A COMPARATIVE CLASSIFICATION OF THE SOURISH-MIXED BUSHVELD ON THE FARM ROODEPLAAT (293 JR) USING QUADRAT AND POINT METHODS

by

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DECLARATION

The work reported in this thesis is the result of the author's original work, unless specifically acknowledged, or stated to the contrary, in the text.

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ABSTRACT

An area- and a point-based technique were used together at each of the same 75 sampling sites (stands), on a Sourish-Mixed Bushveld farm, to collect data for the classification and mapping of the vegetation. Both sets of data were synthesized using the same computer program package and the efficacy of the resulting classifications as well as the efficiency of the two field sampling techniques was compared. Following this, a continuous 7 752 point (1 m apart) transect was carried out, traversing the farm, in order to determine the optimum scales at which to sample Sourish-Mixed Bushveld so as to increase classification efficacy and improve community boundary recognition.

The results indicated that (1) the arbitrarily chosen sampling scale of 1:8 000 was too large for "farm-scale" studies; (2) the area-based method proved to be satisfactory in that the classification and vegetation map produced with this method were verified spatially and environmentally; (3) the point-based method was deficient as a classificatory and mapping tool at large scales, since too few species were recorded with this method to make any sense of the classification and mapping of the vegetation was not possible; (4) less time per species was spent using the area-based method but because more species per stand were recorded with this method, the point-based method was quicker per stand; (5) the area-based method was easier to use in dense vegetation and irregular terrain; and (6) the optimum sampling scales for Sourish-Mixed Bushveld, as indicated by the synthesis of the continuous transect data, are about 1:12 000, 1:50 000 and 1:250 000.

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1. INTRODUCTION

1.1 *CONCEPTS OF VEGETATION CLASSIFICATION*

Francis Bacon (1561 - 1626) derided the science of his day as being of very little practical use and remarked of contemporary scholars that "... the last thing anyone would be likely to entertain is an unfamiliar thought ..." (Brown 1986). He proposed that the truth and value of knowledge should be tested by its utility and judged by its contribution to mankind. Bacon put forward a 'new method' (*Novum Organum*) based on the idea that scientific knowledge is cumulative, and that it can be increased with time by methodical hard work.

Coupled to this new philosophy *i.e.* that the accumulation and dissemination of knowledge would improve science's utilitarian value, early 17th century scientists were making rapid progress largely due to new scientific apparatus such as the telescope and the microscope (Brown 1986). Astronomy and medicine moved from the philosophical to the scientific realm due to the invention and construction of the telescope and the microscope. The progress of science has often been attributed to new theories developed by outstanding scientists like Newton and Einstein but, in reality, science depends largely on the development of new instruments and methods for doing and making things (Brown 1986).

Although these instruments were often invented and built by craftsmen (not scientists) - Hans Lippershey was a Dutch spectacle maker and is credited with inventing the telescope in 1608 - it usually required men with vision to realise the practical applications of these instruments. For example Galileo, on hearing of the telescope, built his own and drew the attention of the Venetian Republic to its potential in marine affairs (Brown 1986).

Theophrastus (300 BC) observed that certain relations existed between plants and their environment and is considered an early contributor to quantitative plant ecology (Bonham 1989). Plant species lists occupied the interest of many early naturalists in Europe such as Von Gesner (1516-1565) and the first ecological treatise by Giraudsoulavie was published in 1783 (Werger 1973). Although much of this early work was descriptive (qualitative)it nevertheless led to vegetation characterization which can be considered a quantitative approach (Bonham 1989).

Therefore integrity, new techniques, insight, quantification of natural phenomena and the accumulation and dissemination of knowledge have all affected the progress of sciences such as astronomy, physics and medicine. Can the same be said for the science of vegetation measurement? This question will be examined by a brief historical outline of the course of vegetation science.

1.1.1 *Early 20th century vegetation classification theories*

In the early 1900's a number of classificatory approaches to the study of vegetation developed from a theoretical way of thinking about the nature of vegetation.Five traditions were identified by Whittaker (1962 cited by Werger 1973):the Southern or Zürich-Montpellier School, the Northern Tradition or Uppsala School, the Russian Tradition, the American Tradition and the British Tradition. These schools were all based on the community unit-theory, which implies that vegetation consists of community types, representing well defined natural entities, which are part of the structure of vegetation and which generally contact one another along narrow boundaries (Werger 1973).

1.1.1.1 The Southern or Zürich-Montpellier School

Also known as the Braun-Blanquet school, these workers classified vegetation into an hierarchy of systematic units patterned along the Linnaean system of plant taxonomy (Mueller-Dombois & Ellenberg 1974). The system works almost exclusively with floristic criteria which relate to character or differential species - species with a restricted ecological amplitude - which show a high degree of presence in the study area (Mueller-Dombois & Ellenberg 1974). This system was not accepted by all vegetation scientists, especially not by the American and English ecologists, since these scientists classified communities into types on the basis of dominant species or dominant species groups as opposed to character or differential species (Mueller-Dombois & Ellenberg 1974).

Nevertheless, the Braun-Blanquet method, as it has become known, has been applied throughout the world, including South Africa, and has influenced the development of European vegetation science for decades (Mueller-Dombois & Ellenberg 1974).

1.1.1.2 The Northern Tradition or Uppsala School

Originating from the work of Von Post, Hult and Serander, this school defined the association as a plant community of definite floristic composition and physiognomy based on the uniformity of stratal structure. Later, Du Rietz developed a complete hierarchy of vegetation units defined by plant dominance (Werger 1973). The rivalry between the Northern and Southern Traditions caused arguments which were "... waged with the special intensity of a civil war ..." (Whittaker 1962 cited by Werger 1973). Reconciliation between these traditions finally took place in 1950 when it was decided to incorporate much of the Uppsala School's terminology with that of the Zürich-Montpellier School (Werger 1973). Thus this system has been indirectly applied in South Africa.

1.1.1.3 The Russian Tradition

Due to its magnitude and diversity, it is difficult to generalize about the Russian Tradition but this school of thought consisted mainly of Russian and Polish workers who characterized plant associations using floristic composition or dominance (Whittaker 1962 cited by Werger 1973). Their concepts were not applied anywhere else in the world (Werger 1973) and so did not influence the science in South Africa. Of note though, is the term 'phytosociology' which was coined by the Pole, Paczoski and is currently used to describe the classification of plant communities in an hierarchical system.

1.1.1.4 The American Tradition

The American ecologist Cowles, in 1899, experimented with vegetation dynamics in simplified plant communities (Mueller-Dombois & Ellenberg 1974). Based largely on this work and the work of Warming (1909 cited by Mueller-Dombois & Ellenberg 1974), Clements developed a system of classification based on successional relations *i.e.* on changes in vegetation over time that he deduced from spatial similarities and differences in dominant species and their community environments (Mueller-Dombois & Ellenberg 1974). The highest expression of vegetation possible under a particular climate formed a regional climatic climax community to which all other communities were related in a chrono-sequence (Mueller-Dombois & Ellenberg 1974). This classification system was widely applied in America until the forties and strongly influenced British and South African ecology (Werger 1973). The dynamic view-point has always been maintained in

North America in variously modified forms. Of these, the continuum concept proposed by Gleason in 1926, which views constituents of vegetation communities as continually changing in space and time (Mueller-Dombois & Ellenberg 1974), has given rise to the consideration of the ordination of plant communities, on the basis of graduated similarity, as an effective alternative to classification (Mueller-Dombois & Ellenberg 1974). However, current thinking among vegetation scientists emphasizes the complementary use of classification and ordination (Gauch 1982) and Greig-Smith (1983) feels that these two techniques add to the understanding of a data set.

1.1.1.5 The British Tradition

In Britain, the name of Tansley dominated for a long time. His theory was similar to that of Clements' except that Tansley underemphasized the role of climatic factors alone in determining vegetation units (Werger 1973). Tansley defined the formation as the unit of vegetation formed by habitat and expressed by distinctive growth forms (Werger 1973). Various South African ecologists have applied the ideas developed by Tansley, for example Adamson (1938) and Edwards (1967), as he allowed for additional components of the 'broader' environment to be included in successional models *eg.* fire and grazing.

1.1.2 *The influence of classification concepts on vegetation research conducted in South Africa*

Vegetation scientists in South Africa have mainly applied the methods of three of these traditions, namely: the Zürich-Montpellier school; the British tradition; and the American Tradition (Werger 1973). The progress of vegetation classification in this country can be divided into four stages *viz.* descriptive studies, successional studies, association analysis and the phytosociological approach.

1.1.2.1 Descriptive studies

In 1918, I.B. Pole Evans was appointed Director of the Advisory Committee for the Botanical Survey. Other Committee members were Bolus, Marloth, Schonland, Bews, Potts, Theiler and Legat. Each of these members was given a region in which they were to conduct research. One of their chief aims was "... to study and map the South African vegetation units and investigate conditions which influenced them ..." (Pole Evans 1922).

The country, according to Pole Evans (1922), could be divided into two regions, the Cape Region and the South African Region. The South African Region was further subdivided into the Namaqualand Desert Province, the Kalahari Park and Bush Province, the Karroo Province and the South African Steppe and Forest Province. For each of these units Pole Evans (1922) listed some of the characteristic species. Bews (1922) urged young scientists to "... compile as complete a record as possible of the plants occurring in his neighbourhood ..." *i.e.* a species checklist. Bews (1922) planned to use all available data to undertake studies using the methods developed by Clements. In the same article he urged beginners to read Clements'(1916) work on plant succession.

Muir (1927) published a list of the species occurring in the Riversdale area in the eastern Cape Province and followed Bews' (1922) advice by describing the succession occurring on bare rock surfaces and cliff faces *i.e.* primary succession.

After 14 years Pole Evans (1936) updated his original 1922 map. More work had been done in surveying the vegetation, especially in the North-Eastern portion of the Union. This map was divided into four units (Forest, Savanna, Grassland and Desert Shrub) each of which was further subdivided into three sub-units.

Adamson, in 1938, produced his own national vegetation map (Adamson 1938). This descriptive map contained five main vegetation types *viz.* Sclerophyll, Forest, Savanna, Grassland and Semi-desert (Adamson 1938). A quick comparison of the two maps (Pole Evans 1936 *vs* Adamson 1938) shows that the only area of agreement was the Fynbos and Knysna forest. Pole Evans (1936) divided the West Coast and adjacent interior into two units namely: 1) Succulent Desert plants and Desert grasses, and 2) Desert Shrub, where Adamson (1938) shows the same area having four units *viz*: 1) Coastal Succulent Bush; 2) Succulent Bush; 3) Sclerophyll, and 4) *Rhigozum* Community. Adamson (1938) depicts five units in the central portion of the Cape province whereas Pole Evans (1936) has only one. Interestingly, a comparison of both these maps to a recent Biome map (Rutherford & Westfall 1986), shows Adamson's (1938) map to have the closest coincidence to this map. The Biome map was drawn using more objective procedures than the earlier two.

Although not adhering strictly to the successional classification of Clements (1916), Adamson (1938) speaks of 'change', 'equilibrium' and 'climax'. Indeed his five classes were based on the structure of the climax communities.

Dyer (1937) listed the plant families occurring around Bathurst and Albany in the eastern Cape Province and discussed the economic importance of certain genera in terms of palatability to livestock, timber for human use and toxicity to both livestock and humans. Dyer (1937) acknowledged the work to be of a "...preliminary nature..." but hoped it would be used "... as a basis for a more exact and detailed study of the vegetation.".

Similarly, Edwards (1967) undertook a vegetation survey of the Tugela basin. The field work for this survey consisted of mapping the vegetation viewed from various vantage points in and around the study area and then recording the species present in each mapped unit.As with Adamson's (1938) work, the concept of succession is evident in the publication. However, Edwards (1967) states: " The survey provides an inventory of basic ecological information." This work is essentially a species checklist and description of the vegetation. This survey would have been much more useful if only a repeatable method had been used.

1.1.2.2 Successional studies

In 1916 John W. Bews published a paper in which he described the chief types of vegetation in South Africa in relation to succession. Bews (1916) emphasized the role geographical conditions and climate played in determining the development of vegetation in Natal. The vegetation around Pietermaritzburg, particularly at Bisley and Thornhill, was the subject of Bews' (1917) next paper. The local populace had replaced indigenous trees with black wattle for firewood and Bews (1917) concluded that the vegetation had succeded back to a stage which he termed Thorn Scrub with *Acacia* species dominant. The object of his next paper (Bews 1920) was to see how far plant distribution in South Africa could be explained on ecological lines. He compared 320 species having a wide distribution and found most of them to be in an early stage of succession. The only climax communities in South Africa were found in coastal forest and forests of other areas. Many of the 320 species were ruderals (weeds) and therophytes (annuals) and he considered them to be pioneer species belonging to the early stages of the xerosere.

The woodlands and grasslands of the Keiskammahoek District, eastern Cape Province, were studied by Story (1952) and even though he considered the division of woodland into types as being completely artificial, "...some arbitrary classification is nevertheless very convenient..." and he accordingly classified the woodlands into seven vegetation types. Within these types he compiled tree species lists by "...crossing the area in various directions until the appearance of unrecorded species ceased more or less completely.". A typical or most representative site was chosen for each type in which the composition of the tree species was studied more intensely by means of belt transects. Of importance in this study was the correlation with maximum and average tree height with "...an orderly change in rainfall...". Story (1952) used succession to explain the differences in species composition between the vegetation types he listed for the area and consequently this study can be considered descriptive and successional.

Killick conducted two similar works in the Table Mountain area, Pietermaritzburg (1958) and in the Cathedral Peak area of the Natal Drakensberg (1963). In both these studies, Killick distinguished the vegetation into units and then discussed the interrelations of the plant communities in terms of successional stages.

In 1953 John Acocks produced what is still today the standard vegetation map of South Africa. The Veld Types map (Acocks 1953) delineates units of vegetation "... whose range of variation is small enough to permit the whole of it to have the same farming potentialities ...". Although definitely influenced by the successional concept, (the red line on his vegetation map indicates the invasion of grassland by karroid scrub due to mismanagement of veld) Acocks (1953) recorded plant species in a subjectively chosen area. He assigned abundance values based on the average distance between plants to each of the species recorded using a 20 class scale. The vegetation was then classified into veld types using a matrix approach (species in rows and samples in columns). The subjective selection of the stands was purposely done in an attempt to record the vegetation in "... it's most useful [in terms of agriculture] form ...". To date Acocks' work is unique in the world, in that no other scientist has single-handedly meticulously surveyed an area as large, at a single scale.

More recently, Scheepers (1978) used the Clementsian approach to study the vegetation of the Westfalia Estates situated near Duiwelskloof in what Rutherford & Westfall (1984) refer to as the north-eastern Transvaal. Species were recorded in "... roughly cruised transects ...". The transects were placed subjectively, with one exception, in "... vegetation which was least disturbed and most typical...". The subjectivity involved in sample positioning and size made studies like this difficult to repeat and the impracticality of work of this kind led researchers to develop more functional and objective methods.

1.1.2.3 Association analysis

One such practical method is Association Analysis which is a generic term covering a wide range of simplifying and systematizing quantitative techniques (*eg.* Cluster Analysis, Two-way Indicator Species Analysis *etc.*), made available through the phenomenal improvement of inexpensive computational facilities. This approach is accredited to the work of Goodall in 1953 (Greig-Smith 1983) and has been used by a number of researchers in South Africa (Grunow 1965, Scheepers 1975). Basically, Association Analysis splits the total number of samples into two groups based on the presence or absence of a single species (Gauch 1982, Grunow *et al.* 1969). This process is repeated to form a hierarchy (Gauch 1982) which will eventually produce a number of groups of sites having no associations (Greig-Smith 1983) and in the final level there will be as many groups as there were sites (samples). In practise, a number of "indicator" species are used to define the dichotomy.

Grunow (1965) sampled the farm Zoutpan in Sour-Mixed Bushveld (Acocks 1975) north of Pretoria and analysed the data using Association Analysis. The technique provided him with 10 plant communities with correlated environmental differences (Greig-Smith 1983). Of importance in this study was the placing of systematic samples using a grid system which allowed statistical testing of the data. Grunow (1966) concluded that by using techniques such as Association Analysis and ordination, hypotheses were generated which were hitherto obscure with less objective techniques.

Scheepers (1975) also used Association Analysis to tabulate data from the Kroonstad and Bethlehem areas. Instead of systematic sampling, Scheepers (1975) employed aerial photographs which he stratified in terms of physiographic and physiognomic units. Samples were placed randomly in these units and this practice (stratified random sampling) has been widely accepted and employed by other workers (Van Staden 1991, Myburgh 1993). Scheepers (1975) expressed caution with the interpretation of the floristic classification, but felt that the results generated using this technique were generally acceptable.

1.1.2.4 Phytosociological studies

The first researcher in southern Africa to use the Zürich-Montpelleir method of plant classification was Werger (1973) in the upper Orange River valley. Werger *et al.* (1972) gave language difficulties as a main reason for the fact that prior to 1969 no scientist in South Africa had used the Zürich-Montpellier method. However, English accounts had been published by *inter alia* Braun-Blanquet (1932), Poore (1955, 1956), Becking (1957) and Moore (1962) (cited by Werger 1973). The Zürich-Montpellier method is a matrix classification of samples by species with cover-abundance values displayed in a tabular format. Species and their cover-abundance values are recorded in selected, representative, homogenous plots of a certain minimum size called a relevé (Werger 1973). Environmental data are collected at each sample site.

Subsequently many researchers have used the Braun-Blanquet method of plant classification including Theron (1973), Bredenkamp (1975), Boucher & Jarman (1977), Van Rooyen (1978), Van der Meulen (1979), Westfall (1981) and, Coetzee (1982).

1.1.3 *Consequences of these philosophies*

Can we call ourselves vegetation scientists? This question was posed earlier in the chapter and based on the five criteria mentioned *viz.* the integrity of research, new techniques, insight,quantification of natural phenomena and the accumulation and dissemination of knowledge, it would appear that we do comply with these requirements and can indeed call ourselves vegetation scientists. However, from the foregoing it can be seen that much varied research has been conducted in an attempt to classifiy, map and better understand the vegetation communities in South Africa. It can also be seen from the above, that the science of vegetation measurement in this country has been mostly fragmented with various workers adhering to different philosophies leading to different methods of vegetation sampling. For example, to synthesize survey data collected in two or more adjoining areas by differing workers,sampling scales and sampling methods in order to produce one classification and map for the combined study area is extremely difficult if not impossible.

This is possibly why the condition of South Africa's natural vegetation resources, particularly the extensive grazing areas, is percieved to be in such a poor state (Aucamp & Danckwerts 1989). What has been done to halt the degeneration of our veld subsequent to 1953, when Acocks (1953) warned that more than 50 000 km² of valuable grassland had become eroded Karoo since the White settlement in the Cape? Vegetation scientists have listed as possible causes of veld degradation the following (Aucamp & Danckwerts 1989):

1) over grazing;
2) over-optimism of farmers;
3) livestock numbers not adjusted to natural environmental conditions;
4) grazing management practices;
5) inadequate knowledge of pasture and fodder crops;
6) farmers' view of veld condition; and
7) decision-making process of the farmer and pasture use.

Bearing in mind that the above list of possible causes have not all been subjected to conclusive cause and effect testing and is at best an objective-driven evaluation, nevertheless vegetation scientists have frequently been forced to make management recommendations when little or no empirical data are available (O'Reagain & Turner 1992). A review of current grazing management recommendations (O'Reagain & Turner 1992) showed that, in some cases certain recommendations can be backed-up by empirical data (*eg*. sheep have a greater potential for degrading range than either cattle or goats) while many others remain untested hypotheses. How can vegetation scientists advise policy-makers on the formulation of scientifically sound guidelines to sustainably manage resources when not all of the recommendations have been adequately tested? To overcome this problem, O'Reagain & Turner (1992) give as a primary requirement an increase in basic research so as to increase the understanding of rangeland systems.

1.1.4 *Basic versus applied research in the context of vegetation science*

The difference between basic and applied research has often been defined in terms of time (Brown 1986). For example, Lord Rutherford proclaimed that his work on the structure of the atom in the 1920s was completely useless, yet the first atomic reactor was in operation by 1942 (Brown 1986). Brown (1986) feels that this argument obscures the real difference between the two and prefers to define basic research as 'curiosity-oriented' and applied research as 'mission-oriented'. Reasons usually given for supporting basic research are: it is an investment in the future; it contributes to national prestige; it builds up a body of expert knowledge; and, it is a valuable cultural activity (Brown 1986). These arguments fail to carry conviction and scientists need to be more articulate in showing more clearly the connections between basic research and practical results, a sentiment held by Bacon in the 17th century.

The science of vegetation ecology is the study of both the structure of vegetation and vegetation systematics (Mueller-Dombois & Ellenberg 1974). This includes the investigation of species composition, the interactions between species in assemblages, spatial or temporal variation, community development, floristic pattern at different scales and correlations between environment and vegetation (Mueller-Dombois & Ellenberg 1974). Both basic and applied research is required in vegetation science but the collection of floristic and ecological information using vegetation surveys is considered to be basic research. However, vegetation surveys and the analyses of these data are becoming more and more sophisticated and the traditional descriptive connotation associated with surveys is no longer always true. Information on vegetation pattern now has numerous applications - land-use planning, vegetation and grazing management, Environmental Impact Assessments *etc*.

That vegetation surveys are necessary can be illustrated by many examples. Burbidge (1991) states that in Australia, biological surveys have become a prerequisite for many land-use decisions and for planning the management of conservation areas. In the United Kingdom, at a symposium on the management of natural and semi-natural vegetation, Cobham (1983) stated that the English were "...surprisingly ignorant..." about the extent and condition of their semi-natural vegetation and more vegetation surveys were required.

Locally, the National Grazing Strategy was announced in Parliament in 1985 and was aimed at checking veld deterioration. To achieve this goal the first question to be asked should be "What is the condition of natural pastures in the RSA?" (Aucamp & Danckwerts 1989). Surveys have to be undertaken to determine the extent and condition of our natural vegetation.

The Aide-Mémoire (Hugo 1992), in accordance with the Minerals Act, No. 50 of 1991, requires new mining ventures to supply an environmental management programme report (EMPR) to the various authorities concerned with the regulation of the environmental impacts of mining. One of the requirements of the Aide-Mémoire is a vegetation survey which must include dominant species, endangered or rare species, invader or exotic species and a vegetation map.

From the foregoing, it can be seen that objective, repeatable and quantitative vegetation surveys are becoming increasingly necessary for an improved understanding of southern African rangeland. Coupled to this, some understanding of the time and costs (in terms of expertise and finance) required, is needed.

1.2 JUSTIFICATION

An investigation in the various agricultural regions to determine the quantity and availability of vegetation survey data was undertaken by the author in 1991. Data are abundant and most are available without cost. One of the problems identified was the techniques used for field data collection *i.e.* quadrat *vs* relative abundance (point-based data). Traditionally, when classifying vegetation to identify and map plant communities, researchers record the presence of plant species in quadrats. These data are then tabulated in groups representing plant communities on the basis of the presence or absence of plants in a particular group. Generally, all the plants occurring in the quadrats are recorded. In contrast, when certain key grass species need to be determined in order to ascertain the condition of the veld, point methods are generally used (Foran *et al.* 1978, Heard *et. al.* 1986, Willis & Trollope 1987). Thus, one of the reasons for undertaking this study was to test the compatability of the data collected using a quadrat method and a point method at the same sampling sites for the classification of vegetation. Since vegetation classifications are based on the presence of species, and both methods record this parameter, the results of a comparative study involving a point and a quadrat method would indicate whether existing point data collected in the regions could be used for classificatory purposes and incorporated into a national data base.

A secondary problem associated with field data collection is that of the type of vegetation cover measured *i.e.* canopy or basal cover. More information can be derived from a measure of canopy cover than from a basal cover measurement. For example, canopy cover can be used:

1) as a measure of soil protection from wind and rain *eg*. the canopies of most plant growth forms cover a larger soil surface area than the basal

areas of the same plants thus affording more protection to the soil surface (Scott 1981) and canopies have an effect on the physical redistribution of rainfall (Morgan 1979);

2) in relation to the quantity of utilizable material available to browsers or grazers (Trollope 1981, Smit 1989);
3) to derive a measure of inter- and intra-specific competition (Van Staden 1991);
4) for classifiying vegetation structure (Edwards 1983);
5) to determine herbivore utilization (O'Reagain & Mentis 1989, Novellie 1990, Laca *et al* 1994);
6) along with canopy structure to measure the effect of fire in controlling bush thickening (Trollope & Tainton 1986) and for this canopy cover must be known; and
7) for monitoring, canopy cover will show all change, be it episodic or cyclical since the range of canopy cover is greater than that of basal cover.

It is also possible to convert canopy cover (combined cover of the individuals in a particular height stratum or growth form) and crown (the canopy of an individual plant)class data, where the plant number scale method of canopy cover determination (Westfall & Panagos 1988) has been used, to the following:

1) density in terms of individuals per hectare;
2) area per individual;
3) mean spacing centre to centre;
4) mean spacing canopy to canopy, gap;
5) mean crown cover; and
6) mean crown crown radius (Westfall 1992).

Such conversions are not possible for basal cover.

The traditional quadrat method of sampling for classification, usually involves a canopy cover estimate *eg*. the Braun-Blanquet cover-abundance scale or the Domin-Krajina cover abundance scale (Mueller-Dombois & Ellenberg 1974). Point methods for determining cover usually involve 'strikes' on living basal cover (Tainton 1981). Both methods have sources of error. Use of cover-abundance scales, such as those mentioned above, are subjective estimates and lack precision in terms of a) repeatability between observers, and b) over- and under-estimation of cover from a static observer position in the stand (Westfall 1992). Similarly, point methods show a) a considerable degree of variability between and within workers in the identification of a 'strike', and b) the probability of recording a 'strike' is extremely low (Hardy & Tainton 1993). Objective techniques have been devised and tested for overcoming the problems incurred with canopy cover estimations using scales such as those mentioned above. These include the cover meter (Westfall & Panagos 1984) and the plant number scale (Westfall & Panagos 1988).

For these reasons it was decided that the plant number scale (Westfall & Panagos 1988), would be used in conjunction with the quadrat method for this study. The point method used for the survey was termed the point canopy intercept method (see 3.3.2.1) with which floristics were recorded according to canopy intercepts which were subsequently converted to canopy cover. Previously tested (in terms of accuracy and precision) point intercept methods, such as the line intercept method, could not be used in this study since cover is measured linearly when employing these methods. The point canopy intercept method (PCIM),provides cover data which are related to area in terms of the mean crown size and the mean gap between crowns for each species recorded in the sample when analysed using PHYTOTAB-PC (Westfall 1992). These cover data are thus comparable to cover data recorded using the plant number scale (Westfall & Panagos 1988).

The second reason for carrying out this study was to determine the efficiency of these two field methods. Many surveys (of both kinds) have been undertaken in this country at considerable expense to the taxpayer. The time and cost taken to complete the field work for these surveys was not considered to be of great importance. This has recently changed since research organizations previously in the public sector now operate as parastatal organizations and have to compete for funds and justify expenditure. As many vegetative survey projects are no longer state funded, competitive and cost-effective budgets must be tabled to secure the necessary funding. The main shortcoming has been the lack of precision by which costs are calculated. Precise cost estimates are now required to ensure the economic competitiveness as well as efficient use of expertise for this important land-use planning tool, and for studies of plant response to impacts.

Finally, it was decided to examine more closely the effect of scale on the classification and mapping of vegetation. Scale has an explicit role in the stratification, sampling and classification of vegetation (Westfall 1992). The amount of detail required in the study will determine the scale but up till now this choice has been biased towards the availability of aerial photographs at different scales or topographic maps at standard scales. These scales, in terms of vegetation classification, are arbitrary and experience has shown that classifications at certain scales show greater pattern strength within the relevés x species matrix than at others. The term relevé means "abstract" in French and refers to a relatively small vegetation sample based on the minimal area concept (Mueller-Dombois & Ellenberg 1974). By pattern strength in the matrix, is meant the constancy with which a species occurs in a relevé group, the number of species occurring in a relevé group and the number of outliers for that group. This phenomenon can be illustrated by Van Staden's (1991) classification at a scale of 1:250 000 showing weaker pattern strength than classifications of Acocks' (1953) data at a scale of 1:1 500 000. Since scales form a continuum, it was decided to investigate whether there are natural scales at which pattern strength in a classification is at an optimum.

1.3 **AIMS**

The aims of this study are to:

1) compare classifications obtained with the quadrat method (Westfall 1992) and a new point canopy intercept method of vegetation sampling using the same computer software package (PHYTOTAB-PC) (Westfall 1992) for efficacy (the capability of producing an intended result) at the same scale;

2) compare the quadrat and the point canopy intercept method of vegetation sampling for sampling efficiency at the same scale; and

3) determine discontinuities in the scale continuum based on classifications to detect any "natural" scales.

