CHAPTER 5
IDENTIFICATION AND DESCRIPTION OF ECOZONES FOR TOURISM WITHIN THE WATERBERG BIOSPHERE RESERVE

5.1 Introduction

There are many management applications for vegetation mapping using predictive models and Geographical Information Systems (GIS) (Tiwari *et al.* 1996). Lechmere-Oertel & Cowling (1999) showed, for example, how the boundary between different biomes can be predicted within a GIS environment and the implication thereof for management and monitoring under South African conditions. The value of using GIS as a tool for the identification of homogenous natural vegetation units on a larger scale can therefore not be underestimated (Fairbanks, 2000).

These large natural units that make up the environment are called ecological zones, or "ecozones". An ecozone is a large natural unit, controlled by a set of common processes, mostly climatic, and is dominated by life-forms with similar physical adaptations to those processes (IUCN, 1992). Gertenbach (1983) used several environmental parameters to zonate the Kruger National Park, South Africa, into 35 landscapes. A landscape was defined as an area with a specific geomorphology, climate, soil and vegetation pattern together with the associated fauna. These landscapes were later combined to produce larger tourism ecozones, providing tourists visiting the park with useful information regarding the environment (Jacana, 1997).

Properties of soils often determine the nature of vegetation (Brady & Weil, 1999). White (1995) described the term catena as the suite of contiguous soils extending from hill top to valley bottom in undulating landscapes, restricted to a single climatic zone, although uniformity of parent material was not a prerequisite. Jacana (1997) showed illustrated examples of these catenas within the Kruger National Park on specific soils underlied by the specific geological formation, with the associated vegetation. Furthermore, Bredenkamp & Brown (2001) stated that any spatial or temporal changes in the physical environment (e .g. change in soil condition from sand to clay etc.) would affect the plant species composition, performance and success

of the vegetation. Catenas are therefore not only restricted to soils within a landscape, but may reflect the gradients between the plant communities associated with the soil types. Using catenas as vertical sections through a larger landscape, may thus be very useful in showing the contiguous soils, geology and plant communities.

The aim of this chapter is to identify and map relatively homogenous ecozones for tourism within the Waterberg Biosphere Reserve, using different environmental parameters with associated plant communities as basis for identification, as also shown by Jacana (1997). Catenas of the ecozones are also produced to show the specific sequences of geology and soils and how the major plant communities types identified in Chapter 4 fit into each specific ecozone. These ecozones should also provide useful information to tourists visiting the Waterberg Biosphere Reserve, as well as information to managers of parks and nature reserves.

5.2 Methods

5.2.1. Field surveys

Field surveys were conducted throughout the Waterberg Biosphere Reserve to identify and correlate specific characteristics of landscapes with known environmental parameters. The surveys involved the identification of specific plant communities previously described within the Waterberg Biosphere Reserve, and correlation of plant communities with soil, geology, climate, geomorphology and altitude. Most of the parks and nature reserves within the Biosphere Reserve were visited as well as some reserves outside the Biosphere Reserve, where similar landscapes occur. Localities where field surveys were conducted include the following:

D'Njala Nature Reserve
Doorndraaidam Nature Reserve
Emaweni Game Lodge
Entabeni Private Game Reserve
Jobedi Game Lodge
Kwalata Game Lodge
Mabalingwe Game Lodge

Mabula Game Lodge
Marakele National Parks
Masebe Nature Reserve
Nylsvley Nature Reserve
Sambane Game Lodge
Slangkuil Game Farm
Suikerboschplaat Game Farm
Welgevonden Private Game Reserve
Wonderkop Nature Reserve

The field surveys provided a valuable basis for understanding the geology and soils, vegetation patterns and climate of the study area, and were extremely useful in the selection of mapable ecozones. The parameters further provided the basis for the identification of the ecozones.

5.2.2 GIS Mapping

Maps are usually created in a Geographical Information System. Predictive vegetation maps can be extrapolated over large areas of remote terrain, thereby reducing the survey effort for checking predictions, and can be used for monitoring and predicting vegetation change in response to global change (Lechmere - Oertel & Cowling, 1999).

The identification of ecozones was done after the field surveys, using digital data from ENPAT (2000) and a digitized geological map from Jansen (1982). Boundaries of geological formations were digitized from a 1:1 000 000 geological map produced by Jansen (1982), within the boundaries of the Biosphere Reserve. The map was valuable for the identification of the ecozones, and was used as an overlay theme with the soils when identifying the ecozones. Other information obtained from the digital database ENPAT (2000), to identify ecozones, were altitude contours and climate. After the identification of the ecozones, an ecozone map was produced in a GIS program, Arcview. The map and a detailed description of ecozone identification and ecozone environmental characteristics are included in the following section.

5.3 Results and Discussion

5.3.1 Identification of ecozones

Figure 5.1 represent the ecozone map of the major part of the Waterberg Biosphere Reserve, while figure 5.2 represent the ecozone map, on a smaller scale, of the Nylsvley Nature Reserve. Different environmental parameters were used to identify and describe the ecozones within the biosphere reserve. Six different ecozones were identified as described in the following section. The high altitude ecozone shows two variations. The Nylsvley Nature Reserve was included in the ecozone identification, although not being part of the Waterberg Biosphere Reserve yet. The Reserve will probably be included into the Biosphere Reserve in the near future.

