Chapter 3: Methods

The study area is demarcated on the Topographical map 2727 Harrismith, scaled 1:250 000. Since the Land Type Series map and the Geological map of the area had not yet been published at the time of the survey, the area was stratified according to the classification of Acocks (1953, 1988). Five main veld types are present, i.e. the Southern Tall Grassland (#65), Highland and Dohne Sourveld (#44a & b), Valley Bushveld (#23), *Themeda - Festuca* Alpine Veld (#58) and Natal Sour Sandveld (#66). Within these broad classifications the vegetation and physical environment were studied and sampled.

A reconnaissance survey was conducted in order to identify the main vegetation types and dominant plant species and to form a basic idea of the topography, physiography as well as land-use of the area.

3.1 Sample plots: number, size and distribution

The number of sample plots to be distributed in a given area depends on various factors, such as the scale of the classification, environmental heterogeneity and the accuracy required for the classification (Bredenkamp 1982).

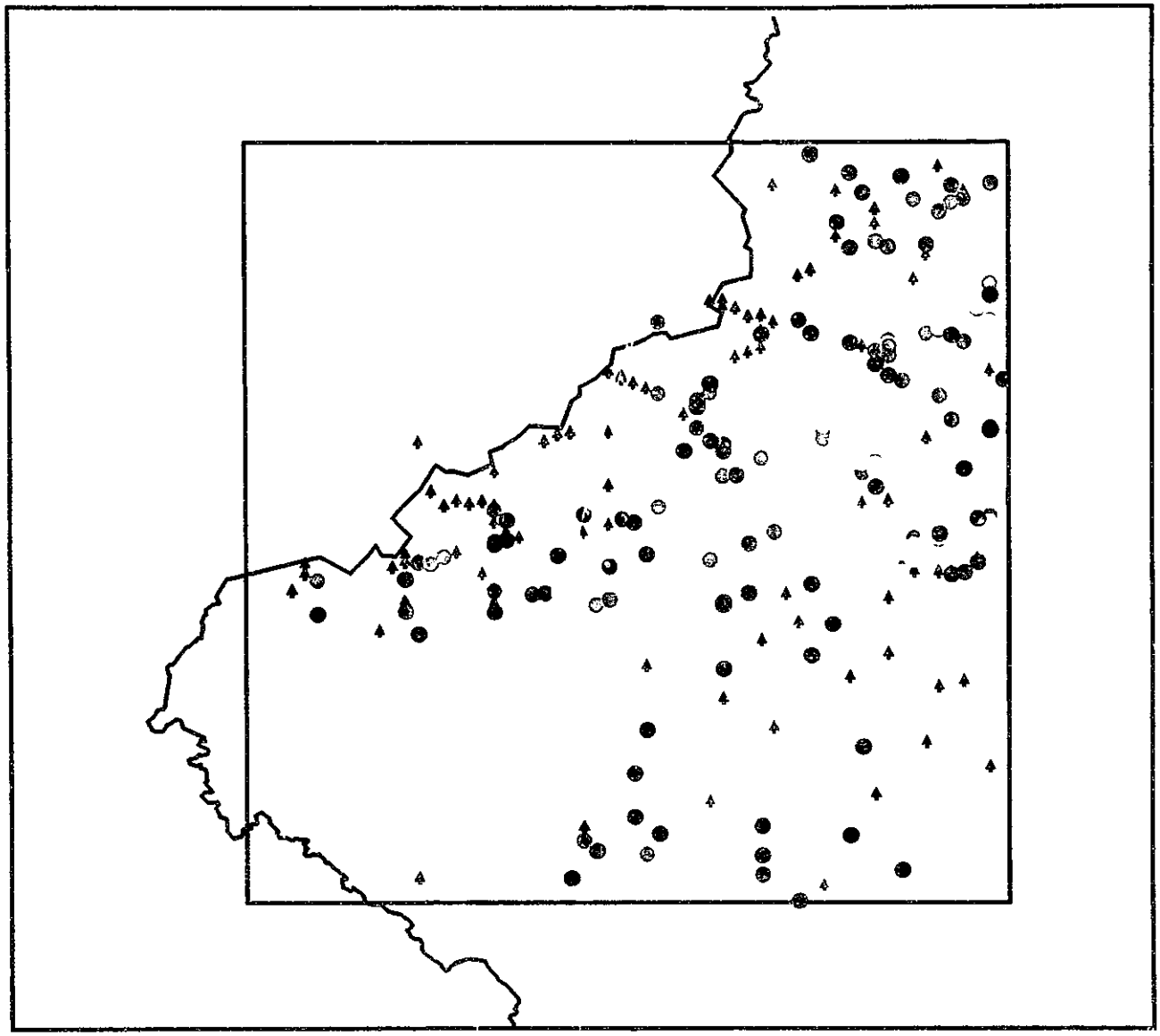
Stratification was primarily based on the veld types according to Acocks' classification (1953, 1988), but was severely restricted in certain areas such as the high mountains, by the inaccessibility of the areas. The Zurich-Montpellier approach of phytosociology (Braun-Blanquet 1964) was followed as recommended by Werger (1973) and Bredenkamp (1982). The position of each sample plot within a relative homogeneous stratification unit was chosen subjectively, provided that the sample plots adequately represented the plant communities concerned. This approach has been successfully applied in South Africa and more specifically in the Grassland Biome (e.g. Bezuidenhout **et. al.** 1988; Behr & Bredenkamp 1988; Bredenkamp **et. al.** 1989; Bezuidenhout & Bredenkamp 1991; Kooij **et. al.** 1990a, b, c; Matthews 1991; Smit 1992).

On a local scale topography was used as a further stratification method in the field, i.e. crest, scarp, midslope, footslope and valley bottoms were stratified within the previously stratified units. Combining the stratification methods described above produces a scale hierarchical approach and also ensures that samples may be associated with environmental variables which can be used to model the relationship between the vegetation and those variables.

The vegetation in the study area varies from grassland, through woodland and forests. Due to species diversity and uneven topography, sample plot sizes of 10 x 10 m for grassland vegetation (Bredenkamp 1975) and 10 x 20 m for woodland and forest vegetation (Bredenkamp 1982) were chosen. The shape of these sample plots were generally square and was only adapted to circumstances where it was necessary, e.g. in ravines or along water courses (Matthews 1991). A total of 526 sample plots were assessed during the growing seasons (December to April) of the years 1994 and 1995 (Figure 3.1).

3.2 Sampling method

A standardised and widely used sampling technique for general vegetation surveying in South Africa is the Braun-Blanquet method (Bredenkamp 1982), which also proved very successful. In order to make the results of the vegetation classification of different areas compatible and comparable, the same techniques were applied in this study as throughout the Grassland Biome Project.



Ladysmith
Gridlines 28° - 29°S and 29° - 30°E
KwaZulu-Natal Boundary
Sample plots of the Monocymbium cerisiiforme - Andropogon shirensis sub-community
Sample plots of the Monocymbium cerisiiforme - Cymbopogon excavatus sub-community
Sample plots of the Hyparrhenia anamesa - Hyparrhenia dregeana community
Sample plots of the Trachypogon spicatus and
Diospyros lycioides - Eragrostis chloromelas communities
Sample plots of the Hyparrhenia hirta - Themeda triandra community
Sample plots of the Maytenus heterophylla - Acalypha angustata community
Sample plots of the Maytenus heterophylla - Rhus pentheri community
Sample plots of the Rhoicissus tridentata - Achyranthes aspera community
Sample plots of the Mariscus congestus - Arundinella nepalensis community

Figure 3.1: Distribution of sample plots in the study area (Community names were allocated to sample plots after classification.

3.3 Floristic analysis

During the survey all plant species in the sample plots and the cover and/or abundance of each species were estimated according to the following Braun-Blanquet cover abundance scale (Mueller-Dombois & Ellenberg 1974):

r : one or few individuals (rare), with less than one percent cover of the total area of the sample plot

+ : infrequent with less than one percent cover of total sample plot area

1 : frequent with low cover, or infrequent but with higher cover, 1-5% cover of the total sample plot area

2 : abundant with 5-25% cover of total sample plot area,

A : >5-12%

B : >12-25%

3 : >25-50% cover of the total sample plot area, irrespective of the number of individuals

4 : >50-75% cover of the total sample plot area, irrespective of the number of individuals

5 : >75% cover of the total sample plot area, irrespective of the number of individuals.

Names of taxa are in accordance with those listed in Arnold and De Wet (1993).

3.4 Habitat analysis

The distribution of plant communities is closely related to environmental conditions (Gauch 1982). Therefore the physical environment has to be dealt with thoroughly in these studies, as it plays an important role in the ecological interpretation of the floristic data (Bezuidenhout 1988). A sample plot represents an area of similar habitat factors, including vegetation physiognomy. The habitat factors investigated in this study were the following:

Geographic position

Altitude- and longitude positions for each relevè were obtained from a Global Positioning System (GPS) (Ensign from Trimble Navigation) in the field.

Geology

Information was obtained from the computer program GIS (Geographical Information Systems). Digital data was obtained from the Counsel of Geoscience (1997).

Climate zone

For each sample plot the climate zone was annotated by making use of the climate zone map, obtained from the Institute for Soil, Climate and Water (1994).

Topography

The following topographical positions were distinguished

- crests
- scarps
- midslopes
- footslopes
- valley bottoms, floodplains or drainage lines.

Altitude, slope and aspect of the slope were determined for each sample plot.

Rockiness

The area of the sample plot covered by surface rock is an estimated percentage:

0 0 to 5%

1 6 to 10%

2 11 to 25%

3 26 to 35%

4 36 to 60%

5 > 60%.

Rock size was determined as follows:

1 no rocks
2 small
3 hand held
4 rocks
5 boulders

General observations

These include extent of erosion, utilisation, disturbances of the vegetation and management practices, where possible.

3.5 Data processing

A list of observations of a sample plot with all its floristic and associated environmental data is called a relevè. The floristic data sets of 1994 and 1995 were subjected to the Two-Way **I**ndicator **Sp**ecies **An**alysis technique (TWINSPAN) (Hill 1979) and subsequently refined by Braun-Blanquet procedures. TWINSPAN was applied to derive a first approximation of the vegetation units. These classifications were further refined by the application of Braun-Blanquet procedures to determine the plant communities. Both the techniques are contained within the mainframe computer programme BBNEW that is available at the Botany Department of the University of Pretoria.

A phytosociological table showing the vegetation lines was used to compile a synoptic table of the datasets. This synoptic table summarised and confirmed the vegetation types. Each major vegetation type was subsequently further analysed by TWINSPAN and afterwards refined by means of Braun-Blanquet procedures to determine the plant communities within the major vegetation types.

Chapter 4: Results

Based on the most prominent species throughout the study area, the vegetation is considered as a *Hyparrhenia hirta - Themeda triandra* major vegetation type. By means of TWINSPAN classification and subsequent refinement by Braun-Blanquet procedures, this major vegetation type was divided into the following vegetation types and communities (Diagram 4.1):

a . The High Altitude mountain vegetation type (Diagram 4.2) (Chapter 5)
1. The *Monocymbium ceresiiforme - Alloteropsis semialata* community
1.1. The *Monocymbium ceresiiforme - Andropogon schirensis* sub-community
1.2. The *Monocymbium ceresiiforme - Cymbopogon excavatus* sub-community

b . The Open Thornveld vegetation type (Diagram 4.3) (Chapter 6)
1. The *Hyparrhenia anamesa - Hyparrhenia dregeana* community
2. The *Trachypogon spicatus - Diheteropogon amplectens* community
3. The *Diospyros lycioides - Eragrostis chloromelas* community
4. The *Hyparrhenia hirta - Themeda triandra* community

c . The Woodland vegetation type (Diagram 4.4) (Chapter 7)
1. The *Maytenus heterophylla - Acalypha angustata* community
2. The *Maytenus heterophylla - Rhus pentheri* community

d. The Thicket vegetation type (Chapter 8)
1. The *Rhoicissus tridentata - Achyranthes aspera* community

e. The Wetland vegetation type (Chapter 8)
1. The *Mariscus congestus - Arundinella nepalensis* community

The relevés compiled in the study area are classified into vegetation types and communities due to differences in species composition. Geology, climate zones, topography, degree of rockiness, altitudinal differences and geographical position are used to ecologically interpret the vegetation types, communities and sub-communities (Diagram 4.1).