1.4 **HYPOTHESES**

The primary hypotheses for this study are:

1) the stratified vegetation units will correspond to the relevé groups produced by the classification process;

2) the classifications produced by the quadrat method and the point canopy intercept method will correspond; and

3) discontinuities corresponding to scale differences will be evident in the repeated classification of a continuous transect.

CHAPTER TWO

2. STUDY AREA

The study area forms part of the Roodeplaat experimental farm which is situated in what Rutherford & Westfall (1984) call the central Transvaal. The farm is *c.*30 km north-east of Pretoria, between southern latitudes 25° 20' and 25° 40' and eastern longitudes 28° 17' and 28° 25'. The Roodeplaat experimental farm consists of portions of three farms, namely; Roodeplaat 293 JR, Buffelsdrift 281 JR and Zeekoegat 296 JR. The area covered by Roodeplaat 293 JR and Buffelsdrift 281 JR is 2 757.15 ha (Figure 2.1). The study was restricted to the natural vegetation which covers *c.* 75% or 2067 ha of the farm. Zeekoegat 296 JR was not included in the study since most of this portion is arable and is used for grazing trials on cultivated pastures.

2.1 *PHYSIOGRAPHY*

The main physiographic features of the study area are the Buffelsdrif ridge (1 285 m a.m.s.l.) in the the south, the Pienaars river (1 160 m a.m.s.l.) bisecting and draining the farm in a north-westerly direction and a plateau (1 220 m a.m.s.l.) in the north (Figure 2.2).

2.2 *GEOLOGY*

The geology of the area around Pretoria has been described by Jansen (1977). The Roodeplaat experimental farm is situated on the Roodeplaat Igneous Complex which belongs to the Post-Waterberg Formation. The Roodeplaat Igneous Complex is a ring-shaped structure with a diameter of *c.* 16km and is also referred to as the "Roodeplaat volcano" (Verwoerd 1966, 1967 cited by Jansen 1977). The "volcano" has an outer zone consisting of trachyte, felsite and pyroclastic breccia and an inner zone of tuffaceous sediments. Tuff is volcanic ash usually more or less stratified and in various states of consolidation (Harmse *et al.* 1984). Both zones are intruded by dykes and sills of diabase.

The farm consists predominantly of the inner zone of the "volcano" with tuff, tuffaceous shale and quartzite present in the north and south in two broad bands (Figure 2.3). The farm is bisected by a band of alluvium on

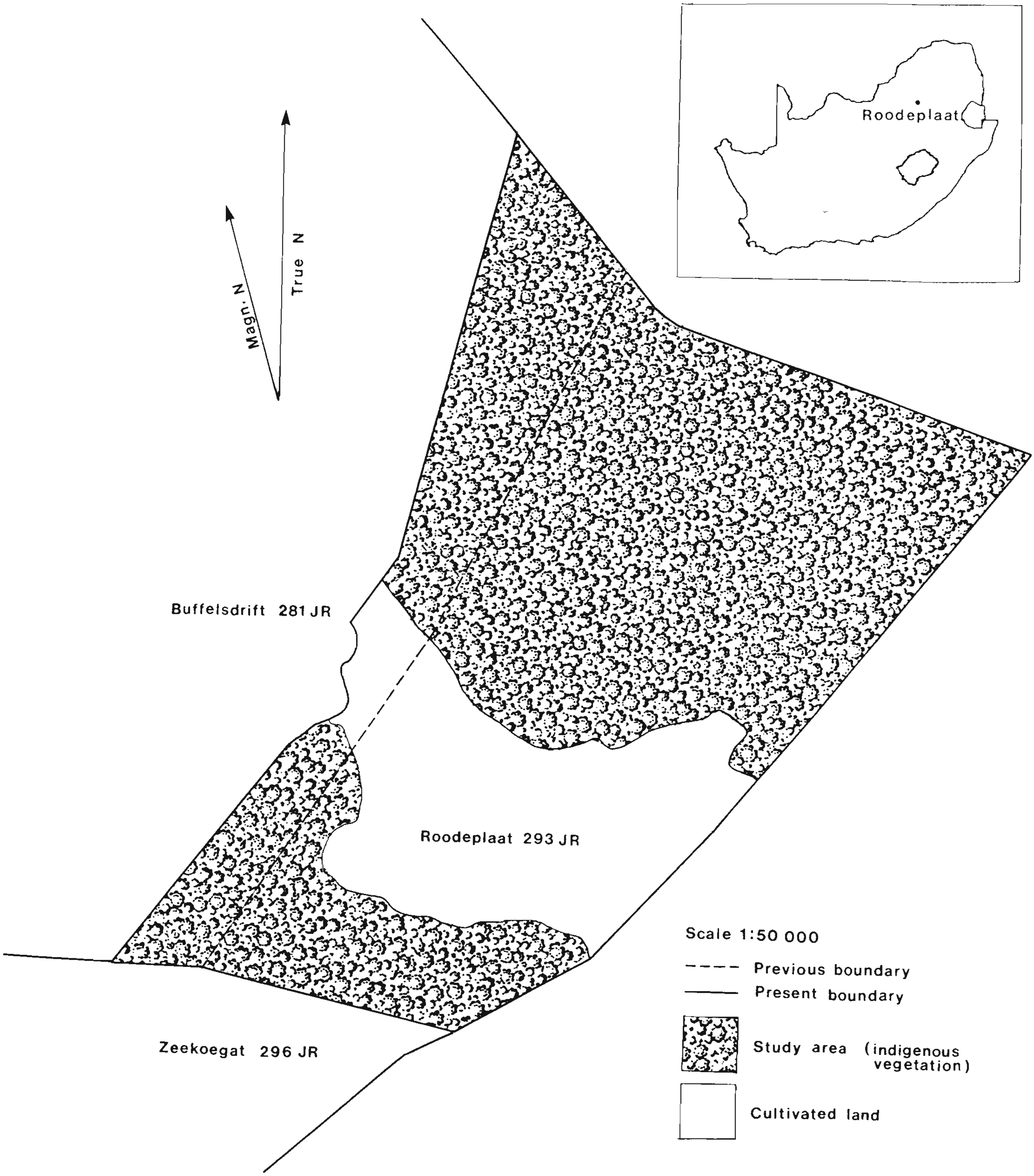

Figure 2.1 The portion of the Roodeplaat Experimental Farm which forms the study area.

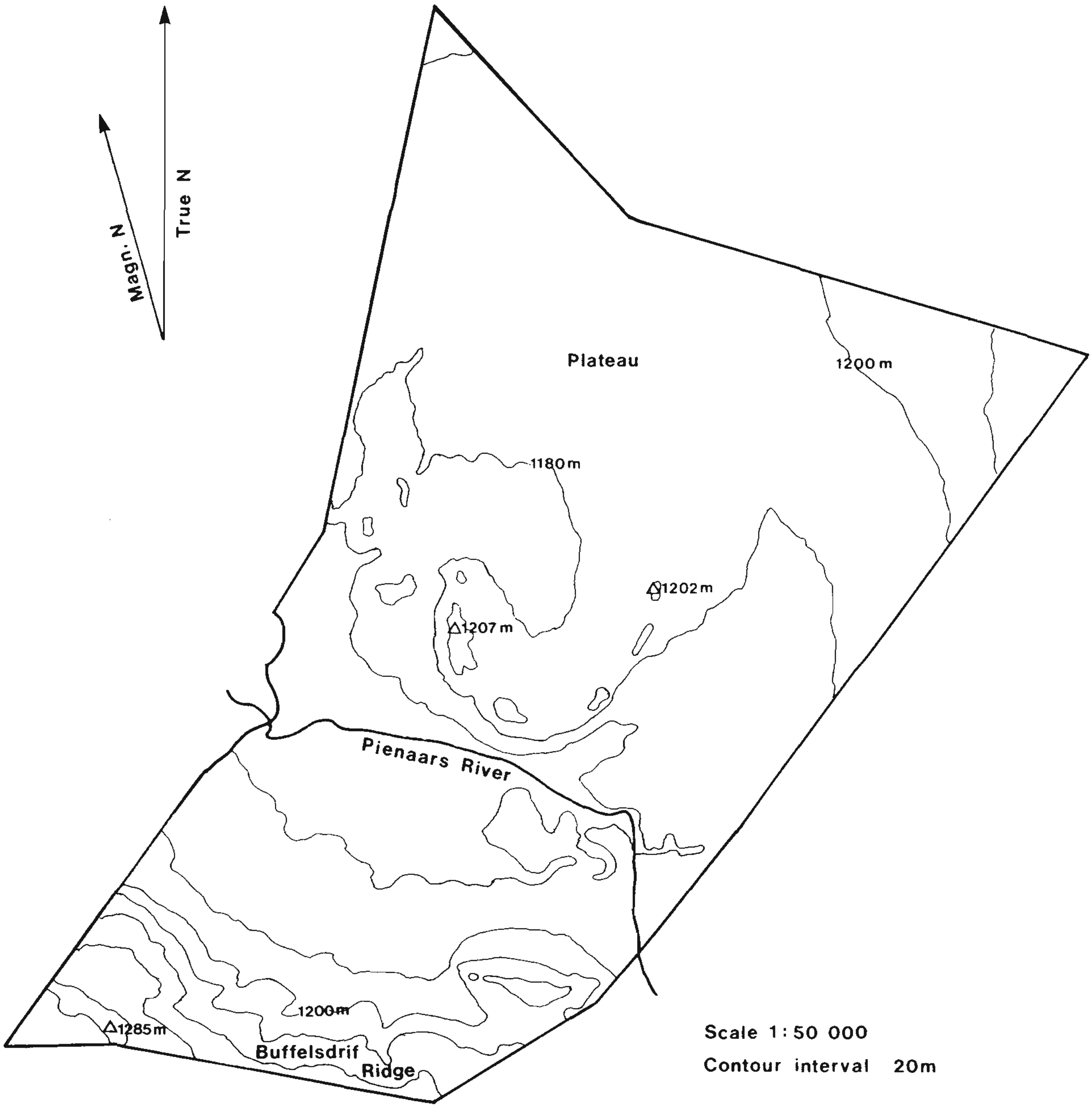

Figure 2.2 The physiography of Roodeplaat farm.

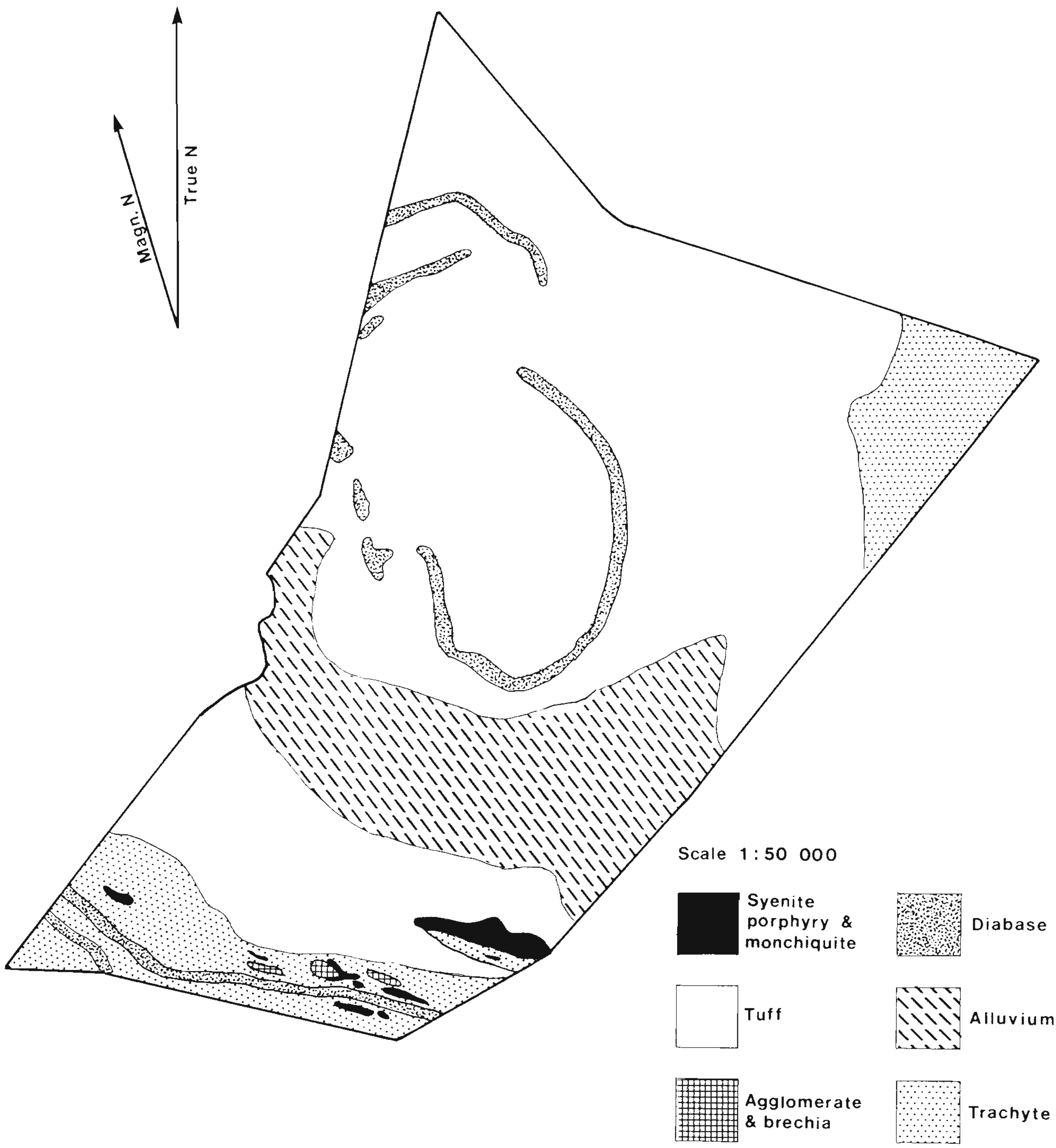

Figure 2.3 The geology of Roodeplaat farm.

either side of the Pienaars river. On the northern plateau, diabase dykes are present centrally and on the north-western boundary. Trachyte, trachyandesite and felsite occur in the north-eastern corner of the farm as well as on the Buffelsdrif ridge in the south (Jansen 1977).

2.3 *SOILS*

The only detailed soil survey carried out on Roodeplaat was done in 1982 and was confined to the arable portions of the farm on either side of the Pienaars river (Plath *et al.* 1982). Soils surveyed by Plath *et al.* (1982) were classified using the Binomial System (MacVicar *et al.* 1977) and the most common soil forms recorded were Valsrivier, Arcadia and Hutton.

No detailed soil map exists for the entire study area. The farm is, however, included on the 1:250 000 Pretoria land type map and consists of two land types namely the Ae and Fa land types described by du Plessis (1987) (Figure 2.4). The Ae land type consists mainly of Hutton and Shortland soil forms while the Fa land type consists mainly of Mispah and Wasbank soil forms.

2.4 *CLIMATE*

The climatic region of the area has been variously classified as temperate (warm) with summer rainfall (Köppen 1918, Köppen 1931, and Köppen & Geiger 1936 cited by Schulze 1947) and sub-humid (warm) with deficient moisture in all seasons (Thornthwaite 1931 cited by Schulze 1947). Schulze (1965) categorizes the area as the Northern Transvaal climatic region which recieves an average annual precipitation of between 380 and 700 mm (Roodeplaat = 646 mm). The average daily maximum and minimum temperature for this region is 32°C and 18°C in January and 22°C and 4°C in July (Roodeplaat = 29°C and 20°C, and 16° and 2° respectively).

From the data presented in Table 2.1, and the AGROMET (1994) data base the climate of Roodeplaat can be summarized as follows:

1) the mean annual rainfall is 646 mm;
2) the absolute daily maximum temperature is 42.3 C° and the absolute daily minimum temperature is -6.7 C° with a range of 49 C°;
3) the mean monthly evaporation is 193.75 mm;
4) the mean monthly wind amounted to 91.9 km with an annual range of 986 km; and

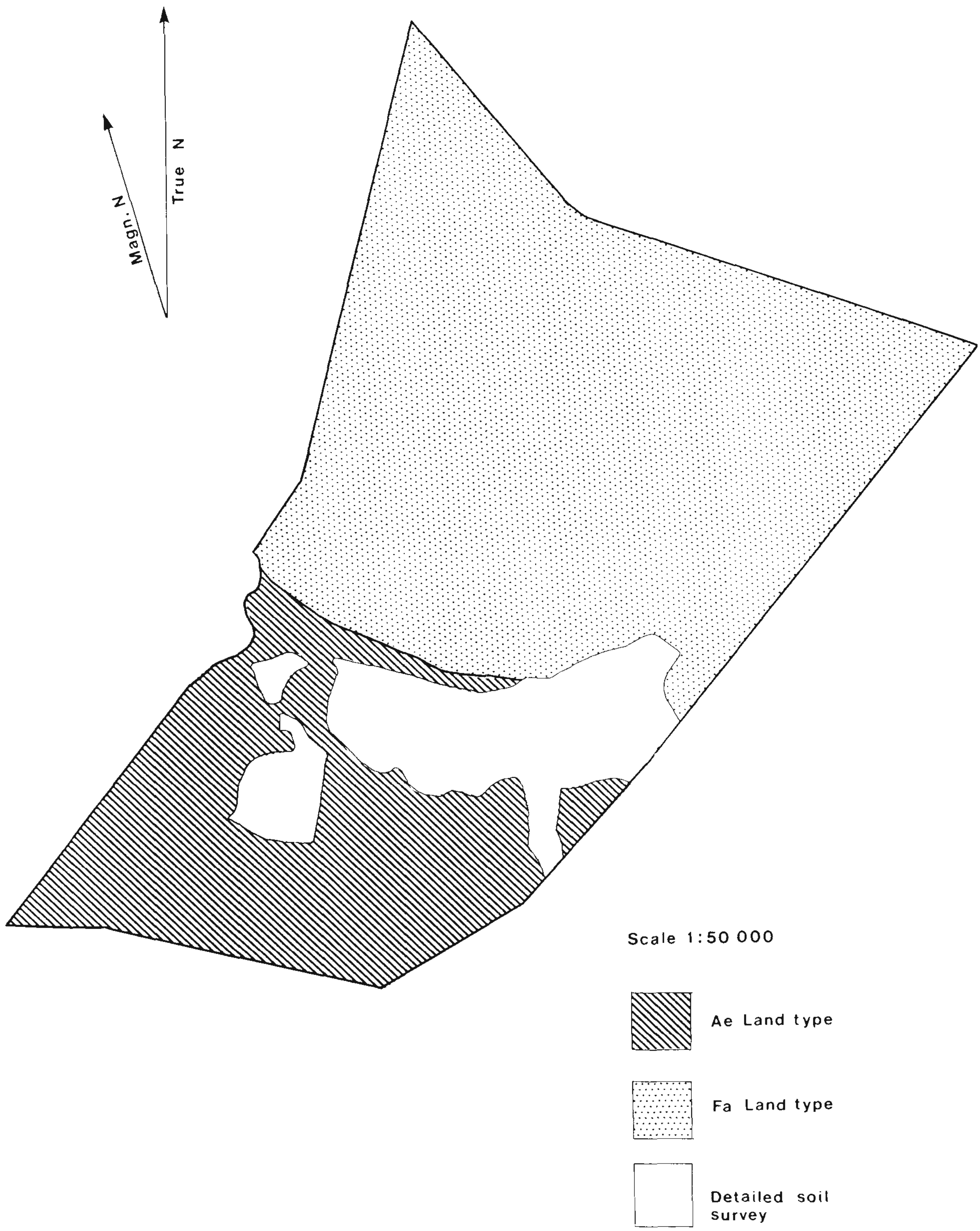

Figure 2.4 The location of the detailed soil survey and the land types on Roodeplaat farm.

Table 2.1 Climatic data for the Roodeplaat Experimental Farm obtained from the AGROMET database (Institute of Soil, Climate and Water, Private Bag X79, Pretoria 0001)

Longterm summary of maximum temperature (C°) for 42 years

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MMTOT	913.9	820.2	864.9	763.8	716.3	608.5	642.5	724.3	804.0	872.8	843.6	890.1
MMMAX	34.0	33.2	32.2	29.9	27.3	24.8	24.9	28.9	32.7	34.3	33.9	33.7
MEAN	29.5	29.0	27.9	25.5	23.1	20.3	20.7	23.4	26.8	28.2	28.1	28.8
S.D.	2.9	2.9	3.0	3.1	2.8	2.7	2.5	3.2	4.0	4.1	3.8	3.3
DMAX	37.6	37.9	36.4	33.1	29.9	31.0	26.6	34.6	34.7	42.3	37.1	37.2
DATE	1973	1983	1984	1987	1959	1953	1968	1981	1983	1954	1981	1957
DMIN	17.0	17.0	15.4	13.4	12.4	7.9	10.6	9.2	9.7	13.4	11.6	16.2
DATE	1972	1955	1975	1972	1969	1964	1957	1983	1974	1973	1968	1966

Longterm summary of minimum temperature (C°) for 42 years

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MMTOT	518.0	462.2	450.0	321.7	181.9	71.8	70.7	140.1	269.8	397.2	441.1	495.3
MMMAX	12.4	12.2	9.8	5.2	0.3	-2.7	-2.7	-1.0	2.7	6.5	10.1	11.6
MEAN	16.7	16.4	14.5	10.7	5.9	2.4	2.3	4.5	9.0	12.8	14.7	16.0
S.D.	2.1	2.1	2.4	2.9	2.9	3.1	2.8	3.2	3.4	3.0	2.5	2.3
DMAX	24.5	25.0	20.9	18.0	15.0	13.0	11.4	15.6	18.6	21.4	25.5	24.8
DATE	1953	1992	1963	1961	1985	1965	1993	1986	1966	1975	1952	1952
DMIN	5.5	8.5	5.7	-0.1	-2.9	-6.7	-6.7	-5.9	-2.0	2.1	6.5	3.1
DATE	1960	1986	1974	1973	1974	1964	1988	1972	1959	1965	1988	1970

Abbreviations used in table

DATE date when the value directly above was recorded
DMAX maximum daily value ever recorded
DMIN minimum daily value ever recorded
MEAN mean
MMAX highest monthly maximum ever recorded
MMIN lowest monthly minimum ever recorded
MMMAX mean monthly maximum
MMTOT mean monthly total
S.D. standard deviation

Table 2.1 (cont.) Climatic data for the Roodeplaat Experimental Farm obtained from the AGROMET database (Institute of Soil, Climate and Water, Private Bag X79, Pretoria 0001)

Longterm summary of rain (mm) for 42 years

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
MMTOT	123.7	82.4	70.8	46.8	15.7	7.6	3.6	5.9	18.9	65.4	104.9	100.5
MMAX	414.7	212.3	209.5	151.2	186.7	62.8	57.0	42.1	98.7	158.7	203.0	192.4
DATE	1975	1980	1991	1963	1956	1989	1957	1979	1987	1964	1971	1966
MMIN	15.0	19.1	13.2	0.0	0.0	0.0	0.0	0.0	0.0	8.8	16.0	22.7
DATE	1990	1960	1963	1956	1962	1953	1953	1953	1955	1965	1988	1978
DMAX	133.7	64.7	83.2	68.0	39.5	37.2	44.0	35.7	31.6	80.8	111.5	70.0
DATE	1975	1985	1967	1965	1956	1963	1957	1979	1987	1986	1955	1969
DMIN	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
DATE	1953	1953	1953	1953	1953	1952	1952	1952	1952	1952	1952	1952

DATE date when the value directly above was recorded
DMAX maximum daily value ever recorded
DMIN minimum daily value ever recorded
MEAN mean
MMAX highest monthly maximum ever recorded
MMIN lowest monthly minimum ever recorded
MMMAX mean monthly maximum
MMTOT mean monthly total
S.D. standard deviation

5) the mean monthly maximum humidity is 81.5% with a range of 16.6% and the the mean monthly minimum humidity is 25.8% with a range of 11.4%.

2.5 *VEGETATION*

Hemicryptophytes (plants which have their perennating buds at the surface of the ground) and phanerophytes (plants which have their bud-bearing shoots elevated and exposed to the atmosphere and are with few exceptions trees and shrubs) (Raunkiaer 1934 cited by Rutherford & Westfall 1986) are given as the codominant (in terms of the relative contribution to total mean annual production)life forms of the Savanna Biome (Rutherford & Westfall 1986), in which the study area is situated.

The vegetation of the farm occurs in Veld Type 19 or Sourish-Mixed Bushveld mapped by Acocks (1988) at a scale of 1:1 500 000. Acocks (1988) states that this veld type is more clearly defined than the Mixed Bushveld and that it occupies an irregular belt on gentle slopes between the sour veld types (both grass and bush) and the mixed veld types of the plains and valleys. *Acacia caffra* is the dominant tree with dense stands of tall grassveld dominated by *Cymbopogon plurinodis, Themeda triandra, Elionurus muticus* and *Hyparrhenia hirta* occurring in this open savanna (Acocks 1988).

Van Rooyen (1983) mapped the vegetation of the Roodeplaat Dam Nature Reserve, which is adjacent to the south-eastern boundary of the Roodeplaat farm, at a more detailed scale (1:33 000). He classified the nature reserve into six communities, two of which he subdivided into another seven variations. Four of these vegetation units adjoin the Roodeplaat farm, namely: the *Rhynchelytrum repens-Cynodon dactylon* oldland grassland; the *Acacia karroo* closed woodland; the *Setaria perennis-Polygala hottentotta* grassland; and the *Acacia caffra-Setaria perennis* closed woodland (Van Rooyen 1983).

2.6 *RESEARCH AT ROODEPLAAT*

In April 1992 the Grassland Research Centre became the Roodeplaat Grassland Institute and research currently being conducted by this organization includes vegetation resource, plant production, forage utilisation and herbivore production studies and provides various services to the animal production industry.

The natural vegetation at Roodeplaat has never been surveyed and classified (R. Drewes, pers. comm. Transvaal Region, Private Bag X180, Pretoria, 0001) and the need for a complete inventory, analysis and classification of the vegetation arose when the Game Production Unit at the Roodeplaat Grassland Institute decided to introduce game to the area north of the Pienaars River.

3. METHODS

The methods described below were employed in both the vegetation survey and the continuous transect on Roodeplaat farm and are divided into preparatory work (3.2), field sampling (3.3) and data analysis (3.4). A brief discussion of available literature dealing with field data capture techniques, studies of comparisons of field techniques and scale-related sampling is presented in 3.1 below.

3.1 *PREVIOUS RESEARCH*

3.1.1 *Research on field data collection techniques*

Bonham (1989) lists many techniques for measuring the frequency, cover, biomass and density of a vegetation unit. The more important measurable quantities in community sampling (all of which were either measured or can be derived from this study) are:

1) species presence;
2) density or number of individuals per unit area;
3) frequency *i.e.* the number of times a species is recorded in a given number of quadrats or at a given number of sample points;
4) cover, either crown or basal; and
5) vegetation structure in terms of growth form and canopy cover.

The concepts of stand and plot, as used in this study, need to be defined to avoid confusion. A plot generally refers to a sampling unit which has measurable area. This includes belt transects, quadrats and variable quadrats (Mueller-Dombois & Ellenberg 1974). Where sampling units have no or negligible area the method is generally referred to as plotless sampling and includes techniques such as point sampling, line intercept sampling, distance measures and descriptive accounts, such as Edwards (1967). The concept of a stand, as defined by Daubenmire (1968) *viz.* "... each piece of vegetation that is essentially homogenous in all layers and differs from contiguous types by either quantitative or qualitative characters is a stand.", is difficult to apply since neither qualitative or quantitative characters can be determined prior to actual field work and data analysis. Thus, the definition of a stand, as used in this study, is a unit of vegetation with area defined according to scale in which sampling, either by plot or plotless, methods is carried out. Stand heterogeneity is inversely proportional to scale and the object of sampling a stand should be to record most of the variation within the stand.

Parameters such as cover, frequency and density can be measured using a variety of techniques (point- or quadrat-based) a few of which are mentioned below.

