The vegetation ecology of the Seringveld Conservancy, Cullinan, South Africa

By

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This thesis is dedicated to Prof G.J. Bredenkamp.

My mentor and friend. Throughout his career, he has made significant contributions towards understanding the dynamics of savanna and grassland systems.

Most importantly, he made an impact on the lives of every student he supervised.

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Abstract

The Seringveld Conservancy is situated near Cullinan in an area is that is characterised by deep sandy soils. Sand mining for the building industry has become a major threat to the biodiversity of the area. The flora of the Conservancy is best described as a gradual ecotone between the grassland and savanna biomes. The fist objective of the study is to describe the vegetation of the Seringveld Conservancy, in terms of plant communities, plant species composition, habitat as well as composing a vegetation map of the area. The second objective of the study is more theoretical and is aimed at providing a definition for savannas as well as shedding light on the complexity of South African savannas and there underlying driving forces.

The Braun-Blanquet approach was used for sampling and 125 relevés were compiled. The data was captured using TURBOVEG and data analysis followed in JUICE 7.0. A total of 376 species was recorded in the area. Analysis from JUICE resulted in a TWINSPAN dendogram, synoptic table and two phytosociological tables. The phytosociological tables obtained from JUICE were refined using Braun-Blanquet procedures. Ten main plant communities and two sub-communities were identified. Each plant community was described in terms of species composition, dominant species and diagnostic species, and ecologically interpreted in terms of habitat characteristics. The plant communities were also compared to communities found in other studies in close proximity of the Seringveld i.e. Ezemvelo Nature Reserve. ArcGIS was used to create various maps further highlighting the uniqueness of the area. A vegetation map indicating the distribution of the plant communities was compiled. The combined results of the phytosociological tables as well as the GIS maps indicate that the Seringveld Conservancy is a complex area containing high biodiversity. Trying to define savanna is related to scale. The study area is considered to be savanna at local scale, this study will refer to savanna as a vegetation type with a well developed grassy layer and an upper layer of woody plants, which can vary from widely spaced to 75 percent tree cover. There is a gradient present between equilibrium and non-equilibrium dynamics in savanna ecosystems of southern Africa.

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Declaration

I, Lorainmari le Grange, hereby declare that this research dissertation is my own work and has not been presented for any degree at another University

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1. Introduction

1.1. Background

The Seringveld Conservancy forms part of the Dinokeng Circuit. The Dinokeng circuit is a tourist driven initiative aimed at increasing job opportunities in the area. The Seringveld Conservancy was established in 1997 and encompasses an area of approximately 18000 ha. The Seringveld lies North west of Cullinan in the Gauteng province (Van Wyk *et al.*, 2007).

The Seringveld falls within the ecotone between the Grassland and Savanna biomes (Van Wyk *et al.*, 2007). Ecotones are defined as zones of tension between two different ecological communities (Harris, 1988). The Conservancy falls within the Crocodile River catchment and provides the catchment with irreplaceable ecological services. The Seringveld Conservancy is characterised by deep sandy soils. These deep sandy soils create a habitat suited for *Burkea africana* and *Terminalia sericea,* both prominent in the area. The production potential of the ecosystem is influenced by the ability of the trees to keep the soils intact as well as trap nutrients. The vegetation of the Conservancy includes the pyrogenic geoxylic suffrutice *Parinari capensis.* Erdvark are still present in the area and hence there is likelihood that *Cucumus humifructus,* which is a rare species, is present in the area (Van Wyk, 2007; Van Wyk *et al.*, 2007).

The deep sandy soils have drawn sand miners to the area. Sand mining that occurs in the area supplies sand to the building industry. During the initial stages of sand mining bulldozers, clear all of the above ground vegetation. No plants are rescued or removed for replanting. Restoration of sand mines is nearly impossible since the top soil layer is lost (Figure 1.1). In recent years, there has been a sudden influx in the demand for building sand, due to the increase in building as well as other infrastructure developments. Mines in the area are supposed to have relevant mining permits but some of the mines in the area fail to comply with these legal requirements. Some of the mines in the area are also guilty of mining in wetlands, rerouting streams; water is extracted from streams for the mining process without the needed authorization of the relevant government authorities. The mines fail to stop runoff polluted water, used during the mining process, from polluting watercourses and wetlands in the area. Sand mining therefore poses a major threat tot the biodiversity of the area. (Van Wyk *et al.,* 2007).

Figure 1.1: Google earth image of one of the active sand mines in the Seringveld Conservancy. Image indicating the destruction sand mines cause as well as the silt dams, which contains polluted water (Google earth, 2009).

Biodiversity became a fashionable term and describes the variation present in all forms of life on earth (Bush 2003). Biodiversity is present on various hierarchical levels that range from gene level to organisms, to populations to communities to ecosystems and finally to landscapes (Risser 1995). The members of the Seringveld Conservancy are desperately trying to conserve the remaining biodiversity found in the Conservancy. The selection of areas, species and populations for conservation is a heavily debated topic in current times. It is appealing to select areas known to be biodiversity hotspots as conservation areas (Forest *et al.*, 2007). Ecotones can be regarded as biodiversity hotspots. Not only do they contain high species diversity but also the specie's genetic composition is also quite diverse, due to the interaction of the two biomes, Grassland and Savanna. It is also thought that ecotones are areas with high levels of endemism (Kark & Jansen van Rensburg, 2006). Not only is the Conservancy under pressure by the sand mining activities but like the rest of South Africa, the biodiversity of the area is also threatened by climate change. It is expected that the biodiversity of South Africa will suffer major impacts as a result of climate change, predominantly due to range shifts, range contractions or a combination of both. It is has also been estimated that South Africa's terrestrial biomes will shrink by approximately 40 % (Van Jaarsveld & Chown, 2001). Ecotones for the most part have been ignored as priority areas for conservation which is quite surprising. Ecotones contain species from both of the homogeneous areas they border and may also contain their own endemic species. From an economical perspective it might also be very advantageous to conserve ecotones, since the combined size of the homogeneous areas they border are much larger than the size of the transitional area. Therefore, by conserving the ecotone, a relatively small area needs to be set aside for conservation and yet a large number of species benefit. It is extremely important that when conserving an ecotone the connectivity remains between the ecotone and the neighbouring homogenous areas (Kark & Jansen van Rensburg, 2006).

An ecosystem is the interacting system that encompasses a community and its non-living, physical environment. Vegetation, the primary producer in an ecosystem, is the logical choice of study because vegetation is, immediately at hand for studying, evident, familiar and easily identifiable if the elements (species) of the vegetation are known. The non-living environment consists of *inter alia* soils, geology, climate, water availability and topography (Solomon *et al.,* 2002). The loss of a single species form an ecosystem can have adverse affects on the ecosystem as well as community properties (Symstad *et al.,* 1998). Vegetation is a group of plants located in the same general area and that are able to grow and survive under the same general conditions in the same area at the same time. Plant communities can be defined as: "The collection of plant species growing together in a particular location that show a definite association or affinity to each other"

(Kent & Coker, 2000). A plant community is unique in its floristic composition as well as the plants species abundances, and associated habitat competition. Plant communities can occur in gradients as a result of continuity in environmental factors or they can be clear and easily identifiable units. Vegetation is a readily observable expression of the ecology and relationships as well as series of interactions between the biotic organisms and their abiotic environment and hence is a physical representation of an ecosystem. It is therefore of grave importance to determine the vegetation ecology of an area to assist before any conservation and land-use planning (Bredenkamp, 2001; Bredenkamp & Brown, 2001).

This is the fist in-depth vegetation ecology study conducted in the Conservancy.

1.2. Objectives

There are two main objectives for this study: Firstly describing the vegetation of the Seringveld Conservancy, in terms of plant communities, plant species composition and habitat. The description of the vegetation can be subdivided into sub objectives:

- To provide a floristic overview as well as a phytosociological classification of the area.
- To provide a vegetation map of the area listing the major plant communities.

These results could form the basis for conservation planning of the area and will hopefully raise the current level of the conservation status of the area. The second objective of the study is more theoretical and is aimed at shedding light on the complexity of South African savannas and there underlying driving forces.

2. Study Area

2.1. Locality

The Seringveld is located in the north-eastern part of the Gauteng Province of South Africa. The area is situated north of Cullinan. The Conservancy is lies between the latitudes of 25º 31' 08.07" S and 25º 39' 00.61" S and longitudes of 28 º31' 34.34" E and 28 º24' 07.71" E. The Conservancy is situated north of the N4 national road and between the R573 and R513. The area is situated north of Cullinan (Figure 2.1).

2.2. Climate

Climate indicates the weather conditions over a period of years and includes the daily seasonal as well as annual variations in these attributes. Vegetation patterns are influenced by climate. Climate has a direct influence on a plants life cycle because of the role that factors like temperature, light exposure as well as moisture play (Schulze, 2003).

The climatic data of Pretoria weather station is seen as representative climatic data for the area. Table 2.1 provides the temperature as well as the precipitation data for the Pretoria weather station from 1961–1990. The warmer months of the year are between September and March and the coldest period is between May to August. During the warmer months, the highest recorded temperature is 36ºC in January and in the cooler months; the lowest recorded temperature is -6 ºC in June.

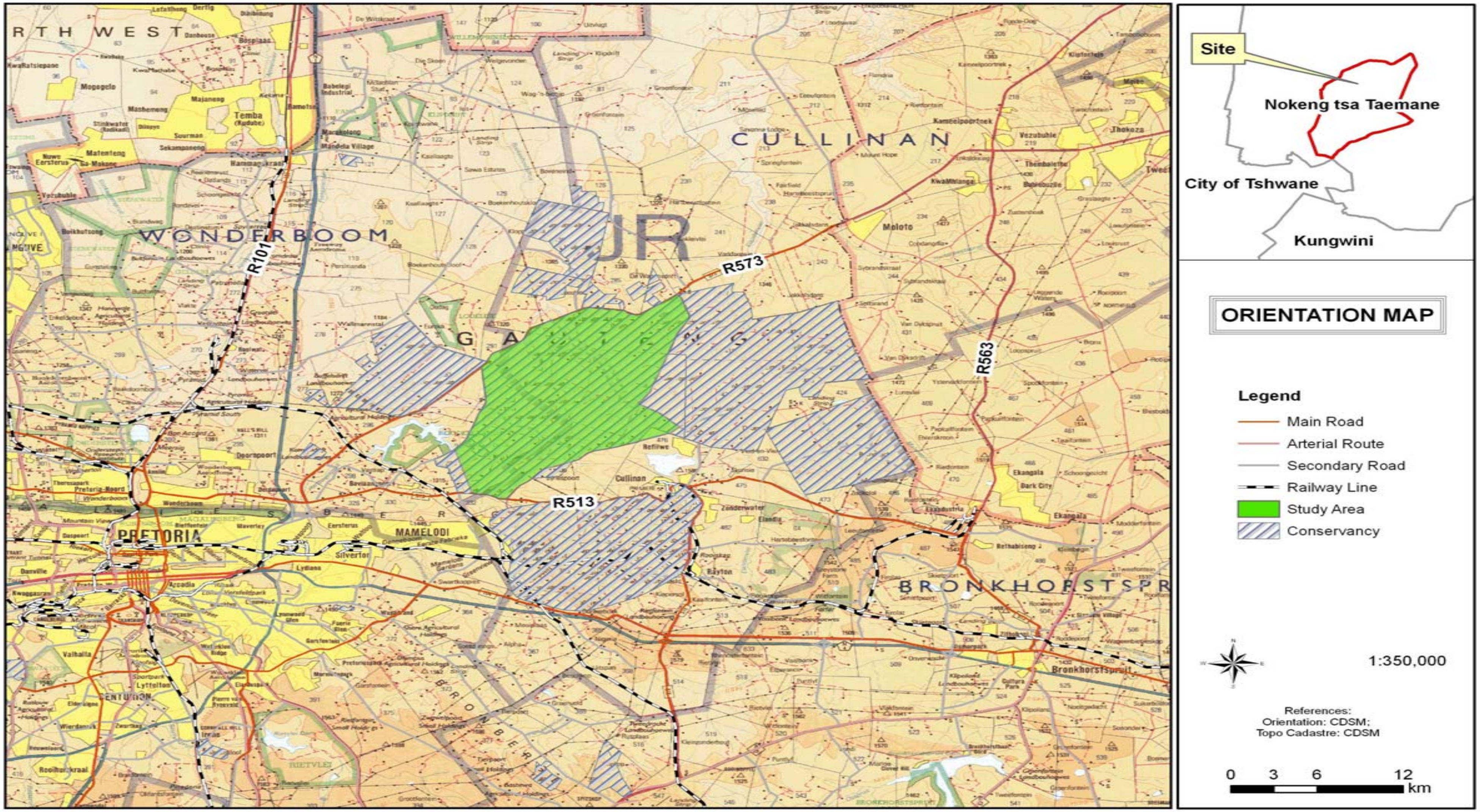

Figure 2.1: Map indicating the locality of the study area in the Gauteng Province. The Seringveld Conservancy (Green) is situated other conservancies i.e. the Cullinan Conservancy.

Table 2.1: Climate data recorded at the Pretoria weather station from 1961–1990.

Month	Temperature (° C)				Precipitation		
	Highest Recorded	Average Daily Maximum	Average Daily Minimum	Lowest Recorded	Average Monthly (mm)	Average Number of days with >= 1mm	Highest 24 Hour Rainfall (mm)
January	36	29	18	8	136	14	160
February	36	28	17	11	75	11	95
March	35	27	16	6	82	10	84
April	33	24	12	3	51	7	72
May	29	22	8	-1	13	3	40
June	25	19	5	-6	7	1	32
July	26	20	5	-4	3	1	18
August	31	22	8	-1	6	2	15
September	34	26	12	2	22	3	43
October	36	27	14	4	71	9	108
November	36	27	16	7	98	12	67
December	35	28	17	7	110	15	50
Year	**36**	**25**	**12**	**-6**	**674**	**87**	**160**

The average annual rainfall in the area is 647 mm. January is the month in which the most rain occurs (Table 2.1.) From May to the end of August, rainfall is low and these are the dry months of the area. The wet period occurs from September to the end of April (Figure 2.2). Frost occurs in the area during the winter months (Mucina & Rutherford, 2006).

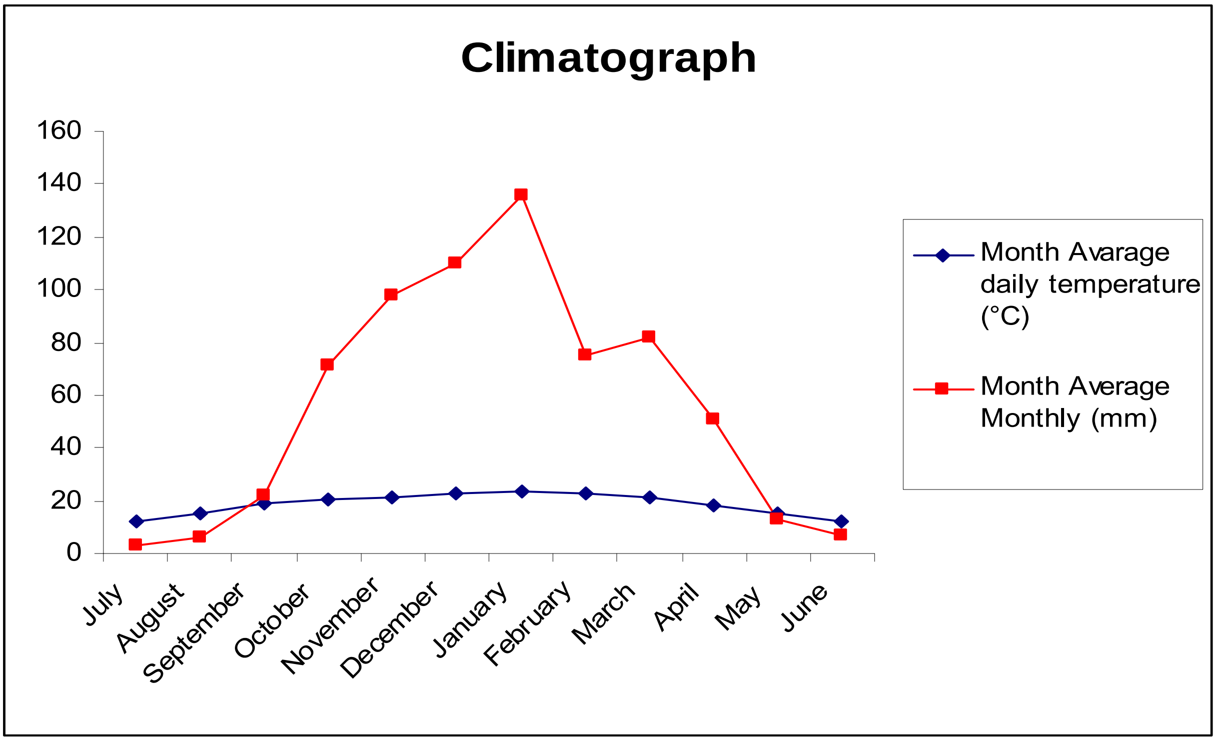

Figure 2.2: Climatograph of the climate data obtained form the Pretoria weather station

2.3. Topography and hydrology

The altitude of the Seringveld Conservancy lies between 1114 and 1491 m above sea level (Figure 2.3). The area contains three main streams namely the Boekenhoutskloofspruit, Krokodilspruit, Tweefonteinspruit, Roodeplaat spruit, Edendalspruit and Melkbosspruit (Figure 2.4). Wetlands and small dams are also present in the area. The ecotone area falls within the Crocodile River catchment. The topographical maps from which the information was obtained is 2528 CB and 2528 DA (Department of Agriculture, 2008).

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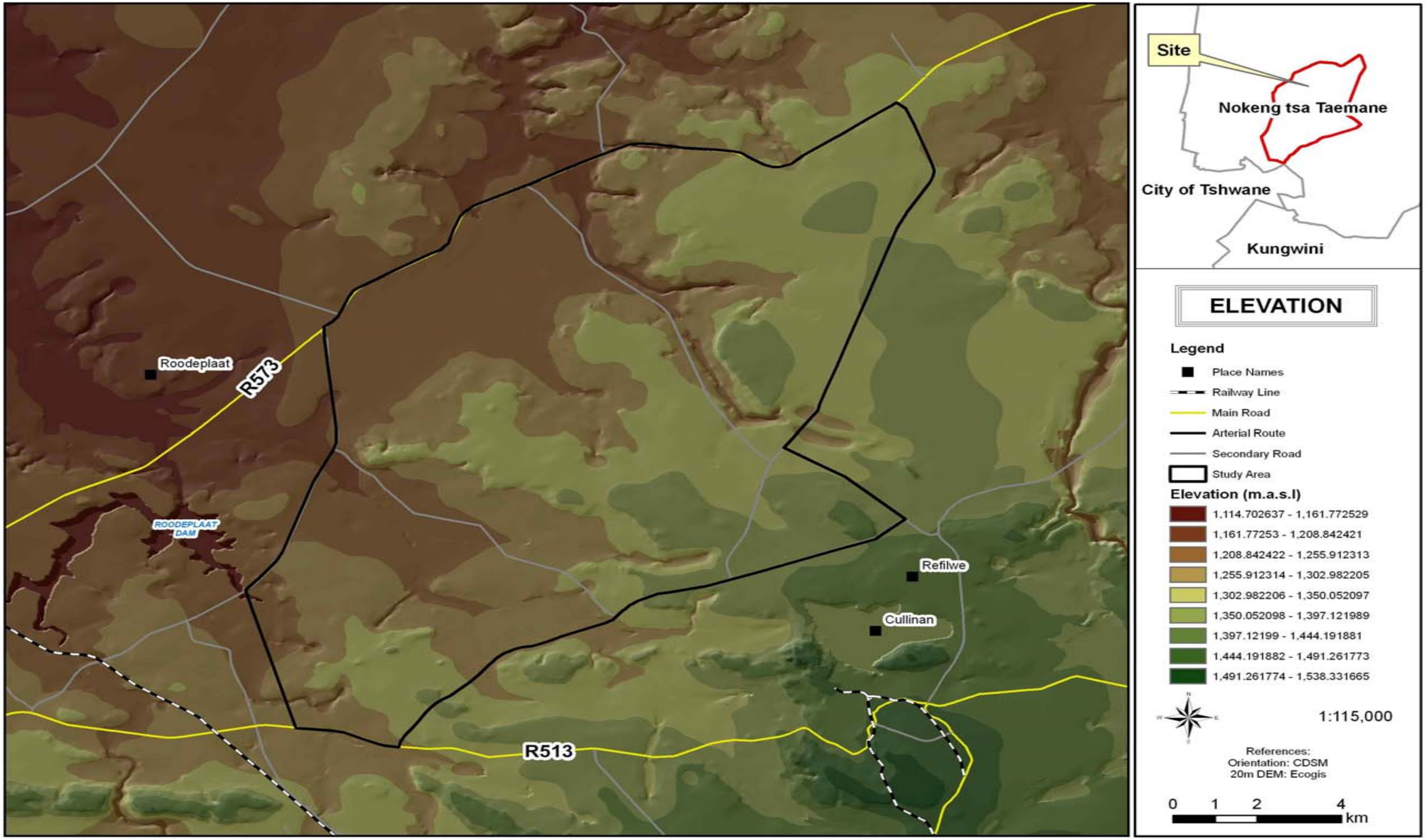

Figure 2.3: Map indicating the elevation present in the Seringveld Conservancy.

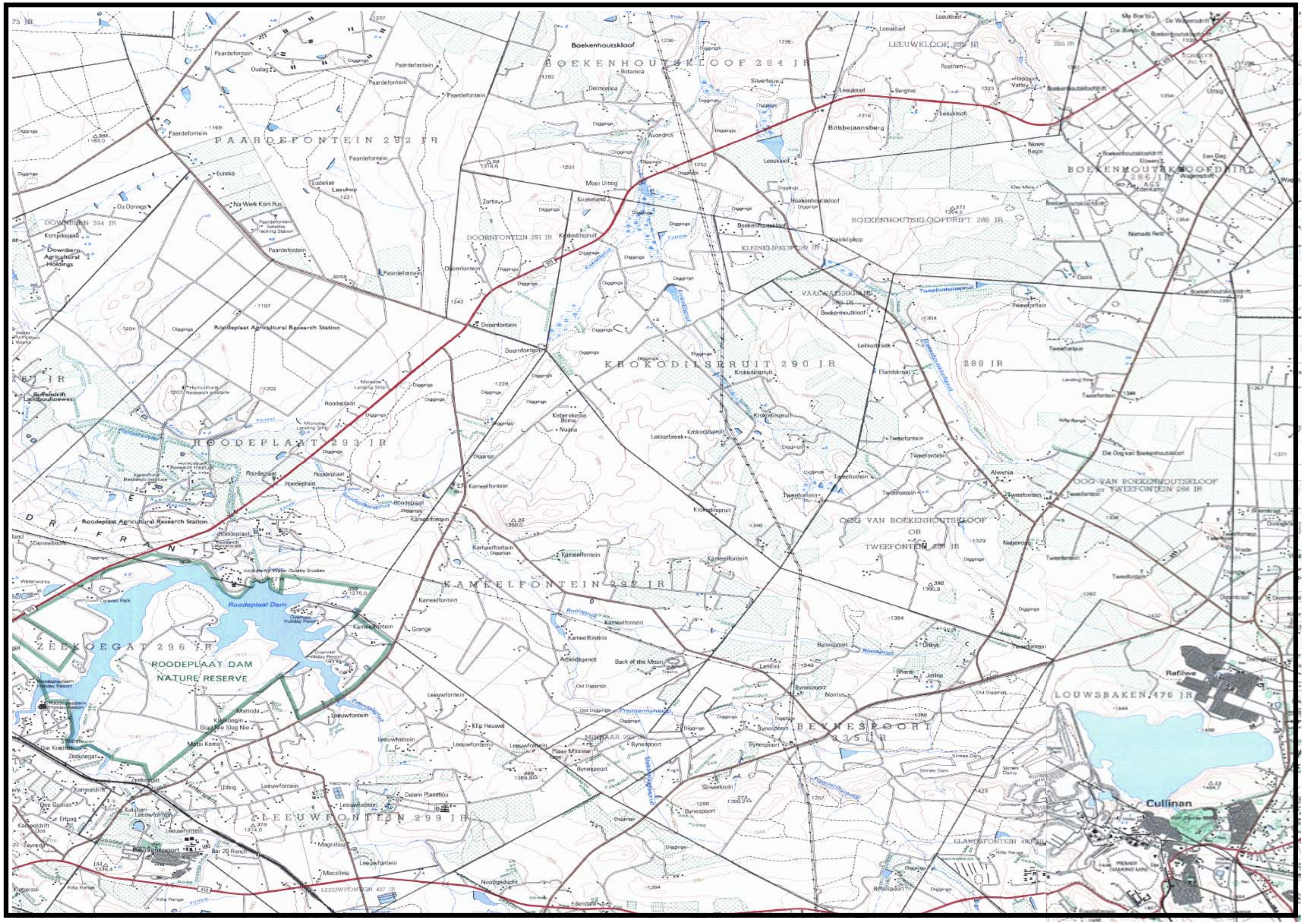

Figure 2.4: Modified 1:50 000 topographical map of the Seringveld Conservancy (Department of Agriculture, 2008).

