fields are also widespread, but occur on shale, on midslopes in the undulating landscape. The soils are deep (> 1 m), brown and appear leached. This vegetation like wise, as in the case of Sub–community 7.1, represents an advanced succession stage. The herbaceous layer is 10–15 cm tall and covers 75 %.

This weedland Sub–community is characterized by Species Group Q (Table 5.1) and the diagnostic species are the weedy *Xanthium strumarium, Oxalis obliquifolia* and *Lactuca inermis*.

The grass layer is dominated by *Eragrostis plana* (Species Group N), *Sporobolus africanus* (Species Group V) and *Cynodon dactylon* (Species Group V). The herbaceous layer is dominated by the weeds *Schkuhria pinnata* (Species Group K), *Richardia brasiliensis* (Species Group M), and *Tagetes minuta* (Species Group V).

H. *Bothriochloa bladhii* Moist grassland

This community is restricted to wet, bottomland areas, though it does not represent a true wetland (see Chapter 6) but is considered a moist grassland.

This wetland community is characterized by Species Group S (Table 5.1), with *Bothriochloa bladhii* as the diagnostic species.

The prominent species is the shrub *Acacia karroo* (Species Group A).

The major community is further divided into two Sub–communities, namely:

(i) *Miscanthus capensis* Sub–community

This Sub–community occurs in valleys in the coastal hills of Transkei. The soils are deeper than 1m, moist dark brown and sandy loam. The vegetation is 40 cm tall and cover 90%.

This grassland Sub–community is characterized by Species Group T (Table 5.1) and the diagnostic species are the hygrophilous grasses *Miscanthus capensis* and *Paspalum urvillei*, the perennial weeds *Sida rhombifolia* and *Sonchus wilmsii*, and the perennial, twining, scandent *Rhynchosia caribaea.*

The grass layer is dominated by *Cynodon dactylon* (Species Group V), the herbaceous layer is dominated by strongly scented annual weed *Tagetes minuta* (Species Group V).

(ii) *Acacia karroo* Sub–community

This Sub–community seems to represent an old field, made in a valley floor with moist soil. The soil is a brown clay, more than 1m deep. *Acacia karroo* shrubs (1m tall) are invading this area. The herbaceous layer is 1.2 m tall and cover 95%.

This shrubveld Sub–community is characterized by Species Group U (Table 5.1) and the diagnostic species are the forb *Sida dregei*, the scrumbling weedy shrub *Lantana camara* and the grasses *Aristida junciformis* and *Brachiaria serrata.*

The grass layer is dominated by *Bothriochloa bladhii* (Species Group S), *Paspalum dilatatum* (Species Group J), the herbaceous layer is dominated by weeds *Bidens pilosa* (Species Group R), *Senecio burchellii* (Species Group P), and the annual, straggly *Hibiscus trionum* (Species Group I), the tree layer is dominated by *Acacia karroo* (Species Group A).

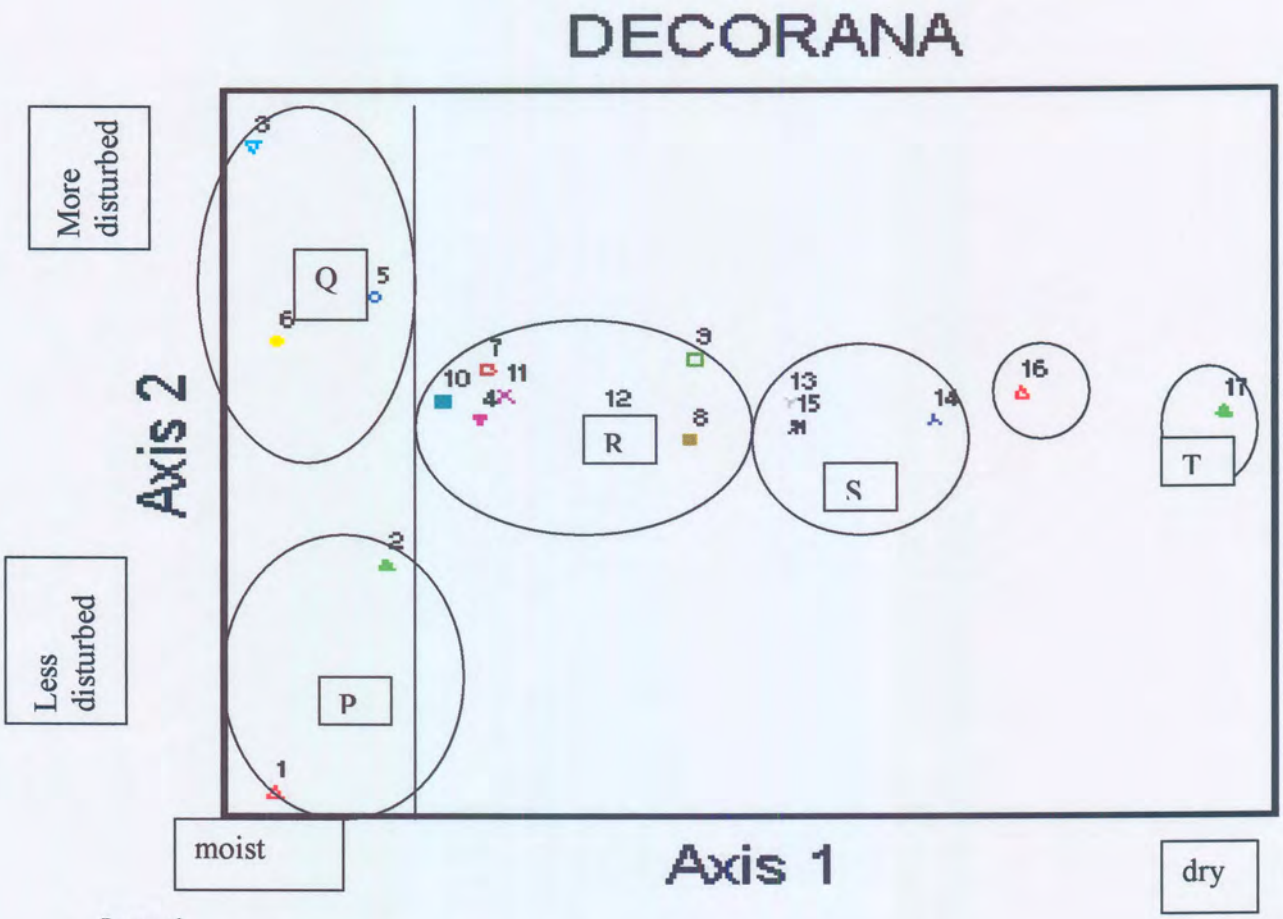
2.3 Discussion

Although not much of the Shrub and Grassland Vegetation Type has been ploughed, cattle and goats often heavily graze these areas, and the grassy layer is often deteriorated. This is evident by the presence, and often abundance of weedy species in the herbaceous layer. At many localities there is also bush encroachment, mostly by *Acacia karroo* but also of karroid dwarf shrubs. This bush encroachment is a sure sign of a deteriorated grass layer (Friedel 1987). In some instances fields to cultivate crops were made, and this cultivation was

abandoned. These old fields now carry weedy plant communities (Smits *et al.* 1999). In spite of the sure signs of degradation this vegetation type still contains a large variety of plant species, especially on the hills and ridges, and these communities are considered to have a fairly high biodiversity, with many of the species restricted to these particular plant communities. This renders these ecosystems worthwhile to conserve, or at least that proper management plans be implemented to secure the existence of these unique plant communities.

2.4 Ordination

Environmental trends were identified by means of DECORANA. Figure 5.2 shows that the vegetation is from the moist environment to the dry (*Acacia* karroo Sub–community) conditions. The Axis 1 represents the vegetation from moist to dry (*Acacia karroo* Sub–community), Community P to Community T, while the Axis 2 is from the less disturbed community, Community P (*Aristida diffusa* Sub–community), to a more disturbed community, Community Q (*Euryops floribundus* Sub–community), (Figure 5.8). *Acacia karroo* is a problem on overgrazed areas, causing bush encroachment (Pooley 1993).



Legend

1. (A. (i)) *Aristida diffusa* Sub–community
2. (A. (ii)) *Cymbopogon excavatus* Sub–community
3. (A. (iii)) *Euryops floribundus* Sub–community
4. (A. (iv)) *Eragrostis lehmanniana* Sub–community
5. (B. (i)) *Microchloa caffra* Sub–community
6. (B. (ii) Typical Sub–community
7. (C.) *Hermannia coccocarpa–Diospyros lycioides* shrubveld
8. (D. (i)) *Eragrostis curvula* Sub–community
9. (D. (ii)) *Pseudognaphalium luteo-album* Sub–community
10. (E. (i)) *Sporobolus africanus* Sub–community
11. (E. (i)) *Richardia brasiliensis* Sub–community
12. (E.) *Eragrostis plana-Aristida congesta* Grassland
13. (F.) *Aloe ferox-Calpurnia aurea* Shrubland
14. (G. (i)) *Senecio burchellii* Sub–community
15. (G. (ii)) *Xanthium strumarium* Sub–community
16. (H. (i)) *Miscanthus capensis* Sub–community
17. (H. (ii)) *Acacia karroo* Sub–community

Figure 5.8 Ordination graph of Bush and Grassland vegetation of drier areas

3 References

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CHAPTER 6

RESULTS: WET AND DISTURBED GRASSLAND

1 Introduction

In the initial classification of the floristic data from the Transkei vegetation survey (See Chapter 4), revealed in the identification of, amongst others, one of the major vegetation types that were identified was the Wet and Disturbed Grassland. This vegetation type is unique, as compared to other grassland types, within the Transkei, with a large number of diagnostic species listed under Species Group B in the synoptic table (Table 4.1). Many of the species present are indicators of moist conditions, for example the reed *Phragmites australis,* sedges such as *Cyperus* spp., *Juncus oxycarpus* and *Typha capensis*, but also hygrophilous herbaceous pioneer plants such as *Verbena bonariensis* and *Senecio inaequidens*. The hygrophilous forbs *Ranunculus multifidus, Ifloga glomerata* and *Senecio inornatus* and grasses *Leersia hexandra* and *Paspalum urvillei* are also diagnostic for this type.

Species from other Species Groups (Table 4.1) that emphasize the wet habitat conditions include *Monopsis decipiens, Mariscus congestus* (Species Group F), *Centella asiatica, Paspalum dilatatum, P. scrobiculatum* and the weed *Hypochaeris radicata* (Species Group I).

The vegetation is mostly quite short, often grazed and trampled and often represents old fields that were abandoned and the pioneer species had already established. In moister sites, merging into wetland vegetation, sedges or reeds may be present. This is emphasized by the presence of various weedy annual species, for example *Tagetes minuta* (Species Group A, Table 4.1), *Verbena brasiliensis* (Species Group A, Table 4.1), *Gomphrena celoceloides* (Species Group A, Table 4.1), and *Xanthium strumarium* (Species Group A, Table 4.1).

Wet and Disturbed Grasslands mostly occur in bottomland environments, or in areas that were intensively utilized during a long period of human settlement. These areas occur widespread over the Transkei area (Figure 6.1). The wet grasslands are not true

wetlands, though they may often occur on the plains adjacent to the floodplains where man often heavily utilizes them.

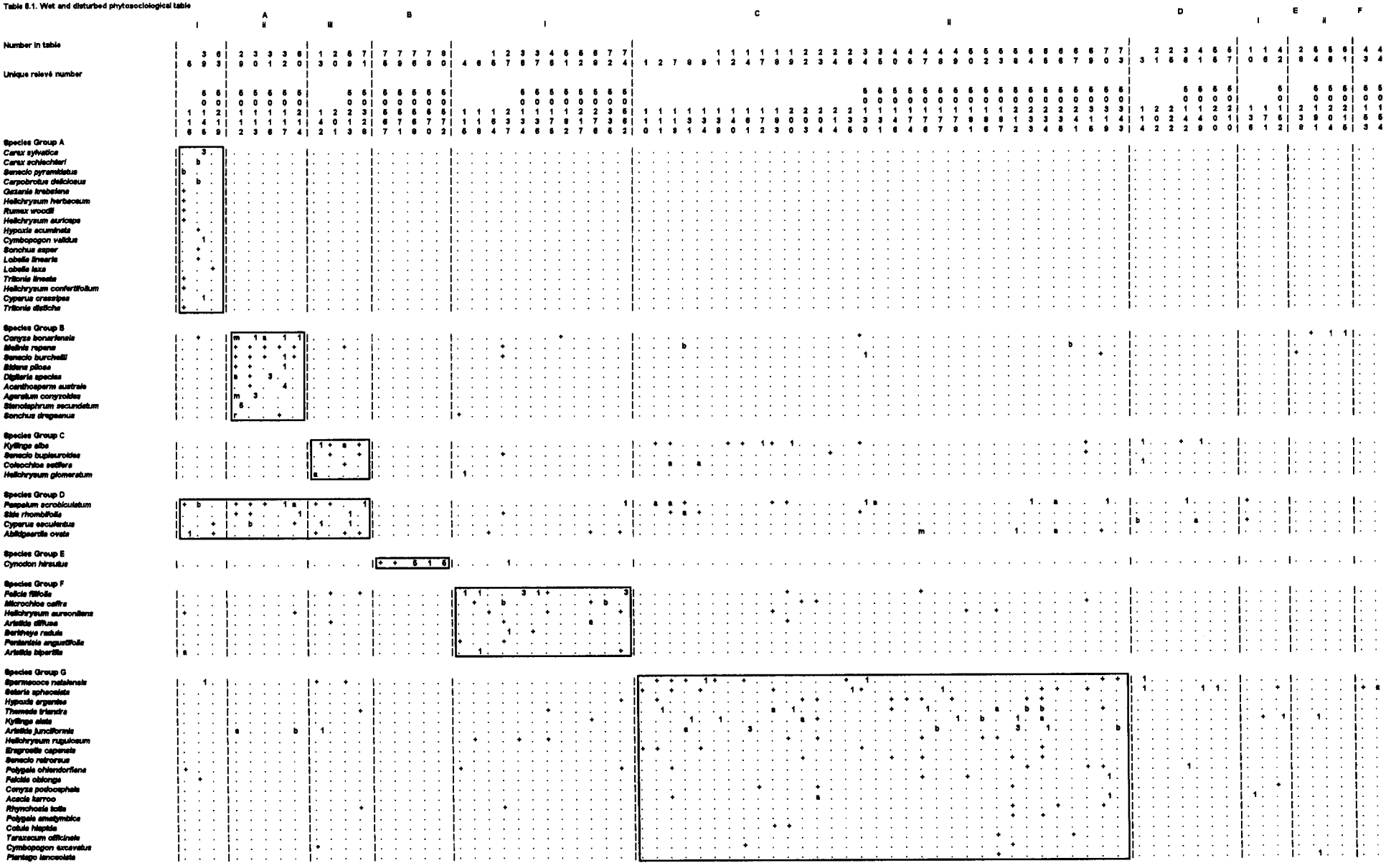
The most dominant and most frequently present species are the grasses *Eragrostis plana, Cynodon dactylon, Sporobolus africamus, Hyparrhenia hirta, Eragrostis curvula* and the weedy forb *Richardia brasiliensis* (Species Group I, Table 4.1), all widespread in the grasslands of Transkei area (Figure 2.1).

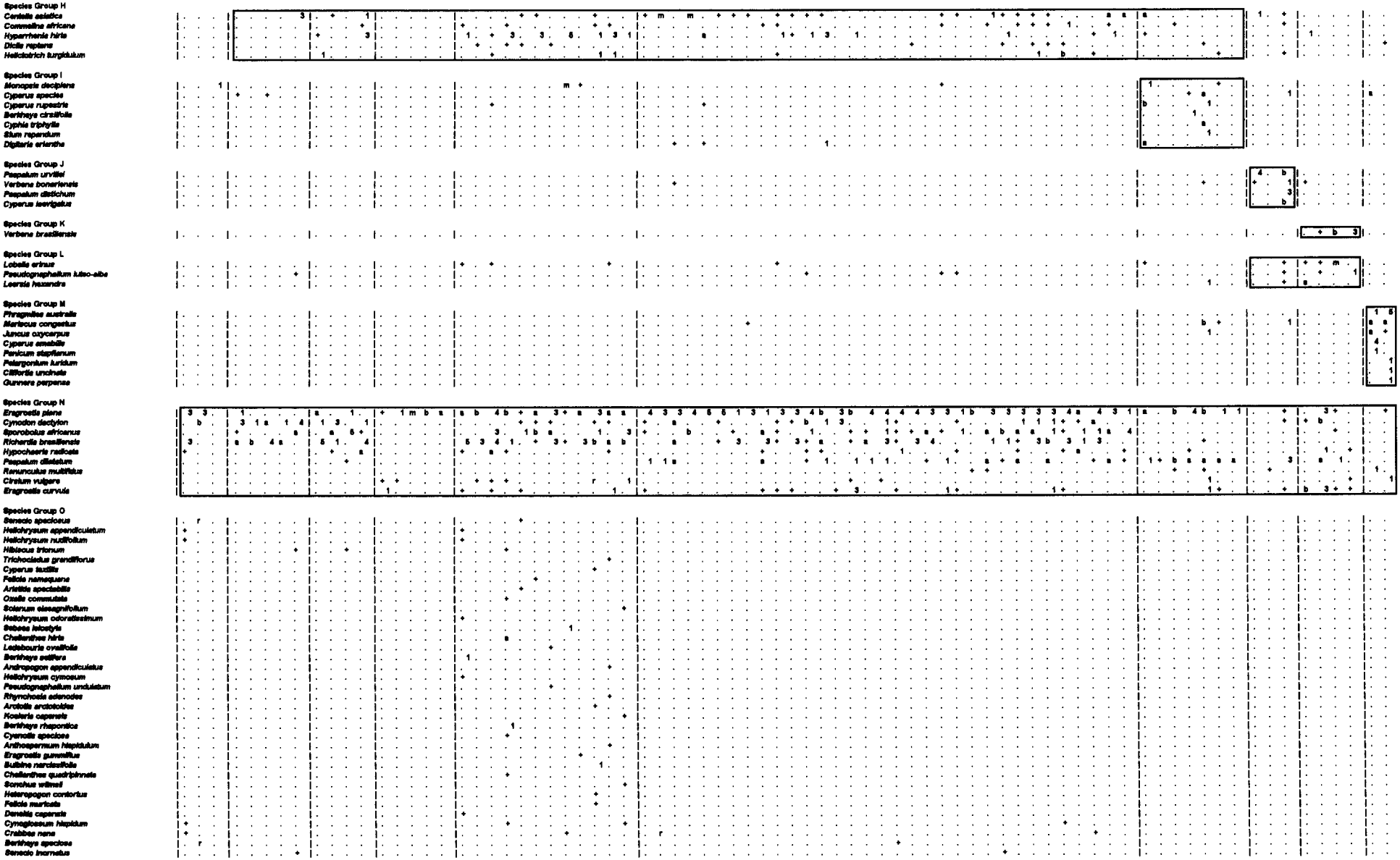
2 Results and discussion

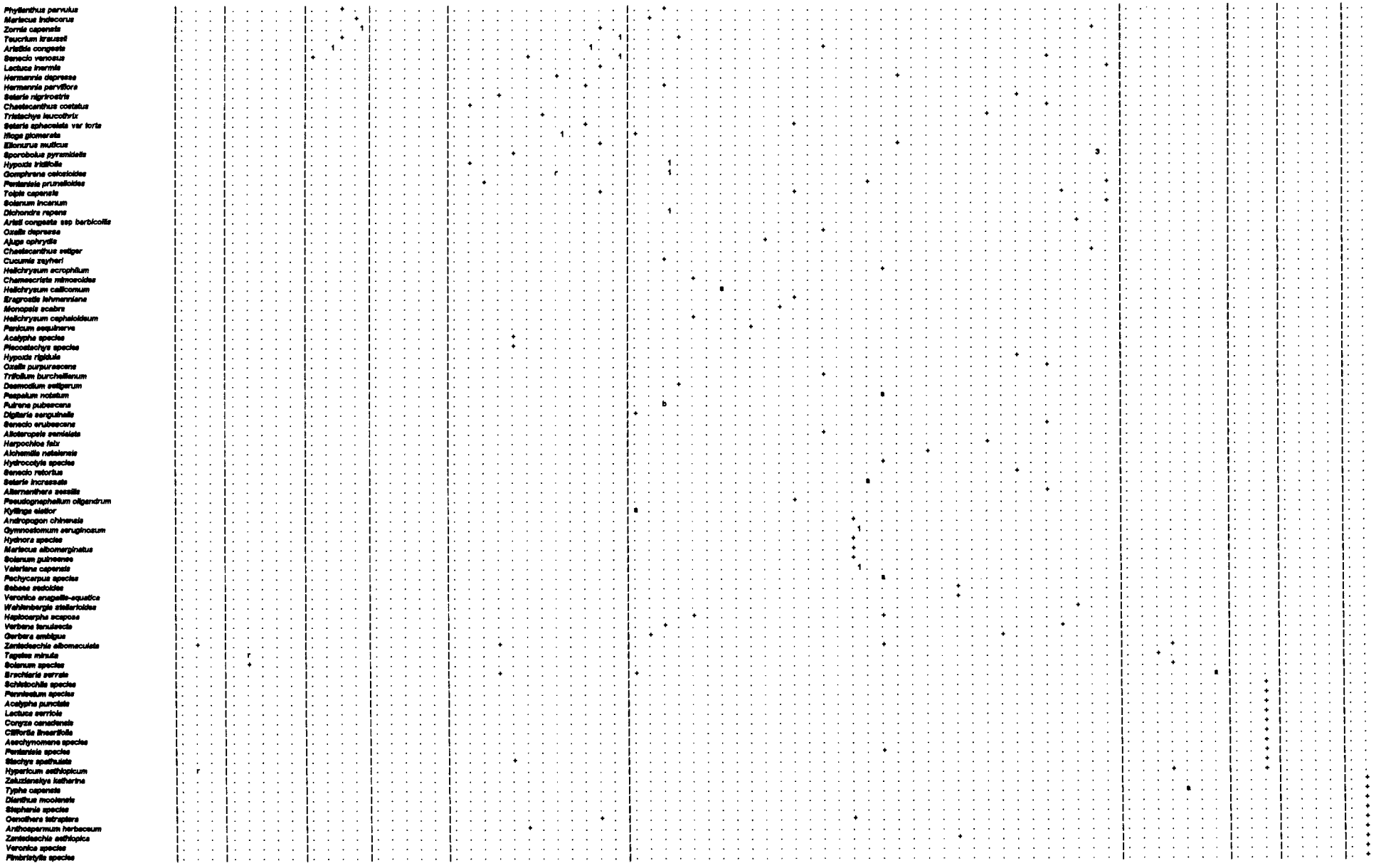
2.1 Classification of plant communities

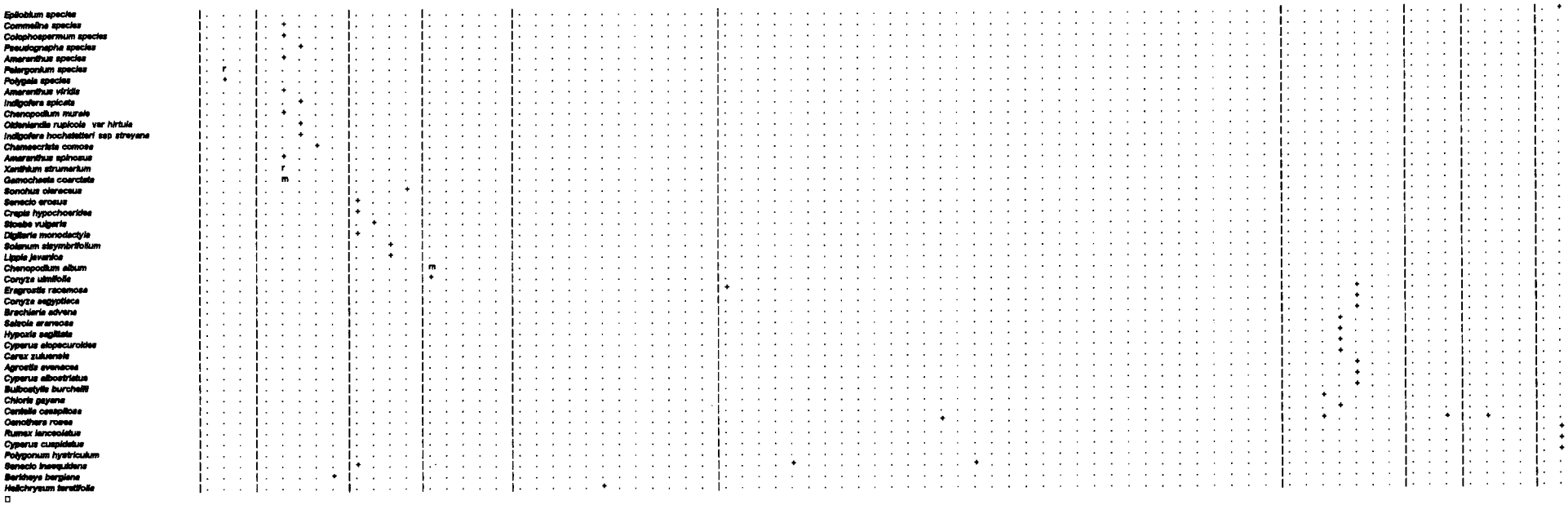
Data collected in the 80 relevés sampled in Wet and Disturbed Grassland were collated in a phytosociological table. This table was further refined, using Braun-Blanquet procedures in the computer program MEGATAB (Hennekens 1996b) (Table 6.1).

Table 6.1. Wet and disturbed phytosociological table




Species Group H
Centella asiatica
Commelina africana
Hyparrhenia hirta
Dicliptera repens
Helictotrich turgidulum
Species Group I
Monopsis decipiens
Cyperus species
Cyperus rupestris
Berkheya ciraiifolia
Cyphia triphylla
Stum repandum
Digitaria eriantha
Species Group J
Pespalum urvillei
Verbena bonariensis
Pespalum distichum
Cyperus isevigatus
Species Group K
Verbena brasiliensis
Species Group L
Lobelia erinus
Pseudognaphalium luteo-alba
Leersia hexandra
Species Group M
Phragmites australis
Mariscus congestus
Juncus oxycarpus
Cyperus emabilis
Panicum stapfianum
Pelargonium luridum
Cliffortia uncinata
Gunnera perpensa
Species Group N
Eragrostis plana
Cynodon dactylon
Sporobolus africanus
Richardia brasiliensis
Hypocheeris radicata
Pespalum dilatatum
Ranunculus multifidus
Cirsium vulgare
Eragrostis curvula
Species Group O
Senecio speciosus
Helichrysum appendiculatum
Helichrysum nudifolium
Hibiscus trionum
Trichocladus grandiflorus
Cyperus textilis
Felicia namaquana
Aristida spectabilis
Oxalis commutata
Solanum elaeagnifolium
Helichrysum odoratissimum
Sebaea leiostyla
Chaetanthus hirta
Lobelsouria ovalifolia
Berkheya setifera
Andropogon appendiculatus
Helichrysum cymosum
Pseudognaphalium undulatum
Rhynchosia sclerodes
Arctotis arctotoides
Hoslaria caparata
Berkheya rhapontica
Cyanella speciosa
Anthospermum hispidulum
Eragrostis gummiflua
Bulbine narcissifolia
Chaetanthus quadripinnata
Sonchus wilmsii
Heteropogon contortus
Felicia muricata
Denekia capensis
Cymaglossum hispidum
Crabbea nana
Berkheya speciosa
Senecio incrassatus


Phyllanthus parvulus
Mariscus thodorus
Zornia capensis
Teucrium trausseli
Aristida congesta
Senecio venosus
Lactuca inermis
Hermannia depressa
Hermannia parviflora
Setaria nigrirostris
Chaetacanthus costatus
Tristachya leucothrix
Setaria sphacelata var torta
Iliogs glomerata
Ellionurus muticus
Sporobolus pyramidalis
Hypoxis iridifolia
Gomphrena celosioides
Pentanisia prunelloides
Tolpis capensis
Solanum incanum
Dichondra repens
Aristi congesta ssp barbicollis
Oxalis depressa
Ajuga ophrydis
Chaetacanthus setiger
Cucumis zeyheri
Helichrysum scrophilum
Chamaecrista mimosoides
Helichrysum callicomum
Eragrostis lehmanniana
Monopsis scabra
Helichrysum cephaloideum
Panicum sequinerve
Acalypha species
Placostachys species
Hypoxis rigidula
Oxalis purpurascens
Trifolium burchellianum
Desmodium setigerum
Paspalum notatum
Pulicaria pubescens
Digitaria sanguinalis
Senecio erubescens
Alloteropsis semialata
Harpochloa falx
Alchemilla natalensis
Hydrocotyle species
Senecio retortus
Setaria incrassata
Alternanthera sessilis
Pseudognaphalium oligandrum
Kyllinga alatior
Andropogon chinensis
Gymnostomum eruginosum
Hydnora species
Mariscus albomarginatus
Solanum pubescens
Valeriana capensis
Pachycarpus species
Sebaea sedoides
Veronica anagallis-aquatica
Wahlenbergia stellaricides
Haplocarpha scaposa
Verbena tenuisecta
Gerbera ambigua
Zantedeschia albomaculata
Tagetes minuta
Solanum species
Brachiaria serrata
Schkuhria species
Pennisetum species
Acalypha punctata
Lactuca serriola
Conyza canadensis
Cliffortia linearifolia
Aeschynomene species
Pentanisia species
Stachys spathulata
Hypericum aethiopicum
Zaluzianskya katherina
Typha capensis
Dianthus mooiensis
Stepharia species
Oenothera tetraptera
Anthospermum herbaceum
Zantedeschia aethiopica
Veronica species
Fimbristylis species


Epilobium species
Commelina species
Colophospermum species
Pseudognaphs species
Amaranthus species
Pelargonium species
Polygala species
Amaranthus viridis
Indigofera spicata
Chenopodium murale
Ctenium rupicola var hirtula
Indigofera hochstetteri ssp streyana
Chamaecrista comosa
Amaranthus spinosus
Xanthium strumarium
Gamochaeta coarctata
Sonchus oleraceus
Senecio erosus
Crepis hypochoeridea
Stoebe vulgaris
Digitaria monodactyla
Solanum sisymbriifolium
Lippia javanica
Chenopodium album
Conyza ulmifolia
Eragrostis racemosa
Conyza aegyptiaca
Brachiaria advena
Setaria sphacelata
Hypoxis sagittata
Cyperus sloepecuroides
Carex zuluensis
Agrostis avenacea
Cyperus albostriatus
Bulbostylis burchellii
Chloris gayana
Centella asiatica
Oenothera rosea
Rumex lanceolatus
Cyperus cuspidatus
Polygonum hystricula
Senecio inaequidens
Berkheya bergiana
Helichrysum teretifolia

In the geological map (Fig. 6.1), the position of the samples plots representing the Wet and Disturbed Grassland areas is shown. This vegetation type is very often found on shale, mudstone, and sometimes on arenite and dolerite. This type is mostly situated between 0 and 2100 m above sea level (Fig. 2.5).