3.1.1.1 Cover

Cover is defined as the vertical projection of the crown or shoot area of a species to the ground surface, usually expressed as a fraction or percentage of a reference area but could also imply the projection of the basal area or area outline of a plant near the ground surface (Mueller-Dombois & Ellenberg 1974). One way of measuring cover is point frames (Bonham 1989). An example of such an apparatus is the bridge point used by Morris & Muller (1970) to determine basal cover variation within and between seasons. Another method for cover determination is the line intercept method whereby a line is spanned at a height to contact plant canopies or plant bases and the length of each intercepted plant part is measured (Bonham 1989, Mueller-Dombois & Ellenberg 1974). Point intercept and line transect methods are sometimes combined for estimating cover of plants in short vegetation types. An example of such a technique is the wheel point technique developed by Tidmarsh & Havenga (1955) where a rimless wheel is rolled along a line and observations are made where a predetermined spike touches the ground (Bonham 1989). Cover can also be determined by charting or mapping methods which involve drawing, to scale, the outline of the plant's canopy or stem on a sheet of graph paper (Tansley & Chipp 1926, Bonham 1989). Various photographic methods exist for estimating cover from photographs *eg*. Ratcliff & Westfall (1973 cited by Bonham 1989) mounted a single lens camera in a downward position, fitted with an inexpensive adaptor to obtain stereophotographs, on a rectangular frame with detachable legs. Cover can be reliably estimated using ocular field instruments. Examples of these include the Bitterlich or angle-guage to determine tree basal cover (Mueller-Dombois & Ellenberg 1974), a rifle telescope converted into a periscope, capable of swivelling through 180°, for point interception of plant canopies (Bonham 1989) and the cover meter described by Westfall & Panagos (1984) which is best suited to canopy cover estimations for different height strata.

For this study, the method used to determine canopy cover in conjunction with the quadrat method of floristic sampling, was the plant number scale (Westfall & Panagos 1988) which is based on Edwards' (1983) definition of crown cover and is a function of the relation between mean crown diameter and mean spacing of plants. Cover is determined simply by a count of the plants in variable-sized transects - the transect width and length depends on the spacing of the plant and mean plant canopy diameter respectively. Using the point canopy intercept method, the percentage canopy cover for each species is derived from the technique and does not have to be measured separately.

3.1.1.2 Frequency

Frequency is a non-absolute measure of abundance (Mueller-Dombois & Ellenberg 1974, Bonham 1989) since it is a function of the size and shape of the sampling unit. Increasing or decreasing quadrat size usually results in a different frequency since plants are seldom randomly distributed (Mueller-Dombois & Ellenberg 1974). Frequency gives an indication of distribution rather than density and little or no indication of cover, when determined in quadrats. For example, a species with few individuals but large canopy or basal areas that cover a high proportion of the sample area will have a low frequency, but high cover (Mueller-Dombois & Ellenberg 1974, Westfall 1992). Frequency can be made an absolute value if the sampling unit is reduced to a point. A needle lowered at predetermined points will either miss or intercept a plant part which gives a record of presence or absence for the more abundant species. This method measures both frequency and basal cover and is called the point-quadrat method (Mueller-Dombois & Ellenberg 1974). Point frequency can be also be determined using distance measures (Bonham 1989). In classical phytosociology, a fixed quadrat is not mandatory and therefore the use of species frequency is problematic and hence the term constancy is used instead of frequency. However, where fixed-sized quadrats have been used (as was the case in this study), frequency and constancy can be used (constancy as an absolute and frequency as a percentage).

3.1.1.3 Density

Density related measurements include cover, frequency and abundance (Bonham 1989). Three main limitations exist in estimating density, namely the definition of the individual plant being counted, the marginal effect or edge effect of the quadrat and the time taken to count herbaceous and shrubby individuals (Mueller-Dombois & Ellenberg 1974). However, density can be derived from cover, frequency and abundance measures where the plant number scale (Westfall & Panagos 1988) is used because, with this method, mean canopy diameter is also recorded (see 3.4.3.2.2). Distance methods are based on the concept that the number of plants per unit area can be estimated from the average stem to stem distance between two plants or between a point and a plant (Bonham 1989). Examples are the closest individual method, the random-pairs method and the point-centered quarter method (Mueller-Dombois & Ellenberg 1974, Bonham 1989).

3.1.2 *Comparative studies of the two techniques used at Roodeplaat*

From the preceding paragraphs, it can be seen that much research has been conducted on the application and usefulness of plot, plotless and quadrat methods of vegetation sampling and these techniques have been described in various textbooks (*eg*. Daubenmire 1968, Mueller-Dombois & Ellenberg 1974, Greig-Smith 1983, Bonham 1989).

Several studies have been conducted in southern Africa, where various data analyses and field sampling techniques were compared for repeatability, accuracy and rapidity (Table 3.1). Comparisons of this nature also enjoy international attention *eg*. distance-based density estimates (Lamacraft *et al*. 1983) and canopy cover estimations (Floyd & Anderson 1987). It would appear that some form of point-based method in conjunction with the key species method of data interpretation and the quadrat method were the preferred field data collection techniques (Table 3.1). For monitoring actions, however, the key species method should be used only after a full survey and classification of the area has been completed since key species change from one vegetation unit to another *eg*. *Urochloa mosambicensis* could be classified as an Increaser II or a Decreaser depending on the annual rainfall of the area in which it occurs (Tainton 1981).

A few researchers have used data collected with the Braun-Blanquet method to determine the veld condition of the area *viz*. Westfall *et al*. (1983) in the Sour Bushveld and Eckhardt *et al*. (1993) in the grassland of the north-eastern Orange Free State. Westfall *et al*. (1983) stated that veld condition assessments should form part of phytosociological studies since they led to a better understanding of the grass dynamics in plant communities. Eckhardt *et al*. (1993) concluded that Braun-Blanquet data should be applied to veld condition assessments since this led to more

Table 3.1 Comparative research conducted in southern Africa on some field data collection and data analysis techniques.

Researcher/s & date	Vegetation type & location	Parameters measured	Technique/s evaluated	Reasons for best(*) suited
Walker 1970	grassland sites in Thornveld Matopos Rhodesia	basal cover density frequency	*·line intercept *·wheel-point *·variable plot ·quadrat counting ·point-centred-quarter ·angle-order ·dry-weight-rank	On the basis of precision & efficiency all 3 methods give rapid though biased estimates Excessive variation occurs between operators.
McNeill Kelly & Barnes 1977	Mopani tree/ shrub savanna Nuanetsi Rhodesia	density & species composition	·closest individual ·nearest neighbour ·random pairs ·point-centred-quarter ·third nearest ·closest individual in 2 sectors *·3rd nearest in 2 sectors ·T-square *·quadrat * 2 x 2 m * 3 x 3 m 5 x 5 m	Least biased estimate of overall density. Smaller quadrats are easier to use.
Mentis 1981	Tall Grassveld Ukulinga Natal	species composition & basal cover	*·wheel-point & nearest plant ·modified wheel-point & nearest plant ·step-point	All 3 methods have advantages & disadvantages. Nearest plant method is recommended for species composition.
Heard, Tainton, Clayton & Hardy 1986	Highland Sourveld & Tall Grassveld Natal	veld condition assessment	·benchmark *.weighted quantitative climax .palatability weighting scale ·productivity weighting scale *·key species ·multivariate analysis	Both methods are superior to the other 3 based on practicality & precision. The key species method is the quickest & simplest.

Table 3.1 (cont.) Comparative research conducted in southern Africa on some field data collection and data analysis techniques.

Researcher/s & date	Vegetation type & location	Parameters measured	Technique/s evaluated	Reasons for best(*) suited
Hardy & Hurt 1989	Highland Sourveld Thabamhlope Natal	index of veld condition	·benchmark .ecological index *·key species .weighted key species ·weighted palatability ·detrended correspondence analysis	This method has the greatest potential since it is the most sensitive.
Hobson & Baarnhoorn 1989	False Upper Karoo Grootfontein Cape Province	browse utilization (point-based)	·% cover *·% edible-strikes *·% twigs-grazed	Both techniques are more sensitive & efficient than % cover.
Hurt & Bosch 1991	Fire-climax & climatic-climax grasslands Transvaal Natal & Orange Free State	index of veld condition	·benchmark .ecological index ·key species *.weighted key species ·weighted palatability *·degradation gradient	These techniques show most potential for providing useful & objective condition indices.
Ivy & Stuart-Hill 1992	Bushveld Bisley Valley Natal	woody plant density, species composition	*·quadrat 5 x 5 m *·nearest plant	Both have advantages as well as disadvantages. The quadrat is simpler to use but the nearest plant is more efficient.
Stokes & Yeaton 1994	Succulent Karoo Worcester Cape Province	% canopy cover, density, frequency & plant structure	*·ellipse intercept ·line-intercept ·point-intercept	This method is as good as the other 2 but provides additional information on plant structure & height.

efficient use of time and maximization of information generated from field data. To date, the quadrat method devised by Westfall (1992) has been used by five researchers to classify vegetation (Roberts 1990, Van Staden 1991, Boswell 1993, Myburgh 1993 and Seppings 1994). A comparison of field data collection techniques was not an objective for any of these workers. The point canopy intercept method of data collection and synthesis, as applied in this study is new (See 3.3.2.1). Previous literature comparing the two methods, therefore, does not exist.

3.1.3 *Scale-related sampling*

Mueller-Dombois & Ellenberg (1974) state that a plant community is " ...a group of plants sharing a common environment and is distinguished by a particular floristic composition.". Plant community recognition depends on the scale at which the work is being done since smaller plant communities can be included in larger plant communities (Westfall 1992). The objective or the amount of detail required in a study will dictate the scale to be used.

Küchler (1973) indirectly highlights the problems of classifying and mapping vegetation when scale is not taken into account. Küchler (1973) gives the example of a cartographer, mapping at a scale of 1:100 000, trying to show the same amount of detail for forestland and the much smaller grassland communities interspersed within the forest. Küchler (1973) states that many mappers show forests in detail, listing dominant species, structural characterstics, and all sorts of other features, and then simply refer to the herbaceous vegetation as grasslands omitting details pertaining to those communities, which he feels is unacceptable. Thus Küchler (1973) concurs with Rutherford & Westfall (1986) when they state that the amount of detail shown on a map is scale-dependant. However, the required detail is often linked to an arbitrary scale based on the availability of aerial photographs and maps. Although scales form a continuum it is unlikely that vegetation will conform to continuous scale changes. It is highly probable that vegetation can be better differentiated at certain scales than at others. Previous literature dealing with optimum sampling scales does not exist and so is addressed in this study.

The scale-related sampling technique used in the present study is described under 3.1.1 and researchers who have successfully applied the scale-related sampling technique devised by Rutherford & Westfall (1986) and refined by Westfall (1992) are Van Staden (1991) in the Steenbokpan area of the north-western Transvaal and Boswell (1993) in the Silverglen Nature Reserve, Durban.

3.2 *PREPARATORY WORK*

3.2.1 *Scale and stratification*

3.2.1.1 Background

Plant community classification in the past has been largely a subjective exercise. Reasons for this include the choice of minimum sample size and observer bias in the sampling and classification phase (Westfall 1992). Another criticism, has been the poor correlation between initial vegetation stratifications and final vegetation maps. Generally, study areas were stratified using aerial photographs, field sampling carried out followed by the classification of the data. A vegetation map was then produced, which often bore little resemblence to the original stratified units.

When using the approach described above, scale was not taken into account at all. Smaller plant communities were included in larger plant communities (Westfall 1992) and this often made community boundary recognition difficult at the relevant scale. Pressey & Bedward (1991) illustrate the effect different scales have on the same data set. At so-called coarse scales the data set showed fewer groups than when classified for finer scales.

The detail at which a study is done, determines the working scale or associated sampling scale, which in turn determines the smallest mappable unit area (SMUA) both in terms of field procedure and cartography (Rutherford & Westfall 1986). These authors state that each SMUA should not be closer than 1 mm to a stratified unit's border and should not be closer than 2 mm to another sampling site at any scale (Figure 3.1). This procedure takes into account the ecotone concept (Daubenmire 1968) which, therefore, is allowed a width of 2 mm.

Less than 2 mm would amount to continuous sampling and more than 2 mm could allow another community in between. In this way, smaller communities are included in larger ones. Stand area (see 3.2.1.2.2 and Table 3.3) is equated with the SMUA and in so doing, scale is taken into account when sampling vegetation (Westfall 1992).

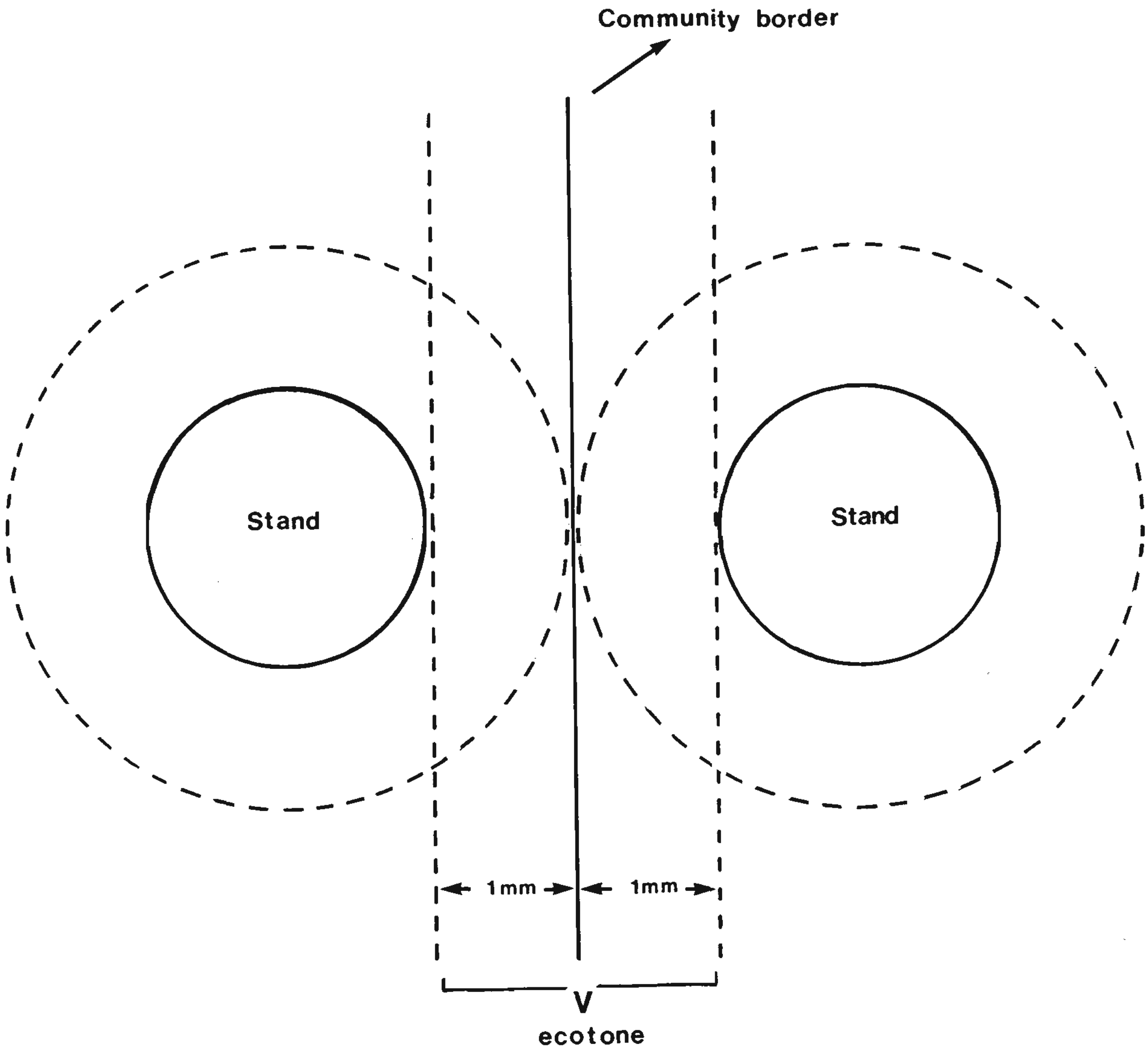

Figure 3.1 Graphic representation of how stands can be placed in stratified units so as to avoid sampling ecotones.

Aerial photographs have been employed to delineate physiographic units such as footslopes, crests, saddles *etc.* (Bloem *et al.* 1993). Physiognomic characters of the vegetation have been used to stratify vegetation and some researchers have used a combination of both physiographic and physiognomic characters. Breytenbach (1991) used the South African Land Type Series to stratify the Grootvlei study area but, as Westfall (1992) points out, non-vegetation factors can only be reliably used for stratification where their limits correspond with those of the vegetation units. Efficiency of these techniques is largely dependent upon the observer's experience (Westfall 1992).

3.2.1.2 Methods employed

A recent (1991) black and white aerial photographic mosaic of the Roodeplaat experimental farm (1:8 000 scale) was used to stratify the area into vegetation units. These units were selected using a method of pattern analysis which involved the visual, and thus subjective, stratification of units by pattern recognition of texture and grey values. It was assumed that these differences in texture and grey values represented the structure and standing biomass of the vegetation. Unit demarcation was done from largest to smallest - smallest being larger than four times the stand area and its buffer zone. Ten stratified units were demarcated in this manner (Figure 3.2).

3.2.1.2.1 Stand positioning

The criteria shown in Figure 3.1 were applied for stand positioning. The stratified units at the relevant scale (1:8 000) were too small for sufficient intercepts using a 4 x 4 mm grid (Rutherford & Westfall 1986) for random stand placement (Figure 3.3). The best fit method of stand placement was therefore employed. Seventy five stands were marked on a film overlay delineating the stratified units (Figure 3.4). Observer bias was eliminated in stand placement by using only the overlay and ignoring the photographic mosaic. Each portion of a stratified unit had at least one stand placed in it with a minimum of four stands per vegetation unit (Table 3.2). No subjective decisions about stand placement were made in the field.

The minimum number of stands (4) used to sample each stratified unit may be considered statistically insufficient in terms of a normal distribution. However, the sampling strategy is designed to determine which species best

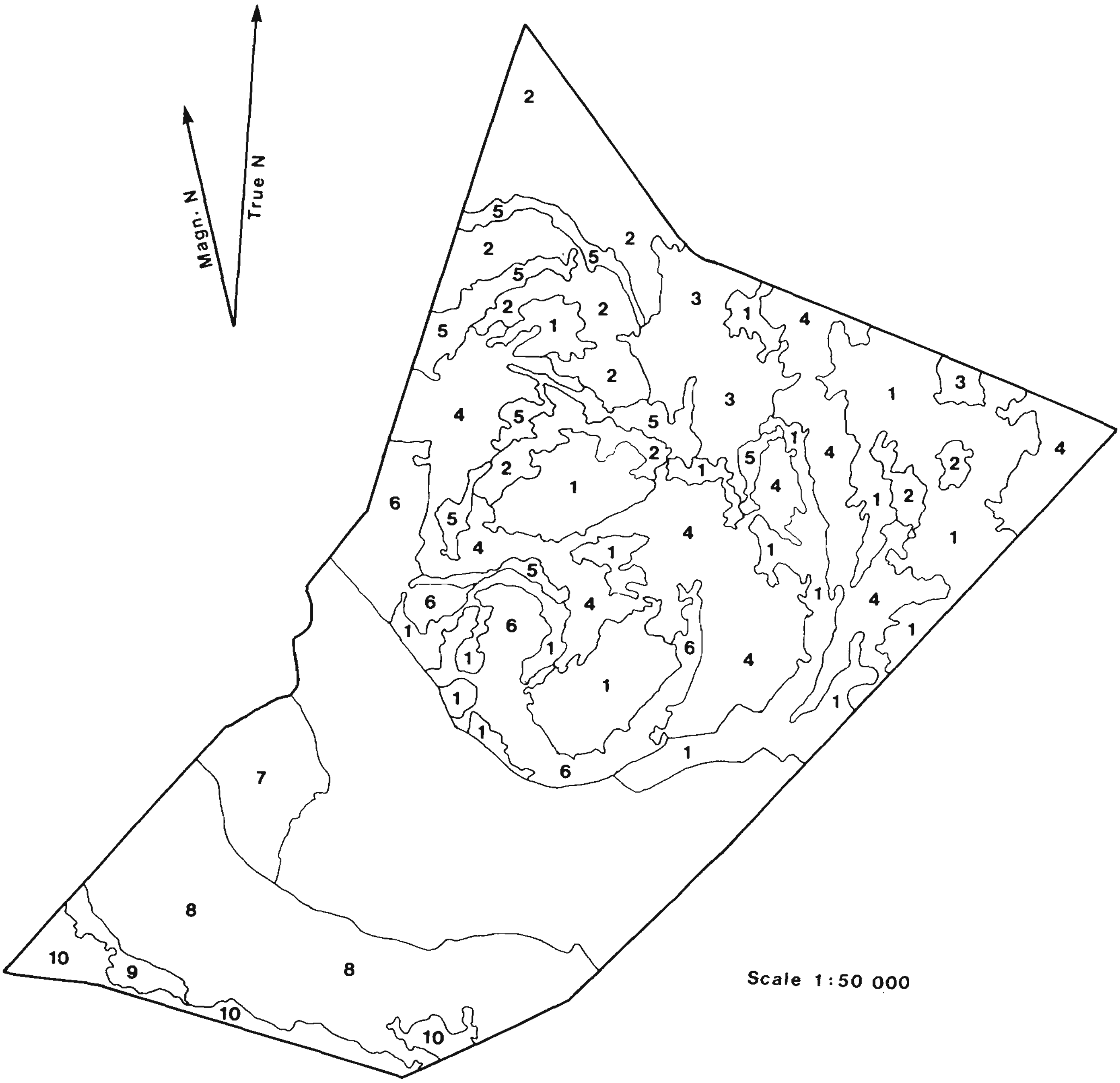

Figure 3.2 The stratified units of the Roodeplaat study area numbered according to the initial air photo-based stratification.

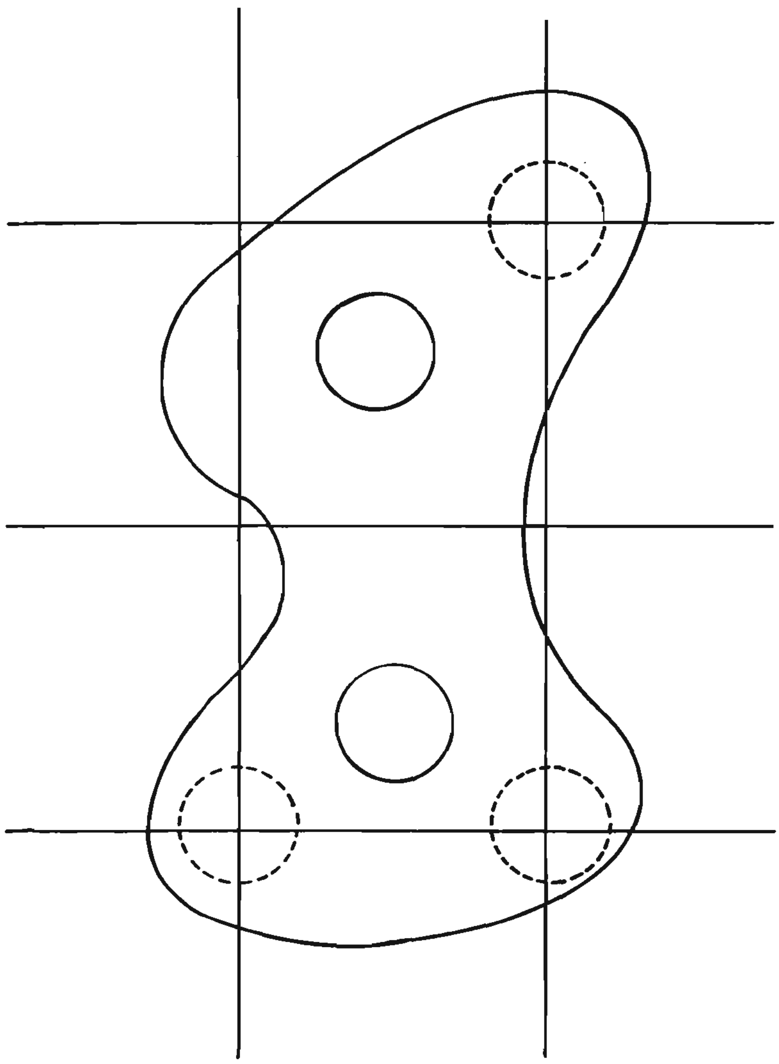

Figure 3.3 Illustration showing the unsuitability of the 4 x 4 mm grid method (Rutherford & Westfall 1986) of stand placement for small communities. The irregular polygon represents the stratified unit's boundary. The circles with broken lines indicate where the stands would have been placed using the 4 x 4 mm grid. These stands are too close to the community borders. The circles with solid lines indicate selected stand positions based on best fit according to equal area representation.

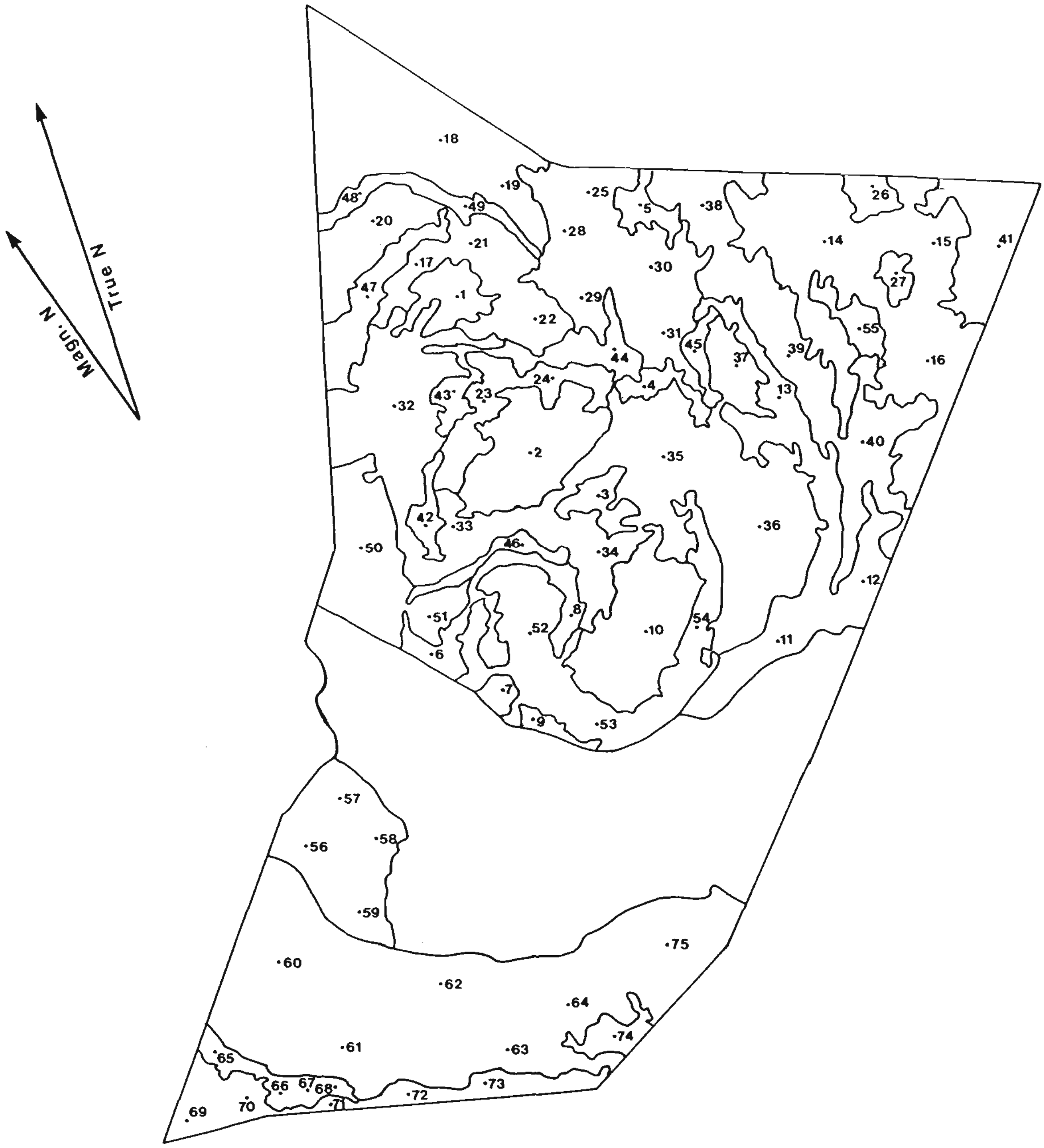

Figure 3.4 The position of objectively placed sampling stands in the Roodeplaat study area, determined by a method of best fit.

Table 3.2 Breakdown of the stratified units showing the number of polygons comprising each unit and the number of stands located in each unit

Vegetation unit no.	Number of polygons per unit	Number of stands per unit
1	11	16
2	6	12
3	1	4
4	3	10
5	6	8
6	2	5
7	1	4
8	1	6
9	1	4
10	2	6
Total	34	75

characterize the community and those responsible for the most significant portion of vegetation cover (Westfall 1992).

3.2.1.2.2 Stand area

Westfall (1992) defines a stand as being " ... generally a relatively homogenous unit of vegetation, smaller than the community of which it is a part, but not smaller than the sampling plot with which it is sampled.". By taking the SMUA (Rutherford & Westfall 1986) into account, stand area becomes a function of scale (Table 3.3). At the selected scale of 1:8 000 the stand for this study had a circular area of 0,02 ha (201 m^2) with a radius of 8 m. Circular stands were used in this study to comply with the concept of scale-related sampling (3.2.1) as well as for convenience in the field (3.3.2.2).