2.4. Vegetation

The Seringveld Conservancy falls within the veld type Bankenveld originally defined by Acocks (1989). According to Acocks, the Bankenveld veld type is seen as “false grassland”. According to Acocks the vegetation should be Savanna, due to the climate conditions but it is a grassland as a result of regular veld fires, hence the use of “false grassland”: The locality of the Bankenveld as described by Acocks is between the 26º E and 30 º E longitudes and it oscillates around 26 º S latitude line. The Bankenveld covers about 23568 km²; in with it is a band of about 60 km broad and in about 400 km in length from east-west (Figure 2.5). The Bankenveld is situated in a climatic transitional zone between sub-tropical savanna and temperate grassland (Bredenkamp & Brown, 2003). Bredenkamp & Brown (2003) redefined and subdivided Bankenveld into various vegetation types, and stated that climatic variation, rather than fire, typical of the ecotone between Savanna and Grassland, as the driving force that determines the different vegetation types.

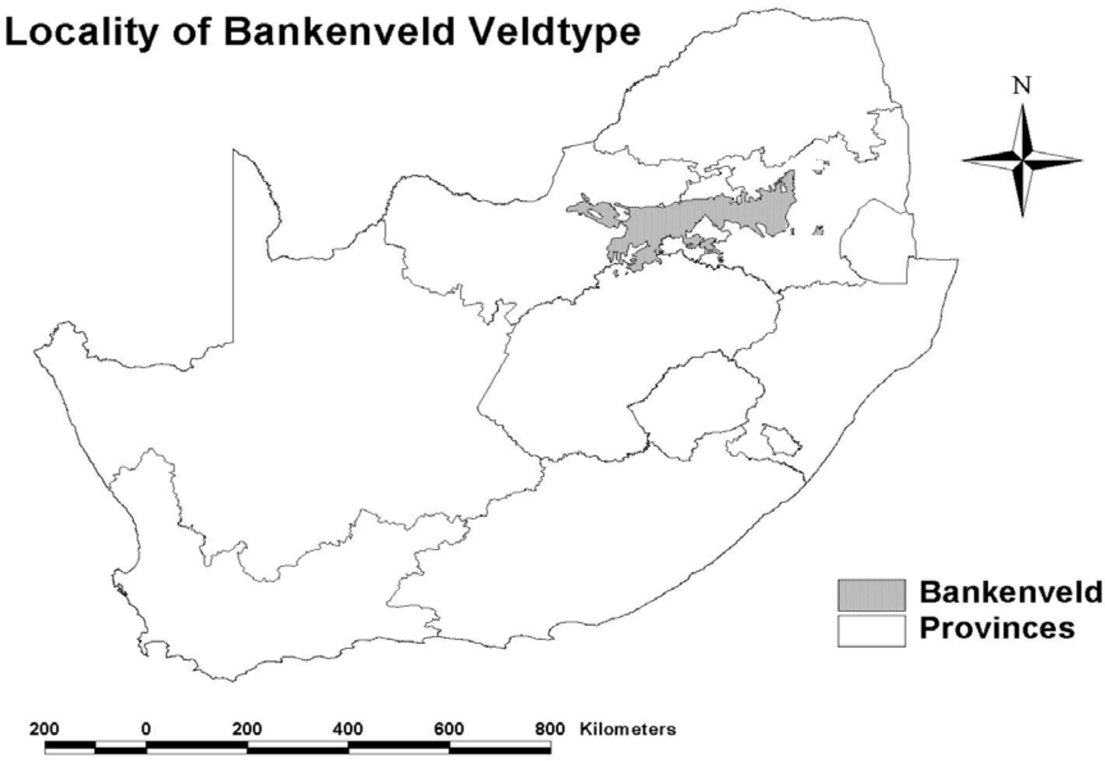

Figure 2.5: The locality of the Bankenveld veld type as described by Acocks (1988) (Bredenkamp & Brown, 2003).

Many maps of the vegetation of South Africa followed Acocks' map of the vegetation of South Africa. The latest vegetation map was constructed under the editorship of Mucina and Rutherford (2006) with the help of several co-workers. This map is not simply a floristic vegetation map that is done by syntaxonomy and thus providing a classification system for the vegetation that is present in the area. According to this map, the Seringveld falls within the following vegetation units (Figure 2.6).

- Marikana Thornveld (SVcb 6)
- Central Sandy Bushveld (SVcb 12)

Although these are the main vegetation types, the grasslands present in the study area may represent species from the Rand Highveld Grassland (GM 11) because it is relatively close to the study area and because of the scale on which the vegetation map was done. The Rand Highveld Grassland vegetation unit falls within the Grassland Biome and the other two vegetation units falls within the Savanna Biome emphasising the ecotonal nature of the Seringveld.

Marikana Thornveld contains open woodlands in lowland hills, slightly undulating plains and valleys that are dominated by *Acacia* species. Frost occurs frequently during the winter. Important taxa are *Acacia burkei, Celtis africana, Dombeya rotundifolia, Pappea capensis, Euclea crispa* subsp. *crispa, Olea europaea* subsp. *africana, Indigofera zeyherii, Rhynchosia nitens* and *Pogonarthria squarrosa* (Rutherford *et al.*, 2006a). The Central Sandy Bushveld occurs in areas that are low lying and undulating, sandy plains as well as between mountains. Species that are characteristic of this vegetation unit are *Burkea africana* and *Terminalia sericea*. These two species are indicative of the presence of deep sandy soils. Other important species in this vegetation unit are: *Acacia robusta, Combretum zeyheri, Indigophora filipes, Hyperthelia dissoluta, Loudetia simplex, Kyphocarpa angustifolia, Waltheria indica* and *Geigeria burkei* (Rutherford *et al.*, 2006 a).).

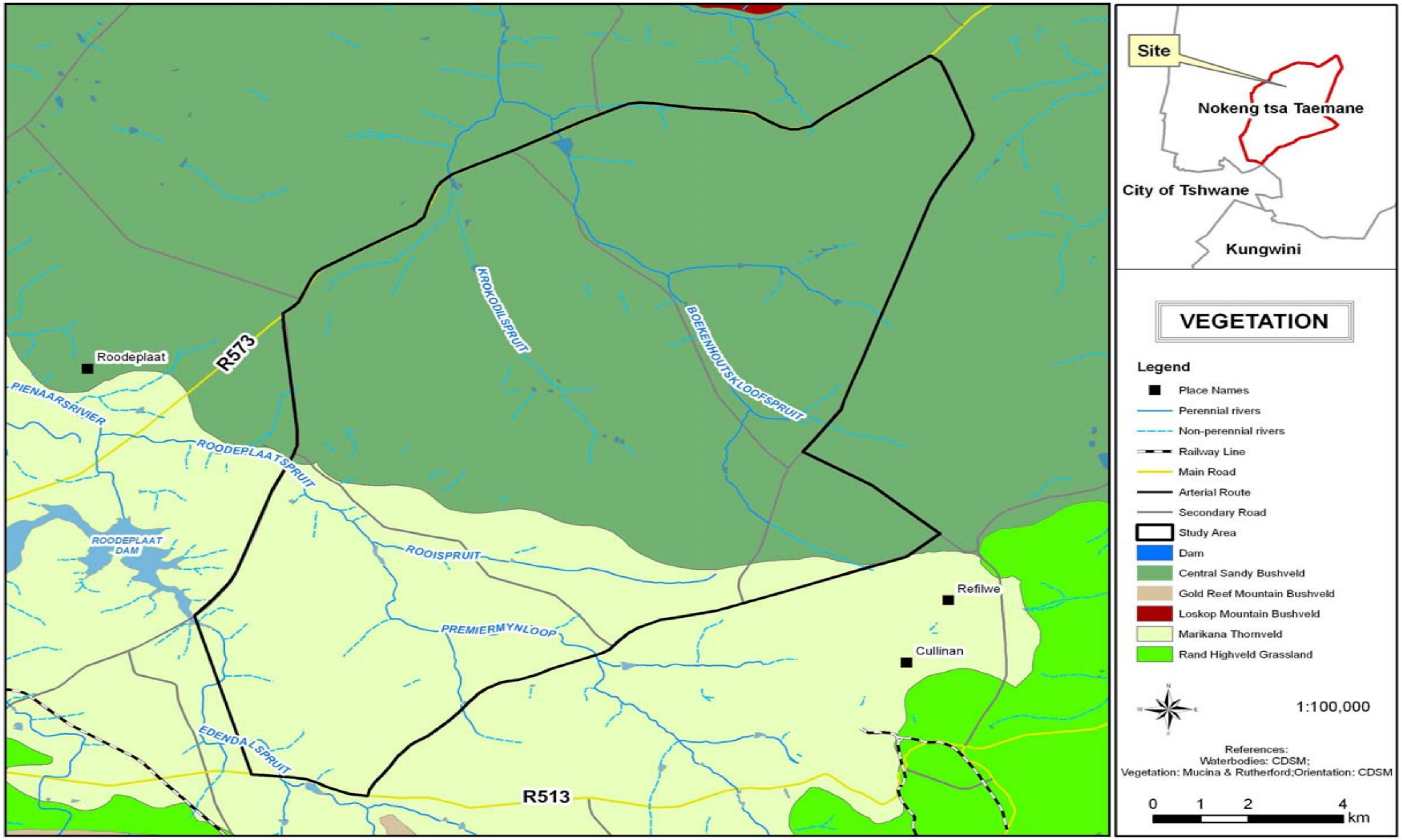

Figure 2.6: Vegetation map of the major vegetation units present in the Seringveld Conservancy. The major vegetation units are the Marikana Thornveld and the Central Sandy Bushveld (Mucina & Rutherford, 2006).

Rand Highveld Grassland occurs on a variety of different landscapes ridges surrounded by higher undulating plains or steep sloping plains. Some important taxa are *Ctenium conicinnum, Trachypogon spicatus, Digitaria tricholaenoides, Eragrostis capensis, Lacuta inermis, Oldenlandia herbacea, Xerophyta retinervis, Cheilanthes hirta, Indigofera comosa* and *Elephantorrhiza elephantina* (Mucina *et al.,* 2006).

2.5. Geology and soils

The Seringveld Conservancy falls within the Bushveld Igneous Complex. Within the Bushveld Igneous Complex, it forms part of the Waterberg system. The Waterberg system is one of the youngest groups of the pre Karroo sediments. The age of the Waterberg system ranges form 1700 – 1800 million years old (Haughton, 1969; Snyman, 1996). The Lebowa Granite Suite as well as the Raashoop Granophyre Suite underlies the Bushveld Igneous Complex (SACS, 1980). The geological substrata form part of the Bushveld Igneous Complex and consist of mainly gabbro, pyroxinite, norite and anorthosite (Haughton, 1969; Snyman, 1996). The Seringveld also falls within the Transvaal sequence. Within the Transvaal sequence, it falls within the Pretoria group. The Pretoria Group also features in the geology of the Marikana Thornveld. Shale and quartzite are predominant in this group. Rocks within the Central Sandy Bushveld fall mainly on the Lebowa Granite Suite but it also to some extent falls within the Raashoop Granophyre Suite. The geological sub-strata of the Central Sandy Bushveld are mostly sandstone, siltstone, shale and conglomerate (Rutherford *et al.*, 2006 a). The Rand Highveld Grassland forms part of the Witwatersrand Supergroup, the Selon's River Formation of the Rooiberg Group and the Pretoria Group (Mucina *et al.,* 2006)(Figure 2.7). .

Soils of the Marikana Thornveld are predominantly deep vertic or melanic clays but some freely drained deep soils as well as dysotrophic and mesothrophic plinthic catenas do occur locally. The soils that are present in the Central Sandy Bushveld are either well drained deep Hutton or Clovelly soils but Glenrosa soils are also present in this vegetation unit (Rutherford *et al.*, 2006 a). The

Rand Highveld Grassland contains Mispah and Glenrosa soils which are generally shallow with underlying rock layers (Mucina *et al.,* 2006).

2.6. Land type

Land type is mainly determined by the geology of the area and thus land types are not discussed in detail. The definition of a land type is: "A land type denotes an area that can be shown at 1:250 000 scale and display a marked degree of uniformity with respect to terrain form, soil pattern and climate" (Land Type Survey Staff, 1985).

Land types of the Rand Highveld Grassland are Ba, Bb, Bc and Ib. Land types present in the Marikana Thornveld are Ae, Ba and Ea. Central Sandy Bushveld contains the Ac, Bb, Bd, Fa land types (Mucina & Rutherford, 2006). From the ArcGIS map, it was deduced that the Seringveld Conservancy falls within the Bb, Ba, Fa, Ae and Fa land types (Figure 2.8).

The A land type usually has red to yellow soils without water tables. The soils are apedal and freely drained. B land types have a plinthic catena and water tables are present (Land Type Survey Staff, 1985). Undulating or flat landscapes are present in A and B land types. The geological sub-strata are usually Karoo sediments, granite or shale. Eastern and southern parts of the Bankenveld contains A and B land types. Grassland vegetation is present on these land types and but on the odd occasion microphyllus thornveld with *Acacia karroo* does occur (Bredenkamp & Brown, 2003).

F land types are associated with Glenrosa and or Mispah foms. These soils have been formed predominantly by the process of rock weathering (Land Type Survey Staff, 1985). The geological sub-strata that underlies the Fa land type is dolomite. The vegetation that covers the Fa land type is mainly grassland with patches of microphyllus thornveld containing *Acacia karoo*.

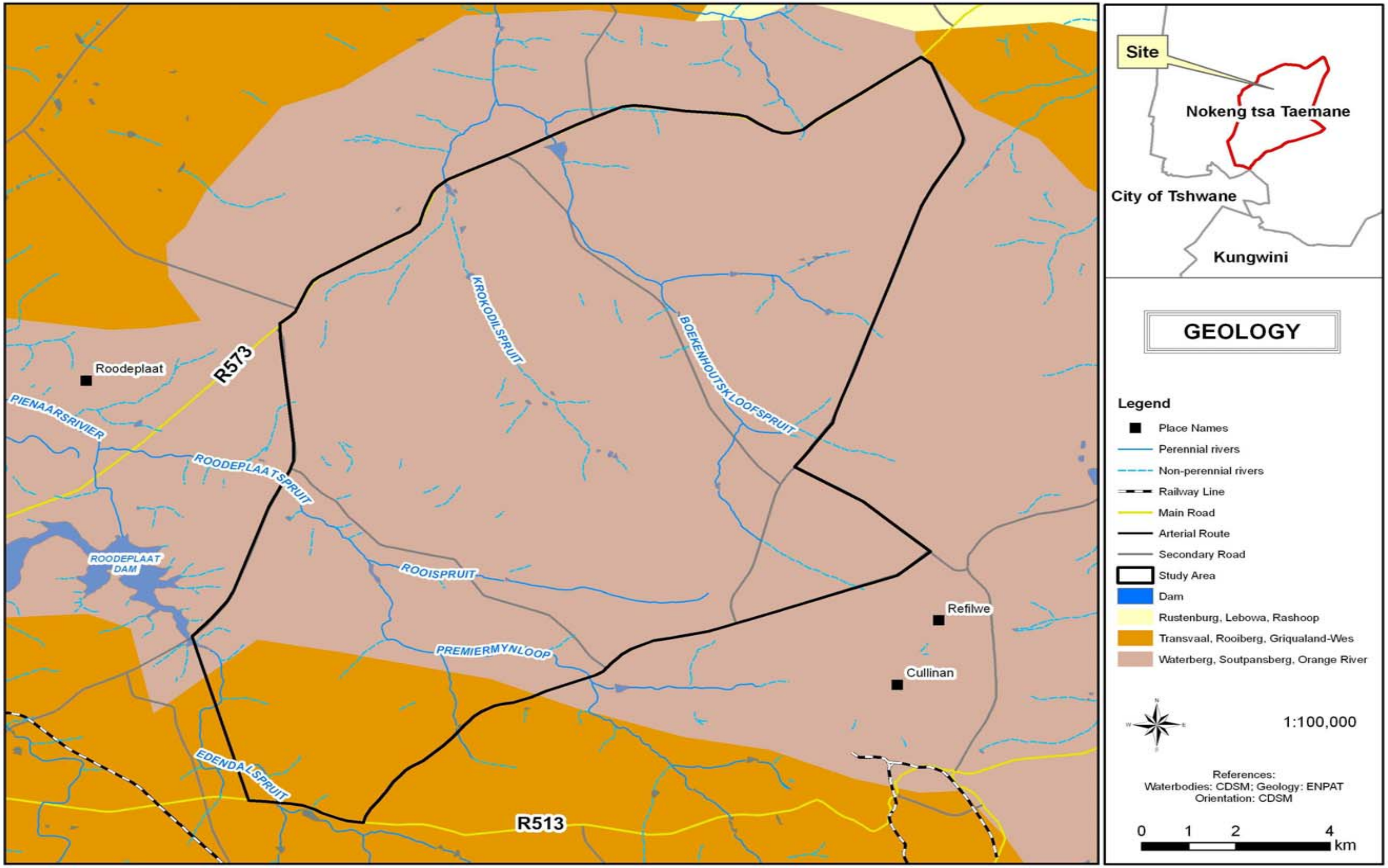

Figure 2.7: Map of the Geology of the Seringveld Conservancy.

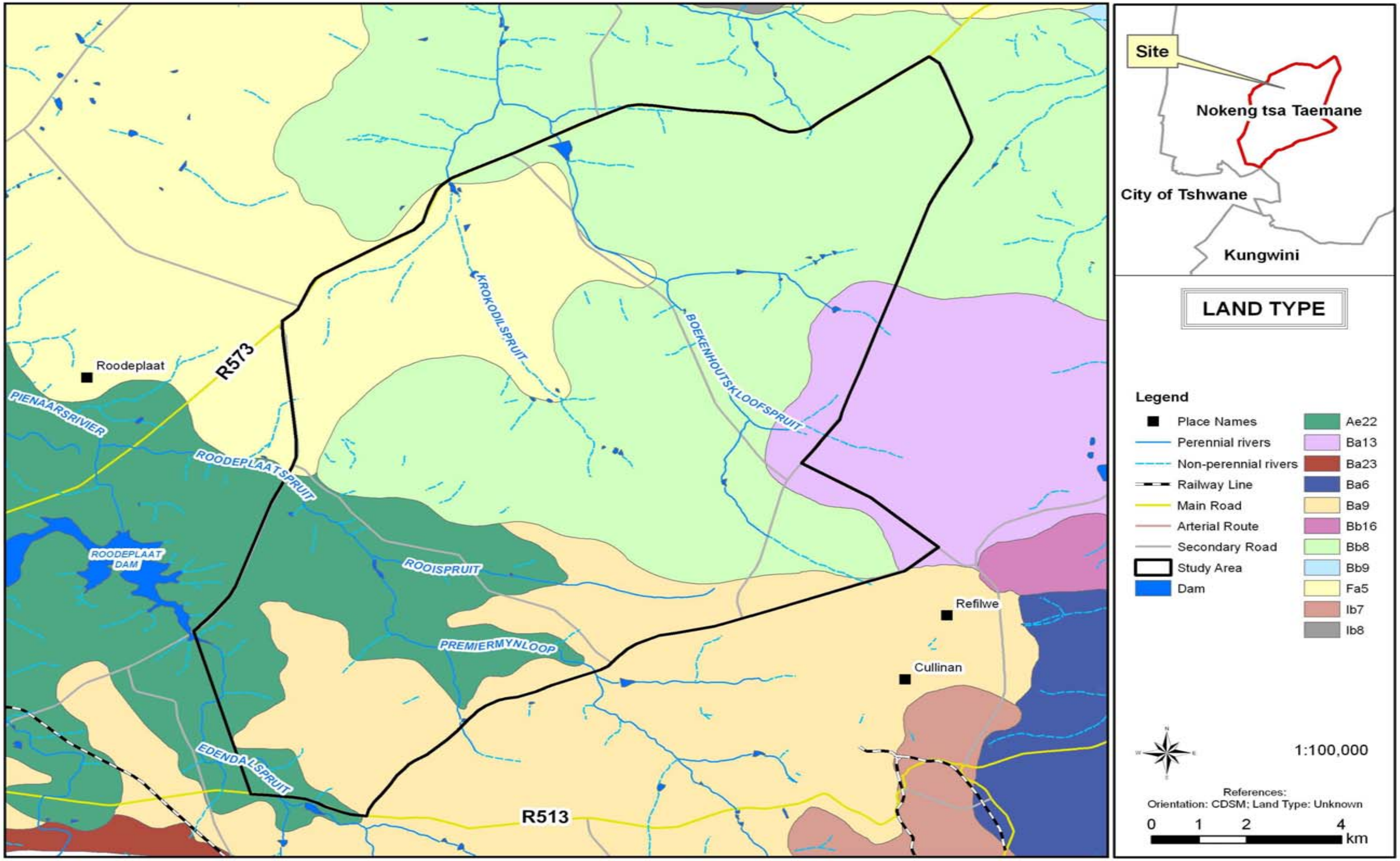

Figure 2.8: Land types present in the Seringveld Conservancy

3. Savanna

The importance of savanna as a vegetation type in global perspective is evident in the fact that it covers twelve percent of the global land surface (Scholes & Hall, 1996). Savanna is also one of the world's major biomes. The largest biome in southern Africa (South Africa, Lesotho and Swaziland) is the Savanna biome covering 32.5 percent of the total surface area (Rutherford *et al.*, 2006 b). Working in an area which is an ecotone between the Grassland and Savanna biomes posed a major headache as to when a wooded grassland is seen as a grassland and a when it is seen as a savanna. The trail of thoughts which follow aims at solving this complex problem.