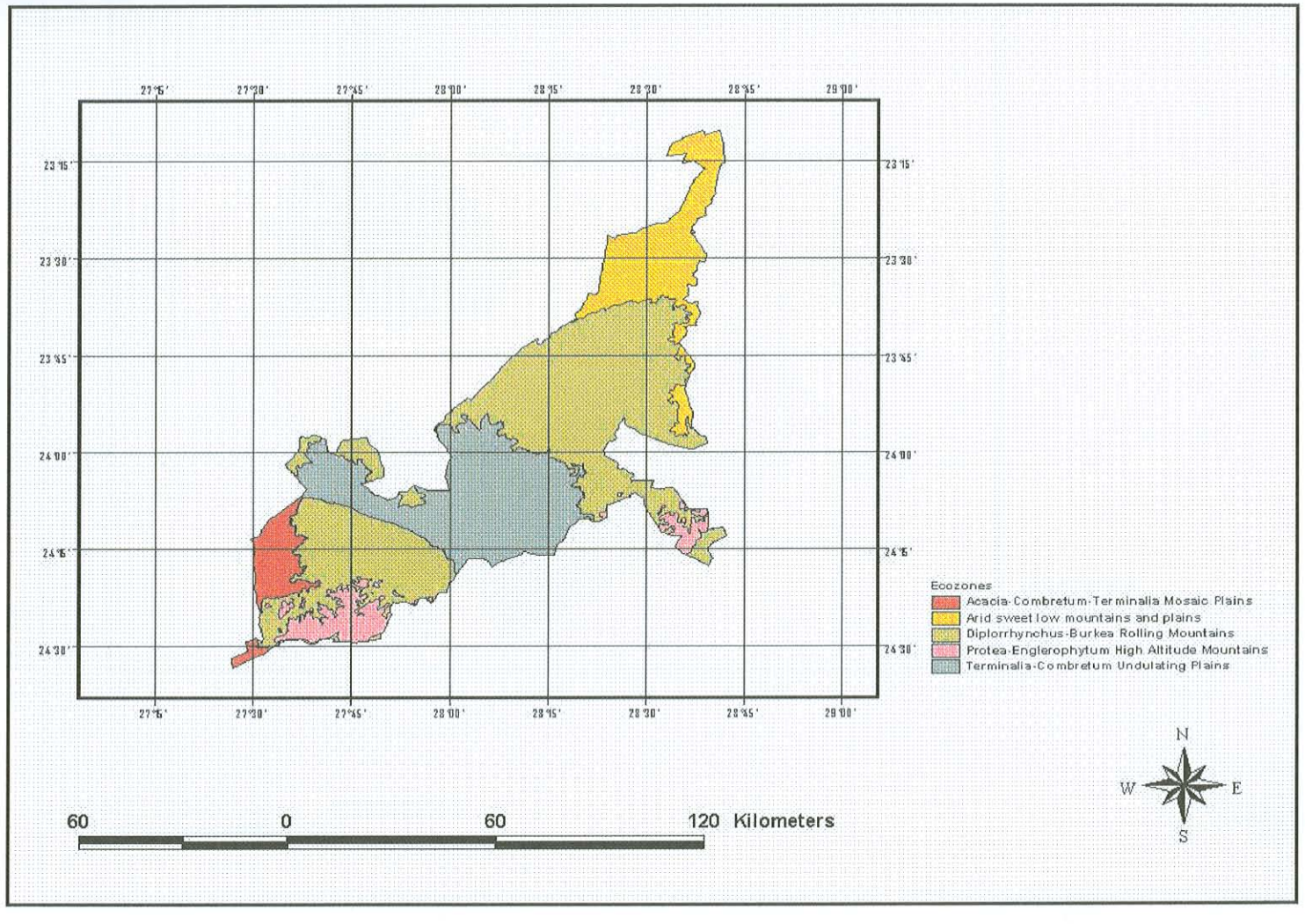


Figure 5.1 The major Ecozones of the Waterberg Biosphere Reserve

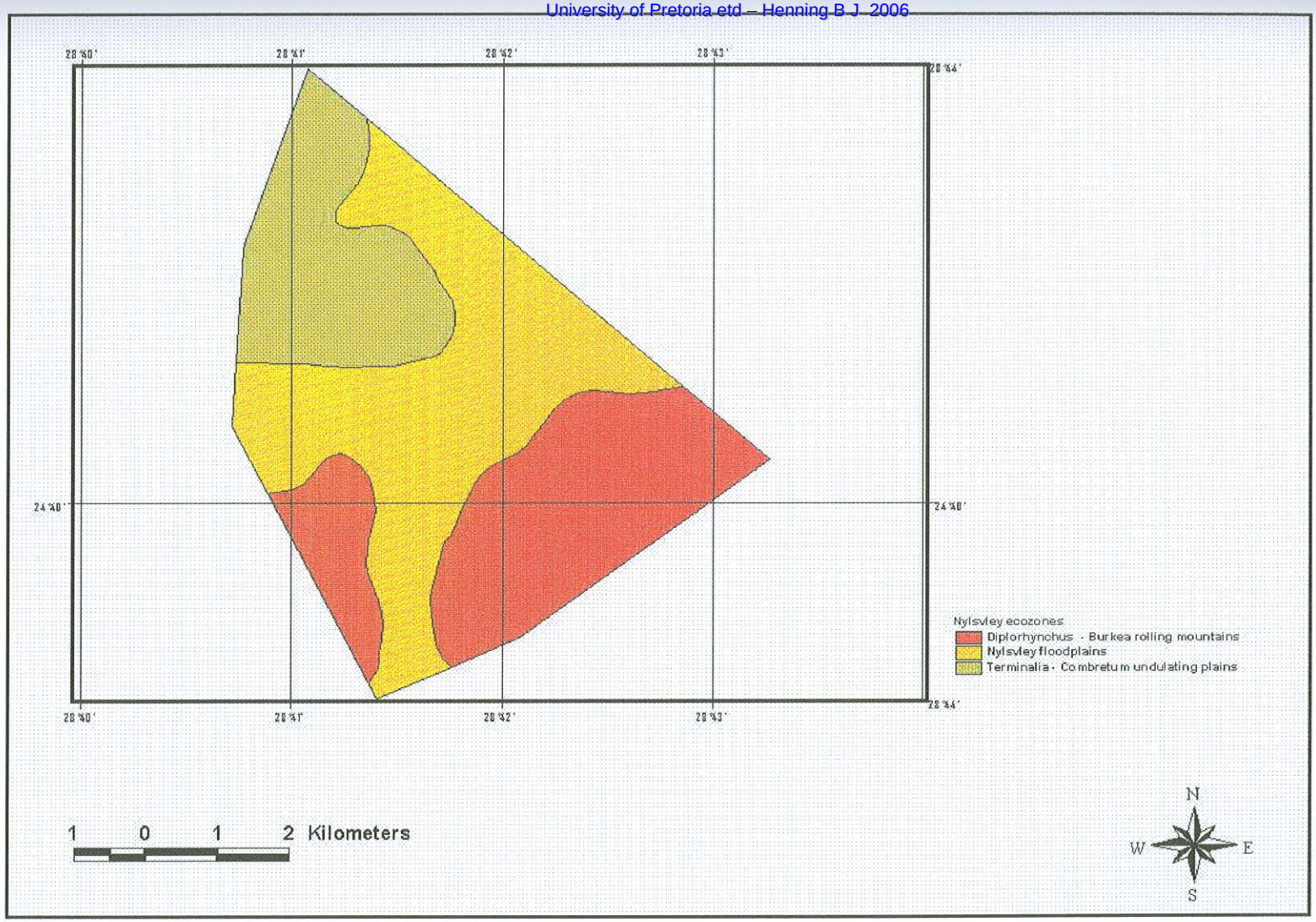


Figure 5.2 The Ecozones within the Nylsvley Nature Reserve

5.3.2 Description of ecozones

5.3.2.1 The *Protea-Englerophytum* High Altitude Escarpment Ecozone

This ecozone were identified as areas of altitude higher than 1500 m. The general climate at such altitudes is much cooler and the major determining factor is thus climate. Higher rainfall and frequent mist (Westfall, 1981) occurring in the upper reaches of this ecozone contribute largely to the vegetation structure, mostly open woodland and closed grassland. Gertenbach (1987) describes rainfall as the single most important component of climate determining vegetation patterns. The plant communities as previously described in Chapter (Ch.) 4 represented in this ecozone are the following:

- The *Fuirena pubescens-Andropogon huilensis* Sponge major plant community
- The *Podocarpus latifolius-Diospyros whyteana* Kloof major plant community
- The *Protea caffra-Loudetia simplex* cool slopes and escarpment crest major plant community
- The *Cynodon dactylon-Dichrostachys cinerea* old fields major plant community

The high altitude mountain ecozone occurs dominant in two localities, namely the in the Kransberg Mountains of the Marakele National Park in the southwest of the Waterberg Biosphere Reserve, and in the Entabeni Game Reserve in the eastern part of the study area. The vegetation varies between the two areas as indicated on the catenas (Fig. 5.3 a, b.) of the vegetation.

a. Variation 1. Vegetation of the Marakele National Park

These high altitude areas are dominated by the *Protea caffra-Loudetia simplex* community (Van Staden, in prep.) on cooler southern and eastern rocky slopes (50% rockiness), on shallow soils of the Mispah soil type. This plant community dominates the ecozone at altitudes of between 1500 - 1700m. The warmer northern and western slopes, with similar rockiness and soils, are dominated by *Englerophytum magalismontanum*, similarly described by Newberry (1998) as the *Englerophytum*

magalismontanum-Mimusops zeyheri short open woodland. The dominant vegetation of the highest altitudes between 1700 - 2100m is mostly short closed grassland [*Andropogon schirensis-Dicoma anomala* community described by Van Staden (in prep.). These grasslands occur in areas where frequent mist occurs and forms part of Acock's (1988) North-Eastern Mountain Sourveld. Coetzee *et al.* (1981) described the grasslands as rare, only represented in areas where the conservation status is high, such as in the Marakele National Park (a core zone of the Waterberg Biosphere Reserve). Bushclumps of isolated forest occur within this plant community (Van Staden, in prep.). Another vegetation type of North Eastern Mountain Sourveld, replaced by the grassland on the upper reaches, occur in this ecozone, namely inland tropical forests. These forests, which form part of the Afro-Montane element of Southern Africa (Coetzee *et al.* 1981), occur in the moist ravines of the Waterberg escarpment and represent the *Podocarpus latifolius-Diospyros whyteana* Kloof major plant community [Chapter (Ch.) 4]. Within this ecozone, the mountain range sometimes forms low-lying valleys where the Matlabas- , Mamba - and Sterkstroom Rivers originate from the shallow submerged marshy areas or sponges (The *Fuirena pubescens-Andropogon huilensis* Sponge plant community). The sponges are sensitive areas, yet play an important role in providing habitats to specific birds and mammals (see Chapter 7). Figure 5.3 shows a typical catena of the plant communities in the landscape, while Figure 5.5 a shows an example of the high altitude areas in the Marakele National Park.

b. Variation 2. Vegetation of the Entabeni Game Reserve

Newberry (1998) described the dominant vegetation community as the *Englerophytum magalismontanum-Mimusops zeyheri* short open woodland, which falls within the *Protea caffra-Loudetia simplex* cool slopes and escarpment crest major plant community (Ch. 4), occurring on shallow Mispah soils, at altitudes between 1500 and 1700 metres (Fig. 5.5b). The escarpment at Entabeni Game Reserve forms rocky crests at these altitudes (Fig. 5.4). Isolated patches of this ecozone occur west of the Entabeni Game Reserve and represent this major plant community. However, at altitudes of 1500 m a large plateau forms within the ENR where the soils are somewhat deeper. Newberry (1998) described two communities on the plateau namely the *Protea caffra-Gnidia capitata* low open woodland occurring

on Avalon soils; and the *Hyparrhenia hirta-Cynodon dactylon* closed grassland community dominated by clovelly soils. The latter community represents the *Cynodon dactylon-Dichrostachys cinerea* old fields and disturbed areas plant community, while the former represents the dominant *Protea caffra-Loudetia simplex* cool slopes and escarpment crest community. Coetzee *et al.* (1981) stated that these old fields are quite common disturbed grassveld patches, and game in the Reserve often heavily grazes these patches, especially after fires. Figure 5.3 b shows the high altitude areas in the Entabeni Game Reserve that forms part of the ecozone.

The dominant geomorphology of the high altitude mountain ecozone is escarpment with ravines, valleys and steep slopes. Plateaus occur on the upper side of the escarpment, as described in the Entabeni Nature Reserve. The geological formations include sandstone of the Sandsriviersberg formation (Marakele National Park) and Mogalakwena formation (Entabeni Nature Reserve and isolated patches). The plant diversity within this ecozone is mostly dependent on ravines, rockiness and temperature - radiation moisture regimes (Coetzee *et al.* 1981).