Table 3.3 Examples of stand areas at different scales (Westfall 1992)

Scale	Area	Radius
1 : 8 000	0.02 ha	radius of stand = 8 m
1 : 50 000	0.75 ha	radius of stand = 50 m
1 : 250 000	20.0 ha	radius of stand = 250 m
1 : 1 500 000	3.14 km	radius of stand = 1 500 m
1 : 10 000 000	314.0 km	radius of stand = 10 000 m

3.3 *FIELD SAMPLING*

Field sampling was conducted over two growing seasons. The survey of the farm commenced in February 1993 and was completed by April of the same year. The continuous transect was completed during the following growing season (January and February 1994). The sampling methods employed during these two periods are described below.

3.3.1 *Stand location*

Stands were located using a film overlay of the stratified 1:8 000 aerial photograph mosaic which also had landmarks indicated (roads, dams *etc.*). Distances on the overlay were converted into metres and a motor vehicle's tripmeter was used to measure off the correct distance to a point on the road directly adjacent to the stand. The distance to the centre of the stand was then paced out by the same fieldworker for each stand. When confronted with a thicket or bush clump, care was taken to move back onto the same bearing after having rounded the obstruction and to adjust for the correct number of paces. The stand centre was referenced for sampling purposes using a fencing dropper.

3.3.2 *Floristic data recording*

Two methods of survey (point canopy intercept method and quadrat method) were carried out at each stand by two different workers, one doing only the quadrat method and the other doing only the point canopy intercept method. Time taken to complete the floristic data recording per stand, for each of the two methods was recorded.

3.3.2.1 Point canopy intercept method (PCIM)

A wheel point (Tidmarsh & Havenga 1955) with a circumference of 2 m, distance between spokes equal to 10 cm and spoke diameter equal to 1 cm was used for the PCIM. An eight metre nylon line was attached to the central dropper and anchored on the perimeter of the stand at right angles to the direction of the slope. Although the object of floristic sampling is to adequately sample the floristic variation in the stand by the most efficient means possible, due to the flatness of the terrain and the general homogeneity of the stands, which were relatively small, orientation of the transects was not critical to sampling variation. The placing of the transect at right angles to the direction of the slope was done at each stand so as to avoid possible operator bias *eg.* purposely placing the transect to miss a thicket. A bearing of the direction of the transect was recorded using a magnetic compass (see Appendix A). Recording was commenced at the stand perimeter and, on reaching the centre of the stand, the line was swivelled 180° and anchored on the opposite side of the stand's perimeter *i.e.* the transect was 16 m long. The exact position of the stand centre was recorded (Appendix A) using a Global Positioning System (GPS) receiver to facilitate future relocation of stands for monitoring actions.

Plant species whose canopies were intercepted by a point were recorded at intervals of 10 cm. This distance (10 cm) between points was a subjective decision based on the dimensions of the stand. Adequate nearest-plant samples have been shown to be in the order of 200 points (Mentis 1981, Hardy & Walker 1991) and since the stand diameter was 16 m the transect consisted of 160 points. Had the distance between points been greater (*eg.* 50 or 100 cm) species with canopies less than this distance might not have been sampled. A point spacing of less than 10 cm would have been inefficient in terms of the time taken to complete a sample, and it was felt that the extra effort would not have yielded additional information than would have been obtained using the 10 cm gap.

Plant canopies intercepted by points were recorded as follows: taxa, growth form and whether the point intercepted part of the preceding plant's above-ground parts (Figure 3.5). For grasses a 'hit' was recorded only if the inner two-thirds of the canopy intercepted the point. Reasons for only regarding the inner two-thirds of a grass canopy include: dynamics of the canopy which can be influenced by moisture and wind; and, projected canopy cover - the outer one-third offers little ground cover. A 'hit' for all

WHEEL POINT TRANSECT FIELD FORM

yyyy-mm-dd	Researcher	Stand/Releve number:
Date: 93/02/25	M. D. Panagos	12

Total points: 160

Point distance: 10cm

Random/systematic number: 12

	deg	min	sec
Latitude:	25	35	05
Longitude:	28	21	58

	Species abbreviation	Point number and (growth form:T,S,D,G,F)-repeated. For same individual use "-" eg. 1(T) 2(T)-3-4. Record soil & rock.
1	BARE SOIL	2,3,4,16,17,
2	ROCK	5,6,
3	Olde her (F)	1,22,
4	Seta sph (G)	7,8,9,25,
5	Them tri (G)	10-11-12, 13, 14-15, 23, 24,
6	Acac tor	18(S)-19-20-21, 24-25(T),
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
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Figure 3.5 Example of field data sheet for recording point canopy intercept data.

other growth forms was recorded when the point intercepted any part of the canopy except for obvious outlying branches. The commas between consecutive points indicate that separate individuals occurred at those points and dashes between consecutive points indicate that the plant occurring at those points formed part of the same individual (Figure 3.5). At any one point, two or more plants with different and/or the same growth forms could be recorded. For example: *Panicum maximum* occurring under *Acacia nilotica* or two grasses occurring under one shrub. Growth forms recorded followed Westfall's (1992) definitions derived from Edwards (1983) and Rutherford & Westfall (1986) as follows:

Tree (T): Trees are rooted, woody, single-stemmed plants > 2 m in height or multi-stemmed > 5 m in height;

Shrub (S): Shrubs are rooted, woody, multi-stemmed plants from 1 to 5 m in height, or single-stemmed when ≤ to 2 m in height;

Dwarf shrub (D): Dwarf shrubs are rooted, woody plants < 1 m in height;

Grasses (G): Grasses are rooted, herbaceous plants belonging to the family Poaceae or graminoid plants such as Cyperaceae and Restionaceae which resemble grasses; and

Forbs (F): Forbs are rooted, non-graminoid, herbaceous plants.

Bare soil and rock were recorded only if no vegetation was intercepted at the point. When terrain prevented the use of the wheel (too rocky or very dense vegetation, such as a bush clump) a 20 m tape measure was used to locate sample points. The same wheel operator and recorder were used for the duration of the field work so as to avoid possible operator bias.

3.3.2.2 Quadrat method (QM)

A variation of the Braun-Blanquet approach developed by Westfall (1992) and used by Van Staden (1991) was also employed for this survey. The field worker was restricted to the circular stand by attaching two 8 m nylon lines to the central dropper, dividing the stand into a quarter using these lines by anchoring the lines on the perimeter of the stand and then recorded all plant taxa rooted in the quarter. A growth form was assigned to each species using the same system as described in 3.3.2.1 above. The procedure was repeated for each of the other three quarters in the stand. A separate sample of cover for each species recorded in the stand was carried out using the plant-number scale (see 3.1.1.1 above) (Westfall & Panagos 1988).

3.3.3 *Plant identification*

Throughout the survey, all taxa recorded for the first time were collected, numbered and encoded using vegetative characters as described by Westfall *et al.* (1986). When a plant was recorded and collected for the point canopy intercept method it was unneccesary to recollect it for the quadrat method and *vice versa*. Field naming was done using a number of field guides (Coates-Palgrave 1988, Van Wyk & Malan 1988, Van Oudtshoorn *et al.* 1992) and when unknown, a nickname was assigned to the plant. All field-assigned names, whether scientific or nicknames, were recorded alongside a short description of the plant. As field work progressed, the workers were able to refer back to the vegetative descriptions when unsure of the identification of a plant.

Plants collected were pressed and in some cases oven-dried (*Aloe* species). Where possible, three specimens for each plant were collected; two were sent to the Grahamstown Herbarium and the Pretoria Herbarium for identification and one was kept at the Roodeplaat Grassland Institute Herbarium. Voucher specimens for all the plants collected during this study are housed at the Roodeplaat Grassland Institute Herbarium (ROOD). Species collected during the survey are numbered Van Staden JM #1284 to #1696 and those collected during the continuous transect are numbered Panagos MD #196 to #416 (see Appendix B).

3.3.4 *Habitat data*

The slope of each stand was measured in degrees using an inclinometer and the aspect was recorded in degrees using a compass. Soil samples were collected in each stand using a bucket soil auger. Each bucket was emptied onto a white plastic background, in separate heaps, in order to facilitate horizon differentiation. Using this technique the following soil characteristics were recorded for each stand:

1) soil depth, by measuring the depth of the augered hole with a tape measure to the nearest centimetre;
2) soil texture, estimated using the "finger test" (F.S.S.A 1974)(see Table 3.4);

3) soil colour of the A and B horizons, using a soil colour chart (Munsell Soil Color Charts 1954); and

4) soil form, determined by diagnostic horizon combinations according to (MacVicar *et al.* 1991).

Table 3.4 The "finger test" method of determining the clay percentage or texture of soil at field capacity (from F.S.S.A. 1974)

Fingers stay clean	0 - 6% clay
Fingers slightly dirty	>6 - 12% clay
Fingers slightly sticky	>12 - 20% clay
Slight glossy smear and concretions	>20 - 35% clay
Highly glossy smear	>35% clay

3.3.5 *Continuous transect*

Starting at the south-western boundary of the farm a continuous transect comprising 7 752 points, one metre apart, was laid out across the farm using a 50 m steel tape measure (Figure 3.6). The transect always ran perpendicular to the slope (up and down) and a compass bearing of the direction of the transect and a GPS reading was noted every time a change in direction was taken (see Appendix A). In other words, the line did not run straight across the farm but zigzagged to maintain perpendicularity in order to record maximum species variation.

Plant canopies intercepted by the point were recorded at each point similar to the point canopy intercept method. However, unlike the PCIM, an indication of the same individual's canopy being intercepted at consecutive points was not recorded since only species presence and not cover was required. Each new species recorded along the transect was collected following the same procedure as described in 3.3.3.

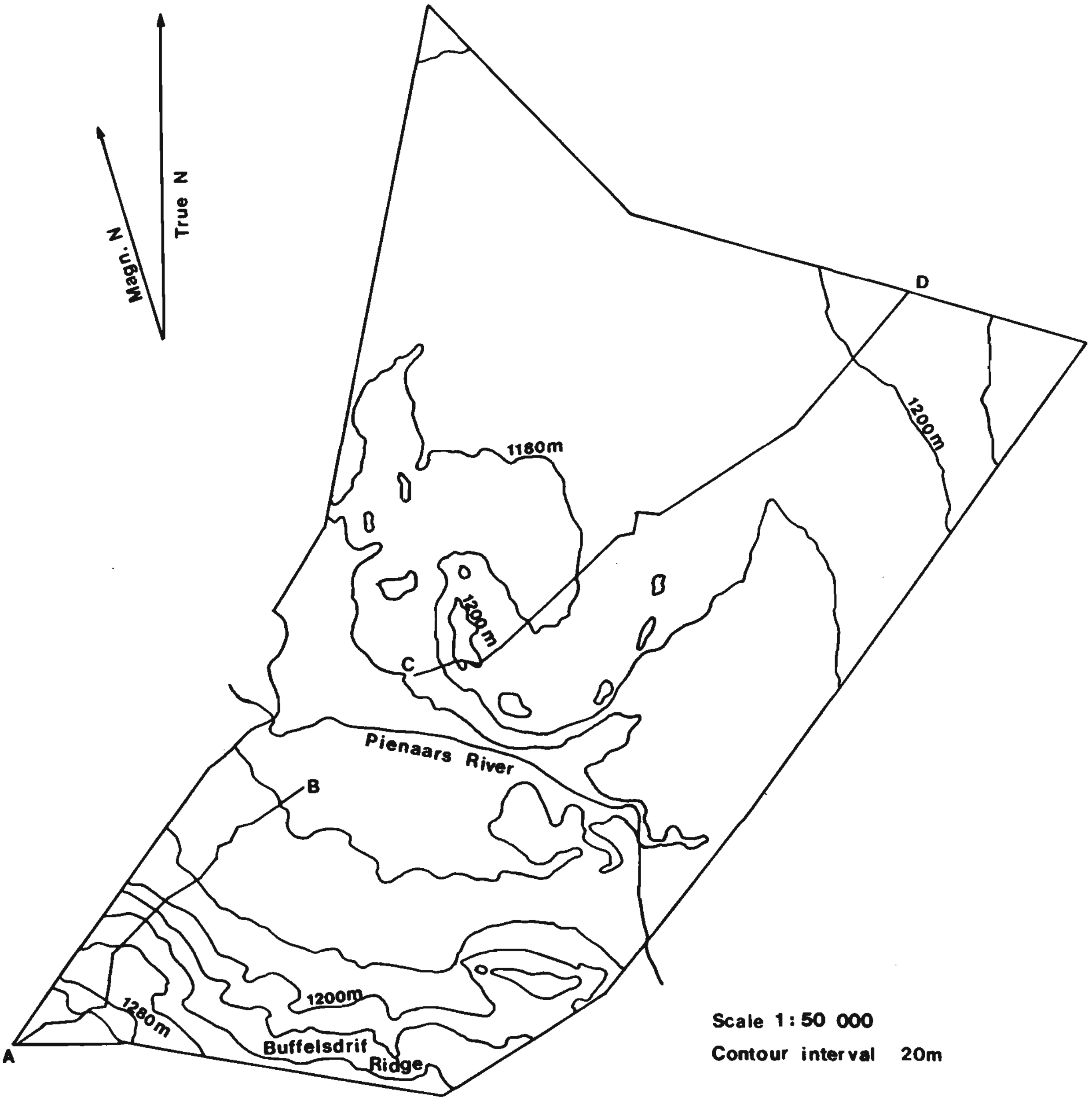

Figure 3.6 The route followed for the 7.752 km continuous transect of the Roodeplaat study area (A to B on the south-western side of the cultivated lands and C to D on the north-eastern side of the cultivated lands). Deviations from a straight line occurred where the transect was directed perpendicular to the contour.

3.4 *DATA ANALYSIS*

Classification is the orderly arrangement of objects according to their differences and similarities (Gabriel & Talbot 1984). In vegetation ecology, the object or unit generally used in classification is the relevé or sample and these are arranged to form plant communities. Gabriel & Talbot (1984) define the plant community as follows: " A unit of vegetation that is relatively uniform in structure and floristic composition and consisting of competing plants of one or more species in a common location. The basic unit of vegetation."

In the past, plant community classification has been largely a subjective exercise. Reasons for this include the choice of minimum sample size, observer bias in the sampling and classification phase. Also, the effect of scale on sampling was not taken into account. Westfall's (1992) study was aimed entirely at making classification less subjective than was previously the case, by examining objectivity in stratification, sampling and vegetation classification. PHTOTAB-PC (Westfall 1992) is a software package which was developed for objective classification of plant communities and was used for the synthesis of the quadrat method (QM), point canopy intercept (PCIM) and the continuous transect data in this study.

Although PHYTOTAB-PC forms part of an unpublished Ph.D thesis (Westfall 1992), and as such has not yet been subjected to peer review, it was nevertheless chosen above other software packages because previous workers (Roberts 1990, Van Staden 1991, Boswell 1993, Myburgh 1993, Seppings 1994) have shown it be a satisfactory classification tool. Van Staden has used the package extensively for unpublished contract work and to date has been unable to fault the program (J.M. Van Staden, pers. comm. Roodeplaat Grassland Institute, Private Bag X05, Lynn East, 0039). TWINSPAN (Hill 1979) was not used since tests have shown this program to be inadequate for final classification in terms of relevé group definition or sequence (Westfall 1992).

3.4.1 *Background on PHYTOTAB-PC*

The method used to portray classified plant communities is a two-way matrix where the species are represented by rows and the samples (or relevés) are arranged in columns. The matrix values at the intercepts of the columns and rows indicate species presence and blank intercepts represent species absence. Each value quantifies the species in terms of cover or cover-abundance (Westfall 1992).

The classification method used in this study aims to:

1) obtain a relevé sequence, where relevé-groups can be formed based on floristic similarity and then sequenced according to floristic similarity;
2) delimit relevé-groups; and
3) obtain a species sequence where the relevé-groups and their relations are emphasized.

The mechanisms by which the program package achieves these aims is shown by means of a flow diagram (Figure 3.7 *ex* Westfall 1992). The initial data input was in the PHYTOTAB format *viz.* relevé, species, cover abundance, species, cover abundance...relevé *etc.* The input file (DATA) was transformed into two matrix data files, namely MATDAT (Phytotab format) and MATDAT (Tabin format). A further input file (COVER), containing the cover codes used in the matrix is then loaded. Subsequent output files generated are a relevé sequence file (RELSEQ), a species sequence file (SPPSEQ), a codename file for species and relevé computer code numbers (CODENA) and a file which transforms the input into a raster format (QMAT). Peripheral data input includes species and community names (DESCRI), growth form data (SPDAT) and habitat data (HABVAR).

The classification of data using PHYTOTAB-PC (Westfall 1992) incorporates three main functions *i.e.* relevé sequencing, relevé grouping and species sequencing.

3.4.1.1 Relevé sequencing

The ideal classification would be one where the groups of relevés form tight groups of species without gaps between the species occurrences and with none of these species occurring outside the group of releves. In practice, however, this seldom occurs since gaps can be caused due to sampling omissions, outliers and, more often, the irregular spacing of the plant species. Gauch (1982) defines pattern as the co-ordinated occurrence and noise as the unco-ordinated occurrence of species in the matrix. Noise and pattern could be seen as opposites so that if noise was reduced pattern would be enhanced (Gauch 1982). Westfall (1992) attributes this noise to gaps in the matrix due to the included blanks which are species absences between the first and last occurrence of each species in the matrix for a

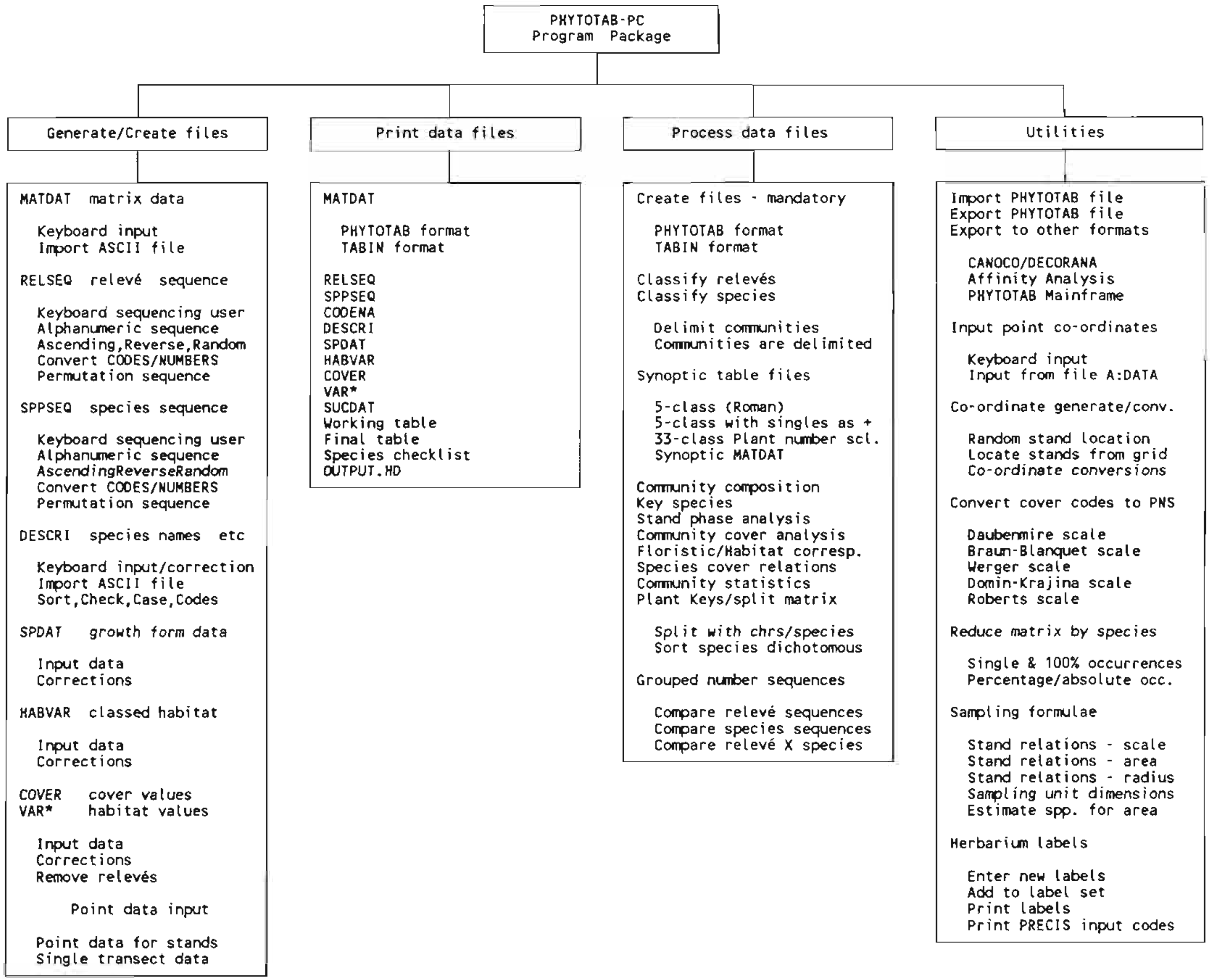

Figure 3.7 A diagramatic explanation of the PHYTOTAB-PC program package (*ex* Westfall 1992).

given relevé sequence. These gaps are termed separation units for a single species and total separation units for all the species in the matrix (Westfall 1992).

To test each relevé in each possible position is, with current computer technology, impractical in terms of the time taken to run such a program. Instead, Westfall (1992) adopted an "heuristic" approach where only the best (in terms of least noise) possibilities are tested. PHYTOTAB-PC objectively sequences relevés in three consecutive steps producing a commonality sequence, a similarity sequence and a separation unit sequence.

3.4.1.1.1 Commonality sequence

This sequence is obtained simply by adding the occurrences throughout the matrix of the species in each relevé, and arranging the relevés in order of magnitude. This sequence is called the commonality sequence, because the one extreme of the sequence represents relevés which have the most generally occurring species in common and the other extreme has the least generally occurring species in common (Westfall 1992).

3.4.1.1.2 Similarity sequence

A similarity coefficient expresses the ratio of the common species to all the species found in two vegetation units (Jaccard 1901, 1912, 1928 cited by Mueller-Dombois & Ellenberg 1974) and can be used to arrange vegetation units along a similarity gradient. However, problems encountered with various similarity coefficients (*eg*. Jaccard 1901, 1912, 1928, Sorenson 1948 cited by Mueller-Dombois & Ellenberg 1974) is that the calculations are based on the comparison of pairs of relevés in isolation to the matrix of which they formed a part (Boswell 1993). The similarity co-efficient used in the PHYTOTAB-PC package is an improvement on previous calculations because cognizance of the position in the matrix of the pair of relevés being compared is taken. The similarity coefficient (C) is given by:

$$C\% = (\tfrac{1}{2}\ S + J/S + J) \times 100$$

where, S = number of single occurrences in both relevés and
J = number of joint occurrences (Westfall 1992).

3.4.1.1.3 Separation unit sequence

The similarity sequence is now used to calculate the total separation units for the matrix. The first relevé is moved successively one position in the sequence and the total separation units are calculated after each move (Westfall 1992). The relevé sequence with the lowest total separation units is retained and the process of moving the first relevé and calculating the total separation units for the matrix is repeated. All relevés are moved in this manner and the sequence with the lowest total separation units for the matrix is reversed and the entire process of moving relevés is repeated. The reversal of the sequence tends to average the position of a relevé where more than one position for that relevé exists (Westfall 1992).

On completion of the relevé shuffling process the sequence with the lowest separation units for the matrix is used to determine new similarity and separation unit sequences and these processes are repeated until an increase in the total separation units is detected. The sequence obtained just prior to the sequence exibiting an increase in total separation units, *i.e.* the lowest, is reversed and the iteration continues. In this way a relevé sequence is produced which represents a matrix with the minimum of included blanks (Westfall 1992).

3.4.1.2 Relevé grouping

The next step in the classification process involves the delimitation of the relevé sequence into groups which may, or may not, represent plant communities. Traditionally, workers producing Braun-Blanquet tables, placed relevés in descending order of number of species in each relevé from left to right in the relevé group (Figure 3.8). The PHYTOTAB-PC package (Westfall 1992) arranges relevés to approximate a sine curve with the relevés in or near the middle of the group best representing the group by virtue of the number of species in the relevé (Figure 3.8).

The number of relevé groups to be recognized is scale-related and should be closest to the the original number of vegetation units stratified (Westfall 1992). However, the program is flexible and allows the user to decide on the number of relevé groups so that data can be classified even if the stratification and sampling processes are not according to scale. Relevé group delimiters are programmatically inserted into the sequence at the appropriate positions.

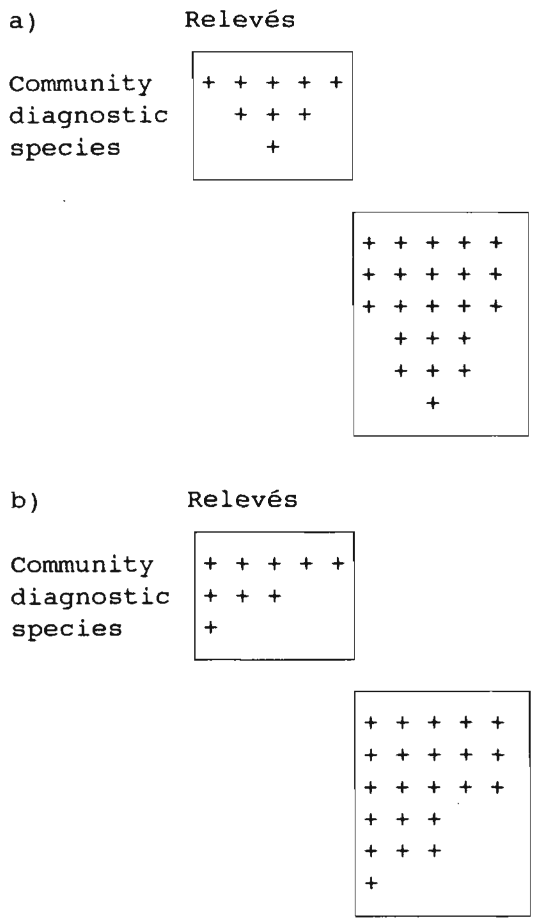

Figure 3.8 a) PHYTOTAB-PC arrangement of relevés and b) traditional arrangement (ex Westfall 1992).

3.4.1.3 Species sequencing

The final step in the classification is to sequence the species so that the relevé groups and their relations are emphasized (Westfall 1992). Pattern enhancement is achieved by placing species in groups with similar distributions according to relevé groups or combinations of relevé groups.

The relation between outliers and pattern is based on minimum outliers and the total number of outliers for any species should not exceed 38% of the total number of occurrences of that species in the matrix. The 38% limit for outliers is based on tests (Westfall 1992). Species occurring in all relevés or as a single occurrence are ignored since they do not contribute to pattern and thus cannot be considered diagnostic for a relevé group.

The species sequence is therefore split, the upper portion representing diagnostic species which contribute to pattern and the lower portion representing non-diagnostic species (general and single occurrences) which do not contribute to pattern. The species in the diagnostic portion of the table are sequenced in ascending order of occurrence in each species group and the species group order is according to presence in:

1) first relevé group;
2) second relevé group;
3) first and second relevé groups;
4) third relevé group;
5) second and third relevé groups; and
6) first, second and third relevé groups and so on as illustrated in Figure 3.9 (*ex* Westfall 1992).

3.4.1.4 Tabular portrayal of results

The PHYTOTAB-PC package (Westfall 1992)provides the user with three options for tabulating the resultant classification. The first option is in the form of a working table which should be generated immediately subsequent to relevé and species classification and prior to the generation of files such as the species name file (DESCRI), the growth form file (SPDAT) and the classed habitat file (HABVAR). The working table provides the user with an easily obtainable classification from which the efficiency of the classification can be ascertained as well as information such as the number of species occurrences in the matrix.