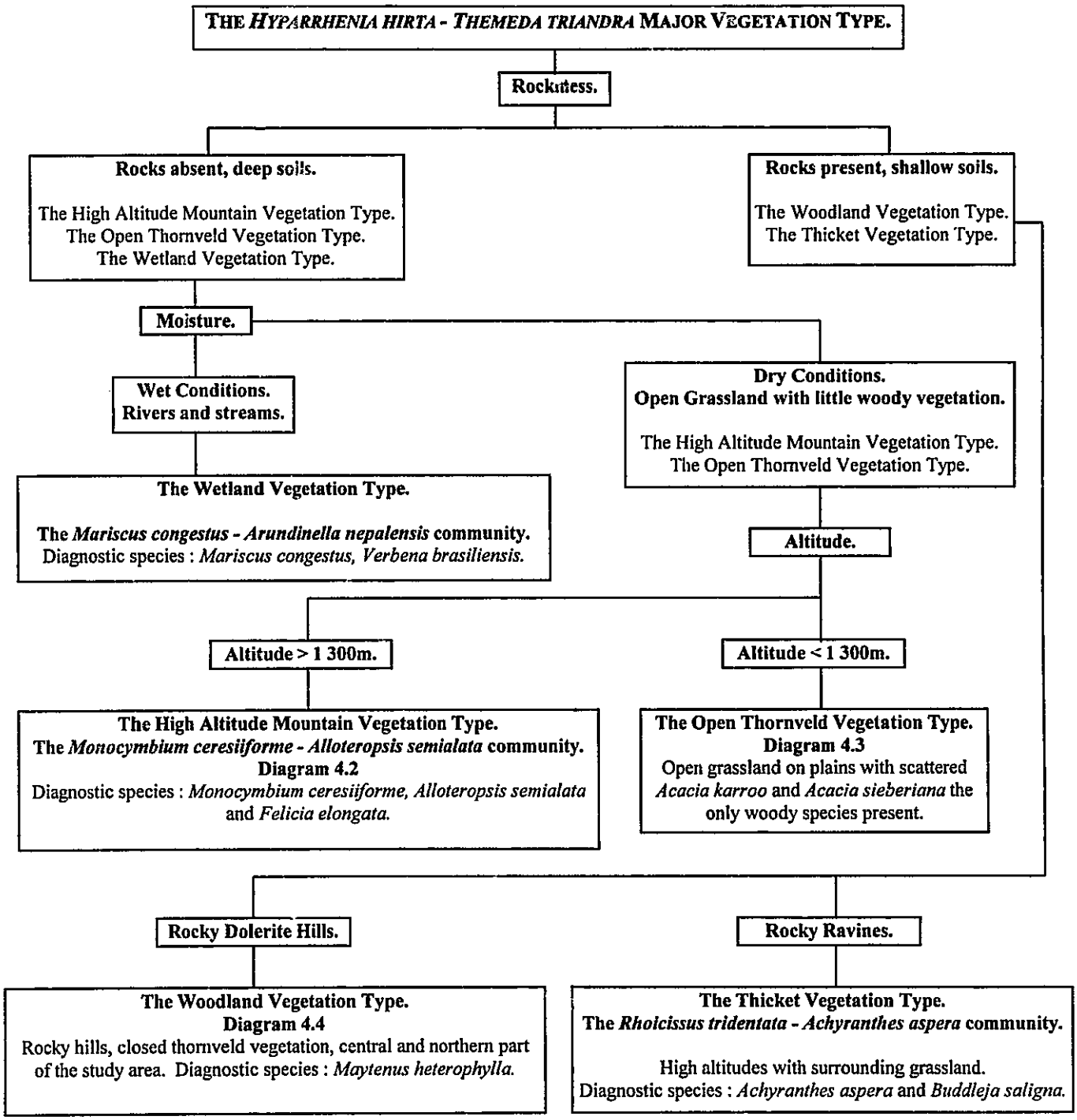
The absence of rocks in the Wetland -, *Monocymbium ceresiiforme* - *Alloteropsis semialata* -, and Open Thornveld Vegetation Types distinguishes them from the Woodland - and Thicket Vegetation Types. In most vegetation types where rocks are absent, soils are generally deep and sandy, but the texture may be sandy - loam and even clayey in the Wetland Vegetation Type.

The Wetland Vegetation Type is differentiated from the others due to the wet conditions that prevail, at least seasonally. Sample plots of this vegetation type are located in bottomlands in close vicinity of streams and rivers. The vegetation is described as the *Mariscus congestus* - *Arundinella nepalensis* community.

In the *Monocymbium ceresiiforme* - *Alloteropsis semialata* - and Open Thornveld Vegetation Types a low occurrence of woody species was recorded. The difference in altitude and associated differences in temperature and water, resulted in major environmental factors, causing differences in species composition. At altitudes higher than 1 300 m a.m.s.l. the vegetation is the *Monocymbium ceresiiforme* - *Alloteropsis semialata* Vegetation Type, whilst the Open Thornveld occur at lower altitudes.

Differences in geology and altitude resulted in the distinction between the Woodland - and Thicket Vegetation Types. The rocks of the Woodland Vegetation Type is of a Karoo Dolerite origin and this Vegetation Type is geographically separated from the Thicket Vegetation Type as the former is located in the eastern part of the study area, described by Acocks (1988) as Valley Bushveld. The Thicket Vegetation Type (*Rhoicissus tridentata* - *Achyranthes aspera* community) is generally present at high

DIAGRAM 4.1: A HABITAT INTERPRETATION OF THE VEGETATION TYPES OF THE *HYPARRHENIA HIRTA - THEMEDA TRIANDRA* MAJOR VEGETATION TYPE



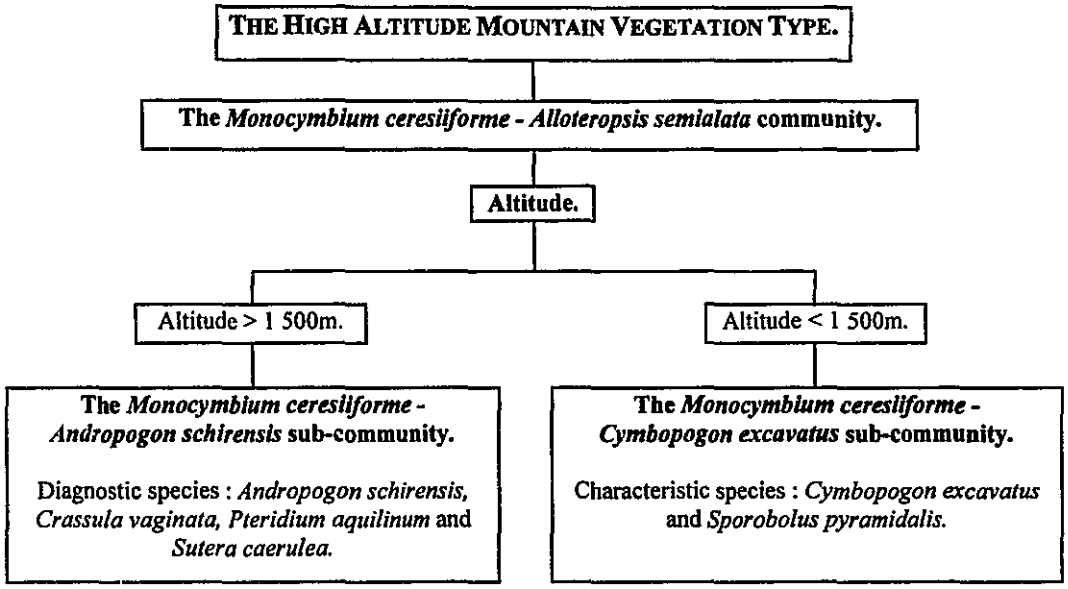
altitudes on the slopes of the Drakensberg and occurs on geological origin other than Karoo Dolerites. In the high mountains the topography includes high cliffs and steep, grassy valleys, whereas the lower slopes of the Drakensberg are gradual. The High Altitude Mountain Vegetation Type is represented by the *Monocymbium ceresiiforme - Alloteropsis semialata* community, which occurs at altitudes higher than 1 300 m a.m.s.l. (Diagram 4.2). The sub-communities of the *Monocymbium ceresiiforme - Alloteropsis semialata* community are distinguished mainly as a result of differences in altitude and in species composition.

At altitudes ranging from 1 300 to 1 500 m a.m.s.l., the vegetation is transitional to Southern Tall Grassveld (#65), as described by Acocks (1988) and is described in this study as the *Monocymbium ceresiiforme - Cymbopogon excavatus* sub-community. Other factors that might play an important role in determining the distribution of this sub-community include rainfall and temperature. A change in these factors correlates with a rapid change in topography.

The Open Thornveld Vegetation Type comprises grasslands on the plains of the Drakensberg footslopes at altitudes lower than 1 300 m a.m.s.l. (Diagram 4.3). The only two woody species that occur frequently in this vegetation type are *Acacia karroo* and *Acacia sieberiana.* The main environmental factors are similar throughout all the sample plots compiled in this vegetation type and it was not possible to interpret the habitat differences between the two sub-communities of this community.

The presence of the descriptive species in the *Hyparrhenia anamesa - Hyparrhenia dregeana* community distinguishes this community from others in the Open Thornveld Vegetation Type. The grass species *Trachypogon spicatus* characterises the *Trachypogon spicatus - Diheteropogon amplectens* community. The presence of the woody species *Diospyros lycioides* distinguishes the *Diospyros lycioides - Eragrostis chloromelas* community. The absence of these species is characteristic of the *Hyparrhenia hirta - Themeda triandra* community.

DIAGRAM 4.2 : THE HIGH ALTITUDE MOUNTAIN VEGETATION TYPE



The communities of the Woodland Vegetation Type are distinguished on basis of the presence and absence of species (Diagram 4.4). The descriptive species *Acalypha angustata* and *Rhus pentheri* distinguish the *Maytenus heterophylla - Acalypha angustata* and *Maytenus heterophylla - Rhus pentheri* communities respectively. The species composition of these communities is also different from the *Maytenus heterophylla - Acalypha angustata* community and is not dominated by woody species to the same degree as the *Maytenus heterophylla - Rhus pentheri* community. These communities are, except for differences in species composition, also geographically separated from the *Maytenus heterophylla - Rhus pentheri* community situated in the Valley Bushveld (Acocks 1988). The *Maytenus heterophylla - Acalypha angustata* community is situated in the Southern Tall Grassveld (Acocks #65). The classification and description of the recognised plant communities and sub-communities of each vegetation type are presented in the following separate chapters.