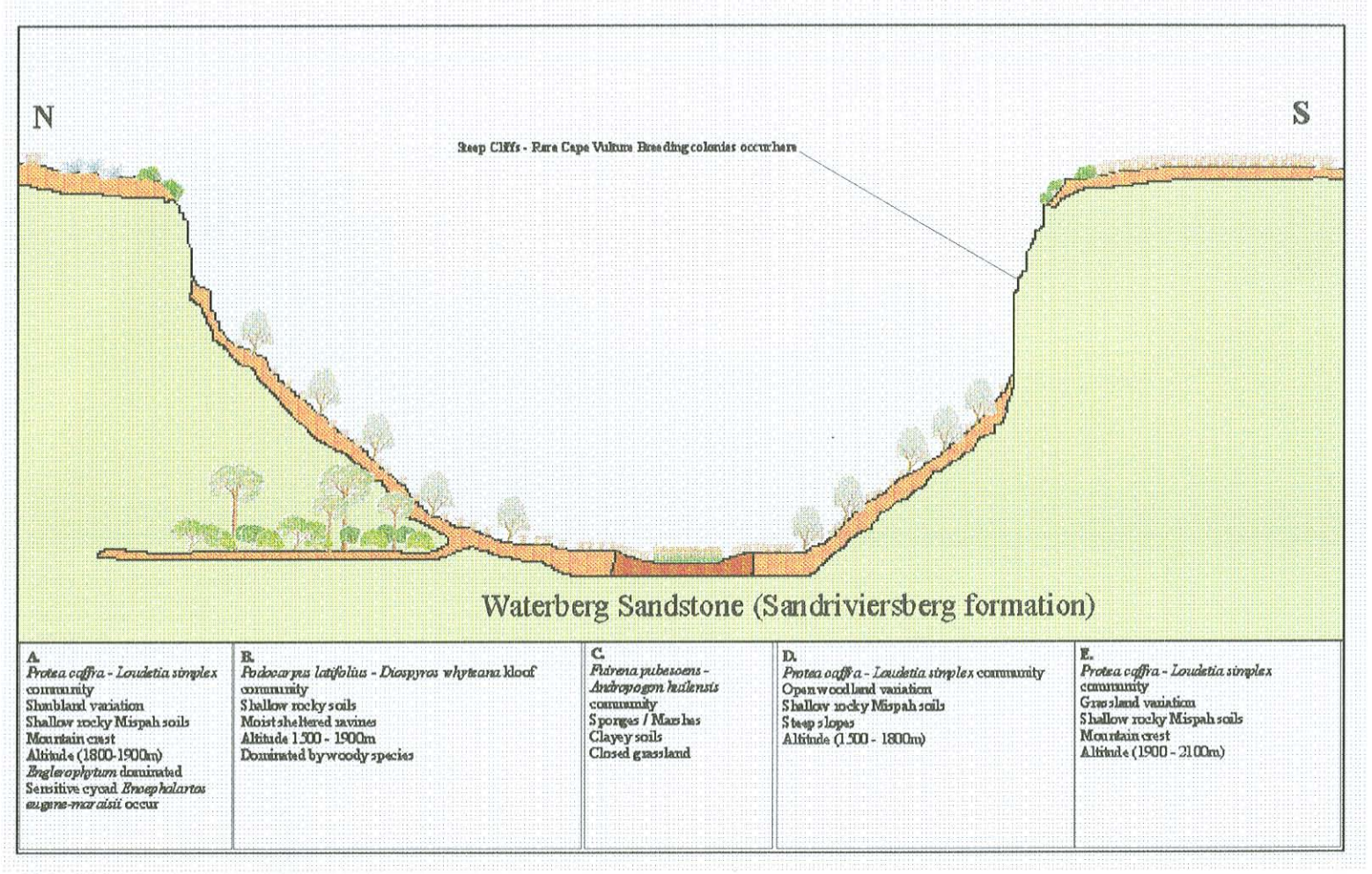


Figure 5.3 Catena of the High Altitude Mountain Ecozone in the Marakele National Park

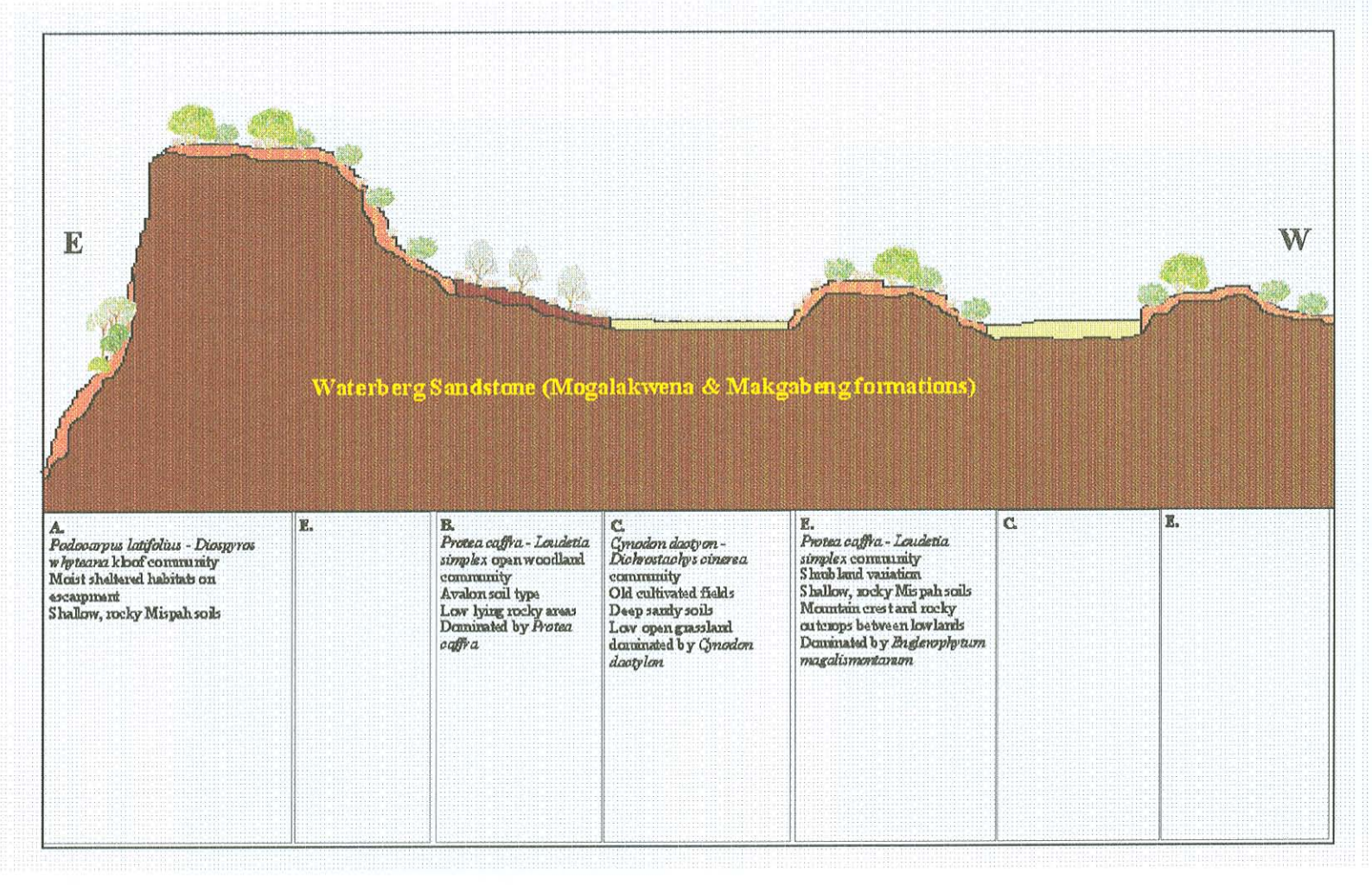
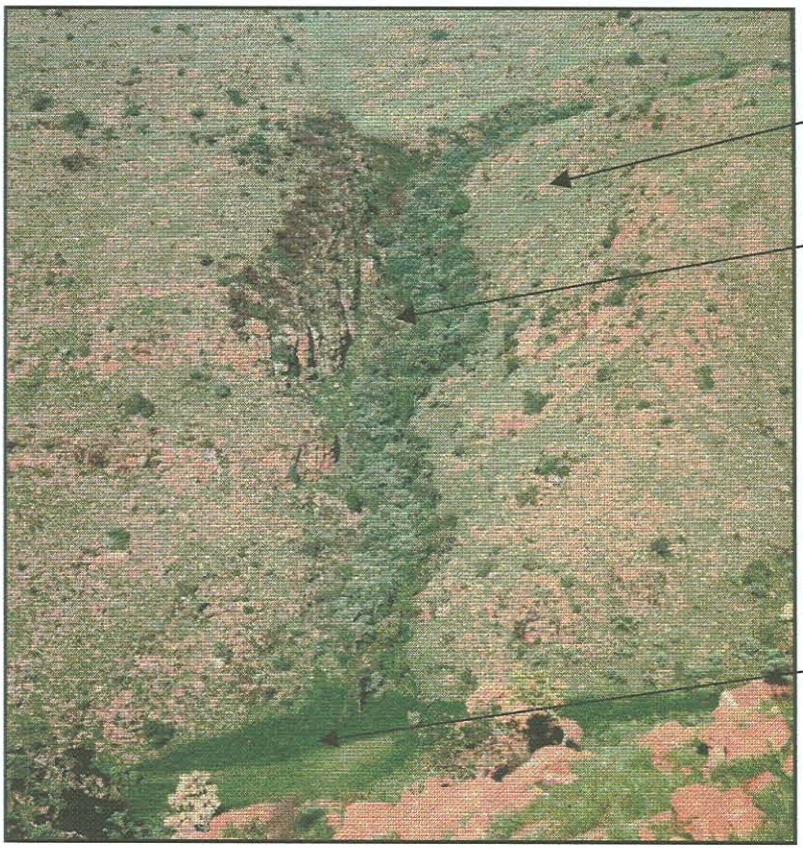


Figure 5.4 Catena of the Entabeni Game Reserve representing a variation of the High Altitude Mountain Ecozone

a.)



b.)