3.1. Trying to define Savanna ?

The most often used definition to describe savanna as a vegetation type is: "Savanna is a vegetation type with a well developed grassy layer and an upper layer of woody plants, which can vary from widely spaced to 75 percent tree cover" (Bredenkamp, 1999). This definition is very similar to the definition used to describe tall grassland with a tree synusia covering 10 – 40 percent. This vegetation unit was described by UNESCO (1973) as: "This is like a very open woodland with more or less continuous ground cover (over 50 percent) of tall graminoids". Although UNESCO clearly stated in the same article that they would not provide a definition for savanna because there are too many conflicting interpretations of the vegetation unit. The tall grassland with a tree synusia covering 10 – 40 percent still falls within the grassland vegetation types rather than a savanna vegetation type. The boundary between herbaceous and woodland vegetation was set at 40 percent by UNESCO, therefore woodland contains a tree layer covering more than 40 percent with trees higher than 5 meters and non-interlocking crowns (1973). Figure 3.1 matches the definition of tall grassland with tree synusia covering 10-40 present but should this not rather be classified as a savanna vegetation type than a grassland vegetation type especially in the tropical regions of the world? Just as grasslands in the northern and southern hemisphere are quite different from one another (UNESCO 1973; Bredenkamp *et al.,* 2002) so are the savannas different to the forest and open woodlands in temperate regions. Since the present study has focused on the description of plant communities, rather than an overview of savannas of the world, this question will not be answered but it might be useful for future literature studies. The most recent literature studies by Furley (2004) on tropical savannas of the world did not attempt to answer the question.

Figure 3.1. Vegetation consisting of tall grassland and trees covering between 10 and 40 percent in South Africa.

When trying to define a certain type of vegetation it is always important to keep in mind the scale at which the definition is applicable. For example in South Africa the definition for savanna (Bredenkamp, 1999) is based on physiognomic appearance of the savannas' but at biome level (higher hierarchy) savannas are not only defined based on vegetation structure but on the basis of macro climate as well as disturbance (Rutherford *et al.*, 2006 b). In any definition, describing a certain vegetation unit should therefore clearly state at which level in the classification hierarchy the definition holds. Then there is another question could savannas be defined on a global scale?

The answer starts with solving the problem of defining a threshold for total tree cover and or abundance for savanna. Savanna lies somewhere in between grassland containing no tree species and a thicket which contains entangled trees or shrubs. In Figure 3.2 the possible parameters for defining savanna on a global scale is highlighted. The distance in between trees and the level of overlap of tree canopies as well as cover should be given a certain range which is diagnostic of savanna. If two trees are present in grassland and their cover is relatively small compared to the cover of the grass layer and the distance between these trees, are relatively big the vegetation type is considered to be wooded grassland? As soon as the grass layer is present but there is a slight overlap between a few individual trees and they form clumps the vegetation type is defined as bush clumps and hence is a form of savanna. If the overlap of tree canopies is more than 75 percent and the trees, still from clumps the type of savanna is referred to as woodland. In terms of global environmental parameters, the most important factor that controls the gradient between grasslands and savanna and between savanna and thicket is climate (Bredenkamp, 1999; Lubke, 1999). The height of the woody vegetation, in order for it to be defined as savanna, should also be taken into consideration i.e. can a shrubland with a prominent grass layer also be considered to be savanna? The origin of the trees is also important i.e. whether the trees are tropical or whether the trees are temperate in origin (Bredenkamp *et al.,* 2002). Human impacts i.e. cutting of trees can also deteriorate a more woody vegetation type to secondary grassland. Should secondary grasslands in tropical areas be defined as grassland or as a savanna? These are but a few factors that can be mentioned that might use as a guide when trying to define the threshold between savanna and grassland.

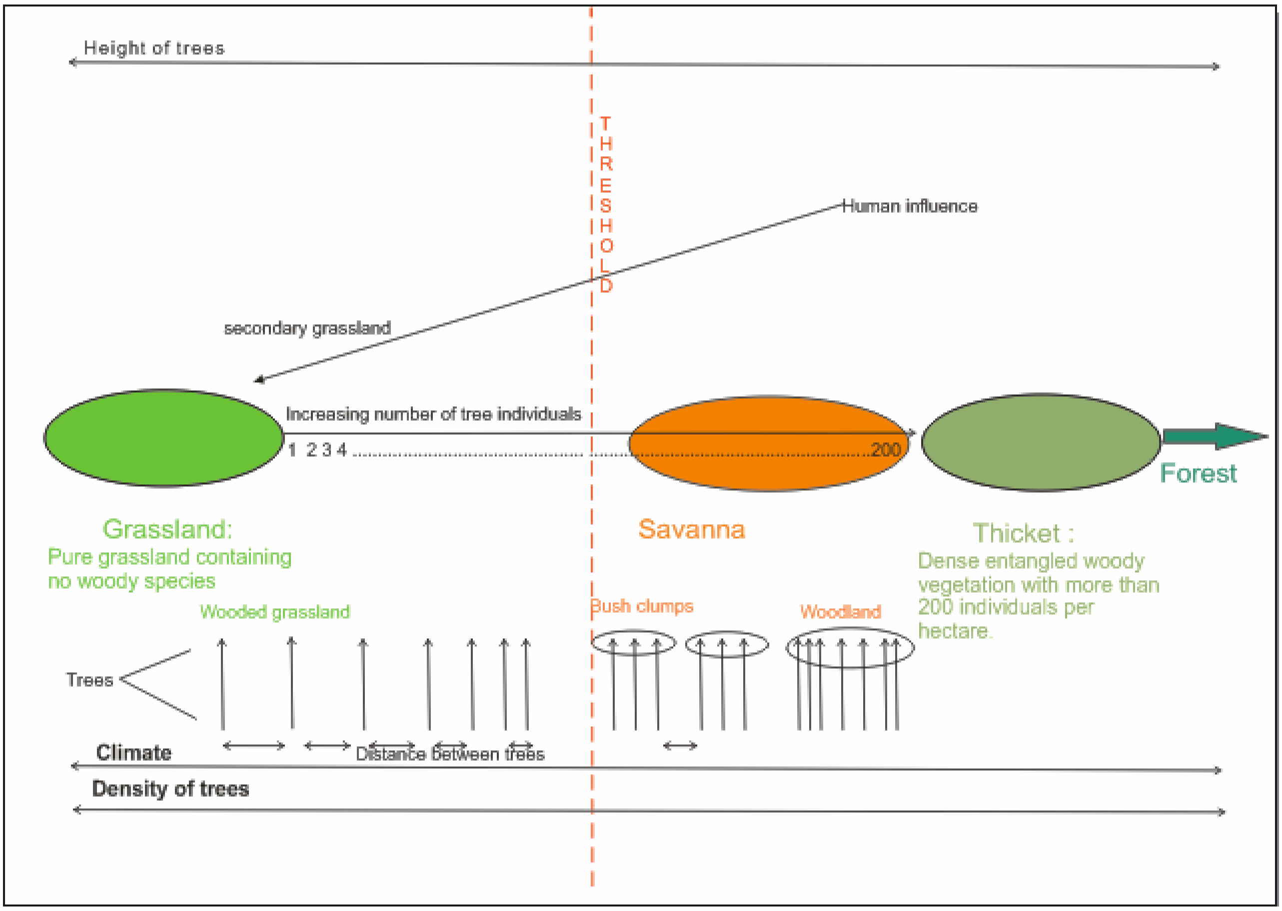

Figure 3.2: Factors that have to be taken into consideration when trying to define a global definition for savannas.

As the study area is considered to be savanna at local scale, this study will refer to savanna as described by Bredenkamp (1999). It is however clear that there is a continuous gradient form grassland via sparsely wooded vegetation, to densely wooded vegetation to thicket and forest. The problem of differentiating grassland from savanna is therefore: where to place the boundaries within the gradient. In southern African context, however, it is cleat that the distribution of typical primary grassland is controlled by temperature (cooler climatic areas), while savannas are restricted to warmer climatic areas (Bredenkamp *et al.,* 2002). The absence of trees in these cooler grassland area are explained by the fact that southern African woody species had a tropical origin, and that these tropical tees did not have adequate time to adapt to the cooler condition further south or at higher altitudes. Almost all typical southern African trees are killed by frost when attempting to plant them in gardens in grassland conditions.

The Seringveld Conservancy (study area) is situated in the Bankenveld (Acocks, 1989), which is a topographically complex area consisting if an undulating terrain of hills, ridges and plains , exactly at the latitude and altitude which results in the threshold temperatures that cause the differentiation between the grassland and savanna (Bredenkamp *et al.,* 2002). Therefore, the Seringveld Conservancy is situated in the transitional zone (threshold area) between the typical Grassland biome (cooler conditions at higher altitudes) and Savanna biome (warmer conditions at lower altitudes). Therefore, typical savanna communities occur in sheltered warmer sites within the study area, while typical grassland communities occur n the cooler exposed sites. It must be emphasised that these grassland communities are primary grassland. Secondary grassland communities, under strong influence and the result of human activities, also occurs within the study area. These secondary plant communities are easily distinguished from primary grassland based on floristic composition.

3.2. Complexity and the underlying driving forces in Southern Africa savanna.

The complexity of savanna does not end by the complex relationship that exists between the tree and grass layer that forms the vegetation type. Seven driving forces have been identified in savanna namely fire, grazing pressure, climate, soil available moisture, soil available nutrients, competition between the tree and grass layers and human influence (Skarp, 1992; Scholes, 1997; Bredenkamp, 1999). The main driving forces in southern African savannas are fire, climate, soil fertility, and competition between the tree and grass layers (Scholes, 1997; Bredenkamp, 1999)

A successional model for savanna dynamics was accepted for a long period of time by vegetation managers in South Africa. The successional model is based on an equilibrium model. When conditions in the niche of the plant is both favourable and has a certain degree of stability, i.e. in an area where nutrients, water and light are readily available to the plant with little variation throughout the year the ecosystem is seen as an equilibrium system. However, there has been a major change in the thought of the dynamics present in savanna. Bredenkamp & Brown (2009) state that there is a gradient present between equilibrium and non-equilibrium dynamics in savanna ecosystems of southern Africa. Moist savannas, according to the same authors, occur more on the equilibrium side of the gradient and dry savannas are present on the non-equilibrium side of the gradient (Bredenkamp & Brown, 2006, 2009)

Ecosystems in equilibrium are controlled by negative feedback control mechanisms responding to biotic interactions and fire. Equilibrium model savannas are degraded and destabilised by overstocking or fire. Management of the degraded ecosystem is then aimed at restoring the equilibrium by reducing the grazing pressure and controlling fire though management. Overstocking and fire are the main negative feed back control mechanisms present in southern African savannas. Stochastic events like droughts inhibit a system to attain an equilibrium status (Bredenkamp & Brown 2006, 2009).

In the non - equilibrium model the ecosystem is controlled by external control mechanisms. These control mechanisms are abiotic and the ecosystem is event driven. These abiotic control mechanisms are less predictable than the biotic control mechanisms of the equilibrium model. The abiotic factors in a non-equilibrium model overwhelm the biotic factors i.e. vegetation suffering from a severe drought (abiotic factor) are influenced more by the drought than the grazing pressure and hence reducing the grazing pressure will not restore the system to equilibrium (Bredenkamp & Brown 2006, 2009).

In southern Africa, there is a strong rainfall gradient from dry in the west to wet in the east. Moist savannas occur in the east of the country whilst going to the more arid western region of the country drier savannas are present (Sholes, 1997; Bredenkamp & Brown 2006, 2009). Southern African savannas can also be divided based on functional type namely fine leaved savannas and broad leaved savannas. Fine leaved savannas occur on nutrient rich clay soils whilst broad leaved savannas occur on leached sandy soils (Sholes, 1997; Bredenkamp, 1999; Bredenkamp & Brown 2006, 2009). Sandy particles are either angular or rounded and have a relatively low surface area because of its large size. Clay soils on the other hand have a smaller size relative to sandy soils and a larger surface area. The larger surface area it allows clay soils to absorb more water as well as other substances. Hence, clay soils are also able to absorb more nutrients and hence are more nutrient rich than sandy soils. Sandy soils are more leached than clay soils (Brady & Weil, 2002). Browsers prefer fine leaved savanna not only because of the high nutritional value but because broad leaved species contain digestion retarding substances in particular tannins ((Sholes, 1997; Bredenkamp & Brown 2006, 2009). Differences in herbivore selection can play a role in the dynamics of different savanna ecosystems.

Fire cannot be ignored as an important factor in the influence of savanna vegetation structure. Fire decreases the number of tree seedlings as well as small trees. Nutrient cycling also benefits from the presence of fire in the ecosystem. Fire frequency and intensity is different in different types of savanna in southern Africa (Bredenkamp & Brown 2009).

Savanna dynamics is primarily influenced by climate especially rainfall. There is also a gradient present between the equilibrium dynamics in wet savanna and non-equilibrium dynamics in arid savannas. The different types of savanna determined by different savanna dynamics are therefore all at different points on the equilibrium : non-equilibrium gradient. The position of the particular savanna type at a certain spatial location on the gradient is determined by the ratio to which equilibrium to non-equilibrium processes occur. On a temporal scale the position of the savanna type may change on the equilibrium : non-equilibrium gradient due to climatic factors i.e. rainfall (Bredenkamp & Brown 2009).

Biotic or abiotic factors that influence the availability of water i.e. soil texture, soil chemistry, soil depth, topography, temperature, animals, fire as well as human disturbance can influence the position of the savanna type on the equilibrium : non-equilibrium gradient. Although herbivory does not play such a big role as climate on the position of the savanna type on the gradient in conditions of severe drought high grazing pressure can further enhance the drought conditions (Bredenkamp & Brown, 2009).

4. Methodology

4.1. Field survey

From December 2007, two site visits were done to obtain a general overview of the area. Sampling was conducted form the 30th of January until the 1st of May 2008 and again in December 2008. A list with all of the farms that form part of the Seringveld Conservancy was obtained form the chairman Jan Visser. Only farms that form part of the Seringveld Conservancy could be sampled. The area was stratified into physiognomic units by the use of aerial photographs, 1:25 000, as well as a topographical map (Department of Agriculture, 2008). On the aerial photographs homogenous units i.e. hills, valleys, slopes etc were identified and delineated. Old agricultural holdings and mines were delineated and excluded from sampling. The wetlands of the area were sampled by another researcher and hence excluded from sampling (Pretorius, 2008). One hundred and twenty five sample plots were located in a randomly stratified manner over the Conservancy (Figure 4.1). This method has been supported by various researchers (Bredenkamp, 1975, 1982; Du Preez, 1991; Bezuidenhout, 1993, Brown 1997; Swanepoel, 2006; Mostert, 2007, Mostert *et al,* 2008). At the start of the project, however for safety reasons and in order to gain knowledge on the species of the area survey work was only conducted on the farm of Jan Visser.

Plot size was 10 x10 m in size. Data collection was done using the Braun-Blanquet sampling technique (Braun-Blanquet, 1932; Werger, 1974; Westhoff & Van der Maarel, 1978; Kent & Coker, 2000). According to Werger (1974), the Braun-Blanquet method is an efficient as well as a reliable tool for vegetation surveys and vegetation classification. Relevés where compiled in each of the 125 sample plots. A relevé captures floristic data as well as associated environmental data (Eckhardt, 1993). The floristic component that was noted for each sample plot contained the species list as well as the cover abundance of each species. Cover in this scenario refers to aerial cover in other words the cover that a species will have when it is projected vertically onto the ground. The cover abundance scale contains seven different units these are:

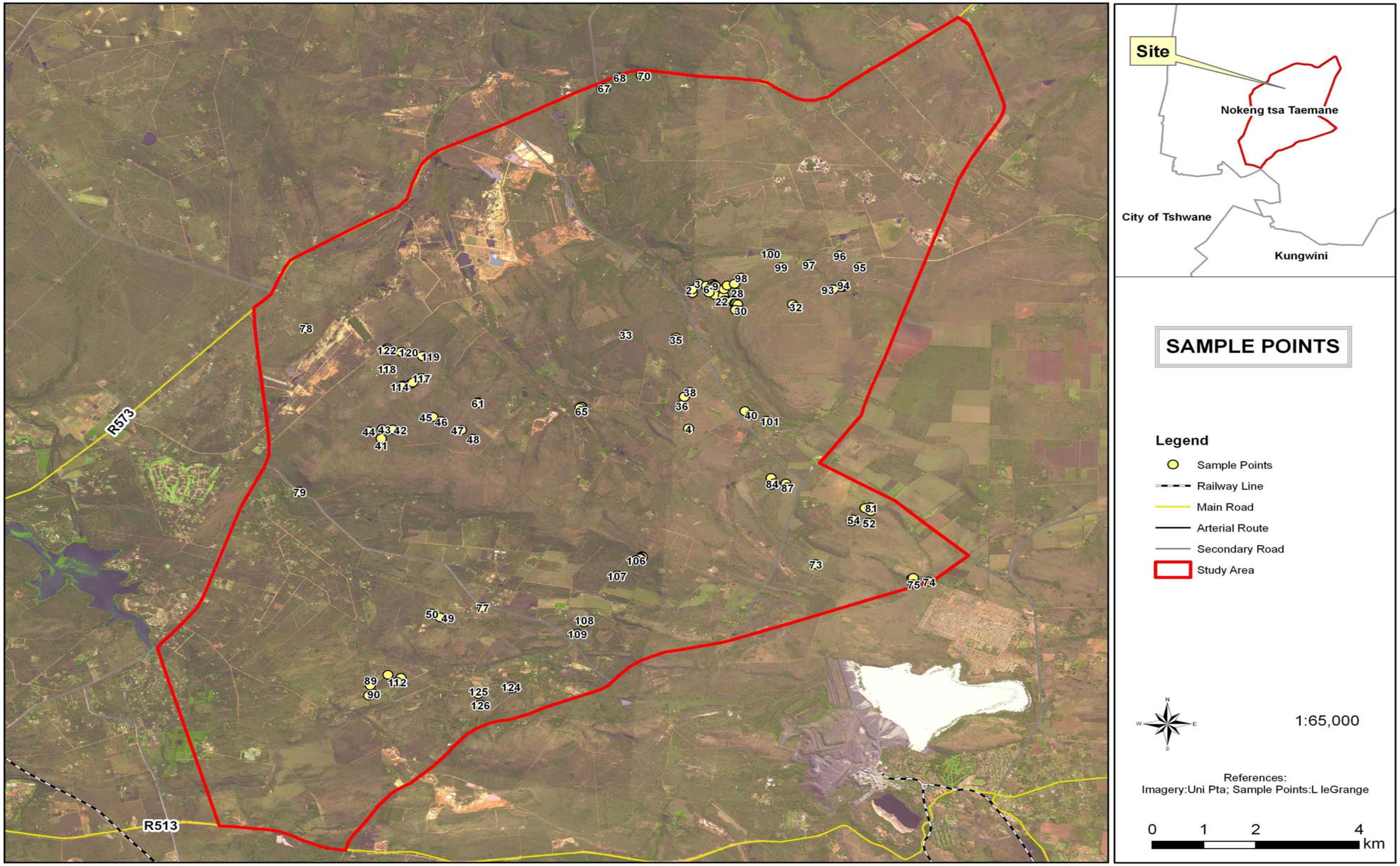

Figure 3.1. Positions of 125 sample plots on a SPOT 5 image.

- r= Value assigned to species which are rare and have a negligible cover
- += Value assigned to species that are abundant but have a cover value of less than 1%.
- 1= Numerous covering but less than 1 % of the quadrate area or not so abundant but covering 1-5% of the quadrate area
- 2= Very numerous and covering less than 5% or covering 5-25% of the quadrate area independent of abundance
- 3= Covering 25-50% of the quadrate area independent of abundance.
- 4= Covering 50-75% of the quadrate independent of abundance
- 5= Covering 75-100% of the quadrate area independent of abundance.

There are also 2 sub units at unit 2 these are:

- 2a= Covering between 5-12% of the quadrate area independent of abundance
- 2b= Covering between 13-25% of the quadrate area independent of abundance.

The use of these to sub units is the decision of the end user but it has been shown as more adequate in surveys conducted in South Africa (Werger, 1974). The vegetation was also divided into a tree, shrub, grass and herb layer and for each layer the percentage cover was estimates. For every layer the highest, average and lowest lengths were estimated.

The GPS co-ordinates were noted for each relevé. Environmental variables that were noted at each sample plot were aspect, slope, rock cover, rock size, altitude. An estimated level of disturbance was assigned to each relevé ranging from low to high levels of disturbance. Additional comments were also recorded and these comments included the location of the sample plot i.e. on which farm and where on the farm, the presence of livestock etc. At each sample plot, a photo was taken and the photo number was also recorded on the data sheet.

Species identification occurred in the field and in the H.G.W.J, Schweickert herbarium of the University of Pretoria as well as with the help of reference books i.e. Van Wyk & Malan (1997), Van Oudtshoorn (2002) Van Wyk & Van Wyk (1997).

4.2. Data analysis

Collected data was captured into the electronic vegetation database TURBOVEG for Windows version 2.80 (Hennekens,1996; Hennekens & Schaminèe, 2001). The data was then exported to JUICE 7.0.28. (Tichý, 2002). After data was imported in JUICE 7.0.28. a Two-Way Indicator Species Analysis or TWINSPAN (Hill, 1979a) analysis was done. The following parameters were used to conduct the TWINSPAN:

- Pseudospecies cut levels: 7
- Values of the cut levels: 0, 1, 5, 12, 25, 50, 75
- Minimum group size: 5
- Maximum level of divisions: 6

After the results form the TWINSPAN was obtained, a modified TWINSPAN was conducted. A modified TWINSPAN allows the user to set the number of clusters present in the classification. The modified TWINSPAN still uses divisive classification. The same parameters were used to conduct the modified TWINSPAN but the number of clusters were selected as 30 and average Jaccard dissimilarity was selected as the statistical parameter (Tichý,*et al.,* 2007; Tichý,*et al.,* 2009). From the TWINSPAN analysis group 10 was selected and a dendogram was constructed.

Next the synoptic table was constructed. Fidelity is described as:" The degree to which a species is concentrated in a given vegetation unit" (Bruelheide, 2000). The synoptic table was constructed in JUICE with the help of a fidelity measure. The fidelity measure that was chosen was the hypergeometric *u*-value (u_{hyp}) because the data set is too small to obtain accurate results with phi coefficients (Bruelheide, 2000; Tichý & Chytrý, 2006). The lower limit of the fidelity threshold was set to 2 and the upper to 4. The entire data set was sorted according to the fidelity measure. The synoptic table was then exported as a RTF file. The analysis of the constancy columns was done next. The fidelity threshold was set to 2, the frequency threshold was set to 40 and the cover threshold was set to 40. The file was saved and later opened in Microsoft word.

The phytosociological table was constructed from the same TWINSPAN results and the species had already been sorted according to the fidelity measure u_{hyp}. From the TWINSPAN dendogram, it was clear that Groups 1-7 formed one cluster and groups 8-10 formed another hence the table was split accordingly. The tables were then refined by making use Braun-Blanquet procedures (Bredenkamp *et al.,* 1989; Du Preez & Venter, 1990; Brown, 1997; Mostert, 2007). For both of the tables the plant communities were described and classified. The naming of the plant communities was done according to the recommendations of Barkman *et al.* (1976). Each plant community was ascribed a binomial name. The name of the diagnostic species was used as the first part of the plant community name whilst the second part is the name of a dominant species in the plant community. Diagnostic species in JUICE are defined as:" Species with a distinct concentration of occurrence or abundance in a particular vegetation unit" (Chytrý & Tichý, 2003). Diagnostic species were determined in terms of fidelity while dominant species and constant were identified according to their percentage cover or frequency of occurrence. Dominant species are defined by Chytrý & Tichý (2003) as:" Species which often attain high cover values in the given vegetation unit". In this data set, dominant species were specified as species with a percentage cover higher than 40 percent. Constant species are defined as:" Species with a high occurrence frequency in a given vegetation unit" (Chytrý & Tichý, 2003). The frequency threshold for selecting constant species in JUICE was set as 40 percent frequency of occurrence.