DIAGRAM 4.3: THE OPEN THORNVELD VEGETATION TYPE

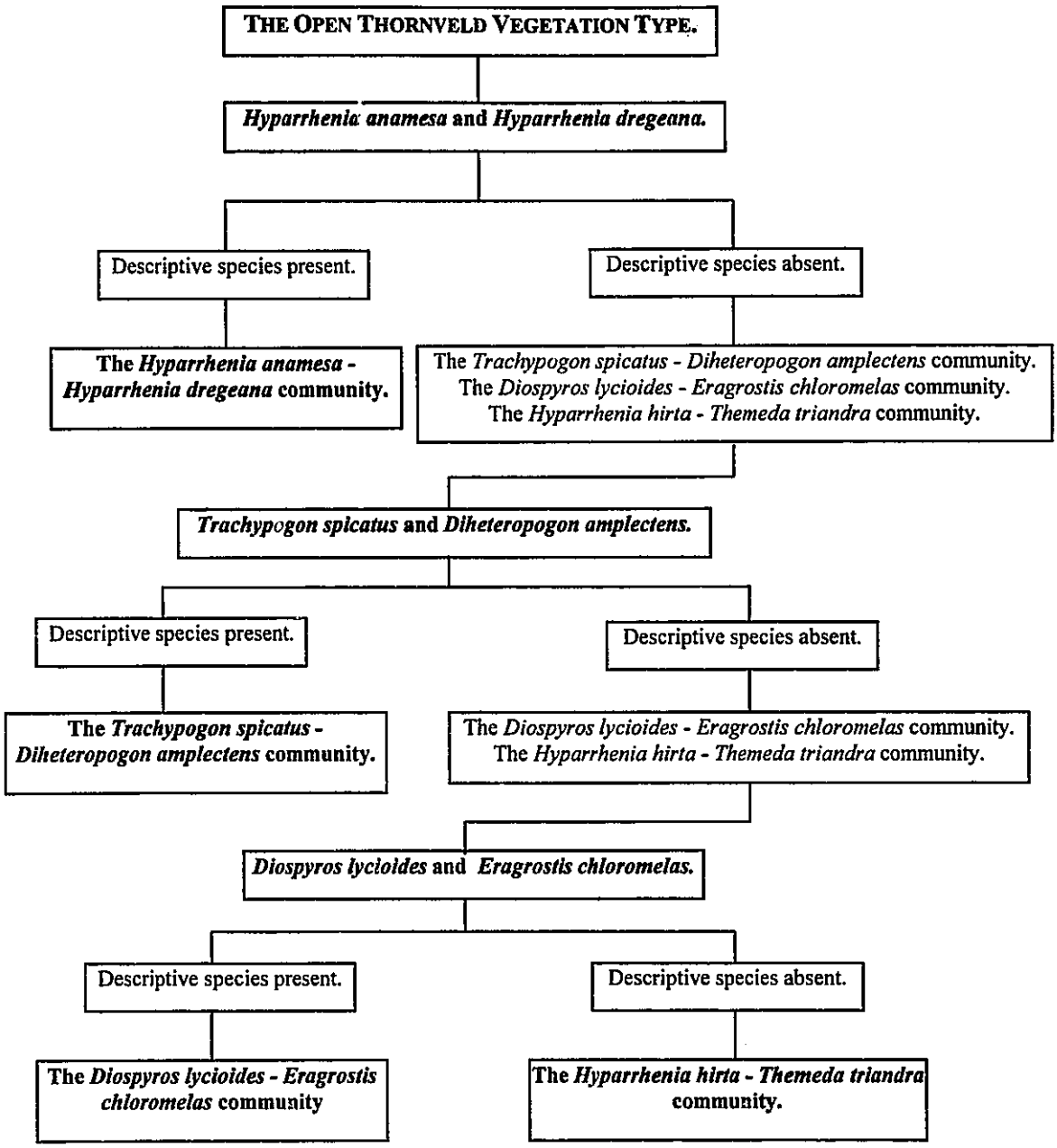
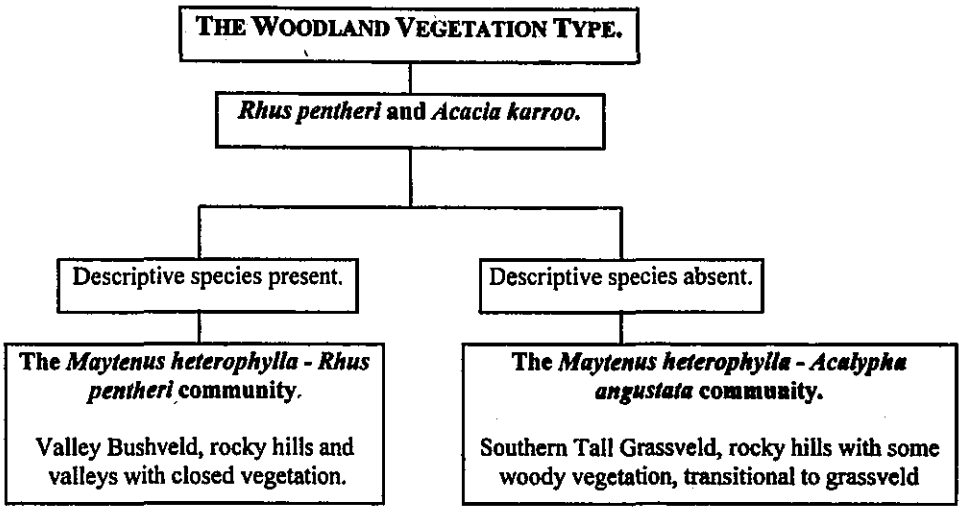


DIAGRAM 4.4: THE WOODLAND VEGETATION TYPE



Chapter 5: The High Altitude Mountain Vegetation Type

5.1 The *Monocymbium ceresiiforme - Alloteropsis semialata* grassland community

This vegetation type is situated in the western part and high altitude northern plains of the study area, along the slopes of the Drakensberg mountains, at altitudes higher than 1 300 m (Figure 5.1).

The floristic composition of this community is given in Table 5.1 with diagnostic species listed in Species group A, namely the grasses *Monocymbium ceresiiforme, Alloteropsis semialata* and the forb *Felicia elongata*. Prominent species that occur throughout this community are the grasses *Hyparrhenia hirta, Eragrostis plana, Tristachya leucothrix, Elionurus muticus* and the forbs *Vernonia natalensis, Berkheya setifera, Gladiolus woodii, Acalypha angustata, Senecio brevidentatus* and *Pelargonium luridum* (Species group AD). It is distinguished from the Open Thornveld and Woodland Vegetation Types due to the absence of species like *Hyparrhenia anamesa, Hyparrhenia dregeana, Trachypogon spicatus, Walafrida tenuifolia, Aloe marlothii, Maytenus heterophylla* and *Acacia karroo*. The absence of a diversity of wetland species and trees distinguish this Vegetation Type from the Wetland and Thicket Vegetation Types.

Classification of the relevès by means of Two Way Indicator Species Analysis (TWINSPAN) and subsequent refinement by Braun-Blanquet procedures resulted in the recognition of the following sub-communities and variations (Table 5.1):

5.1 The *Monocymbium ceresiiforme - Alloteropsis semialata* community
5.1.1 The *Monocymbium ceresiiforme - Andropogon schirensis* sub-community
5.1.1.1 The *Erica drakensbergensis - Helichrysum umbraculigerum* variation
5.1.1.2 The *Sporobolus centrifugus - Aristea woodii* variation
5.1.1.3 The *0394 001 - Trachypogon spicatus* variation
5.1.1.4 The *Loudetia flavida - Tristachya leucothrix* variation
5.1.1.5 The *Andropogon schirensis - Aristida junciformis* variation
5.1.1.6 The *Pteridium aquilinum - Eragrostis plana* variation

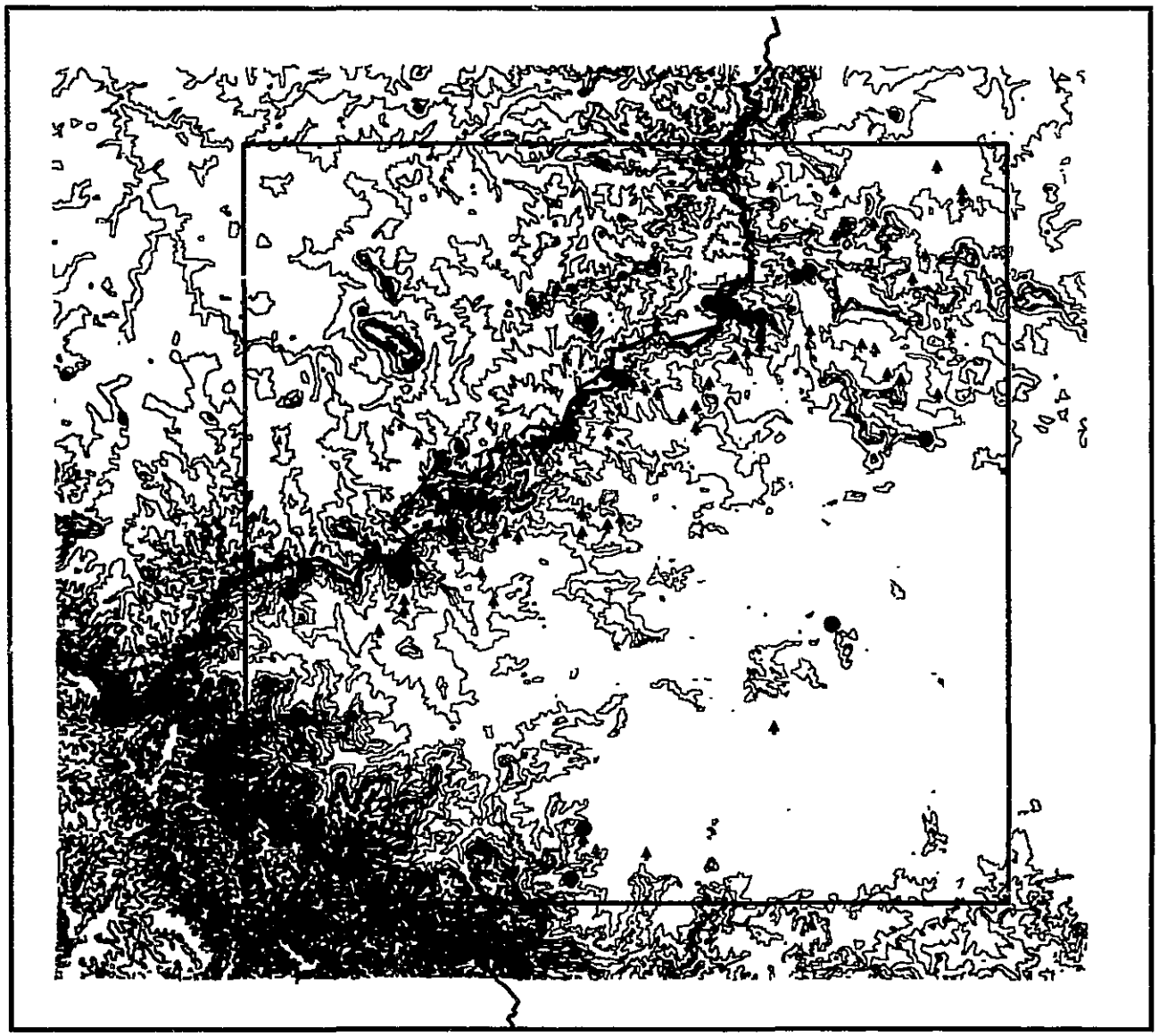


Figure 5.1: Distribution of the High Altitude Mountain Vegetation Type sample plots in the study area (contour interval 100m).