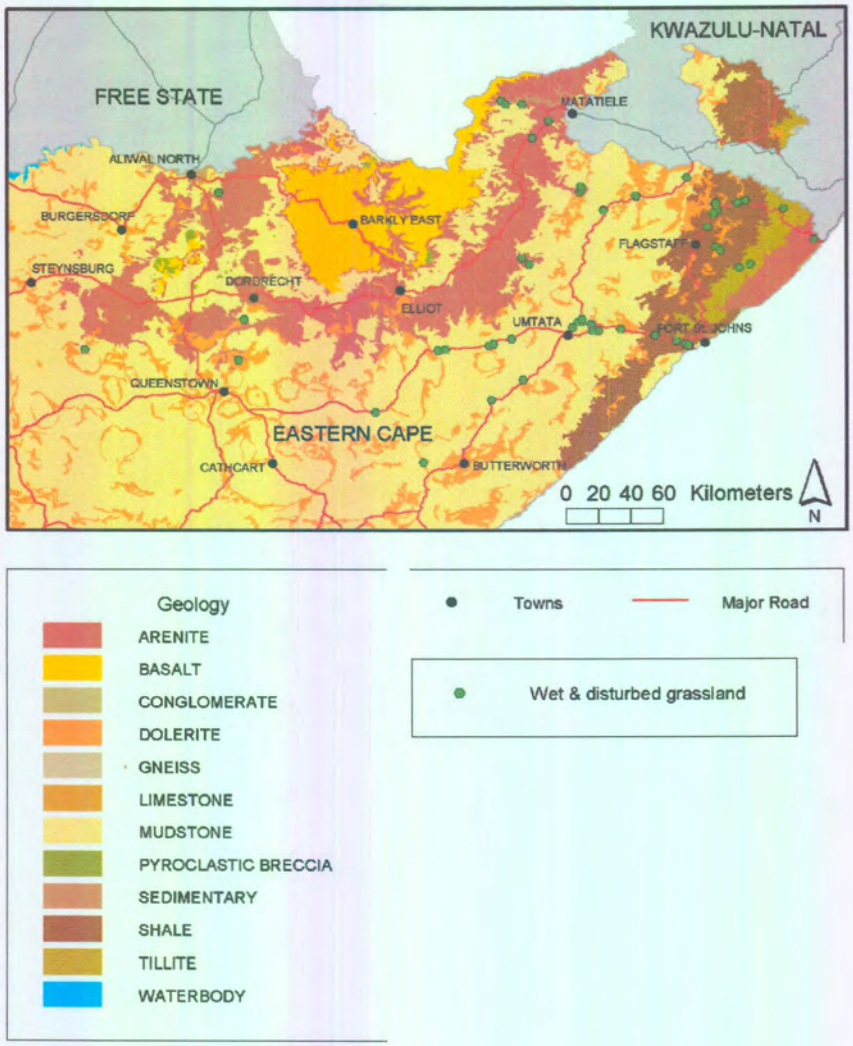


Figure 6.1 A Geological map of Transkei with the position of the sample plots representing the Wet and Disturbed Grassland community with geology

The classification revealed 6 communities and 7 sub-communities. These are:

A. *Paspalum scrobiculatum-Cynodon dactylon* old-field vegetation

(i) *Paspalum scrobiculatum-Carex sylvatica* old fields in wetlands

(ii) *Cynodon dactylon-Conyza bonariensis* young old fields

(iii) *Cynodon dactylon-Kyllinga alba* older old fields

B. *Eragrostis plana-Cynodon hirsutus* grazed short grassland

C. *Eragrostis plana-Centella asiatica* degraded grassland

(i) *Eragrostis plana-Centella asiatica-Hyparrhenia hirta* Sub-community

(ii) *Eragrostis plana-Centella asiatica-Aristida junciformis* Sub-community

D. *Eragrostis plana- Paspalum dilatatum* disturbed moist grassland

E. *Leersia hexandra-Lobelia erinus* disturbed wetland

(i) *Paspalum urvillei* Sub-community

(ii) *Verbena brasiliensis* Sub–community

F. *Phragmites australis-Juncus oxycarpus* Reed community

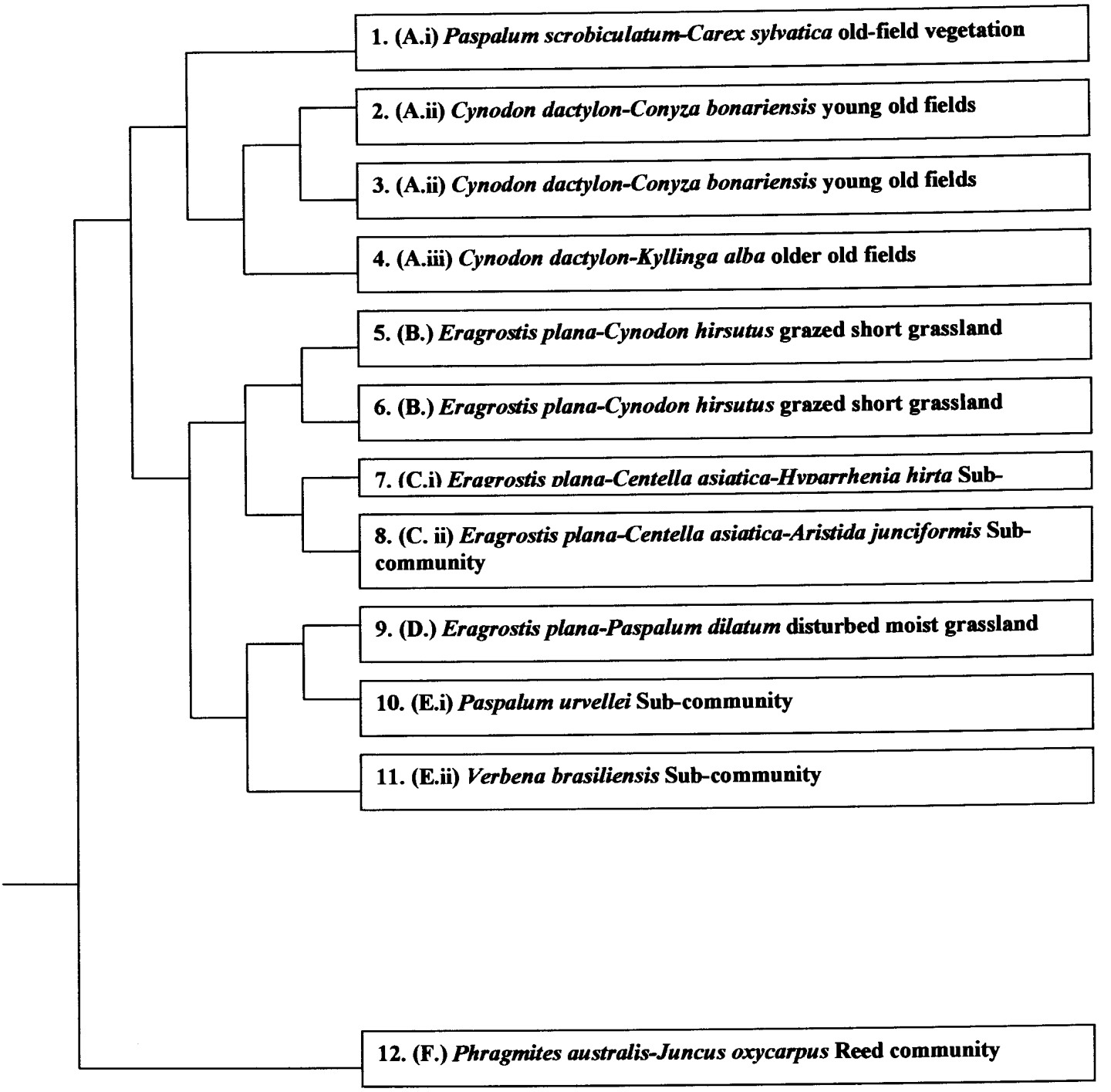


Figure 6.2 Dendrogram representing Wet and Disturbed Grassland community

2.2 Description of plant communities

A. *Paspalum scrobiculatum-Cynodon dactylon* old-field vegetation

This community is found in disturbed wet grassland or wet old fields. This old-field vegetation occurs on midslopes within undulating landscape. Slopes are 15° towards South and East. The soils are brown to black clays. The vegetation is in a very poor condition due to overgrazing by goats and cattle. The total vegetation cover is 76% on average, with herbaceous layer 15 cm tall, on average, covering 76%.

This old–field vegetation is characterized by Species Group D (Table 6.1) of which the diagnostic species include the grass *Paspalum scrobiculatum,* and the weedy sedge *Cyperus esculentus*.

The prominent species in the grass layer include *Aristida junciformis* (Species Group G), *Eragrostis plana, Cynodon dactylon,* (Species Group N), and the herbaceous layer is dominated by the hygrophilous *Centella asiatica* (Species Group H) and the weedy *Richardia brasieliensis* (Species Group N).
This plant community is subdivided into two sub-communities, namely:

(i) *Paspalum scrobiculatum-Carex sylvatica* old fields in wetlands

This sub–community is situated on midslopes of undulating landscapes with 12° south and east facing slopes. The soils are black to dark brown with only 1% rock cover. This old-field grassland is heavily disturbed by goats and cattle. No trees occur here. The total cover of the herbaceous vegetation is 88% on average, and it is on average 28 cm tall.

This type of old-field is found in disturbed wetlands, and is characterized by Species Group A (Table 6.1).

The diagnostic species include the grass *Cymbopogon validus,* and the herbaceous layer is dominated by the sedges *Carex sylvatica, C. schlechteri* and *Cyperus crassipes,* and the forbs *Senecio pyramidatus, Carpobrotus deliciosus.*

Prominent species in the grass layer include the grasses *Paspalum scrobiculatum* (Species Group D), *Eragrostis plana*, *Cynodon dactylon* (Species Group N) and the herbaceous layer has prominent species such as the sedge *Abildgaardia ovata* (Species Group D), forbs such as *Richardia brasiliensis* (Species Group N).

(ii) *Cynodon dactylon-Conyza bonariensis* young old-fields

This sub-community is found on very young old fields (approximately 2 years old), and represents vegetation in the early stages of succession. It occurs on midslopes within an undulating landscape, with slopes up to 5° facing towards the south and east. The soils are dark–brown in colour, sandy loam in texture. These old–fields were ploughed 2 years ago. No trees or shrubs are found. The total vegetation cover is 85%, while the herbaceous layer is 12 cm tall, on average.

This community is characterized by Species Group B (Table 6.1). The diagnostic species in the grass layer are *Melinis repens, Digitaria species* and *Stenotaphrrum secundatum,* and the herbaceous layer include the annual weeds *Conyza bonariensis, Ageratum conyzoides* and *Bidens pilosa,* the sedge *Senecio bupleuroides, Acanthospermum australe,* and *Sonchus dregeanus.*
The prominent species in the grass layer are *Paspalum scrobiculatum* (Species Group D), *Aristida junciformis* (Species Group G), *Eragrostis plana*, *Cynodon dactylon* and *Sporobolus africanus* (Species Group N). The herbaceous layer is dominated by *Sida rhombifolia, Cyperus esculentus* (Species Group D), *Centella asiatica* (Species Group H) and *Richardia brasiliensis* (Species Group N).

(iii) *Cynodon dactylon-Kyllinga alba* older old-fields

This sub-community (Figure 6.3) is representative of the older old-field vegetation, which is representative of seral communities between the pioneer and climax stages. These old fields occur on midslopes, with slopes up to 4° towards east. The soils are light brown to dark brown, brown–grey.
The vegetation is in very poor condition due to disturbances and overgrazing by cattle and goats.

No trees or shrubs are present, while the herbaceous layer is 20 cm tall, on average and covers 85% on average.

This sub-community is characterized by Species Group C (Table 6.1). The diagnostic species in the herbaceous layer are the grassland sedge *Kyllinga alba* and the forb *Helichrysum glomeratum*, and there are no dominant diagnostic grasses in this group.

The prominent species in the grass layer include, the widespread *Hyparrhenia hirta* (Species Group H), *Eragrostis plana*, *Cynodon dactylon* and *Sporobolus africana* (Species Group N). The herbaceous layer has species such as *Spermacoce natalensis* (Species Group G), *Centella asiatica* (Species Group H), and *Richardia brasiliensis* (Species Group N).

Figure 6.3 *Cynodon dactylon-Kyllinga alba* older old-field

B. *Eragrostis plana-Cynodon hirsutus* grazed short grassland

This short grassland occurs in the bottom broad valleys. The soils are clayey and sodic and often wet. The vegetation of this community is represents very short (about 1-5 cm tall), heavily grazed vegetation. The total vegetation is 85%, while herbaceous layer is 55 cm tall, on average, covering 82%.

This short grassland type is characterized by Species Group E (Table 6.1). The diagnostic species is the short creeping lawngrass *Cynodon hirsutus* while Juncus spp. is also prominent in some sites.

The prominent species in the grass layer include *Eragrostis plana* (Species Group N) and the herbaceous layer includes weedy species such as *Cirsium vulgare* (Species Group N).

C. *Eragrostis plana-Centella asiatica* degraded grassland

This community is a degraded grassland on red to black loamy-clay soils and is situated on midslopes in undulating areas. The vegetation is in a poor condition.The herbaceous vegetation cover is 78 %, on average, while the herbaceous layer is 23 cm tall, on average. No trees are found in this vegetation.

This degraded dry grassland community is characterized by Species Group H (Table 6.1). The diagnostic species include the tall grass *Hyparrhenia hirta* and *Helictotrichon turgidulum* and forbs such as *Commelina africana, Diclis reptans,* and *Centella asiatica.*

The dominant species in the grass layer include species such as *Melinis repens* (Species Group B), *Paspalum scrobiculatum,* (Species Group D), *Microchloa caffra* (Species Group F), *Eragrostis plana*, *E. curvula, Cynodon dactylon* and *Sporobolus africana* (Species Group N). The herbaceous layer includes species such as the sedges *Abildgaardia ovata* (Species Group D), and the forbs *Sida rhombifolia,* (Species Group D), *Helichrysum aureonitens* (Species Group F), *Polygala ohlendorfiana, Helichrysum rugulosum,* (Species Group G), *Kyllinga alata* (Species Group G), and

the weeds *Cirsium vulgare* and *Hypochaeris radicata*, (Species Group N), and the herb *Richardia brasiliensis* (Species Group N).

(i) *Eragrostis plana-Centella asiatica-Hyparrhenia hirta* Sub-community

This Sub-community is associated with degraded, overgrazed, dry grassland on black vertic soils and is situated on midslopes in undulating grassland landscapes, on slopes of up to 4° towards the north and west. The soils are black to grey, with stones of up to 1m in diameter, covering 10–40% of the soil surface.
The vegetation is in poor state, and very dry due to grazing and there are termitaria present. Very few woody plants are found. The herbaceous layer is approximately 25 cm tall covering 65%, on average.

This Variation is characterized by Species Group F (Table 6.1). Diagnostic species in the grass layer include *Microchloa caffra, Aristida diffusa* and *A. bipartita* and also the dwarf shrub *Felicia filifolia* and the forb *Helichrysum aureonitens.*

The dominant species in the grass layer include species such as *Hyparrhenia hirta* (Species Group H), *Eragrostis plana, E. curvula, Cynodon dactylon, Sporobolus africana* (Species Group N), and in the herbaceous layer species such as *Helichrysum rugulosum* (Species Group G), *Commelina africana, Diclis reptans* (Species Group H), *Lobelia erinus* (Species Group L) and the weeds *Richardia brasiliensis* and *Cirsium vulgare* (Species Group N).

(ii) *Eragrostis plana-Centella asiatica-Aristida junciformis* Sub-community

This Sub-community is found in degraded grazed dry grassland on rocky areas and also occurs on midslopes to valley bottoms in rolling grassland landscapes. The slopes range between 0°–6°. The soils are deep, of more than 1m. The soils are light brown to grey sandy loams and in some areas leached soils occur.

The total vegetation cover is, on average, 80%, while herbaceous layer is, on average, 20 cm tall, and covers 10%, on average.

This Sub-community is characterized by Species Group G (Table 6.1). The diagnostic species in grass layer include *Aristida junciformis, Themeda triandra, Setaria sphacelata*, and forbs such as *Spermacoce natalensis, Helichrysum rugulosum,* the sedge *Kyllinga alata* and the shrub *Acacia karroo*.

The dominant species in the grass layer include species such as *Melinis repens* (Species Group B), *Paspalum scrobiculatum* (Species Group D), *Helictotrichon turgidulum* (Species Group H), *Eragrostis plana, E. curvula, Cynodon dactylon, Sporobolus africana, Paspalum dilatatum* (Species Group N). Prominent species in the herbaceous layer are the sedges *Kyllinga alba* (Species Group C), and *Abildgaardia ovata* (Species Group D), the forbs *Sida rhombifolia* (Species Group D), *Commelina africana, Diclis reptans, Centella asiatica* (Species Group H) and the weeds *Hypochaeris radicata, Richardia brasiliensis* (Species Group N).

D. *Eragrostis plana- Paspalum dilatatum* disturbed moist grassland

This community (Figure 6.4) is found in moist, overgrazed, disturbed grassland, and is situated in bottomlands along streams often with waterlogged soil, or standing water. Slopes are flat to 4°. The soils are light brown to dark brown or grey with a clay loam texture. There is mostly no rocks, though may cover up to 5%.

The herbaceous layer is 35 cm tall, on average, covering 90%. In some cases, (*e.g* relevé 222), the tree layer is 2 m tall, covering only 3%.

This disturbed, moist grassland community is characterized by Species Group I (Table 6.1). The diagnostic species include the grass *Digitaria eriantha,* the forbs *Monopsis decipens* and *Berkheya cirsiifolia* and the sedge *Cyperus rupestris.*

The dominant species in the grass layer include species such as *Setaria sphacelata* (Species Group G), *Eragrostis plana, E. curvula* and *Paspalum dilatatum* (Species Group N), whereas the herbaceous layer is dominated by the sedges *Kyllinga alba* (Species Group C), *Cyperus esculentus* (Species Group D) and *Mariscus congestus* (Species Group M).

Figure 6.4 *Eragrostis plana- Paspalum dilatatum* disturbed moist grassland

E *Leersia hexandra-Lobelia erinus* disturbed wetland

This Sub–community occurs in bottomlands or on midslopes along small streams in undulating landscape, where the slope is not more than 3°. Free flowing water is often present. The soils are light brown to red. The vegetation is in poor condition and lots of grazing. This community is also found in disturbed wetlands.
The herbaceous layer is 25 cm tall, on average, covering 80%. No trees are found in this community.

This community is characterized by Species Group L (Table 6.1). The diagnostic species include the hygrophilous grass *Leersia hexandra* and forbs such as *Lobelia erinus* and *Pseudognaphalium luteo-alba.*

The prominent species in the grass layer include *Eragrostis plana, E. curvula, Cynodon dactylon* and *Paspalum dilatatum* (Species Group N) and the herbaceous layer are dominated by the sedge *Kyllinga alata* (Species Group G) and the weedy *Verbena bonariensis* (Species Group J).

This disturbed wetland vegetation is subdivided into two Sub-communities, namely:

(i) *Paspalum urvillei* Sub-community

This Sub–community is situated in bottomlands and sometimes in wetlands with free flowing water, within undulating hills, which may have slopes of up to 5°.The soils are red sandy loam, with rocks of 30 cm in diameter, which covers 10%.

This Sub-community is characterized by Species Group J (Table 6.1). The diagnostic species include grasses such as *Paspalum urvillei, P. dilatum* and the sedge *Cyperus laevigatus*. The weed *Verbena bonariensis* dominates the herbaceous layer.

The prominent species in the grass layer include *Eragrostis plana, E. curvula, Cynodon dactylon* and *Paspalum dilatatum* (Species Group N) whereas the herbaceous layer is dominated by the sedges *Kyllinga alata* (Species Group G), the

forb *Centella asiatica* (Species Group H) and *Mariscus congestus* (Species Group M). The woody layer is dominated by *Acacia karroo* (Species Group G).

(ii) *Verbena brasiliensis* Sub-community

The Sub-community is situated on the old-field, on flat plains below the mountains, or in bottomlands, where the slopes are up to 1.5° facing east. The soils are light brown to black, clay loam, up to 30 m deep and saturated with water, often with free flowing water in little streams. The vegetation is in poor condition due to the disturbances and grazing by cattle and goats. The herbaceous layer is 40 cm tall, on average, covering 90%, on average, and no trees are found here.

This Sub-community is characterized by Species Group K (Table 6.1) of which only *Verbena brasiliensis* is the diagnostic species is the annual weed.

The prominent species in the grass layer include *Hyparrhenia hirta* (Species Group H), the hygrophilous grass *Leersia hexandra* (Species Group L), *Eragrostis plana*, *E. curvula*, *Cynodon dactylon* and *Paspalum dilatatum* (Species Group N). Prominent species in the herbaceous layer are the annual weeds *Conyza bonariensis* (Species Group B) and *Pseudognaphalium luteo-album* (Species Group L), the perennial weeds *Plantago lanceolata* (Species Group G) and *Hypochaeris radicata* (Species group N), the forb *Lobelia erinus* (Species Group L), and the sedge *Kyllinga alata* (Species Group G).

F. *Phragmites australis-Juncus oxycarpus* Reed community

This reed community mostly occur in wet and moist environments in bottomlands (Figure 6.5) or in streambeds, with the stones greater than 1 m in diameter, scattered in streambeds. Free flowing water is often present. The herbaceous layer is 50 cm, on average, covering 95% and no trees are found here.

This community is characterized by Species Group M (Table 6.1).

The diagnostic species include the reed *Phragmites australis,* the sedges *Mariscus congestus, Juncus oxycarpus* and *Cyperus amabilis,* the forb *Pelargonium luridum* and the shrub *Cliffortia uncinata* (Species Group M).

The prominent species in the grass layer include *Setaria sphacelata* (Species Group G) and *Eragrostis plana* (Species Group N) and the herbaceous layer is dominated by *Diclis reptans* (Species Group H), *Ranunculus multifidus* (Species Group N), and the weed *Cirsium vulgare* (Species Group N).

Figure 6.5 *Phragmites australis-Juncus oxycarpus* Reed community

2.3 Discussion

The weedy vegetation found in old fields of the Transkei was described by Smits *et al.* (1999). This present classification was derived from classifying all the relevés from various grassland and woodland ecosystems (excluding forest and coastal vegetation) from the Transkei, though the syntaxa described by Smits *et al.* (1999) could be recognised in some of the plant communities described above.

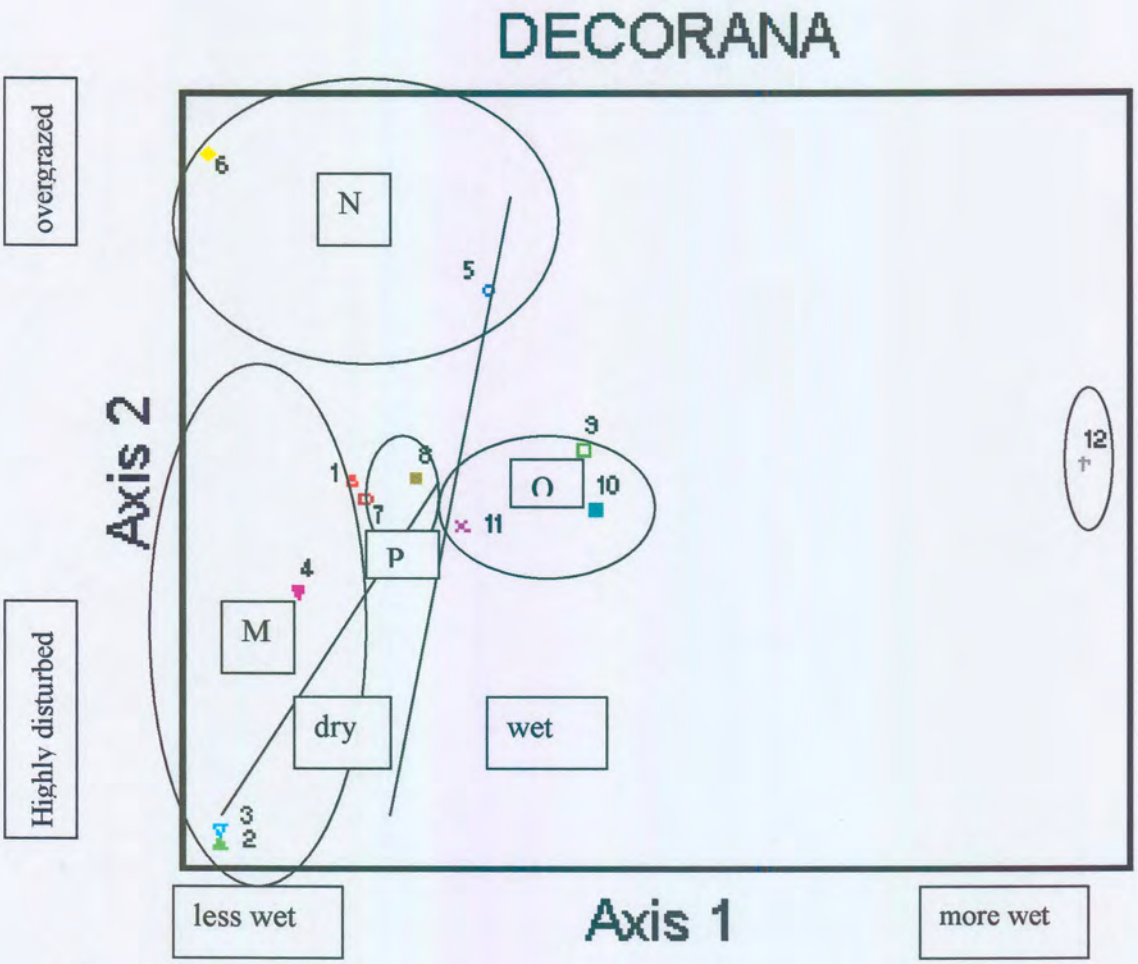
The *Richardio brasiliensis-Eragrostietum planae* (Smits *et al.* 1999) is represented in Community 3.2 (*Eragrostis plana-Centella asiatica-Aristida junciformis* Sub-community) of the present classification. Furthermore, the *Aristida junciformis* Old Fields described by Smits *et al.* (1999) also falls under this Sub-community. This Sub-community is widespread over the Tanskei area, and some variation does occur within this vegetation. It seems, however, that *Aristida junciformis* may become established at various localities within this Sub-community as well as in other communities (see its distribution in Table 6.1, Species Group G). It may be suggested that the relevés of this Sub-community be analysed further to try to indicate whether *Aristida junciformis* does form identifyable communities.