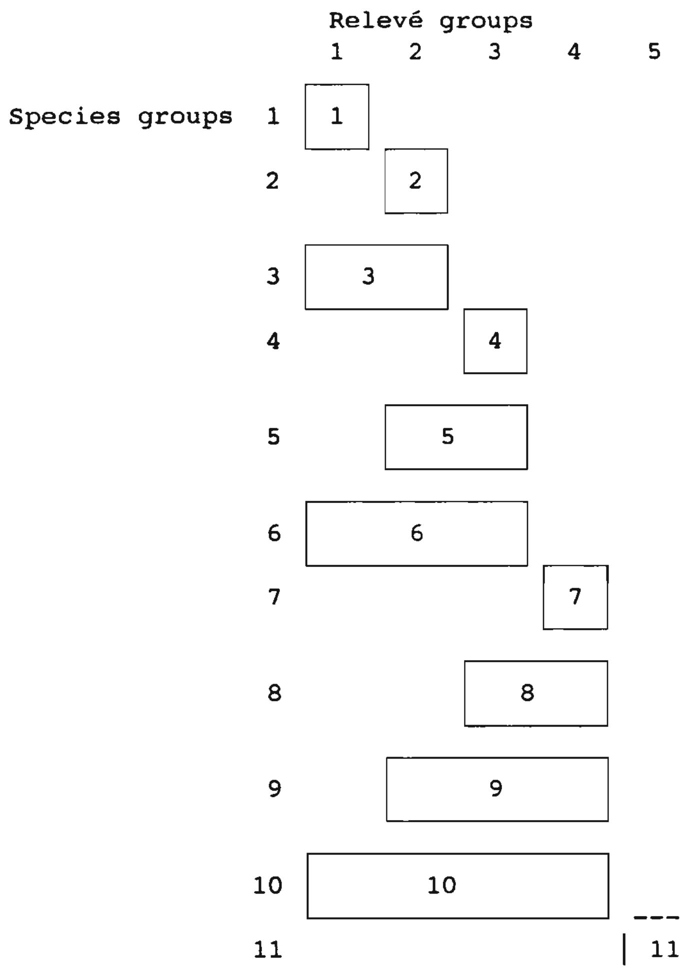

Figure 3.9 Simplified schematic diagram showing the sequence of species-groups construction, according to the relevé group sequence (*ex* Westfall 1992).

The second option of tabulating the classification is by using the synoptic table which is programmaticaly generated and shows a synoptic relevé for each community and the species associated with that community showing their mean cover or constancy values. The synoptic table is generally used when data reduction is required for either publication purposes or for a cursory look at the classification. However, it is also useful for the comparison of communities with environmental gradients using ordination techniques such as a detrended correspondence analysis (DCA) (ter Braak 1987). The positions of the synoptic relevés along axes can be examined for possible correlation of the communities with various environmental parameters.

A complete classification, or final table, shows both diagnostic and non-diagnostic portions of the table, community and species names, habitat variables and environmental gradients. This table can be arranged in the traditional manner (Figure 3.9) or, to highlight the environmental gradients, as has been done in this thesis (see 3.4.3.1.3).

3.4.2 *Verification*

The procedure of testing a classification is termed the verification process (Westfall 1992). Since the PHYTOTAB-PC package uses a heuristic or best fit approach for classification and the total separation units is merely a rating of the adequacy of the classification, other methods of verification have to be used.

One such measure is the relation between all the blanks (not just included blanks) in the matrix and the total separation units. This relative value is termed the classification efficiency (E) and is calculated as follows:

$$E\% = 100 - \frac{(TSU \times 100)}{AG}$$

where TSU = total separation units, and

AG = all gaps in the matrix

Based on tests of several authors' classifications, a classification efficiency (E) of 60% or more is considered to be an adequate classification (Westfall 1992).

Other methods of verification involve spatial relations between the stratification process and the classification process, floristic and habitat correlations and ground truthing.

If the classification is adequate (E ≥ 60%), does not invalidate the stratification and corresponds well with the habitat data and field assessment, then stratification, habitat correspondence and classification can all be deemed satisfactory (Westfall 1992). Should this not be the case, then the classification is not necessarily invalidated. Rather the process/es which does not verify the classification should be examined (Westfall 1992).

3.4.3 *Derivatives*

The term derivative implies information that can be derived directly (primary derivatives) or indirectly (secondary derivatives) from the classification.

3.4.3.1 Primary derivatives

Primary derivatives can be obtained from a synoptic matrix (Werger 1974) or, as was the case in this study, from the final phytosociological table.

3.4.3.1.1 Plant communities

A study area is generally delimited according to some geo-physical attribute (*eg.* from a 1:50 000 topographic sheet or a farm boundary) and hence the proportion of the plant communities enclosed in the study area is unknown. This affects the sampling of the species variation in the community since its full extent outside the study area is not known. Thus the classification has to be restricted to the study area for its composition, diagnosis and description to make any sense (Westfall 1992). Bearing this in mind, the diagnostic species in a community, the plant community composition and the plant community names can be obtained from the classified matrix. Because of differing scales and sampling intensities, adjoining properties can end up with very different classifications *eg.* Van Rooyen's (1983) study of the Roodeplaat Nature Reserve adjoining the Roodeplaat experimental farm (see 2.5).

3.4.3.1.2 Community definition

The diagnostic species pattern can be used to infer the degree to which a community is defined. Examples of this are given in Figure 3.10 (*ex* Westfall 1992).

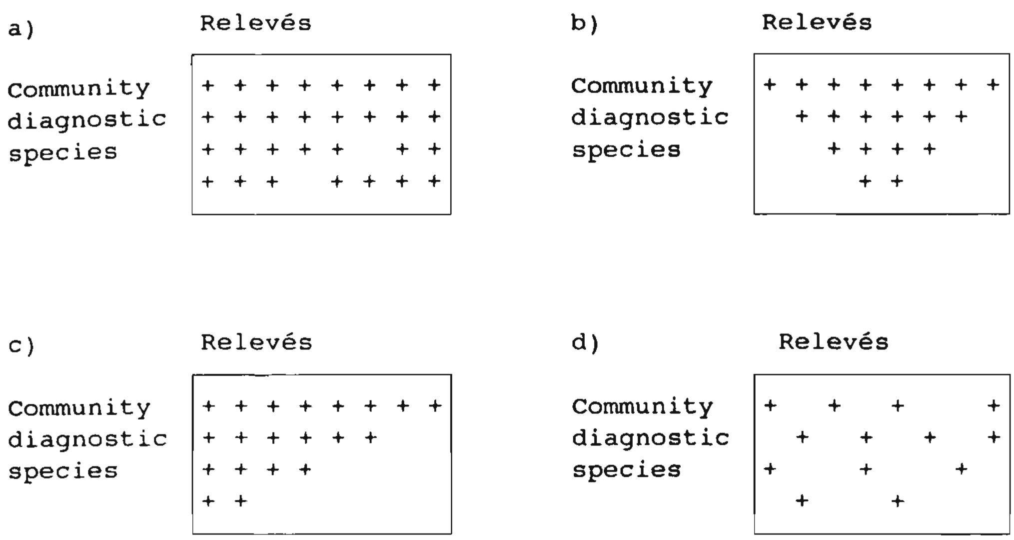

Figure 3.10 Species presence in community diagnostic species-groups: a) few blanks indicating a well-defined community corresponding to an abrupt environmental change at the community limits; b) species presence approximates a normal curve, indicating a well-defined community but with a less abrupt change at the community limits than in (a); c) a variation of (b) where the relevés have been rearranged so that the strongest community expression, in terms of species presence, is at the left of the group, decreasing towards the right. This pattern does not adequately show spatial relationships because the relevés on the extreme right can often be adjacent to different communities; and d) a poorly-defined community (*ex* Westfall 1992).

3.4.3.1.3 Gradients

In order to highlight environmental gradients the matrix can be simplified by arranging species groups representing two or more relevé groups as shown in Figure 3.11 (*ex* Westfall 1992). Two main patterns can emerge, namely, a) a gradient with both upper and lower environmental limits, or b) a gradient with either upper or lower environmental limits only. A combination of these species groups arranged along an environmental gradient in combination with the community diagnostic and non-diagnostic species groups is given in Figure 3.12 (*ex* Westfall 1992).

3.4.3.2 Secondary derivatives

These derivatives are information computed from the recorded data but are dependent on the classification for grouping (Westfall 1992).

3.4.3.2.1 Structure

Layer diagrams of the vegetation structure, according to the total recorded canopy cover for all species, within each growth form class can be generated using the PHYTOTAB-PC package (Westfall 1992).

3.4.3.2.2 Community composition analysis

By calculating projected canopy cover-to-frequency ratios of species in five growth form classes (tree, shrub, dwarf shrub, grass and forb), the PHYTOTAB-PC program package (Westfall 1992) produces a community composition analysis (CCA). Linear regressions for the cover and frequencies in each growth form class are determined on a community basis.

A linear relation between cover and frequency is assumed and the expected cover for the actual frequency of each species is calculated according to the regressions (see Appendices C,D,E and 4.1.4.1). The species are then arranged in decreasing order of the differences between the actual and predicted cover. Three distinct groups are formed *i.e.* those with a higher cover and those with a lower cover than the standard error of the mean. The third group of species fall within the range between the first two groups. Westfall (1992) refers to the first group as strong competitor species because of their high resource-space requirements and the second group as being weak competitor species. The third is termed normal competitor species. In this way 15 possible classes per community can be determined as

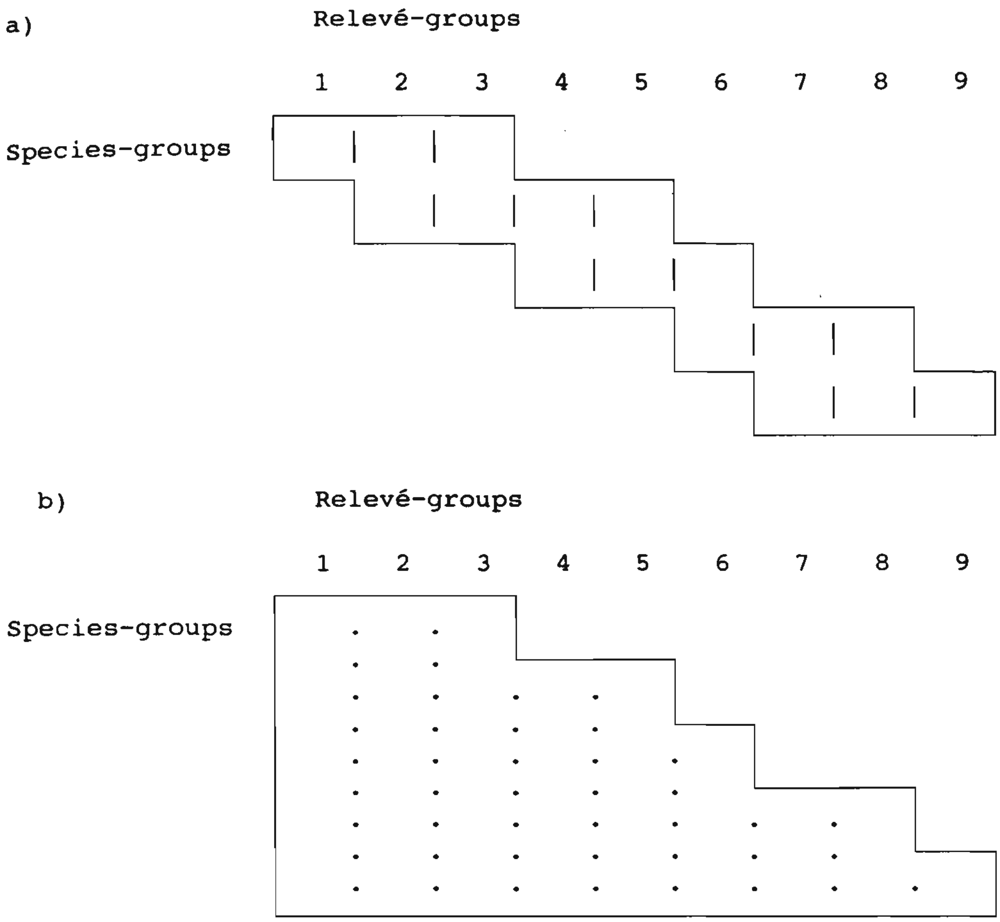

Figure 3.11 Species-groups representing two or more communities, sequenced to correspond to an environmental gradient of which a) both the upper and lower limits for differentiated communities can be ascertained and b) only the upper or lower limits for differentiated communities can be ascertained. This also applies to the horizontal mirror-image of the illustrated pattern (*ex* Westfall 1992).

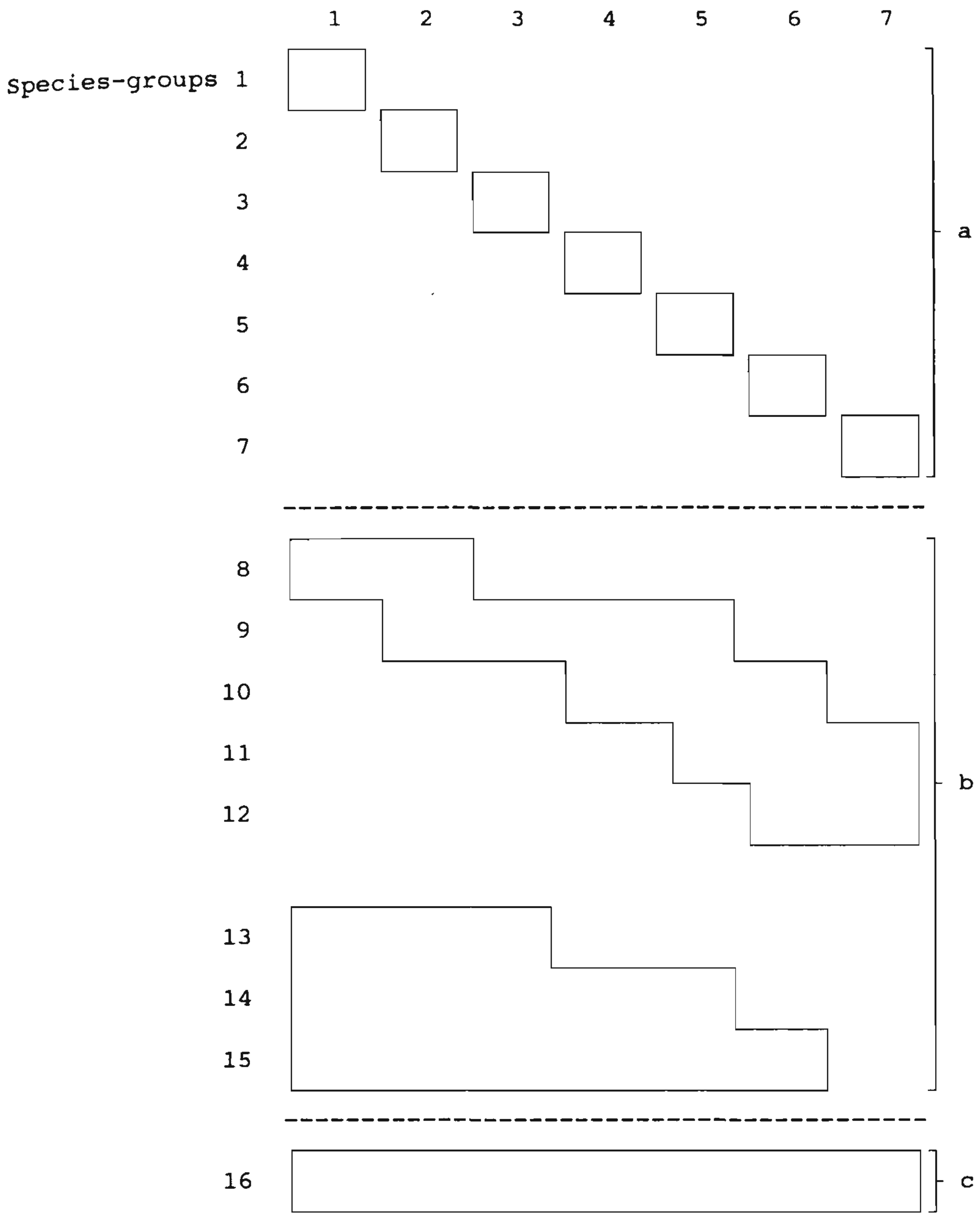

Figure 3.12 Schematic illustration of the simplification of a phytosociological table into 3 sections: a) community diagnostic species-groups; b) species-groups corresponding to environmental gradients. Horizontal mirror-images of the illustrated pattern also apply; and c) non-diagnostic species (*ex* Westfall 1992).

well as the effect of their competition on each other. His logic is based on the assumption that high density (in terms of frequency and cover) of a potential species results from a strong competitive ability.

3.4.3.2.3 Grouped number sequences

A grouped number sequence refers to a sequence of whole non-duplicated numbers arranged in groups by delimeters. The degree of correspondence of the numbers in each group of each sequence is calculated. For example, sequence A and sequence B are identical having three groups of numbers, group one containing numbers one to three, group two containing numbers four to six and group three containing numbers seven to nine. The percentage correspondence for the two grouped sequences would be 100%. A reversal of one of the sequences (from nine to one) would result in 0% correspondence.

The determination of the degree of correspondence between two grouped number sequences is a valuable tool when comparing a classified relevé sequence with the sequence of relevés as delimited in the stratified units since this indicates the efficacy, or lack thereof, of the stratification. The degree of correspondence between two classified grouped sequences can be used to determine the similarity or dissimilarity of the two sequences and is especially useful, as was the case in this study, when comparing two methods used for classificatory purposes.

3.4.3.2.4 Community statistics

PHYTOTAB-PC (Westfall 1992) provides the user with some comprehensive statistics calculated for each plant community (see 4.1.3.3) and this option facilitates the comparison of each community.

3.4.4 *Synthesis and comparison of the quadrat and the point canopy intercept method's classifications*

Both the QM data set and the PCIM data set were subjected to the process described above. Comparisons between the two classified matrices were made using the following criteria:

1) the classification efficiency as defined by Westfall (1992);
2) the number of relevé groups representing communities;
3) the number of species recorded;

4) the number of diagnostic species groups and species;
5) the number of non-diagnostic species;
6) the number of high and low constancy species;
7) the number of single species occurrences;
8) diagnostic species pattern strength;
9) comparison of the classified relevé group sequences with eaeh other and with the sequence of grouped relevés as they occcurred in the stratified units;
10) strength of environmental gradients portrayed in the classification;
11) correlation of communities with environmental parameters;
12) ordination (DCA) of the synoptic relevés for each community; and
13) percentage canopy cover for species common to both matrices.

In order to compare two data sets using ordinations, it was necessary to have the same number of relevés and species for both data sets. Since all the species recorded using the PCIM were also recorded using the QM for each relevé, it was possible to classify the PCIM data set using the classified QM relevé sequence and CODENA file, and generate a matrix with the PCIM species re-classified according to the QM relevé sequence. This re-classified PCIM matrix was compared directly with the original PCIM matrix. Hereafter, this PCIM data set will be referred to as the re-classified PCIM data set.

The CANOCO version of a detrended correspondence analysis (DCA)(ter Braak 1987) using the synoptic relevés for each of the seven communities was carried out on: a) all the species present in the PCIM matrix, the re-classified PCIM data set and the QM classifications; and, b) the diagnostic portion of the synoptic data for the PCIM, the re-classified PCIM and the QM classifications. These six ordinations were compared with the order of the communities as arranged by the classification to see if they showed any correspondence with the environmental gradients shown in the classifications.

3.4.5 *Synthesis of the continuous transect data*

This data set was also synthesized using the PHYTOTAB-PC program package (Westfall 1992) option for point data input (single transect data)(see Figure 3.7). The algorithms for synthesizing continuous transect data include discontinuity determination based on species and distance in both transect directions, referred to as discontinuity analysis. Species within discontinuities form groups and the package allows for iterative groupings *i.e.* a grouping of a groups. In order to ascertain sampling scales for these iterative groupings, the mean minimum cross section of a community has to be determined. This represents a number of circular stands (n) with stand diameters of x metres placed side by side along the transect. The stand diameter is then determined by:

$$x = \frac{p}{n}$$

where x = stand diameter (m)

p = total points (*i.e.* 7 752 points 1 m apart), and

n = number of relevés as grouped.

Stand diameter is then equated with the appropriate sampling scale (see 3.2.1 above).

CHAPTER 4

4. RESULTS OF THE COMPARISONS BETWEEN THE TWO METHODS AND THE COMMUNITY DESCRIPTIONS

4.1 *COMPARISON OF THE CLASSIFICATIONS OF THE QUADRAT, THE POINT CANOPY INTERCEPT AND THE RE-CLASSIFIED POINT CANOPY INTERCEPT'S MATRICES*

The comparison of the two classifications was approached from two different perspectives. The first involved the comparison of the two classifications as two separate entities and simply presents the merits or demerits of each in tabular form (see 4.1.1). The second perspective employed was a direct comparison *i.e.* two classifications were generated, one being the original PCIM classification and the other being the re-classified PCIM data set (see 3.4.4), in order to facilitate a direct comparison of the habitat and floristic correlations of the two classifications using the CANOCO program's version of detrended correspondence analysis (DCA) (ter Braak 1987).

Also included in this chapter are the derivatives *i.e.* information derived directly and indirectly from the classifications. Although the verification of the classifications, which led to the selection of the best classification for the study area is handled in chapter five, the community descriptions and the vegetation map for the study area, based on the QM classification, is presented in this chapter under the heading of primary derivatives.

4.1.1 *Comparison of the classifications of the quadrat and the point canopy intercept method's matrices*

The initial comparison of the QM and PCIM classifications made use of programmatically generated working tables (Tables 4.1 and 4.2 respectively - located in the pouch at the back of the thesis).

4.1.1.1 Comparison of the species numbers and positions in the quadrat and point canopy intercept method's classifications

In this study, the term constancy was used when discussing species presence throughout the study area and frequency was used when describing the species in a community. High constancy species occur in 10 or more relevés and low constancy species occur in less than 10 relevés and include single occurrences. The results pertinent to the species groupings and numbers obtained from the working tables generated for the QM and the PCIM data sets are given in Table 4.3

Using the working tables (4.1 and 4.2), the verification process of the relevé groups, spatially and environmentally, was found to be unsatisfactory for either of these parameters *i.e.* relevés could not be correlated to any environmental factor and the geographical distribution of relevés made grouping for mapping purposes impossible. The reason for this poor correlation was the arbitrarily chosen working scale of 1:8 000 *i.e.* the scale at which the stratification was done. Another factor which detracted from the two classifications was the low number of diagnostic species for both the QM and PCIM classifications (107 of 353 or 30.3% and 65 of 212 or 30.7% respectively). Three relevé groups in the QM classification did not have any community diagnostic species at all (Table 4.4). Since the samples were placed in positions which precluded sampling transitional zones *i.e.* away from stratified unit boundaries, the relevé groups should theoretically have formed distinct entities with their own diagnostic species.

Accordingly, the community delimiters in the relevé sequences of both the PCIM and the QM data sets were replaced subjectively, to adjust for scale, using the stratification unit overlay and the aerial photograph in the decision making process. It must be stressed that at no time during this, or any other process, was the order of the programmaticaly generated relevé sequences for either data set changed as this would have confounded the objectivity of the relevé sequencing process.

Having adjusted the two relevé sequences' delimiters for scale, the species in each data set were reclassified, new working tables were generated (Tables 4.5 (QM) and 4.6 (PCIM) in the back pocket of the thesis) and the improvement in both classifications in relation to species groupings and community diagnostic species numbers is illustrated in Tables 4.7 and 4.8.

The main difference between these two classifications (Table 4.5 & Table 4.6)is the number of species recorded. Using the QM, 39.9% more species were recorded than was the case for the PCIM. Two other differences which will affect the efficacy of the PCIM, especially for the community composition analysis, is the extremely low number of high constancy species (1 of 212) and the high number of single occurrences (82 of 212).

Table 4.3 The comparison of species groups and numbers using the initial working tables produced for the quadrat and the point canopy intercept methods (figures in brackets are percentages of the total number of species in each data set)

	QM		PCIM	
Total number of species:	353		212	
Number of diagnostic species groups:	24		17	
Number of diagnostic species:	107	(30.3)	65	(30.7)
Number of non-diagnostic species:	246	(69.7)	147	(69.3)
Number of high constancy species:	113	(32.0)	21	(9.9)
Number of low constancy species:	133	(37.9)	126	(59.4)
Number of single species occurrences:	56	(15.9)	82	(38.7)

Table 4.4 Comparison of the number of community diagnostic species for the quadrat and the point canopy intercept method's working tables prior to scale-adjustment

Relevé group number (QM)	Number of species (QM)	Relevé group number (PCIM)	Number of species (PCIM)
1	22	1	6
2	3	2	10
3	0	3	1
4	3	4	3
5	4	5	1
6	0	6	5
7	1	7	1
8	2	8	17
9	0		—
10	3		Total 44
11	13		
	—		
	Total 51		

Table 4.7 The comparison of species groups and numbers using the scale-adjusted working tables produced for the quadrat and the point canopy intercept methods (the figures in brackets are percentages of the total number of species in each data set)

	QM		PCIM	
Total number of species:	353		212	
Number of diagnostic species groups:	25		17	
Number of diagnostic species:	179	(50.7)	91	(42.9)
Number of non-diagnostic species:	174	(49.3)	121	(58.5)
Number of high constancy species:	62	(17.6)	1	(0.5)
Number of low constancy species:	112	(31.7)	120	(58.0)
Number of single species occurrences:	56	(15.9)	82	(38.7)

Table 4.8 Comparison of the number of community diagnostic species for the quadrat and the point canopy intercept method's classifications after scale-adjustment

Relevé group number (QM)	Number of species (QM)	Relevé group number (PCIM)	Number of species (PCIM)
1	6	1	1
2	1	2	22
3	8	3	5
4	22	4	3
5	17	5	2
6	1	6	10
7	13	7	1
	Total 68		Total 44

Also of interest was the comparison of the 120 low constancy species in the PCIM classification in relation to their positions in the QM classification. In the QM classification these low constancy PCIM species corresponded to 73 diagnostic species, 15 high constancy species and only 32 species were low constancy species. In other words, of the 120 low constancy PCIM species, 88 were important in the QM classification.

4.1.1.2 Comparison of relevé groupings and positions for the quadrat and point canopy intercept method's matrices

Prior to the delimiters being moved to adjust for scale, the QM had 11 relevé groups and the PCIM had eight. Subsequent to adjustment for scale the QM had seven relevé groups as did the PCIM. A comparison of the seven relevé groups (communities) for the QM and the PCIM was done by employing the PHYTOTAB-PC (Westfall 1992) option of comparing grouped number sequences and which arranges the result as a percentage correspondence table (Table 4.9). The relevés within each group of set A (QM) were compared with the relevés within each group of set B (PCIM). There was a 22% mean correspondence between the two grouped sequences.

By arranging set A (QM) in numerical order from one to seven and assigning the PCIM relevé group (set B) with the greatest percentage correspondence to each of the QM groups, it can be seen that not all the PCIM relevé groups are represented *i.e.* PCIM groups one and five. Also, PCIM groups two, three and seven are represented twice. Conversely, by arranging the PCIM groups from one to seven and assigning the QM groups having the highest percentage correspondence, QM groups three and six are not represented and groups one and seven are represented twice. Thus there is not a one to one relation between the two sets of communities and very little correspondence exists between the two.

4.1.2 *Comparison of the classifications of the re-classified point canopy intercept and the point canopy intercept method's matrices*

4.1.2.1 Comparison of the species numbers and positions in the re-classified point canopy intercept and the point canopy intercept method's classifications

The direct comparison between the PCIM and the re-classified PCIM classifications was done by means of working tables (Tables 4.6 and 4.10 in the back pocket). The results pertinent to the species groupings and numbers obtained from the working tables generated for the PCIM and the re-

Table 4.9 The percentage correspondence between the quadrat (set A) and the point canopy intercept (set B) method's grouped relevé sequences

Set B (PCIM)	Set A (QM) 1	2	3	4	5	6	7	Total percentage correspondence
1	18*	0	0	13	0	0	0	31
2	0	0	6	27	55*	27*	13	128
3	11	0	25*	45*	0	13	0	94
4	0	60*	16	0	0	0	7	83
5	11	0	12	9	0	0	38*	70
6	14	8	0	6	6	8	60*	102
7	44*	14	25*	0	18	0	0	101
Total percentage correspondence	98	82	84	100	79	48	118	

* the groups having the highest percentage correspondence

classified PCIM data sets are given in Tables 4.11 and 4.12. That the number of PCIM community diagnostic species is greater (91 or 42.9%) than for the re-classified PCIM (65 or 30.8%) as well as the PCIM having fewer diagnostic species groups (17 versus 19) would seem to indicate this classification is the better of the two. However, both matrices still have very few high constancy species (1 and 15) and this factor, together with the high number of single occurrence species will affect their efficacy, especially with respect to the community composition analysis.

4.1.2.2 Comparison of relevé groupings and positions for the re-classified point canopy intercept and the point canopy intercept method's matrices

A comparison of the seven relevé groups (communities) for the PCIM and the re-classified PCIM gave a 22% mean correspondence between the two sets of grouped numbers, which was to be expected since the re-classified PCIM relevé sequence is exactly the same as the QM relevé sequence. A comparison of the two sequences, as was done in 4.1.1.2 above, provides the same information i.e. a low degree of correspondence exists between the two grouped sequences (Table 4.13).