Ordination was done using the computer programme PC-ORD 5 (McCune & Mefford, 2006). Ordinations that were conducted included, Bray-Curtis polar ordination (Bray & Curtis, 1957) and Non-Metric Multidimensional Scaling abbreviated as NMS (Kruskal & Wish, 1978). The only other ordination that seemed viable to the data set was CCA but it was not performed. The reason for this being is that the data was that the environmental factors were not known prior to the ordinationand hence the CCA (Conocial Correspondence Analysis) was not suited for the data (Ter Braak, 1986; Ter Braak, 1994; McCune & Mefford, 2006; Peck, 2009). Species cover data was selected rather than absence presence data in TURBOVEG before the data base was exported. The main matrix was imported from the TURBOVEG data base. A second matrix was constructed in excel to match the relevé numbers to the plant communities to which they belong and then imported in PC-ORD 5. A Bray-Curtis analysis was conducted and on the data and the distance measure selected was relative Sørensen. Variance regression was selected as the endpoint selection and the city block distance measures were selected as the axis projection as well as the residual distance. The main matrix that was exported form the TURBOVEG data base as a cornel condensed file species absence presence data was selected rather than percentage cover. This was selected because the area had high species richness but only a few species had a high percentage cover. A second matrix was constructed in excel to match the relevé numbers to the plant communities to which they belong and then imported to PR-ORD 5. The Jaccard distance measure that was selected. The parameter set up was as follows:

- Number of axis:2
- Number of runs within the real data: 50
- Stability criterion: 0.00001
- Iterations to evaluate stability: 15
- Maximum number of iterations:250
- Starting co-ordinates were random numbers

The NMS was run and the two dimensional as well as three dimensional results were obtained.

SPOT 5 images as well as areal photographs of the area were obtained for the Department of Geography of the University of Pretoria (Poli *et al.*, 2004). From TURBOVEG the header data could be exported to excel and the GPS co-ordinates of the sample plots were then converted to a shape file in ArcCatalog using WGS 1984 as a reference point. The Geographic Information Systems (GIS) maps were then further developed by ECOGIS[1].

A vegetation map of the area was produced. This was constructed using the SPOT 5 images as well as the sample plots. All of the sample plots belonging to one community as determined from the synoptic table were made the same colour. Old as well as current agricultural holdings and mining sites were mapped in two distinct colours separate form the plant communities. Polygons containing sample plots form the same plant community could be demarcated on the SPOT 5 image. ECOGIS further constructed the vegetation map. . [1]

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[1] ECOGIS- Vee Cowie (ecogis@telkomsa.net)

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4.3. Presentation of results

The results are presented as follow. Firstly, the dendogram obtained from TWINSPAN (Hill, 1979a) is presented. Following the TWINSPAN, the two phytosociological tables are displayed as well as the description of the plant communities and sub-communities present in the phytosociological table. The description of the plant communities includes a representative photo of each plant community. Factors that used to describe each plant community include species composition as well as the environmental variables responsible for the presence of the plant community. From the analysis of the synoptic table in JUICE 7.0. an list of diagnostic, constant, dominant species for each plant community was obtained and the list is not be presented as a separate result but rather included in the description of the plant communities.

To further enhance the relevance of the phytosociological tables the synoptic table is presented. Due to the fact that the synoptic table was constructed using u_{hyp} as the fidelity measure the synoptic table has a not only an ecological significance but also a statistical significance. If the u_{hyp} value was bigger than 2 the plant community also is significantly different from the other plant communities. The average positive fidelity values for each plant community obtained from JUICE 7.0. is also included indicating the statistical significance of each plant community (Tichý & Chytrý, 2006).

The Bray-Curtis ordination results were not included. Despite selecting all the possible parameters to lesser the extent of clustering the ordination was still too clustered for any interpretation to follow. Only the NMS (Non-Metric Multidimensional Scaling) ordination will be presented. Vegetation can be seen as a mosaic of continuity and discontinuity (Bredenkamp *et al.*, 2001). Both ordination as well as the Braun-Blanquet method puts emphasis on continuity and discontinuity. However whilst the Braun-Blanquet approach is more focused on species individuality the ordination approach puts its emphasis on species groupings. Therefore, the ordination should aid in explaining the variation present form the classification. Environmental gradients are responsible for the variation in species as well as community patterns. Floristic data provides the basis on which both ordination as well as classification is based excluding environmental data and hence the environmental interpretation of the data is conducted as a separate step (Gauch, 1982; Mostert, 2007).

The GIS maps obtained from ECO GIS are be discussed. The vegetation map will be discussed first. Gauteng Department of Agriculture, Conservation and Environment (GDACE) have developed a conservation plan of the whole province. The maps presented are based on the data from GDACE and they highlight sensitive features as well as ecological processes that are imperative for the conservation of the biodiversity of the Province. A map including the ridges policy also from GDACE is included (Pfab, 2001).

5. Results & Discussion

5.1. TWINSPAN dendogram

The modified TWINSPAN analysis indicated that there are 10 main plant communities. The TWINSPAN also provided the basis on which the phytosociological table was split into two in order for the table to be clearly presented and interpreted. Plant communities one to seven are more closely related to one another than to plant communities eight to ten and the phytosociological table was split accordingly (Figure 5.1.). Communities one to seven are moist communities that occur on clay soils with while communities eight, nine and ten are drier communities that occur on sandy soils. This result is further supported by the NMS ordination that is discussed later on.

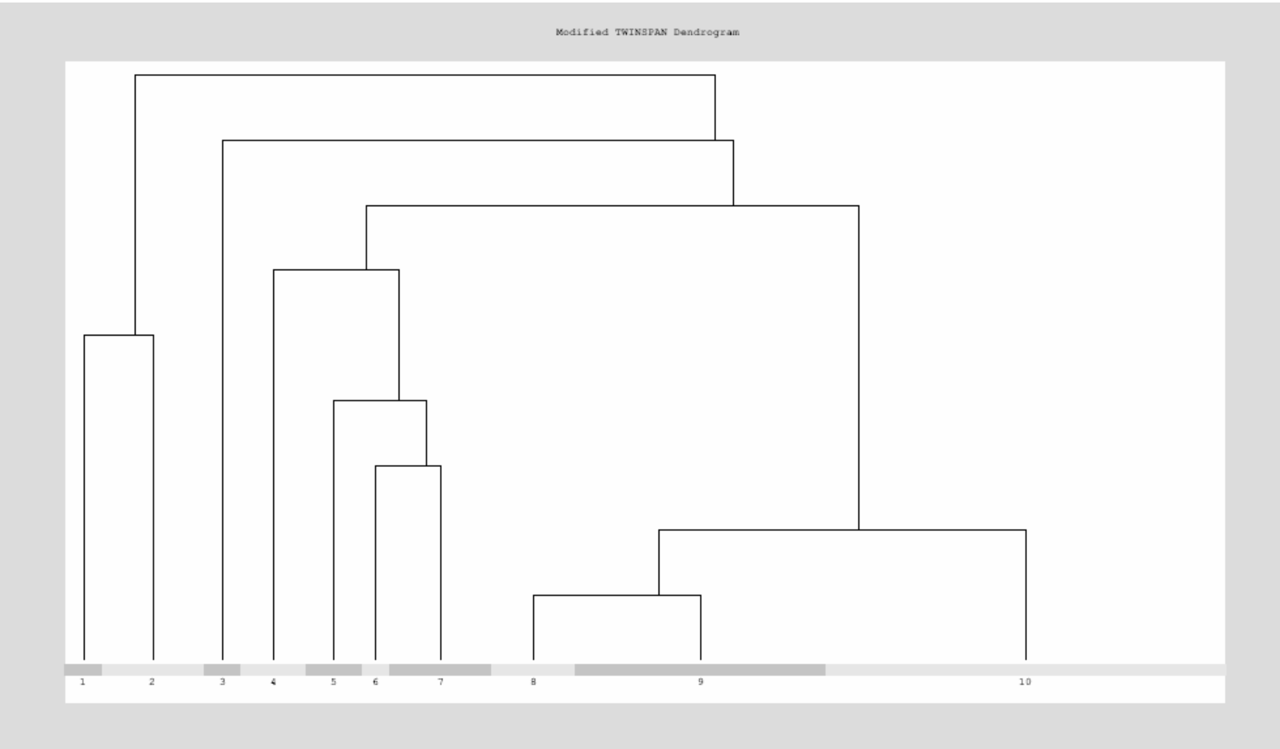

Figure 5.1: Modified TWINSPAN analysis results indication that there are 10 main plant communities present. Plant communities one to seven are more related to one another then to plan communities eight to ten.

The 10 major plant communities are:

1. *Acacia mearnsii – Acacia caffra* riparian woodland on nutrient rich clay soils with a slight slope
2. *Combretum apiculatum – Croton gratissimus* dense woodland on steep mid slopes with boulders present
3. *Osteospermum muricatum - Paspalum urvillei* secondary grassland on recently utilised agricultural fields with clay soil.
4. *Elionurus muticus –Setaria sphacelata* grassland community on clay soils.
5. *Elephantorrhiza elephantina – Faurea saligna* bush clumps on loamy soils
6. *Pteridium aquilinum - Heteropyxis natalensis* sheltered woodland.
7. *Hyperthelia dissoluta – Acacia karroo* sweet open savanna on nutrient rich clay soils.
8. *Sphenostylis angustifolia – Melinis nerviglumis* shrubland with rocks.

   8.1. *Myrothamnus flabellifolius- Croton gratissimus* open shrubland on rock sheets with smaller rocks present.

   8.2. *Sphenostylis angustifolia – Protea caffra* open woodland on southern slopes on rock outcrops.
9. *Combretum molle – Lannea discolor* bush clumps.
10. *Trachypogon spicatus – Loudetia simplex* rocky grassland on sandy soils.

5.2. Description of the plant communities

Community 1: *Acacia mearnsii – Acacia caffra* riparian woodland on nutrient rich clay soils with a slight slope

Figure 5.2: *Acacia mearnsii – Acacia caffra* riparian woodland on nutrient rich clay soils with a slight slope.

Habitat

The habitat in which this plant community occurs is predominantly near water streams and usually with nutrient rich clay soils. No rocks or boulders are present in this habitat. The slope on which this woodland occurs was less than three degrees and on the southern slopes mostly (Figure 5.2). Two of the sample plots were located adjacent to the Boekenhoutskloofspruit.

<u>*Vegetation*</u>

The vegetation of the area can best be described as dense woodland. The trees are mostly fine-leaved but still form a dense canopy. The tree layer is dominant over the gras / forb layer. Parts of this plant community are severely invaded by *Acacia mearnsii* (Figure 5.2). These invaded areas may be regarded as a separate sub-community, as suggested by the distribution of the diagnostic species in species group 1 (Table 5.1). The community is represented by four relevés (Table 5.1 & Table 5.3).

Diagnostic species

Plant species that are considered to be diagnostic, as determined from the analysis of the phytosociological table (Table 5.1) as well as the synoptic table (Table 5.3) fall within species group 1 in both the tables. The diagnostic woody species are *Acacia mearnsii* and *Euclea undulata.* Diagnostic forbs include *Oxalis depressa* and *Gerbera piloselloides*.

Dominant species

Dominant woody species are *Acacia mearnsii, Euclea undulata* (Species group 1), *.Ziziphus mucronata*, *Acacia caffra,* (Species group 3) and *Acacia karroo* (Species group 8). The dominant grass species for this plant community is the shade-loving grass *Panicum maximum* (Species group 3).

Constant species

Constant woody species are *Searsia leptodictya, Dombeya rotundifolia, Berchemia discolor, Celtis africana* (Species group 3) and *Faurea saligna* (Species group 6). Constant grasses include *Setaria sphacelata* and *Themeda triandra* (Species group 11), while constantly present forbs include *Tagetes minuta, Conyza bonariensis* and *Lantana camara* (Species group 11).

The plant community is similar to the *Acacia dealbata* rivirine woodland of Swanepoel (2006), Acacia caffra – *Pavetta gardenifolia* closed woodland of Combrink (2000) and the *Acacia caffra* – *Setaria sphacelata* closed woodland (Coetzee, 1993). All of these communities occur on the foot hill of the catena as well as the southern slope. The *Acacia dealbata* community of Swanepoel (2006) contains a diagnostic as well as dominant invasive species along the Wilge River similar to the *Acacia mearnsii* occurring along the Boekenhoutskloof spruit.

Community 2: *Combretum apiculatum – Croton gratissimus* dense woodland on steep mid-slopes with boulders present

Habitat

The community occurs predominantly on steep, moist north-facing, and occasionally on steep south-facing mid-slopes with large boulders. Due to its position on the steep mid-slopes and the presence of large boulders, the vegetation is more sheltered than on the crests or plateaus of the ridges (Figure 5.3).

Figure 5.3: *Combretum apiculatum – Croton gratissimus* dense woodland on steep mid slopes with boulders present.

<u>*Vegetation*</u>

The structure of the plant community can best be described as dense woodland (Figure 5.3). The tree layers forms a dense canopy over the grass / forb layer and hence is dominant over the grass / forb layer. A number of invasive species are present in this community. The plant community is represented by eleven relevés (Table 5.1 & Table 5.3).

Diagnostic species

Diagnostic species are represented by species group 2 in Table 5.1 &Table 5.3. The diagnostic woody species present in this dense woodland community are *Combretum apiculatum, Croton gratissimus, Pappea capensis, Diplorynchus condylocarpon, Euclea crispa, Combretum molle, Englerophytum magalismontanum, Bridelia mollis, Lannea discolor, Gymnosporia buxifolia* and *Braychylaena rotundata*. *Setaria lindenbergiana* was the diagnostic grass species present in the vegetation unit. Diagnostic forbs are *Achyranthes aspera, Cheilanthes viridis, Hibscus calyphyllus* and *Phyllanthus maderaspatensis.*

Dominant species

The dominant woody species is *Croton gratissimus*, *Combretum apiculatum* (species group 2) *Acacia caffra* and *Dombeya rotundifolia* (Species group 3). *Setaria lindenbergiana* is the dominant grass species present (Species group 2).

Constant species

Constant woody species are *Euclea crispa, Combretum molle, Englerophytum magalismontanum, Bridelia mollis, Pappea capensis, Lannea discolor, Brachylaena rotundata* (Species group 2), *Acacia caffra, Ziziphus mucronata, Searsia leptodictya*, *Dichrostachys cinerea* and *Celtis africana* (Species group 3). Constant grass species include *Panicum maximum* (Species group 3), *Setaria sphacelata* and *Melinis repens* (Species group 11). Constant forbs include *Achyranthes aspera*, *Cheilanthes viridis*, *Hibscus calyphyllus, Solanum panduriforme* (Species group 2), *Lantana rugosa* (Species group 3), and the weeds *Tagetes minuta, Conyza bonariensis* and *Lantana camara* (Species group 11)

The community is similar to the *Combretum apiculatum* - *Dombeya rotundifolia* bushveld of the northern slopes in the Byenespoort game park (Hauptfleisch, 1999). The *Burkea africana – Ochna pulchta – Croton gratissimus* north facing slope woodland found in the Ezemvelo Nature Reserve (Swanepoel, 2006) also shows similarity in species composition.

Community 3: *Osteospermum muricatum - Paspalum urvillei* secondary grassland on recently utilised agricultural fields with clay soil.

Figure 5.4: *Osteospermum muricatum - Paspalum urvillei* secondary grassland on recently utilised agricultural fields with clay soil.

<u>*Habitat*</u>

This secondary grassland community occurs on agricultural fields that were recently cultivated, approximately within the last 5 years. The community occurs on level terrain with nutrient rich clay soils. Invasive, weedy species are quite often present on these old agricultural fields. There are no rocks or boulders present in the community (Figure 5.4).

Vegetation

This is a grassland community, mostly without any woody species present. The absence of woody plants is often the result of the agricultural activity; however, this type of habitat is often covered by (primary) grassland, due to the specific cooler climatic conditions on the plains. This plant community can be seen as one of the intra-zonal pockets of the Rand Highveld Grassland within the savanna biome (Mucina *et al.,* 2006). The community is represented by four relevés (Table 5.1 & Table 5.3).

Diagnostic species

The diagnostic species are represented by species group four in Table 5.1 and Table 4.3. There are no diagnostic woody species present in this plant community. The diagnostic grass species is *Paspalum urvillei* and *Hyparrhenia hirta.* Diagnostic forbs include *Osteospermum muricatum, Oxalis corniculata, Kleinia longiflora, Hibiscus microcarpus, Cucumis zeyheri* and *Cotula anthemoides.*

Dominant species

The only dominant woody species that occurs in the community is *Acacia karroo* (Species group 9). *Paspalum urvillei* is both a dominant as well as the diagnostic grass species in the community (Species group 4). *Eragrostis curvula* (Species group 10) and *Themeda triandra* are other prominent grass species (Species group 11). The dominant forb is the naturalised, weedy *Verbena bonariensis* (Species group 10).

Constant species

The constantly present grass species in the community are *Digitaria eriantha, Setaria sphacelata* and *Melinis repens* (Species group 11). Constant forbs species are the weeds *Pseudognaphalium luteo-album, Waltheria indica* and *Conyza albida* (Species group 10).

Community 4: *Elionurus muticus – Setaria sphacelata* grassland community on clay soils.

Figure 5.5: *Elionurus muticus –Setaria sphacelata* grassland community on clay soils.

Habitat

The community comprises of 7 relevés. The community is present on nutrient rich clay soils. The slope of the community is less than 1% and no rocks or boulders are present (Figure 5.5.). The high water table in this plant community may be responsible for the lack of woody species.

Vegetation

The vegetation can be described as a grassland and can also be seen as one of the intra-zonal pockets of the Rand Highveld grassland. Some wetland species are present in the community, indicating wetter conditions caused by the high water table. In two sample plots (relevé 81and 107) small *Acacia karroo* trees of less than half a meter in size were present. No other tree species was present in the community. The community is represented by seven relevés (Table 5.1 & Table 5.3).

Diagnostic species

Diagnostic species are represented by species group five in Table 5.1 and Table 5.3. No diagnostic woody species was present in this plant community. Diagnostic grass species are *Elionurus muticus, Tristachya biseriata* and *Eragrostis superba.* Diagnostic forbs are *Hermannia depressa, Nidorella hottentotica, Hypoxis iridifolia, Lippia rehmannii* and *Triumfetta sonderi.*

Dominant species

Dominant species present in the plant community are only grass species namely *Setaria sphacelata, Themeda triandra* (Species group 11) and *Eragrostis curvula* (Species group 10).

Constant species

The constant woody species is *Acacia karroo* (Species group 8). Constant grass species are *Melinis repens, Heteropogon contortus* (Species group 11) *Cyperus rupestris* and *Harpochloa falx* (Species group 5). Forbs species that are constantly present in the community include *Aloe greatheadii, Senecio venosus, Conyza bonariensis* (Species group 11) and *Helichrysum rugulosum* (Species group 10).

Community 5: *Elephantorrhiza elephantina – Faurea saligna* bush clumps on loamy soils.

<u>Habitat</u>

The community is mostly situated on plains between ridges. Seasonal wetlands are often present on these plains. There are no rocks or boulders present in this plant community. The slope of this plant community is less than one degree (Figure 5.6).

Vegetation

The community has a clear distinction between the grass and the tree layer. The grass layer also contains wetland species like *Cyperus denudatus*. The community is represented by six relevés (Table 5.1 & Table 5.3).

Figure 5.6: *Elephantorrhiza elephantina – Faurea saligna* bush clumps on nutrient rich clay soils.

Diagnostic species

Species group six represents the diagnostic species of this community (Table 5.1 & Table 5.3). The diagnostic woody species is *Faurea saligna*. Diagnostic grass species are *Eragrostis gummiflua,* and *Aristida diffusa*. Diagnostic forbs include *Bulbostylis hispidula, Elephantorrhiza elephantina, Polygala hottentotta, Oldenlandia herbacea, Agathisanthemum bojeri, Schkuhria pinnata, Gomphrena celosioides, Monsonia angustifolia, Helichrysum coriaceum, Cyperus denudatus, Cleome macrophylla, Lannea edulis, Phylica parviflora* and *Hypoxis acuminata.*

Dominant species

Faurea saligna is both the dominant and diagnostic woody species (Species group 6). The dominant grass species are *Eragrostis gummiflua* (Species group 6) and *Setaria sphacelata* (Species group 11). Dominant forbs are *Elephantorrhiza elephantina, Schkuhria pinnata* (Species group 6) and *Tagetes minuta* (Species group 11).

Constant species

Constant grass species are *Themeda triandra* (Species group 11), *Eragrostis curvula* (Species group 10) and *Pogonarthria squarrosa* (Species group 9) while the sedge *Bulbostylis hispidula* (Species group 6) is also constantly present. Constant forbs include *Polygala hottentotta* (Species group 6), *Vernonia poskeana,* and also the weeds *Bidens bipinnata* (Species group 9), *Pseudognaphalium luteo-album, Conyza albida* (Species group 10) *Conyza bonariensis* and *Pentarrhinum insipidum* (Species group 11).

Community 6: *Pteridium aquilinum - Heteropyxis natalensis* sheltered woodland

Figure 5.7: *Pteridium aquilinum - Heteropyxis natalensis* sheltered woodland.

Habitat

The plant community occurs in the kloof of the Boekenhoutskloofspruit stream as well as on lower slopes. The area is very rocky and large rock sheets are evident. The plants find shelter under and around the rock plates as well as boulders. The soil layer is shallow and contains a high organic component. South-facing slopes under 10 degrees are characteristic of the community (Figure 5.7). Seepage or drainage lines cause an increase in water available for the plant communities (Swanepoel, 2006; Coetzee, 1993). Generally, the community occurs in moister and more sheltered conditions than the other south facing rocky communities which are more exposed.

Vegetation

The tree layer is not adequately dense to form woodland, though it is still prominent. The layer of the encroaching fern *Pteridium aquilinum* is very prominent but in the absence of this species, the herb-grass layer is not dense. Invasive species are present. Only three relevés represent this community (Table 5.1 & Table 5.3).

Diagnostic species

Species group 7 represents the diagnostic species (Table 5.1 & Table 5.3). Diagnostic woody species include *Heteropyxis natalensis* and *Searsia pyroides*. Diagnostic forbs include *Stoebe vulgaris* and *Ceratotheca triloba.*

Dominant species

The dominant woody species is *Combretum erythrophyllum* (Species group 7). There is only one dominant grass species namely *Eragrostis curvula* (Species group 10). The two dominant forbs are *Pteridium aquilinum* (Species group 7) and *Tagetes minuta* (Species group 11).

Constant species

Woody species that are constant are *Faurea saligna* (Species group 6) and *Dombeya rotundifolia* (Species group 3). A constant grass species is *Melinis repens* (Species group 11). The constant forbs are the weedy *Ceratotheca triloba* (Species group 7) *Tagetes minuta* and *Lantana camara* (Species group 11).

This plant community was also found in the Ezemvelo Nature Reserve close to Bronkhorspruit by Swanepoel (2006). The *Heteropyxis natalensis – Pteridium aquilinum* sheltered woodland community of Ezemvelo shares floristic similarity to the *Pteridium aquilinum - Heteropyxis natalensis* community in the Seringveld Conservancy. The communities both occur in sheltered kloofs on south facing slopes. Both of these communities have an increase in water supply not only because of the presence of a stream or river but also because of the presence of seepage and drainage lines.