The *Trichoneuro grandiglumis-Aristidetum congestae* (Smits *et al.* 1999) seems to fit Sub-community 3.1 (the *Eragrostis plana-Centella asiatica-Hyparrhenia hirta* Sub-community) of the present classification. However, the *Hyparrhenia hirta* Old Fields (Smits *et al.* 1999) also fits into this Sub-community. *Hyparrhenia hirta* is considered to be an anthropogenic grass (Brown & Bredenkamp 2003) that occurs widespread in all disturbed sites in the grassland biome of southern Africa, and although it does form a separate community in places, it occurs in many localities in the Transkei (see Table 6.1, Species Group H). A revision of all *Hyparrhenia hirta* communities in southern Africa is needed to explain its ecology.

The *Tageto minutae-Cynodontetum dactyli* (Smits *et al.* 1999) corresponds to Sub-community 1.2 (*Cynodon dactylon-Conyza bonariensis* young old fields) of the present classification.

2.4 Ordination

Environmental trends were identified by means of DECORANA (Hill 1979a). The Axis 1 shows that the vegetation is from less wet, Community M (*Cynodon dactylon-Conyza bonariensis* young old-fields), to more wetter vegetation, i.e. *Phragmites australis-Juncus oxycarpus* Reed community, plant community 12, while the *Cynodon dactylon-Conyza bonariensis* young old-fields community, Axis 2, Community M, represents highly disturbed vegetation and *Eragrostis plana-Cynodon dactylon* grazed short grassland, Community N, indicates the areas where the vegetation is overgrazed (Figure 6.6). Community M to Community O clearly indicates the succession. Figure 6.2 distinctively indicates that the wetter vegetation is separated from the rest.



Legend

1. (A. (i)) *Paspalum scrobiculatum-Carex sylvatica* old fields in wetlands
2. (A. (ii)) *Cynodon dactylon-Conyza bonariensis* young old fields
3. (A. (ii)) *Cynodon dactylon-Conyza bonariensis* young old fields
4. (A. (iii)) *Cynodon dactylon-Kyllinga alba* older old fields
5. (B.) *Eragrostis plana-Cynodon hirsutus* grazed short grassland
6. (B.) *Eragrostis plana-Cynodon hirsutus* grazed short grassland
7. (C. (i)) *Eragrostis plana-Centella asiatica-Hyparrhenia hirta* Sub-community
8. (C. (ii) *Eragrostis plana-Centella asiatica-Aristida junciformis* Sub-community
9. (D.) *Eragrostis plana- Paspalum dilatatum* disturbed moist grassland
10. (E. (i)) *Paspalum urvillei* Sub-community
11. (E. (ii)) *Verbena brasiliensis* Subcommunity
12. (F.) *Phragmites australis-Juncus oxycarpus* Reed community

Figure 6.6 Ordination graph of Wet and Disturbed Grassland

3 References

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CHAPTER 7

RESULTS: GRASSLAND OF UNDULATING AREAS

1 Introduction

In the initial classification of the floristic data from the Transkei vegetation survey (See Chapter 4), one of the major vegetation types that were identified was the Grassland of Undulating Areas. This vegetation type is unique within the Transkei, with a large number of diagnostic species listed under Species Group C in the synoptic table (Table 4.1).

Although also widespread over the Transkei area, this vegetation type is more prominent in the northern and western areas, at higher altitudes, where the landscape is transitional to the mountain area (Figure 7.1).

The vegetation is dominated by tall grasses, which are typical of the higher altitude mountain areas along the eastern escarpment of southern Africa, including *Trachypogon spicatus, Panicum aequinerve, Cymbopogon validus* and *Diheteropogon amplectens*. On rocky outcrops woody bushclumps may occur, these include woody species of the wetter Drakensberg area for example *Ficus thonningii, Rhus dentata, Artimisia afra* and *Leucosidea sericea.*

The diagnostic species are listed in Species Group C (Table 4.1). Grasses and forbs, typically found on the slopes in the Drakensberg area, also on hills and ridges in the Bankenveld (Acocks 1988, Bredenkamp & Brown 2003) are included as diagnostic. Some examples are the grasses *Trachypogon spicatus, Cymbopogon validus, Diheteropogon amplectens, Loudetia simplex, Eragrostis superba, Eulalia villosa* and *Andropogon schirensis*, and the forbs *Spermacoce natalensis, Anthospermum herbaceum, Zornia capensis, Pentanisia angustifolia, Berkheya speciosa, Thunbergia atriplicifolia, Thunbergia neglecta, Eriosema salignum, Sebaea leiostyla, Acalypha ambigua, Athrixia elata* and *Aster peglerae* and the fern *Pteridium aquilinum.*
Other species that are conspicuously present are the grass *Alloteropsis semialata,* the sedge *Cyperus obtusiflorus* and the forbs *Scabiosa columbaria, Helichrysum*

mudifolium, H. pilosellum and *Acalypha punctata* (Species Group E, Table 4.1) and the geophyte *Tritonia lineata* (Species Group F, Table 4.1).

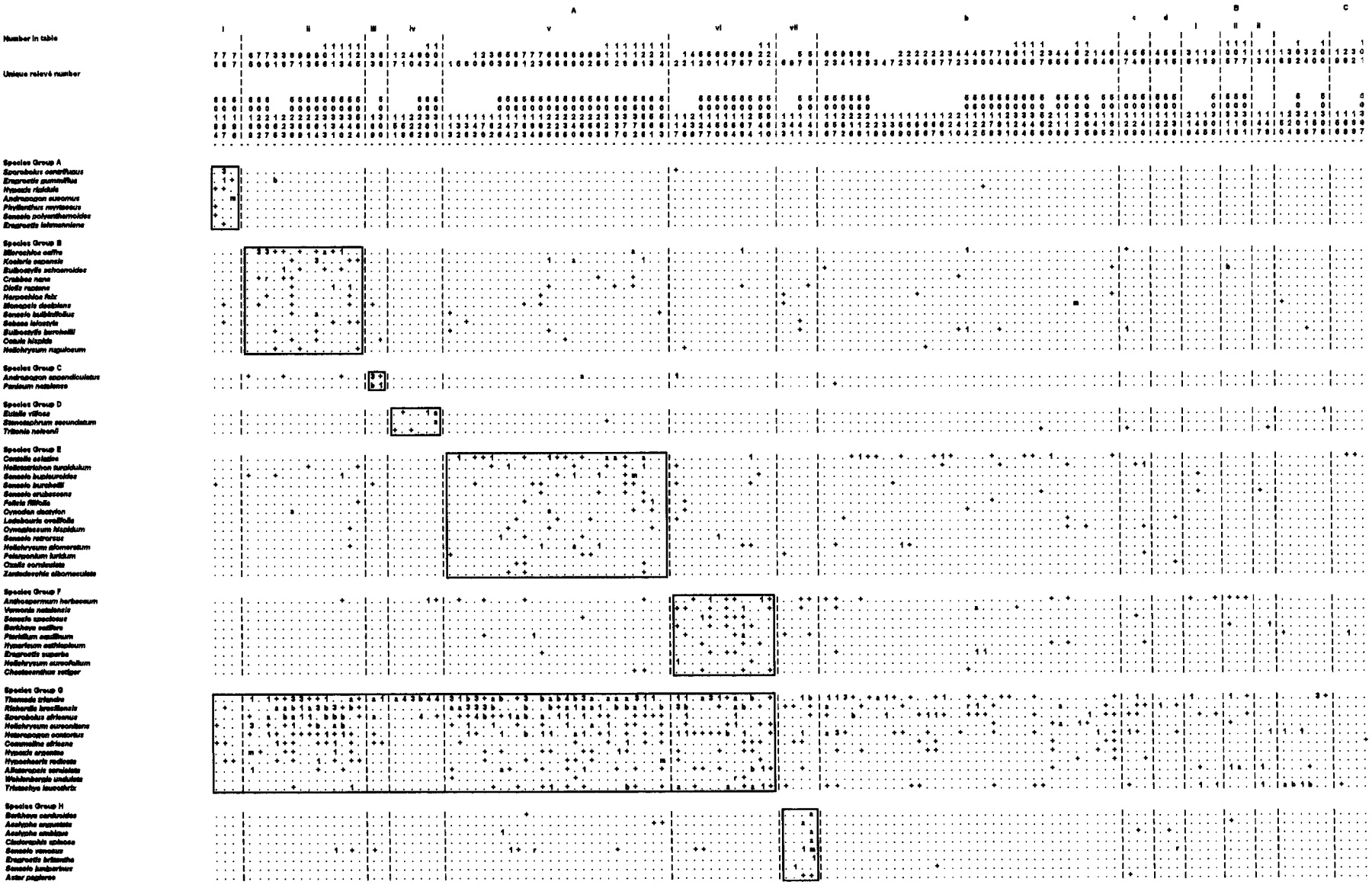
As typical for most of the Transkei, the dominant species are listed in Species Group I (Table 4.1), and include the grasses *Eragrostis plana, Themeda triandra, Heteeopogon contortus, Eragrostis capensis, E. curvula, Sporobolus africanus, Hyparrhenia hirta, Setaria sphacelata, Aristida junciformis* and the forbs *Richardia brasiliensis* and *Helichrysum aureonitens.*

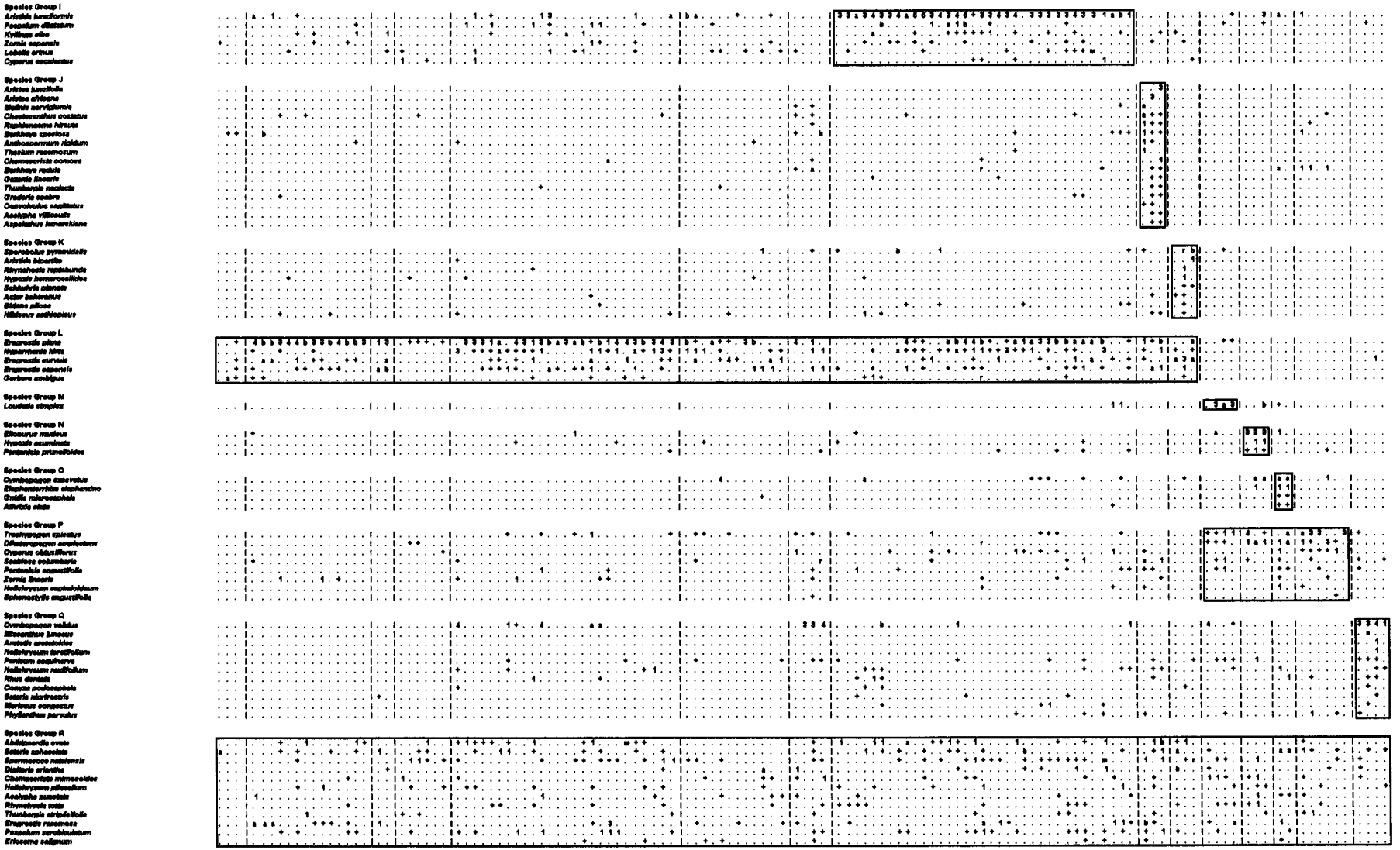
2 Results and discussion

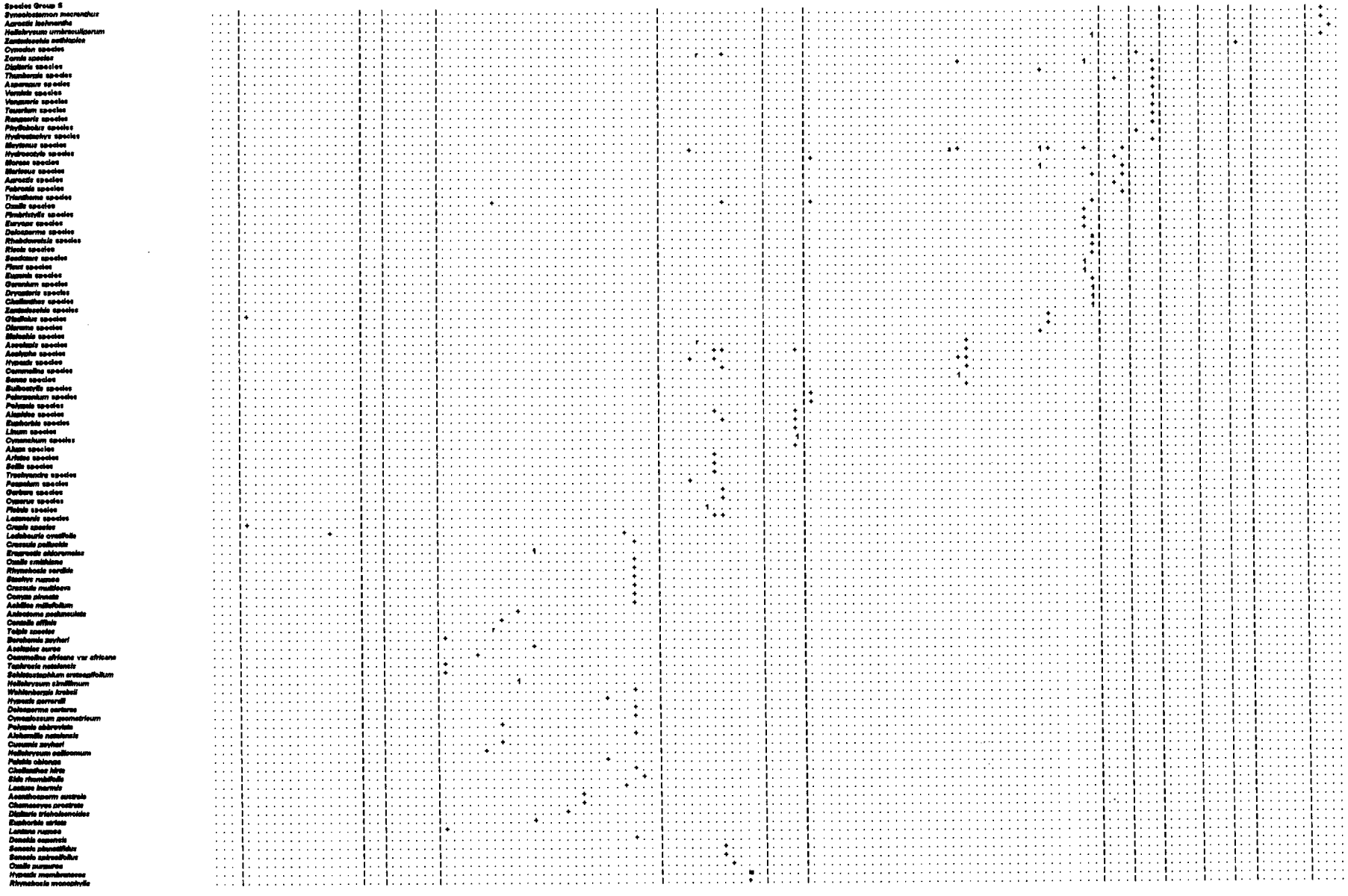
2.1 Classification of plant communities

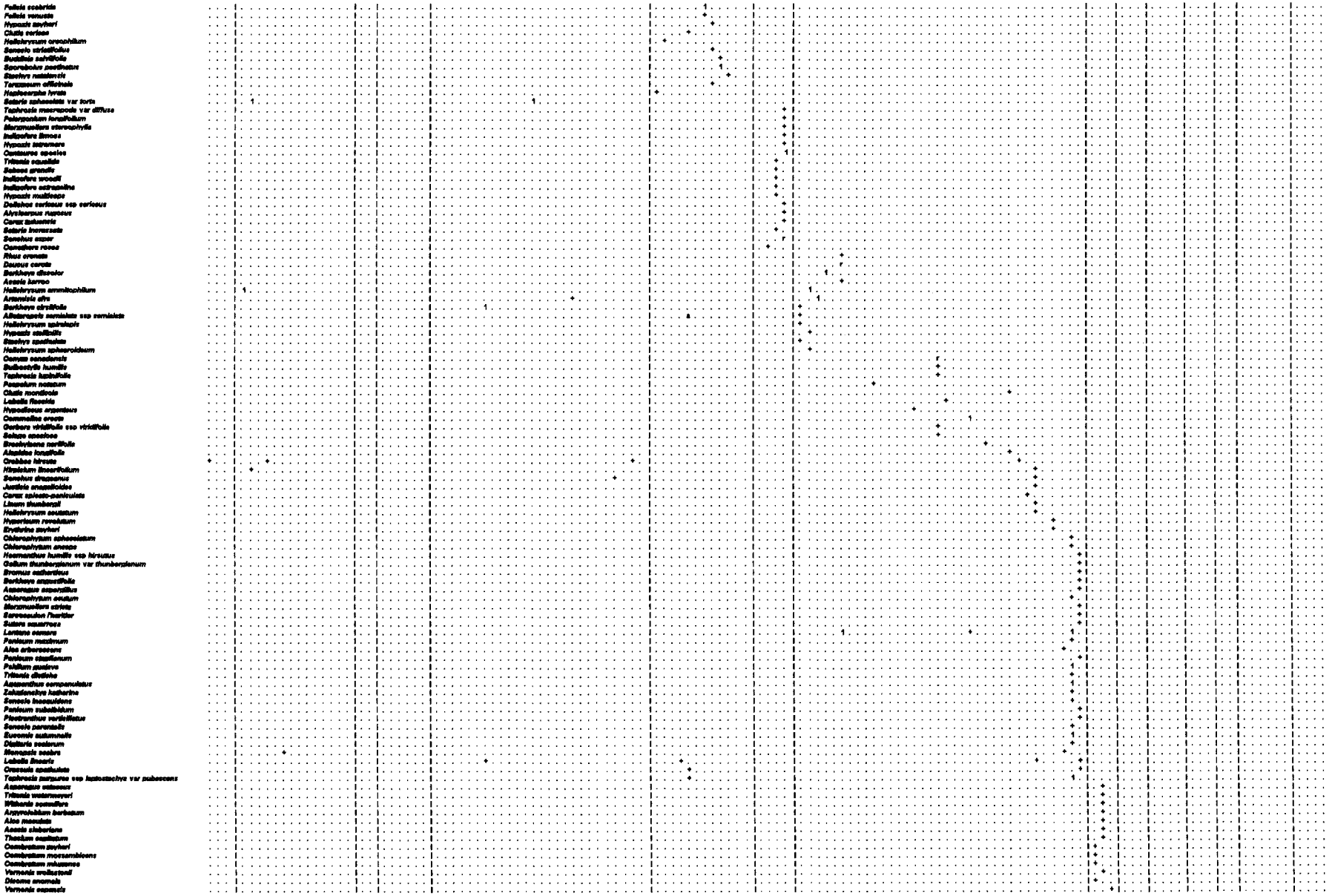
Data collected in the 127 relevés sampled in Grassland of Undulating Areas were collated in a phytosociological table. This table was further refined, using the computer program MEGATAB (Hennekens 1996b), to produce Table 7.1.

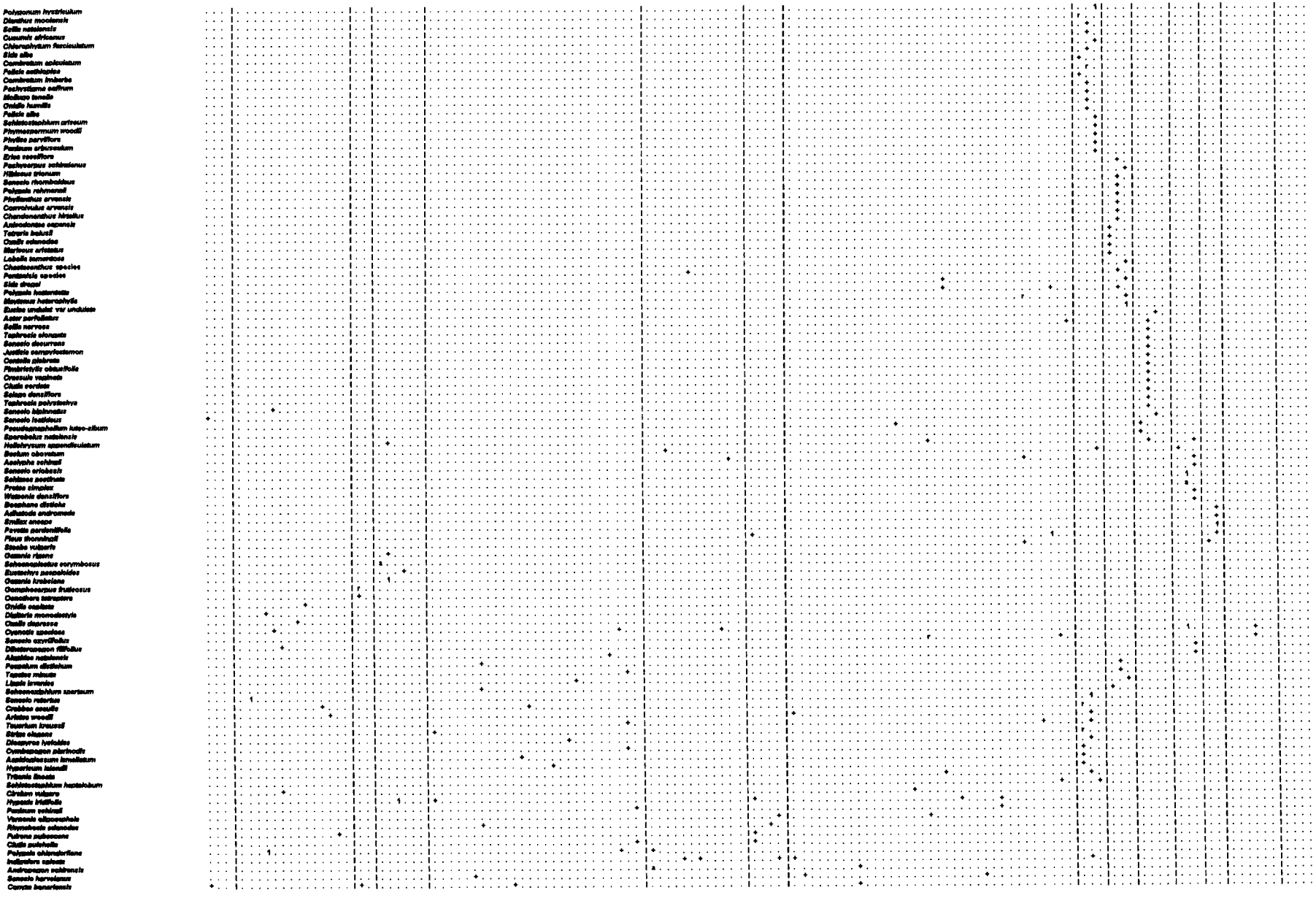
Table 7.1. Grassland of Undulating Areas phytosociological table











Oxalis obliquifolia
Brachiaria serrata
Melinis repens
Chlorophytum cooperi
Cheilanthes quadripinnata
Mohria caffrorum
Acacia mearnsii
Sonchus wilmsii
Ajuga ophrydis
Pichnia lateralis
Aristida diffusa
Leucosidea sericea
Tristachya nodiglumis
Plantago species
Felicia bergerana
Anthospermum hispidulum
Berkheya bergiana
Anthospermum rigidum ssp pumilum
Gnidia kraussiana
Hibiscus pusillus
Androcymbium schlechteri
Rhus discolor
Rhoicissus tridentata
Kohautia amatymbica
Gerbera piloselloides
Crepis hypochoeridea
Berkheya rhapontica
Cyperus rupestris
Plectranthus spicatus
Pennisetum thunbergii
Panicum volutans
Aristida congesta ssp congesta
Kyllinga alata
Coleochloa setifera
Haplocarpha scaposa
Erythrina caffra
Polygala amatymbica
Helichrysum acrophilum
Helichrysum miconiifolium
Eriosema cordatum
Androcymbium eucomoides
0

In Figure 7.1, which is a geological map, the position of the samples plots representing the Grassland of Undulating Areas are shown. This vegetation type is very often found on dolorite and shale, but may also occur on conglomerate, arenite and mudstone, and sometimes on sedimentary rocks. This vegetation is mostly restricted to higher lying areas of approximately 2100 m above sea level (Fig. 2.5).

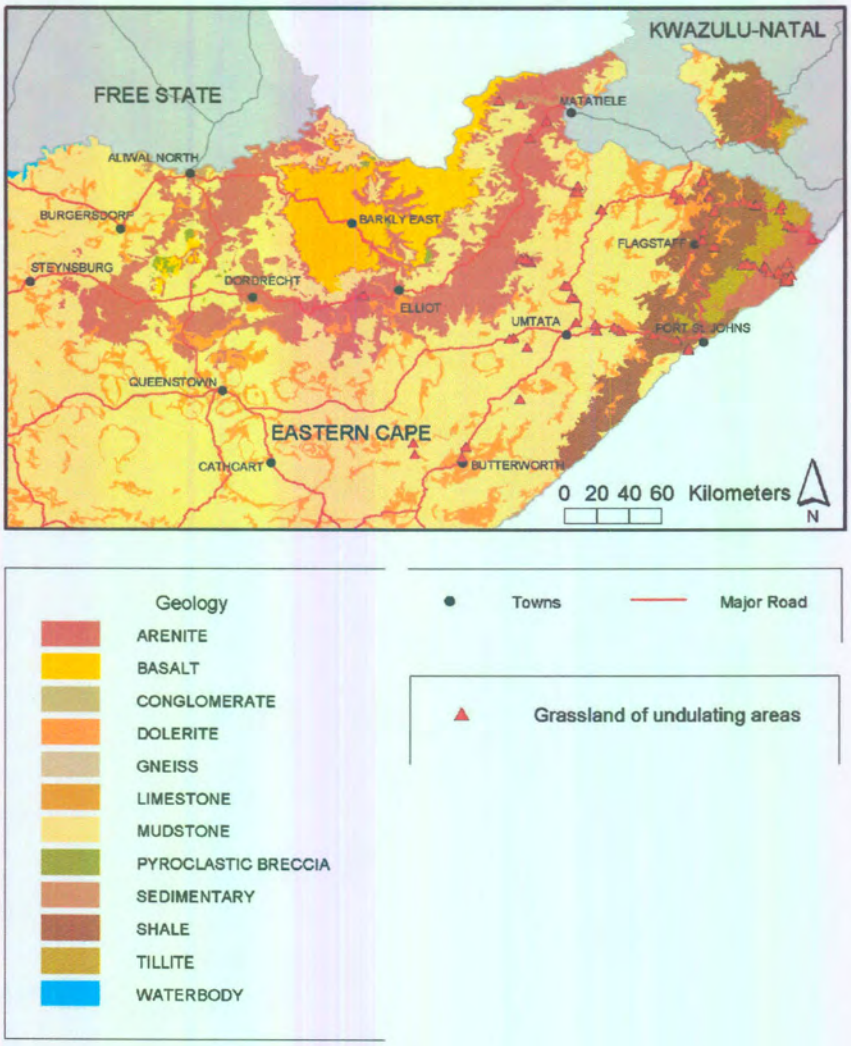


Figure 7.1 A geological map of the Transkei, with the portion of the 127 plots of the Grassland of Undulating Areas.