Figure 5.4. The *Protea-Englerophytum* High Altitude Escarpment Ecozone, showing the major plant communities occurring in the two variations, namely the Marakele National Park (a) and Entabeni Game Reserve (b).

5.3.2.2 *Diplorhynchus-Burkea* Rolling Mountains Ecozone

The *Diplorhynchus-Burkea* Ecozone is the most dominant ecozone within the Waterberg landscape. The ecozone was identified based on geology and soils. The geology underlying the vegetation is Waterberg sandstone of the Sandriviersberg and Mogalakwena formations, lower than 1500 metres altitude (Fig. 5.6). Callaghan (1987) described these two formations together based on sedimentary style, and he even submitted a proposal to the SACS working group for the Waterberg and Soutpansberg Groups in which the formations are considered a single formation. Diabase and dolerite dykes also frequently occupy topographic depressions or rifts in the sandstone formations. The geomorphology of the area is classified as table-lands (ENPAT, 2000). The following major plant communities occur within this ecozone (Ch. 4):

- The *Diplorhynchus condylocarpon-Englerophyton magalismontanum* rocky slope major plant community
- The *Burkea africana-Setaria sphacelata* undulating plains, footslopes, terraces and plateaus major plant community
- The *Terminalia sericea-Eragrostis pallens* deep sands of the lowlands major plant community
- The *Protea caffra-Loudetia simplex* cool slopes major plant community
- The *Phragmites australis- Persicaria serrulata* vlei major plant community
- The *Podocarpus latifolius-Diospyros whyteana* kloof major plant community
- The *Cynodon dactylon-Dichrostachys cinerea* old fields and disturbed areas major plant community
- The *Dombeya rotundifolia-Panicum maximum* sweet rocky major plant community
- The *Acacia tortilis-Panicum maximum-Ziziphus mucronata* termitaria major plant community

Well-known places where this ecozone occurs include the Welgevonden Game Reserve, Marakele National Park, Shambala Private Game Reserve, Lapalala Wilderness Area, Kwalata Game Lodge, Entabeni Game Reserve (Mmadikiri

section), Nylsvley Nature Reserve, Masebe Nature Reserve, Touchstone Game Lodge and Mokolo Dam Nature Reserve

The plant communities are correlated to the landscape geomorphology, aspect and rockiness. The warm northern and western slopes are dominated by the *Diplorhynchus condylocarpon-Englerophyton magalismontanum* rocky slope community, occuring on Mispah and Glenrosa soil types on rocky slopes. It is classified by Coetzee *et al.* (1981), as warm moderate deciduous broadleaf sour bushveld. The cooler southern and eastern slopes consist of deciduous broadleaf species such as *Faurea saligna, Heteropyxis natalensis* and *Protea caffra,* and the microphyllous *Acacia caffra* sometimes dominating southern slopes (Coetzee *et al.* 1981). These species form part of the *Protea caffra-Loudetia simplex* cool slopes community. Although only occurring in small isolated patches, the *Podocarpus latifolius-Diospyros whyteana* community occurs in isolated ravine areas among these slopes, in places such as the Emaweni Game Lodge and Shambala Private Nature Reserve.

The foothills, terraces and rocky plateaus of the mountainous slopes represent the habitat of the *Burkea africana-Setaria sphacelata* community. *Burkea africana* shows a high affinity to these warmer, lower lying communities in rocky places. In some places, Coetzee *et al.* (1981) noted that stands of *Burkea africana* can be almost pure, with *Combretum apiculatum* dominating terraces with conglomerates as substrate. This plant community sometimes forms a mosaic with the *Terminalia sericea-Eragrostis pallens* deep sands community of the lowlands and sandy plateaus. The habitat of this community is leached, sandy soils dominated by *Terminalia sericea* and *Eragrostis pallens.* The sandy areas of the lowlands and plateaus also provide the habitat for the *Cynodon dactylon-Dichrostachys cinerea* old fields and disturbed areas community, typical of low lying areas within the Waterberg, yet providing an important habitat for several antelope grazing species. Both primary and secondary old fields occur as previously discussed.

The nutritionally enriched soil types, described by Coetzee (1975), as *Acacia caffra* savannas on diabase and in sheltered valleys, form the substrate on which the sweet rocky *Dombeya rotundifolia-Panicum maximum* community occurs. These areas

occur as dolerite and diabase dykes between slopes, or as rocky outcrops, such as on Tafelkop in the Emaweni Game Lodge, and the western mountainous part of Entabeni Nature Reserve. Another sweet bushveld plant community occurring in this ecozone is the *Acacia tortilis-Panicum maximum-Ziziphus mucronata* termitaria, mostly occurring in low lying areas, plateaus and terraces, where the soils are deeper, with a clayey layer underneath the sand. These termitaria provide useful grazing, shelter and nesting sites to birds and animals from the otherwise low value grazing in these areas.

The wetter zones along rivers and dams within the ecozone represent the *Phragmites australis-Persicaria serrulata* vlei community. This vegetation type is well represented throughout the ecozone in the Emaweni Game Lodge, Welgevonden Game Reserve and Marakele National Park.

Figure 5.6 shows the catena of the typical landscape geomorphology, geology, soils and major plant communities, while Figure 5.7 shows a photograph of the rolling mountains occurring in this ecozone.

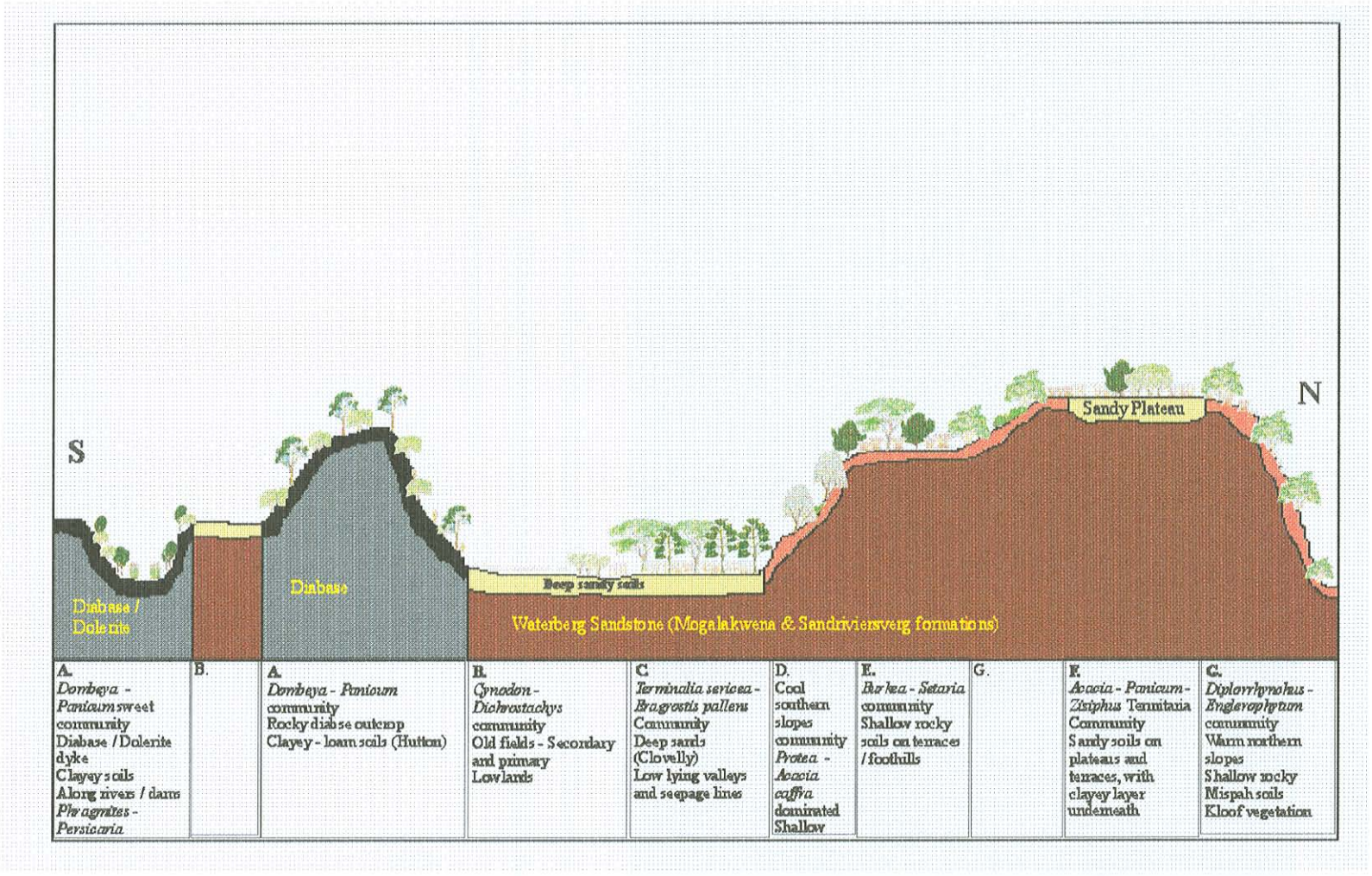


Figure 5.6 Catena of the *Diplorhynchus-Burkea* Rolling Mountains Ecozone

Figure 5.7 A typical example of the *Diplorhynchus-Burkea* Rolling Mountain Ecozone, showing *Burkea africana* (white arrow) and *Diplorhynchus condylocarpon* (yellow arrow) as the dominant species