Table 4.11 The comparison of the species groupings and numbers for the point canopy intercept and the re-classified point canopy intercept method's classifications (the figures in brackets are percentages of the total number of species in each classification)

	PCIM		Re-classified PCIM	
Total number of species:	212		212	
Number of diagnostic species groups:	17		19	
Number of diagnostic species:	91	(42.9)	65	(30.7)
Number of non-diagnostic species:	121	(58.5)	147	(69.3)
Number of high constancy species:	1	(0.5)	15	(7.1)
Number of low constancy species:	120	(58.0)	132	(62.3)
Number of single species occurrences:	82	(38.7)	82	(38.7)

Table 4.12 Comparison of the number of community diagnostic species for the point canopy intercept and the re-classified point canopy intercept method's matrices.

Relevé group number (PCIM)	Number of species (PCIM)	Relevé group number (re-classified PCIM)	Number of species (re-classified PCIM)
1	1	1	3
2	22	2	1
3	5	3	1
4	3	4	8
5	2	5	6
6	10	6	1
7	1	7	9
	Total 44		Total 29

Table 4.13 The percentage correspondence between the point canopy intercept (set A) and the re-classified point canopy intercept (set B) method's grouped relevé sequences

	Set A (PCIM) 1	2	3	4	5	6	7	Total percentage correspondence
Set B (re-cla.) (PCIM) 1	18*	0	11	0	11	14	44*	98
2	0	0	0	60*	0	8	14	82
3	0	6	25*	16	12	0	25*	84
4	13	27	45*	0	9	6	0	100
5	0	55*	0	0	0	9	18	79
6	0	27*	13	0	0	8	8	48
7	0	13	0	7	38*	60*	0	118
Total percentage correspondence	31	128	94	83	70	102	101	

* the groups having the highest percentage correspondence

4.1.3 *Primary derivatives*

4.1.3.1 Tabular portrayal of the classifications

The synoptic tables generated for this study were used solely for the purpose of determining a synoptic relevé for use in the DCA ordinations to determine correlation with the environmental gradients. A community is thus represented by a synoptic relevé containing either the mean canopy cover or the mean constancy for each species in that community. Synoptic tables are usually used for summarizing the complete classification table. Apart from synoptisizing the relevé sequence and cover values for each species, a synoptic table still includes all the species in a classification and thus does not reduce the length of a table. Synoptic tables impart less information than that which can be derived from the final tables and as a result have not been included in this thesis.

The primary derivatives for the three classifications (QM, PCIM and re-classified PCIM) are portrayed in tables 4.14, 4.15, and 4.16 respectively (located in the back pocket of the thesis). Traditionally phytosociological tables are divided into two halves - the upper half representing diagnostic species groups and the lower half representing the non-diagnostic species (eg. Bredenkamp 1975, Van Rooyen 1978). The format of the phytosociological tables for each of the three matrices generated during this study differs substantially from the traditional format and is aimed at making the tables simple and easily understandable (see Figure 3.12 above).

4.1.3.2 Species list

The species list (Appendix B) contains all the species collected for the QM, the PCIM and the continuous transect. Bearing utility in mind, the list for this study differs in format from previous lists (*eg*. Bredenkamp 1975, Gertenbach 1978 and Van Rooyen 1978) and follows Van Staden (1991). Previously, species lists were very often just that - a list arranged in order of families, which from a taxonomists viewpoint is the correct method, but which makes quick referencing difficult as the families of species are not always known to all readers. The genera, and the species within the genera, for this study are listed alphabetically and include species, authors, collectors specimen number, growth form and the constancy with which it occurred in each survey method *i.e.* the QM, the PCIM and the continuous transect.

4.1.3.3 A description of the plant communities of Roodeplaat obtained using the quadrat method's classification

Following the code of the standardization of syntaxonomic nomenclature (South African Syntaxonomical Nomenclature Committee, unpublished manuscript), each of the the seven communities were named using a binomial representing a diagnostic species and a dominant species. Also, the binomials were chosen using a tree and a grass, where possible, since the survey was conducted in savanna, which is defined by Rutherford & Westfall (1986) as having trees and grasses as the dominant life forms. The structural epithet following the species names is according to Edwards (1983) and is based on cover and height of the plants present in the community.

The spatial relations of the communities are presented in Figure 4.1 in the form of a vegetation map. The correlation of the classification with the relevés and the stratification units is discussed in the next chapter.

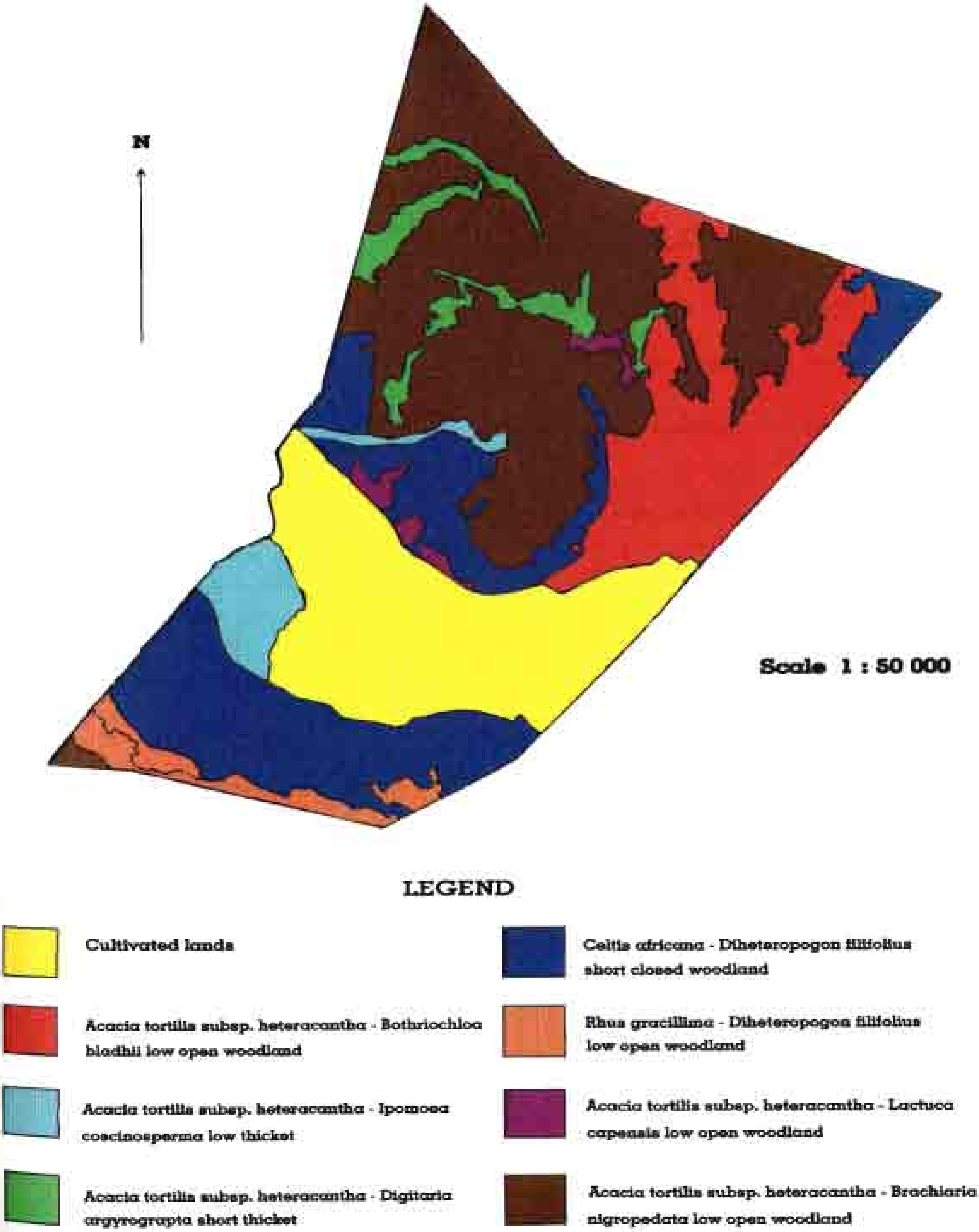

Figure 4.1 The plant communities of the Roodeplaat study area

The community names used in the phytosociological classification of the QM data set (Table 4.14 in the pocket at the back of the thesis) are:

Community 1 *Acacia tortilis* subsp. *heteracantha* - *Bothriochloa bladhii* low open woodland;

Community 2 *Acacia tortilis* subsp. *heteracantha* - *Ipomoea coscinosperma* low thicket;

Community 3 *Acacia tortilis* subsp. *heteracantha* - *Digitaria argyrograpta* short thicket;

Community 4 *Celtis africana* - *Diheteropogon filifolius* short closed woodland;

Community 5 *Rhus gracillima* - *Diheteropogon filifolius* low open woodland;

Community 6 *Acacia tortilis* subsp. *heterecantha* - *Lactuca capensis* low open woodland; and

Community 7 *Acacia tortilis* subsp. *heteracantha* - *Brachiaria nigropedata* low open woodland.

A brief description of the seven plant communities follows, with quantitative data for each community in the form of tables and layer diagrams to facilitate visual comparison. The introductory paragraph to each community is in effect a short descriptive summary of some of the quantitative data presented for each community. Each community is discussed under the following headings:

A: Community name and short description

B: Community statistics (ex PHYTOTAB-PC, Westfall 1992)

C: Environmental parameters (ex field measurements and maps)

The most important environmental information for each community is listed pointwise under the following headings:

1) Physiography;
2) Geology;
3) Soil form;
4) Soil texture;
5) Soil depth; and
6) Slope.

D: Vegetation cover and structure

E: Species and growth form relations

Explanation of the abbreviations used for these tables are as follows:

comp. status = the competition status derived from the community composition analysis (CCA) (see 4.1.4);

freq. = frequency for the community expressed as a percentage;

canopy cover = percentage canopy cover according to the plant number scale (Westfall & Panagos 1988);

crown diam. = mean crown diameter expressed in meters;

ind./ha = estimated number of individuals per hectare; and

canopy/canopy gap = mean gap between canopies.

The species present in these tables represent the more important species with canopy cover values of 1% or more.

4.1.3.3.1 The *Acacia tortilis* subsp. *heteracantha* - *Bothriochloa bladhii* - low open woodland (community 1)

Community 1 is diagnosed by *Acacia tortilis* trees (2 - 5 m in height) and by the grass *Bothriochloa bladhii* in the herbaceous layer. Grasses having canopy cover in excess of 1% in this low open woodland (Figure 4.3 & Table 4.18)) are *Digitaria eriantha*, *Elionurus muticus*, *Aristida congesta*, *Melinis repens*, *Eragrostis chloromelas* and *E. gummiflua* (Table 4.17) and the grass cover is relatively high at 26% (Figure 4.2). This community is differentiated from the others since it occurs only on relatively deep, generally well-drained, previously cultivated soils and is mainly restricted to the flat lowlands (< 1 200 m a.m.s.l.) in the north-eastern portion of the study area.

B. Community statistics

Relevé numbers: 0016 0040 0012 0038 0036 0039 0037 0058 0011

Total relevés in community: 9

Total species in community: 140

Total diagnostic species in community: 51

Diagnostic proportion: 36.4%

Species richness in terms of mean species per relevé: 43

Community variation:

Minimum species per relevé: 23

Maximum species per relevé: 56

Range of species per relevé: 33

Mean species per relevé: 43

Standard error of the mean of species per relevé: 3.1

Community variation (proportion spp/relevé/community): 30.6%

Community variation in terms of standard deviation: 6.7%

C. Environmental parameters

- Physiography: previously cultivated
- Geology: mainly tuff - also trachyte and alluvium
- Soil form: mainly Westleigh - also Mispah, Shortlands and Avalon
- Soil texture: A-horizon - sandy clayloam - mean of 26% clay
  B-horizon - sandy clayloam - mean of 26% clay
- Soil depth: mean of 45 cm (min = 20 cm; max = 75 cm)
- Slope: mean of 1°

D. Community cover and structure

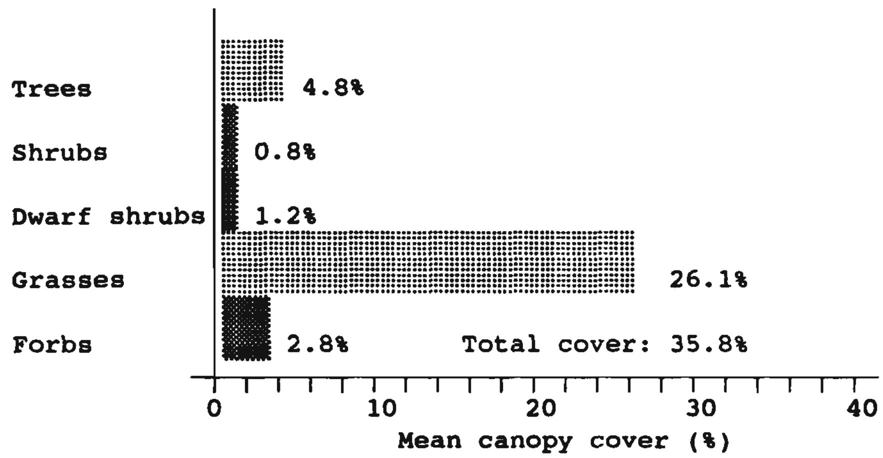

Figure 4.2 The percentage canopy cover in community 1.

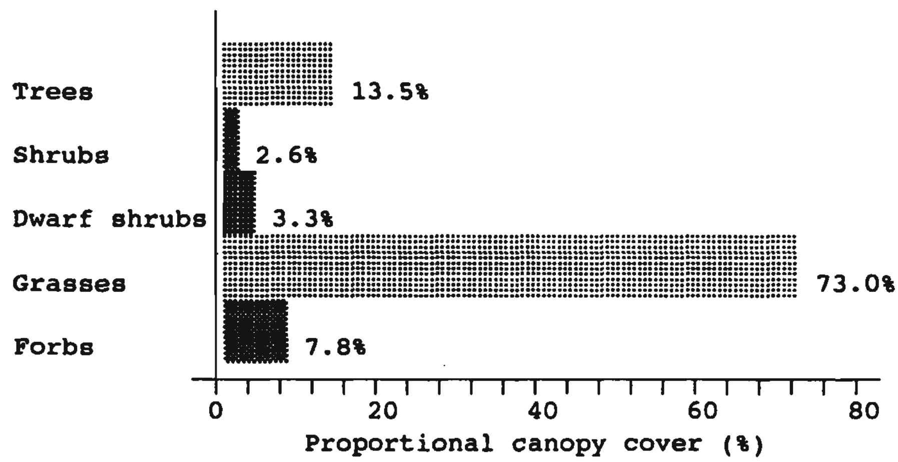

Figure 4.3 The structure of community 1.

E. Species and growth form relations

Table 4.17 - Species relations in community 1

Species	Growth form	Comp. status	Freq. (%)	Canopy cover (%)	Crown diam. (m)	Ind./ ha	Canopy/ canopy gap (m)
Acacia tortilis subsp. *heteracantha*	t	normal	77	3.9	1.17	402	4.460
Digitaria eriantha	g	strong	66	9.0	0.07	311772	0.137
Elionurus muticus	g	strong	77	7.2	0.25	6111	0.113
Aristida congesta subsp. *congesta*	g	normal	88	1.8	0.07	63184	0.384
Melinis repens subsp. *grandiflora*	g	normal	66	1.6	0.07	57392	0.406
Eragrostis chloromelas	g	normal	100	1.7	0.07	58095	0.403
Eragrostis gummiflua	g	normal	100	1.0	0.07	34522	0.542

Table 4.18 - Growth form relations in community 1

Growth form	% Canopy cover		Species richness	
	Plant number scale	Proportional	Number of species	Species/ 1 000m²
Trees	4.8	13.5	5	8
Shrubs	0.8	2.4	7	11
Dwarf shrubs	1.2	3.3	18	29
Grasses	26.1	73.0	41	66
Forbs	2.8	7.8	69	111
Total	35.8	100.0	140	226

4.1.3.3.2 The *Acacia tortilis* subsp. *heteracantha* - *Ipomoea coscinosperma* - low thicket (community 2)

This low thicket community (Figure 4.5 & Table 4.20) is dominated by low *Acacia* shrubs (1 - 5 m in height) such as *A. tortilis, A. mellifera, A. nilotica,* and *A. karroo* as well as the shrub *Tarchonanthus camphoratus* (Table 4.19). The dominant plants in the 1 m stratum are the dwarf shrub *Aloe greatheadii* and the grasses *Eragrostis chloromelas, Digitaria eriantha, Enneapogon scoparius, Sporobolus ioclados* and *Bothriochloa insculpta* which together with the other grass species constitute nearly half of the cover for the whole community (Figure 4.4). Community 2 is restricted to two relatively flat portions of the study area adjacent to the south-western boundary of the farm and is differentiated from the other communities since it occurs only on well-drained relatively deep (mean of 77 cm) soils.

B. Community statistics

Relevé numbers: 0034 0057 0059 0046 0056
Total relevés in community: 5
Total species in community: 125
Total diagnostic species in community: 51
Diagnostic proportion: 40.8%
Species richness in terms of mean species per relevé: 50

Community variation:

Minimum species per relevé: 34
Maximum species per relevé: 61
Range of species per relevé: 27
Mean species per relevé: 50
Standard error of the mean of species per relevé: 5.03
Community variation (proportion spp/relevé/community): 40.0%
Community variation in terms of standard deviation: 9.0%

C. Environmental parameters

- Physiography: flats
- Geology: mainly tuff, also alluvium
- Soil form: Valsrivier, Rensburg and Westleigh
- Soil texture: A-horizon - sandy clayloam - mean of 34% clay
  B-horizon - sandclay - mean of 43% clay
- Soil depth: mean of 77 cm (min = 50 cm; max = 100 cm)
- Slope: mean of 1°

D. Community cover and structure

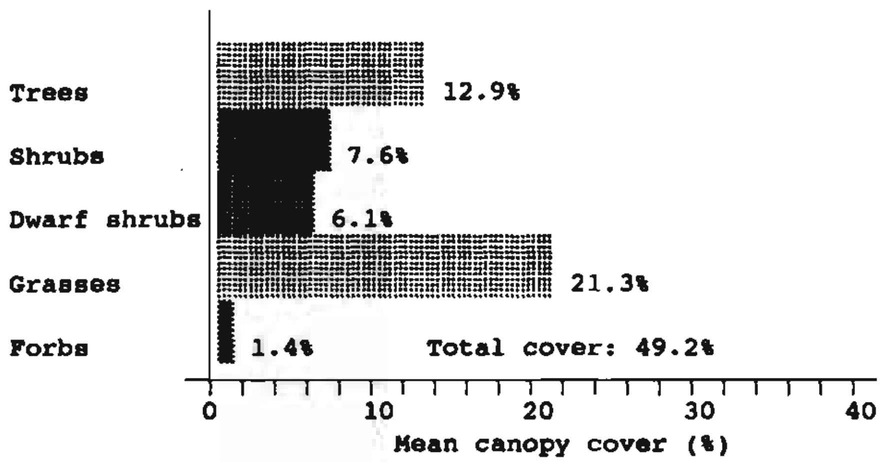

Figure 4.4 The percentage canopy cover in community 2.

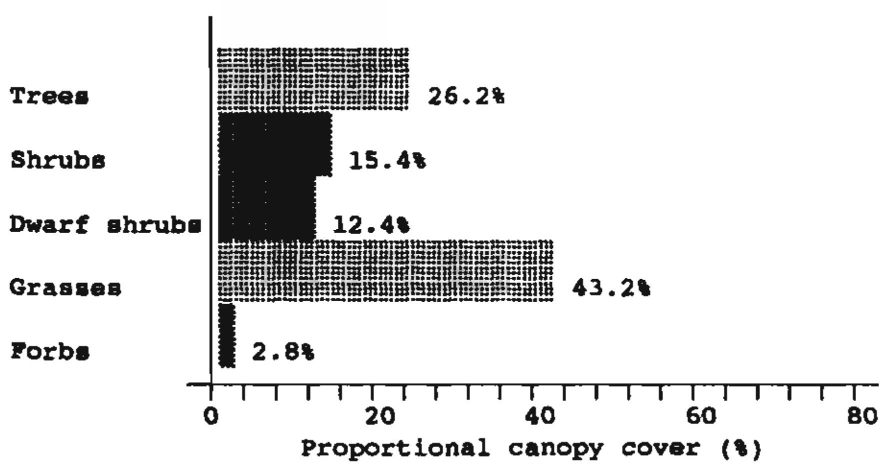

Figure 4.5 The structure of community 2.

E. Species and growth form relations

Table 4.19 - Species relations in community 2

Species	Growth form	Comp. status	Freq. (%)	Canopy cover (%)	Crown diam. (m)	Ind./ ha	Canopy/ canopy gap (m)
Acacia mellifera subsp. *mellifera*	t	strong	20	5.8	3.05	159	5.887
Acacia tortilis subsp. *heteracantha*	t	normal	80	4.1	1.89	145	7.475
Acacia nilotica subsp. *nilotica*	t	normal	20	1.3	3.05	128	6.922
Acacia karroo	t	normal	60	1.6	1.89	91	9.896
Tarchonanthus camphoratus	s	strong	20	4.0	0.72	3158	1.288
Unidentifiable sp. 1685	s	normal	100	1.2	0.72	291	5.886
Aloe greatheadii var. *davyana*	ds	strong	100	3.8	0.07	114877	0.268
Solanum panduriforme	ds	strong	40	1.3	0.07	39116	0.506
Eragrostis chloromelas	g	strong	100	7.3	0.07	220473	0.175
Digitaria eriantha	g	strong	60	3.8	0.04	315763	0.161
Enneapogon scoparius	g	strong	40	2.8	0.04	238891	0.191
Sporobolus ioclados	g	normal	20	1.3	0.03	919584	0.093
Bothriochloa insculpta	g	normal	100	1.1	0.04	86739	0.343

Table 4.20 - Growth form relations in community 2

Growth form	% Canopy cover		Species richness	
	Plant number scale	Proportional	Number of species	Species/ 1 000m²
Trees	12.9	26.2	7	11
Shrubs	7.6	15.4	10	16
Dwarf shrubs	6.1	12.4	16	25
Grasses	21.3	43.2	35	56
Forbs	1.4	2.8	57	92
Total	49.2	100.0	125	200

4.1.3.3.3 The *Acacia tortilis* subsp. *heteracantha* - *Digitaria argyrograpta* - short thicket (community 3)

Acacia tortilis and *Digitaria argyrograpta* diagnose this short thicket community (Figure 4.7 & Table 4.22). Some of the character species found in this community include *Acacia nilotica, A. robusta and A. tortilis* as well as a number of broad-leaved trees such as *Rhus leptodictya, Pappea capensis* and *Pavetta gardeniifolia* (Table 4.21 & Table 4.14 in the pocket at the back of the thesis). Important grasses (in terms of cover and frequency - see Figure 4.6) are *Cymbopogon plurinodis, Heteropogon contortus, Panicum coloratum* and *P. maximum* and *Setaria sphacelata* (Table 4.21). Community 3 forms dense belts of vegetation along the diabase ridges (which differentiates it from the other communities) present on the upland plateau in the central and nothern portion of the study area.

B. Community statistics

Relevé numbers: 0030 0048 0045 0047 0049 0044 0032
Total relevés in community: 7
Total species in community: 186
Total diagnostic species in community: 97
Diagnostic proportion: 52.2%
Species richness in terms of mean species per relevé: 75

Community variation:

Minimum species per relevé: 67
Maximum species per relevé: 86
Range of species per relevé: 19
Mean species per relevé: 75
Standard error of the mean of species per relevé: 2.5
Community variation (proportion spp/relevé/community): 40.3%
Community variation in terms of standard deviation: 3.5%

C. Environmental parameters

- Physiography: flats
- Geology: diabase
- Soil form: Westleigh, Avalon and Mispah
- Soil texture: A-horizon - sandy clayloam - mean of 24% clay
  B-horizon - sandy clayloan - mean of 22% clay
- Soil depth: mean of 38 cm (min = 10 cm; max = 95 cm)
- Slope: mean of 1°

D. Community cover and structure

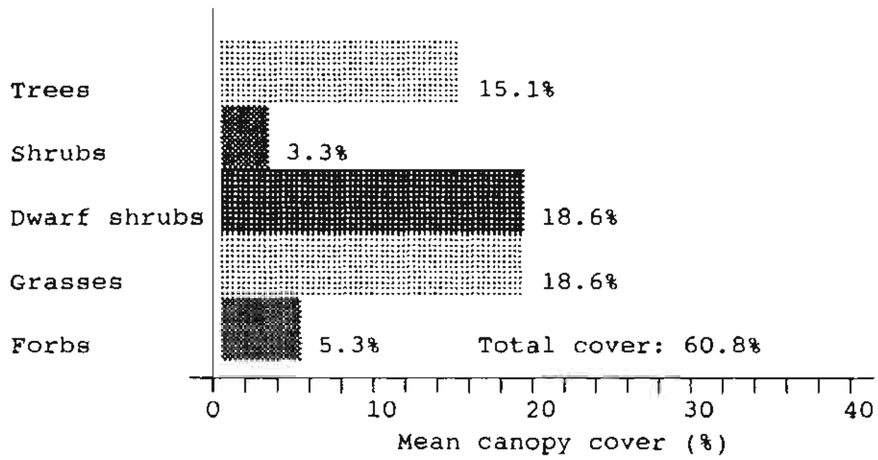

Figure 4.6 The percentage canopy cover in community 3.

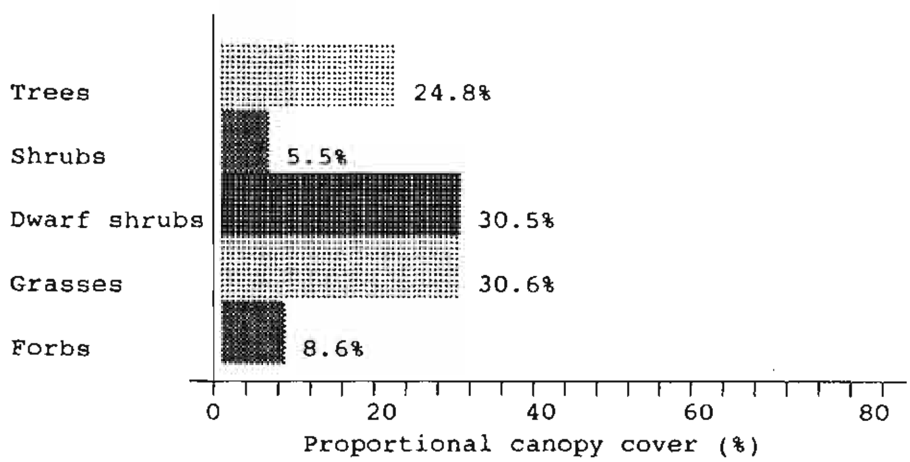

Figure 4.7 The structure of community 3.

E. Species and growth form relations

Table 4.21 - Species relations in community 3

Species	Growth form	Comp. status	Freq. (%)	Canopy cover (%)	Crown diam. (m)	Ind./ha	Canopy/canopy gap (m)
Acacia nilotica subsp. *nilotica*	t	strong	71	7.7	3.05	133	6.733
Acacia robusta subsp. *robusta*	t	normal	57	4.4	1.17	826	2.760
Acacia tortilis subsp. *heteracantha*	t	normal	85	2.2	1.89	86	10.239
Rhus leptodictya	s	strong	100	1.2	1.17	108	9.692
Aloe greatheadii var. *davyana*	ds	strong	100	17.1	0.11	197531	0.149
Cymbopogon plurinodis	g	strong	57	5.1	0.11	75181	0.307
Panicum maximum	g	strong	57	2.0	0.07	68709	0.365
Heteropogon contortus	g	strong	100	2.5	0.07	75942	0.344
Panicum coloratum var. *coloratum*	g	strong	14	1.2	0.11	94468	0.262
Setaria sphacelata var. *torta*	g	strong	85	2.1	0.04	171773	0.232
Indogofera rhytidocarpa subsp. *rhytidocarpa*	f	strong	100	2.7	0.07	80721	0.332

Table 4.22 - Growth form relations in community 3

Growth form	% Canopy cover		Species richness	
	Plant number scale	Propor-tional	Number of species	Species/1 000m²
Trees	15.1	24.8	7	11
Shrubs	3.3	5.5	13	21
Dwarf shrubs	18.6	30.5	28	45
Grasses	18.6	30.6	49	79
Forbs	5.3	8.6	89	144
Total	60.8	100.0	186	300

4.1.3.3.4 The *Celtis africana - Diheteropogon filifolius* - short closed woodland (community 4)

Celtis africana and *Diheteropogon filifolius* are the diagnostic species for this short closed woodland community (Figure 4.9 and Table 4.24). Other woody species occurring in this community are *Acacia caffra*, *Acacia tortilis*, *Rhus lancea* and *Ehretia rigida* (Table 4.23). Grasses having a canopy cover of 1% or more include *Enneapogon scoparius*, *Setaria sphacelata* and *Heteropogon contortus* (Table 4.23) and the grass component totals 22% of the cover for the community (Figure 4.8). This community is differentiated from the other communities because it occurs only on the upland slopes (> 1 180 m a.m.s.l.) of the study area *i.e.* on the northern slopes of the Buffelsdrif ridge (Figure 2.2), on the ridge just north of the Pienaars river and in the north-eastern corner of the study area (Figure 4.1).