According to Swanepoel (2006) the *Heteropyxis natalensis – Pteridium aquilinum* sheltered woodland in Ezemvelo shares similarity to the *Coleochloa setifera – Cheilanthes hirta* sparse shrubland described by Coetzee (1993). The *Pteridium aquilinum - Heteropyxis natalensis* community in the Seringveld Conservancy does not share floristic similarity to he *Coleochloa setifera – Cheilanthes hirta* sparse shrubland. Although the *Coleochloa setifera – Cheilanthes hirta* sparse shrubland is present on rock sheets like the *Pteridium aquilinum - Heteropyxis natalensis* community in the Seringveld it is thought that this community because of its presence on the upper steep slopes is more exposed to extreme climatic conditions. Because the *Pteridium aquilinum - Heteropyxis natalensis* community in the Seringveld is situated in a kloof formed by the Boekenhoutskloofspruit it is more shelterd. The *Heteropyxis natalensis – Pteridium aquilinum* sheltered woodland in Ezemvelo is also situated in a sheltered kloof and hence this may explain the similarity in floristic composition.

Community 7: *Hyperthelia dissoluta – Acacia karroo* sweet open savanna on nutrient rich clay soils.

Habitat

The community is situated on the foot slopes of ridges in the area or on the platos. The community may occur on flat areas or with a slight slope less than three degrees. If a slope is present, the community is predominantly on the south-facing slope. The soil is clayey and nutrient rich. Rocks and boulders may occur in the plant community but there is mostly very little rock cover (Figure 5.8).

Vegetation

The community has a distinct grass and tree layer. There are quite a number of invasive species present. Furthermore, disturbance is also indicated by the pioneer grass species *Perotis patens*. The community is represented by eleven relevés (Table 5.1 & Table 5.3).

Figure 5.8: *Hyperthelia dissoluta – Acacia karroo* sweet open savanna on nutrient rich clay soils.

Diagnostic species

Diagnostic species are represented by species group eight in Table 5.1 and Table 5.3. Diagnostic woody species is *Acacia karroo.* The diagnostic grass species are the tall-growing *Hyperthelia dissoluta* and *Preotis patens*. The diagnostic forbs include the weed *Richardia brasiliensis* and *Felicia mossamemedensis*.

Dominant species

Acacia karroo is the dominant woody species whilst *Hyperthelia dissoluta* (Species group 8), *Eragrostis curvula* (Species group 10) and *Melinis repens* (Species group 11) are the dominant grass species. The dominant forb is *Richardia brasiliensis* (Species group 8).

Constant species

Constant grass species are *Perotis patens* (Species group 8) and *Digitaria eriantha* (Species group 11). Constant forbs are the weeds *Pseudognaphalium luteo-album* (Species group 10), *Tagetes minuta* and *Conyza bonariensis* and the succulent *Aloe greatheadii* (Species group 11).

The plant community shares floristic similarity to the *Cynodon dactylon – Acacia Karroo* bushveld in the Byenespoort Game Reserve as described by Hauptfleisch (1999). The Byenespoort Game Park borders the Seringveld on its southern border and lies in between the Seringveld Conservancy and the Cullinan Conservancy (Figure 2.1). The *Hyperthelia dissoluta – Acacia karroo* sweet open savanna of the Seringveld especially shares floristic similarity with the *Solanum panduriforme – Acacia karroo* disturbed bushveld variation of the *Cynodon dactylon – Acacia Karroo* bushveld in Byenespoort. Disturbance as well as the same habitat is most likely the explanation to the floristic similarity. Because of the close proximity of the Byenespoort Game Park to the Seringveld it would be interesting to include the data of the *Cynodon dactylon – Acacia karroo* bushveld in the Seringveld data set.

Table 4.1.: Phytosociological table of the moister communities on clay soil of the Seringveld Conservancy

Relevé number:	82	77	99	100	96	3	105	79	78	69	68	67	66	66	117	84	86	85	83	124	120	121	125	81	106	123	39	31	43	41	95	44	55	90	93	74	75	49	50	123	108	94	54	98	40	111
Communities	**1**				**2**											**3**				**4**							**5**						**6**			**7**										
Species Group 1																																														
Acacia mearnsii	.	.	5	5	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euclea undulata	1	1	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oxalis depressa	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gerbera piloselloides	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Species Group 2																																														
Achyranthes aspera	.	.	.	.	+	.	+	+	+	+	1	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.
Combretum apiculatum	.	.	.	.	.	+	.	1	.	1	1	1	1	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.
Cheilanthes viridis	.	.	.	.	+	.	+	+	.	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	+	.	.
Croton gratissimus	.	.	.	.	2	4	.	.	.	.	2	3	2	2	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pappea capensis	.	.	.	.	.	+	+	.	.	+	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hibiscus calyphyllus	.	2	.	.	.	.	.	.	+	+	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Diplorhynchus condylocarpon	.	.	.	.	.	.	.	.	.	+	+	2	+	1	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Setaria lindenbergiana	.	.	.	.	2	.	.	.	.	3	2	2	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Euclea crispa	.	.	.	.	.	+	1	.	2	.	.	+	.	+	.	.	.	.	.	.	.	.	.	1	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Combretum molle	.	.	.	.	1	+	.	2	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Englerophytum magalismontanum	.	.	.	.	1	+	.	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bridelia mollis	.	.	.	.	.	.	.	.	.	+	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lannea discolor	.	.	.	.	1	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gymnosporia buxifolia	.	.	.	.	+	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Solanum panduriforme	.	.	.	.	.	.	.	+	+	.	+	.	.	.	.	+	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.
Phyllanthus maderaspatensis	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Brachylaena rotundata	.	.	.	.	.	.	.	.	.	.	+	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sporobolus africanus	.	.	.	.	2	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhoicissus tridentata	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Relevé number:	82	77	99	100	96	3	105	79	78	69	68	67	66	66	117	84	86	85	83	124	120	121	125	81	106	123	39	31	43	41	95	44	55	90	93	74	75	49	50	123	108	94	54	98	40	111
Communities	**1**				**2**											**3**				**4**							**5**						**6**			**7**										
Species group 2																																														
Opuntia ficus-indica	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Pavonia burchellii	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tragia dioica	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Canthium mundianum	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Strychnos pungens	.	.	.	.	.	.	.	.	.	.	.	+	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Spirostachys africana	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Species Group 3																																														
Acacia caffra	.	3	.	.	2	+	+	.	1	1	1	+	+	1	.	.	.	.	.	.	.	.	.	.	1	.	+	+	r	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	2	1
Ziziphus mucronata	1	+	+	.	.	+	+	+	+	+	1	+	+	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.
Dombeya rotundifolia	+	.	1	.	1	+	.	2	+	1	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	+	.	.	.	.	.	.	.	.
Panicum maximum	.	1	+	+	+	+	.	.	1	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.
Searsia leptodictya	.	1	+	.	+	.	.	.	1	+	.	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Dichrostachys cinerea	.	+	.	.	.	.	.	.	+	+	1	+	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.
Lantana rugosa	+	.	.	.	.	.	1	.	.	.	+	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Celtis africana	.	+	.	+	.	.	.	.	.	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Ehretia rigida	.	+	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Rhynchosia venulosa	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aloe marlothii	.	2	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Berchemia discolor	.	1	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sida dregei	.	+	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Relevé number:	82	77	99	100	96	3	105	79	78	69	68	67	66	66	117	84	86	85	83	124	120	121	125	81	106	123	39	31	43	41	95	44	55	90	93	74	75	49	50	123	108	94	54	98	40	111
Communities	**1**				**2**											**3**				**4**							**5**						**6**			**7**										
Species Group 4																																														
Paspalum urvillei	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	4	4	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.
Hyparrhenia hirta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	1	.	2	.	.	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	.	.	2	.	.	+	.	.	.	.
Cucumis zeyheri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Osteospermum muricatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oxalis corniculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cotula anthemoides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Unknown species 21	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hibiscus microcarpus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Kleinia longiflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gomphocarpus fruticosus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Sphenostylis angustifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Species Group 5																																														
Elionurus muticus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	1	.	3	+	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lippia rehmannii	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	1	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+
Nidorella hottentotica	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+
Hypoxis iridifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	r	.	.	.
Triumfetta sonderi	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	1	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Harpochloa falx	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	2	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cyperus rupestris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	3	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hermannia depressa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Tristachya biseriata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Eragrostis superba	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Relevé number:	82	77	99	100	96	3	105	79	78	69	68	67	66	66	117	84	86	85	83	124	120	121	125	81	106	123	39	31	43	41	95	44	55	90	93	74	75	49	50	123	108	94	54	98	40	111
Communities	**1**				**2**											**3**				**4**							**5**						**6**			**7**										
Species Group 6																																														
Faurea saligna	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	3	4	.	2	.	.	.	.	.	.	.	.	.	.	.	.
Elephantorrhiza elephantina	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Bulbostylis hispidula	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	+	.	.	.	.	.	.	.	r	.	.	.	+	.	.	.
Polygala hottentotta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Oldenlandia herbacea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.
Eragrostis gummiflua	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	.	.	.	.	+	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Agathisanthemum bojeri	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Schkuhria pinnata	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Gomphrena celosioides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Aristida diffusa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.
Monsonia angustifolia	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	r	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Helichrysum coriaceum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cyperus denudatus	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Cleome macrophylla	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lannea edulis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Phylica parviflora	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Hypoxis acuminata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Species Group 7																																														
Heteropyxis natalensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	2	2	.	.	.	.	.	.	.	.	.	.	.
Ceratotheca triloba	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	+	.	+	.	.	.	.	.	.	.	.	.	.	.
Stoebe vulgaris	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	.	.	.
Crepis hypochoeridea	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	+	.	.	.	.
Ptedidium aquilinum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	4	.	.	.	.	.	.	.	.	.	.	.	.
Rubus rigida	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.
Helichrysum acutatum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.	.

Relevé number:	82	77	99	100	96	3	105	79	78	69	68	67	66	66	117	84	86	85	83	124	120	121	125	81	106	123	39	31	43	41	95	44	55	90	93	74	75	49	50	123	108	94	54	98	40	111
Communities	**1**				**2**											**3**				**4**							**5**						**6**			**7**										
Species group 7																																														
Combretum erythrophyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	.	.	.	.	.	.	.	.	.	.	.
Searsia pyroides	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.
Dipcadi rigidifolium	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	.
Species Group 8																																														
Acacia karroo	3	2	.	.	.	.	.	.	1	.	.	.	.	.	.	+	3	.	.	.	.	.	.	+	2	.	.	.	.	.	.	.	.	.	.	2	3	2	2	1	.	.	3	.	.	.
Hyperthelia dissoluta	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	.	.	.	.	.	2	.	3	+	3	3	4	5	3
Richardia brasiliensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	+	.	.	.	.	+	2	2	.	.	.	+	+	r	+
Perotis patens	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	r	+	1	.	+	.	.	.	.
Felicia muricata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	1	.	.	.	.
Felicia mossamedensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	+	.	1	.	.	.	1
Species Group 9																																														
Commelina africana	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	+	+	.	.	+	.	.	+	.	+	.	r	.	+	.	.	.	+	.	.
Phyllanthus parvulus	.	.	.	.	+	.	.	+	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	.	.	+	.	.	+	.	.	+	.	.	.	2	.	.	.	.
Bidens bipinnata	.	.	.	.	.	5	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2	+	.	.	+	.	.	.	.	.	+	.	.	.	.	.	+	+	.
Vernonia poskeana	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	3	+	.	.	+	.	.	.	.	.	+	+	.	.	.	r	.	.	.
Pogonarthria squarrosa	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	3	+	.	.	.	.	.	.	.	.	.	2	+	.	.	.	1	.	1	.
Sesamum triphyllum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	.	+	.
Cleome maculata	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	r	.	.	.	+	.	.	.	.	.	.	.	.

Relevé number:				1			1								1					1	1	1	1		1	1															1	1					1
	8	7	9	0	9		0	7	7	6	6	6	6	6	1	8	8	8	8	2	2	2	2	8	0	2	3	3	4	4	9	4	5	9	9	7	7	4	5	2	0	9	5	9	4	1
	2	7	9	0	6	3	5	9	8	9	8	7	6	6	7	4	6	5	3	4	0	1	5	1	6	3	9	1	3	1	5	4	5	0	3	4	5	9	0	3	8	4	4	8	0	1
Communities	**1**				**2**											**3**				**4**							**5**						**6**			**7**										
Species Group 10																																														
Eragrostis curvula	+	.	.	.	1	.	.	.	.	.	.	.	.	.	.	1	.	.	2	+	2	3	.	+	+	1	r	.	.	+	+	+	.	+	2	2	3	+	+	2	2	+	.	1	+	.
Pseudognaphalium luteo-album	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	+	.	+	+	.	.	.	.	1	+	+	+	+	+	.	.	+	.	.	+	+	.	1	.	+	+	+	1
Conyza albida	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	+	+	+	+	+	+	.	.	+	.	.	+	+	.	.	+	.	+	+	+
Helichrysum rugulosum	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	2	1	.	.	+	.	2	+	.	.	r	.	.	.	.	.	+	.	.	+	.	+	.	.	+	.	.	.	.
Verbena bonariensis	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	2	1	.	.	.	.	+	.	.	.	.	.	.	1	.	.	+	.	.	.	.	.	.	.	+	.	+	+	+
Waltheria indica	.	.	.	.	+	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	.	1	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	+
Species Group 11																																														
Tagetes minuta	.	+	.	+	+	2	+	.	+	+	+	1	1	+	+	.	.	.	.	.	+	+	.	.	.	.	1	2	+	r	.	+	4	+	+	2	+	+	.	.	+	.	2	+	1	+
Conyza bonariensis	+	.	.	+	.	.	+	+	+	r	.	.	.	.	.	.	+	.	.	.	+	+	+	.	.	.	+	+	+	+	+	+	.	+	.	+	+	+	+	.	+	.	+	.	+	.
Melinis repens	.	.	.	.	+	.	1	1	.	.	.	.	.	.	.	.	+	.	.	.	+	.	+	.	+	1	.	.	+	.	+	.	+	1	.	+	+	+	+	2	3	1	r	1	.	+
Setaria sphacelata	1	.	.	.	.	.	1	.	.	.	+	.	2	2	.	+	.	.	.	2	3	1	3	+	+	2	+	+	1	1	2	+	.	.	2	.	.	.	.	.	.	.	r	.	.	.
Aloe greatheadii	+	.	.	.	+	+	+	.	.	.	.	.	.	.	.	.	+	.	+	.	+	.	.	+	+	+	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	+	+	.	2
Pentarrhinum insipidum	.	.	.	.	.	.	+	+	.	r	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	+	+	.	.	+	+	.	.	+	+	.	.	.	.	.	+	.	.	+
Themeda triandra	1	.	.	.	.	.	2	.	.	.	.	.	.	.	.	1	.	2	.	.	+	.	2	2	1	.	.	+	1	+	.	+	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Lantana camara	.	2	.	.	+	.	+	1	1	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	r	.	.	.	.	.	+	1	.	.	.	.	.	.	.	.	+	.	+	.
Senecio venosus	.	.	.	.	.	+	.	.	.	.	+	.	.	.	.	.	.	.	.	+	.	.	+	+	.	.	.	.	+	+	.	.	.	.	.	.	.	.	.	.	.	.	+	.	.	.
Heteropogon contortus	.	.	.	.	.	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	.	1	+	.	+	.	.	.	.	1	+	.	.	.	.	.	.	.	+	.	+	.	.	.	.	.
Digitaria eriantha	.	.	.	.	.	.	.	+	.	.	.	.	.	.	.	1	.	.	2	.	.	.	.	.	.	.	.	.	+	.	.	.	.	.	.	2	1	.	+	+	.	.	.	.	.	.

Community 8: *Sphenostylis angustifolia – Melinis nerviglumis* shrubland with rocks

Habitat

The community occurs mostly on rocky outcrops or rocky sheets. The community also occurs on south facing slopes and in generally dry and exposed to frost in winter. Where soil is present, it is gravely and shallow (Figure 5.9, Figure 5.10).

Vegetation

Woody species are present on these rocky outcrops but the climatic conditions are more sever on the southern facing slopes and hence young seedlings battle to establish themselves Trees also battle with the drier conditions and the lack of water on the southern facing slopes. In this community, there are two variations or sub communities present. The plant community contains 9 relevés (Table 5.2 & Table 5.4).

Diagnostic species

The diagnostic species are represented in Table 5.2 & Table 5.4 by species group 12 and species group 13. The diagnostic woody species are *Croton gratissimus* and *Combretum apiculatum*. Diagnostic grass species is *Brachiaria serrata* and *Elionurus muticus*. *Myrothamnus flabellifolius*, *Zornia linearis, Chameacrista mimosoides, Sphenostylis angustifolia, Ipomoea obscura, Cyanotis speciosa, Kalanchoe thyrsiflora,* and *Diathus mooiensis* are diagnostic forbs.

Dominant species

Dominant grass species include *Diheteropogon amplectens* (Species group 17), *Melinis nerviglumis* and *Themeda triandra* (Species group 19).

Constant species

Constant grass species include *Loudetia simplex, Trhistachya biseriata*. The constant forbs are *Sphenostylis angustifolia* (Species group 13), *Ipomoea crassipes*, *Xerophyta retinervis* (Species group 17), *Cheilanthes viridis* and *Commelina africana* (Species group 18).

Sub Community 8.1: *Myrothamnus flabellifolius – Croton gratissimus* open shrubland on rock sheets.

Figure 5.9: *Myrothamnus flabellifolius – Croton gratissimus* open shrubland on rock sheets with smaller rocks present.

Habitat

The sub community occurs on southern facing slopes. The slope is generally less than 3 degrees. The area is dry and very rocky with rock plates as well as rocks present. The soil layer is very shallow (Figure 5.9).

Vegetation

The vegetation of the sub community can best be described as an open shrubland. *Croton gratissimus* does occur in the site as the dominant tree but these trees are still young and less than a meter in size. *Myrothamnus flabellifolius* has adapted to the extreme dry conditions present in the area. The sub community contains three relevés (Table 5.2 & Table 5.4).

Diagnostic species

Diagnostic species are represented by species group 12 in Table 5.2 and Table 5.4. *Croton gratissimus* and *Combretum apiculatum* are the diagnostic woody species. Diagnostic forbs are *Zornia linearis* and *Myrothamnus flabellifolius* (Table 5.2, Species group 13).

Dominant species

Dominant woody species is *Croton gratissimus* (Species group 13). Dominant grass species is *Melinis nerviglumis* (Species group 19). Dominant forbes include *Myrothamnus flabellifolius* (Species group 13) and *Cyperus rupestris* (Species group 19).

Constant species

The only constant species is the fern *Cheilanthes viridis* (Species group 19).

The sub community shares floristic similarity with the *Myrothamnus flabellifolius – Urisina nana* grassland in the Witbank Nature reserve as described by Combrink (2000). Like the *Myrothamnus flabellifolius – Croton gratissimus* sub community in the Seringveld the habitat is extremely rocky in the Witbank Nature Reserve.

<u>Sub community 8.2: *Sphenostylis angustufolia – Protea caffra* open woodland on rock outcrops.</u>

<u>*Habitat*</u>

The shrubland occurs on the rocky outcrops on the southern slopes of the Conservancy. The rock size in this sub community doesn't form sheets but rather just loose rocks and hence difference in floristic composition with sub community 8.1. The slope where the sub community occurs fluctuates between 4 – 10 degrees. The rock cover of the sub community ranges from between 40 – 85 percent (Figure 5.10).

Vegetation

The southern slopes provide a favourable environment for shrubs like *Xerophyta retinervis*. The sub community also contains *Burkea africana* where there is a bit of sandy soil available closer to the foothill of the ridge. The *Burkea africana* trees present in the sub community are not as big as the species present on the plains between the ridges in the Conservancy. The sub community is represented by six relevés (Table 5.2 & Table 5.4).

Figure 5.10: *Sphenostylis angustufolia – Protea caffra* open woodland on southern slopes on rock outcrops.

Diagnostic species

Diagnostic species are represented by species group 13 in Table 5.2 & Table 5.4. The diagnostic grass species for this sub community are *Brachiaria serrata* and *Elionurus muticus*. The diagnostic forbs are *Chameecrista mimosoides, Sphenostylis angustifolia Ipomoea obscura, Cyanotis speciosa, Kalanchoe thrysiflora* and *Diathus mooiensis.*

Dominant species

Dominant woody species present in the sub community is *Protea caffra* and *Burkea africana* (Species group 17). Dominant grass species include *Diheteropogon amplectens* (Species group 17), *Themeda triandra* and *Melinis nerviglumis* (Species group 18). Dominant forbs include *Xerophyta retinervis* (Species group 17).

Constant species

Constant woody species is *Strychnos pungens* (Species group 17). *Loudetia* simplex and *Tristachya biseriata* are constant grass species. *Ancylobotrys capensis,Ipomoea crassipes, Bulbostylis hispudula* (Species group 17) and *Commelina africana* (Species group 18) are the constant forbs.

The sub community is similar in floristic composition to the *Loudetia simplex - Protea caffra* open shrubland in Ezemvelo as described by Swanepoel (2006), the *Protea caffra – Athrixia elata* open woodland (Coetzee, 1993) as well as the *Protea caffra – Athrixia elata* open woodland sub community in the Witbank Nature Reserve (Combrink, 2000).

Community 9: *Combretum molle – Lannea discolor* bush clumps present with small rocks

<u>*Habitat*</u>

The community occurs either on the plato of a ridge and closer to the plato than plant community two. Therefore, the community is less sheltered against climatic variables and hence less dense. On the plato the presence of small rocks provide shelter to some extent. This allows the tree species to germinate. Where the rocks become less there is a decrease in the number of trees and an increase in grass species. The area contains a small rocks and rock cover is less than 6 %. The slope ranges from 1- 6 percent (Figure 5.11).

Figure 5.11: *Combretum molle – Lannea discolor* bush clumps present with small rocks.

Vegetation

The trees form clumps and are not as dense as the woodland of plant community two. There is quite a persistent grass layer present although it does not as prominent as the *Hyperthelia dissoluta* layer in community 7 or the grassland communities 3 and 4. The community consist out of 23 relevés (Table 5.2 & Table 5.4).

Diagnostic species

The diagnostic woody species is *Combretum molle*, *Lannea discolor, Euclea crispa, Combretum zeyheri* and *Searsia leptodictya.* The diagnostic grass is *Eragrostis curvula*. *Kalanchoe paniculata, Fuirena pubescens, Dipcadi ciliare*, *Polichia campestris* and *Dichapetalum cymosum* are diagnostic forbs for the community (Table 5.2. & Table 5.4; Species group 14).

Dominant species

Dominant woody species of the community are *Lannea discolor, Combretum zeyheri* (Species group 14), *Faurea saligna* (Species group 16), *Burkea africana*, *Stychnos pungens* (Species group 17) and *Vangueria infausta* (Species group 18). Dominant grasses include *Diheteropogon amplectens, Loudetia simplex, Tristachya biseriata* (Species group 17) and *Melinis repens* (Species group 18). Dominant forbs are *Kalancahoe paniculata* (Species group 14), *Indigophora comosa* (Species group 16), *Ancylobotrys capensis* (Species group 17) and *Tagetes minuta* (Species group 18).

Constant species

Ochna pulchra (Species group 17) is the only constant woody species present in the plant community. Constant grass species is *Eragrostis curvula* (Species group 14). Constant forbs are *Oldenlandia herbacea, Asparagus suaveolens, Indigopfera comosa* (Species group 16), *Bulbostylis hispidula* (Species group 17), *Aloe greatheadii, Cheilathes viridis, Phyllanthus parvulus* and *Conyza bonariensis* (Species group 18).