5.1.2 The *Monocymbium ceresiiforme - Cymbopogon excavatus* sub-community

5.1.2.1 The *Eragrostis gummiflua - Eragrostis chloromelas* variation

5.1.2.2 The *Sporobolus africanus - Richardia brasiliensis* variation

5.1.2.3 The *Diheteropogon amplectens - Hypoxis rigidula* variation

5.1.2.4 The *Paspalum scrobiculatum - Acanthospermum australe* variation

5.1.2.5 The *Cephalanthus natalensis - Trachypogon spicatus* variation

5.1.2.6 The *Eriosema cordatum - Helichrysum rugulosum* variation

5.1.2.7 The *Themeda triandra - Berkheya setifera* variation

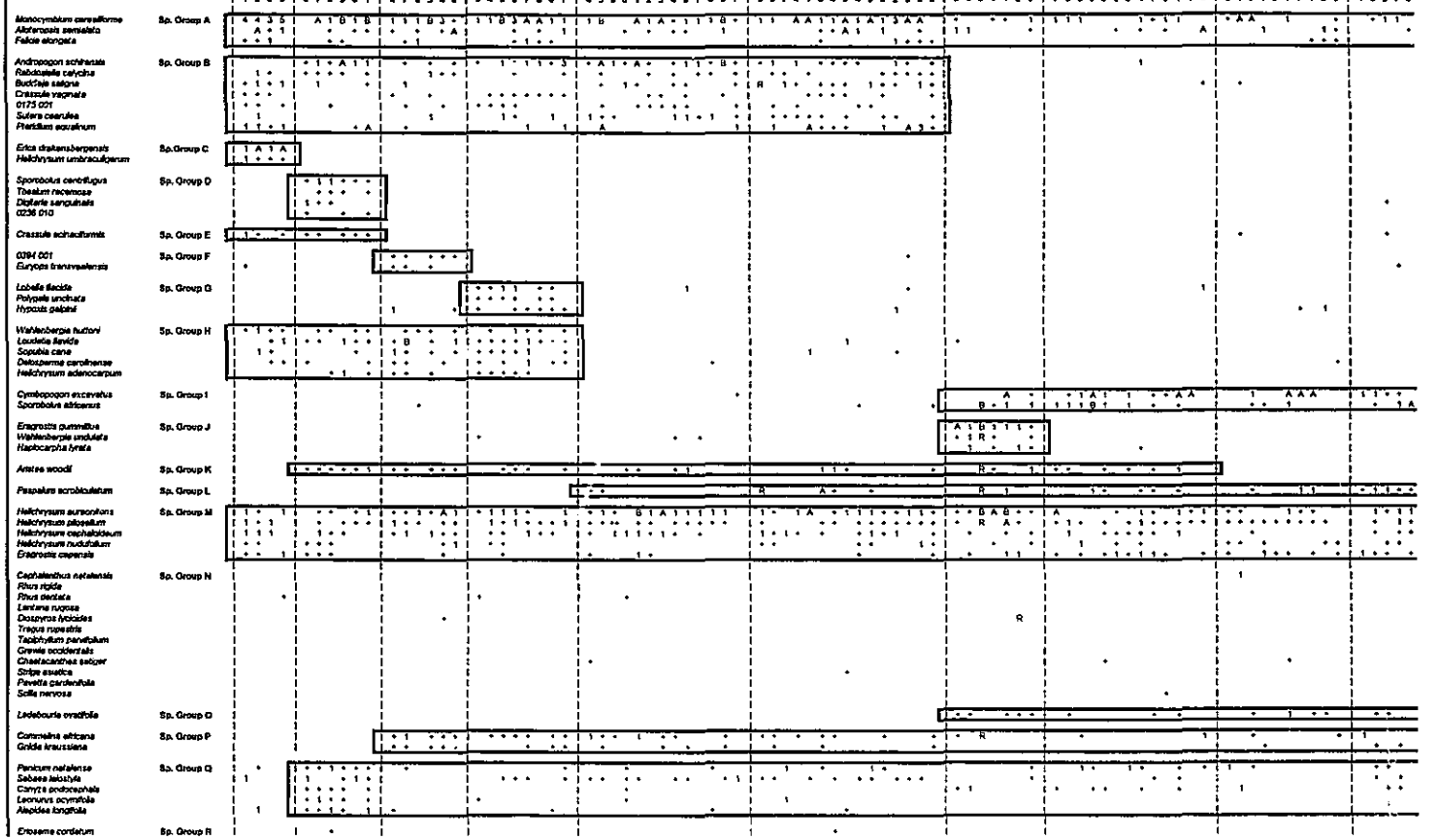
Woody species do occur in some of the variations, but this community is generally described as grassland.

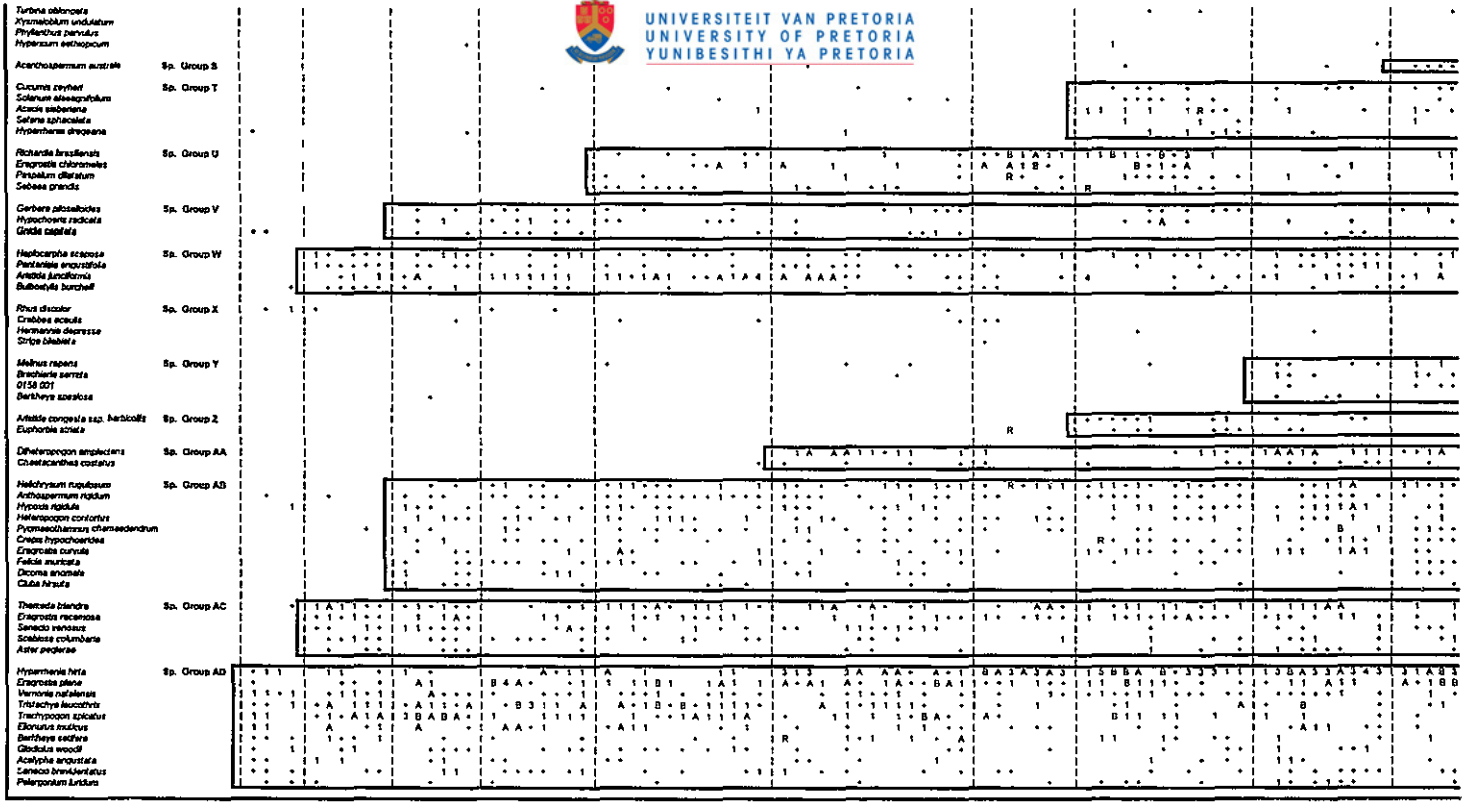
Sample plots of this community are distributed in three veld types described by Acocks (1988) (Figure 5.2), including the Southern Tall Grassveld (#65), the Highland Sourveld and Dohne Sourveld (#44) and Natal Sour Sandveld (#66). *Themeda triandra* and *Hyparrhenia hirta* dominate the Southern Tall Grassveld (#65) which normally occurs at altitude ranging from 600 to 1 350 m, though below 1 050 m a.m.s.l. the vegetation is transitional to Valley Bushveld. At altitudes above 1 050 m a.m.s.l. an open savanna of *Acacia sieberiana* in sourish mixed grassveld is found. According to Low and Rebelo (1996) the Southern Tall Grassveld corresponds to the Natal Central Bushveld (Granger 1996) (#25). However, the sample plots are mostly found in the North-eastern Mountain Grassland (Bredenkamp **et. al.** 1996c) (#43) and Wet Cold Highveld Grassland (Bredenkamp **et. al.** 1996a) (#41) (Figure 5.3).

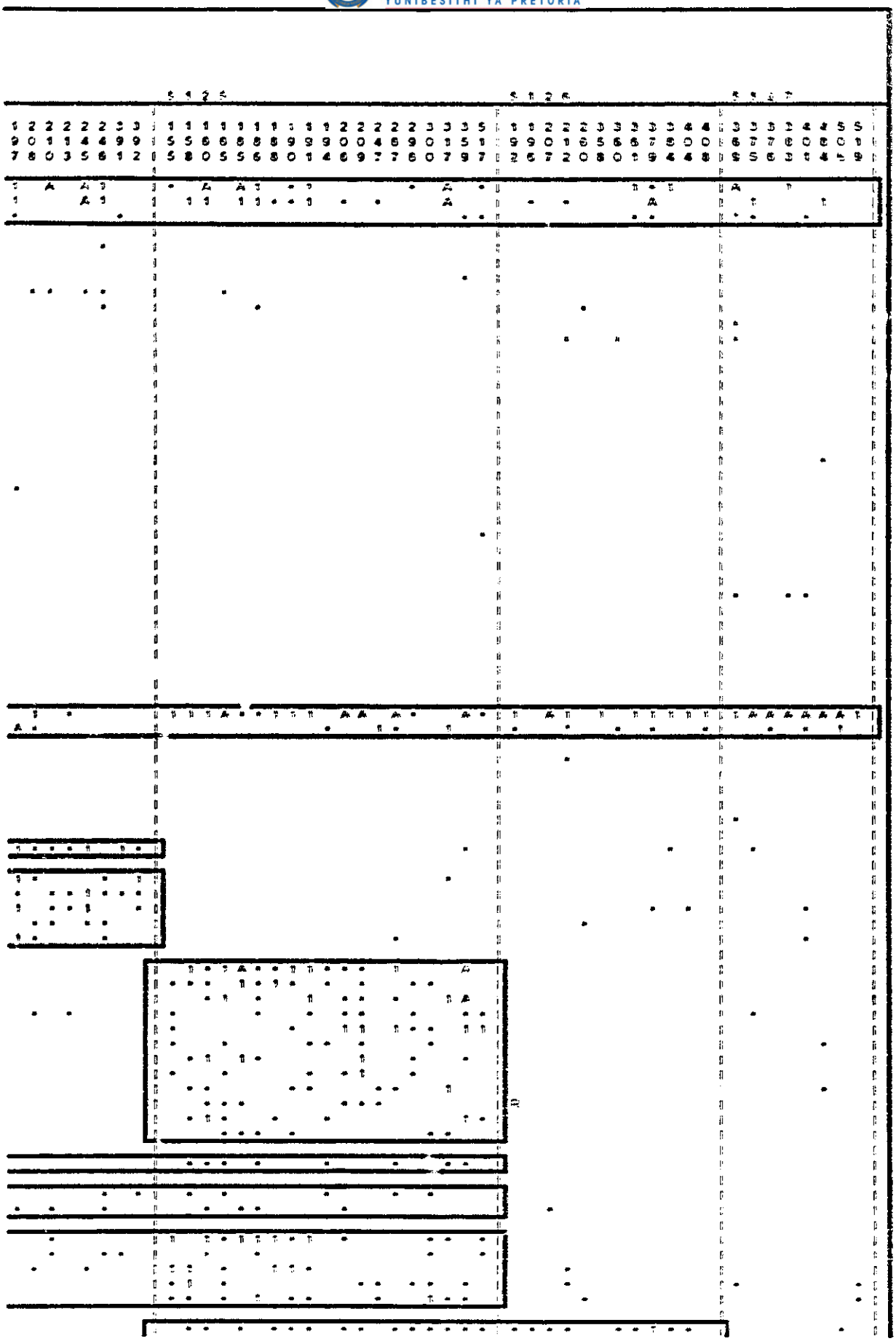
The Highland Sourveld (#44) is situated on the eastern slopes and foothills of the Drakensberg, from 1 350 to 2 150 m a.m.s.l. Frost is severe in winter and snow fall at the higher altitudes. It is an undulating landscape, inscised by numerous valleys with tall grassveld vegetation. A pure grassveld replaces the valley forests on the plains, lacking