5.3.2.3 *Terminalia-Combretum* Undulating Plains Ecozone

The *Terminalia-Combretum* Ecozone occurs in the valley in the Vaalwater area, stretching to the north to Melkrivier, and to the west, to just south of Mokolo Dam. The ecozone was identified according to the characteristic geomorphology of the area, although the underlying geology and soils determined the boundaries of this ecozone (Fig. 5.8). Van Rooyen & Bredenkamp (1996) described this area as the Mixed Bushveld Vegetation Type, and the boundaries of the mixed bushveld correlates closely to the geology boundaries. The underlying geology is of the Vaalwater and Cleremont formations. The Vaalwater formation differs from the Cleremont formation in being thicker, and representing a finer facies from a similar environment to the thinner Cleremont formation (Callaghan, 1987). The area representing this ecozone in the Nylsvley Nature Reserve is however underlain by granite, similarly described by Gertenbach (1983) as the mixed *Combretum / Terminalia sericea* woodland on granite. Conservation areas within the ecozone are Slangkuil Game Ranch, Jobedi Game Lodge, Mokolo River Nature Reserve, Nylsvley Nature Reserve and the southern parts of Kwalata Game Lodge. The typical geomorphology is moderately undulating plains in which the following major plant commuities occur (Ch. 4):

- The *Burkea africana-Setaria sphacelata* undulating plains major plant community
- The *Terminalia sericea-Eragrostis pallens* deep sands of the lowlands major plant community
- The *Cynodon dactylon-Dichrostachys cinerea* old fields and disturbed areas major plant community
- The *Dombeya rotundifolia-Panicum maximum* sweet rocky major plant community
- The *Acacia tortilis-Panicum maximum-Ziziphus mucronata* termitaria and encroached areas major plant community

Figure 5.8 shows a typical catena of the landscape. The low-lying areas are highly leached, with a high base status on Cartref and Clovelly soil types (Von Holdt, 1995). These areas are often totally dominated by the *Terminalia sericea-Eragrostis pallens* deep sand community, with *Terminalia sericea* often forming almost pure stands in

the low lying areas and seepage lines. When these areas have a clayey layer underneath a sandy layer, the *Acacia tortilis-Panicum maximum-Ziziphus mucronata* termitaria community becomes more prominent. These termitaria have enriched soils with typical sweet bushveld elements like *Acacia* species, *Pappea capensis* and *Panicum maximum*. Game farms previously used for cattle farming often have the encroached variation of this major community, where *Dichrostachys cinerea* completely dominates, and often form impenetrable thickets. As described in Ch. 4, the low-lying sandy areas were previously used for crop cultivation, and therefore when abandoned, undergo successional stages. Variations of both primary and secondary old fields occur in the ecozone. The secondary old fields often have more woody species like *Terminalia sericea* and *Acacia karroo*, while the primary old fields form low, open grasslands, dominated by *Cynodon dactylon* and *Hyparrhenia hirta*.

The low lying areas underlain by diabase or dolerite, provide the habitat for the *Dombeya rotundifolia-Panicum maximum* sweet rocky community, although in this ecozone the rockiness is often not as high as in the *Diplorhynchus-Burkea* Rolling Mountains Ecozone. Soils of the Milkwood and Westleight soil forms often dominate and occurs along dykes that form small rivers and streams.

The undulating areas of the ecozone are the most rocky, and dominated by Mispah and Glenrosa soil types. These low-lying warm slopes are often dominated by *Combretum apiculatum* and *Pterocarpus rotundifolius* (Coetzee *et al.* 1981) and forms part of the *Terminalio sericeae-Combretetea apiculati* class described by Winterbach (1998). The typical undulating landscape can be seen in figure 5.9.

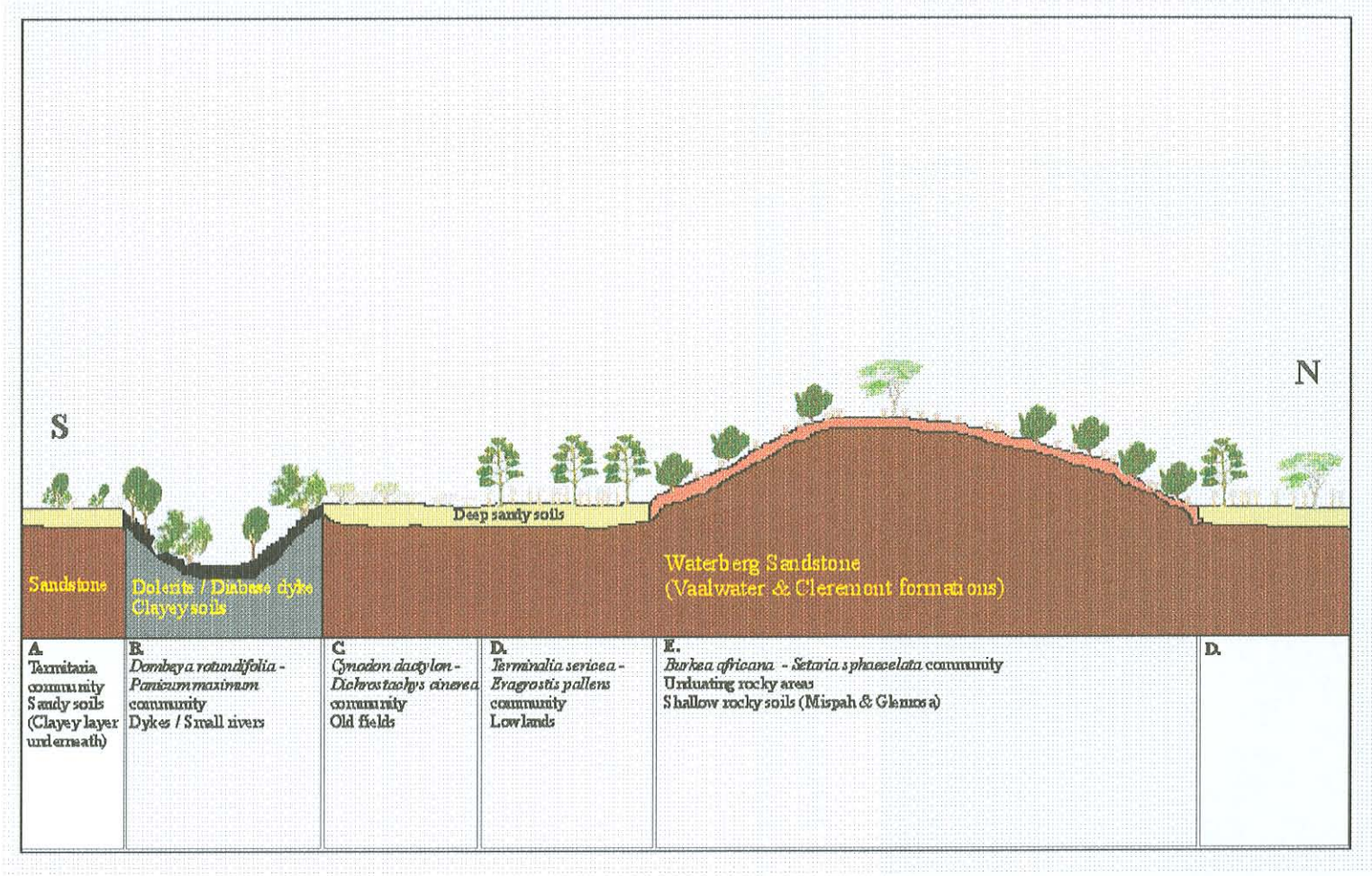


Figure 5.8 Catena of the *Terminalia-Combretum* Undulating Plains Ecozone

Figure 5.9. The *Terminalia-Combretum* undulating plains ecozone in the Vaalwater area showing typical undulating areas dominated by *Combretum apiculatum* (arrow)