The community is similar in species composition to the *Burkea africana – Eragrostis curvula* bush clumps community found in Ezemvelo (Swanepoel, 2006). Both the community in the Seringveld and in Ezemvelo occurs on sandy soils. They also both have a slight slope. The community in the Seringveld also corresponds to the *Burkea africana - Englerophytum magalismontanum* open woodland as described by Coetzee (1993) which also occurs on the crest and the steep upper slopes of rocky outcrops.

Community 10: *Trachypogon spicatus – Loudetia simplex* rocky grassland on sandy soils

Habitat

The community occurs widespread on plains with deep sandy soil in the conservancy. These sandy soils are leached. There are some small rocks present but rock cover is usually less than 25 percent. The area is exposed and when it is in an open plain there is no protection form the frost in winter and hence there are no tree seedlings. However if the plain is situated between two hills that are relatively close to one another they are will contain *Burkea africana* etc. The slope ranges between 0 and 5 percent (Figure 5.12).

Figure 5.12: *Trachypogon spicatus – Loudetia simplex* rocky grassland on sandy soils

Vegetation

The community is a typical Rocky Highveld Grassland as described by Bredenkamp & Brown (2003). The grassland layer is the dominant layer. In some instances, *Burkea africana* is present as a variation in this community but this tree layer is less prominent than the grass layer.

Figure 5.13: *Trachypogon spicatus – Loudetia simplex* variation with *Burkea africana*

Diagnostic species

The diagnostic species are represented in Table 5.2 & Table 5.4 in species group 15. Diagnostic grass species are *Trachypogon spicatus, Schizachyrium sanguineum, Digitaria eriantha, Perotis patens, Pogonarthria squarrosa, Harpochloa flax, Trichoneura grandiglumis* and *Eragrostis gummiflua.* Diagnostic forbs include *Protulaca kermesina*, *Cleome maculata, Kyphocarpa angustifolia, Conyza albida Leucas glabrata, Sckhuria pinnata, Hibuscus trionum, Phylica parviflora, Leonotis ocymifolia* variense *raineriana, Pavetta gardeniifolia, Dicoma anomala, Limeum fenestratum, Bewesia biflora* and *Lapeirosia sandersonii*.

Dominant species

Dominant woody species is *Burkea africana* (Species group 17). Dominant grass species include *Pogonarthria squarrosa* (Species group 15) and *Loudetia simplex* (Species group 17). *Vernonia poskeana* (Species group 16) is the dominant forb.

Constant species

Constant woody species include *Vangueria infausta* and *Mundulea sericea* (Species group 18) Constant grass species include *Trachypogon spicatus, Schizachyrium sanguineum* (Species group 15) *Diheteropogon amplectens* (Species group 17) *Melinis repens, Setaria sphacelata Melinis nerviglumis* and *Themeda triandra* (Species group 18). *Cleome maculata, Protulaca kermesina, Conyza albida Kyphocarpa angustifolia* (Species group 15), Oldenlandia herbacea (Species group 16), *Bulbostylis hispidula* (Species group 17), *Tagetes minuta, Aloe greatheadii*, *Phyllanthus parvulus, Waltheria indica, Conyza bonariensis* and *Commelina africana* (Species group 18).

The plant community in the Seringveld corresponds to the *Loudetia simplex- Trachypogon spicatus* rocky Highveld grassland in Ezemvelo as described by Swanepoel (2006). The variation with *Burkea africana* corresponds well with the *Searsia magalismontana – Loudetia simplex* rocky grassland sub community. Coetzee's (1993) *Bewesia biflora – Digitaria brazzae* grassland which he related to the *Trachypogon spicatus – Diheteropogon amplectens* moist cool temperate grassland of Werger (1978).

Table 5.2. Phytosociological table of the drier communities on sandy soils of the Seringveld Conservancy

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Relevé number:	5	4	6	8	2	3	2	3	1	2	7	1	0	9	1	8	7	0	6	3	2	4	9	7	0	1	2	6	9	2	5	4	3	9	2	8	7	5	5	2	9	7	5	6	6	4	3	9	8	8	0	8	3	6	5	6	7	3	8	7	4	4	2	4	0	1	7	3	2	8	5	7	1	2	0	9	6	1	2
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Sub-communities		8.1				8.2																																																																									
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Relevé number:	115 114 116	88 112 113 72 73 71	92 87 91 30 119 61 118 97 80 76 103 102 104 109 107 110 51 102 56 89 62 65 64 63 9 2 8	47 35 25 42 29 27 5 46 36 14 23 59 18 58 60 38 53 26 45 16 7 33 28 37 34 24 22 4 20 11 17 13 52 48 15 57 1 12 10 19 6 21 32
Communities	8		9	10
Sub-communities	8.1	8.2		
Species Group 15				
Trachypogon spicatus	. . .	. . . 1 . +	. . . . + . . . + . + + +	+ + + r . . 1 + . 2 + . + + . . + + + 1 + r + . r + . . + 1 + + + + + . + + + + . + .
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Conyza albida	. . .	. . + . . .	. . . . + ... + ... + ...	. + . + + + . + + r + . . + ... + + . r + + . + + . + . + . + + + ...
Schizachyrium sanguineum	. . .	. + + . . .	. . . . + ... + + . . .	. . . . + . . + . r + + . + + + . + 1 + ... + r . . + . + . . + + ... + . . .
Kyphocarpa angustifolia	. . .	. . . . . .	. . . . r . .	. . . . . . + + + r . . + . r + ... + r + . + + . + + . r . . . + . + r r r . r r
Unknown species 1	. . .	. . . . . .	. . . . . + ...	+ . . . . . . + ... + + + + + + + + r . . + . + . . + ... + + . . . + + . .
Digitaria eriantha	. . .	. . . . . .	. 2 . . . . + . +	. r . . . . . + ... + . + . . . + r + ... + + ... + . . . + + . +
Perotis patens	. . .	. . . . . .	. + ... r	. . . . . . 1 + ... + + + ... + + + . . . + . + . + + . + + . +
Pogonarthria squarrosa	. . .	. . . . . .	. . + . . + . + ...	. . . r . . . . + . + + . + . . + ... + . + ... + 1 4 . . . . r + . .
Elephantorrhiza elephantina	. . .	. + . + . .	. . . . + .	+ . . . . + . . + . 1 . + r . . . . . . 1 . + ... + + . + ... +
Leucas glabrata	. . .	. + ...	. . . . + ...	+ + + ... r . . + r . . . . . + ... + + . + . . 2 . . . . . r . + . . .
Lapeirousia sandersonii	. . .	. . . . . .	. . . .	. . + . + + ... 1 . . . . r . + . . + . . + . . + + . + ... r + + + . .
Schkuhria pinnata	. . .	. . . . . .	. . . . . + ...	. . . + ... r . + + . r . . 1 . . . . r . r . 1 + . + . . 2 . .
Hibiscus trionum	. . .	. . . . . .	. . + ... + ...	. . + ... + . + . . . 1 . . . + + . . + ... + 2
Harpochloa falx	. . .	. . . . . .	. . . . + ...	. . . r r + ... + . . + ... + . . + 2 . . . . + . . . +
Richardia brasiliensis	. . .	. . . . . .	. . . . r	. . . . . . + ... r . . . 2 . . . . . + ... + ... + + + +
Phylica parviflora	. . .	. . . . . .	. . . .	+ . + + + ... + ... + ... +
Leonotis ocymifolia v. raineriana	. . .	. . . . . .	. . . .	. . . . r + + ... + ... r + . . + ...
Pavetta gardeniifolia	. . .	. . . . . .	. . . .	. . . . + . + ... + . . . + . + . . . + + ...
Dicoma anomala	. . .	. . . . . .	. . . .	+ r . . . . + ... + ... + r . . . .
Trichoneura grandiglumis	. . .	. . . . . .	. . . .	. . . . + ... r . . r . . . . r . . . + . . . r . . . .
Unknown species 3	. . .	. . . . . .	. . . .	. . . . + . + + . . . + ... + . + .
Limeum fenestratum	. . .	. . . . . .	. . . .	+ . . . . + ... + . . . r . + ...
Bewsia biflora	. . .	. . . . . .	. . . .	. + + + + + ...
Eragrostis gummiflua	. . .	. . . . . .	. . . .	. . . . + 1 . . . . 1 1 . . . . . 1 . .
Species Group 16				
Vernonia poskeana	. . .	. . . . . .	. . . . . + ... + . . . + + + r . . .	+ + + r + + 4 . + . + + r 1 . . + + + 2 + + + 2 + + + . + . r 1 + + 1 + . + + + . + 4
Oldenlandia herbacea	. . .	. . . . . .	+ + + . + . + ... + ... r . . . + +	. . + + . + + . + + + + r . . + . + . + + + + + + + + + + . . + r + + . + + . . + + .
Bidens bipinnata	. . .	. . . . . .	. . . + . + ... + + + . . + +	. + + . . + . . + + . . . + . r . . . + + + + + . + + . + . + + . . 3 . . 1 + + 2 + 2
Asparagus suaveolens	. . .	. . . . . .	. . . . 1 + + . + . + ... + . + + +	+ . + . . + . . . + . + ... + . r . . . . + ... + . . . +
Cymbopogon plurinodis	. . .	. r	. . . . + ... + ... 2 1 . + . . . + .	. . + r . . . + . . + 2 + 1 . . . 2 . . . + . . . + . . + . . + ...
Tapiphyllum parvifolium	. . .	. . . . . .	. . . + ... + . . + . . 1 + . . + + .	. . . . + . r . . + . . . r . . r 1 . . . + ... + + ... + + ...
Indigofera comosa	. . .	+	. . . . . . + + + . + . . . + + . . . + ... +	+ . . . . + . + + ... + ... + ... + ... r .
Faurea saligna	. . .	. . . . . .	. . . . 2 2 3 2 . . . 2 . . . 1 2	. + . + 1 . . . . 3 . . + . . + . . . + . . + ... + . + ...
Pseudognaphalium luteo-album	. . .	. . . . . .	. + . . + ... + . . + ... + ...	. . . + + . . . + ... + ... + . . + . + + . + ... + . + .
Hyparrhenia hirta	. . .	. . . . . .	. . . r . . . . 1 . . . . + ...	. . . . 1 . . . . . + ... r . . . + . . + . . . + . + + + . . . + . .
Tephrosia longipes	. . .	. . + . . .	. r . . . . . + ... + + ...	+ . . . . . . r . . . . . + . . . + ... + + ... + ...
Rhynchosia monophylla	. . .	. . . . . .	. . . . + . + ... 1	+ + . . r . . + ... + . . + + ... + ...
Triumfetta sonderi	. . .	. . . . . .	. . . + 1 . . . . + ... 1 1	. . . . r . . r . . . . + ...
Clerodendrum triphyllum	. . .	. . . . . .	. . . . + ...	. . + . + + . . + ... + ... + ... + .

	8.1	8.2	9	10
Relevé number:	115 114 116	88 112 113 72 73 71	92 87 91 30 119 61 118 97 80 76 103 102 104 109 107 110 51 102 56 89 62 65 64 63 9 2 8	47 35 25 42 29 27 5 46 36 14 23 59 18 58 60 38 53 26 45 16 7 33 28 37 34 24 22 4 20 11 17 13 52 48 15 57 1 12 10 19 6 21 32
Communities	8	8	9	10
Sub-communities	8.1	8.2		
Species Group 17				
Diheteropogon amplectens	. . .	+ . + 2 . 2	. + + . + . + 2 . + + . 1 + + 2 . + . 1 . + + . 1 + +	+ + + . . + + + r + + + + + + + 1 + + + + + + + + 1 + + + + + . + . + . + + . + r 1 +
Loudetia simplex	. + .	1 r + 1 + 1	. + . . + . 1 2 . . . . + . + . 2 + + 2 2 1 1 2 1 + +	+ 3 2 . . + . 3 2 2 2 2 + 2 + . 1 2 . . + 2 2 + 1 2 2 2 2 1 2 1 + + . 3 1 3 1 . . 2 .
Bulbostylis hispidula	. . .	1 . + + + .	1 1 . . + + . + . + . . . + + . 1 2 + 2 . . r 1 + . +	+ . . + 1 + + + + + + + + + + . 1 + . 1 + + + + . 1 + . + . . + 1 + + + + + + + . + 1
Tristachya biseriata	. . .	. 1 1 + + +	. . . . + 2 . 2 3 . 2 r 1 . . + + + . 1 + 1	3 + + . + + . 1 + + + + + 2 . . . . + . . + + . + + + + + + 1 . . . . . + + + . . + .
Burkea africana	. . .	1 3 2 . . .	1 2 . 1 + . . 2 . 1 . . . . . + 1 + . 2 + + + 2 . . +	. . . 1 . . + + . r 2 + 2 + . . 2 . 2 + + . + 2 2 . 2 2 2 . 1 . 2 . + + + 2 . 2 . . .
Ochna pulchra	. . .	1 + ...	+ + . + + ... r 1 . . 2 . . . + . . .	1 r . . . 2 . + . r 1 . . . . . 2 + 2 . . r . . + . . r 1 . . . 3 . . . 1 . + 1 . 1 +
Ancylobotrys capensis	. . .	1 1 1 . + .	. + . r . . 1 1 . . . . 2 . . . . 2 . 2 1 + . +	. . . . . . + 1 . . 1 + ... + ... r + . + . + . + ... 1 . + + . .
Xerophyta retinervis	. . 2	2 . . 1 + +	+ . . . . + . 1 . + ... + . + + . + .	. + + ... 1 2 . + 2 . + . + ... + . . + . + . . . r . . . .
Strychnos pungens	. . .	2 r . . + .	+ 2 . . . 1 . . . . . 3 . 2 . 1 . 3 . 1 2 . . 1 + . +	. . . . r . . + . 2 . . . . . . + ... + . . 2 . . . . + r . . . . .
Ipomoea crassipes	. . .	+ . + + + +	. . . . + + + ...	. + + . . + . + . r + + . . + ... + . . . + 1 . . . + ... + ... + .
Lannea edulis	. . .	1 . + . . .	. 2 . . + . + + + 1	. + . 1 . . . . + r . . . . 1 . . + . + 1 . . . . + + + . . +
Parinari capensis	. . .	+ . . . + .	1 1 . . . . 2 + ... + ...	1 . . . . + ... 1 . + ... 2 . + ... 1 . . + ...
Protea caffra	. . .	. . . 2 2 2	. . . . 2 3 2 . . . . + +	. 2 . . . . . + ... 2 . . . . 3 . 3 . . . .
Species Group 18				
Melinis repens	+ . .	2 . . . 1 .	1 1 1 . + 2 1 + 2 . + 2 1 1 1 1 + 2 . + 1 + + + + + +	+ . + . + + + + r . + + + 1 + + + + + . . r + . + + . + + + . . + . + + + . r . + . .
Tagetes minuta	. 1 .	. . + . . .	+ + + + + 2 + + . . . 1 + + + . 2 + 2 . + . + . + . .	+ 1 . r + + + . + + + + + + + + ... + + . + + . 1 + + + + + + . 1 2 + . . . + + +
Aloe greatheadii	. . .	+ . . . . +	. + . . 1 1 . . . 1 + + 1 r + + 1 1 + ... + + +	. 1 + . . r + . + + + . 1 r . + . . . r 2 r . 1 + . + + . + + + r . + + + 1 + 2 + + 2
Cheilanthes viridis	1 + +	+	+ r . . . . r + + + + + + + + + + + r + + r + . + . .	. r . . . . . + 1 . . . . + . + ... 2 . + . . + + . . + . + . . . + + + + + + + .
Setaria sphacelata	. . .	. 1 1 . . .	+ + + . 2 . . . . 2 . . . . + . +	+ . + 2 . 2 . + . + + ... + + 1 + + 1 1 . + + . 1 1 + + + 2 + . + + + 2 . + +
Themeda triandra	+ . .	1 1 1 + . 2	. 1 . . 1 + 1 + ... 2 . . 1	. . . + . . + + . . . 1 r + + + . . + 2 + + . . . r + + + . + . . . + 1 . r + + + . +
Phyllanthus parvulus	. . .	. . . . . .	. + . + . + . + + + . . . + . + . + . + ...	. . . . . + . + + . + + . + + . . . + . + + + + . . + + . + . + . . r . + r + r + + .
Waltheria indica	. . .	+ + + . . .	. + + . + + + + . + ... +	+ . . . . + . + . + . + . . . + + + + + + . + + . 1 + . + . r + . + . + + + . +
Conyza bonariensis	. . .	. . + . . .	. . . . . . + + . + . + + + + + + ... + ...	. + . + + . . . + r + r . . . . r + + . . + + . . . + . + . + + + ... + + . + +
Commelina africana	r . .	. + + + + +	. . + + + . + + 2 . . . . + .	. . . . + . . + + + . . . + . + + . . + . + . + . + + . + + . r . + + + + . . +
Melinis nerviglumis	+ 2 1	2 3 2 2 . 1	. . . . . + 1 . . + ... +	. . . r . + + + . + . r 2 . + . . + . . + + . . + + . . + . . + + . r . . + . + . . .
Heteropogon contortus	. + .	. 1 1 . . +	+ . . . . 2 2 . . . 2 . 1 r + ... + . . .	. + 2 r . . . . . + + + . + + . + + . r . . + . r . + ... + ... + + .
Vangueria infausta	. . .	. . . . . .	. . . + . . . + 1 1 1 . . . 2 . + + + . . + + + + 2 +	. . + ... + . . + . . . + . . + . + + ... + 2 . . r . + . . . + . .
Mundulea sericea	. 2 .	. 1 2 . . .	. . . . . + 1 . . . . r . 1 2 . . . . + . +	. + + ... + + . + . + ... + r + . + 1 + + + . + ... + . + + 2 .
Senecio venosus	. . .	. . . . + .	. . . + . . . + . + . . . 1 . . . + . . . + + . 1 + .	. 1 + + 1 + ... + . + . . 1 + ... + . . + ... + + ... + + . . + .
Cleome monophylla	. . .	. . . . . +	. . . . + . + . . . +	r . . . . . . + + . . + . + . . + . . + . . + ... + ... + . . + + . . r . . .
Cyperus rupestris	2 . 1	+	+ + 2 . . + . . . + ...	. . + . . . + . . . + . + . + + . . . + + . + . + . + ... r . + . + r . . . . .
Englerophytum magalismontanum	. . .	+	1 . + ... 1 . . . . 1 . . + + + .	. . . . . . + . . 2 + . . 1 . . . . . . + + . . 2 . . . . + ... + 2 . . . . .
Eragrostis racemosa	. . 1	. . . + . +	. . + . . r . . . . + . + ... + . .	+ . + ... + . + ... + ... + . + + . . . + . + . + ...
Sporobolus africanus	. 3 .	. . . . + .	. . . 2 . + . + 1 . . . + + ... 2	. . . . . . + + . + ... + . . . + ... + ... + ...
Pentarrhinum insipidum	. . .	. . . . . .	. . . . . . + . . + + . + . . . + ... + ... +	. . . . . + ... + ... + + . . r + 2 . . . . . . + . + .
Pearsonia sessilifolia	. . .	. . . + . +	. . . . . + . . . + + . . + + + ... + .	. . + . . + . . . + + . . . + ... + ...
Acacia caffra	. . .	. . . . . .	. . . 1 . . . + 1 2 . . + ... + ...	. . . . 1 . . . . + ... + ... 1 . 2
Panicum maximum	. . .	. . . . . .	. . + ... + ...	. . + . + + 1 . . . . + . . + ... + + + ... + . .
Aristida congesta	. . .	. . . + . .	. . . . + ... + ... r	. . . . + . 2 + . . . + . . . + . + ... + ... + ...
Lantana camara	. . .	r	. . . . + . + + ... + . + .	. 1 . . . . 1 . + ... + ...

5.3. *Relevance of the synoptic table*

There are various options available in JUICE to display the synoptic table. In two synoptic tables produced (Table 5.3 &Table 5.4) the value of the fidelity measure is displayed and then the frequency of occurrence of a specific species is displayed as an exponential measure. The outlay of the following two synoptic tables was chosen to emphasize the importance of the use of a fidelity measure to determine the diagnostic species. Unfortunately, the options to display the fidelity measure with the percentage cover values as exponential values is not available in JUICE, but from the analysis of the synoptic table, which is included in the description of the plant communities, and hence dominant species could easily be identified. The synoptic table could also be displayed in the categorical view as described by Westhoff & Van der Maarel (1980), but in categorical view, the focus is shifted more on the constancy rather than the fidelity measure. A difference of nineteen percent per category is also thought to be relatively big (Tichy & Holt, 2006).

A positive fidelity value of higher than two for the u_{hyp} is statistically significant (Bruelheide, 2000). The use of a statistical value to further enhance the significance of the traditional sense of a diagnostic species or character species as described by Werger (1974) has decreased the subjectivity of Braun – Blanquet approach. In the description of the plant communities plants with fidelity lower than two were not identified as diagnostic species even thought they were local character species. Differential species were also not included in the description of the plant communities as diagnostic species. Negative fidelity is indicated by - - - in the synoptic tables and indicates that the species at hand was not present in the given plant community.

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Table 5.3. Synoptic table of the moister communities of the Seringveld Conservancy.

Group Number	1	2	3	4	5	6	7
Number of relevés	4	11	4	7	6	3	11
Species group 1							
Acacia mearnsii	4.6 [50]	--- .	--- .	--- .	--- .	--- .	--- .
Euclea undulata	4.1 [50]	--- 9	--- .	--- .	--- .	--- .	--- .
Oxalis depressa	2.3 [25]	--- .	--- .	--- .	--- .	--- .	--- .
Gerbera piloselloides	2.0 [25]	--- .	--- .	--- .	--- .	--- .	--- .
Species group 2							
Achyranthes aspera	--- .	4.6 [82]	--- .	--- .	--- .	--- 33	--- 9
Combretum apiculatum	--- .	4.4 [73]	--- .	--- .	--- .	--- 33	--- .
Cheilanthes viridis	--- .	3.5 [73]	--- .	--- .	--- .	--- 67	--- 9
Croton gratissimus	--- .	5.2 [64]	--- .	--- .	--- .	--- .	--- .
Pappea capensis	--- .	4.8 [55]	--- .	--- .	--- .	--- .	--- .
Hibiscus calyphyllus	--- 25	3.7 [55]	--- .	--- .	--- .	--- .	--- .
Diplorhynchus condylocarpon	--- .	4.8 [55]	--- .	--- .	--- .	--- .	--- .
Setaria lindenbergiana	--- .	4.3 [45]	--- .	--- .	--- .	--- .	--- .
Euclea crispa	--- .	3.1 [45]	--- .	--- 29	--- .	--- .	--- .
Combretum molle	--- .	3.8 [36]	--- .	--- .	--- .	--- .	--- .
Englerophytum magalismontanum	--- .	3.8 [36]	--- .	--- .	--- .	--- .	--- .
Bridelia mollis	--- .	3.8 [36]	--- .	--- .	--- .	--- .	--- .
Lannea discolor	--- .	2.4 [27]	--- .	--- .	--- 17	--- .	--- .
Gymnosporia buxifolia	--- .	3.3 [27]	--- .	--- .	--- .	--- .	--- .
Solanum panduriforme	--- .	--- 27	--- 25	--- 14	--- .	--- .	--- 18
Phyllanthus maderaspatensis	--- .	3.3 [27]	--- .	--- .	--- .	--- .	--- .
Brachylaena rotundata	--- .	3.3 [27]	--- .	--- .	--- .	--- .	--- .
Sporobolus africanus	--- .	--- 18	--- .	--- .	--- .	--- 33	--- .
Rhoicissus tridentata	--- .	--- 18	--- .	--- .	--- .	--- .	--- .
Opuntia ficus-indica	--- .	--- 18	--- .	--- .	--- .	--- .	--- .
Pavonia burchellii	--- .	--- 18	--- .	--- .	--- .	--- .	--- .
Tragia dioica	--- .	--- 18	--- .	--- .	--- .	--- .	--- .
Canthium mundianum	--- .	--- 18	--- .	--- .	--- .	--- .	--- .
Strychnos pungens	--- .	--- 18	--- .	--- .	--- .	--- .	--- .
Spirostachys africana	--- .	--- 18	--- .	--- .	--- .	--- .	--- .