B. Community statistics

Relevé numbers: 0064 0060 0075 0054 0062 0051 0050 0052 0053 0041 0061 0063 0027

Total relevés in community: 13

Total species in community: 239

Total diagnostic species in community: 131

Diagnostic proportion: 54.8%

Species richness in terms of mean species per relevé: 68

Community variation:

Minimum species per relevé: 48

Maximum species per relevé: 82

Range of species per relevé: 34

Mean species per relevé: 68

Standard error of the mean of species per relevé: 2.73

Community variation (proportion spp/relevé/community): 28.6%

Community variation in terms of standard deviation: 4.1%

C. Environmental parameters

- Physiography: undulating upland slopes
- Geology: mainly tuff, also trachyte
- Soil form: Mispah
- Soil texture: A-horizon - sandy clayloam - mean of 21% clay
  B-horizon - rock - mean of 0% clay
- Soil depth: mean of 11 cm (min = 10 cm; max = 20 cm)
- Slope: mean of 4°

D. Community cover and structure

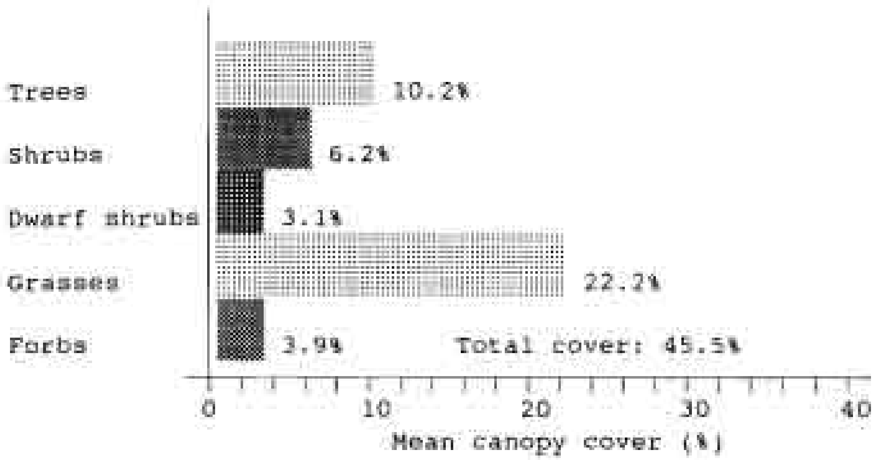

Figure 4.8 The percentage canopy cover in community 4.

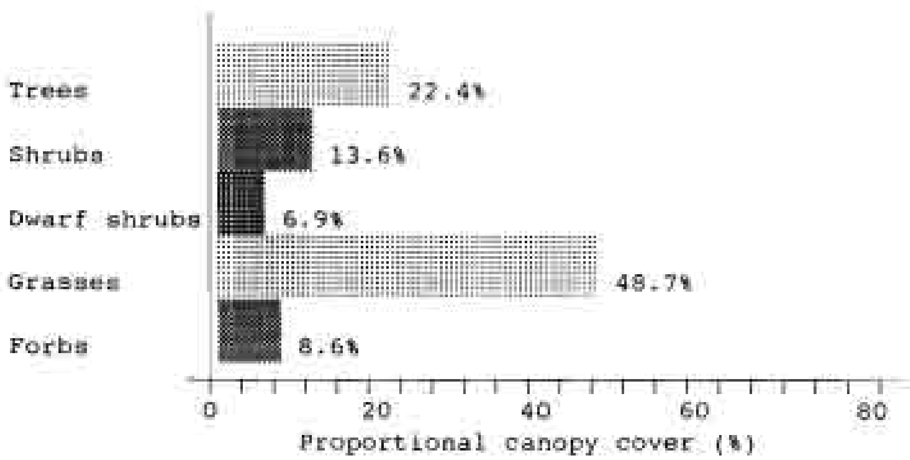

Figure 4.9 The structure of community 4.

E. Species and growth form relations

Table 4.23 - Species relations in community 4

Species	Growth form	Comp. status	Freq. (%)	Canopy cover (%)	Crown diam. (m)	Ind./ ha	Canopy/ canopy gap (m)
Acacia caffra	t	strong	92	5.3	1.17	542	3.678
Acacia tortilis subsp. *heteracantha*	t	normal	23	1.4	1.89	252	5.213
Rhus lancea	s	strong	23	1.0	1.17	677	3.169
Ehretia rigida	s	strong	77	1.3	0.45	884	3.349
Aloe greatheadii var. *davyana*	ds	strong	92	1.3	0.07	42259	0.484
Enneapogon scoparius	g	strong	69	3.8	0.04	397520	0.139
Setaria sphacelata var. *torta*	g	strong	77	3.2	0.07	102322	0.288
Heteropogon contortus	g	strong	92	3.1	0.07	94881	0.301
Aristida scabrivalvis subsp. *scabrivalvis*	g	strong	54	2.1	0.04	204759	0.209
Panicum maximum	g	strong	69	2.1	0.07	69405	0.363

Table 4.24 - Growth form relations in community 4

Growth form	% Canopy cover		Species richness	
	Plant number scale	Proportional	Number of species	Species/ 1 000m²
Trees	10.2	22.4	13	21
Shrubs	6.2	13.6	19	30
Dwarf shrubs	3.1	6.9	36	58
Grasses	22.2	48.7	59	95
Forbs	3.9	8.6	112	181
Total	45.5	100.0	239	385

4.1.3.3.5 The *Rhus gracillima* - *Diheteropogon filifolius* - low open woodland (community 5)

This low open woodland community (Figure 4.11 & Table 4.26) is diagnosed by the shrub *Rhus gracillima* and the grass *Diheteropogon filifolius*. It has been divided into two sub-communities *i.e.* 5.1 and 5.2 (Table 4.14 at the back of the thesis). Diagnostic species in sub-community 5.1 include *Vitex obovata* and *Maytenus tenuispina* whereas species diagnostic for sub-community 5.2 include *Gnidia sericocephala* and *Nolletia rarifolia*. Species common to both sub-communities, having canopy cover in excess of 1%, include *Acacia caffra*, *Ziziphus zeyheriana*, *Aloe greatheadii*, *Setaria sphacelata* and *Melinis repens* and the total cover for the whole community is low (25%) (Figure 4.10). Community 5 is restricted to the crest of the Buffelsdrif ridge (Figure 2.2) and this sets it apart environmentally from the other communities in the study area.

B. Community statistics

Relevé numbers: 0035 0043 0068 0067 0065 0066 0070 0073 0074 0071 0072 0026 0015
Total relevés in community: 13
Total species in community: 222
Total diagnostic species in community: 121
Diagnostic proportion: 54.5%
Species richness in terms of mean species per relevé: 64

Community variation:

Minimum species per relevé: 40
Maximum species per relevé: 82
Range of species per relevé: 42
Mean species per relevé: 64
Standard error of the mean of species per relevé: 3.16
Community variation (proportion spp/relevé/community): 28.8%
Community variation in terms of standard deviation: 5.1%

C. Environmental parameters

- Physiography: crests
- Geology: mainly trachyte, also tuff and diabase
- Soil form: mainly Mispah, also Westleigh
- Soil texture: A-horizon - sandloam - mean of 18% clay
  B-horizon - mainly rock - mean of 2% clay
- Soil depth: mean of 10 cm (min = 5 cm; max = 28 cm)
- Slope: mean of 4°

D. Community cover and structure

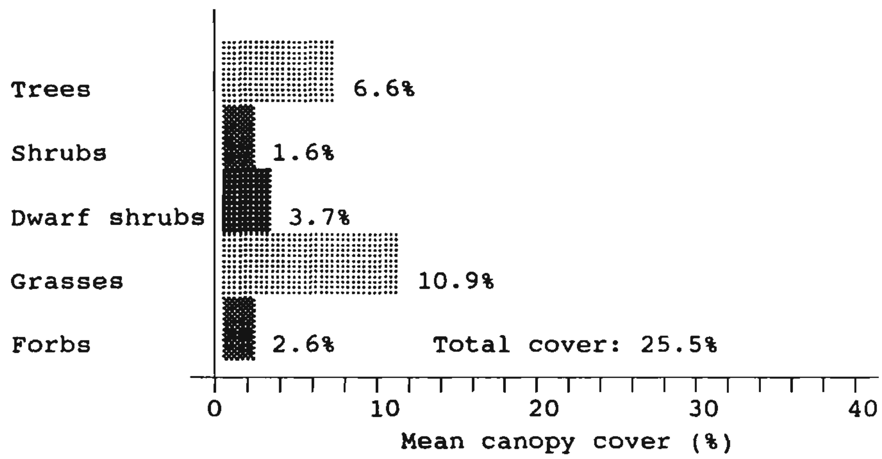

Figure 4.10 The percentage canopy cover in community 5.

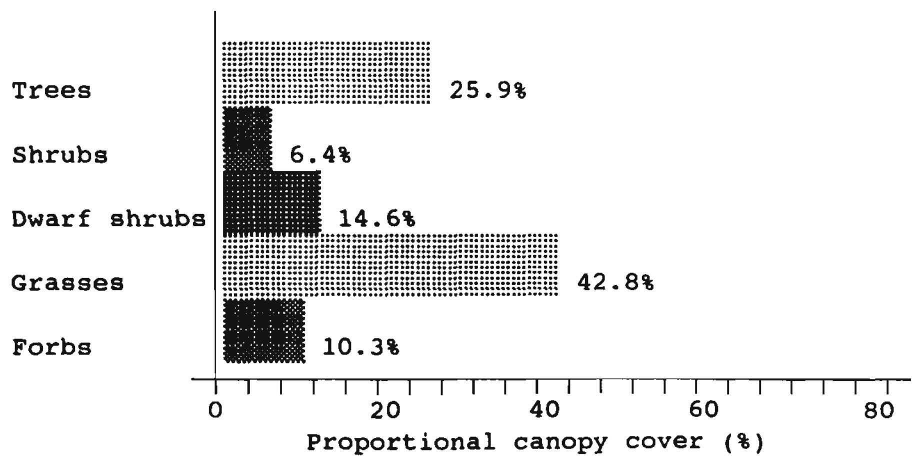

Figure 4.11 The structure of community 5.

E. Species and growth form relations

Table 4.25 - Species relations in community 5

Species	Growth form	Comp. status	Freq. (%)	Canopy cover (%)	Crown diam. (m)	Ind./ ha	Canopy/ canopy gap (m)
Acacia caffra	t	strong	77	3.5	1.17	432	4.262
Ziziphus zeyheriana	ds	strong	7	1.7	0.04	610298	0.104
Aloe greatheadii var. *davyana*	ds	strong	84	1.2	0.07	38504	0.510
Setaria sphacelata var. *torta*	g	strong	61	1.6	0.07	58927	0.400
Melinis repens subsp. *grandiflora*	g	strong	100	1.3	0.04	101859	0.314

Table 4.26 - Growth form relations in community 5

Growth form	% Canopy cover		Species richness	
	Plant number scale	Propor- tional	Number of species	Species/ 1 000m²
Trees	6.6	25.9	11	17
Shrubs	1.6	6.4	13	21
Dwarf shrubs	3.7	14.6	32	51
Grasses	10.9	42.8	55	89
Forbs	2.6	10.3	111	179
Total	25.5	100.0	222	357

4.1.3.3.6 The *Acacia tortilis* subsp. *heteracantha* - *Lactuca capensis* - low open woodland (community 6)

The diagnostic species for this low open woodland community (Figure 4.13 & Table 4.28) are the tree *Acacia tortilis* and the forb *Lactuca capensis*. Other character species present in this community, having cover values greater than 1%, are *Aloe greatheadii*, *Schizachyrium sanguineum*, *Themeda triandra*, *Loudetia flavida* and *Setaria sphacelata* (Table 4.27). Dwarf shrubs and grasses are responsible for most of the cover together totaling 24% of the 29% total cover for the community. This community is differentiated from the others since it only occurs in four discrete units north of the Pienaars river on undulating lowland slopes (Figure 2.2 & Figure 4.1).

B. Community statistics

Relevé numbers: 0033 0023 0004 0009 0006 0007

Total relevés in community: 6

Total species in community: 148

Total diagnostic species in community: 80

Diagnostic proportion: 54.1%

Species richness in terms of mean species per relevé: 59

Community variation:

Minimum species per relevé: 45

Maximum species per relevé: 80

Range of species per relevé: 35

Mean species per relevé: 59

Standard error of the mean of species per relevé: 5.68

Community variation (proportion spp/relevé/community): 39.5%

Community variation in terms of standard deviation: 9.4%

C. Environmental parameters

- Physiography: undulating lowland slopes
- Geology: tuff
- Soil form: mainly Mispah, also Westleigh
- Soil texture: A-horizon - sandy clayloam - mean of 21% clay

  B-horizon - mainly rock - mean of 6% clay
- Soil depth: mean of 14 cm (min = 10 cm; max = 22 cm)
- Slope: mean of 3°

D. Community cover and structure

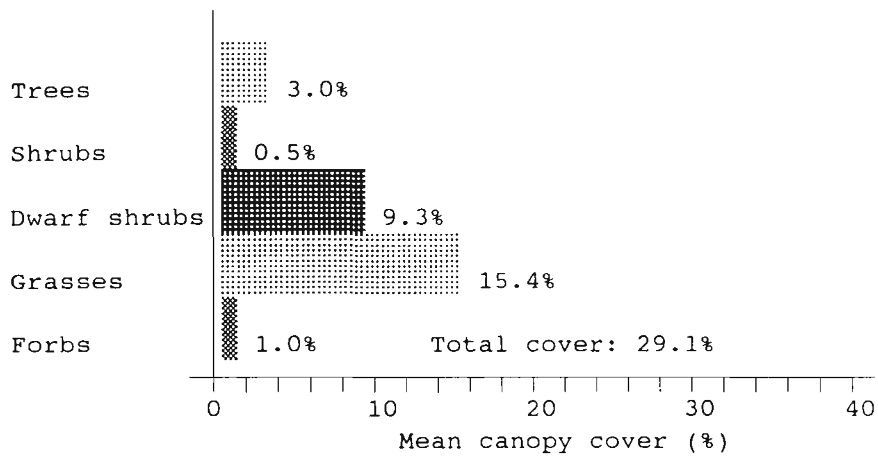

Figure 4.12 *The percentage canopy cover in community 6.*

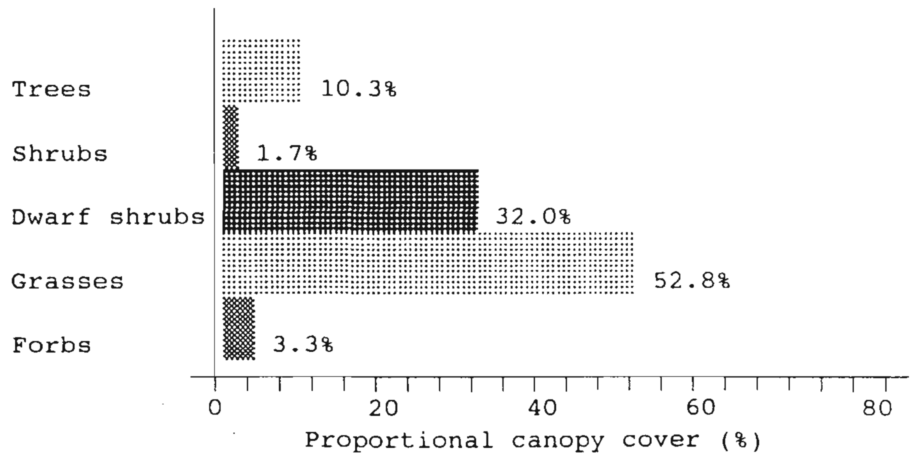

Figure 4.13 The structure of community 6.

E. Species and growth form relations

Table 4.27 - Species relations in community 6

Species	Growth form	Comp. status	Freq. (%)	Canopy cover (%)	Crown diam. (m)	Ind./ ha	Canopy/ canopy gap (m)
Acacia tortilis subsp. *heteracantha*	t	normal	23	1.9	1.17	178	7.276
Aloe greatheadii var. *davyana*	ds	strong	46	7.7	0.11	88847	0.274
Schizachyrium sanguineum	g	strong	23	4.0	0.11	98356	0.255
Themeda triandra	g	strong	46	4.4	0.11	50429	0.397
Loudetia flavida	g	normal	46	1.6	0.11	18631	0.722
Setaria sphacelata var. *torta*	g	normal	46	1.3	0.07	37569	0.517

Table 4.28 - Growth form relations in community 6

Growth form	% Canopy cover		Species richness	
	Plant number scale	Proportional	Number of species	Species/ 1 000m²
Trees	3.0	10.3	3	4
Shrubs	0.5	1.7	6	9
Dwarf shrubs	9.3	32.0	23	37
Grasses	15.4	52.8	40	64
Forbs	1.0	3.3	76	123
Total	29.1	100.0	148	237

4.1.3.3.7 The *Acacia tortilis* subsp. *heteracantha* - *Brachiaria nigropedata* low open woodland (community 7)

Acacia tortilis and *Brachiaria nigropedata* are the diagnostic tree and grass species for this low open woodland community (Figure 4.15 & Table 4.30). Dominant species (in terms of frequency and cover) include *Acacia robusta, Aloe greatheadii, Setaria sphacelata, Panicim maximum, Elionurus muticus, Melinis repens, Themeda triandra, Eragrostis chloromelas, Aristida canescens* and *Indigofera rhytidocarpa* (Table 4.29). The total cover for the community is relatively low at 35% (Figure 4.14). This community is differentiated from the other six in the study area on the basis of its poorly drained soils. Characteristic of this community is bush clumping which occurs on termitaria interspersed in open grassland.

B. Community statistics

Relevé numbers: 0031 0025 0022 0021 0013 0024 0018 0017 0008 0042 0005 0030 0055 0069 0029 0028 0014 0010 0019 0003 0002 0001

Total relevés in community: 22

Total species in community: 193

Total diagnostic species in community: 96

Diagnostic proportion: 49.7%

Species richness in terms of mean species per relevé: 53

Community variation:

Minimum species per relevé: 33

Maximum species per relevé: 76

Range of species per relevé: 43

Mean species per relevé: 53

Median species per relevé: 51.5

Standard error of the mean of species per relevé: 2.49

Community variation (proportion spp/relevé/community): 27.4%

Community variation in terms of standard deviation: 6.0%

C. Environmental parameters

- Physiography: flats
- Geology: mainly tuff, also trachyte
- Soil form: Westleigh and Mispah
- Soil texture: A-horizon - sandy clayloam - mean of 23% clay
  B-horizon - sandloam - mean of 18% clay
- Soil depth: mean of 31 cm (min = 5 cm; max = 80 cm)
- Slope: mean of 1°

D. Community cover and structure

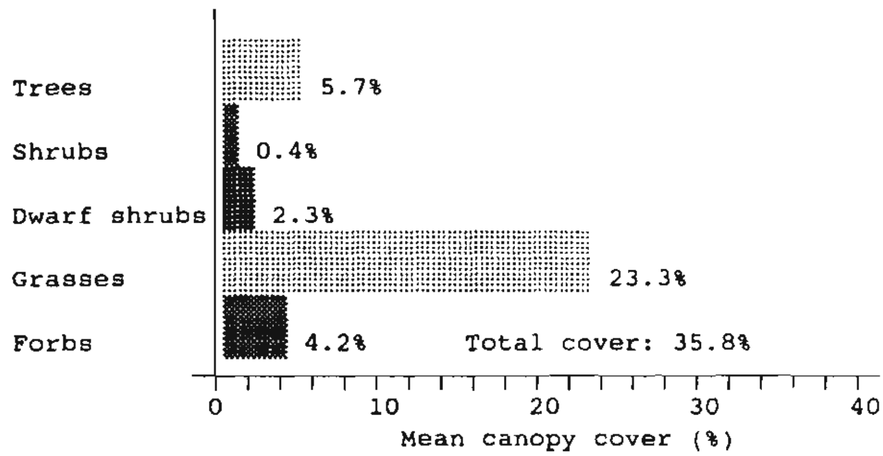

Figure 4.14 The percentage canopy cover in community 7.

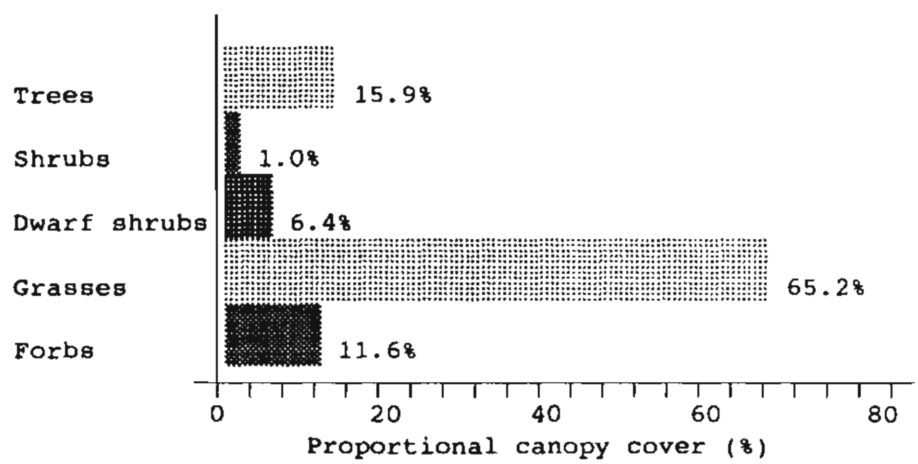

Figure 4.15 The structure of community 7.

E. Species cover and growth form relations

Table 4.29 - Species relations in community 7

Species	Growth form	Comp. status	Freq. (%)	Canopy cover (%)	Crown diam. (m)	Ind./ ha	Canopy/ canopy gap (m)
Acacia robusta subsp. *robusta*	t	normal	27	1.6	1.89	185	6.394
Acacia tortilis subsp. *tortilis*	t	normal	68	3.5	1.89	140	7.635
Aloe greatheadii var. *davyana*	ds	strong	100	1.3	0.17	5803	1.311
Setaria sphacelata var. *torta*	g	strong	82	4.9	0.07	174281	0.205
Panicum maximum	g	strong	41	3.2	0.11	74578	0.308
Elionurus muticus	g	strong	73	2.5	0.07	128529	0.250
Melinis repens subsp. *grandiflora*	g	strong	91	2.5	0.07	75476	0.346
Themeda triandra	g	normal	82	2.0	0.11	22987	0.639
Digitaria eriantha	g	normal	45	1.0	0.07	70161	0.361
Eragrostis chloromelas	g	normal	82	1.5	0.07	44957	0.467
Aristida canescens subsp. *canescens*	g	normal	86	1.4	0.07	54751	0.417
Indigofera rhytidocarpa subsp. *rhytidocarpa*	f	strong	77	1.1	0.11	16252	0.780

Table 4.30 - Growth form relations in community 7

Growth form	% Canopy cover		Species richness	
	Plant number scale	Proportional	Number of species	Species/ 1 000m²
Trees	5.7	15.9	5	8
Shrubs	0.4	1.0	7	11
Dwarf shrubs	2.3	6.4	25	40
Grasses	23.3	65.2	52	84
Forbs	4.2	11.6	104	168
Total	29.1	100.0	193	311

4.1.4 *Secondary derivatives*

Secondary derivatives are computed from the recorded data but are dependent on the classification, since different classifications will produce different computations. These derivatives include structure, community composition analysis, grouped number sequences and community statistics. Grouped number sequences have been dealt with in 4.1.1 above.

4.1.4.1 Community composition analysis (CCA)

Mean percentage canopy cover for the five growth form classes in the QM and PCIM matrices can be compared directly for the entire study area. However, comparisons of cover, and competitor status within communities, has to be done using the QM and the re-classified PCIM matrices since the communities for the QM and the PCIM differ, *i.e.* they consist of different relevés.

Using the CCA's for the QM and the PCIM (Appendix C and D respectively), the mean percentage canopy cover for each growth form in the QM and PCIM matrices for the whole of the study area was compared and the percentage difference between the means of the two methods for each growth form was the following: trees = 80.1%; shrubs = 90.4%; dwarf shrubs = 88.5%; grass = 73.6%; and, forbs = 88.3%. The means (40.2% and 8.2%) of the totals for each growth form differed by 79.6% *i.e.* the PCIM recorded nearly 80% less cover than the QM for the whole survey.

Using the CCA's for the QM and the re-classified PCIM (Appendix C and E respectively), a direct comparison of the number of strong competitors in each of the five growth form classes for each of the seven communities is presented in Table 4.31. Strong competitors were chosen since these species by virtue of their high resource-space requirements could become problematic in the future *eg.* invasive species or resulting in bush thickening in the case of woody plants. The figure in brackets (c) indicates the number of species common to both methods in the respective competitor and growth form classes.

In nine of the categories, equal numbers of strong competitors were recorded for both methods, the QM had more strong competitors than the re-classified PCIM in 22 of the 35 categories and only thrice did the re-classified PCIM have more strong competitors than the QM. Twenty eight species were common to both methods (c) and the percentage cover recorded varied considerably *eg.* in community 2, *Aloe greatheadii*'s cover was 3.8%

using the QM and only 0.6% using the re-classified PCIM, and in community 3 the same species had a cover of 17.1% using the QM and only 3.0% using the re-classified PCIM.

A closer look at the differences in competitor class and cover for different species common to both methods indicated that the re-classified PCIM generally underestimated the percentage canopy cover in a community. A number of species were selected in the different growth form classes and are shown in Table 4.32.

A comparison of the cover for each growth form in each community for both the QM and the re-classified PCIM highlights the large difference in cover estimation between the two methods (Table 4.33). The percentage difference between the means of the two methods for each growth form was the following:

- trees = 86.4%;
- shrubs = 96.6%;
- dwarf shrubs = 87.0%;
- grass = 80.3%; and
- forbs = 87.3%.

The means (40.2% and 6.3%) of the totals for each community differed by 84.3% *i.e.* the re-classified PCIM recorded 84% less cover than the QM for the whole survey.