5.3.2.4 *Acacia-Combretum-Terminalia* Mosaic Plains Ecozone

Werger & Coetzee (1978) classified this ecozone as part of the Moderate Plains Bushveld. The area lies west of the Kransberg block and includes the plains to the east and northeast of Thabazimbi within the Waterberg Biosphere Reserve, stretching towards the Kransberg. The ecozone is represented in the plains area of the Marakele National Park, which includes the area at Kwaggasvlakte and the old cattle farms around Duikerspan to the north. The plains within which the ecozone occurs were distinguished by using the geomorphology of the area, the soil types, and the geology, as seen in the catena of the ecozone (Fig. 5.10). This ecozone is a mosaic of different plant communities due to the great variation in geological formations that converge in this area; post-Waterberg intrusions like diabase, dolerite and gabbro are present. The geology varied from granite and granophyre on the most western plains of the Marakele National Park, local intrusions of diabase, gabbro and granophyre in the north (Coetzee *et al.* 1981), and siltstone, mudstone, shale and Waterberg Sandstone closer to the escarpment (Jansen, 1982). Certain areas are also heavily encroached by woody species (Coetzee *et al.* 1981). The most dominant plant communities occurring on the plains in this ecozone are the following (Ch. 4):

- The *Terminalia sericea-Eragrostis pallens* deep sands major plant community
- The *Cynodon dactylon-Dichrostachys cinerea* old fields and disturbed areas major plant community
- The *Dombeya rotundifolia-Panicum maximum* sweet rocky major plant community
- The *Acacia tortilis-Panicum maximum-Ziziphus mucronata* termitaria and encroached areas major plant community
- The *Acacia nigrescens-Grewia flava* plains major plant community

The areas closer to the mountains are Sour Bushveld (Acocks, 1988), and are dominated by deep Clovelly soils, originating from Waterberg sandstone of the Skilpadkop formation, on which the *Terminalia sericea-Eragrostis pallens* community dominates. These areas also provide the suitable habitat for the sandveld-termitaria, *Acacia tortilis-Panicum maximum-Ziziphus mucronata* termitaria. Areas

further away from the mountains were previously overgrazed when used for cattle farming, and serious encroaching occurred on these sandy areas, often forming thickets dominated by woody species such as *Dichrostachys cinerea*, *Acacia erubescens* and *Acacia mellifera* (Coetzee *et al.* 1981). The Kwaggasvlakte plains area of the Marakele National Park is underlain by granite and can be compared to the Mixed Bushwillow Woodlands Ecozone in the Kruger National Park (Jacana, 1997). The plant community represented is the *Acacia nigrescens* - *Grewia flava* plains community, also described by Schmidt (1992). Low-lying areas are often dominated by *Acacia* species, while slight undulations cause *Combretum* species to become more dominant. However, these areas rather form a mosaic, as described by Winterbach (1998), and no definite distinction between vegetation communities can be made at this scale. The sandy, low-lying areas of this ecozone also include the *Cynodon dactylon-Dichrostachys cinerea* old fields community, mostly of the secondary successional stage.

Towards the northern parts, diabase dyke intrusions are prominent and subsequently the sweet *Dombeya rotundifolia-Panicum maximum* community is more prominent in these areas. A typical landscape in the mosaic plains ecozone is shown in figure 5.11.

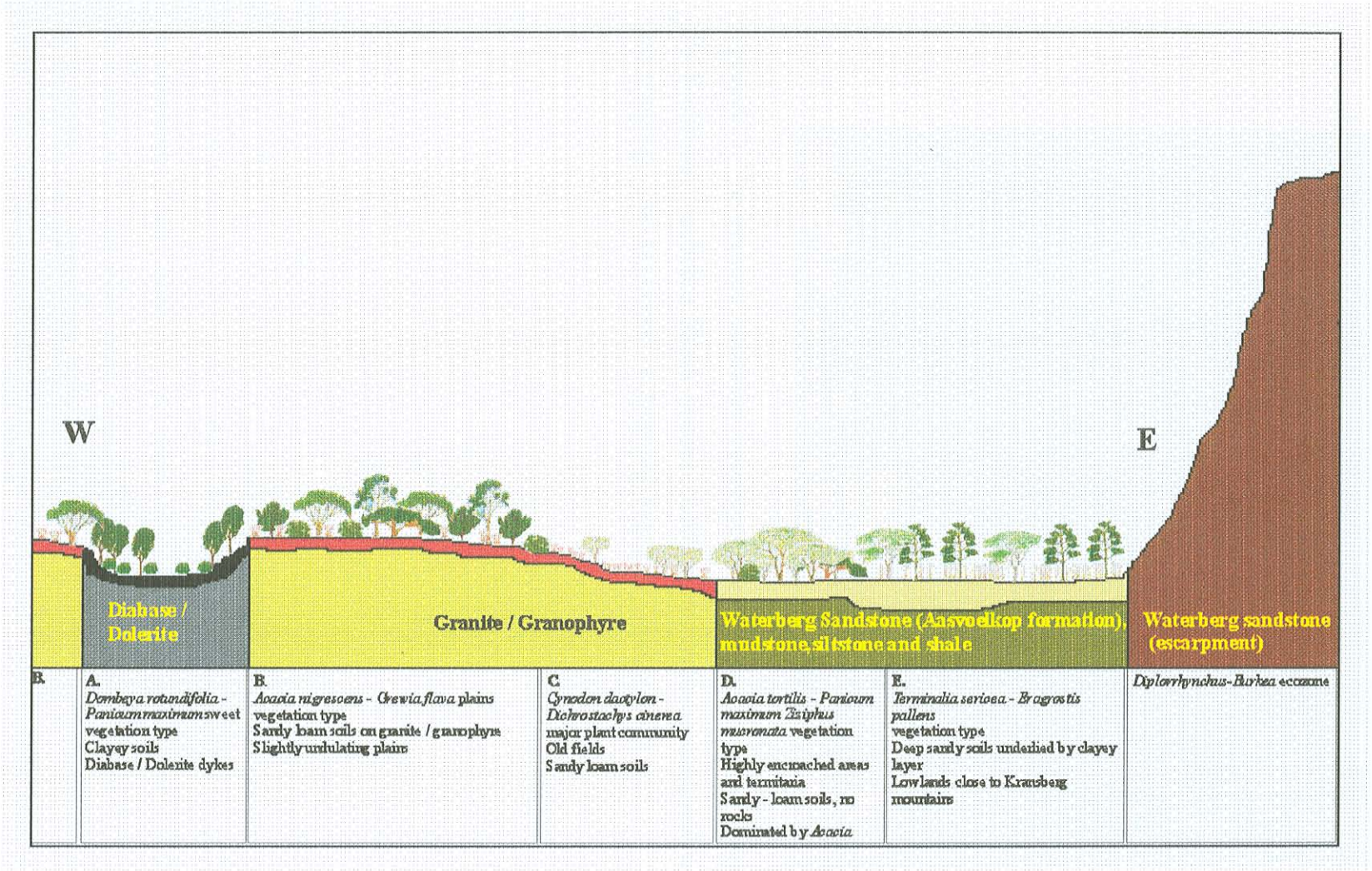


Figure 5.10 Catena of the *Acacia-Combretum-Terminalia* Mosaic Plains Ecozone

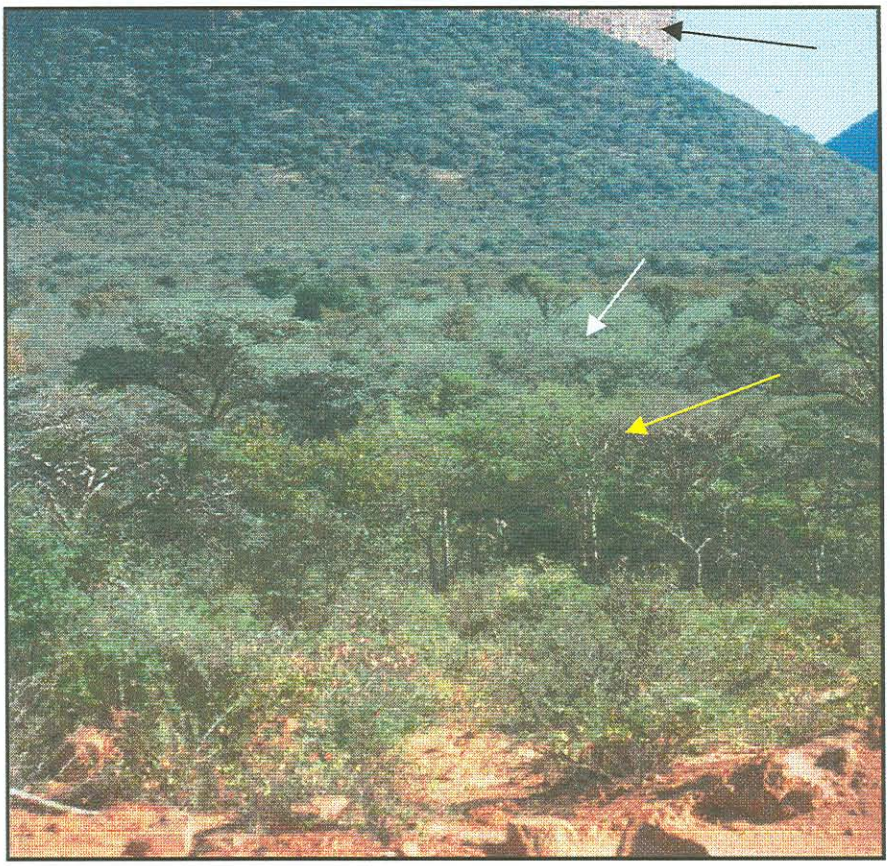


Figure 5.11. The *Acacia-Combretum-Terminalia* mosaic plains ecozone to the west of the Kransberg mountains (black arrow), showing encroached areas (yellow arrow), and a seepage line dominated by *Terminalia sericea* (white arrow)