Group Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Number of relevés	**4**	**11**	**4**	**7**	**6**	**3**	**11**
Species group 3							
Acacia caffra	--- 80	2.9 82	--- .	--- 14	--- 50	--- 33	--- 18
Ziziphus mucronata	--- 75	3.5 82	--- .	--- 14	--- .	--- .	--- 9
Dombeya rotundifolia	--- 50	3.6 82	--- .	--- .	--- .	--- 33	--- 9
Panicum maximum	3.5 75	--- 36	--- .	--- .	--- .	--- 33	--- 9
Searsia leptodictya	--- 50	--- 36	--- .	--- 14	--- 17	--- .	--- .
Dichrostachys cinerea	--- 25	2.0 36	--- .	--- 14	--- .	--- .	--- 9
Lantana rugosa	--- 25	2.0 36	--- 25	--- .	--- .	--- .	--- .
Celtis africana	--- 50	--- 27	--- .	--- .	--- .	--- 33	--- .
Ehretia rigida	--- 25	--- 18	--- .	--- 14	--- .	--- .	--- .
Rhynchosia venulosa	--- 25	--- 9	--- .	--- .	--- .	--- .	--- .
Aloe marlothii	--- 25	--- 9	--- .	--- .	--- .	--- .	--- .
Berchemia discolor	--- 25	--- 9	--- .	--- .	--- .	--- .	--- .
Sida dregei	--- 25	--- 9	--- .	--- .	--- .	--- .	--- .
Species group 4							
Paspalum urvillei	--- .	--- .	3.7 75	--- .	--- .	3.2 67	--- .
Hyparrhenia hirta	--- .	--- .	3.4 75	--- .	--- 33	--- 33	--- 18
Cucumis zeyheri	--- .	--- .	3.8 50	--- .	--- 17	--- .	--- .
Osteospermum muricatum	--- .	--- .	5.7 75	--- .	--- .	--- .	--- .
Oxalis corniculata	--- .	--- .	4.6 50	--- .	--- .	--- .	--- .
Cotula anthemoides	--- .	--- .	4.6 50	--- .	--- .	--- .	--- .
Unknown species 21	--- .	--- .	4.6 50	--- .	--- .	--- .	--- .
Hibiscus microcarpus	--- .	--- .	4.6 50	--- .	--- .	--- .	--- .
Kleinia longiflora	--- .	--- .	4.6 50	--- .	--- .	--- .	--- .
Gomphocarpus fruticosus	--- .	--- .	--- 25	--- .	--- .	--- .	--- .
Sphenostylis angustifolia	--- .	--- .	--- 25	--- .	--- .	--- .	--- .

Group Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Number of relevés	**4**	**11**	**4**	**7**	**6**	**3**	**11**
Species group 5							
Elionurus muticus	--- ·	--- ·	--- ·	6.1 86	--- ·	--- ·	--- ·
Lippia rehmannii	--- ·	--- ·	--- 25	2.5 43	--- ·	--- ·	--- 18
Nidorella hottentotica	--- ·	--- ·	--- ·	3.3 43	--- ·	--- ·	--- 18
Hypoxis iridifolia	--- ·	--- ·	--- ·	2.6 43	--- ·	--- 33	--- 9
Triumfetta sonderi	--- ·	--- ·	--- ·	4.2 43	--- ·	--- ·	--- ·
Harpochloa falx	--- ·	--- ·	--- ·	--- 29	--- 17	--- ·	--- ·
Cyperus rupestris	--- ·	--- ·	--- ·	--- 29	--- 17	--- ·	--- ·
Hermannia depressa	--- ·	--- ·	--- ·	3.4 29	--- ·	--- ·	--- ·
Tristachya biseriata	--- ·	--- ·	--- ·	3.4 29	--- ·	--- ·	--- ·
Eragrostis superba	--- ·	--- ·	--- ·	3.4 29	--- ·	--- ·	--- ·
Species group 6							
Faurea saligna	--- 25	--- ·	--- ·	--- ·	3.5 67	--- 33	--- ·
Elephantorrhiza elephantina	--- ·	--- ·	--- ·	--- 14	5.5 83	--- ·	--- ·
Bulbostylis hispidula	--- ·	--- ·	--- ·	--- 14	3.2 50	--- ·	--- 18
Polygala hottentotta	--- ·	--- ·	--- 25	--- 14	3.1 50	--- ·	--- ·
Oldenlandia herbacea	--- ·	--- ·	--- ·	--- ·	2.4 50	3.7 67	--- ·
Eragrostis gummiflua	--- ·	--- ·	--- ·	--- 14	3.9 50	--- ·	--- ·
Agathisanthemum bojeri	--- ·	--- ·	--- ·	--- ·	5.3 67	--- ·	--- ·
Schkuhria pinnata	--- ·	--- 9	--- ·	--- ·	3.1 33	--- ·	--- ·
Gomphrena celosioides	--- ·	--- ·	--- 25	--- ·	2.5 33	--- ·	--- ·
Aristida diffusa	--- ·	--- ·	--- ·	--- ·	3.1 33	--- ·	--- 9
Monsonia angustifolia	--- ·	--- ·	--- ·	--- ·	3.7 33	--- ·	--- ·
Helichrysum coriaceum	--- ·	--- ·	--- ·	--- ·	3.7 33	--- ·	--- ·
Cyperus denudatus	--- ·	--- ·	--- ·	--- ·	3.7 33	--- ·	--- ·
Cleome macrophylla	--- ·	--- ·	--- ·	--- ·	3.7 33	--- ·	--- ·
Lannea edulis	--- ·	--- ·	--- ·	--- ·	3.7 33	--- ·	--- ·
Phylica parviflora	--- ·	--- ·	--- ·	--- ·	3.7 33	--- ·	--- ·
Hypoxis acuminata	--- ·	--- ·	--- ·	--- ·	3.7 33	--- ·	--- ·

Group Number	1	2	3	4	5	6	7
Number of relevés	**4**	**11**	**4**	**7**	**6**	**3**	**11**
Species group 7							
Heteropyxis natalensis	--- .	--- .	--- .	--- .	--- .	5.3 ^{67}	--- .
Ceratotheca triloba	--- .	--- ^{9}	--- .	--- .	--- ^{17}	4.3 ^{67}	--- .
Stoebe vulgaris	--- .	--- .	--- .	--- .	--- .	5.3 ^{67}	--- .
Crepis hypochoeridea	--- .	--- .	--- .	--- .	--- .	--- ^{33}	--- ^{9}
Pteridium aquilinum	--- .	--- .	--- .	--- .	--- .	--- ^{33}	--- .
Rubus rigida	--- .	--- .	--- .	--- .	--- .	--- ^{33}	--- .
Helichrysum acutatum	--- .	--- .	--- .	--- .	--- .	--- ^{33}	--- .
Combretum erythrophyllum	--- .	--- .	--- .	--- .	--- .	--- ^{33}	--- .
Searsia pyroides	--- .	--- .	--- .	--- .	--- .	2.0 ^{33}	--- .
Dipcadi rigidifolium	--- .	--- .	--- .	--- .	--- .	--- ^{33}	--- .
Species group 8							
Acacia karroo	--- ^{50}	--- ^{9}	--- ^{50}	--- ^{29}	--- .	--- .	2.0 ^{55}
Hyperthelia dissoluta	--- .	--- .	--- .	--- .	--- ^{17}	--- .	4.9 ^{73}
Richardia brasiliensis	--- .	--- .	--- .	--- .	--- ^{33}	--- .	3.9 ^{64}
Perotis patens	--- .	--- .	--- .	--- .	--- ^{33}	--- .	2.4 ^{36}
Felicia muricata	--- .	--- .	--- ^{25}	--- ^{14}	--- .	--- .	--- ^{18}
Felicia mossamedensis	--- .	--- .	--- .	--- .	--- ^{17}	--- .	2.4 ^{27}
Species group 9							
Commelina africana	--- .	--- ^{9}	--- .	--- ^{14}	--- ^{50}	--- ^{33}	--- ^{36}
Phyllanthus parvulus	--- .	--- ^{27}	--- .	--- ^{14}	--- ^{33}	--- ^{33}	--- ^{18}
Bidens bipinnata	--- .	--- ^{18}	--- .	--- .	3.8 ^{67}	--- .	--- ^{27}
Vernonia poskeana	--- .	--- .	--- .	--- .	4.3 ^{67}	--- .	--- ^{27}
Pogonarthria squarrosa	--- .	--- .	--- .	--- .	--- ^{33}	--- .	2.4 ^{36}
Sesamum triphyllum	--- .	--- .	--- .	--- .	--- ^{17}	--- ^{33}	--- ^{18}
Cleome maculata	--- .	--- .	--- .	--- .	--- ^{17}	--- ^{33}	--- ^{9}

Group Number	1	2	3	4	5	6	7
Number of relevés	4	11	4	7	6	3	11
Species group 10							
Eragrostis curvula	--- 25	--- 9	--- 50	--- 86	--- 67	--- 67	1.5 82
Pseudognaphalium luteo-album	--- 25	--- .	--- 50	--- 29	3.2 100	--- 33	--- 64
Conyza albida	--- 25	--- .	--- 25	--- .	3.8 100	--- 33	--- 55
Helichrysum rugulosum	--- .	--- .	4.0 100	--- 43	--- 17	--- 33	--- 27
Verbena bonariensis	--- .	--- .	3.2 75	--- 14	--- 17	--- 33	--- 36
Waltheria indica	--- .	--- 9	--- 25	--- .	--- 17	--- 33	--- 18
Species group 11							
Tagetes minuta	--- 50	1.7 91	--- .	--- 29	--- 83	--- 100	--- 73
Conyza bonariensis	--- 50	--- 36	--- 25	--- 43	2.7 100	--- 33	--- 64
Melinis repens	--- .	--- 27	--- 25	--- 57	--- 33	--- 67	2.7 91
Setaria sphacelata	--- 25	--- 36	--- 25	2.9 100	2.9 100	--- 33	--- 9
Aloe greatheadii	--- 25	--- 27	--- 50	--- 57	--- 17	--- .	--- 36
Pentarrhinum insipidum	--- .	--- 36	--- .	--- .	--- 50	--- 33	--- 36
Themeda triandra	--- .	--- 9	--- 50	1.9 57	2.5 67	--- .	--- .
Lantana camara	--- 25	--- 36	--- .	--- .	--- 17	--- 67	--- 18
Senecio venosus	--- .	--- 18	--- .	--- 43	--- 33	--- .	--- 9
Heteropogon contortus	--- .	--- 9	--- .	--- 43	--- 33	--- .	--- 18
Digitaria eriantha		--- 9	--- 50	--- .	--- 17	--- .	--- 36

Table 5.4. Synoptic table of the drier communities of the Seringveld Conservancy.

Group Number	**1**		**2**		**3**	
Number of relevés	**9**		**27**		**43**	
Species group 12						
Croton gratissimus	2.9	63	---	15	---	·
Ziziphus mucronata	---	11	---	7	---	5
Zornia linearis	3.1	33	---	7	---	2
Combretum apiculatum	3.0	22	---	4	---	·
Achyranthes aspera	---	·	---	4	---	2
Myrothamnus flabellifolius	3.2	42	---	·	---	2
Species group 13						
Elionurus muticus	4.7	56	---	11	---	5
Chamaecrista mimosoides	3.9	44	---	7	---	7
Sphenostylis angustifolia	6.7	67	---	·	---	·
Brachiaria serrata	4.0	33	---	4	---	·
Ipomoea obscura	4.4	33	---	·	---	·
Cyanotis speciosa	4.8	44	---	4	---	·
Kalanchoe thyrsiflora	3.5	22	---	·	---	·
Dianthus mooiensis	3.5	22	---	·	---	·
Species group 14						
Combretum molle	---	·	6.0	70	---	12
Eragrostis curvula	---	·	3.6	44	---	19
Lannea discolor	---	11	2.9	33	---	5
Kalanchoe paniculata	---	11	3.4	37	---	2
Euclea crispa	---	·	3.2	26	---	5
Combretum zeyheri	---	·	3.5	26	---	2
Diplorhynchus condylocarpon	---	11	---	19	---	5
Searsia leptodictya	---	·	3.5	22	---	·
Fuirena pubescens	---	11	2.2	22	---	·
Dipcadi ciliare	---	11	1.8	19	---	·
Pollichia campestris	---	·	2.8	19	---	2
Dichapetalum cymosum	---	·	2.4	11	---	·
Species group 15						
Trachypogon spicatus	---	22	---	19	4.4	72
Cleome maculata	---	·	---	15	5.4	65
Portulaca kermesina	---	·	---	4	6.0	60
Conyza albida	---	11	---	11	3.7	49
Schizachyrium sanguineum	---	22	---	11	2.4	42
Kyphocarpa angustifolia	---	·	---	4	5.3	51
Unknown species 1	---	·	---	4	4.6	42
Digitaria eriantha	---	·	---	11	3.0	30
Perotis patens	---	·	---	7	3.7	35
Pogonarthria squarrosa	---	·	---	11	3.0	30
Elephantorrhiza elephantina	---	22	---	4	1.6	28
Leucas glabrata	---	11	---	4	2.7	30
Lapeirousia sandersonii	---	·	---	·	4.5	35
Schkuhria pinnata	---	·	---	4	3.5	28
Hibiscus trionum	---	·	---	7	2.5	21
Harpochloa falx	---	·	---	4	3.1	23
Richardia brasiliensis	---	·	---	4	2.9	21
Phylica parviflora	---	·	---	·	3.0	16
Leonotis ocymifolia v. raineriana	---	·	---	·	3.0	16
Pavetta gardeniifolia	---	·	---	·	3.0	16
Dicoma anomala	---	·	---	·	2.8	14
Trichoneura grandiglumis	---	·	---	·	2.8	14
Unknown species 3	---	·	---	·	2.8	14
Limeum fenestratum	---	·	---	·	2.5	12
Bewsia biflora	---	·	---	·	2.5	12

Eragrostis gummiflua	--- .	--- .	2.5 12
Group Number	**1**	**2**	**3**
Number of relevés	**9**	**27**	**43**
Species group 16			
Vernonia poskeana	--- .	--- 22	6.2 81
Oldenlandia herbacea	--- .	--- 33	4.5 67
Bidens bipinnata	--- .	--- 26	4.0 56
Asparagus suaveolens	--- .	--- 33	--- 23
Cymbopogon plurinodis	--- 11	--- 22	--- 28
Tapiphyllum parvifolium	--- .	--- 26	--- 26
Indigofera comosa	--- 11	--- 30	--- 19
Faurea saligna	--- .	--- 26	--- 23
Pseudognaphalium luteo-album	--- .	--- 19	--- 26
Hyparrhenia hirta	--- .	--- 11	--- 23
Tephrosia longipes	--- 11	--- 15	--- 16
Rhynchosia monophylla	--- .	--- 11	--- 19
Triumfetta sonderi	--- .	--- 19	--- 7
Clerodendrum triphyllum	--- .	--- 4	--- 16
Species group 17			
Diheteropogon amplectens	--- 44	--- 67	2.7 86
Loudetia simplex	--- 78	--- 63	--- 77
Bulbostylis hispidula	--- 44	--- 59	2.3 79
Tristachya biseriata	--- 56	--- 48	--- 60
Burkea africana	--- 33	--- 56	--- 58
Ochna pulchra	--- 22	--- 30	--- 44
Ancylobotrys capensis	--- 44	--- 37	--- 30
Xerophyta retinervis	--- 56	--- 30	--- 28
Strychnos pungens	--- 33	1.6 44	--- 19
Ipomoea crassipes	--- 56	--- 11	--- 33
Lannea edulis	--- 22	--- 22	--- 28
Parinari capensis	--- 22	--- 19	--- 19
Protea caffra	--- 70	--- 19	--- 12
Species group 18			
Melinis repens	--- 33	3.3 89	--- 67
Tagetes minuta	--- 22	--- 67	--- 72
Aloe greatheadii	--- 22	--- 59	--- 70
Cheilanthes viridis	--- 44	2.6 74	--- 42
Setaria sphacelata	--- 22	--- 26	3.7 67
Themeda triandra	--- 67	--- 26	--- 56
Phyllanthus parvulus	--- .	--- 37	3.2 53
Waltheria indica	--- 33	--- 30	1.9 53
Conyza bonariensis	--- 11	--- 37	--- 49
Commelina africana	--- 67	--- 26	--- 47
Melinis nerviglumis	4.9 89	--- 15	--- 44
Heteropogon contortus	--- 44	--- 30	--- 40
Vangueria infausta	--- .	3.9 56	--- 28
Mundulea sericea	--- 33	--- 26	--- 44
Senecio venosus	--- 11	--- 33	--- 37
Cleome monophylla	--- 11	--- 11	2.1 30
Cyperus rupestris	--- 33	--- 19	--- 35
Englerophytum magalismontanum	--- 11	--- 26	--- 23
Eragrostis racemosa	--- 33	--- 19	--- 26
Sporobolus africanus	--- 22	--- 26	--- 16
Pentarrhinum insipidum	--- .	--- 26	--- 21
Pearsonia sessilifolia	--- 22	--- 26	--- 14
Acacia caffra	--- .	--- 22	--- 12
Panicum maximum	--- .	--- 7	2.7 23
Aristida congesta	--- 11	--- 11	--- 19
Lantana camara	--- 11	--- 19	--- 9

5.4. Ordination

The Nonmetric Multidimentsional Scaling (NMS) uses a dissimilarity matrix to compare the relevé. Therefore, in the multidimensional space the further apart the relevé are from one another the lower the floristic similarity is. Figure 5.14 represents the NMS results. The tree main environmental gradients responsible for the scatter diagram are clay soils to sandy soils, from moister to drier conditions and from the absence of rocks to an abundance of rock cover. Sandy particles are either angular or rounded and have a relatively low surface area because of its large size. Clay soils on the other hand have a smaller size relative to sandy soils and a larger surface area. The larger surface area it allows clay soils to absorb more water as well as other substances. Hence, clay soils are also able to absorb more nutrients and hence are more nutrient rich than sandy soils. Sandy soils are more leached than clay soils (Brady & Weil, 2002). The percentage rock cover increased along axis one from left to right. The distribution of the plant communities along axis 2 range from wetter communities with sufficient or ample supply of water to drier communities with less water available.

The NMS can more or less be divided in half. The bottom half representing the communities with higher moisture availability on clay soils with little to no rock cover. The top half is represented by the drier communities on sandy soils with a larger rock cover. Plant communities one to seven are found in the bottom half of the NMS and communities eight; nine and ten are located in the top half of the NMS. Communities one and two are in close proximity to one another. Plant communities four, five, six and seven are also more closely related floristically. The NMS is representative of the TWINSPAN dendogram (Figure 5.1).

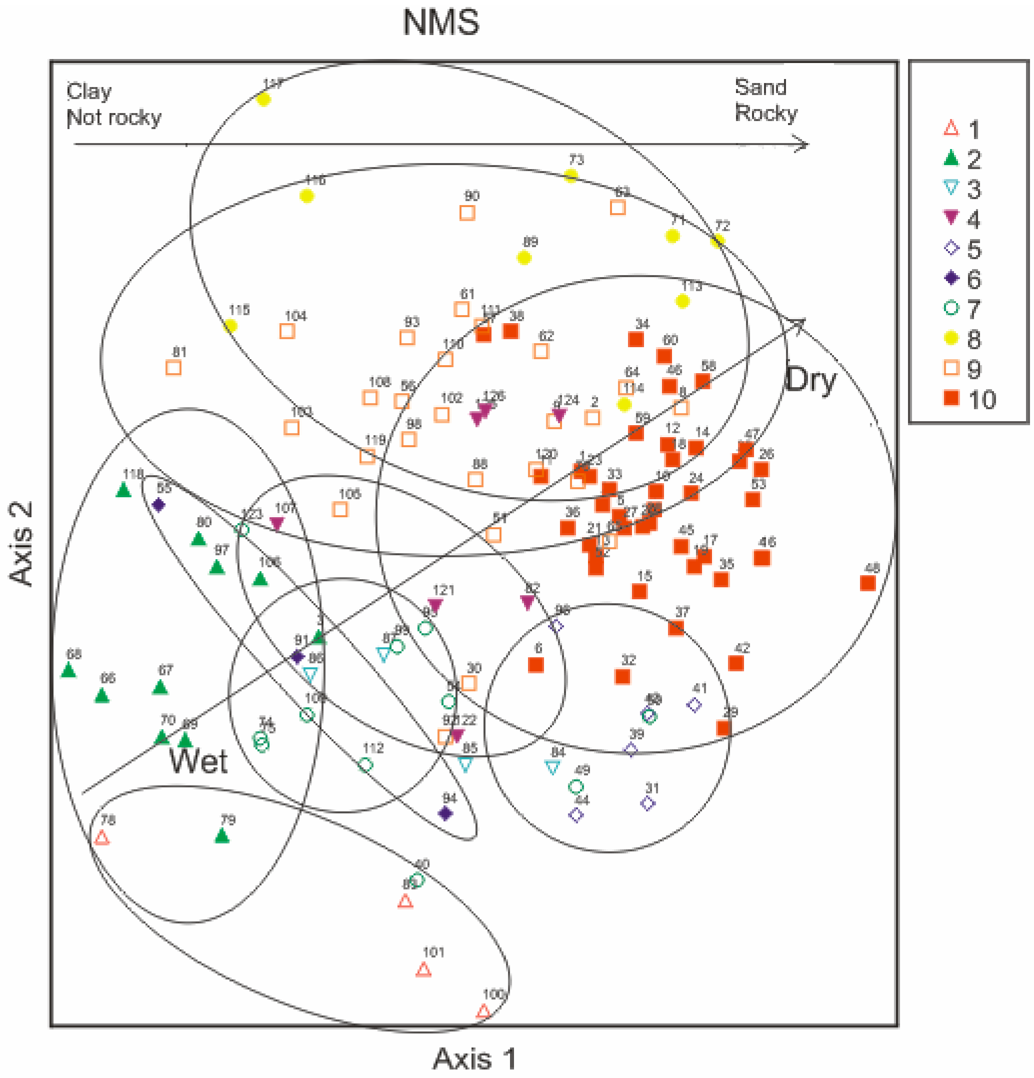

Figure 5.14: NMS scatter diagram of axis one and two representing the distribution of the plant communities along environmental gradients.

5.5. Maps of the Seringveld Conservancy

5.5.1. Vegetation map

The vegetation map produced of the area again emphasises patterns that were seen in the TWINSPAN analysis, classification as well as the NMS results. Communities eight, nine and ten are either border one another or are in relatively close proximity of one another. Community six

Pteridium aquilinum - Heteropyxis natalensis sheltered woodland only occurs only once because of the suitable environment the kloof provides the plants.

Community two *Combretum apiculatum – Croton gratissimus* dense woodland is present on the steeper moister parts of the ridges whilst community nine *Combretum molle – Lannea discolor* bush clumps occurs more on the more exposed crests or plato's of the ridges. Community 10 the *Trachypogon spicatus – Loudetia simplex* rocky grassland on sandy soils is present on more exposed plains and plato's of the Seringveld. It is interesting to note that the mining activity is in close proximity to the streams present in the area. The area also has quite a number of small agricultural holdings as well as agricultural activity (Figure 4.15).