The classification revealed 3 major communities, 4 communities, and 10 sub-communities.

A. *Eragrostis plana–Eragrostis curvula* grassland of flat plains or lowland areas

a. *Themeda triandra-Richardia brasiliensis* grassland

(i) *Eragrostis gummiflua* Sub–community - on somewhat wetter clayey sites

(ii) *Microchloa caffra* Sub–community – on shallow rocky sites

(iii) *Panicum natalense* Sub–community - on rocky sites

(iv) *Eulalia villosa* Sub–community - on very rocky sites

(v) *Centella asiatica* Sub–community – on clayey sites

(vi) *Vernonia natalensis* Sub–community on moist plains

(vii) *Senecio venosus* Sub–community

b. *Aristida junciformis-Zornia capensis* grassland on rocky terraces

c. *Hyparrhenia hirta-Chaetacanthus costatus* grassland of over-utilized sites

d. *Stipagrostis zeyheri-Sporobolus pyramidalis* dry grassland on clay

B. *Trachypogon spicatus-Diheteropogon amplectens* grassland of crests on upland sites

(i) *Loudetia simplex* Sub–community of rocky upland crests

(ii) *Elionurus muticus* Sub–community at the coast

(iii) *Cymbopogon excavatus* Sub–community on moist rocky slopes on the coastal plain

C. *Cymbopogon validus* grassland along watercourses, or on wetter sites

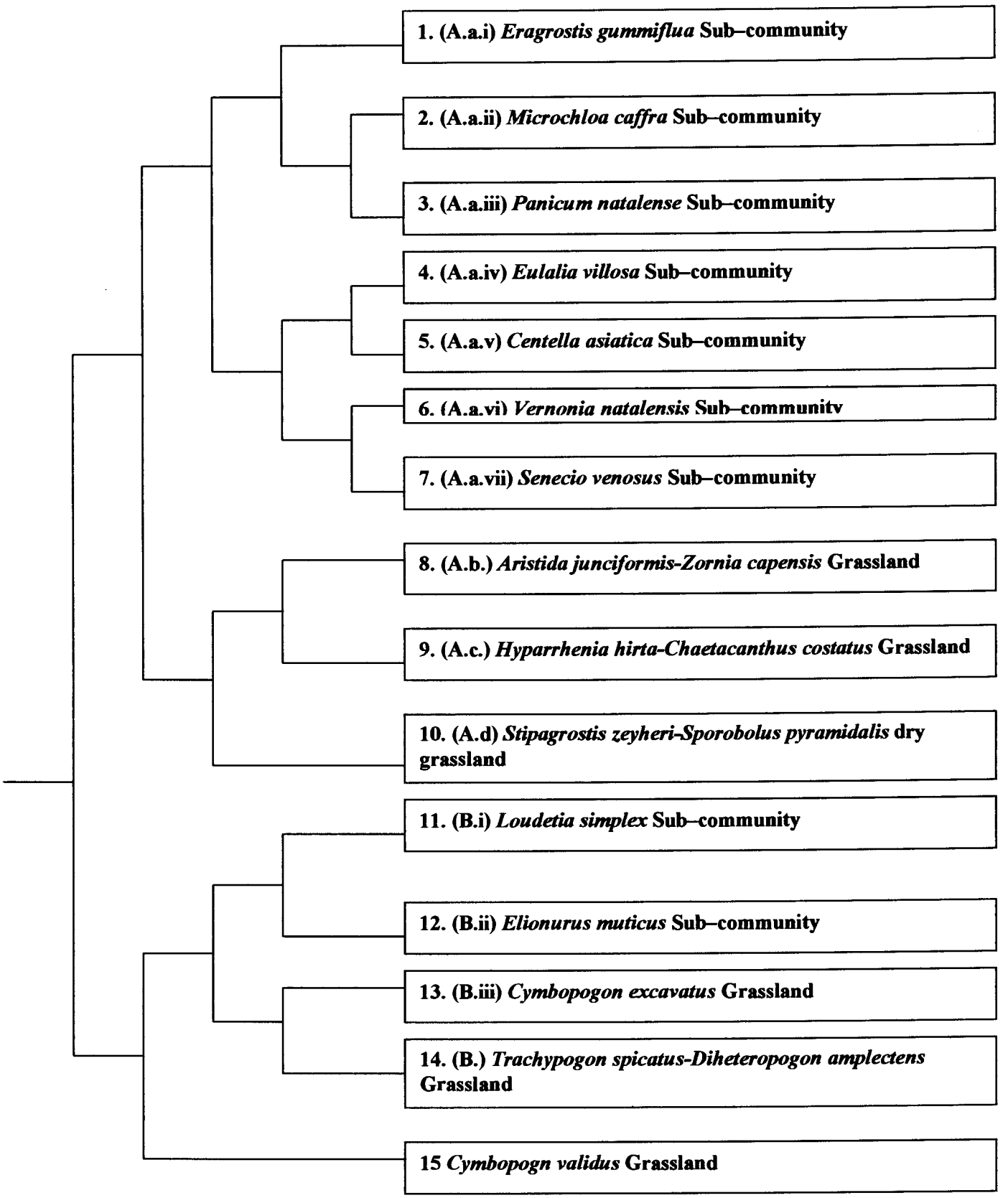


Figure 7.2 Dendrogram representing Grassland of Undulating Areas

2.2 Description of plant communities

The classification is shown in the phytosociological table (Table 7.1). The species groups in this community are not so strong because many species might have disappeared due to human impacts over many years. In some cases the diagnostic species may have been pushed out by more aggressive pioneer or seral species, which became established due to the degradation of the systems present within the area. This may have resulted in a poor representation of diagnostic species, and therefore in some difficulty in identifying the representative ecosystems and their associated plant communities.

A. *Eragrostis plana–Eragrostis curvula* grassland of flat plains or lowland areas

This community is widely distributed, situated in flat plains to bottomland sites as well as rocky hills and mountain slopes. The soils are light brown to dark brown, and in some areas there is invasion of the exotic tree *Acacia mearnsii*.

This grassland is characterized by Species Group L (Table 7.1). Diagnostic species include the grasses *Eragrostis plana*, *E. curvula*, *E. capensis*, *Hyparrhenia hirta* whereas the herbaceous layer is dominated by the perennial forb *Gerbera ambigua*.

The prominent species in the grass layer are *Heteropogon contortus*, *Sporobolus africanus*, *Themeda triandra* (Species Group G), *Aristida junciformis* (Species Group I), *Trachypogon spicatus* (Species Group P), *Eragrostis racemosa* and *Setaria sphacelata* (Species Group R). The herbaceous layer is dominated by the forbs *Centella asiatica* (Species Group E), *Anthospermamum herbaceum* (Species Group F), *Helichrysum pilosellum*, and *Spermacoce natalesis* (Species Group R), and the sedge *Abildgaardia ovata* (Species Group R).

This major community is further divided into four sub-communities:

a. *Themeda triandra-Richardia brasiliensis* grassland

This Sub–community is situated on the vast undulating plains to more rocky hills and is only slightly overgrazed and degraded, therefore reflecting a fairly good veld condition.

This sub-community is characterized by Species Group G (Table 7.1) and the diagnostic species are the grasses *Heteropogon contortus, Sporobolus africanus, Themeda triandra*. The herbaceous layer has diagnostic such as the perennial weeds *Hypochaeris radicata* and *Richardia brasiliensis.*

The dominant species in the grass layer are *Aristida junciformis* (Species Group I), *Eragrostis plana, E. curvula, E. capensis, Hyparrhenia hirta* (Species Group L), *Cymbopogon validus* (Species Group Q), *Eragrostis racemosa* (Species Group R). The herbaceous layer is dominated by various herbaceous species, such as *Senecio bupleuroides* (Species Group E), *Anthospermamum herbaceum* (Species Group F), *Senecio venosus* (Species Group H), *Lobelia erinus* (Species Group I), *Helichrysum pilosellum,* and *Spermacoce natalesis* (Species Group R) and the sedge *Abildgaardia ovata* (Species Group R).

Due to smaller floristic variations this sub-community is sub-divided into seven Sub–communities, namely:

(i) *Eragrostis gummiflua* Sub–community

This Sub–community occurs on midslopes and valleys open to the coast, on northwest to southeast facing slopes of 1°–20°. The soils are whitish sandy light brown. The herbaceous layer is 25 cm tall, on average, covering 55%, on average.

This Sub–community is characterized by Species Group A (Table 7.1). The diagnostic species include grasses such as *Eragrostis gummiflua, Sporobolus centrifugus* and *Andropogon eucomus,* all indicators of wet soils, and *Hypoxis rigidula* and *Senecio polyanthemoides* in the herbaceous layer.

The dominant grass is *Setaria sphacelata* (Species Group R) whereas species such as *Commelina africana,* the perennial weed *Hypochaeris radicata* (Species Group G), *Berkheya speciosa* (Species Group J) and *Gerbera ambigua* (Species Group L) are dominant in the herbaceous layer.

(ii) *Microchloa caffra* Sub–community

This Sub–community is situated on footslopes to midslopes, widely distributed over slightly undulating plains and crests. The slopes are gradual, 1°–10° in all aspects. The soils are light brown, greyish brown to brown, sandy loams, with stones size 40 cm in diameter, covering 5%. The soils are derived from sandstone or dolerite, and are shallow (<1 m) (Figure 7.3). Goats and cattle graze the vegetation. Moles are often found in this area. The herbaceous layer is 15 cm tall, on average, covering 65%, on average.

This Sub–community is characterized by Species Group B (Table 7.1). The diagnostic species in the grass layer are *Microchloa caffra, Harpochloa falx, Koeleria capensis* and the forb *Monopsis decipiens* and sedge *Bulbostylis schoenoides.*

The dominant species in the grass layer include *Heteropogon contortus, Sporobolus africanus, Themeda triandra* (Species Group G), *Eragrostis plana, E. curvula, E. capensis* (Species Group L), *Eragrostis racemosa, Paspalum scrobiculatum, Setaria sphacelata* (Species Group R) and the herbaceous layer includes the forbs *Senecio bupleuroides (*Species Group E*), Helichrysum aureonitens* and *Commelina africana,* the geophyte *Hypoxis argentea,* the weeds *Richardia brasiliensis* and perennial *Hypochaeris radicata* (Species Group G), and the sedges *Kyllinga alba* (Species Group I) and *Abildgaardia ovata (*Species Group R).

Figure 7.3 *Microchloa caffra* Sub–community - on shallow rocks

(iii) *Panicum natalense* Sub–community

This Sub–community is situated in lower undulating slopes of the Drakensberg, in the west of the study area, on slopes of 1°–14° facing towards East. The soils are rocky and shallow. The veld condition is good. The herbaceous layer is 85 cm tall, on average, and covering 90%.

It is characterized by Species Group C (Table 7.1). The diagnostic species are the grasses *Panicum natalense* and *Andropogon appendiculatus*.

The prominent species in the grass layer include *Sporobolus africanus, Themeda triandra* (Species Group G), *Eragrostis plana, E. curvula, E. capensis* (Species Group L), *Eragrostis racemosa* and *Setaria sphacelata* (Species Group R) and herbaceous layer includes species such as the forb *Commelina africana* (Species Group G) and the sedge *Kyllinga alba* (Species Group I).

(iv) *Eulalia villosa* Sub–community

This Sub–community is situated on the coastal plains, adjacent to the Indian Ocean, in the Mkambati Nature Reserve, where the slopes are flat and here the soils are very rocky. The soils are brown to black humic fine sandy loams. The vegetation is moderately grazed by wild game and the veld is in good state. The herbaceous layer is 5–10 cm tall, on average, and covers 95%.

It is characterized by Species Group D (Table 7.1). The diagnostic species in the grass layer are *Stenotaphrum secundatum* and *Eulalia villosa* and a diagnostic forb is the geophyte *Tritonia nelsonii*.

The prominent species in the grass layer include *Eragrostis plana* (Species Group L) and *Diheteropogon amplectens* (Species Group P) and herbaceous layer includes species such as the forbs *Anthospermum herbaceum* (Species Group F), *Cyperus esculentus* (Species Group I), *Spermacoce natalesis, Helichrysum pilosellum, Chamaecrista mimosoides* and *Thunbergia atriplicifolia* (Species Group R) and the sedges *Abildgaardia ovata* (Species Group R).

(v) *Centella asiatica* Sub–community

This Sub–community is very widespread over the slightly undulating plains of the Transkei. It occurs on midslopes and crests of undulating or rolling hills. The slopes are 0–20° steep, mostly on clayey soils. The soils are light to dark brown, mostly clayey, and rockiness varies from 0–30%. There are termitaria in some localities, and the veld is often disturbed due to overgrazing. The herbaceous layer is 30 cm tall, on average, and covering 80%.

It is characterized by Species Group E (Table 7.1). The diagnostic species in the grass layer are *Cynodon dactylon* and *Helictotrichon turgidulum* and herbaceous layer includes species such *Centella asiatica, Senecio bupleuroides, S. burchellii, Felicia filifolia* and *Helichrysum glomeratum.*

The prominent species in the grass layer include *Koeleria capensis* (Species Group B), *Heteropogon contortus, Sporobolus africanus, Themeda triandra* (Species Group G), *Aristida junciformis, Paspalum dilatum* (Species Group I), *Eragrostis plana, E. curvula, E. capensis, Hyparrhenia hirta* (Species Group L), *Trachypogon spicatus* (Species Group P), *Cymbopogon validus* (Species Group Q), *Eragrostis racemosa, Paspalum scrobiculatum* and *Setaria sphacelata* (Species Group R). In the herbaceous layer includes the forbs *Anthospermum herbaceum* (Species Group F), *Helichrysum aureonitens, Commelina africana* (Species Group G), *Senecio venosus* (Species Group H), *Zornia capensis (*Species Group I), *Chaetacanthus costatus (*Species Group J*), Zornia linearis* (Species Group P), *Helichrysum nudifolium* (Species Group Q), *Helichrysum pilosellum, Rhychosia totta, Spermacoce natalensis* (Species Group R) the geophyte *Hypoxis argentea* (Species Group G), the sedges *Kyllinga alb* (Species Group I) and *Abildgaardia ovata* (Species Group R) are abundant, whereas shrub *Rhus dentata* (Species Group Q) is a prominent shrub.

(vi) *Vernonia natalensis* Sub–community

This Sub–community is found on midslopes or crests of hills or mountains. These landscapes are quite rocky, and the slopes are 3°–20°, facing towards the north or west. The soils are reddish, light to dark brown, loamy clays to sandy loams. The veld

condition is poor due to soil erosion and grazing. The herbaceous layer is 30 cm tall, on average, covering 85%.

It is characterized by Species Group F (Table 7.1). The diagnostic species in the grass layer is *Eragrostis superba* and the herbaceous layer include the forbs *Anthospermum herbaceum, Vernonia natalensis, Senecio speciosus* and *Hypericum aethiopicum* and the fern *Pteridium aquilinum.*

The prominent species in the grass layer include *Heteropogon contortus, Sporobolus africanus, Themeda triandra* (Species Group G), *Aristida junciformis* (Species Group I) *Eragrostis plana, E. curvula, E. capensis, Hyparrhenia hirta* (Species Group L), *Cymbopogon excavatus* (Species Group O) and *Trachypogon spicatus* (Species Group P) while the herbaceous layer includes the forbs *Helichrysum aureonitens, Commelina africana* (Species Group G), *Lobelia erinus* (Species Group I), *Chamaecrista mimosoides, Acalypha punctata, Spermacoce natalensis* (Species Group R), the geophyte *Hypoxis argentea* and the weeds *Richardia brasiliensis* and *Hypochaeris radicata (*Species Group G*)*.

(vii) *Senecio venosus* Sub–community

This Sub–community is tall grassland situated on hills that are much drier, with slopes of up to 14°, towards east, south and north. Soils are grey, and stoney, with the stone size greater than 1 m in diameter, covering up to 7%. The veld condition is disturbed due to grazing. The herbaceous layer is 110 cm tall, on average, covering 80%, on average.

It is characterized by Species Group H (Table 7.1). The diagnostic species in the grass layer are *Eragrostis brizantha* and herbaceous layer has *Aster peglerae, Senecio venosus* and *Acalypha ambigua.*

The prominent species in the grass layer include *Themeda triandra, Heteropogon contortus* (Species Group G), *Melinis nerviglumis* (Species Group J), *Eragrostis plana, E. capensis, Hyparrhenia hirta* (Species Group L), *Trachypogon spicatus* (Species Group P), *Cymbopogon validus, Panicum aequinerve* (Species Group Q) and *Paspalum scrobiculatum* (Species Group R). The herbaceous layer includes the forbs

Anthospermum herbaceum (Species Group F), *Commelina africana, Richardia brasiliensis,* (Species Group G), *Chaetacanthus costatus, Berkheya radula, B. speciosa* (Species Group J) and *Chamaecrista mimosoides* (Species Group R) and also the sedge *Cyperus obtusiflorus* (Species Group P).

b. *Aristida junciformis-Zornia capensis* grassland on rocky terraces

This grassland community is situated in the northern parts of Transkei, from the coast to inland areas on rocky terraces (Figure 7.4) in an undulating landscape. The slopes are often steep, 25°–33° and north–facing. Soils are shallow black/grey and white sandy loams. The stones are medium in size, and cover 20% of the soil surface.The vegetation is disturbed due to grazing.

The herbaceous layer is approximately 20cm tall, covering 80%, on average.

It is characterized by Species Group I (Table 7.1). The diagnostic species in the grass layer are *Aristida junciformis* and *Paspalum dilatum* whereas the herbaceous layer *Kyllinga alba, Zornia capensis* and *Lobelia erinus* as diagnostic species.

The prominent species in the grass layer include *Helictotrichon turgidulum* (Species Group E), *Heteropogon contortus, Sporobolus africanus, Themeda triandra* (Species Group G), *Sporobolus pyramidalis* (Species Group K), *Eragrostis plana, E. curvula, E. capensis, Hyparrhenia hirta* (Species Group L), *Cymbopogon excavatus* (Species Group O), *Trachypogon spicatus* (Species Group P), *Cymbopogon validus* (Species Group Q), *Digitaria eriantha, Eragrostis racemosa, Paspalum scrobiculatum* and *Setaria sphacelata* (Species Group R). The herbaceous layer includes the forbs *Centella asiata* (Species Group E), *Anthospermum herbaceum* (Species Group F), *Helichrysum aureonitens* (Species Group G), *Pentanisia angustifolia* (Species Group P), *Helichrysum nudifolium* (Species Group Q), *Chamaecrista mimosoides, Helichrysum pilosellum, Rhynchosia totta* and *Spermacoce natalensis* (Species Group R), the sedges *Abildgaardia ovata* (Species Group R) and *Cyperus obtusiflorus* (Species Group P) and the weeds *Richardia brasiliensis* (Species Group G), and *Bidens pilosa* (Species Group K).

Figure 7.4 *Aristida junciformis-Zornia capensis* grassland on rocky terraces

c. *Hyparrhenia hirta-Chaetacanthus costatus* grassland of over-utilized sites

This Community occurs on coastal plains, steep hills or mountains and is situated at over-utilized sites (Figure 7.5), though the vegetation is not so degraded to be classified under the Wet and Disturbed Grassland (see Chapter 6). The soils are light grey, shallow (3–40 cm) and the stones are small, covering 20%. The veld condition is disturbed due to erosion and grazing. The herbaceous layer is 20 cm tall, on average, covering 80%. The tree layer is 60 cm tall, covering 3% (relevé 50129).

The vegetation is characterized by Species Group J (Table 7.1). The diagnostic species in the grass layer is *Melinis nerviglumis* and diagnostic forbs are *Chaetacanthus costatus, Raphionacme hirsuta, Aristea africana, and A. juncifolia* and *Berkheya speciosa.*

The dominant species in the grass layer include *Helictotrichon turgidulum* (Species Group E), *Heteropogon contortus, Themeda triandra* (Species Group G), *Eragrostis plana, E. capensis, Hyparrhenia hirta* (Species Group L), *Eragrostis racemosa, Paspalum scrobiculatum* and *Setaria sphacelata* (Species Group R). Prominent species in the herbaceous layer include the forbs *Commelina africana, Richardia brasiliensis* (Species Group G), *Hibiscus aethiopicus* (Species Group K), *Scabiosa columbaria, Pentanisia angustifolia* (Species Group P) and *Spermacoce natalensis* and the sedge *Abildgaardia ovata* (Species Group R).

Figure 7.5 *Hyparrhenia hirta-Chaetacanthus costatus* grassland of over-utilized sites

d. *Stipagrostis zeyheri-Sporobolus pyramidalis* dry grassland on clay

This grassland community is situated on steep hillsides with terraces and wet clay soils and there is an invasion of exotic *Acacia mearnsii.* The total vegetation cover is 90%, while the herbaceous layer is 30 cm tall, on average, covering 90%, on average. The tree layer is 75 cm tall, on average, and covering 3%.

It is characterized by Species Group K (Table 7.1). The diagnostic species in the herbaceous layer are the grasses *Aristida bipartita* and *Sporobolus pyramidalis* and the forbs *Aster bakeranus,* and *Rhynchosia reptabunda* and the geophyte *Hypoxis hemerocallidea.*

The dominant species in the grass layer are *Eragrostis plana, E. curvula, E. capensis, Hyparrhenia hirta* (Species Group L), *Digitaria eriantha* (Species Group R) and *Setaria sphacelata* (Species Group R). In the herbaceous layer species such as the weedy *Richardia brasiliensis* (Species Group G), the sedge *Abildgaardia ovata* and the forb *Spermacoce natalensis* (Species Group R) are prominent.

B. *Trachypogon spicatus-Diheteropogon amplectens* grassland of crests on upland sites or coastal hills

This major grassland community is situated on crests on upland sites, in the Drakensberg foothills with slopes 3° or steeper, facing eastwards or westwards. It also occurs on steep rolling hills on the coastal plain. The soil is grey to brown, and its depth is greater than 1 m. The grass layer may be moribund, forming canopy approximately 20 cm in height, which collapse when walked upon. The vegetation is grazed by wild game

It is characterized by Species Group P (Table 7.1). The diagnostic species in the grass layer are *Trachypogon spicatus* and *Diheteropogon amplectens* and diagnostic forbs are the sedge *Cyperus obtusiflorus* and the herbaceous *Pentanisia angustifolia* and *Scabiosa columbaria.*
The dominant species in the grass layer are *Tristachya leucothrix, Themeda triandra, Alloteropsis semialata* (Species Group G), *Aristida junciformis* (Species Group I) and

Setaria sphacelata (Species Group R) and forbs such as *Chamaecrista mimosoides, Helichrysum pilosellum, Acalypha punctata* and *Rhynchosia totta* (Species Group R) are conspicuous.

This sub community is further divided into three Sub–communities, namely:

(i) *Loudetia simplex* Sub–community of rocky upland crests

This Sub–community is found on rocky sites on the crests of upland areas (Figure 7.6), on southwest–facing slopes of 2° or steeper. The soils are grey blackish brown. The veld condition is poor but it is utilized by wild game. The herbaceous layer is 40 cm tall, on average, covering 90%.

It is characterized by Species Group M (Table 7.1). The only diagnostic species is the grass *Loudetia simplex*.

The prominent species in the grass layer are *Tristachya leucothrix, Sporobolus africanus,* (Species Group G), *Eragrostis plana* (Species Group L), *Elionurus muticus* (Species Group N), *Trachypogon spicatus, Diheteropogon amplectens* (Species Group P), *Cymbopogon validus, Panicum aequinerve,* (Species Group Q) and *Eragrostis racemosa* (Species Group R). The herbaceous layer has species such as *Anthospermum herbaceum* (Species Group F), *Pentanisia angustifolia, Scabiosa columbaria* (Species Group P), *Chamaecrista mimosoides, Rhynchosia totta* and *Spermacoce natalensis* (Species Group R).

Figure 7.6 *Loudetia simplex* Sub–community of rocky upland crests

(ii) *Elionurus muticus* Sub–community at the coast

This Sub–community is associated with coastal grassland, on flat areas where large rocks cover 10–40% of the surface. The soils are grey brown, and found mostly sandy, and >1 m deep. These areas are covered and the veld is grazed by wild game. The herbaceous layer is 40 cm tall, on average, covering 90%.

It is characterized by Species Group N (Table 7.1). The diagnostic species are the grass *Elionurus muticus*, the forb *Pentanisia prunelloides,* and the geophyte *Hypoxis acuminata.*

The prominent species in the grass layer are *Themeda triandra, Alloteropsis semialata* (Species Group G), *Aristida junciformis* (Species Group I), *Cymbopogon excavatus* (Species Group O), *Trachypogon spicatus* and *Diheteropogon amplectens* (Species Group P). The herbaceous layer has species such as *Bulbostylis burchellii* (Species Group B), *Anthospermum herbaceum* (Species Group F), *Chamaecrista mimosoides, Rhynchosia totta, Helichrysum pilosellum* and *Spermacoce natalensis* (Species Group R).

(iii) *Cymbopogon excavatus* Sub–community of moist rocky slopes on coastal plain

This Sub–community is found on moist rocky slopes of hills on the coastal plain, where the stone size is greater than 1 m and stone cover is 20%, on average. The soils are brown to grey, >1 m deep and the texture is sandy. The veld condition is disturbed due to grazing. The herbaceous layer is 35 cm tall, on average, covering 80%.

It is characterized by Species Group O (Table 7.1). The diagnostic species are the grass *Cymbopogon excavatus* and the forb *Gnidia microcephala* and the shrubby *Athrixia elata* and *Elephantorrhiza elephantina.*

The dominant species in the grass layer are *Heteropogon contortus, Tristachya leucothrix, Alloteropsis semialata* (Species Group G), *Aristida junciformis* (Species Group I), *Elionurus muticus* (Species Group N), *Trachypogon spicatus,*

Diheteropogon amplectens (Species Group P), *Eragrostis racemosa* and *Setaria sphacelata* (Species Group R), the forbs *Berkheya setifera* (Species Group F), *Berkheya radula* (Species Group J), *Pentanisia angustifolia, Helichrysum cephaloideum* (Species Group P), and *Acalypha punctata* (Species Group R) and the sedge *Cyperus obtusiflorus* (Species Group P). The shrubby *Rhus dentata* (Species Group Q) is also conspicuous in this vegetation.

C. *Cymbopogon validus–Panicum aequinerve* grassland along coastal water courses or at wetter sites

This grassland community occurs on the coastal plain, in Mkambati Nature Reserve or water courses or on wetter conditions. The soils are sandy, clay loam in texture, and the stone sizes are 30–250 cm in diameter, covering 25% at places. The veld condition is good although it is grazed by game.The herbaceous layer is 60 cm tall, covering 70%.

It is characterized by Species Group Q (Table 7.1). The diagnostic species include the grasses *Miscanthus junceus, Cymbopogon validus, Panicum aequinerve* and the forbs *Helichrysum nudifolium, H. teretifolium* and *Arctotis arctotoides* and shrub *Rhus dentata.*

The prominent species in the grass layer include *Eragrostis curvula* (Species Group L) and *Setaria sphacelata* (Species Group R) and herbaceous layer has species such as *Centella asiatica* (Species Group E) and *Scabiosa columbaria* (Species Group P), and the fern *Pteridium aquilinum* (Species Group F).