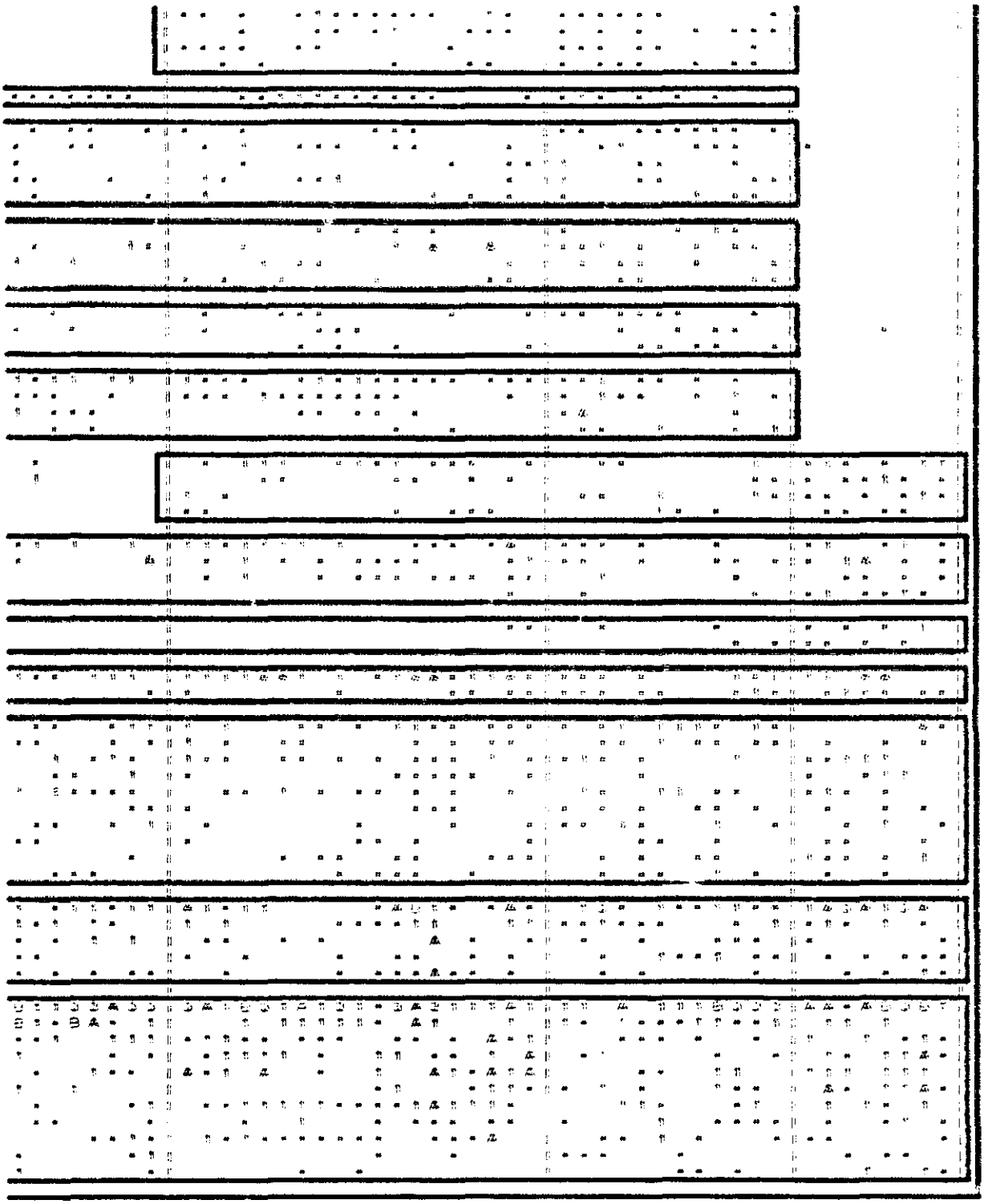
Plant communities of the Monocymbium ceresiiforme - Alloteropsis se

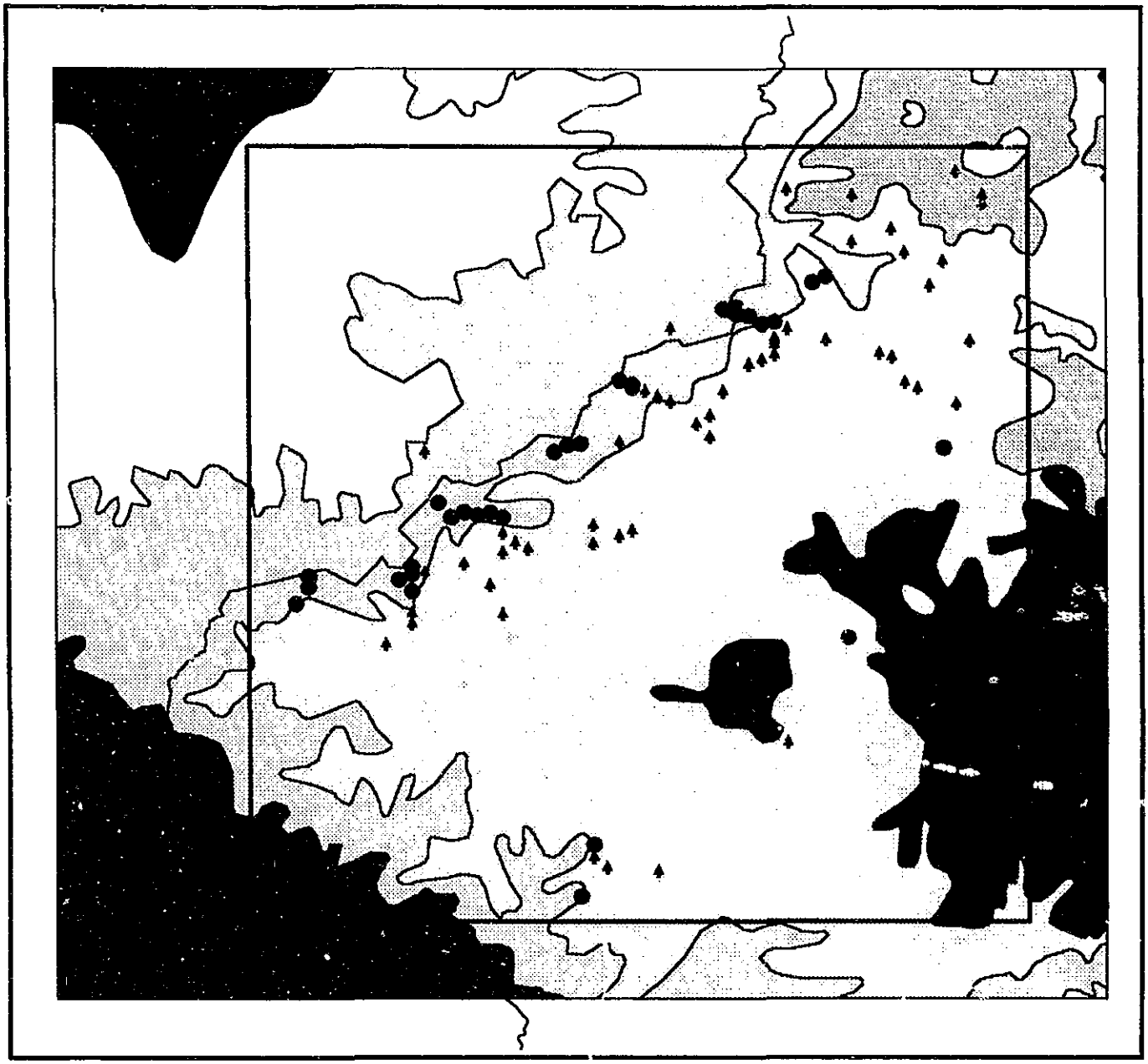
Table 5.1











Ladysmith
Gridlines 28° - 29°S and 29° - 30°E
KwaZulu-Natal Boundary
Sample plots of the Monocymbium cerisiiforme - Andropogon shirensis sub-community
Sample plots of the Monocymbium cerisiiforme - Cymbopogon excavatus sub-community

Acocks Veld Types
Cymbopogon - Themeda Veld (Sandy) (#48)
Highland Sourveld and Dohne Sourveld (#44)
Highland Sourveld to Cymbopogon - Themeda Transition (Eastern Free State Highveld) (#49)
Natal Sour Sandveld (#66)
Southern Tall Grassveld (#65)
Themeda Veld to Cymbopopogon - Themeda Veld Transition (Patchy) (#53)
Themeda - Festuca Alpine Veld (#58)
Valley Bushveld (#23)

Figure 5.2: Distribution of the High Altitude Mountain Vegetation Type sample plots in Acocks Veld Types of the study area.

thickets and shrubs. The veld is easily reduced to an *Eragrostis plana* disturbed grassland by trampling and selective grazing by cattle. This veld type is included in the Wet Cold Highveld Grassland (#41) described by Bredenkamp **et. al.** (1996a) (Figure 5.3).

Natal Sour Sandveld (Acocks #66) is an open savanna of *Acacia sieberiana*. The shrub forest of the hills is similar to the Southern Tall Grassveld (#65), but more tropical. Altitude ranges from 900 to 1 350 m a.m.s.l. and rainfall from 600 to 900 mm per annum, falling in summer. *Tristachya leucothrix* and *Digitaria tricholaenoides* dominate this veld type. The Natal Sour Sandveld (Acocks #66) is classified by Granger (1996) as Natal Central Bushveld (#25). However, sample plots are mainly located in the North-eastern Mountain Grassland (Bredenkamp **et. al.** (1996c) (#43) and it seems as if the classification of Granger (1996) should be followed and Natal Sour Sandveld (Acocks #66) not recognised as a separate vegetation type.