5.3.2.5 Arid Sweet Low Mountains and Plains Ecozone

This ecozone lies in the northern areas of the Biosphere Reserve. The main environmental parameters used for identification were climate and soil types. The area has a much lower rainfall (average rainfall for Marken 450 mm annually, compared to 620 mm annually at Vaalwater). The ecozone also lies at lower altitudes between 900 and 1000 m. The area has two different geomorphological formations. The far northern parts form extensive mountainous terrain with low-lying valleys and plains, well represented in the Wonderkop Nature Reserve (Fig. 5.13). Soils are mostly shallow rocky Mispah and Glenrosa soil types in the mountainous parts derived from Waterberg Sandstone of the Mogalakwena and Makgabeng formations, while the soils of the plain areas are mostly red-yellow apedal, freely drained soils with a high base status, derived from sedimentary stones (ENPAT, 2000). Plain areas with scattered mountains and hills dominate the southern area of the ecozone. The following major plant communities occur in the ecozone (Ch. 4):

- The *Dombeya rotundifolia-Panicum maximum* sweet rocky major plant community
- The *Acacia nigrescens-Grewia flava* plains major plant community
- The *Burkea africana-Setaria sphacelata* footslopes and terraces major plant community
- The *Terminalia sericea-Eragrostis pallens* deep sands of drainage lines major plant community
- The *Cynodon dactylon-Dichrostachys cinerea* old fields and disturbed areas major plant community

The low mountains occurring to the north form an extremely interesting ecosystem. The underlying geology is Waterberg sandstone, yet due to the drier conditions, common Waterberg species like *Englerophytum magalismontanum* and *Diplorhynchus condylocarpon* do not occur here. The dominant vegetation type of the rocky mountainous terrain represents the *Dombeya rotundifolia-Panicum maximum* sweet rocky community, usually common on diabase and dolerite dykes. It is very similar to the *Kirkia wilmsii-Terminalia prunioides* closed mountain bushveld

described by Siebert (2001) in Sekhukuneland. Terraces and footslopes of the mountainous areas are represented by the *Burkea africana-Setaria sphacelata* community, especially dominated by *Combretum apiculatum*. Dolerite and diabase dykes do also occur in this ecozone as intrusions. The valleys between the low mountains, and the plains areas in the southern parts of this ecozone, consist of sandy-loam soils on which the *Acacia nigrescens* - *Grewia flava* plains community occurs. Seepage lines occur within this plains vegetation type, especially in low lying areas where sand may accumulate, and form the habitat of the dominant *Terminalia sericea-Eragrostis pallens* community. Secondary old fields occur on old cultivated fields, while dense stands of *Dichrostachys cinerea* occur in areas of old cattle farms. Both these variations form part of the *Cynodon dactylon-Dichrostachys cinerea* old fields and disturbed areas major plant community. A catena of the ecozone shows the different environmental factors and plant communities that occur in the ecozone (Fig. 5.12).

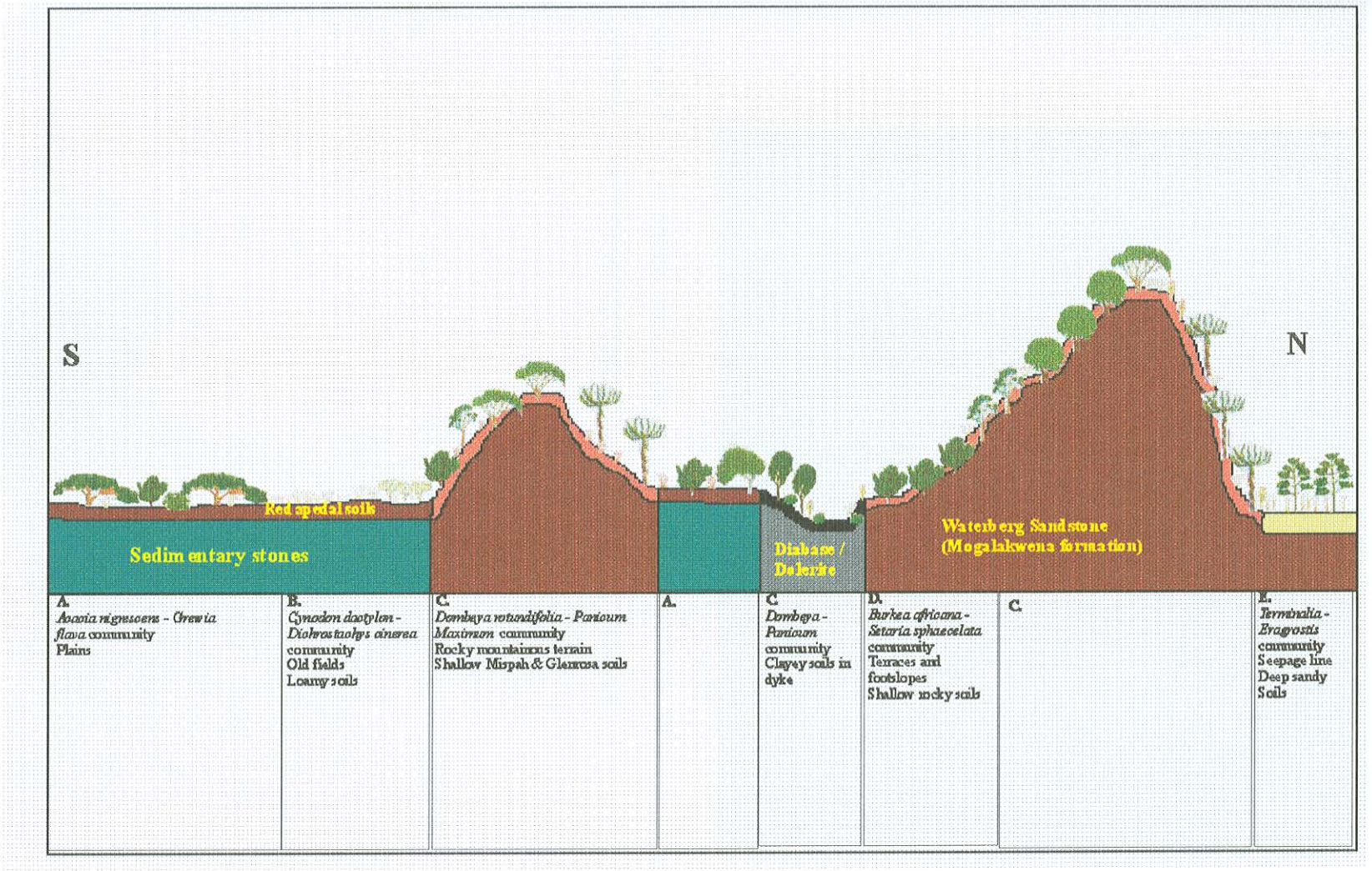


Figure 5.12 Catena of the Arid Sweet Low Mountains and Plains Ecozone

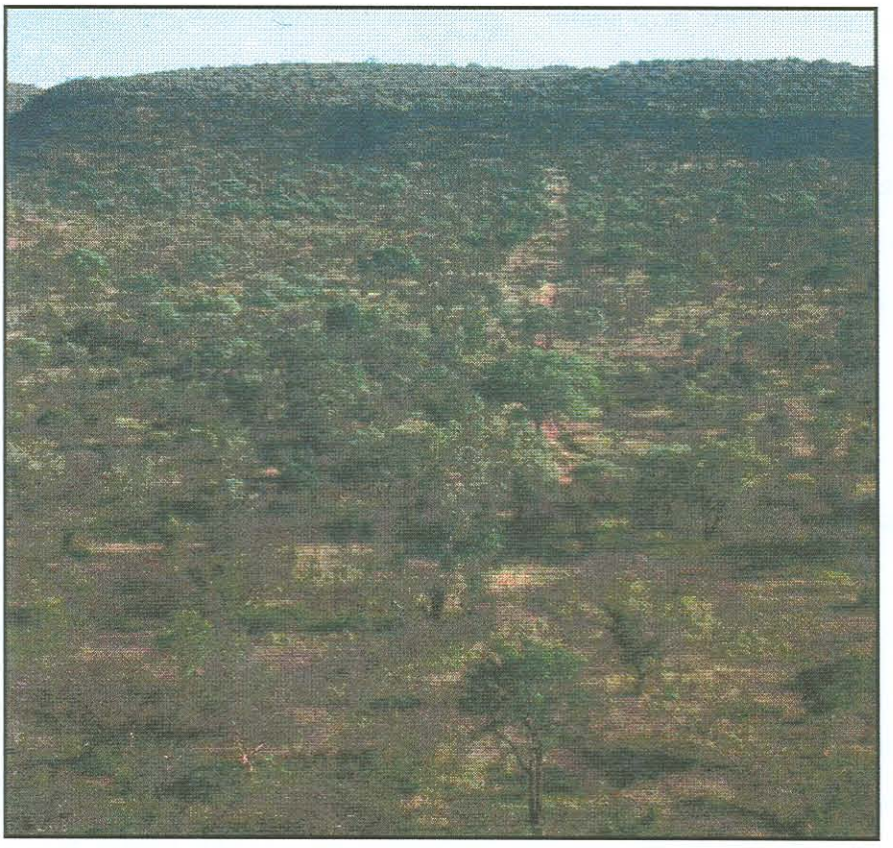


Figure 5.13. A typical landscape of the Arid Sweet Low Mountains and Plains Ecozone in the Wonderkop Nature Reserve, Limpopo Province.