2.3 Discussion

The Grassland of the undulating areas is mostly situated to the west of the Transkei area, towards the Drakensberg Mountains. The habitat of these grasslands are therefore mostly at higher altitudes and the vegetation tends to become related to the mountain vegetation. Related plant communities were described by Bester (1988). Due to the higher altitudes and the more rocky nature of the soil, these areas have been less utilized for agriculture, though grazing by cattle and goats has occurred for

many years. In some areas where there are managements plans, (Figure 7.7) there is a great improvement of the grass species.

Figure 7.7 The effect of fence on the grassland

There are also patches of forests (Figure 7.8), and more especially the exotic species that the people in these areas utilize for furniture or firewood (McKenzie 1984, Cawe 1986). Although this lead to a degree of deterioration, this area of the Transkei is generally in a better condition and is better conserved than the plains towards the east.

Figure 7.8 Forest patch of the *Eucalyptus* sp.

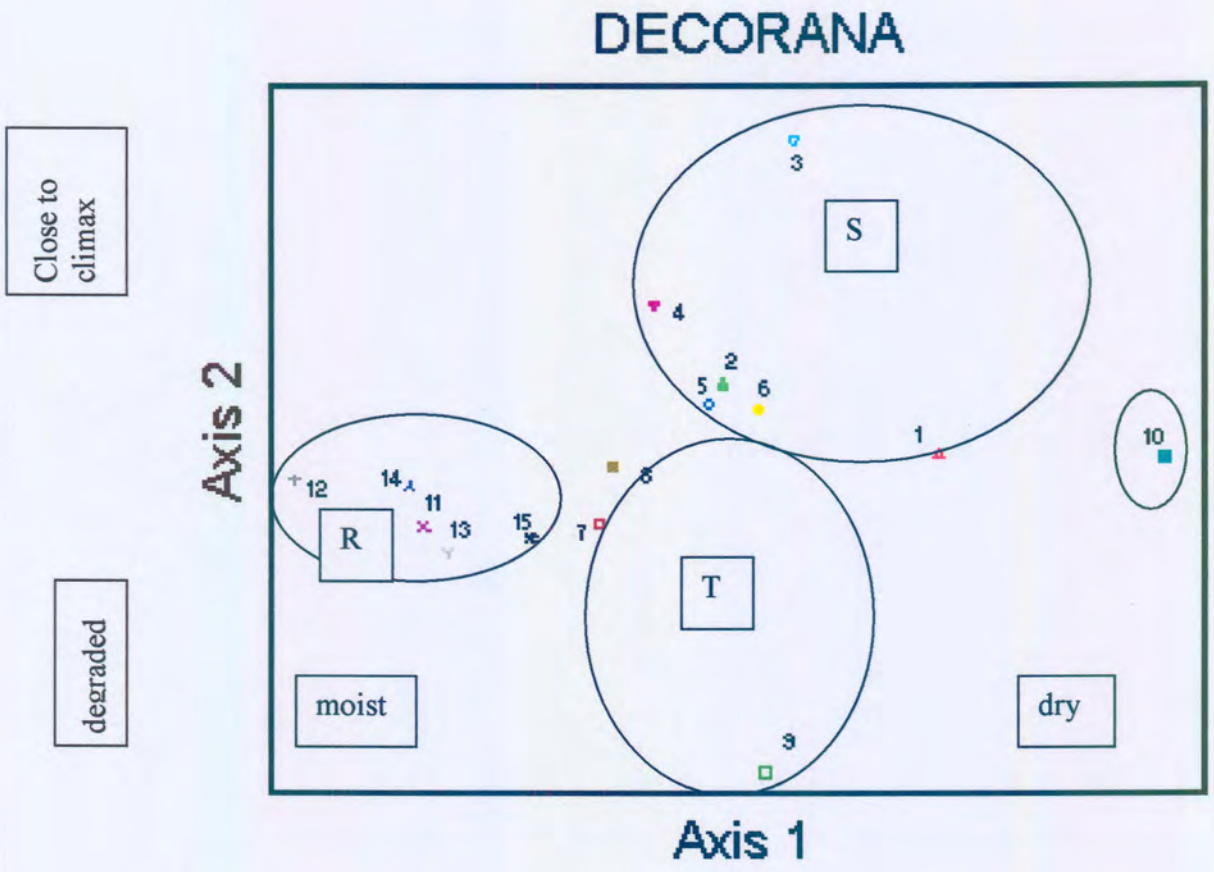
2.4 Ordination

Environmental trends were identified by means of DECORANA (Hill 1979a). Figure 7.8 indicates environmental gradients from moist, Community R (*Elionurus muticus* Sub–community) to dry grassland (*Stipagrostis zeyheri-Sporobolus pyramidalis* dry grassland community), plant community 10, in the Axis 1 and the Community S, are closely related to plant community 12, *i.e. Stipagrostis zeyheri-Sporobolus pyramidalis* dry grassland community, due to their dryness.

Axis 2 (Figure 7.9) indicates that the vegetation is from degraded to close to climax (*Panicum natalense* Sub–community).

The *Stipagrostis zeyheri-Sporobolus pyramidalis* dry grassland community is closely related to Community S, which are all Sub–communities.

Figure 7.2 shows that plant communities 11 to 15 belong to the same cluster and are found in moist environments.



Legend

1. (A. a. (i)) *Eragrostis gummiflua* Sub–community
2. (A. a. (ii)) *Microchloa caffra* Sub–community
3. (A. a. (iii)) *Panicum natalense* Sub–community
4. (A. a. (iv)) *Eulalia villosa* Sub–community
5. (A. a. (v)) *Centella asiatica* Sub–community
6. (A. a. (vi)) *Vernonia natalensis* Sub–community
7. (A. a. (vii)) *Senecio venosus* Sub–community
8. (A. b.) *Aristida junciformis-Zornia capensis* grassland
9. (A. c.) *Hyparrhenia hirta-Chaetacanthus costatus* grassland
10. (A. d.) *Stipagrostis zeyheri-Sporobolus pyramidalis* dry grassland
11. (B. (i)) *Loudetia simplex* Sub–community
12. (B. (ii)) *Elionurus muticus* Sub–community
13. (B. (iii)) *Cymbopogon excavatus* Sub–community
14. (B.) *Trachypogon spicatus-Diheteropogon amplectens* grassland
15. (C.) *Cymbopogon validus* grassland

Figure 7.9 Ordination graph of Grassland of Undulating Areas

3 References

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CHAPTER 8

RESULTS: MOIST GRASSLANDS ON FLAT PLAINS

1 Introduction

The initial classification of the floristic data from the Transkei vegetation survey (Chapter 4) indicated one of the major vegetation types that were identified as the Moist Grasslands on Flat Plains. It was indicated that this vegetation type is unique within the Transkei, with a number of diagnostic species listed under Species Group D in the synoptic table (Table 4.1).

These grasslands are situated on the flat plains of Transkei, which occur widespread over the region, though are the most prominent in the central parts, in the region of Umtata. The vegetation is often short, grazed grassland with scattered old fields and moister wetlands (Figure 8.1).

The diagnostic species found in this vegetation type (Species Group D, Table 4.1) include the grasses *Harpochloa falx, Cymbopogon plurinodis, Andropogon appendiculatus* and *Eustachys paspaloides,* the forbs *Vernonia natalensis, Turbina oblongata, Haplocarpha scaposa, Euphorbia striata, Gnidia kraussiana* and *Hibiscus pusillus*, while the geophytes *Ledebouria ovatifolia, L. ovalifolia* and *Boophane disticha* are diagnostically present.

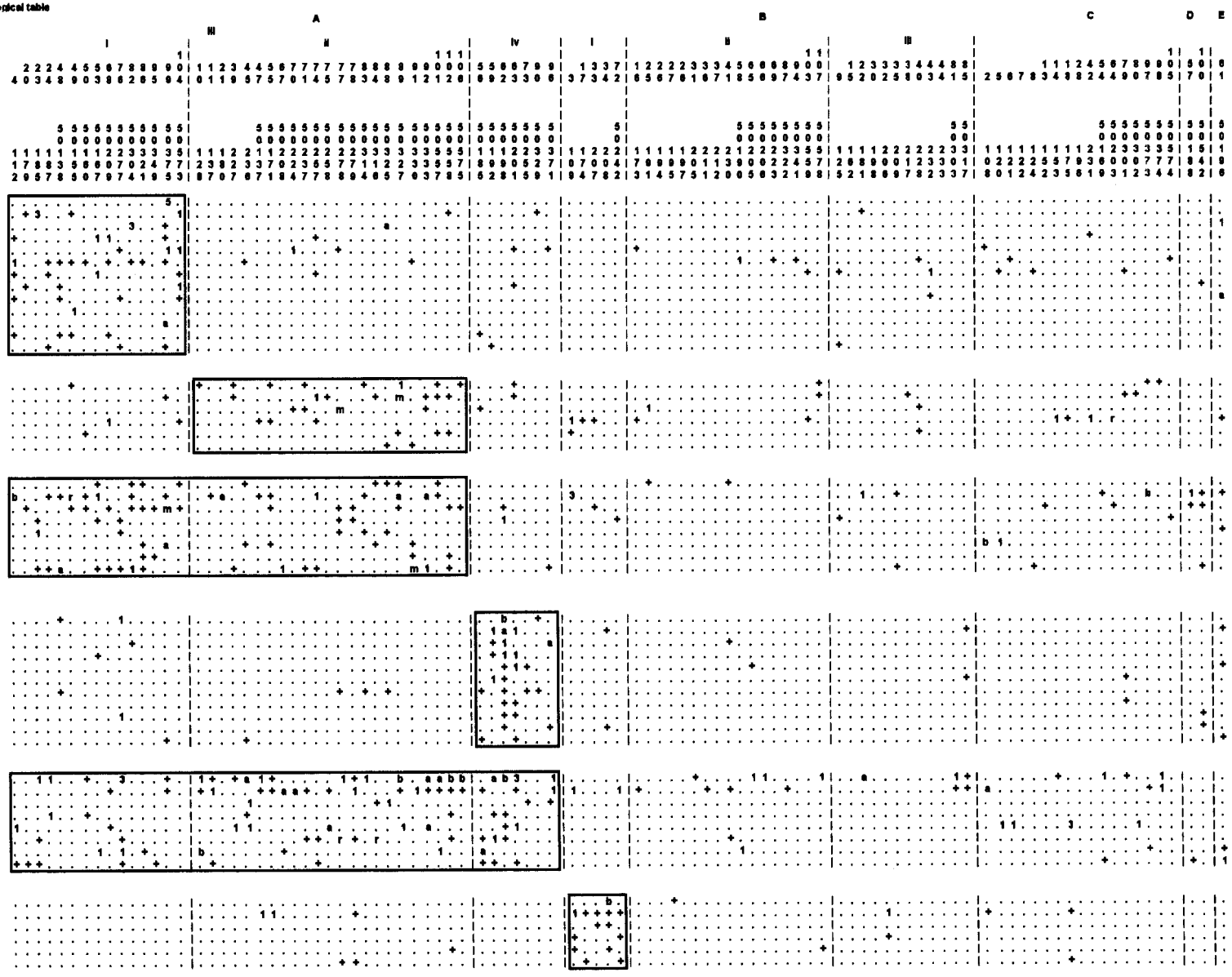
Other conspicuous species include the forbs *Scabiosa columbaria* and *Helichrysum pilosellum* (Species Group E, Table 4.1), *Hibiscus aethiopicus* (Species Group G, Table 4.1), and the widespread and often dominant grass species listed in Species Group I, Table 4.1, including *Eragrostis plana, Eragrostis capensis, Eragrostis curvula, Eragrostis racemosa, Cynodon dactylon, Themeda triandra, Heteropogon contortus, Sporobolus africanus, Microchloa caffra, Hyparrhenia hirta, Setaria sphacelata, Brachiaria serrata,* and *Elionurus muticus.* Forbs that are often encountered in this grassland are *Commelina africana, Richardia brasiliensis, Felicia filifolia, Helichrysum rugulosum, Senecio bupleuroides, Abildgaardia ovata* and *Rhynchosia totta.*

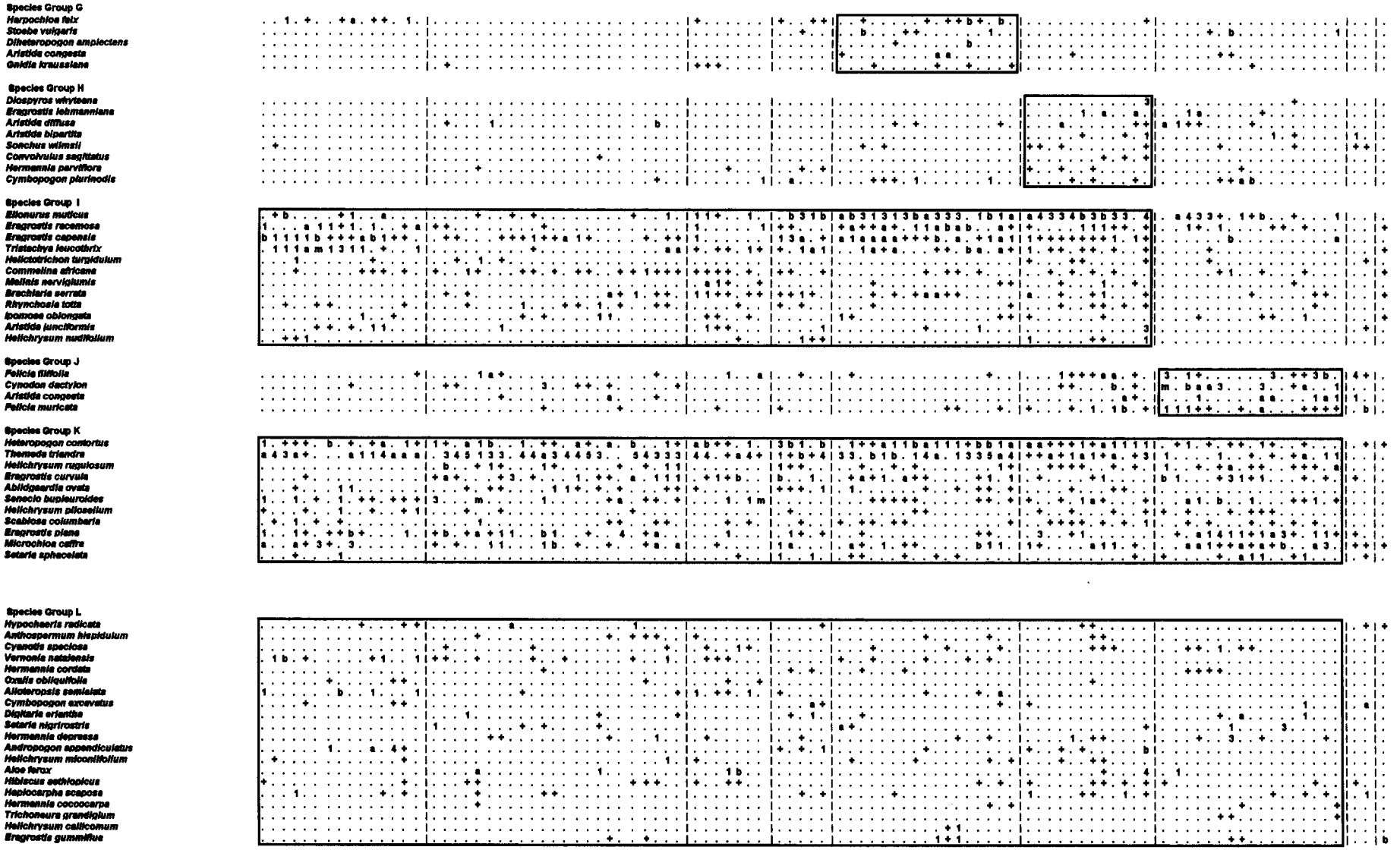
2 Results and discussion

2.1 Classification of plant communities

Data collected in the 107 relevés sampled in Moist Grasslands on Flat Plains were collated in a phytosociological table. This table was further refined, using the computer program MEGATAB (Hennekens 1996b), to produce Table 8.1.

Table 8.1. Moist Grasslands on Flat Plains Phytosociological table




Species Group G
Harpochloa falx
Stoebe vulgaris
Diheteropogon amplectens
Aristida congesta
Gnidia kraussiana
Species Group H
Diospyros whyteana
Eragrostis lehmanniana
Aristida diffusa
Aristida bipartita
Sonchus wilmsii
Convolvulus sagittatus
Hermannia parviflora
Cymbopogon plurinodis
Species Group I
Ellionurus muticus
Eragrostis racemosa
Eragrostis capensis
Tristachya leucothrix
Helictotrichon turgidulum
Commelina africana
Mellinis setviglumis
Brachiaria serrata
Rhynchosia totta
Ipomoea oblongata
Aristida junciformis
Helichrysum nudifolium
Species Group J
Felicia filifolia
Cynodon dactylon
Aristida congesta
Felicia muricata
Species Group K
Heteropogon contortus
Themeda triandra
Helichrysum reguiosum
Eragrostis curvula
Abildgaardia ovata
Senecio bupleuroides
Helichrysum pilosellum
Scabiosa columbaria
Eragrostis plana
Microchloa caffra
Setaria sphacelata
Species Group L
Hypocharis radicata
Anthospermum hispidulum
Cyanotis speciosa
Vernonia natalensis
Hermannia cordata
Oxalis obliquifolia
Alloteropsis semialata
Cymbopogon excavatus
Digitaria eriantha
Setaria nigrirostris
Hermannia depressa
Andropogon appendiculatus
Helichrysum miconiifolium
Aloe ferox
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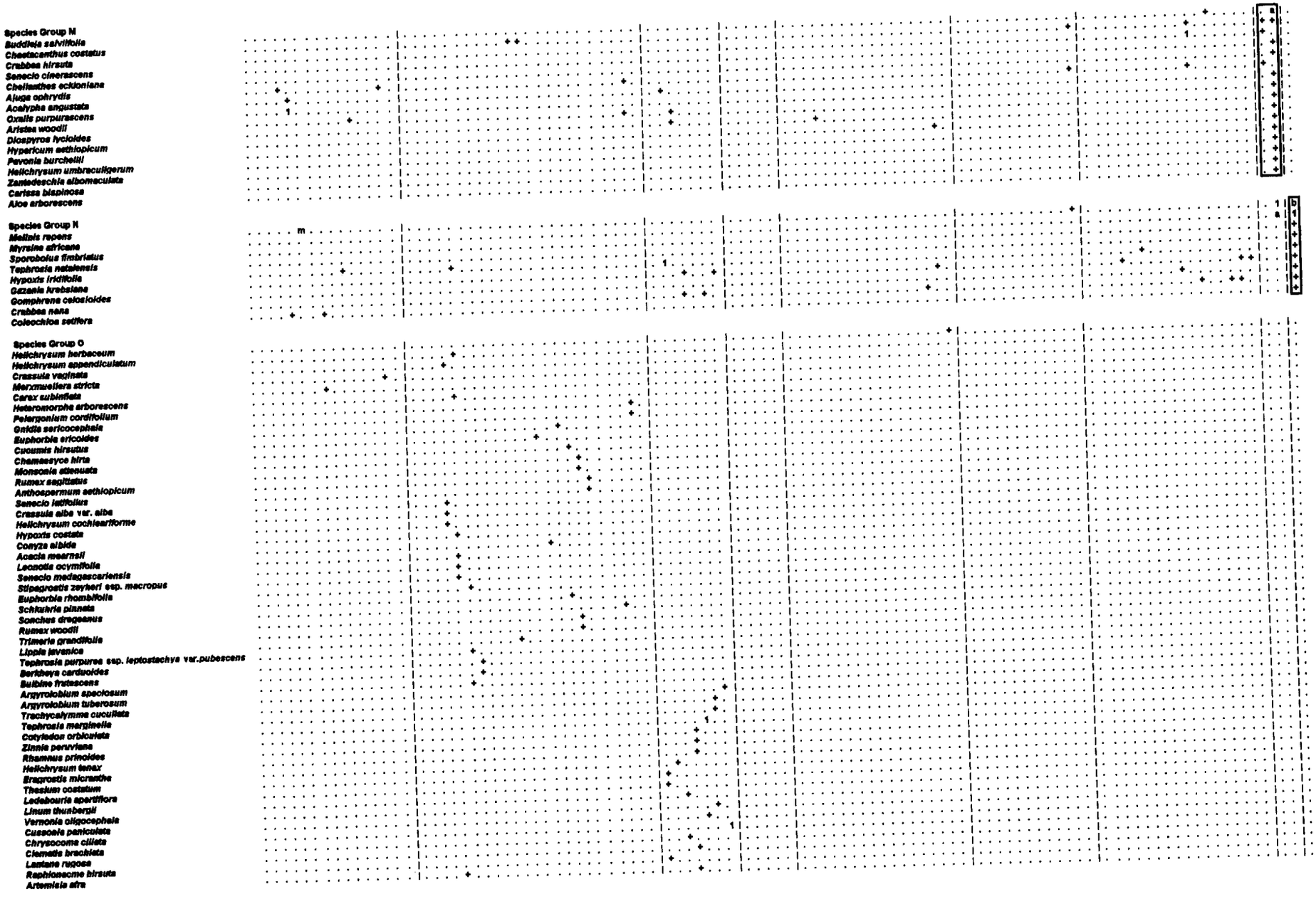
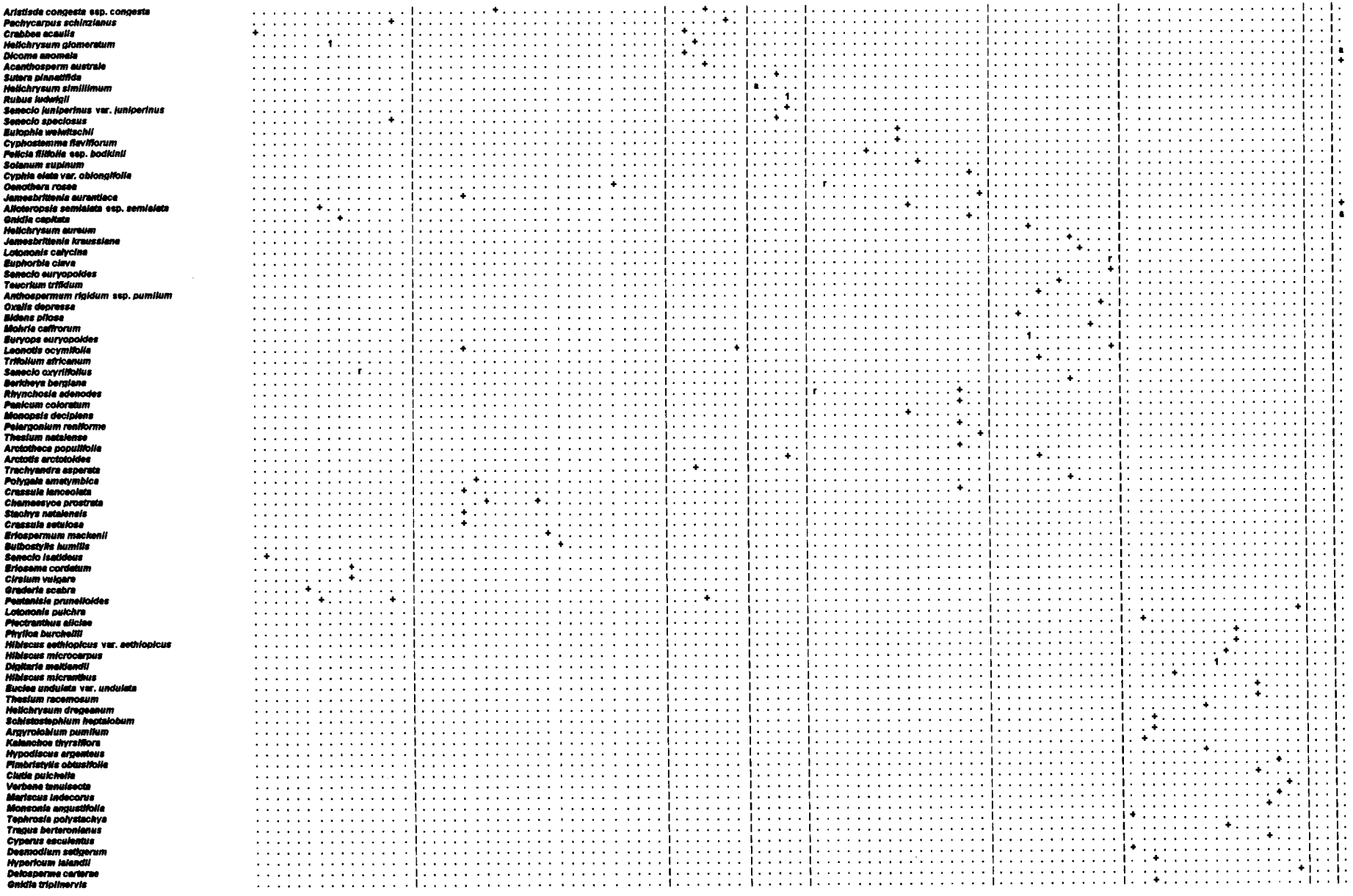
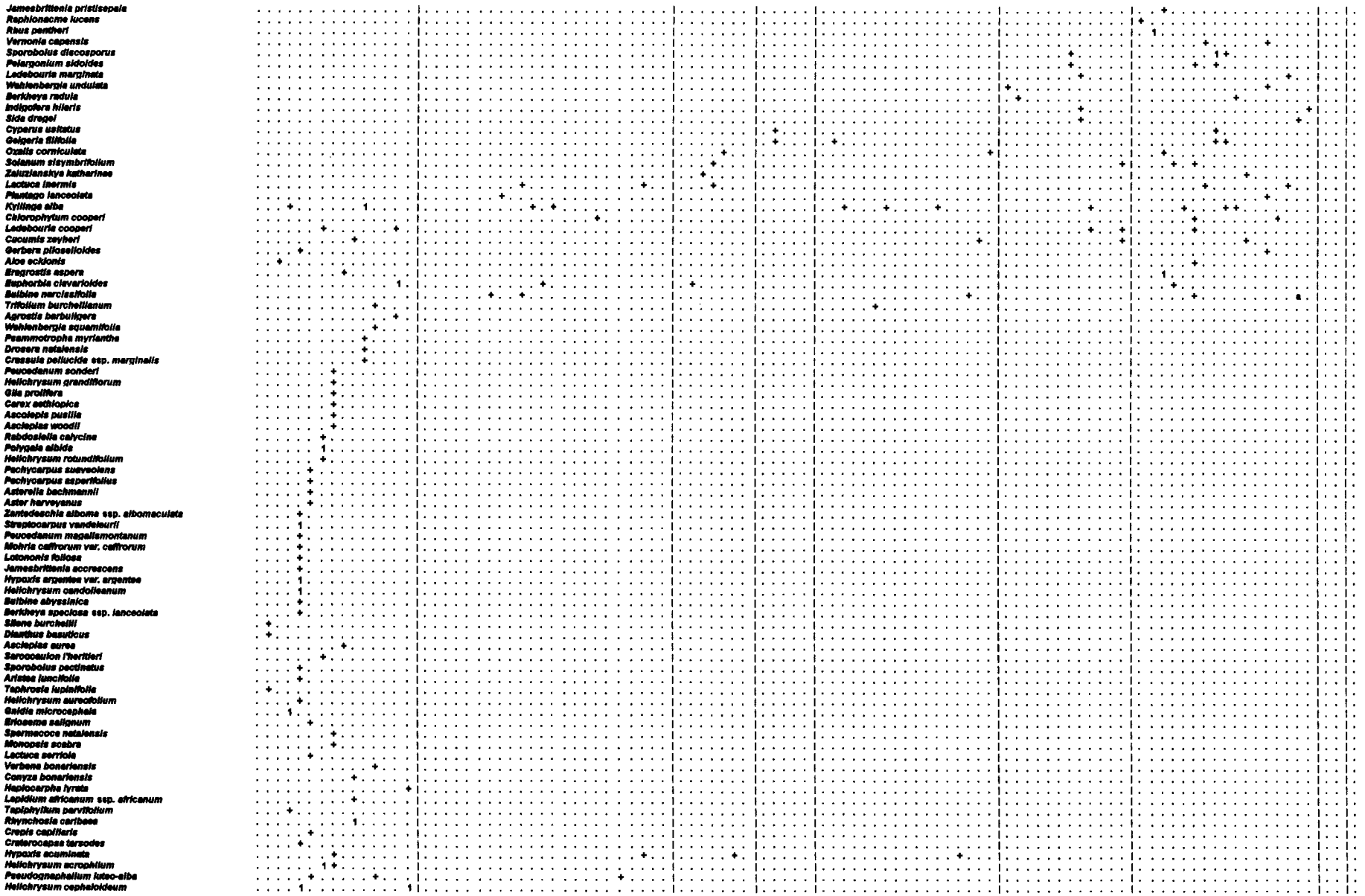
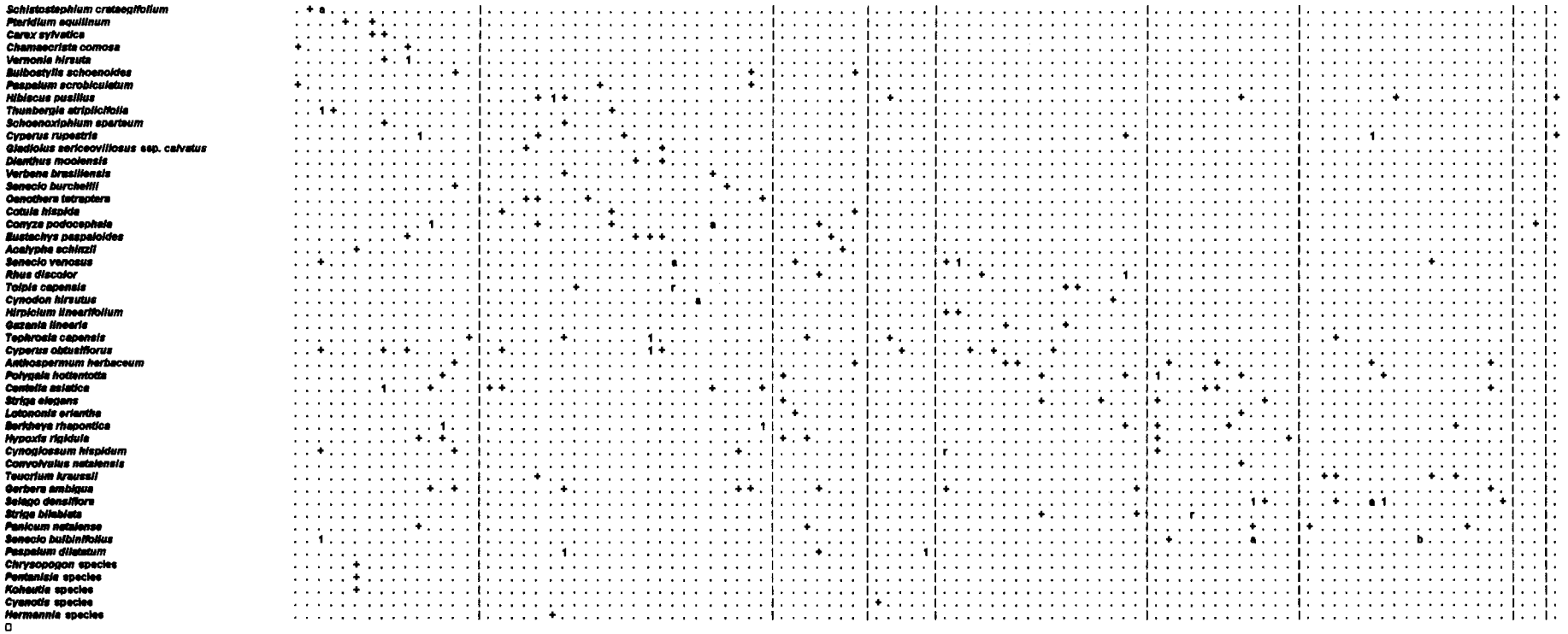
Helichrysum callicomum
Eragrostis gummiflua