The Wet Cold Highveld Grassland (Bredenkamp **et. al.** 1996a) (#41) is associated with rocky slopes and ravines of the Drakensberg at altitudes higher than 1 750 m. Soils are shallow lithosoils, mainly representative of the Glenrosa (Orthic A, lithocutanic B) and Mispah (Orthic A, hard rock) soil forms. Sandstones and mudstones of the Beaufort Group are predominant. It is mountain grassland, associated with the typical cool, wet Drakensberg montane climate and severe frost. A woody layer can form dense thickets in this grassland. The North-eastern Mountain Grassland (Bredenkamp **et. al.** 1996c) (#43) comprises the grasslands of the great escarpment mountains. Altitude ranges from 1 400 to 1 900 m a.m.s.l. Soils are mostly shallow, derived from a variety of rock types. This is an area with many rare and endemic species, which are often threatened by expanding forestry. Patches of natural forest occur in this escarpment grassland.

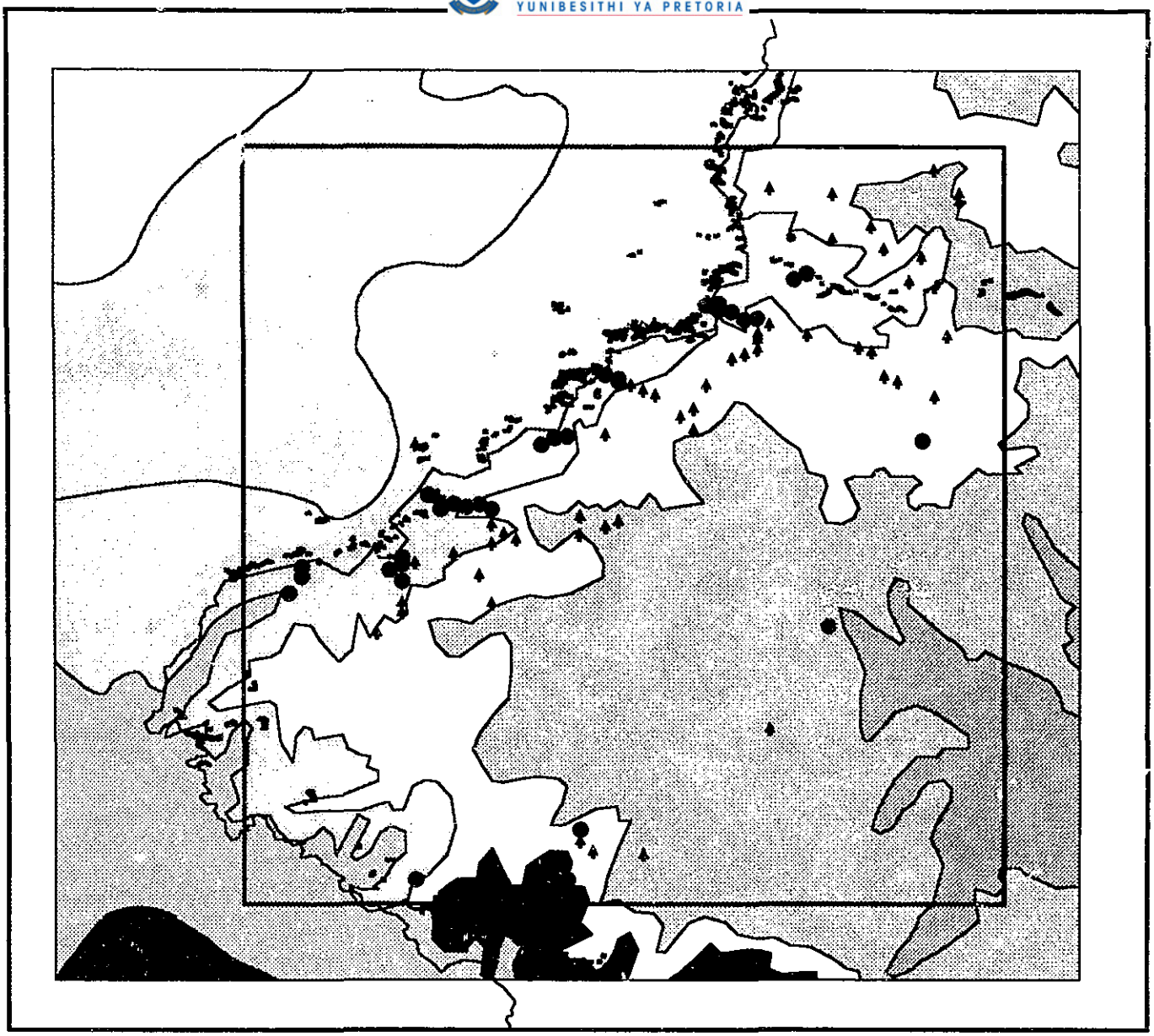


Figure 5.3: Distribution of the High Altitude Mountain Vegetation Type sample plots in Low and Rebelo Vegetation Types of the study area.

It is therefore concluded that this vegetation type probably represents Highveld Sourveld of Acocks and that the southern border of this veld type should be moved southwards (into the Southern Tall Grassveld) to include the high mountain areas. As for the Low and Rebelo vegetation types, it seems as if the Wet Cold Highveld Grassland (Bredenkamp **et. al.** 1996a) (#41) is representing the High Altitude Mountain Vegetation Type. The North-eastern Mountain Grassland (Bredenkamp **et. al.** 1996c) (#43) should be merged with the Cold Highveld Grassland (Bredenkamp **et. al.** 1996a) (#41) in this study area.

Climate zones of importance include 375, 383, 379, 526 and 384. The 375 climate zone is found in the southern part of the study area. Climate zone 383 is situated in high mountains where snow and frost frequently occur for prolonged periods of the year. The 379 and 383 climate zones stretch along the western border of the study area, following the high Drakensberg mountains (Institute for Soil, Water & Climate 1994). The lowest rainfall is recorded in climate zone 379, namely 766.3 mm per annum and the highest 1006.1 mm in climate zone 383. The highest average temperatures are found in the 375 climate zone (33.1°C) and the lowest in the 383 climate zone (-2.2°C).

Sample plots of this community are distributed over various geological formations and groups present in the study area, though primarily on the Tarkastad Subgroup, Beaufort Group and Vryheid Formation (Figure 5.4). The Volksrust Shale Formation forms part of the Northern Facies of the Ecca Shale Formation. It follows conformably on the Vryheid Formation and consists of soft, bluish shale. Fossils are scarce and consist of fish scales and fragments of petrified wood.

The Beaufort Group covers the largest area in the Karoo Basin and reaches a maximum thickness of 6 000 m in the eastern Cape Province. It comprises of alternating arenaceous and agrillaceous sediments that are terrestrial deposits. The agrillaceous deposits are mainly greenish-grey, bluish-grey or red and purple mudstone, which is inclined to weather into blocks. The arenaceous deposits are composed of yellowish, "dirty", i.e.

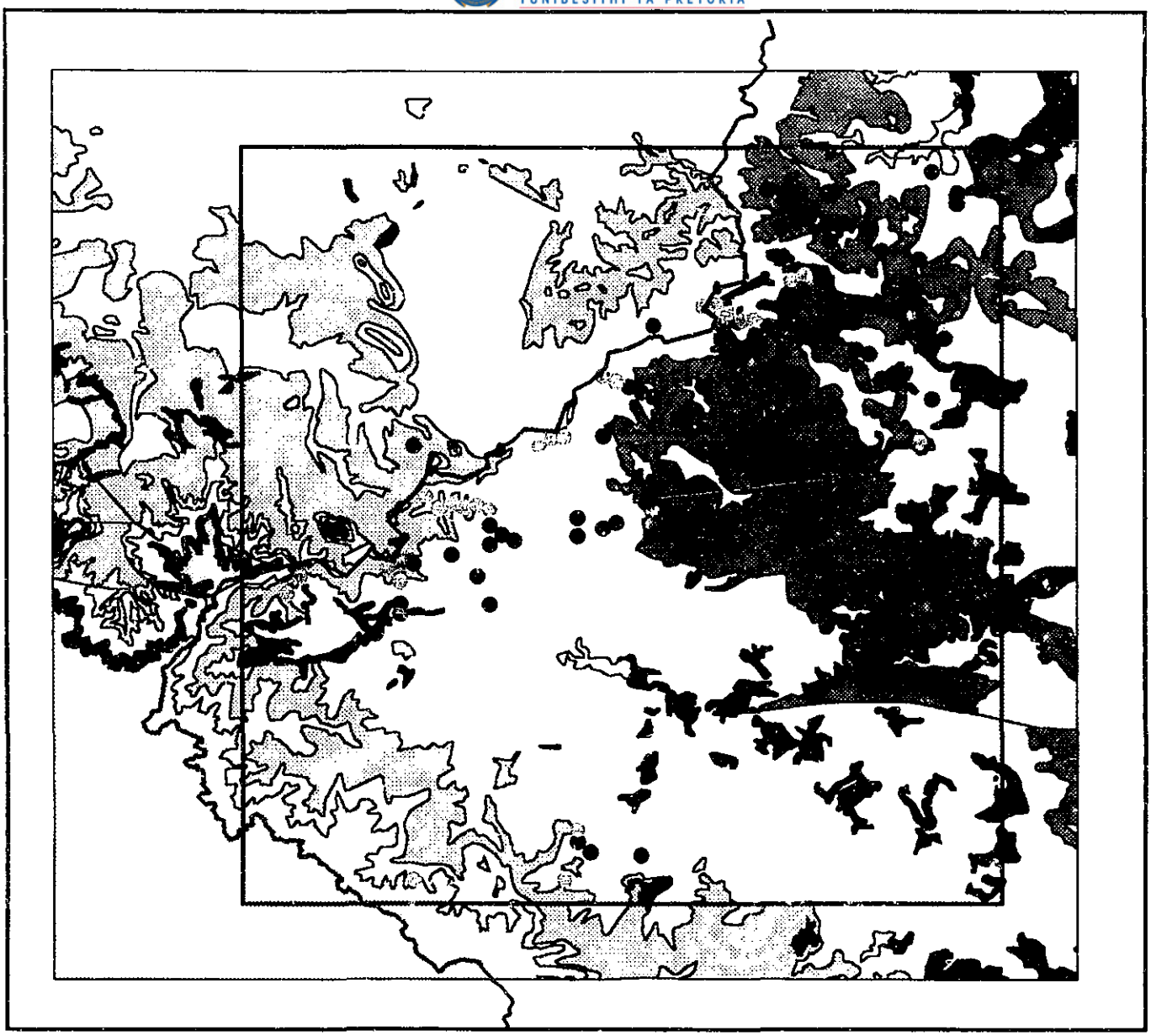
immature sandstones, which are present throughout the group and are characterised by cross-bedding.

The Tarkastad Subgroup consists of the Katberg Formation at the base and the Burgersdorp Formation at the top. The Katberg Formation in the south is composed of pale, greenish-grey and pink sandstone and intercalculations with mudstone become more plentiful towards the North. The Burgersdorp Formation is composed principally of red and green mudstone with numerous calcareous nodules. Reptilian fossils are common and plant remnants are found in the topmost part of the formation.

5.1.1 The *Monocymbium ceresiiforme - Andropogon schirensis* sub-community

Diagnostic species of this sub-community include the grass *Andropogon schirensis*, the forbs *Crassula vaginata, 0175 001, Pteridium aquilinum* and *Sutera caerulea* as well as the characteristic forbs *Rhabdosiella calycina* and shrub *Buddleja saligna*. It is distinguished from the *Monocymbium ceresiiforme - Cymbopogon excavatus* sub-community by the absence of species groups I, J, N, O, R, S, T, X, Y and Z (Table 5.1). The grass species *Monocymbium ceresiiforme* (Species group A) has a high cover in this sub-community. Other prominent species include the grasses *Tristachya leucothrix, Trachypogon spicatus* (Species group AD) and the forbs *Helichrysum aureonitens* and *Helichrysum pilosellum* (Species group M).