5.3.2.6 Nylsvley Floodplains Ecozone

Coetzee *et al.* (1976) conducted a phytosociological study in this ecozone, which provide some of the most important breeding habitats to waterbirds in Southern Africa. Several soil types and plant communities occur within the Reserve as shown in figure 5.14. The floodplains ecozone was identified as lowlands, having calcareous clayey soils with marsh vegetation, fringed by microphyllous deciduous thorn savannas (Frost, 1987). The soils in these areas are alluvial, illuvial and vertisols (Harmse, 1977). The major plant communities occurring in these low lying clayey areas are the following:

- The *Phragmites australis-Persicaria serrulata* vlei major plant community
- The *Acacia tortilis-Panicum maximum-Ziziphus mucronata* termitaria major plant community
- The *Setaria incrassata-Aristida bipartita* vertic clay major plant community

The permanent wet zone, occuring along the fringes of the Nyl river, representing the *Phragmites australis - Persicaria serrulata* vlei community, have not been described by Coetzee *et al.* (1976), This ecozone plays an important role in providing the habitat for several fish species, waterbird feeding and nesting sites, and drinking place to mammals. The permanent wet zone is surrounded by the *Setaria incrassata-Aristida bipartita* vertic clay community type. The vegetation structure was classified by Coetzee *et al.* (1976) as tree savanna and grassland, closely related to the Black Turf Thornveld (Acocks, 1988) occurring on heavy, calcareous clays. The vegetation consists mainly of a seasonally wet grassland of grasses and forbs. Woody species occur on the drier sites and the crests of gilgai mounds. The absence of woody elements reflects the seasonally high water table of these soils which tend to drown any woody seedlings (Frost, 1987). The *Acacia tortilis-Panicum maximum-Ziziphus mucronata* termitaria vegetation type occurs on the lighter, less compacted and less brackish soils and on often impenetrable termitaria thickets (Coetzee *et al.* 1976). The ecozone is represented in the Nylslvley catena which consist of three different ecozones, coming together in an area of only 2300 hectares (Fig. 5.14). Figure 5.15

shows the seasonally flooded grassland and the vertic clay thornveld in the floodplains area of the Nylsvley Nature Reserve.

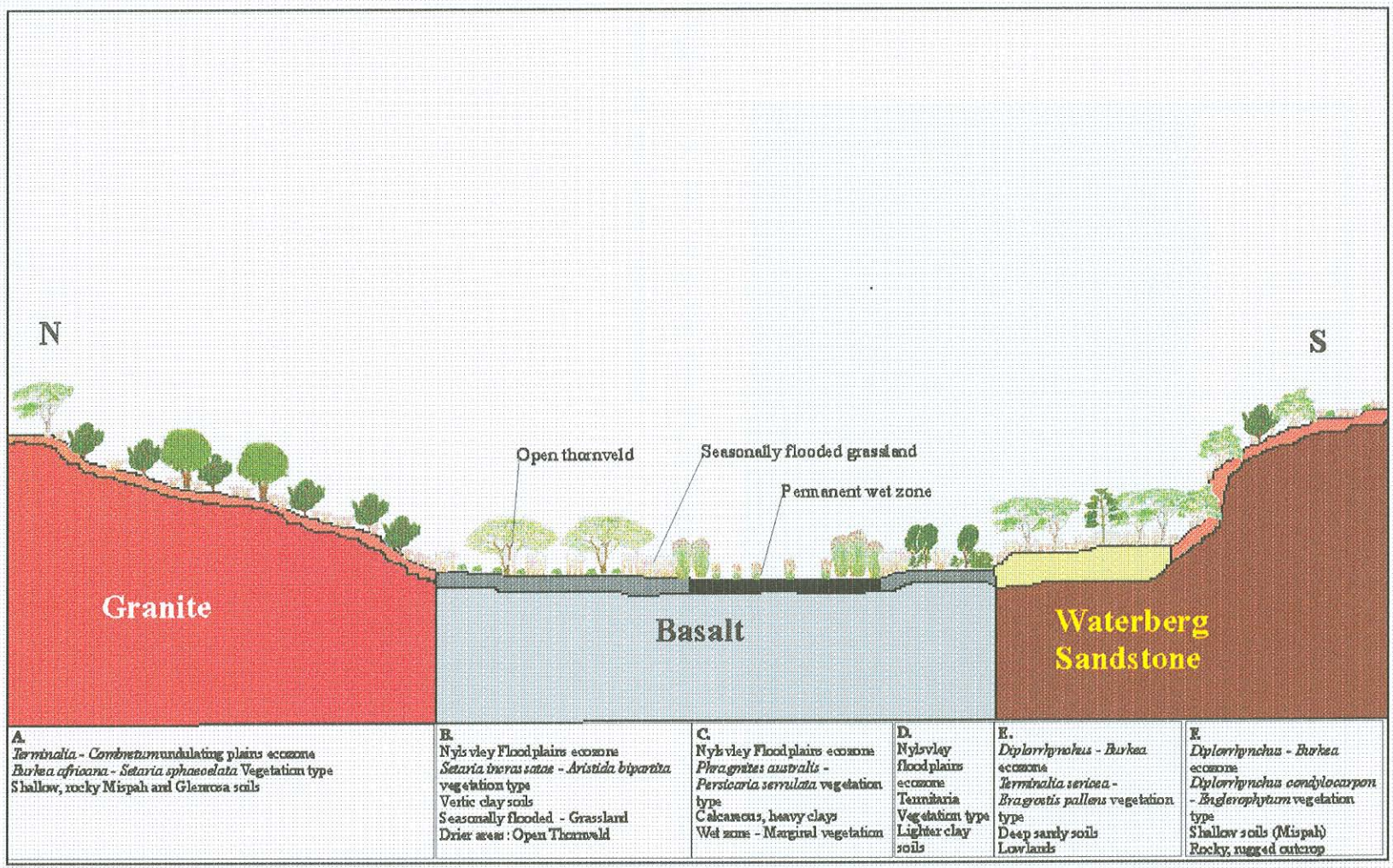


Figure 5.14 Catena of the Nylsvley Nature Reserve, indicating the Nylsvley Floodplains Ecozone

Figure 5.15. The Nylsvley floodplain Ecozone showing the seasonally flooded grassland and vertic clay thornveld

5.4 Conclusion

Booth *et al.* (1994) classified South Africa into 10 different ecozones, mostly based on the vegetation biomes identified by Rutherford & Westfall (1986). Jacana (1997) produced a tourism booklet on the ecozones of the Kruger National Park based on the combination of similar landscapes described by Gertenbach (1983). This showed that ecozones could be identified as smaller units within a large area, comparing differences in environmental parameters like climate, geology, soils and geomorphology.

The following ecozones were identified within the Waterberg Biosphere Reserve based on geology and soils, climate, altitude and geomorphology:

- *Protea-Englerophyton* High Altitude Escarpment Ecozone
- *Diplorhynchus-Burkea* Rolling Mountain Ecozone
- *Terminalia-Combretum* Undulating Plains Ecozone
- *Acacia-Combretum-Terminalia* Mosaic Plains Ecozone
- Arid Sweet Low Mountains and Plains Ecozone
- Nylsvley Floodplains Ecozone

Scientists who study ecozones do not agree on exactly where they are, or even how to define them, due to attaching different importance values to combination of environmental factors (Booth *et al.* 1994). The ecozones identified within the Waterberg Biosphere Reserve were also done placing importance on different environmental factors. For example, the *Protea-Englerophytum* High Altitude Ecozone was identified as areas above 1500 m altitude, while the *Diplorhynchus - Burkea* rolling mountain ecozone was identified occurring on specific geological formations (below 1500 m) which create a specific geomorphological landscape. The importance for the identification of these ecozones is that they must be easily recognizable and the criteria is that at least 2 of the environmental parameters must be identified as different from other areas.

Jacana (1997) provides tourists with useful information on the habitats of the larger mammals within the Kruger National Park. The ecozones within the Waterberg Biosphere Reserve will provide the same basis to show mammal, bird and tree habitat within plant communities to tourists, as discussed in the following chapter.

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