Jamesbrittenia pristisepala
Raphionacme lucens
Rhus pentheri
Vernonia capensis
Sporobolus discosporus
Pelargonium sidoides
Ledebouria marginata
Wahlenbergia undulata
Berkheya radula
Indigofera hilaris
Sida dregei
Cyperus usitatus
Geigeria filifolia
Oxalis corniculata
Solanum sisymbriifolium
Zaluzianskya katharinae
Lactuca inermis
Plantago lanceolata
Kyllinga alba
Chlorophytum cooperi
Ledebouria cooperi
Cucumis zeyheri
Gerbera piloselloides
Aloe ecklonis
Eragrostis aspera
Euphorbia clavarioides
Selaginella narcissifolia
Trifolium burchellianum
Agrostis barbuligera
Wahlenbergia squamifolia
Psammotropha myriantha
Drosera natalensis
Crassula pellucida ssp. marginalis
Peucedanum sonderi
Helichrysum grandiflorum
Gila proliféra
Carex esthiopica
Asclepias pusilla
Asclepias woodii
Rabdosiella calycina
Polygala albida
Helichrysum rotundifolium
Pachycarpus suaveolens
Pachycarpus asperifolius
Asteriella bachmannii
Aster harveyanus
Zantedeschia albomaculata ssp. albomaculata
Streptocarpus vandeleurii
Peucedanum magaliesmontanum
Monsonia attenuata var. attenuata
Lotononis foliosa
Jamesbrittenia accrescens
Hypoxis argentea var. argentea
Helichrysum candolleanum
Selaginella abyssinica
Berkheya speciosa ssp. lanceolata
Silene burchellii
Dianthus basuticus
Asclepias aurea
Sarcocaulon patersonii
Sporobolus pectinatus
Aristea lugubris
Tephrosia lupinifolia
Helichrysum aureofolium
Galidia microcephala
Eriosema salignum
Spermacoce natalensis
Monopsis scabra
Lactuca serriola
Verbena bonariensis
Conyza bonariensis
Haplocarpha lyrata
Lepidium africanum ssp. africanum
Tephrosia lupinifolia
Rhynchosia caribaea
Crepis capillaris
Craterocapsa tarsodes
Hypoxis acuminata
Helichrysum acrophilum
Pseudognaphalium luteo-album
Helichrysum cephaloideum


Schistostephium crataegifolium
Pteridium aquilinum
Carex sylvatica
Chamaecrista comosa
Vernonia hirsuta
Bulbostylis schoenoides
Paspalum scrobiculatum
Hibiscus pusillus
Thunbergia atriplicifolia
Schoenoxiphium sparteum
Cyperus rupestris
Gladiolus sericeovillosus ssp. calvatus
Dianthus mooiensis
Verbena brasiliensis
Senecio burchellii
Oenothera tetraptera
Cotula hispida
Conyza podocephala
Eustachys paspaloides
Aeschynomene schimperi
Senecio venosus
Rhus discolor
Tolpis capensis
Cynodon hirsutus
Hirpicium linearifolium
Gazania linearis
Tephrosia capensis
Cyperus obtusiflorus
Anthospermum herbaceum
Polygala hottentotta
Centella asiatica
Striga elegans
Lotononis eriantha
Berkheya rhapontica
Hypoxis rigidula
Cynoglossum hispidum
Convolvulus natalensis
Teucrium kraussii
Gerbera ambigua
Selago densiflora
Striga bilabiata
Panicum natalense
Senecio bulbiniifolius
Paspalum dilatatum
Chrysopogon species
Pentanisia species
Kohautia species
Cynodis species
Hermannia species

In Figure 8.1, which is a geological map, the position of the samples plots representing the Moist Grasslands on Flat Plains areas are also shown. This vegetation type is very often found on dolorite and mudstone, but may also occur on arenite and few on shale. This vegetation is mostly situated at altitudes between 601m and 2100 m (Figure. 2.5).

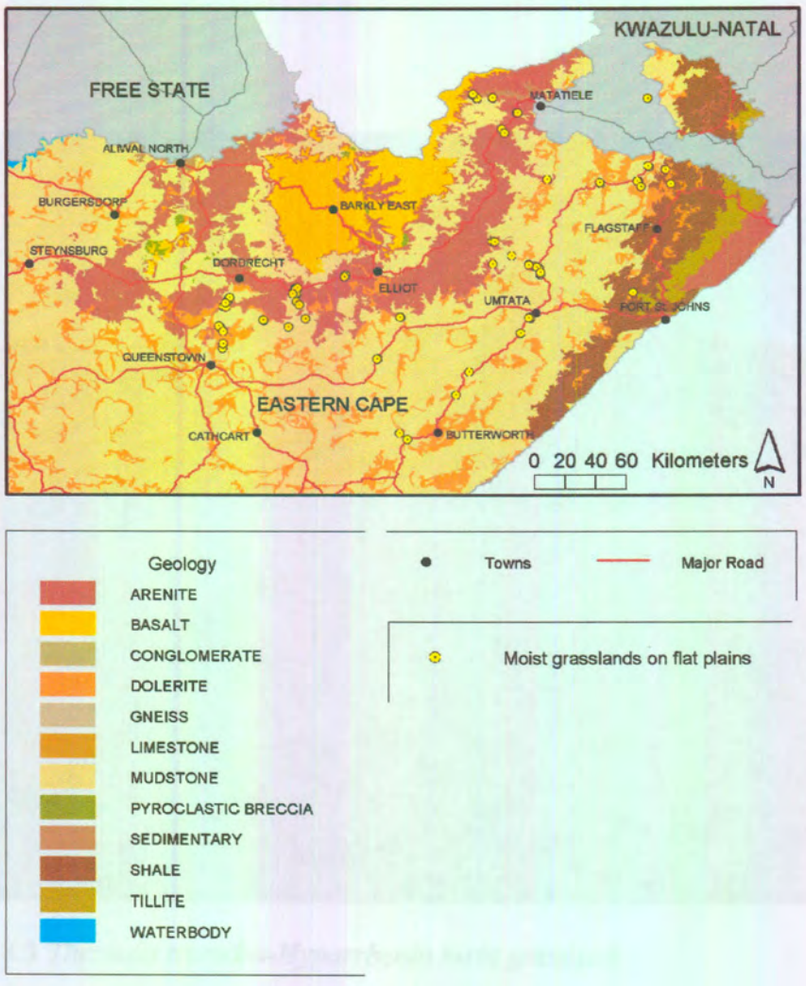


Figure 8.1 A Geological map of Transkei with the position of the sample plots representing the Moist Grasslands on Flat Plains with geology.

The classification revealed 5 communities and 7 sub-communities. These are:

A. *Themeda triandra-Hyparrhenia hirta* grassland

(i) *Themeda triandra-Helichrysum aureonitens* moist grassland

(ii) *Themeda triandra-Sporobolus africanus* grassland

(iii) *Themeda triandra-Richardia brasiliensis* grassland

(iv) *Themeda triandra-Trachypogon spicatus* grassland

B. *Elionurus muticus-Eragrostis racemosa* grassland

(i) *Elionurus muticus-Senecio retrorsus* grassland

(ii) *Elionurus muticus-Harpochloa falx* grassland

(iii) *Elionurus muticus-Eragrostis lehmanniana* grassland

C. *Cynodon dactylon-Felicia filifolia* degraded grassland

D. *Aloe arborescens-Buddleja salvifolia* bush on rocky boulders

E. *Myrsine africana-Coleochloa setifera* bush on rocky boulders

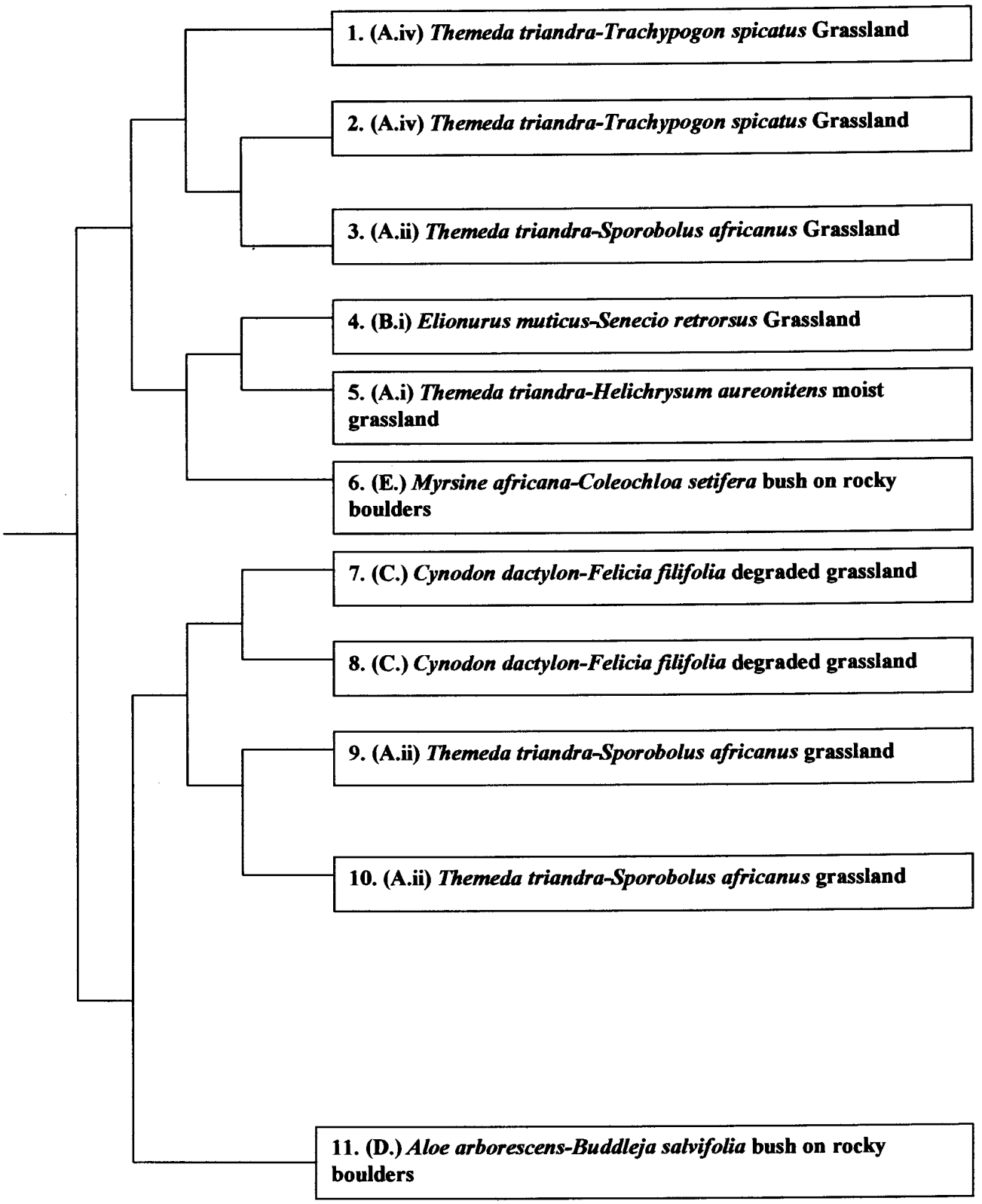


Figure 8.2 Dendrogram representing Moist Grasslands on Flat Plains

2.2 Description of plant communities

A. *Themeda triandra-Hyparrhenia hirta* grassland

This grassland (Figure 8.3) occurs on the slightly undulating landscape, with plains and rolling hills in the Umtata region of Transkei.

This grassland community is characterized by Species Group E (Table 8.1), and the diagnostic species include the grasses *Hyparrhenia hirta* and *Sporobolus africanus* and the shrub *Rhus dentata.*

The prominent species include the grasses *Eragrostis capensis* (Species Group I), *Themeda triandra, Heteropogon contortus, Microchloa caffra* and *Eragrostis plana* (Species Group K), forbs such as *Helichrysum aureonitens* (Species Group A), *Lobelia erinus* (Species Group C), *Richardia brasiliensis* (Species Group C), *Senecio bupleuroides* (Species Group K), *Rhynchosia totta* and *Commelina africana* (Species Group I).

Figure 8.3 *Themeda triandra-Hyparrhenia hirta* grassland

This grassland community is sub-divided into four Sub-communities:

(i) *Themeda triandra-Helichrysum aureonitens* moist grassland

This Sub-community is found in the slightly rolling landscape where the slopes varies from 0°–20°. The soils are light brown, reddish brown and black in colour, and its depth is greater than 1 m in diameter and the texture is mostly loamy to clay loam. The rocks are sandstone or dolerite, and in some cases rocks may cover up to 20% of the surface. The land is utilized by wild game for grazing. The total vegetation cover is 80%, while the herbaceous layer is 10 cm tall, on average.

This Sub–community characterized by Species Group A (Table 8.1), and the diagnostic species include the grasses *Digitaria monodactyla* and *Koeleria linearis,* herbs include *Helichrysum aurenitens* and *Chamaecrista mimosoides*.
The prominent species in grass layer are *Hyparrhenia hirta* (Species Group E), *Eragrostis racemosa, E. capensis* (Species Group I), *Themeda triandra, Eragrostis plana, Microchloa caffra* (Species Group K), and *Andropogon appendiculatus* (Species Group L), and the dominant species in the herbaceous layer are the weedy *Richardia brasiliensis* (Species Group C), the geophyte *Hypoxis argentea* (Species Group C), and the forbs *Lobelia erinus* (Species Group C), *Commelina africana* (Species Group I), *Senecio bupleuroides* and *Helichrysum pilosellum* (Species Group K).

(ii) *Themeda triandra-Sporobolus africanus* grassland

This grassland (Figure 8.4) Sub-community occurs on slopes (1°–10°), sometimes steeper within the undulating landscapes. The soils are grey, reddish brown, light brown, dark brown in colour, and its depth is 20 cm to >1 m. the texture is sandy loam to clay loam. Stones of up to 1 m in diameter, covering up to 40% are often found in this landscape.

The total vegetation cover is 70%, while the herbaceous layer is only 5 cm tall, due to continuous grazing.

This Sub–community characterized by Species Group B (Table 8.1), and the diagnostic species include the forb *Polygala ohlendorfiana* and *Chaetacanthus setiger* and the grassland sedge *Cyperus obtusiflorus.*

The dominant species include grasses such as *Hyparrhenia hirta, Sporobolus africanus* (Species Group E), *Eragrostis capensis* (species group I) and *Eragrostis curvula* (Species Group K). The herbaceous layer is dominated by species such as the weedy *Richardia brasiliensis* (Species Group C), the geophytes *Hypoxis argentea* (Species Group C), *Lobelia erinus* (Species Group C) and *Boophane disticha* (Species Group E), the forbs *Rhynchosia totta, Ipomoea oblongata, Commelina africana* (Species Group I), *Helichrysum rugulosum*, *Senecio bupleuroides* (Species Group K and the succulent *Aloe ferox* (Species Group L).

Figure 8.4 *Themeda triandra-Sporobolus africanus* grassland

(iii) *Themeda triandra-Richardia brasiliensis* grassland

This grassland occurs on midslopes within the undulating landscapes, towards east–facing slope. The soils are light to dark brown in colour and the veld condition is poor due to overgrazing by wild game. The herbaceous layer is 7.5 cm tall, covering 75%.

This Sub–community is characterized by Species Group C (Table 8.1), and the diagnostic species include the herbaceous *Richardia brasiliensis,* and *Lobelia erinus* and the geophyte *Hypoxis argentea.*

The dominant species include grasses such as *Hyparrhenia hirta, Sporobolus africanus* (Species Group E), *Eragrostis capensis* (Species Group I), *Themeda triandra, Heteropogon contortus* and *Eragrostis plana* (Species Group K), and the herbaceous *Commelina africana* (Species Group I) and *Vernonia natalensis* (Species group L) are conspicuously present.

(iv) *Themeda triandra-Trachypogon spicatus* grassland

This grassland is found on hills and mountain slopes and crests, the slopes being 15° or steeper, facing east or west. The soils are light brown in colour, and have a sandy texture. The soils are shallow, up to 35 cm deep. Large stones of >1 m in diameter, cover up to 30% of the area. The veld condition is utilized by cattle and goats for grazing.
The herbaceous layer is 25 cm tall, on average, covering 50%. The tree layer is 1.0 m tall, on average, covering 10%.

This Sub–community is characterized by Species Group D (Table 8.1). The diagnostic species include the grass *Trachypogon spicatus* and herbs such as the geophyte *Hypoxis hemerocallidea* and the forbs *Berkheya setifera* and *Pelargonium luridum.*

The prominent species in the grass layer include species such as *Hyparrhenia hirta* (Species Group E), *Melinis nerviglumis, Brachiaria serrata, Elionurus muticus,* (Species Group I), *Themeda triandra, Heteropogon contortus, Eragrostis curvula,* (Species Group K) and *Alloteropsis semialata* (Species Group L). The herbaceous

layer has species such as *Commelina africana* (Species Group I) and *Senecio bupleuroides* (Species Group K), while the succulent *Aloe ferox* (Species Group L) is also conspicuously present.

B. *Elionurus muticus-Eragrostis racemosa* grassland

This grassland (Figure 8.5) occurs in midslopes (6°) within the undulating landscapes. The soils are dark to light brown. The soil depth is greater than 20 cm in diameter, covering 20%. The veld condition is in poor state due to erosion and grazing by wild game.
The total vegetation cover is 70%, while the herbaceous layer is 20 cm tall, and covering 70%. The tree layer is 1.2 m tall, covering 15%.

This grassland community is characterized by Species Group I (Table 8.1), and the diagnostic species include the grasses *Eragrostis racemosa*, *Brachiaria serrata*, *Eragrostis capensis*, *Elionurus muticus* and *Tristachya leucothrix*, while the herbaceous layer includes species such as *Commelina africana.*

The prominent species in the grass layer include *Themeda triandra, Heteropogon contortus, Eragrostis curvula,* and *Microchloa caffra* (Species Group K) and the herbaceous layer includes the forbs *Scabiosa columbaria* (Species Group K) and *Haplocarpha scaposa* (Species Group L).

Figure 8.5 *Eliomurus muticus-Eragrostis racemosa* grassland

This grassland community is sub-divided into three Sub-communities:

(i) *Elionurus muticus-Senecio retrorsus* grassland

This Sub-community is found in the south–western parts of Transkei, close to the foothills of the Drakensberg, often on drier rocky hills or slopes that can be 5°–20° or even steeper. The soils are shallow, about 20 cm deep. The colour of the soil is light to dark brown and sandy loam in texture. The veld condition is poor due to grazing by wild game.

The herbaceous layer is 25 cm tall, on average, covering 80%. The tree layer is 0.2 m tall, and covers 10%.

This Sub–community is characterized by Species Group F (Table 8.1), and the diagnostic species include forb *Senecio retrorsus* and the shrubby tree *Rhus pyroides*.

The dominant species in grass layer are include *Sporobolus africanus* (Species Group E), *Eragrostis capensis, Tristachya leucothrix, Aristida junciformis* (Species Group I) *Themeda triandra, Heteropogon contortus, Eragrostis curvula, Setaria sphacelata, Abildgaardia ovata, Microchloa caffra* (Species Group K), *Andropogon appendiculatus* (Species Group L) and *Elionurus muticus* (Species Group I) while the herbaceous layer includes the weedy *Richardia brasiliensis* (Species Group C).

(ii) *Elionurus muticus-Harpochloa falx* grassland

This Sub-community occurs on rocky ridges, hills or mountains within the undulating landscapes. The slopes are 5°–30° steeper, facing towards east or west. The soils are light brown, reddish brown in colour and sandy in texture. The stones are large (60 cm in diameter), cover up to 20%. The veld condition is good but there are termitaria. The herbaceous layer is 15 cm tall, on average, covering 60%, on average. Trees cover 3.5% on average.

This Sub–community is characterized by Species Group G (Table 8.1) and the diagnostic species include grasses such as *Harpochloa falx* and *Aristida congesta* and

the herbaceous layer includes the weedy dwarf shrub encroacher species *Stoebe vulgaris* and the forb *Gnidia kraussiana.*

The prominent species in the grass layer include species such as *Hyparrhenia hirta, Sporobolus africanus* (Species Group E), *Cymbopogon plurinodis* (Species Group H), *Eragrostis racemosa, E. capensis, Bracharia serrata, Elionurus muticus, Tristachya leucothrix, Aristida junciformis* (Species Group I), *Heteropogon contortus, Themeda triandra, Eragrostis curvula, Microchloa caffra* (Species Group K) and *Andropogon appendiculatus* (Species Group L) and the herbaceous layer is dominated by *Commelina Africana* (Species Group I), *Helichrysum rugulosum* (Species Group K), *Senecio bupeuroides* (Species Group K) and *Vernonia natalensis* (species group L).

(iii) *Elionurus muticus-Eragrostis lehmanniana* grassland

This Sub-community occurs in gentle midslopes (5°) within undulating landscape. The rocks are greater than 1 m in diameter, and covers up to 40%. The soils are shallow (15–20 cm deep), dark brown to reddish brown in colour and sandy loam to clayey loam in texture. There are termitaria, and the veld condition is poor due to grazing. The herbaceous layer is 30 cm tall, on average, and covering 50%. The tree layer is 70 cm tall, covering 35%, on average.

This Sub–community is characterized by Species Group H (Table 8.1), and the diagnostic species include grasses such *Eragrostis lehmanniana* and *Aristida bipartita*, and the herbaceous layer often contains the forb *Sonchus wilmsii.* The shrubby *Diospyros whyteana* is also conspicuously present.

The prominent species in the grass layer include *Eragrostis racemosa, E. capensis, Bracharia serrata, Tristachya leucothrix, Aristida junciformis, Elionurus muticus* (Species Group I), *Cynodon dactylon* (Species Group J), *Themeda triandra, Heteropogon contortus, Eragrostis curvula, E. plana, Setaria sphacelata Microchloa caffra* (Species Group K) and *Andropogon appendiculatus* (Species Group L). The herbaceous layer is dominated by species such as the dwarf shrub *Felicia filifolia* (Species Group J), the forbs *Senecio bupleuroides, Helichrysum pilosellum, Scabiosa*

columbaria (Species Group K), *Haplocarpha scaposa* and *Hibiscus aethiopicus* (Species Group L), and the grassland sedge *Abildgaardia ovata* (Species Group K).

C. *Cynodon dactylon-Felicia filifolia* degraded grassland

This grassland (Figure 8.6) is situated on midslopes (3°), and also on crests within the undulating landscape. The soils are light brown, yellow brown, to dark brown. The stone sizes are medium round, 1–15 cm in diameter, on average, covering 35% of the area. The veld condition is poor due o erosion and grazing and there are termitaria. These areas are often degraded, with a dry karoo–like appearance. The herbaceous layer is 25 cm tall, on average, covering 65%.

This grassland is characterized by Species Group J (Table 8.1), and the diagnostic species include the pioneer grasses *Cynodon dactylon* and *Aristida congesta* and the karroid dwarf shrubs *Felicia filifolia* and *F. muricata.*

The prominent species in the grass layer include *Eragrostis lehmanniana, Cymbopogon plurinodis,* (Species Group H), *Eragrostis racemosa, E. capensis* (Species Group I), *Heteropgon contortus, Themeda triandra, Eragrostis curvula, E. plana, Microchloa caffra, Setaria sphacelata* (Species Group K), *Elionurus muticus* (Species Group I), and *Setaria nigrirostris* (Species Group L), and the herbaceous layer includes *Anthospermum rigidum* (Species Group B), *Hermania depressa, Cyanotis speciosa* (Species Group L), *Commelina africana, Ipomoea oblongata* (Species Group I), *Helichrysum rugulosum* and *Senecio bupleuroides* (Species Group K).

Figure 8.6 *Cynodon dactylon-Felicia filifolia* degraded grassland

D. *Aloe arborescens-Buddleja salvifolia* bush on rocky boulders

This community is found on hills with rocky boulders on gradual to steep north facing slopes. Large rocks (sizes 100 mm to 2 m in diameter) cover 50% of the area.
The total vegetation cover is 40%, while the herbaceous layer is 35 cm tall, covering 40%, on average. The tree layer is 2.6 m tall, covering 30%.

This community is characterized by Species Group M (Table 8.1). The diagnostic species include the grass *Aristea woodii*, the herbaceous *Chaetacanthus costatus* and the shrubs *Buddleja salviifolia,* and *Myrsine africana* (Species Group L) and the succulent *Aloe arborescens*.

The prominent species in grass layer are *Microchloa caffra* (Species Group K), *Cymbopogon excavatus* (Species Group L) and *Melinis repens* (Species Group N). The dominant species in the herbaceous layer includes the weedy *Richardia brasiliensis* (Species Group C), the geophyte *Hypoxis argentea* (Species Group C), the dwarf shrubs *Felicia filifolia* and *F. muricata* (Species Group J) and the forb *Haplocarpha scaposa* (Species Group L).