<u>5.5.2. Conservation plan maps.</u>

In Gauteng the Department of Agriculture, Conservation, Environment and Land Affairs (GDACE) has constructed a conservation plan for the province. The plan focuses and delineates important features as well as ecological processes that should be conserved. The information is available to import into Arc GIS and then can be used by the end user to highlight the importance of a several area in terms of provincial conservation goals (GDACE, 2009)

The important features have two main areas that should be kept in mind when namely important and irreplaceable areas. An important area according to GDACE (2009) is:" A site designated as important in meeting targets set for the conservation of biodiversity, the significance of which is subject to ground truthing. The site is important to protect in some way, but not essential and can be replaced by a similar site, but a trade-off in the efficiency of the conservation plan may be the result". An irreplaceable area is defined as:" A site designated as essential in meeting targets set for the conservation of biodiversity. Options for achieving these targets will be reduced should the site not be protected" (GDACE, 2009). Figure 4.16 shows that there are both important as well as irreplaceable areas present in the Seringveld conservancy. It is also interesting to note that a lot of

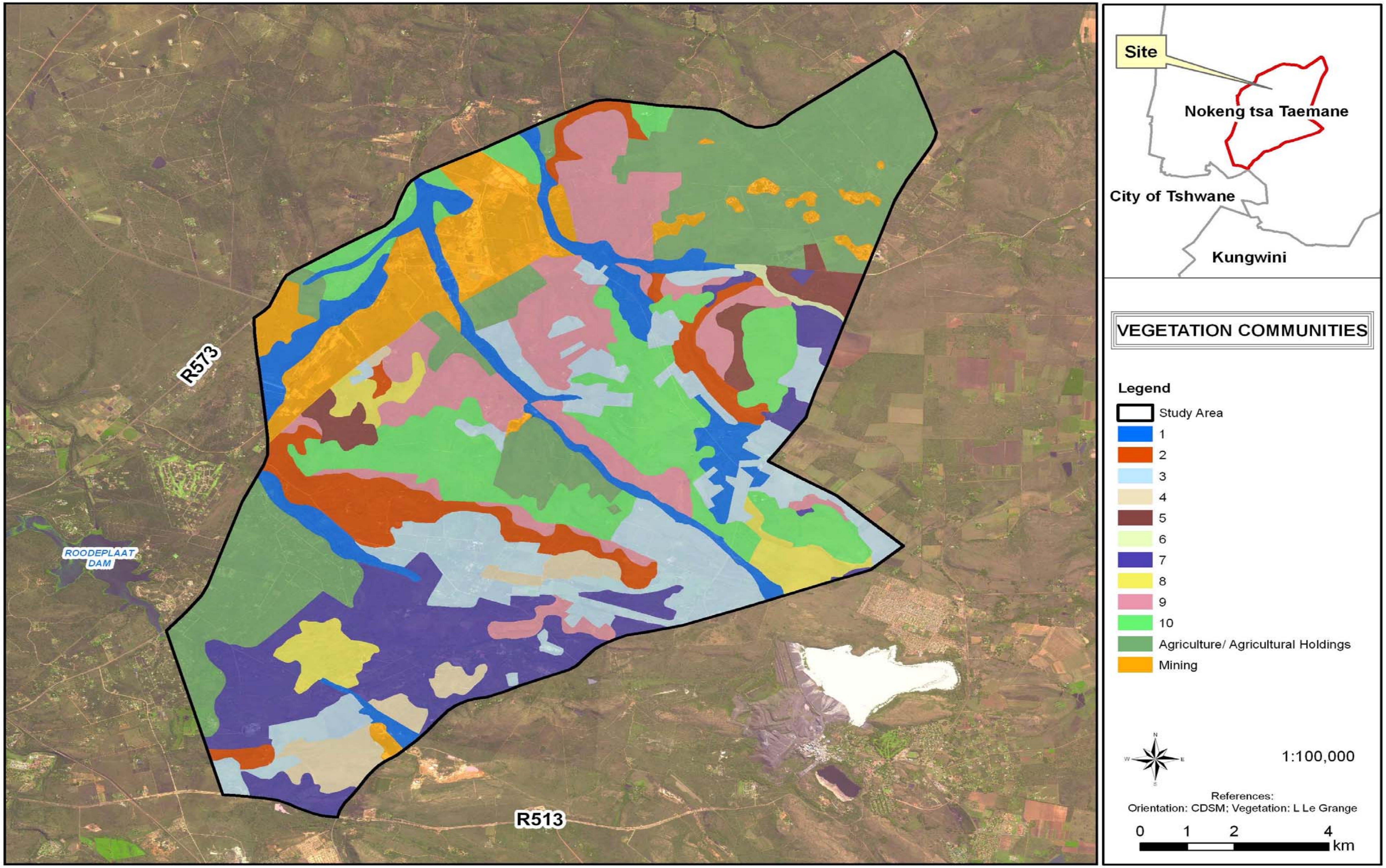

Figure 5.15: Vegetation map of the Seringveld Conservancy

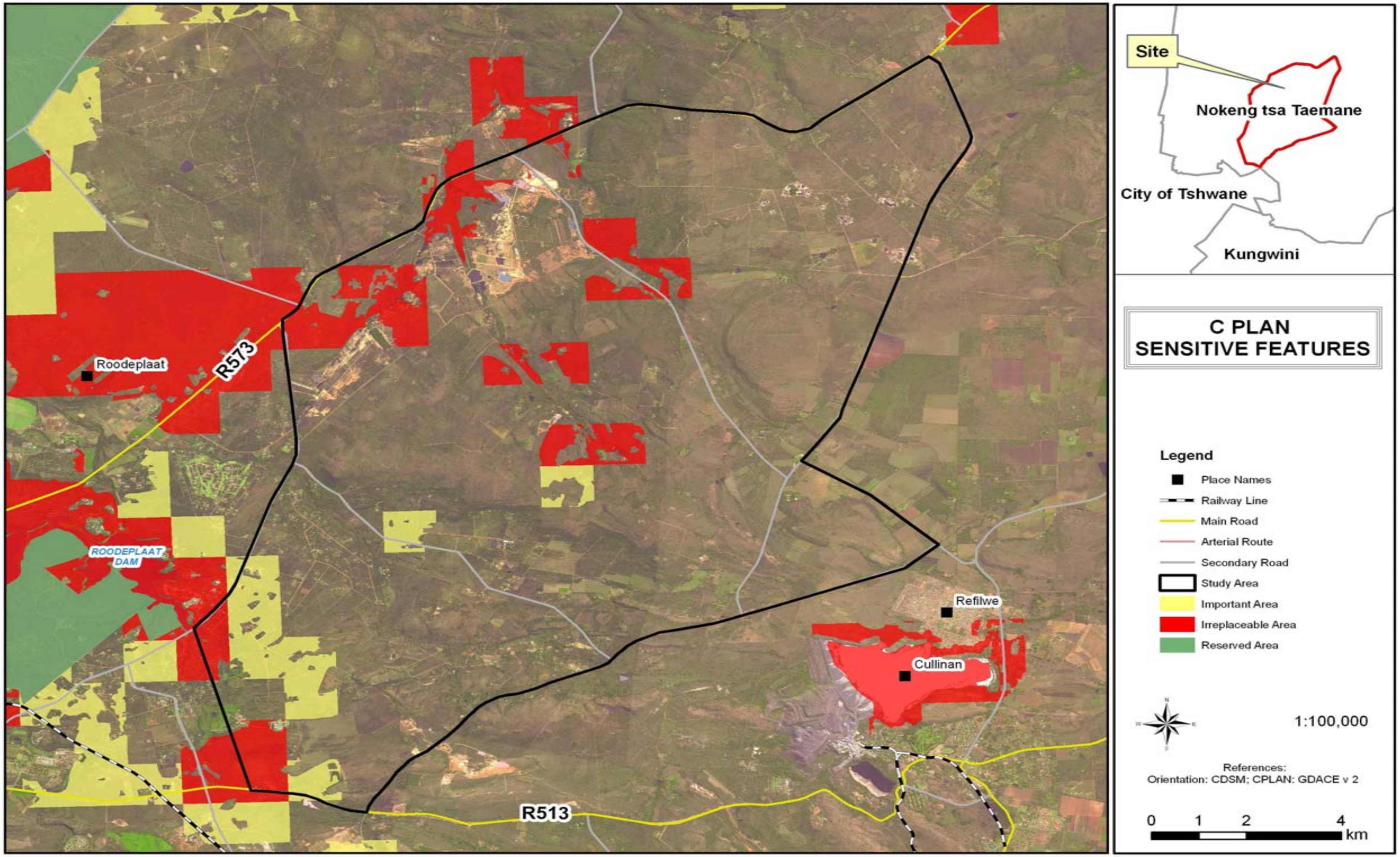

Figure 5.16: Map indicating the presence of irreplaceable areas in the Seringveld Conservancy in terms of irreplaceable as well as important areas for conservation.

mine activity has already taken place close as well as in between areas that have been delineated as irreplaceable areas. Along the ridges in the Seringveld Conservancy, irreplaceable as well as important areas are present. It is interesting to note that the silt dam of the Cullinan diamond mine has been marked as a irreplaceable area according to the conservation plan of GDACE, what the reason for this is can only be speculated but surely sever amounts of damage can be caused if development in the area causes a leak in the silt dam and in the worst case floods the nearby Refilwe township.

In C-plan, the Department also highlights important areas for ecological processes. In Figure 5.17. the important ecological processes in the Seringveld Conservancy are shown. As stated before in the introduction ecotone areas are important for evolution and hence it is not surprising that in Figure 5.17 this topic is once again highlighted. Other important processes that were included were hydrological processes, nutrient cycling, pollination and wild life dispersal. Another important feature is ground water dynamics. It is interesting to note that most of these processes occurs where community one occurs. Community one is already threatened by *Acacia mearnsii* and therefore it is important to take action in against these invasive species but to ensure that they are removed with as little as possible disturbance. The ridges of the area are also important in terms of ecological processes. Community two and nine are present on the ridges of the area and hence special attention should be given to these communities in future management plans.

The ridges policy was developed because of the importance of ridges in ecosystem processes in Gauteng in terms of biodiversity as well as socio-cultural aspects. The term ridges for in terms of the policy refers to mountains, hills, koppies kloofs and gorges present in Gauteng. In this policy, the Department forbid development on ridges in Gauteng. Even where development has already occurred before, the implementation of the policy the ridges are still closely monitored and new development is not allowed unless an Environmental Impact Assessment (EIA) is conducted and from the EIA it is concluded that the impacts of the proposed development are low enough. GDACE assigned classes to the ridges according to the percentage of land that has been transformed on a specific ridge.

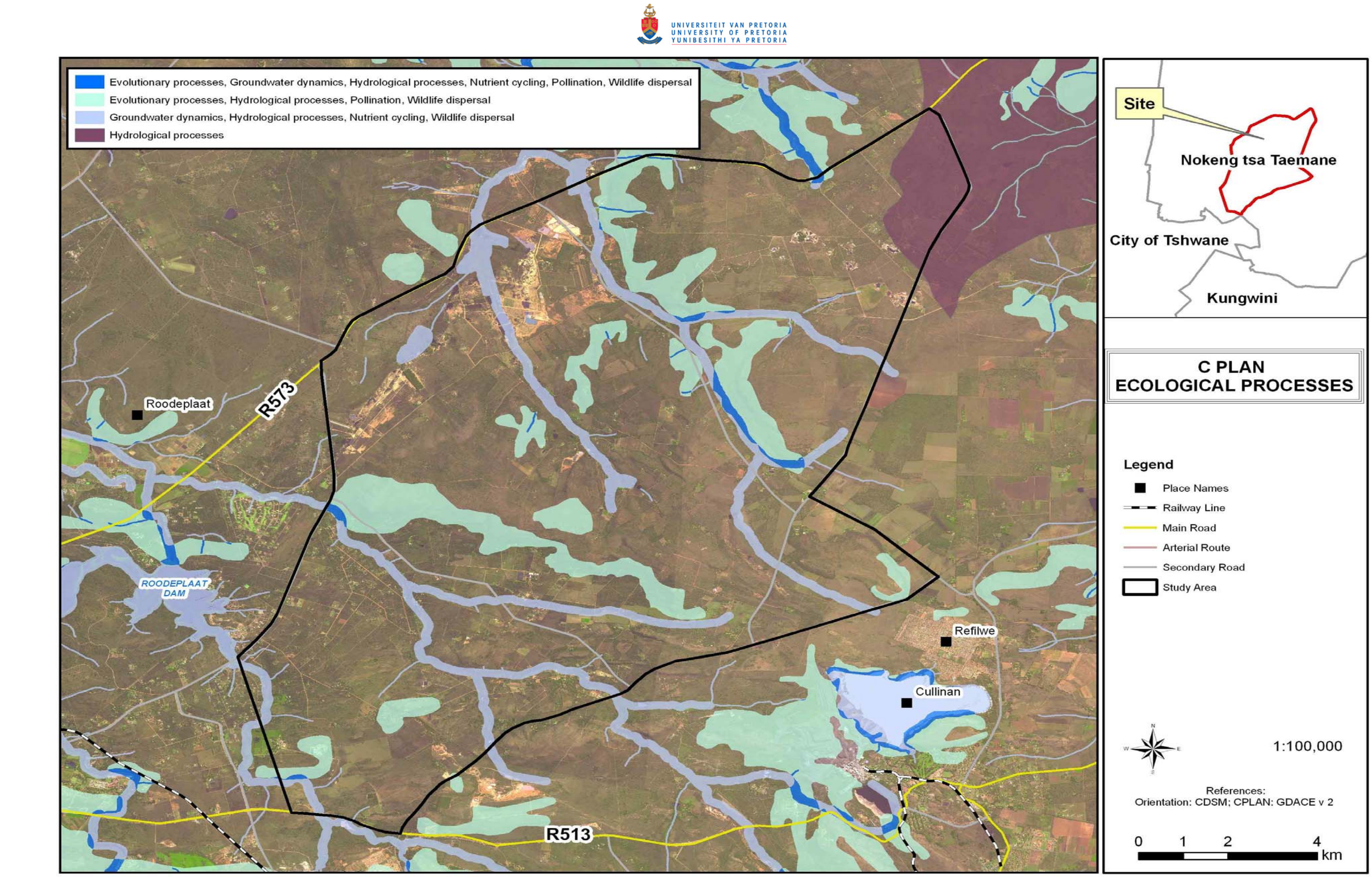

Figure 5.17: Important ecological processes present in the Seringveld Conservancy according to the conservation plan of GDACE.

Class one ridges are ridges were less than five percent of land has been transformed or developed. Ridges that have between five and thirty five percent of area transformed are Class two ridges. Class three ridges have between 35 and 65 percent of the area transformed. Class four ridges are ridges that have more than 65 percent of the area transformed or developed. Figure 5.18 shows that there are class one, two and three ridges present in the area. Class one ridges are by far the most prominent in the Conservancy and hence in a sense large portions of the Seringveld are already considered to be no go areas for development. For the class two ridges only low impact development i.e. tourism might be considered but still a full EIA must be conducted.

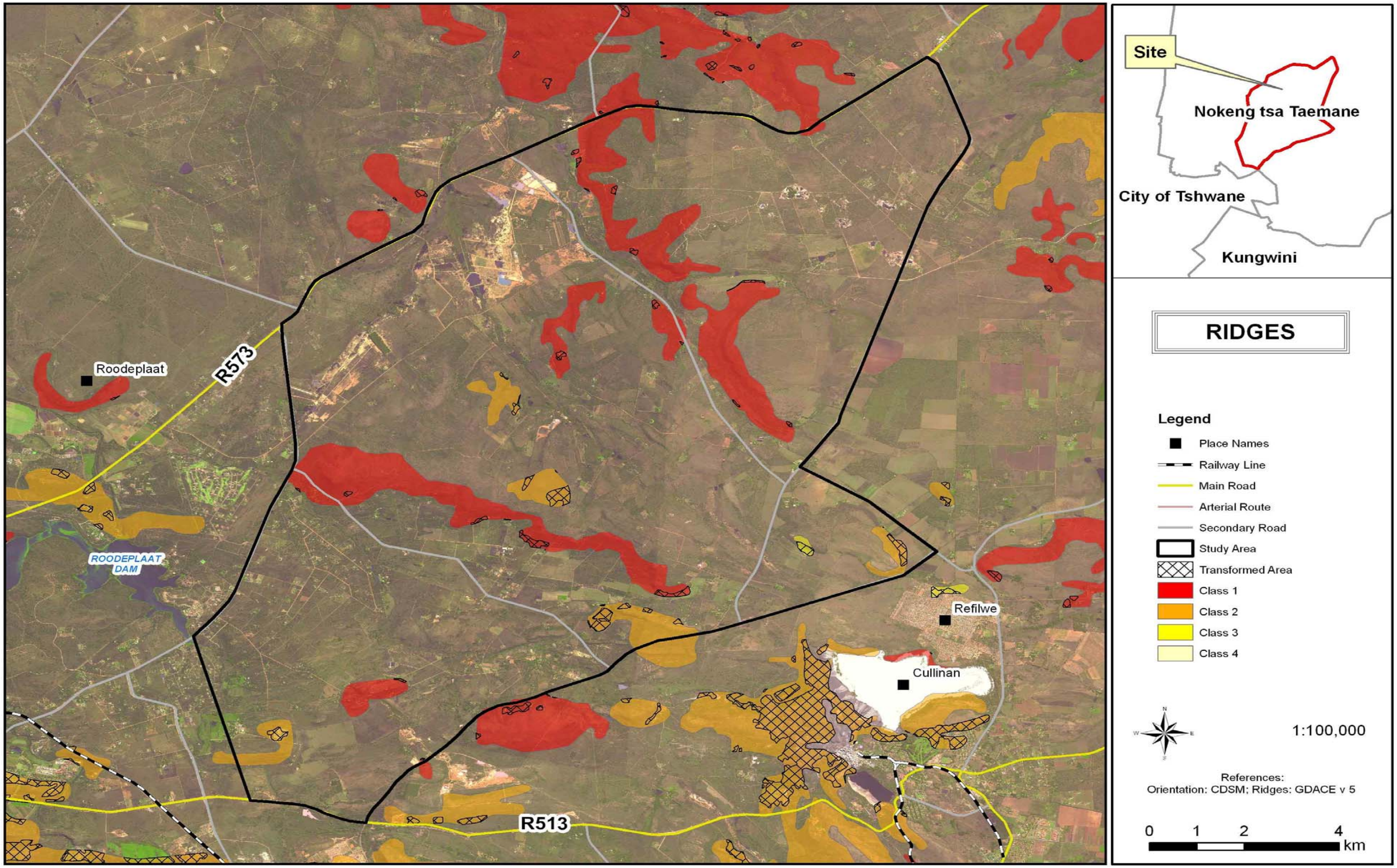

Figure 5.18: Map indicating the presence of various classes of ridges in the Seringveld Conservancy.

6. Conclusion

The study objectives were met. The Seringveld Conservancy was described in terms of plant communities, plant species composition and habitat by providing a floristic overview and producing a vegetation map of the conservancy. The complexity of savanna dynamics as well as the problems with trying to define savanna was addressed.

The Seringveld Conservancy is situated in an ecotone between the grassland and savanna biomes of South Africa. Savannas are hard to define on a global scale, however at the local scale as a vegetation unit in the definition :" Savanna is a vegetation type with a well developed grassy layer and an upper layer of woody plants, which can vary from widely spaced to 75 percent tree cover" is adequate (Bredenkamp, 1999). Savannas are complex systems and in southern Africa, the type of savanna is determined by its position on the equilibrium non-equilibrium gradient. The equilibrium non-equilibrium gradient is mainly influenced by climate but also to a lesser extent by fire, grazing pressure, soil water availability, soil nutrient availability and human influence.

The Seringveld Conservancy has about 674 mm of rain annually which places categorises the Seringveld as a moist savanna. The broad leaved savanna communities on nutrient poor sandy soils in the Seringveld Conservancy are close to an equilibrium system but in server drought, as a result of climatic variation or human induction, increase the amount of non–equilibrium dynamics present in the system. The fine leaved communities on nutrient rich clay soils of the Seringveld Conservancy places it more on the non-equilibrium side of the gradient. For the herbaceous layer this is especially true because of the periodicity of the rainfall that causes drought in the drier periods of the year which is invigorated by the clay soils which induce a physiological drought on the herbaceous layer in particular. Because the trees are able to obtain additional water from the water table throughout the year, there dynamics are more representative of an equilibrium system (Bredenkamp & Brown, 2009).

The Seringveld Conservancy has a high species richness containing 376 species (Appendix A). The area contains 10 main plant communities and 2 sub communities. The plant communities are present on a moisture gradient. On the one end of the gradient are the moister more sheltered communities and on the other is the drier more exposed communities. Other factors that are responsible for the presence of different plant communities is soil as well as percentage rocky cover. Both grassland and savanna communities were present in the Conservancy. The grassland communities were intra zonal pockets of the Rand Highveld Grassland vegetation unit. The savanna communities were representative of the Central Sandy Bushveld and the Marikana Thornveld (Mucina & Rutherford, 2006). The communities present in the Seringveld Conservancy were had floristic similarity with communities present in the Byenespoort Game Park close to Cullinan (Hauptfleish, 1999), the Ezemvelo Nature Reserve close to Bronkhorstpruit, the vegetation of the Ba and Ib land types in the Pretoria-Witbank-Heidelbrg area (Coetzee, 1993) and the Witbank Nature Reserve (Combrink, 2000).

The use of fidelity measures to determine diagnostic species is not only useful but also adds statistical significance to the method of assigning names to plant communities and therefore to some extent decreases the biased nature of naming of communities of the Braun-Blanquet method (Braun- Blanquet, 1932; Werger; 1974). The classification of the plant communities in the Seringveld conservancy is supported by the NMS ordination.

The vegetation map of the conservancy once highlights its complexity. The vegetation map also showed the same relationships as the classification and the ordination of the plant communities. The plant communities more closely related to one another based on the TWINSPAN analysis occurred in closer proximity to one another compared to the more unrelated communities.

The Seringveld Conservancy also contains a number of irreplaceable and important areas according to the conservation plan to the Gauteng Department of Department of Agriculture, Conservation, Environment and Land Affairs. The Conservancy also has plays and important role in the conservation of important ecological processes namely hydrological processes, nutrient cycling, pollination and wild life dispersal. Based on the vegetation map most of these processes occur where community one occurs. The community already threatened by *Acacia mearnsii* and therefore it is important to take action in against these invasive species but to ensure that they are removed with as little as possible disturbance. Hardly any of the relevés have did not contain some invasive species. The Seringveld Conservancy have already acted against species like *Lantana camara* and *Opuntia ficus-indica* but and although these efforts are remarkable there is still a long list of species that needs attention. The ridges in the Conservancy are sensitive and relatively undeveloped and from a conservation perspective it would be ideal for these areas to stay untouched.

Not only is the Seringveld conservancy is a species rich area with complex vegetation patterns but it also has a vast amount of area that is important to conserve as part of the conservation plan of Gauteng. The areas deep sandy soils may cause its downfall and collapse of the ecosystem if sand mining in the area is not reduced or at least limited by means of not allowing present mines to continue but to prohibit the opening of new mines to open in the area.

The vegetation map produced can now form the basis for future studies in the area, i.e. small mammal, bird, insect and mammal studies, to further enhance the importance of the area as well as to gain a better understanding of the ecosystem and eventually to develop a management plan for the area. It is my sincere hope that this study helps raise the conservation status of the area and aid the Seringvelders with there quest to protect the Conservancy from the destruction of sand mines.

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