The distribution of this sub-community generally conforms to the Wet Cold Highveld Grassland (Bredenkamp **et. al.** 1996a). Three climate zones are represented in this vegetation type, namely 375, 383 and 379. Sample plots of this sub-community are situated in the mountainous western part of the study area at high altitudes (> 1 500 m a.m.s.l.). Snow occurs with severe frost for most of the winter. In these areas plains are present with steep grassy slopes, sometimes covered with dense woody vegetation. A combination of rainfall, altitude and utilisation is important in determining the different variations. Six variations were recognised in the *Monocymbium ceresiiforme - Andropogon schirensis* sub-community.



- Ladysmith
- Gridlines 28° - 29°S and 29° - 30°E
- KwaZulu-Natal Boundary
- Sample plots of the Monocymbium cerisiiforme - Andropogon shirensis sub-community
- Sample plots of the Monocymbium cerisiforme - Cymbopogon excavatus sub-community

Geological Formations

- Beaufort
- Clarens
- Drakensberg
- Karoo
- Karoo Dolerite
- Molteno
- Tarkastad
- Volksrust
- Vryheid

Figure 5.4: Distribution of the High Altitude Mountain Vegetation Type sample plots in the geological formations of the study area.

5.1.1.1 The *Erica drakensbergensis - Helichrysum umbraculigerum* variation

This is the only variation of the *Monocymbium ceresiiforme - Hyparrhenia hirta* sub-community that is present in the 375 climate zone, with an average rainfall of 910 mm per annum, falling in summer with severe frost in winter (Institute for Soil, Water & Climate 1994). The geology conforms to the Tarkastad Subgroup, which consist mainly of sandstone, weathering to a coarse grainy substrate with low clay content. Rocks are present in this variation, with an average size of 250 mm and a percentage cover of 16 to 30%.

The *Erica drakensbergensis - Helichrysum umbraculigerum* variation is characterised by the diagnostic species group C. It is distinguished from other variations in the *Monocymbium ceresiiforme - Andropogon schirensis* sub-community by the absence of species groups D, F, G, K, L, P, Q, U, V, W, AA, AB and AC, as well as the absence of the grass species *Andropogon schirensis* (Species group B) (Table 5.1). Prominent species are the grasses *Monocymbium ceresiiforme* (Species group A), *Alloteropsis semialata* (Species group AD) and the forbs *Helichrysum cephaloideum* (Species group M) and *Vernonia natalensis* (Species group AD).

This veld is prone to degradation due to over-utilisation and selective grazing by cattle. However, the presence of the palatable species *Monocymbium ceresiiforme* and *Alloteropsis semialata*, as well as the absence of unpalatable species such as *Eragrostis plana* is an indication that the veld is suitable for grazing and is therefore often over-utilised. The short growing season and leached soils make it difficult to stock at high rates (Acocks 1988).

5.1.1.2 The *Sporobolus centrifugus - Aristea woodii* variation

This variation is present in the 383 climate zone, with an average rainfall of 1006.1 mm per annum, falling mostly in summer. For most of the winter season severe frost occur with snow. An average annual minimum temperature of -2.2 °C is recorded. The Acocks Veld Type in this variation is the Highland Sourveld (#44) and represents the sour

grassveld variation. Low and Rebelo (1996) described this variation as Wet Cold Highveld Grassland (Bredenkamp **et. al.** 1996a) (#41), a grassland with occasional thickets. Sample plots of this variation are located in the Beaufort Group and Volksrust Formation. Soils are shallow and rocks are larger than 500 mm.

Utilisation is more pronounced than in the *Erica drakensbergensis - Helichrysum umbraculigerum* variation and unpalatable grass species, such as *Sporobolus centrifugus* (Species group D), *Loudetia flavida* (Species group H) and *Eragrostis racemosa* (Species group AC) are noted (Table 5.1). However, the presence of palatable species, such as *Andropogon schirensis* (Species group B), *Panicum natalense* (Species group Q), *Themeda triandra* (Species group AC), and *Trachypogon spicatus* (Species group AD) indicates that the veld of this variation is in a good condition.

The *Sporobolus centrifugus - Aristea woodii* variation is characterised by the diagnostic species group D and is further distinguished from the other variations in this sub-community by the absence of species groups C, F, G, P, U, V and AB. Grass species that have a high cover in this variation are *Monocymbium ceresiiforme* (Species group A), *Andropogon schirensis* (Species group B), *Panicum natalense* (Species group Q), *Themeda triandra, Eragrostis racemosa* (Species group AC), *Tristachya leucothrix* and *Trachypogon spicatus* (Species group AD). Prominent forbs include *Crassula acinaciformis* (Species group E), *Aristea woodii* (Species group K), *Haplocarpha scaposa* and *Pentanisia angustifolia* (Species group W). The *Erica drakensbergensis - Helichrysum umbraculigerum* and *Sporobolus centrifugus - Aristea woodii* sub-communities occur in the Highland Sourveld (Acocks #44). The forb *Crassula acinaciformis* (Species group E) is characteristic to both these variations.

5.1.1.3 The *0394 001 - Trachypogon spicatus* variation

This variation is present in the 379 climate zone, average annual rainfall 766.3 mm per annum. This climate zone is situated along the western border of the study area on the flatter patches along the escarpment. The geology conforms to the Tarkastad Sub-group,

which consists of sandstone and weathers to shallow lithosoils. Rocks are absent, and sample plots were situated in areas where slopes were not pronounced. The *0394 001 - Trachypogon spicatus* variation is found exclusively in the Highland Sourveld (Acocks #44) and the Wet Cold Highveld Grassland (#41) (Bredenkamp **et. al.** 1996a).

The presence of diagnostic species group F and the absence of species groups C, D, E, G, L, U and AA distinguish this variation from other variations in the *Monocymbium ceresiiforme - Andropogon schirensis* sub-community (Table 5.1). The veld is in good condition with little or no signs of utilisation and various palatable species occur, such as *Monocymbium ceresiiforme* (Species group A), *Themeda triandra* (Species group AC), *Tristachya leucothrix* and *Trachypogon spicatus* (Species group AD).

Many forbs, such as *Crassula vaginata* (Species group B), *Aristea woodii* (Species group K), *Helichrysum aureonitens, Helichrysum pilosellum* (Species group M), *Commelina africana* (Species group P), *Haplocarpha scaposa* (Species group W) and *Senecio venosus* (Species group AC) have high cover values.

5.1.1.4 The *Loudetia flavida - Tristachya leucothrix* variation

Diagnostic species group G characterises this variation. Species group H is common to this and the previous three variations. The species indicate moist conditions and shallow soils on the rocky hills where these variations are found. The *Loudetia flavida - Tristachya leucothrix* variation is found in the 379 climate zone at altitudes between 1 850 and 2 150 m a.m.s.l. on the Tarkastad Sub-group and Beaufort Group geological formations, which weathers to a shallow sandy soil. Rocks are generally absent, but soils are shallow on slopes with an incline of less than 5°. Acocks (1988) described this as the Highland Sourveld (#44), but Bredenkamp **et. al.** (1996c) refers to this area as the North-eastern Mountain Grassland (#43).

Utilisation in this variation is severe. The absence of palatable grass species such as *Eragrostis curvula* (Species group AB), *Themeda triandra* (Species group AC) and

Hyparrhenia hirta (Species group AD), as well as the presence of unpalatable species such as *Panicum natalense* (Species group Q), *Loudetia flavida* (Species group H), *Aristida junciformis* (Species group W) and *Eragrostis plana* (Species group AD) (Table 5.1) indicate over-utilisation and degradation. The main result of mismanagement in this veld type is the conversion of this veld into a Karoid False Fynbos (Acocks 1988).

As a result of the drier conditions that prevails in this variation, the herbaceous layer is well developed, with species such as *Crassula vaginata* (Species group B), *Helichrysum aureonitens, Helichrysum pilosellum* (Species group M), *Commelina africana* (Species group P) and *Senecio brevidentatus* (Species group AD), with high cover abundance values.

5.1.1.5 The *Andropogon schirensis - Aristida junciformis* variation

This variation is recognised by the absence of species groups C, D, E, F, G, H and AA and the presence of species group U (Table 5.1). It is found in the northern and central areas of the 383 climate zone that stretches along the western border of the study area on the escarpment and foothills of the Drakensberg. The average rainfall for this climate zone is 1 006.1 mm per annum (Institute for Soil, Water & Climate 1994). It is present on the Beaufort Geological Group.

The *Andropogon schirensis - Aristida junciformis* variation is found in the Highland Sourveld (#44) described by Acocks (1988), and the Wet Cold Highveld Grassland (#41) described by Bredenkamp **et. al.** (1996a). Relevès were present on footslopes of less than 6° with little or no rocks present. Utilisation varies and a combination of palatable and unpalatable grass species occur in this variation, such as *Andropogon schirensis* (Species group B), *Aristida junciformis* (Species group W) and *Themeda triandra* (Species group AC), *Monocymbium ceresiiforme* (Species group A), *Tristachya leucothrix, Trachypogon spicatus* (Species group AD). The forbs *Helichrysum aureonitens, Helichrysum pilosellum, Helichrysum cephaloideum* (Species group M) and *Anthospermum rigidum* (Species group AB) (Table 5.1) have high cover values.

5.1.1.6 The *Pteridium aquilinum - Eragrostis plana* variation

This variation is present in the southern part of the 383 climate zone (Rainfall 1006.1 mm per annum) and is distinguished from other variations by the presence of species groups L and AA as well as the absence of species groups C, D, E, F, G and H (Table 5.1). Relevès representing this variation were present on the footslopes of the Drakensberg with a slope not exceeding 5°. Bredenkamp **et. al.** (1996a) described this area as the Wet Cold Highveld Grassland (#41). Relevès of this variation are not restricted to a single geological formation, but the Karoo Dolerite, Beaufort Group and Tarkastad Sub-group geological formations are represented.

Utilisation seems to be higher in this variation than in the *Andropogon schirensis - Aristida junciformis* variation. Grass species such as *Monocymbium ceresiiforme* (Species group A), *Aristida junciformis* (Species group W), *Diheteropogon amplectens* (Species group AA), *Hyparrhenia hirta* and *Eragrostis plana* (Species group AD), the fern *Pteridium aquilinum* (Species group B) and the forb *Helichrysum aureonitens* (Species group M) have high cover abundance values.

5.1.2 The *Monocymbium ceresiiforme - Cymbopogon excavatus* sub-community

The sample plots of this sub-community are mostly situated in the Southern Tall Grassveld (Acocks #65), but some relevès of Natal Sour Sandveld (Acocks #66) are found in one variation. Southern Tall Grassveld (#65) is described by Acocks (1988) as being dominated by *Themeda triandra* and *Hyparrhenia hirta*. Altitudes ranges from 1 350 m a.m.s.l. and are lower than the *Monocymbium ceresiiforme - Andropogon schirensis* sub-community which occurs at altitudes above 1 500 m a.m.s.l. The Southern Tall Grassveld (Acocks #65) is however divided into Open Thornveld and Shrub Forest. The Open Thornveld is an open savanna of *Acacia sieberiana* in sourish mixed grassveld. Topsoil is shallow and consequently prone to erosion.

Rainfall in the *Monocymbium ceresiiforme - Cymbopogon excavatus* sub-community is between 600 to 900 mm per annum. It is markedly different from the North-eastern

Mountain Grassland (Bredenkamp **et. al.** 1996c) (#43), which is said to be a pure grassland occurring at altitudes of 1 400 to 1 900 m a.m.s.l. and rainfall of 700 to 1 100 mm per annum (Institute for Soil, Water & Climate 1994).