E. *Myrsine africana-Coleochloa setifera* bush on rocky boulders

This community occurs on a crest of a hill, about 1410 m above sea level. The rocks of > 1 m in diameter, cover 50% of the area. The herbaceous layer is 45 cm tall, covering 40% and the shrub layer, up to 1.5 m tall, cover up to 20%.

These rocky boulders are characterized by Species Group N (Table 8.1) and the diagnostic species include the grasses *Melinis repens* and *Sporobolus fimbriatus* and the herbaceous layer has the shrubby species *Myrsine africana* and the sedge *Coleochloa setifera.*

The prominent species in the grass layer include *Digitaria monodactyla* (Species Group A) and *Eragrostis gummiflua* (Species Group L) and in the herbaceous layer the grassland sedge *Bulbostylis burchellii* (Species Group A) and the geophyte *Ledebouria ovalifolia* (Species Group E) are conspicuously present.

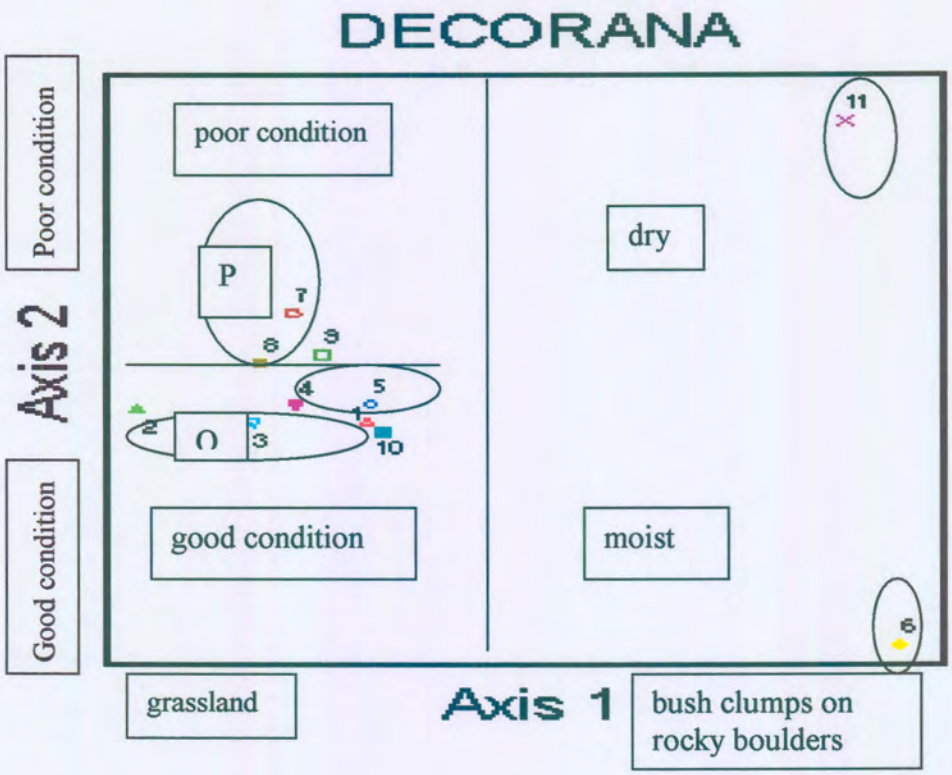
2.3 Discussion

Local inhabitants utilized these grasslands over a long period of time (Cawe 1986, McKenzie 1984). This resulted in some degree of disturbance over large parts of the grassland, as also indicated by the presence, and often abundance of weedy species. This is particularly conspicuous in areas where fields for cultivation of crops have been abandoned and natural vegetation had time to establish and recover (Smits *et al.* 1999). In spite of this utilisation some areas still contain grassland in a close to climax condition, indicated by the prominence of *Themeda triandra*. It also appears that, when degraded the *Themeda triandra*-dominated grassland may change to an *Eragrostis plana*-dominated grassland, with a high cover of the weed *Richardia brasiliensis*. Recovery of these degraded sites may lead to the establishment of *Hyparrhenia hirta*. Once established, *Hyparrhenia hirta* tends to become dominant and the vegetation remains *Hyparrhenia hirta*-dominated for a long time, preventing *Themeda triandra* to become established (Moll 1965, Bredenkamp & Brown 2003). For this reason Bredenkamp & Brown (2003) consider *Hyparrhenia hirta*-dominated grassland as being anthropogenic in origin. However, sites were observed where the grassland was protected from utilisation for a few years by fences, and here *Themeda triandra* took over dominance (Figure 7.6). It therefore seems that recovery towards *Themeda triandra*-dominated grassland is possible with specific management actions.

2.4 Ordination

Environmental trends were identified by means of DECORANA (Hill 1979a). The dendrogram that represents Moist Grasslands on Flat Plains (Figure 8.2) indicates that most of the communities are dominated by *Themeda triandra* species.

From the ordination graph (Figure 8.7) Axis 1 represents vegetation from the grassland (*Themeda triandra-Trachypogon spicatus* grassland) to the bushy clumps on rocky boulders (*Myrsine Africana-Coleochloa setifera* bush on rocky boulders). Axis 2 distinguishes between the good condition, Community Q (*Elionurus muticus-Senecio retrosus* grassland) and poor conditions, Community P (*Cynodon dactylon-Felicia filifolia* degraded grassland).



Legend

1. (A. (iv)) *Themeda triandra-Trachypogon spicatus* grassland
2. (A. (iv)) *Themeda triandra-Trachypogon spicatus* grassland
3. (A. (ii)) *Themeda triandra-Sporobolus africanus* grassland
4. (B. (i)) *Elionurus muticus-Senecio retrorsus* grassland
5. (A. (i)) *Themeda triandra-Helichrysum aureonitens* moist grassland
6. (E.) *Myrsine africana-Coleochloa setifera* bush on rocky boulders
7. (C.) *Cynodon dactylon-Felicia filifolia* degraded grassland
8. (C.) *Cynodon dactylon-Felicia filifolia* degraded grassland
9. (A. (ii)) *Themeda triandra-Sporobolus africanus* grassland
10. (A. (ii)) *Themeda triandra-Sporobolus africanus* grassland
11. (D.) *Aloe arborescens-Buddleja salvifolia* bush on rocky boulders

Figure 8.7 Ordination graph of Moist Grasslands on Flat Plains

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CHAPTER 9

CONCLUSIONS

The standard Braun-Blanquet (BB) procedures were successfully used to produce a classification of the grassland of the Eastern Cape and to relate these to environmental parameters. The BB method has been proved to be useful in describing vegetation patterns in South Africa (Bredenkamp *et al* 1991). A total of 22 communities, and 43 sub-communities were identified and described.

TWINSPAN (Hill 1979b) produced four major plant communities, namely: Bush and grassland vegetation of drier areas, Wet and disturbed grassland, Grassland of undulating areas, and Moist grasslands on flat plains.

The Bush and Grassland vegetation of drier areas community occurs widely over Transkei although it is restricted to drier areas where the rainfall is lower. At many localities there is also bush encroachment, mostly by *Acacia karroo* but also of karroid dwarf shrubs. This bush encroachment is a sure sign of a deteriorated grass layer (Friedel 1987). The vegetation can vary according to specific plant communities within this vegetation type, from open to dense *Acacia karroo* bush, to dry mountain slopes covered with *Aloe ferox*-dominated shrubland, to a short dry shrubland dominated by shrubs such as *Diospyros lycioides*, *Euryops floribundus*, *Asparagus suaveolens*, *Ziziphus mucronata* to a dry grassland with very few woody species.

The Wet and Disturbed grassland community mostly occur in bottomland situations, or in areas that were intensively utilized during a long period of human settlement (Smits *et al*. 1999). The vegetation is mostly quite short, often grazed and trampled and often represents old fields that were abandoned and the pioneer vegetation had already become established. Many of the species present are indicators of moist conditions, for example the reed *Phragmites australis*, sedges such as *Cyperus* spp., *Juncus oxycarpus* and *Typha capensis*, but also hygrophilous herbaceous pioneer plants for example *Verbena bonariensis* and Senecio *inaequidens*.

The Grassland of Undulating Areas community occurs mostly on the northern and western areas, at higher altitudes, where the landscape is transitional to the mountain

area. The vegetation is dominated by tall grasses, which are typical of the higher altitude mountain areas along the eastern escarpment of southern Africa, such as *Trachypogon spicatus, Panicum aequinerve, Cymbopogon validus* and *Diheteropogon amplectens*. On rocky outcrops woody bushclumps may occur, these include woody species of the wetter Drakensberg area for example *Ficus thonningii, Rhus dentata, Artimisia afra* and *Leucosidea sericea.*

The Moist Grasslands on Flat Plains community is situated on the flat plains of Transkei, which occur widespread over the region. The vegetation is often short, grazed grassland with scattered old fields and moister wetlands.

The human population pressure would appear to be too high for the sustainable use of these grasslands and an inevitable deterioration has been underway for some time (Phillips 1973). There are no conservation areas within these grasslands and biodiversity, especially in the herbaceous layer, can be assumed to be declining. In the study area the greatest threat to the flora is that of afforestation with alien timber trees, which destroy the floristically rich low and high altitude open grasslands, leaving the floristically poorer areas undisturbed. This, together with sound management plans, which include a burning program, would help to conserve the rich grassland flora. The practice of regular burning is essential, as the grassland communities have evolved with regular fire regime (O'Connor & Bredenkamp 1997). Many species have decreased flowering and die when the grassland habitats they occupy are not subjected to regular burning.

Species such as *Acacia mearnsii*, which is an alien, should be eradicated as they occupy enormous spaces more especially in the mountainous areas, thereby threatening the indigenous flora.

The results found in this study should contribute greatly to the much needed land care programs in the Transkei, whereby efficient land-use can be obtained, while the biodiversity and ecosystems of the area are effectively conserved.

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APPENDIX 1. A checklist of the plant species found in the present study, arranged alphabetical according to the families (nomenclature after Arnold & De wet 1993).

During the field survey a total of 100 families and 825 species were identified.

ACANTHACEAE

Adhatoda andromeda (Lindau) C.B.Clarke

Blepharis integrifolia (L.f.) E.Mey. ex Schinz

Chaetacanthus burchellii Nees

Chaetacanthus costatus Nees

Chaetacanthus setiger (Pers.) Lindl.

Chaetacanthus species

Crabbea acaulis N.E.Br.

Crabbea hirsuta Harv.

Crabbea nana Nees

Justicia anagalloides (Nees) T.Anderson

Justicia campylostemon (Nees) T.Anderson

Thunbergia atriplicifolia E.Mey. ex Nees

Thunbergia neglecta Sond.

Thunbergia species

ADIANTACEAE

Cheilanthes eckloniana (Kunze) Mett.

Cheilanthes hirta Sw.

Cheilanthes quadripinnata (Forssk.) Kuhn

Cheilanthes species

Pellaea calomelanos (Sw.) Link

AIZOACEAE

Psammotropha myriantha Sond.

ALLIACEAE

Agapanthus campanulatus Leight.

AMARANTHACEAE

Alternanthera sessilis (L.) DC.

Amaranthus species

Amaranthus spinosus L.

Amaranthus viridis L.

Gomphrena celosioides Mart.

Guilleminea species

AMARYLLIDACEAE

Boophane disticha (L.f.) Herb.

Brunsvigia species

Haemanthus humilis Jacq. ssp. *hirsutus* (Baker) Snijman

Scadoxus species

ANACARDIACEAE

Rhus crenata Thunb.

Rhus dentata Thunb.

Rhus discolor E.Mey. ex Sond.

Rhus glauca Thunb.

Rhus pentheri Zahlbr.

Rhus pyroides Burch.

Rhus rigida Mill.

ANTHERICACEAE

Chlorophytum acutum (C.H.Wr.) Nordal

Chlorophytum anceps (Baker) Kativu

Chlorophytum cooperi (Baker) Nordal

Chlorophytum fasciculatum (Baker) Kativu

APIACEAE

Alepidea longifolia E.Mey.

Alepidea natalensis J.M.Wood & M.S.Evans

Alepidea species

Centella affinis (Eckl. & Zeyh.) Adamson

Centella asiatica (L.) Urb.

Centella caespitosa Adamson

Centella fusca (Eckl. & Zeyh.) Adamson

Centella glabrata L.

Daucus carota L.

Glia prolifera (Burm.f.) B.L.Burtt

Heteromorpha arborescens (Spreng.) Cham. & Schltdl. var. *abyssinica* (A.Rich.) Wolf

Hydrocotyle species

Peucedanum magalismontanum Sond.

Peucedanum sonderi (Hiroë) B.L.Burtt

Sium repandum Welw. ex Hiern

APOCYNACEAE

Carissa bispinosa (L.) Desf. ex Brenan

ARACEAE

Zantedeschia aethiopica (L.) Spreng.

Zantedeschia albomaculata (Hook.) Baill.

Zantedeschia albomaculata (Hook.) Baill. ssp. *albomaculata*

Zantedeschia species

ARALIACEAE

Cussonia natalensis Sond.

Cussonia paniculata Eckl. & Zeyh.

ASCLEPIADACEAE

Asclepias aurea (Schltr.) Schltr.

Asclepias woodii (Schltr.) Schltr.

Aspidoglossum lamellatum (Schltr.) Kupicha

Cynanchum species

Gomphocarpus fruticosus (L.) Aiton f.

Pachycarpus asperifolius Meisn.

Pachycarpus schinzianus (Schltr.) N.E.Br.

Pachycarpus species

Pachycarpus suaveolens (Schltr.) Nicholas & Goyder

Trachycalymma cucullata (Schltr.) Bullock

ASPARAGACEAE

Asparagus aspergillus Jessop

Asparagus laricinus Burch.

Asparagus setaceus (Kunth) Jessop

Asparagus species

Asparagus suaveolens Burch.

ASPHODELACEAE

Aloe arborescens Mill.

Aloe ecklonis Salm-Dyck

Aloe ferox Mill.

Aloe maculata All.

Bulbine abyssinica A.Rich.

Bulbine frutescens (L.) Willd.

Bulbine narcissifolia Salm-Dyck

Bulbine species

Trachyandra asperata Kunth

Trachyandra species

ASTERACEAE

Acanthospermum australe (Loefl.) Kuntze

Achillea millefolium L. sens. lat.

Ageratum conyzoides L.

Arctotheca populifolia (P.J.Bergius) Norl.

Arctotis arctotoides (L.f.) O.Hoffm.

Artemisia afra Jacq. ex Willd.

Aster bakeranus Burtt Davy ex C.A.Sm.

Aster harveyanus Kuntze

Aster peglerae Bolus

Aster perfoliatus Oliv.

Aster squamatus (Spreng.) Hieron.

Athrixia elata Sond.

Berchemia zeyheri (Sond.) Grubov

Berkheya angustifolia (Houtt.) Merr.

Berkheya bergiana Söderb.

Berkheya carduoides (Less.) Hutch.

Berkheya cirsiifolia (DC.) Roessler

Berkheya discolor (DC.) O.Hoffm. & Muschl.

Berkheya radula (Harv.) De Wild.

Berkheya rhapontica (DC.) Hutch. & Burtt Davy

Berkheya setifera DC.

Berkheya speciosa (DC.) O.Hoffm.

Berkheya speciosa (DC.) O.Hoffm. ssp. *lanceolata* Roessler

Bidens bipinnata L.

Bidens pilosa L.

Brachylaena neriifolia (L.) R.Br.

Centaurea species

Chrysocoma ciliata L.

Chrysocoma oblongifolia DC.

Cirsium vulgare (Savi) Ten.

Conyza aegyptiaca (L.) Aiton

Conyza albida Spreng.

Conyza bonariensis (L.) Cronquist

Conyza canadensis (L.) Cronquist

Conyza pinnata (L.f.) Kuntze

Conyza podocephala DC.

Conyza ulmifolia (Burm.f.) Kuntze

Cotula hispida (DC.) Harv.

Crepis capillaris (L.) Wallr.

Crepis hypochoeridea (DC.) Thell.

Crepis species

Denekia capensis Thunb.

Dicoma anomala Sond.

Euryops euryopoides (DC.) B.Nord.

Euryops floribundus N.E.Br.

Euryops species

Felicia namaquana (Harv.) Merxm.

Felicia aethiopica (Burm.f.) Bolus & Wolley-Dod ex Adamson & T.M.Salter

Felicia alba Grau

Felicia bergerana (Spreng.) O.Hoffm.

Felicia filifolia (Vent.) Burtt Davy

Felicia filifolia (Vent.) Burtt Davy ssp. *bodkinii* (Compton) Grau

Felicia linifolia (Harv.) Grau

Felicia microcephala Grau

Felicia muricata (Thunb.) Nees

Felicia muricata (Thunb.) Nees ssp. *cinerascens* Grau

Felicia scabrida (DC.) Range

Felicia venusta S.Moore

Galinsoga parviflora Cav.

Gamochaeta coarctata (Willd.) Kerguélen

Gazania krebsiana Less.

Gazania linearis (Thunb.) Druce

Gazania rigens (L.) Gaertn.

Geigeria filifolia Mattf.

Gerbera ambigua (Cass.) Sch.Bip.

Gerbera piloselloides (L.) Cass.

Gerbera species

Gerbera viridifolia (DC.) Sch.Bip. ssp. *viridifolia*

Gnaphalium vestitum Thunb.

Haplocarpha lyrata Harv.

Haplocarpha scaposa Harv.

Helichrysum acrophilum Bolus

Helichrysum acutatum DC.

Helichrysum album N.E.Br.

Helichrysum ammitophilum Hilliard

Helichrysum appendiculatum (L.f.) Less.

Helichrysum aureofolium Hilliard

Helichrysum aureonitens Sch.Bip.

Helichrysum aureum (Houtt.) Merr.

Helichrysum auriceps Hilliard

Helichrysum callicomum Harv.

Helichrysum candolleanum H.Buek

Helichrysum cephaloideum DC.

Helichrysum confertifolium Klatt

Helichrysum cymosum (L.) D.Don

Helichrysum dregeanum Sond. & Harv.

Helichrysum glomeratum Klatt

Helichrysum grandiflorum (L.) D.Don

Helichrysum herbaceum (Andrews) Sweet

Helichrysum miconiifolium DC.

Helichrysum nudifolium (L.) Less.

Helichrysum obtusum (S.Moore) Moeser

Helichrysum odoratissimum (L.) Sweet

Helichrysum oreophilum Klatt

Helichrysum pilosellum (L.f.) Less.

Helichrysum rosum (P.J.Bergius) Less.

Helichrysum rotundifolium (Thunb.) Less.

Helichrysum rugulosum Less.

Helichrysum simillimum DC.

Helichrysum sphaeroideum Moeser

Helichrysum spiralepis Hilliard & B.L.Burtt

Helichrysum tenax M.D.Hend.

Helichrysum teretifolium (L.) D.Don

Helichrysum umbraculigerum Less.

Hirpicium linearifolium (Bolus) Roessler

Hypochaeris radicata L.

Ifloga glomerata (Harv.) Schltr.

Lactuca inermis Forssk.

Lactuca serriola L.

Metalasia brevifolia (Lam.) Levyns

Phymaspermum woodii (Thell.) Källersjö

Plecostachys species

Pseudognaphalium luteo-album (L.) Hilliard & B.L.Burtt

Pseudognaphalium oligandrum (DC.) Hilliard & B.L.Burtt

Pseudognaphalium undulatum (L.) Hilliard & B.L.Burtt

Schistostephium crataegifolium (DC.) Fenzl ex Harv.

Schistostephium griseum (Harv.) Hutch.

Schistostephium heptalobum (DC.) Oliv. & Hiern

Schkuhria pinnata (Lam.) Cabrera

Senecio asperulus DC.

Senecio bipinnatus (Thunb.) Less.

Senecio bulbinifolius DC.

Senecio bupleuroides DC.

Senecio burchellii DC.

Senecio cinerascens Aiton

Senecio decurrens DC.

Senecio eriobasis DC.

Senecio erosus L.f.

Senecio erubescens Aiton

Senecio euryopoides DC.

Senecio harveianus MacOwan

Senecio inaequidens DC.

Senecio inornatus DC.

Senecio isatideus DC.

Senecio juniperinus L.f.

Senecio juniperinus L.f. var. *juniperinus.*

Senecio latifolius DC.

Senecio madagascariensis Poir.

Senecio oxyriifolius DC.

Senecio parentalis Hilliard & B.L.Burtt

Senecio pinnatifidus (P.J.Bergius) Less.

Senecio polyanthemoides Sch.Bip.

Senecio pyramidatus DC.

Senecio retortus (DC.) Benth.

Senecio retrorsus DC.

Senecio rhomboideus Harv.

Senecio speciosus Willd.

Senecio spiraeifolius Thunb.

Senecio striatifolius DC.

Senecio venosus Harv.

Sonchus asper (L.) Hill

Sonchus dregeanus DC.

Sonchus wilmsii R.E.Fr.

Stoebe vulgaris Levyns

Tagetes minuta L.

Taraxacum brachyglossum (Dahlst.) Dahlst.

Taraxacum officinale Weber sensu lato

Tolpis capensis (L.) Sch.Bip.

Tolpis species

Vernonia capensis (Houtt.) Druce

Vernonia hirsuta (DC.) Sch.Bip. ex Walp.

Vernonia natalensis Sch.Bip. ex Walp.

Vernonia oligocephala (DC.) Sch.Bip. ex Walp.

Vernonia wollastonii S.Moore

Veronica anagallis-aquatica L.

Veronica species

Xanthium spinosum L.

Xanthium strumarium L.

Zinnia peruviana (L.) L.

AYTONIACEAE

Asterella bachmannii (Steph.) S.W.Arnell

BORAGINACEAE

Cynoglossum geometricum Baker & C.H.Wright

Cynoglossum hispidum Thunb.

BRASSICACEAE

Lepidium africanum (Burm.f.) DC. ssp. *Africanum*

CAESALPINIOIDEAE

Colophospermum species

CAMPANULACEAE

Craterocapsa tarsodes Hilliard & B.L.Burtt

Wahlenbergia juncea (H.Buek) Lammers

Wahlenbergia krebsii Cham.

Wahlenbergia sphaerica Brehmer

Wahlenbergia squamifolia Brehmer

Wahlenbergia stellarioides Cham. & Schltdl.

Wahlenbergia undulata (L.f.) A.DC.

CARYOPHYLLACEAE

Dianthus basuticus Burtt Davy

Dianthus mooiensis F.N.Williams

Silene burchellii Otth

Vaccaria species

CELASTRACEAE

Maytenus heterophylla (Eckl. & Zeyh.) N.Robson

Maytenus species

CHENOPODIACEAE

Chenopodium album L.

Chenopodium murale L.

Chenopodium species

Salsola araneosa Botsch.

CLUSIACEAE

Hypericum aethiopicum Thunb.

Hypericum lalandii Choisy

Hypericum revolutum Vahl

COLCHICACEAE

Androcymbium eucomoides (Jacq.) Willd.

Androcymbium schlechteri K.Krause

COMBRETACEAE

Combretum apiculatum Sond.

Combretum imberbe Wawra

Combretum mkuzense Carr & Retief

Combretum mossambicense (Klotzsch) Engl.

Combretum zeyheri Sond.

COMMELINACEAE

Commelina africana L.

Commelina africana L. var. africana

Commelina erecta L.

Commelina species

Cyanotis species

Cyanotis speciosa (L.f.) Hassk.

CONVOLVULACEAE

Convolvulus arvensis L.

Convolvulus natalensis Bernh.

Convolvulus sagittatus Thunb

Dichondra repens J.R.& G.Forst.

Falckia oblonga Bernh. ex C.Krauss

Ipomoea oblongata E.Mey. ex Choisy

CRASSULACEAE

Cotyledon orbiculata L.

Crassula alba Forssk. var. alba

*Crassula lanceolata (*Eckl. *&* Zeyh.*)* Endl. ex Walp.

Crassula multicava Lem.

Crassula pellucida L.

Crassula pellucida L. ssp. *marginalis* (Dryand. in Aiton) Toelken

Crassula setulosa Harv.

Crassula spathulata Thunb.

Crassula species

Crassula vaginata Eckl. & Zeyh.

Kalanchoe thyrsiflora Harv.

CYPERACEAE

Abildgaardia ovata (Burm.f.) Kral

Ascolepis pusilla Ridl.

Ascolepis species

Bulbostylis burchellii (Ficalho & Hiern) C.B.Clarke

Bulbostylis humilis (Kunth) C.B.Clarke

Bulbostylis schoenoides (Kunth) C.B.Clarke

Bulbostylis species

Carex aethiopica Schkuhr

Carex schlechteri Nelmes

Carex spicato-paniculata C.B.Clarke

Carex subinflata Nelmes

Carex sylvatica Huds.

Carex zuluensis C.B.Clarke

Coleochloa setifera (Ridl.) Gilly

Cyperus albostriatus Schrad.

Cyperus alopecuroides Rottb.

Cyperus amabilis Vahl

Cyperus crassipes Vahl

Cyperus cuspidatus Kunth

Cyperus esculentus L.

Cyperus laevigatus L.

Cyperus obtusiflorus Vahl

Cyperus obtusiflorus Vahl var. *flavissimus* (Schrad.) Boeck.

Cyperus rupestris Kunth

Cyperus species

Cyperus textilis Thunb.

Cyperus usitatus Burch.

Ficinia lateralis (Vahl) Kunth

Ficinia species

Fimbristylis obtusifolia (Lam.) Kunth

Fimbristylis species

Fuirena pubescens (Poir.) Kunth

Kyllinga alata Nees

Kyllinga alba Nees

Kyllinga elatior Kunth

Mariscus albomarginatus C.B.Clarke

Mariscus aristatus (Rottb.) Cherm.

Mariscus congestus (Vahl) C.B.Clarke

Mariscus indecorus (Kunth) Podlech

Mariscus species

Schoenoplectus corymbosus (Roth ex Roem. & Schult.) J.Raynal

Schoenoxiphium sparteum (Wahlenb.) C.B.Clarke

Tetraria bolusii C.B.Clarke

CUCURBITACEAE

Coccinia species

Cucumis africanus L.f.

Cucumis hirsutus Sond.

Cucumis zeyheri Sond.

DENNSTAEDTIACEAE

Pteridium aquilinum (L.) Kuhn

DIPSACACEAE

Scabiosa columbaria L.

DROSERACEAE

Drosera natalensis Diels

DRYOPTERIDACEAE

Dryopteris species

EBENACEAE

Diospyros lycioides Desf.

Diospyros whyteana (Hiern) F.White

Euclea undulata Thunb. var. *undulata*

EUPHORBIACEAE

Acalypha ambigua Pax

Acalypha angustata Sond.

Acalypha punctata Meisn.

Acalypha schinzii Pax

Acalypha species

Acalypha villicaulis Hochst. ex A.Rich.

Chamaesyce hirta (L.) Millsp.

Chamaesyce prostrata (Aiton) Small

Clutia cordata Bernh. ex C.Krauss

Clutia monticola S.Moore

Clutia pulchella L.

Clutia sericea Müll.Arg.

Euphorbia clava Jacq.

Euphorbia clavarioides Boiss.

Euphorbia epicyparissias E.Mey. ex Boiss.

Euphorbia ericoides Lam.

Euphorbia peplus L.

Euphorbia rhombifolia Boiss.

Euphorbia species

Euphorbia striata Thunb.

Phyllanthus arvensis Müll.Arg.

Phyllanthus myrtaceus Sond.

Phyllanthus parvulus Sond.

Vernicia species

ERICACEAE

Erica sacciflora Salisb.

ERIOSPERMACEAE

Eriospermum mackenii (Hook.f.) Baker

FABRONIACEAE

Fabronia species

FLACOURTIACEAE

Trimeria grandifolia (Hochst.) Warb.

GENTIANACEAE

Sebaea grandis (E.Mey.) Steud.

Sebaea leiostyla Gilg

Sebaea sedoides Gilg

GERANIACEAE

Monsonia angustifolia E.Mey. ex A.Rich.

Monsonia attenuata Harv.

Geranium species

Pelargonium cordifolium (Cav.) Curtis

Pelargonium longifolium (Burm.f.) Jacq.

Pelargonium luridum (Andrews) Sweet

Pelargonium reniforme Curtis

Pelargonium senecioides L'Hér.

Pelargonium sidoides DC.

Pelargonium species

Pelargonium species

Sarcocaulon l'heritieri Sweet

GESNERIACEAE

Streptocarpus vandeleurii Baker f. & S.Moore

GUNNERACEAE

Gunnera perpensa L.

HAMAMELIDACEAE

Trichocladus grandiflorus Oliv.

HYACINTHACEAE

Dipcadi viride (L.) Moench

Drimia elata Jacq.

Eucomis autumnalis (Mill.) Chitt.

Lachenalia capensis W.F.Barker

Ledebouria apertiflora (Baker) Jessop

Ledebouria cooperi (Hook.f.) Jessop

Ledebouria marginata (Baker) Jessop

Ledebouria ovalifolia (Schrad.) Jessop

Ledebouria ovatifolia (Baker) Jessop

Scilla natalensis Planch.

Scilla nervosa (Burch.) Jessop

Scilla species

HYDNORACEAE

Hydnora species

HYDROSTACHYACEAE

Hydrostachys species

HYPOXIDACEAE

Hypoxis acuminata Baker

Hypoxis argentea Harv. ex Baker

Hypoxis argentea Harv. ex Baker var. *argentea*

Hypoxis costata Baker

Hypoxis gerrardii Baker

Hypoxis hemerocallidea Fisch. & C.A.Mey.

Hypoxis iridifolia Baker

Hypoxis membranacea Baker

Hypoxis multiceps Buchinger ex Baker

Hypoxis rigidula Baker

Hypoxis sagittata Nel

Hypoxis species

Hypoxis stellipilis Ker Gawl.

Hypoxis tetramera Hilliard & B.L.Burtt

Hypoxis zeyheri Baker

IRIDACEAE

Dierama species

Moraea species

JUNCACEAE

Juncus oxycarpus E.Mey. ex Kunth

LAMIACEAE

Ajuga ophrydis Burch. ex Benth.

Ajuga species

Becium obovatum (E.Mey. ex Benth.) N.E.Br.

Lamium amplexicaule L.

Lamium species

Leonotis ocymifolia (Burm.f.) Iwarsson

Leonotis ocymifolia (Burm.f.) Iwarsson var. *raineriana* (Vis.) Iwarsson

Plectranthus aliciae (Codd) Van Jaarsv. & T.J.Edwards

Plectranthus spicatus E.Mey. ex Benth.

Plectranthus verticillatus (L.f.) Druce

Rabdosiella calycina (Benth.) Codd

Stachys natalensis Hochst.

Stachys rugosa Aiton

Stachys spathulata Burch. ex Benth.

Syncolostemon macranthus (Gürke) M.Ashby

Teucrium africanum Thunb.

Teucrium kraussii Codd

Teucrium species

Teucrium trifidum Retz.

LINACEAE

Linum species

Linum thunbergii Eckl. & Zeyh.

LOBELIACEAE

Cyphia elata Harv. var. *oblongifolia* (Sond. & Harv.) E.Phillips

Cyphia triphylla E.Phillips

Lobelia erinus L.

Lobelia flaccida (C.Presl) A.DC.

Lobelia laxa MacOwan

Lobelia linearis Thunb.

Lobelia tomentosa L.f.

Monopsis decipiens (Sond.) Thulin

Monopsis scabra (Thunb.) Urb.

LOGANIACEAE

Buddleja salviifolia (L.) Lam.

MALVACEAE

Abutilon species

Anisodontea capensis (L.) Bates

Anisotoma pedunculata N.E.Br.

Hibiscus aethiopicus L.

Hibiscus aethiopicus L. var. *aethiopicus*

Hibiscus micranthus L.f.

Hibiscus microcarpus Garcke

Hibiscus pusillus Thunb.

Hibiscus trionum L.

Pavonia burchellii (DC.) R.A.Dyer

Sida alba L.

Sida chrysantha Ulbr.

Sida dregei Burtt Davy

Sida rhombifolia L.

MENISPERMACEAE

Stephania species

MESEMBRYANTHEMACEAE

Carpobrotus deliciosus (L.Bolus) L.Bolus

Delosperma carterae L.Bolus

Delosperma species

Phyllobolus species

MIMOSOIDEAE

Acacia karroo Hayne

Acacia mearnsii De Wild.

Acacia sieberiana DC.

Alysicarpus rugosus (Willd.) DC.

Argyrolobium barbatum Walp.

Argyrolobium parviflorum T.J.Edwards

Argyrolobium pumilum Eckl. & Zeyh.

Argyrolobium speciosum Eckl. & Zeyh.

Argyrolobium tuberosum Eckl. & Zeyh.

Aspalathus lamarckiana R.Dahlgren

Chamaecrista comosa E.Mey.

Chamaecrista mimosoides (L.) Greene

Desmodium setigerum (E.Mey.) Benth. ex Harv.

Dolichos sericeus E.Mey. ssp. *sericeus*

Elephantorrhiza elephantina (Burch.) Skeels

Eriosema cordatum E.Mey.

Eriosema psoraleoides (Lam.) G.Don

Eriosema salignum E.Mey.

Erythrina caffra Thunb.

Erythrina zeyheri Harv.

Indigofera astragalina DC.

Indigofera hilaris Eckl. & Zeyh.

Indigofera hochstetteri Baker ssp. *streyana* (Merxm.) A.Schreib.

Indigofera limosa L.Bolus

Indigofera sessilifolia DC.

Indigofera spicata Forssk.

Indigofera woodii Bolus

Lotononis calycina (E.Mey.) Benth.

Lotononis eriantha Benth.

Lotononis foliosa Bolus

Lotononis laxa Eckl. & Zeyh.

Lotononis pulchra Dummer

Lotononis species

Medicago species

Psoralea cordata Thunb.

Rhynchosia adenodes Eckl. & Zeyh.

Rhynchosia caribaea (Jacq.) DC.

Rhynchosia monophylla Schltr.

Rhynchosia reptabunda N.E.Br.

Rhynchosia sordida (E.Mey.) Schinz

Rhynchosia totta (Thunb.) DC.

Sphenostylis angustifolia Sond.

Tephrosia capensis (Jacq.) Pers.

Tephrosia elongata E.Mey.

Tephrosia lupinifolia DC.

Tephrosia macropoda (E.Mey.) Harv. var. *diffusa* (E.Mey.) Schrire

Tephrosia marginella H.M.L.Forbes

Tephrosia natalensis H.M.L.Forbes

Tephrosia polystachya E.Mey.

Tephrosia purpurea (L.) Pers. ssp. *leptostachya* (DC.) Brummitt var. *pubescens* Baker

Trifolium africanum Ser.

Trifolium burchellianum Ser.

Trifolium burchellianum Ser.

Trigonella species

Zornia capensis Pers.

Zornia linearis E.Mey.

Zornia species

MOLLUGINACEAE

Mollugo tenella Bolus

MORACEAE

Ficus species

Ficus thonningii Blume

MYRSINACEAE

Eugenia species

Myrsine africana L.

Psidium guajava L.

IRIDACEAE

Aristea africana (L.) Hoffmanns.

Aristea juncifolia Baker

Aristea species

Aristea woodii N.E.Br.

Gladiolus sericeovillosus Hook.f. ssp. *calvatus* (Baker) Goldblatt

Gladiolus species

*Tritonia disticha (*Klatt) Baker

Tritonia lineata (Salisb.) Ker Gawl.

Tritonia nelsonii Baker

Tritonia squalida (Aiton) Ker Gawl.

Tritonia watermeyeri L.Bolus

Watsonia densiflora Baker

JUNGERMANNIACEAE

Chandonanthus hirtellus (F.Weber) Mitt.

ONAGRACEAE

Epilobium species

Oenothera rosea L'Hér. ex Aiton

Oenothera tetraptera Cav.

ORCHIDACEAE

Eulophia welwitschii (Rchb.f.) Rolfe

Rangaeris species

OXALIDACEAE

Oxalis adenodes Sond.

Oxalis commutata Sond.

Oxalis convexula Jacq.

Oxalis corniculata L.

Oxalis depressa Eckl. & Zeyh.

Oxalis obliquifolia Steud. ex Rich.

Oxalis purpurascens Salter

Oxalis purpurea L.

Oxalis smithiana Eckl. & Zeyh.

Oxalis species

PAPILIONOIDEAE

Aeschynomene species

Calpurnia aurea (Aiton) Benth.

Millettia species

PERIPLOCACEAE

Raphionacme hirsuta (E.Mey.) R.A.Dyer ex E.Phillips

Raphionacme lucens Venter & R.L.Verh.

POACEAE

Agrostis avenacea C.C.Gmel.

Agrostis barbuligera Stapf

Agrostis lachnantha Nees

Agrostis species

Alloteropsis semialata (R.Br.) Hitchc.

Alloteropsis semialata (R.Br.) Hitchc. ssp. *semialata*

Andropogon appendiculatus Nees

Andropogon chinensis (Nees) Merr.

Andropogon eucomus Nees

Andropogon schirensis A.Rich.

Aristida bipartita (Nees) Trin. & Rupr.

Aristida congesta Roem. & Schult.

Aristida congesta Roem. & Schult. ssp. *barbicollis* (Trin. & Rupr.) De Winter

Aristida congesta Roem. & Schult. ssp. *congesta*

Aristida diffusa Trin.

Aristida junciformis Trin. & Rupr.

Aristida spectabilis Hack.

Brachiaria advena Vickery

Brachiaria eruciformis (Sm.) Griseb.

Brachiaria serrata (Thunb.) Stapf

Bothriochloa bladhii (Retz.) S.T.Blake

Bothriochloa insculpta (A.Rich.) A.Camus

Bromus catharticus Vahl

Chloris gayana Kunth

Chrysopogon species

Cymbopogon excavatus (Hochst.) Stapf ex Burtt Davy

Cymbopogon plurinodis (Stapf) Stapf ex Burtt Davy

Cymbopogon validus (Stapf) Stapf ex Burtt Davy

Cladoraphis spinosa (L.f.) S.M.Phillips

Cynodon dactylon (L.) Pers.

Cynodon hirsutus Stent

Cynodon species

Digitaria angolensis Rendle

Digitaria eriantha Steud.

Digitaria maitlandii Stapf & C.E.Hubb.

Digitaria monodactyla (Nees) Stapf

Digitaria sanguinalis (L.) Scop.

Digitaria scalarum (Schweinf.) Chiov.

Digitaria species

Digitaria tricholaenoides Stapf

Diheteropogon amplectens (Nees) Clayton

Diheteropogon filifolius (Nees) Clayton

Elionurus muticus (Spreng.) Kunth

Eragrostis aspera (Jacq.) Nees

Eragrostis brizantha Nees

Eragrostis capensis (Thunb.) Trin.

Eragrostis chloromelas Steud.

Eragrostis curvula (Schrad.) Nees

Eragrostis gummiflua Nees

Eragrostis lehmanniana Nees

Eragrostis micrantha Hack.

Eragrostis obtusa Munro ex Ficalho & Hiern

Eragrostis plana Nees

Eragrostis racemosa (Thunb.) Steud.

Eragrostis superba Peyr.

Eulalia villosa (Thunb.) Nees

Eustachys paspaloides (Vahl) Lanza & Mattei

Harpochloa falx (L.f.) Kuntze

Helictotrichon turgidulum (Stapf) Schweick.

Heteropogon contortus (L.) Roem. & Schult.

Hyparrhenia hirta (L.) Stapf

Koeleria capensis (Steud.) Nees

Leersia hexandra Sw.

Loudetia simplex (Nees) C.E.Hubb.

Melinis nerviglumis (Franch.) Zizka

Melinis repens (Willd.) Zizka

Merxmuellera stereophylla (J.G.Anderson) Conert

Merxmuellera stricta (Schrad.) Conert

Microchloa caffra Nees

Miscanthus capensis (Nees) Andersson

Miscanthus junceus (Stapf) Pilg.

Panicum aequinerve Nees

Panicum arbusculum Mez

Panicum coloratum L.

Panicum maximum Jacq.

Panicum natalense Hochst.

Panicum schinzii Hack.

Panicum stapfianum Fourc.

Panicum subalbidum Kunth

Panicum volutans J.G.Anderson

Paspalum dilatatum Poir.

Paspalum distichum L.

Paspalum notatum Flüggé

Paspalum scrobiculatum L.

Paspalum species

Paspalum urvillei Steud.

Pennisetum species

Pennisetum thunbergii Kunth

Phragmites australis (Cav.) Steud.

Setaria incrassata (Hochst.) Hack.

Setaria nigrirostris (Nees) T.Durand & Schinz

Setaria species

Setaria sphacelata (Schumach.) Moss

Setaria sphacelata (Schumach.) Moss var. *sericea* (Stapf) Clayton

Setaria sphacelata (Schumach.) Moss var. *torta* (Stapf) Clayton

Sporobolus africanus (Poir.) Robyns & Tournay

Sporobolus centrifugus (Trin.) Nees

Sporobolus discosporus Nees

Sporobolus fimbriatus (Trin.) Nees

Sporobolus natalensis (Steud.) T.Durand & Schinz

Sporobolus pectinatus Hack.

Sporobolus pyramidalis P.Beauv.

Sporobolus species

Stipagrostis zeyheri (Nees) De Winter ssp. macropus (Nees) De Winter

Stenotaphrum secundatum (H.Walter) Kuntze

Themeda triandra Forssk.

Trachypogon spicatus (L.f.) Kuntze

Tragus berteronianus Schult.

Tragus koelerioides Asch.

Tragus species

Trichoneura grandiglumis (Nees) Ekman

Tristachya leucothrix Nees

Tristachya nodiglumis K.Schum.

Urochloa panicoides P.Beauv.

POLYGALACEAE

Polygala abbreviata Markötter

Polygala albida Schinz

Polygala amatymbica Eckl. & Zeyh.

Polygala hottentotta C.Presl

Polygala ohlendorfiana Eckl. & Zeyh.

Polygala rehmannii Chodat

Polygala species

Polygonum hystriculum J.Schust.

POLYGONACEAE

Rumex lanceolatus Thunb.

Rumex sagittatus Thunb.

Rumex woodii N.E.Br.

POTTIACEAE

Gymnostomum aeruginosum Sm.

PORTULACACEAE

Portulaca oleracea L.

Talinum caffrum (Thunb.) Eckl. & Zeyh.

PLANTAGINACEAE

Plantago lanceolata L.

Plantago species

PROTEACEAE

Protea simplex E.Phillips

RANUNCULACEAE

Anemone species

Clematis brachiata Thunb.

Ranunculus multifidus Forssk.

RESTIONACEAE

Hypodiscus argenteus (Thunb.) Mast.

RHABDOWEISIACEAE

Rhabdoweisia species

RHAMNACEAE

Phylica burchellii Pillans

Phylica parviflora P.J.Bergius

Rhamnus prinoides L'Hér.

Ziziphus mucronata Willd.

RICCIACEAE

Riccia species

ROSACEAE

Agrimonia procera Wallr.

Alchemilla natalensis Engl.

Cliffortia linearifolia Eckl. & Zeyh.

Cliffortia uncinata Weim.

Leucosidea sericea Eckl. & Zeyh.

Rubus cuneifolius Pursh

Rubus ludwigii Eckl. & Zeyh.

Senna species

RUBIACEAE

Anthospermum aethiopicum L.

Anthospermum herbaceum L.f.

Anthospermum hispidulum E.Mey. ex Sond.

Anthospermum rigidum Eckl. & Zeyh.

Anthospermum rigidum Eckl. & Zeyh. ssp. *pumilum* (Sond.) Puff

Galium thunbergianum Eckl. & Zeyh. var. *thunbergianum*

Kohautia amatymbica Eckl. & Zeyh.

Kohautia species

Oldenlandia rupicola (Sond.) Kuntze var. *hirtula* (Sond.) Bremek.

Pachystigma caffrum (Sim) Robyns

Pavetta gardeniifolia A.Rich.

Pentanisia angustifolia (Hochst.) Hochst.

Pentanisia prunelloides (Klotzsch ex Eckl. & Zeyh.) Walp.

Pentanisia species

Richardia brasiliensis Gomes

Spermacoce natalensis Hochst.

Tapiphyllum parvifolium (Sond.) Robyns

Vangueria species

SANTALACEAE

Thesium capitatum L.

Thesium costatum A.W.Hill

Thesium natalense Sond.

Thesium racemosum Bernh.

SCHISTOCHILACEAE

Schistochila species

SCHIZAEACEAE

Mohria caffrorum (L.) Desv.

Mohria caffrorum (L.) Desv. var. *caffrorum*

Schizaea pectinata (L.) Sw.

SCROPHULARIACEAE

Diclis reptans Benth.

Graderia scabra (L.f.) Benth.

Halleria lucida L.

Jamesbrittenia accrescens (Hiern) Hilliard

Jamesbrittenia aurantiaca (Burch.) Hilliard

Jamesbrittenia kraussiana (Bernh.) Hilliard

Jamesbrittenia pristisepala (Hiern) Hilliard

Nemesia saccata E.Mey. ex Benth.

Striga bilabiata (Thunb.) Kuntze

Striga elegans Benth.

Sutera pinnatifida (Benth.) Kuntze

Sutera squarrosa (Pilg.) Hiern ex Range

Zaluzianskya katharinae Hiern

SELAGINACEAE

Selago speciosa Rolfe

Walafrida densiflora (Rolfe) Rolfe

Walafrida geniculata L.f. Rolfe

SMILACACEAE

Smilax anceps Willd.

SOLANACEAE

Lycium cinereum Thunb. sensu lato

Lycium species

Lycium villosum Schinz

Solanum elaeagnifolium Cav.

Solanum guineense L.

Solanum incanum L.

Solanum nigrum L.

Solanum sisymbrifolium Lam.

Solanum species

Solanum supinum Dunal

Solanum tomentosum L.

Withania somnifera (L.) Dunal

STERCULIACEAE

Hermannia althaeifolia L.

Hermannia bicolor Engl. & Dinter

Hermannia coccocarpa (Eckl. & Zeyh.) Kuntze

Hermannia cordata (E.Mey. ex E.Phillips) De Winter

Hermannia depressa N.E.Br.

Hermannia parviflora Eckl. & Zeyh.

Hermannia species

Melochia species

TILIACEAE

Grewia flava DC.

Grewia tenax (Forssk.) Fiori

THYMELAEACEAE

*Gnidia calocephala (*C.A.Mey.) Gilg

Gnidia capitata L.f.

Gnidia humilis Meisn.

Gnidia kraussiana Meisn.

Gnidia microcephala Meisn.

Gnidia sericocephala (Meisn.) Gilg ex Engl.

Gnidia triplinervis Meisn.

TYPHACEAE

Typha capensis (Rohrb.) N.E.Br.

VALERIANACEAE

Valeriana capensis Thunb.

VITACEAE

Cyphostemma flaviflorum (Sprague) Desc.

Rhoicissus tridentata (L.f.) Wild & R.B.Drumm.

VERBENACEAE

Lantana camara L.

Lantana rugosa Thunb.

Lippia javanica (Burm.f.) Spreng.

Verbena bonariensis L.

Verbena brasiliensis Vell.

Verbena species

Verbena tenuisecta Briq.

ZYGOPHYLLACEAE

Tribulus terrestris L.

APPENDIX 2:CO-ORDINATES OF THE SAMPLE PLOTS.

NOTES:

a) Sample plot number 1 corresponds to relevé number 107, and 377 corresponds to 50579

b) Latitude is given in degrees, minutes and seconds SOUTH, and Longitude in degrees, minutes, and seconds EAST.

c) Environmental data for each sample is stored in the TURBOVEG Grassland Data Base at the University of Pretoria.

d) The following relevés, 120, 147, 202, 50222, 50319, and 50324 were omitted because they do not have latitudes and longitudes:

numbers	releve.no	Latitude	Longitude
1	107	311447	283856
2	108	311501	283836
3	109	310946	283140
4	110	310945	283139
5	111	311143	283413
6	112	311000	283234
7	113	311112	283521
8	114	310554	293554
9	115	305917	293321
10	116	305432	293524
11	117	305424	293609
12	118	313650	282814
13	119	314015	260632
15	121	314211	265701
16	122	314012	265529
17	123	313542	265616
18	124	313318	265727
19	125	313057	265840
20	126	315800	272729
21	127	315319	275033
22	128	302330	284037
23	129	314027	292734
24	130	313706	292347
25	131	313528	291544
26	132	313403	290522
27	133	311239	295303
28	134	311200	294734
29	135	311209	294526
30	136	313857	292708
31	137	311810	284434

32	138	313327	290427
33	139	313325	290432
34	140	313351	285712
35	141	313148	285644
36	142	313148	285444
37	143	313351	285712
38	144	311624	300041
39	145	311644	295913
40	146	305310	293627
42	148	311537	300146
43	149	311637	295925
44	150	311731	300011
45	151	311728	300040
46	152	312635	272218
47	153	313131	272251
48	154	312811	272152
49	155	311609	300009
50	156	311726	300043
51	157	311728	300040
52	158	311132	300038
53	159	310354	293134
54	160	310611	293630
55	161	311303	294401
56	162	313054	265847
57	163	313649	265601
58	164	305917	293321
59	165	311312	295339
60	166	311226	294851
61	167	311141	294638
62	168	310609	293634
63	169	310348	293213
64	170	310034	293253
65	171	305513	293516
66	172	305351	293635
67	173	312812	272137
68	174	312209	273948
69	175	312635	272229
70	176	312804	292107
71	177	314032	272010
72	178	313816	271119
73	179	313723	284516
74	180	314249	284143
75	181	315648	282337
76	182	321636	281223
77	183	321801	275853
78	184	315455	282740
79	185	313723	284515
80	186	313928	283359
81	187	322051	280146
82	188	321537	275648

83	189	312225	273858
84	190	313732	272535
85	191	312632	272234
86	192	313720	272417
87	193	313847	272153
88	194	313238	272349
89	195	312826	272311
90	196	312632	272234
91	197	312205	273947
92	198	313814	271116
93	199	313743	272532
94	200	314038	280349
95	201	313854	282042
97	203	313823	282216
98	204	314018	280614
99	205	314813	265647
100	206	314109	265615
101	207	314635	265702
102	208	313002	265913
103	209	314100	265610
104	210	313624	265409
105	211	313315	265708
106	212	312957	265923
107	213	313345	265719
108	214	314342	265733
109	215	313755	265547
110	216	313756	265525
111	217	313200	265753
112	218	311421	295737
113	219	311509	295746
114	220	310347	293218
115	221	311132	294720
116	222	313822	292556
117	223	313614	282937
118	224	311731	300011
119	225	311728	300040
120	226	313822	292556
121	227	311840	284632
122	228	313815	271118
123	229	314141	271646
124	230	301825	292616
125	231	313326	265758
126	232	314012	265529
127	233	314211	265701
128	234	314539	265704
129	235	305108	294319
130	236	302327	284024
131	237	313409	285515
132	238	305127	293550
133	239	305128	294813

134	240	311209	294526
135	50112	310339	300844
136	50113	310339	300844
137	50114	310341	300842
138	50115	310342	300844
139	50116	310339	300844
140	50117	310336	300842
141	50118	305335	295808
142	50119	305939	300159
143	50120	305939	300159
144	50121	310342	300844
145	50122	305201	295846
146	50123	305901	300044
147	50124	305337	295806
148	50125	305901	300039
149	50126	305955	300044
150	50127	305021	294610
151	50128	305204	294957
152	50129	309539	300160
153	50130	305311	295838
154	50131	305111	294323
155	50132	304240	292633
156	50133	304240	292655
157	50134	304728	285105
158	50135	304240	292633
159	50136	304243	292627
160	50137	304255	292644
161	50138	304357	293229
162	50139	305942	300201
163	50140	305851	300034
164	50141	305207	294950
165	50142	305026	294612
166	50143	305204	295007
167	50144	305023	294608
168	50145	305027	294608
169	50146	305033	294558
170	50147	305202	295015
171	50148	305104	294255
172	50149	305107	294320
173	50150	305114	294322
174	50151	305151	293509
175	50152	305129	293559
176	50153	305132	293605
177	50154	305134	293606
178	50155	304912	293433
179	50156	304908	293428
180	50157	304840	293428
181	50158	304306	293229
182	50159	304357	293228
183	50160	304359	293240

184	50161	305012	292358
185	50162	304355	293226
186	50163	313334	271443
187	50164	305010	292434
188	50165	315158	275129
189	50166	314458	275654
190	50167	321845	275909
191	50168	305016	292527
192	50169	304808	292309
193	50170	304812	292314
194	50171	304813	292310
195	50172	304812	292258
196	50173	304012	292314
197	50174	304856	290947
198	50175	304855	290946
199	50176	304843	290935
200	50177	301657	282452
201	50178	304626	285129
202	50179	304515	285101
203	50180	304450	285115
204	50181	304727	265100
205	50182	304529	285119
206	50183	304733	285004
207	50184	305129	294814
208	50185	301826	282609
209	50186	305328	285849
210	50187	305338	285849
211	50188	304856	290947
212	50189	301801	283152
213	50190	301805	283157
214	50191	301758	283151
215	50192	301833	282627
216	50193	314021	292736
217	50194	314021	292736
218	50195	302917	283506
219	50196	302923	283501
220	50197	302922	283509
221	50198	301833	282627
222	50199	302922	283509
223	50200	302334	284040
224	50201	302329	284033
225	50202	302328	284041
226	50203	302328	284041
227	50204	301759	282621
228	50205	301808	283149
229	50206	301808	283149
230	50207	301703	282458
231	50208	301812	282622
232	50209	301657	282449
233	50210	301657	282452

234	50211	313525	291547
235	50212	313531	291536
236	50213	313525	291547
237	50214	313730	292301
238	50215	301759	282621
239	50216	313708	292334
240	50217	302910	283510
241	50218	314021	292736
242	50219	313851	292657
243	50220	313851	292657
244	50221	313947	292738
246	50223	301657	282444
247	50224	312138	284836
248	50225	313111	285024
249	50226	313111	285024
250	50233	313110	285129
251	50234	313107	285134
252	50235	313111	285024
253	50236	312253	284949
254	50237	311924	284813
255	50238	313259	284834
256	50239	312250	284850
257	50240	312248	284853
258	50241	313259	284834
259	50242	312139	284841
260	50255	311859	284713
261	50256	311015	283417
262	50257	311815	284434
263	50258	311841	284619
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268	50263	311027	283434
269	50264	310958	283207
270	50274	321248	281342
271	50275	314837	283541
272	50276	315700	282137
273	50277	313703	284506
274	50278	313710	284508
275	50279	313711	284507
276	50280	314028	272007
277	50281	313809	271121
278	50282	313346	272456
279	50283	313734	272559
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281	50285	312157	274003
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283	50287	313707	275929
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287	50291	313212	275214
288	50292	313259	275333
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290	50294	310057	274435
291	50295	315845	274801
292	50296	313235	275246
293	50297	313700	275927
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296	50300	312208	273955
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298	50302	312825	272237
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302	50306	311528	300149
303	50307	311615	295952
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306	50310	311721	300041
307	50311	311533	300146
308	50312	312639	272222
309	50313	315653	283141
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311	50315	315026	283206
312	50316	311900	284721
313	50317	313805	271111
314	50318	311400	295740
316	50320	314021	292729
317	50321	311758	283151
318	50322	301646	282457
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321	50325	303047	283600
322	50326	313250	290300
323	50327	311813	284433
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325	50329	312100	284842
326	50330	301758	283151
327	50331	304931	292456
328	50332	320053	274430
329	50333	315203	275102
330	50334	320124	271744
331	50335	320111	274256
332	50336	320054	272036
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334	50338	313707	275929
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336	50340	310955	283337

337	50341	312629	272306
338	50342	305323	285845
339	50343	310704	293736
340	50344	311242	295251
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342	50347	311637	295925
343	50348	313759	265542
344	50349	313200	265753
345	50350	313438	265537
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347	50370	321143	275620
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349	50372	305333	285848
350	50373	304838	290935
351	50374	304809	292235
352	50375	305012	292358
353	50541	304908	293450
354	50542	304909	293431
355	50556	304727	285100
356	50557	304240	292633
357	50558	320505	281852
358	50559	312157	274003
359	50560	304924	293451
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361	50562	305432	293524
362	50563	305424	293609
363	50564	313650	282814
364	50565	311206	294736
365	50566	311239	295303
366	50567	313010	265917
367	50568	313010	265917
368	50570	313010	265917
369	50571	313010	265917
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371	50573	313701	275912
372	50574	312836	272126
373	50575	312230	273938
374	50576	313744	272638
375	50577	313431	272546
376	50578	312230	273938
377	50579	321800	281100