The data from relevès as well as descriptions from Acocks show a correspondence to the Natal Central Bushveld (Granger 1996) (#25), rather than to North-eastern Mountain Grassland (Bredenkamp **et. al.** 1996c) (#43).

Except for variation 5.2.5., which is located on the crests of rocky hills, rocks are absent in this sub-community. The remainder of relevès is found on footslopes of hills, with a slope of less than 5°. Utilisation varies in the different variations and the presence of various unpalatable species as well as various forbs give an indication that this sub-community might be prone to degradation.

Various geological formations are represented in this sub-community, but the Beaufort Group and Tarkastad Sub-group tend to dominate. It consists of a thick bed of sandstone at the base, followed by an alteration of sandstone, and brownish-red and green mudstone.

The *Monocymbium ceresiiforme - Cymbopogon excavatus* sub-community is found on the footslopes of the Drakensberg in the western and northern parts of the study area. The sample plots are mainly located in climate zones 384, 387 and 526. In these climate zones the highest average maximum temperature of 31.6°C was recorded in the 384 climate zone, situated on the western side of the study area on the footslopes of the Drakensberg. The lowest average minimum temperature of 2.4°C was recorded in the 388 climate zone, situated in the northern part of the study area stretching from west to east.

The average yearly rainfall is the highest in climate zone 387, namely 908.5 mm per annum. Only a small percentage of the sample plots are, however, found in this zone. The largest proportion of the sample plots is found in the 384 climate zone with an

average rainfall of 850 mm per annum (Institute for Soil, Water & Climate 1994).

The *Monocymbium ceresiiforme - Cymbopogon excavatus* sub-community is further characterised by the presence of the grasses *Cymbopogon excavatus* and *Sporobolus africanus* (Species group I). It is distinguished from the *Monocymbium ceresiiforme - Andropogon schirensis* sub-community by the absence of species groups B, C, D, E, F, G and H (Table 5.1). The diagnostic species of the High Altitude Mountain Vegetation Type, namely *Monocymbium ceresiiforme,* is not as dominant in this sub-community as in the previous. Other species that tend to dominate locally are the grasses *Diheteropogon amplectens* (Species group AA), *Themeda triandra* (Species group AC) and *Hyparrhenia hirta* (Species group AD). These grasses occur throughout the study area. *Hyparrhenia hirta* (Species group AD) is more prominent in this sub-community than in the *Monocymbium ceresiiforme - Andropogon schirensis* sub-community. Seven variations were recognised in this sub-community.

5.1.2.1 The *Eragrostis gummiflua - Eragrostis chloromelas* variation

This variation is found in little depressions, slightly wetter than the surrounding areas in the 526 climate zone, which is situated in the northern part of the study area. The average rainfall is 695.9 mm per annum, falling during the summer. Geology conforms to the Vryheid- and Volksrust Formations weathering to a shallow, sandy soil. Rocks are absent and sample plots are situated on the footslopes of hills with slopes of less than 5°. Sample plots of this variation are found in the Natal Sour Sandveld (Acocks #66), which is similar to the Natal Central Bushveld (#25), described by Granger (1996).

Little or no evidence of utilisation has been noted in this variation, but the veld seems to be in a degraded condition. This can be derived from the presence of unpalatable species, such as *Eragrostis gummiflua* (Species group J) and *Eragrostis chloromelas* (Species group U) and the presence of various forbs, such as *Richardia brasiliensis* (Species group U), together with the absence or low cover of palatable grass species (Table 5.1).

The *Eragrostis gummiflua* - *Eragrostis chloromelas* variation is characterised by the presence of species group J, consisting of the grass *Eragrostis gummiflua* and the diagnostic forb species *Wahlenbergia undulata* and *Haplocarpha lyrata*. The grass *Eragrostis gummiflua* occurs throughout the study area. It is distinguished from other variations by the absence of species groups N, R, S, X, Y and Z. Species with a high cover abundance in this variation are the grasses *Eragrostis chloromelas* (Species group U), *Themeda triandra, Eragrostis racemosa* (Species group AC), *Hyparrhenia hirta* and *Eragrostis plana* (Species group AD) as well as the forbs *Richardia brasiliensis* (Species group U) and *Helichrysum rugulosum* (Species group AB).

5.1.2.2 The *Sporobolus africanus - Richardia brasiliensis* variation

Representative sample plots of this variation are found on various geological formations, but mainly the Volksrust Formation. It occurs in areas where a slope of less than 6° and little or no rocks are present, but soils are shallow and sandy. The *Sporobolus africanus - Richardia brasiliensis* variation is distinguished from the other variations due to the presence of species group K, L, M, O, P, Q, T, U, V, W and Z and the absence of species groups J, N, R, S, X and Y (Table 5.1).

Prominent grasses in this variation are *Cymbopogon excavatus* (Species group I), *Aristida congesta* ssp. *barbicollis* (Species group Z), *Eragrostis curvula* (Species group AB), *Themeda triandra, Eragrostis racemosa* (Species group AC), *Hyparrhenia hirta* and *Eragrostis plana* (Species group AD). The forbs *Helichrysum pilosellum* (Species group M), *Richardia brasiliensis* (Species group U), *Helichrysum rugulosum, Anthospermum rigidum, Crepis hypochoeridea* (Species group AB) and *Vernonia natalensis* (Species group AD) have high cover values. The prominent forb stratum, the presence of various unpalatable grass species and a high degree of *Acacia sieberiana* seedlings present indicate that this variation is already degrading and might require careful management.

5.1.2.3 The *Diheteropogon amplectens - Hypoxis rigidula* variation

Sample plots of this variation are located in the Southern Tall Grassveld (Acocks #65) in areas where there is marked evidence of utilisation on shallow and sandy soils. This vegetation corresponds with the Natal Central Bushveld (Granger 1996) (#25), poorly conserved as well as being highly transformed (Low and Rebelo 1996). The presence of highly erodible, shallow duplex soils, require careful management by fire and grazing. As this vegetation is situated in areas with slope less than 5° with no rocks on the soil surface, the area is heavily trampled and intensive utilisation by cattle will have a pronounced effect on the vegetation. The sample plots of this variation is situated in the Beaufort geological group.

This variation is recognised by the presence of species groups L, M, O, P, Q, T, U, V, W, Y and Z as well as the absence of species groups J, K, R, S, X and Y (Table 5.1). It is found in the 384 climate zone with an average rainfall of 850 mm per annum and a maximum temperature of 31.6°C during December (Institute for Soil, Water & Climate 1994). Species that have a high cover abundance in this variation are the grasses *Diheteropogon amplectens* (Species group AA), *Themeda triandra, Eragrostis racemosa* (Species group AC), *Hyparrhenia hirta* (Species group AD) and the forbs *Helichrysum pilosellum* (Species group M), *Haplocarpha scaposa* (Species group W) and *Hypoxis rigidula* (Species group AB).

5.1.2.4 The *Paspalum scrobiculatum - Acanthospermum australe* variation

This variation is found in the northern part of climate zone 384, with an average rainfall of 850 mm per annum and a maximum temperature of 31.6°C in December (Institute for Soil, Water & Climate 1994). It is located mainly on the Beaufort Geological Group, but elements of the Volksrust Formation are also present in this variation. Relevès of this variation are situated on the escarpment of the Drakensberg, on the footslopes of hills with a slope of less than 6°.

Despite shallow, sandy topsoil, no rocks are present in these sample plots. Elements of the Highland Sourveld (Acocks #44) as well as the Southern Tall Grassveld (Acocks #65) are present in this variation. Bredenkamp **et. al.** (1996c) described this vegetation as North-eastern Mountain Grassland (#43). It is characterised by the presence of species groups L, M, O, P, Q, S, T, U and Y and the absence of species groups J, K, N, R and X. Evidence of heavy utilisation is present, this is reflected in the high percentage occurrence of forbs like *Helichrysum pilosellum, Helichrysum cephaloideum* (Species group M), *Acanthospermum australe* (Species group S), *Haplocarpha scaposa, Pentanisia angustifolia* (Species group W), *Helichrysum rugulosum, Pygmaeothamnus chamaedendrum* (Species group AB) and *Vernonia natalensis* (Species group AD). An admixture of palatable and unpalatable grass species, such as *Paspalum scrobiculatum* (Species group L), *Diheteropogon amplectens* (Species group AA), *Themeda triandra* (Species group AA), *Hyparrhenia hirta* and *Eragrostis plana* (Species group AD) occur in this variation.

5.1.2.5 The *Cephalanthus natalensis - Trachypogon spicatus* variation

This variation represents the scattered woody clumps of vegetation on rocky hills occasionally found in the Southern Tall Grassveld (Acocks #65). Various woody species represented are characteristic species of this specific vegetation, but they do also occur throughout the study area. These include *Cephalanthus natalensis, Rhus dentata, Rhus rigida, Diospyros lycioides, Tapiphylum parvifolium* and *Pavetta gardenifolia* (Species group N). Various climate zones and geological formations are represented. The main characteristic of this variation is the rockiness of the sample plots (up to 75%, average rock size more than 1 000 mm), with the Mispah soil form dominant (Orthic A, hard rock) (Macvicar **et. al.** 1977).

Species group N characterises this variation (Table 5.1). Species with high cover values include the grasses *Cymbopogon excavatus* (Species group I), *Panicum natalense* (Species group Q), *Melinis repens, Brachiaria serrata* (Species group Y), *Diheteropogon amplectens* (Species group AA), *Themeda triandra* (Species group AC), *Hyparrhenia*

hirta, *Tristachya leucothrix* and *Trachypogon spicatus* (Species group AD). Prominent forbs include *Eriosema cordatum*, *Turbina oblongata* (Species group Q), *Acanthospermum australe* (Species group S), *Haplocarpha scaposa* (Species group W), *Helichrysum rugulosum*, *Hypoxis rigidula*, *Pygmaeothamnus chamaedendrum* (Species group AB), *Vernonia natalense*, *Berkheya setifera and Acalypha angustata* (Species group AD). This mixture of palatable and unpalatable grass species, together with the prominent forb layer, is an indication of a high utilisation factor.

5.1.2.6 The *Eriosema cordatum - Helichrysum rugulosum* variation

This variation occurs mainly in the 384 climate zone, with an average rainfall of 850 mm per annum. It is situated on the escarpment of the Drakensberg, where the geology conforms to the Beaufort group. Relevès representing this variation occur on footslopes of hills where rocks are absent and the slope is less than 6°. It is distinguished from other variations in this sub-community by the presence of species groups I and R to AD, as well as the absence of species groups J to Q (Table 5.1).

This variation has an appearance of heavily utilised grassland, with areas of bare soil in some places. The presence of unpalatable grass species such as *Cymbopogon excavatus* (Species group I), *Eragrostis chloromelas* (Species group U), *Eragrostis plana* (Species group AD) and various forb species give an indication that degradation can become a problem.

5.1.2.7 The *Themeda triandra - Berkheya setifera* variation

This variation is distinguished from other variations in the *Monocymbium ceresiiforme - Cymbopogon excavatus* sub-community by the presence of species groups X to AD as well as the absence of species groups J to W (Table 5.1). This variation represents the Southern Tall Grassveld (#65), described by Acocks (1988). The geology of the distribution area of this variation, is representative of the Beaufort Group.

Three grass species dominate in this variation, namely *Cymbopogon excavatus* (Species group I), *Themeda triandra* (Species group AC) and *Hyparrhenia hirta* (Species group AD), with *Diheteropogon amplectens* (Species group AA), *Trachypogon spicatus* and *Elionurus muticus* (Species group AD) being conspicuous.