4.1.4.2 Comparison of the community structure for the point canopy intercept and the re-classified point canopy intercept method's classifications

The calculation of canopy cover in each of the five growth form classes per community using the CCA, produces a structural layer diagram showing the proportion of each growth form in relation to the total cover for that community (see Figures 4.2 to 4.15 above). A direct comparison of the structure derived from the QM and re-classified PCIM CCA's (Table 4.34) showed that, within communities, the proportion of growth forms for each method corresponded much better than the percentage canopy cover recorded for each growth form. The shrub growth form had the least correspondence between the two methods with a tendency for closer correspondence for the trees and the herbaceous layer (forbs and grasses). The percentage

Table 4.31 A comparison of the number of species recorded in the strong competitor class in each growth form class per community derived from the community composition analyses of the quadrat and the re-classified point canopy intercept method's matrices

	Community 1			Community 2			Community 3			Community 4			Community 5			Community 6			Community 7		
	QM	rec.PCIM	c	QM	rec.PCIM	c	QM	rec.PCIM	c	QM	rec.PCIM	c	QM	rec.PCIM	c	QM	rec.PCIM	c	QM	rec.PCIM	c
Tree	0	0	(0)	1	0	(0)	1	0	(0)	1	2	(0)	1	1	(0)	0	0	(0)	0	0	(0)
Shrub	1	0	(0)	1	0	(0)	2	1	(0)	3	0	(0)	1	0	(0)	1	0	(0)	1	0	(0)
Dwarf shrub	2	0	(0)	2	1	(0)	1	1	(1)	2	1	(1)	2	1	(0)	1	1	(0)	2	2	(1)
Grass	2	2	(1)	3	3	(2)	5	3	(3)	6	2	(2)	5	3	(2)	2	2	(1)	4	3	(2)
Forb	4	1	(1)	7	1	(1)	3	2	(2)	5	6	(1)	6	1	(1)	7	19	(5)	4	2	(1)

Table 4.32 A comparison of the competitor status (St.) and the percentage cover (% C) recorded for some species taken from the community composition analyses of the quadrat and the re-classified point canopy intercept method' matrices where s = strong competitor, n = normal competitor, w = weak competitor and n/r = not recorded

	Heteropogon contortus				Aristida congesta				Bidens bipinnata				Aloe greatheadii				Acacia tortilis			
	QM		rec. PCIM		QM		rec. PCIM		QM		rec. PCIM		QM		rec. PCIM		QM		rec. PCIM	
	St.	% C	St.	% C	St.	% C	St.	% C	St.	% C	St.	% C	St.	% C	St.	% C	St.	% C	St.	% C
Community 1	w	0.49	n	0.04	n	1.80	n	0.23	n	0.01	n/r		s	0.74	n	0.31	n	3.85	n/r	
Community 2	n	0.93	n	0.08	n	0.69	n	0.00	s	0.11	n/r		s	3.81	n	0.57	n	4.06	n/r	
Community 3	s	2.52	s	0.39	n	0.81	w	0.03	n	0.07	n	0.00	s	17.10	s	3.04	n	2.19	n/r	
Community 4	s	3.08	s	0.63	w	0.22	n	0.01	s	0.54	n	0.00	s	1.28	s	0.25	n	1.43	n/r	
Community 5	n	0.73	s	0.18	w	0.13	w	0.10	s	0.17	n/r		s	1.21	n	0.05	n	0.07	n/r	
Community 6	n	0.66	w	0.11	n	0.09	n	0.00	s	0.07	n/r		s	7.69	n	0.63	n	1.90	n/r	
Community 7	w	0.21	n	0.01	n	0.83	n	0.04	n	0.05	n	0.00	s	1.32	n	0.19	n	3.49	n	1.29

Table 4.33 A comparison of the total percentage canopy cover in each growth form per community recorded for the quadrat and the re-classified point canopy intercept method's matrices

	Community 1		Community 2		Community 3		Community 4		Community 5		Community 6		Community 7		Mean cover	
	QM	rec.PCIM	QM	rec.PCIM	QM	rec.PCIM	QM	rec.PCIM	QM	rec.PCIM	QM	rec.PCIM	QM	rec.PCIM	QM	rec. PCIM
Tree	4.84	0.50	12.91	1.21	15.06	1.92	10.18	1.74	6.62	0.75	3.00	0.16	5.67	1.60	8.33	1.13
Shrub	0.84	0.05	7.56	0.04	3.32	0.09	6.18	0.45	1.63	0.04	0.50	0.00	0.35	0.01	2.91	0.10
Dwarf shrub	1.19	0.33	6.09	0.82	18.55	3.15	3.12	0.31	3.72	0.13	9.32	0.72	2.28	0.29	6.32	0.82
Grass	26.11	8.36	21.26	3.22	18.61	1.74	22.15	2.31	10.94	0.86	15.37	4.78	23.30	5.81	19.68	3.87
Forb	2.78	0.68	1.35	0.14	5.25	0.67	3.90	0.13	2.63	0.40	0.95	0.08	4.15	0.56	3.00	0.38
Total	35.77	9.92	49.18	5.44	60.78	7.58	45.52	4.94	25.54	2.17	29.14	5.74	35.76	8.28	40.24	6.30

Table 4.34 A comparison of the percentage proportional cover of the five growth form classes (structure) of each community for the quadrat and the re-classified point canopy intercept method's classifications

	Community 1		Community 2		Community 3		Community 4		Community 5		Community 6		Community 7		Mean cover	
	QM	tr.PCIM	QM	tr.PCIM	QM	tr.PCIM	QM	tr.PCIM	QM	tr.PCIM	QM	tr.PCIM	QM	tr.PCIM	QM	tr. PCIM
Tree	13.53	5.08	26.24	22.26	24.77	25.33	22.35	35.12	25.93	34.73	10.28	2.70	15.86	19.38	19.85	20.65
Shrub	2.36	0.52	15.38	0.74	5.46	1.17	13.58	9.15	6.39	1.77	1.72	0.00	0.99	0.13	6.55	1.93
Dwarf shrub	3.33	3.31	12.39	15.16	30.52	41.62	6.86	6.26	14.56	5.95	31.99	12.60	6.38	3.53	15.15	12.63
Grass	73.00	84.23	43.23	59.27	30.62	22.98	48.65	46.76	42.84	39.36	52.75	83.25	65.17	70.18	50.89	58.00
Forb	7.78	6.85	2.75	2.58	8.63	8.90	8.57	2.71	10.29	18.19	3.26	1.45	11.61	6.77	7.56	6.78

difference between the means of each growth form emphasises this:

trees = 3.9%;

shrubs = 70.5%;

dwarf shrubs = 16.6%;

grass = 12.3%; and

forbs = 10.3%.

4.1.4.3 Community statistics and stand transect data

The PHYTOTAB-PC program package (Westfall 1992) provides statistics such as those used in the community descriptions for the QM classification (see 4.1.3.3 above). Various statistics have already been compared (*eg.* number of diagnostic species, single occurrences *etc.*) and will be examined further for determination of sampling efficiency (see 4.2 below).

Information such as the frequency, canopy cover, mean spacing and crown diameter and density for the two methods has been generated - see Appendix F for PCIM data and Tables 4.17, 4.19, 4.21, 4.23, 4.25, 4.27 and 4.29 for QM data. A direct comparison of mean spacing, crown diameter and density is not possible since these parameters are calculated per relevé for the PCIM and per community for the QM. Nevertheless, these derivatives, seldom calculated from phytosociological tables, are important quantitative information for land-use management.

4.2 *EFFICIENCY ANALYSIS OF THE TWO SAMPLING METHODS*

The assumption made for this study is that time spent in the field is directly proportional to the species richness of the stand being sampled *i.e.* more species per unit area means more time in the field. The number of species recorded can be regarded as the independent variable and time, the dependent variable, since the primary parameter measured in any vegetation survey is the presence of the plant species. Previously published literature shows that when time was measured as a parameter, it was recorded, for example, per point (McNeill *et al.* 1977) or per technique (Mentis 1981, Stuart-Hill 1991). For this study, the comparison of methods was based on time as a function of the number of plant taxa recorded.

It is also assumed that time is required to identify and/or re-familiarise oneself with plant taxa. Then it follows that the rate of sampling at the beginning of a survey will be less than the sampling rate at the end of the survey.

Since the methods used for the Roodeplaat survey required that all plant taxa recorded for the first time be collected and encoded (see 3.3.3), it follows that the stands sampled at the beginning of the survey would take longer than those sampled later in the survey. To determine a commencement of survey data set and a middle and end of survey data set, a number of histograms were generated depicting the stands arranged from 1 to 75 and grouped in various class intervals against the number of incremental plant species recorded for each stand (species not previously encountered at preceding stands). For stand class intervals ranging from 3 to 7 the trend indicted by the histograms was that species increment decreased rapidly from stand 1 to between stands 9 and 16 (mean of 13 stands). From 9 to 16 stands, the species increment was five species or less on average. This trend is best illustrated using a class interval of four stands (Figure 4.16).

4.2.1 *Point canopy intercept data*

The time taken to complete floristic data recording for each stand using the point canopy intercept method was noted for 73 stands. The first two stands were completed before the timing of field work was implemented. Of these 73, 12 stands were omitted from the data as data collection had taken too much time for the relatively few species recorded for the following reasons:

1. high rock cover slowed recording (3 stands);
2. dense swards of grass caused difficulty in deciding whether the individual at the preceeding point was the same individual at the next point or not (4 stands);
3. high tree cover caused the operator to look up and down when determining which plants were included in the 'hit' (2 stands);
4. tall grasses becoming entangled in the spokes of the wheel and causing a canopy dragging effect (1 stand): and
5. unexplained - possibly a distraction in the field (2 stands).

A separate linear regression of species recorded and the time taken to do so, was generated for these data ($r = 0.52$).

The remaining data were split into two groups, namely; stands completed in the beginning of the survey ($n = 11$) and stands completed in the middle and at the end of the survey ($n = 50$). The linear regressions for the number of

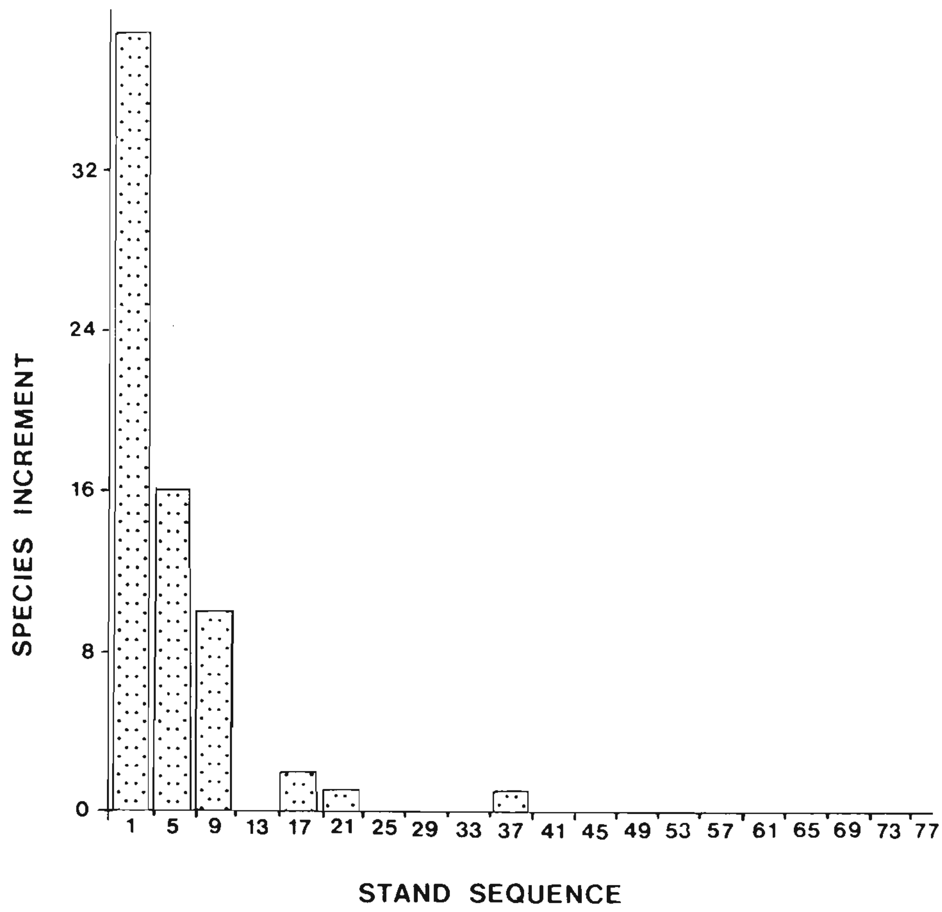

Figure 4.16 Histogram showing rapidly decreasing species increment for the first 13 stands and subsequent increment values of less than five for the remainder of the stands sampled at Roodeplaat.

species recorded versus time taken for the two data sets with correlation coefficient (r) values of 0.70 and 0.63 respectively are shown in Figures 4.17 a & b. At the beginning of the survey a mean of 17.9 species per stand were recorded taking a mean time of 26.6 minutes (1.5 minutes per species) and at the end of the survey a mean of 16.8 species per stand were recorded in a mean time of 17.5 minutes (1.0 minutes per species).

4.2.2 *Quadrat data*

Similarly, the time taken to record plants using the quadrat method was recorded for 71 stands (the operator only started recording time at the fourth stand). Seven stands were omitted from the data set since they were completed very rapidly relative to the high number of species recorded. This was attributable to six of the stands having a very low tree and grass cover and less time was spent on cover determination. One stand was unexplained. A linear regression for these seven data pairs was generated (r = 0.57). The remaining data were split into a beginning of the survey set (n = 11) and a middle and end set (n = 53). The linear regressions generated for the beginning of the survey data set (r = 0.82) and the end of the survey data set (r = 0.61) respectively, are shown in Figures 4.17 c & d. At the outset of the survey a mean of 45.0 species per stand were recorded in a mean time of 47.5 minutes (1.05 minutes per species) and at the end of the survey a mean of 63.4 species per stand were recorded in a mean time of 46.1 minutes (0.7 minutes per species).

4.2.3 *Combined linear regressions*

At the outset of the survey the time required per species recorded varied between 1.5 minutes for the point canopy intercept method and 1.1 minutes for the quadrat method (a difference of 26 seconds). Similarly, at the end of the survey, the point canopy intercept method required 1.0 minutes per species as opposed to the quadrat method's 0.7 minutes per species (a difference of 19 seconds).

Possible reasons for the point canopy intercept method taking more time to record a plant than the quadrat method is that the former method forces the recorder to identify the plant intercepted by the point. Often the species intercepted is not in a condition conducive to quick identification (*eg.* grazed, trampled or insect-eaten). The quadrat method recorder has an advantage in that he is able to walk around in the stand and record readily identifiable plants. The point canopy intercept method is also more regimented in that a predetermined line has to be followed over or through obstructions (bush clumps, termitaria, rocks *etc.*). The quadrat method recorder, once again is advantaged, in that he can walk around a bush clump to record plants rather than through it. Further, more symbols are recorded on the data sheets with the point canopy intercept method than with the quadrat method.

The two data sets for the beginning of the survey ($n = 22$) were combined as were the two data sets for the end of the survey ($n = 103$) (Figure 4.17 e & f). Linear regressions between sampling time and species increment, for these two data sets, gave correlation coefficient values (r) of 0.9035 and 0.9098 respectively.

The main difference between the two methods is the number of species recorded. The mean number of species recorded for the whole survey using the point canopy intercept method was 16.4 per stand, taking a mean time of 20.5 minutes and that for the quadrat method was 60.4 species per stand in 45.6 minutes. The quadrat method requires that the operator record all the species within the sample. The point canopy intercept method, as employed in this survey, requires that the operator records species along a predetermined line through the stand so as to remove possible observer bias and maintain repeatability. Local disturbances such as a termitarium or an exposed patch of ground would cause an increase in the number of species recorded using the quadrat method but which would not necessarily be noted using the point canopy intercept method (Figure 4.18).

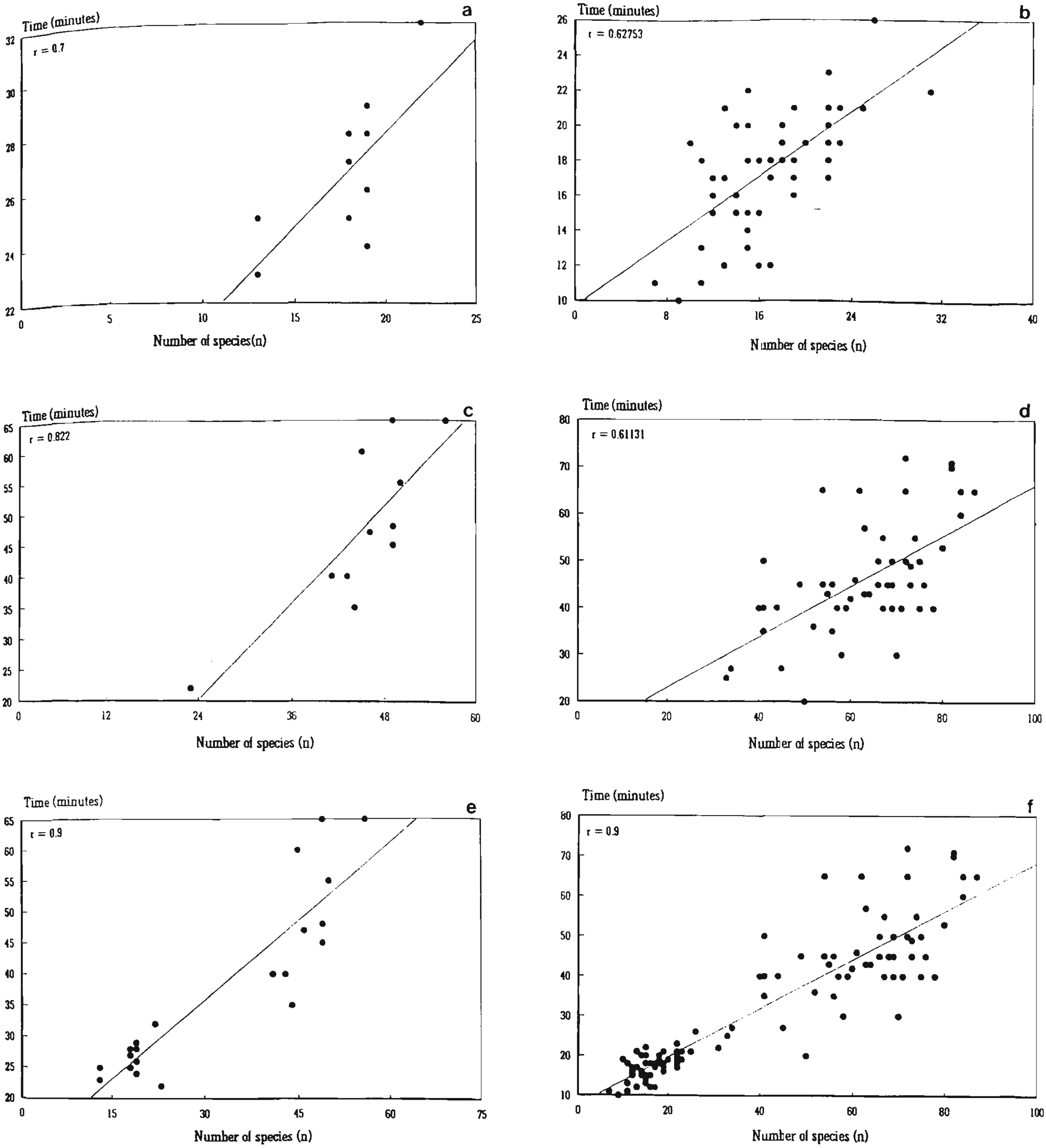

Figure 4.17 Relation between the number of species recorded and the time required to complete recording per stand for: the point canopy intercept method at (a) the beginning and (b) the middle and end of the survey; the quadrat method at (c) the beginning and (d) the middle and end of the survey; and the combined data sets of the quadrat and point canopy intercept method at (e) the beginning and (f) the middle and end of the survey.

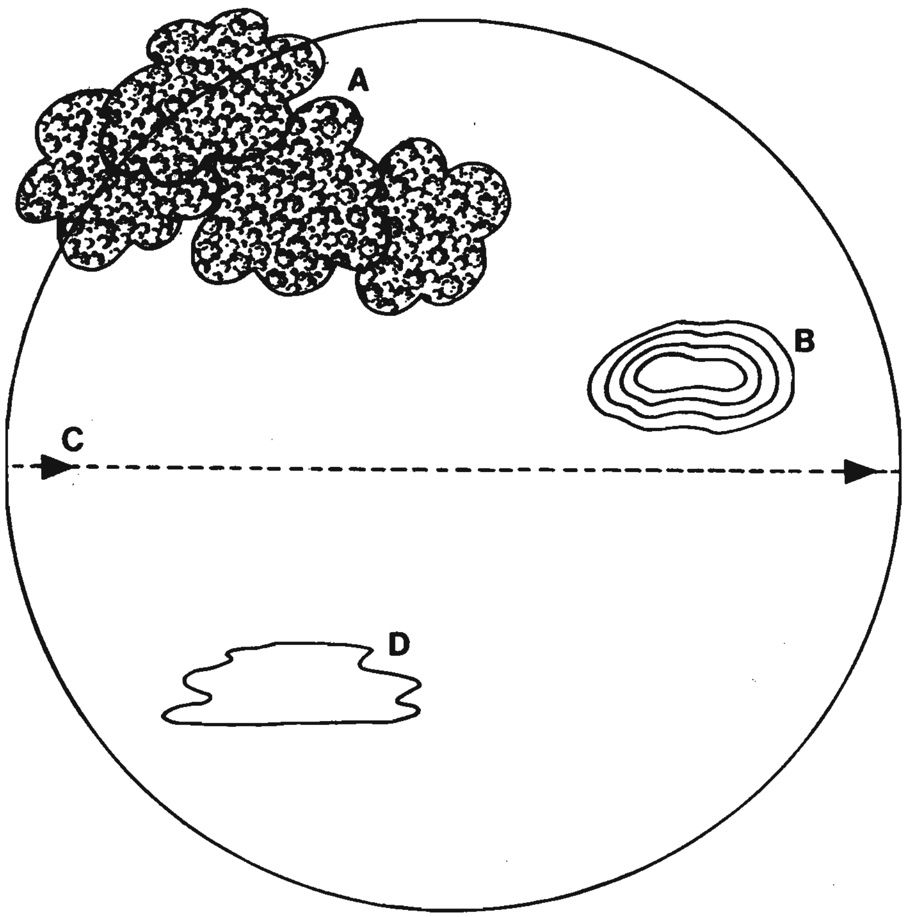

Figure 4.18 Illustration of how local variations in environment and vegetation structure result in the difference in the number of species recorded by the point canopy intercept method and the quadrat method. A = bush clump, B = termitarium, C = direction of point transect and D = exposed ground.

4.3 *DISCONTINUITIES IN THE SCALE CONTINUUM*

The calculated stand diameters for the iterative groupings of the 7 752 points are as follows:

1st grouping (332 relevés) = 23.34 m;
2nd grouping (86 relevés) = 90.14 m;
3rd grouping (15 relevés) = 516.80 m; and
4th grouping (1 relevés) = 7 752.00 m.

By applying the formula used for stand area determination (see 3.2.1.2.2) and rounding off the stand diameters obtained by the discontinuity analyses the following sampling scales become evident:

1) A stand diameter of 24 m (radius of 12 m) has a sampling scale of 1:12 000;
2) A stand diameter of 90 m (radius of 45 m) has a sampling scale of 1:45 000; and
3) A stand diameter of 500 m (radius of 250 m) has a sampling scale of 1:250 000.

The last grouping cannot be used since only one group was identified and the discontinuities in this classification (2) were produced by the extreme limits of the transect and not necessarily by the vegetation.

Using these discontinuity sequences, matrices were generated and the standard PHYTOTAB-PC classification process was then applied to the 332 and 86 group matrices. The sequence of 332 groups was arranged in 82 communities and the sequence of 86 groups was arranged in 8 communities, the delimitation of which corroborates the discontinuity analyses since both classifications produced communities totaling less than the corresponding discontinuity analyses sequences *i.e.* 82 < 86 and 8 < 15.

CHAPTER 5

5. INTERPRETATION

5.1 *EFFICACY OF THE CLASSIFICATIONS PRODUCED BY THE TWO METHODS*

The intended result of any vegetation classification and mapping exercise should be the maximum usefulness of the product for the land user. To attain maximum usefulness the classification should be easily understandable yet contain as much information as possible regarding not only the vegetation but also the habitat and the dynamics of both. Above all, the classification has to be valid. Thus a classification needs to be tested since, as Westfall (1992) states "... more than one solution to a classification is possible...". In this section of Chapter 5 the testing of the classification for validity will be discussed followed by the interpretation of the derivatives presented in the previous chapter.

5.1.1. *The verification of the quadrat and point canopy intercept method's classifications*

The process of testing a classification can be termed the verification. Methods of verification include examination of the spatial integrity of the relevés, floristic and habitat correlations and ground truthing. A fourth method entails examining the relation between all the blanks in the classification matrix and the included gaps or total separation units, termed the classification efficiency (Westfall 1992) (see Chapter 3).

5.1.1.1 The classification efficiencies of the quadrat, the point canopy intercept and the re-classified point canopy intercept method's matrices

The classification efficiency value for the QM classification was 54%, 64% for the PCIM classification and 50% for the re-classified PCIM classification (Tables 4.5, 4.6 and 4.10 respectively in the back pouch). A matrix with a classification efficiency of 62% and greater is considered adequate because of increasing robustness while a matrix having a classification efficiency value of 38% is the equivalent of a random classification (Westfall 1992). Robustness refers to the stability of a classification *i.e.* should a classification, with an efficiency value of 62% or greater, be re-classified subsequent to the removal of duplicate species from the matrix, then the relevé sequence should not alter dramatically. However, classifications having efficiency values of less than 62% are less robust and the removal of duplicate species will alter the relevé sequence when re-classified.

From the efficiency values scored for the classifications it would appear that the PCIM classification is the better than the QM's classification. However, it has a higher score than the QM simply because it has fewer species (212 as opposed to 353) resulting in less noise which in turn results in fewer potential separation units.

The re-classified PCIM classification had the lowest efficiency value because the optimum relevé sequence for this data set was not used *i.e.* it is an artificial classification where the species recorded using the PCIM (212) were classified using the QM relevé sequence which was classified using 315 species. By 'superimposing' PCIM species on the QM relevé sequence, and re-classifying, the efficiency is weakened relative to the PCIM. The main purpose for generating this artificial matrix was for use in the comparison of the detrended correspondence analyses of the QM and the PCIM for floristic and habitat correlation (see 5.1.1.3 below).

Classification efficiency could have been increased, for this study, had the sampling unit size been increased commensurate with the correct sampling scale of 1:12 000 *i.e.* from a stand with a radius of 8 m to a stand with a radius of 12 m. Also, by using the correct sampling scale (1:12 000), the stratification, although independent of the classification, would have had fewer, larger stratified units, thus reducing the amount of noise which could have occurred due to samples being too close or even in ecotones or transitional areas.

5.1.1.2 Spatial integrity of relevés in the quadrat and the point canopy intercept method's classifications

To determine the degree of spatial integrity of relevés within the classified groups (communities), two methods were followed for this study. The first method involved comparing the grouped number sequence of the relevés as arranged in the stratified units, with the relevés grouped according to the classifications of the QM and PCIM matrices (Table 5.1 and 5.2 respectively). The second method involved using an overlay-map of the stratified units on which the relevés were colour-coded for each classified relevé group for both the PCIM and QM classifications.

The QM grouped sequence showed a 27% correspondence with the stratified unit sequence whereas the PCIM grouped sequence had a 23% correspondence. By arranging the stratified units in numerical order (1 - 10) and assigning the QM relevé group (set B) with the greatest percentage correspondence to each of the stratified groups, it can be seen that QM group six is not represented and QM groups four, five and seven are represented more than once (Table 5.1). A similar comparison of the stratified units with the PCIM relevé groups shows that PCIM groups one and seven are not represented and that PCIM groups two, four and six are represented more than once (Table 5.2). Besides the fact that there is not a one to one correspondence between either the QM or the PCIM groups with the stratified unit sequence, the other effect of using an inappropriate scale for stratification was shown by the non-representation of one (QM) and two (PCIM) relevé groups in the stratification sequence.

Table 5.1 The percentage correspondence between the stratified unit relevé sequence (set A) and the quadrat method's classified relevé sequence (set B)

		Set A (strat. sequence)										Total percentage correspondence
		1	2	3	4	5	6	7	8	9	10	
Set B (QM)	1	24	0	0	52*	0	0	15	0	0	0	91
	2	0	0	0	13	15	0	66*	0	0	0	94
	3	0	0	18	11	66*	0	0	0	0	0	95
	4	0	8	0	8	0	55*	0	63*	0	0	134
	5	6	8	0	8	9	0	0	0	47*	52*	130
	6	36	11	0	12	0	0	0	0	0	0	59
	7	42*	52*	23*	0	6	0	0	0	0	7	130
Total percentage correspondence		108	79	41	104	96	55	81	63	47	59	

* the QM relevé groups having the highest percentage correspondence with the stratified unit relevé groups.

Table 5.2 The percentage correspondence between the stratified unit relevé sequence (set A) and the point canopy intercept method's classified relevé sequence (set B)

Set B (PCIM)	Set A (strat. sequence) 1	2	3	4	5	6	7	8	9	10	Total percentage correspondence
1	11	0	0	0	0	28	0	0	0	0	39
2	20	11	0	12	12	0	0	34*	22*	34*	145
3	8	0	0	10	23	57*	0	13	0	0	111
4	0	0	0	0	46*	0	44*	0	0	0	90
5	24	28*	0	21	0	0	0	0	0	13	86
6	35*	16	27*	14	0	0	0	0	0	0	122
7	8	0	15	31*	11	0	30	0	15	0	110
Total percentage correspondence	106	85	42	88	92	85	74	47	37	47	

* the PCIM relevé groups having the highest percentage correspondence with the stratified unit relevé groups.

From these correspondence tables (5.1 & 5.2), the spread of communities over a stratified unit can be quantified. For example, QM communities number one, five, six and seven are all represented in stratified unit number one. The ideal would be one community per stratified unit but this seldom happens due to sampling and stratification errors. However, the QM classification is better than the PCIM in this regard since three stratified units (six, eight and nine) are represented by one community whereas the PCIM has only one stratified unit in which only one community occurs. Also, the sum of all the communities represented in the 10 stratified units is less for the QM (27) (Table 5.1) than the PCIM (30) (Table 5.2).

The higher degree of correspondence between the QM and the stratified units was also reflected by the overlay method. Sixty four of the QM relevés were easily grouped and the 11 outliers could, for the most part, be explained (see 5.1.1.4). The PCIM had fewer relevés (60) which could be mapped and more outliers (15). This implies a correspondence of 85% between the classified communities and the stratified units for the QM and an 80% correspondence for the PCIM. The relatively high number of outliers for both classifications is probably due to sampling anomalies occurring as a result of the arbitrarily chosen sampling scale of 1:8 000. Had the sampling scale been smaller *eg* 1:10 000 or 1:15 000, more species would have been recorded and this would probably have resulted in fewer outliers.

From Figures 3.2 and 4.1 it can be seen that in some cases a plant community covered more than one stratified unit (also an anomaly of the inappropriate sampling scale) and in these cases the neighboring units were amalgamated.

5.1.1.3 Floristic and habitat correlation of the quadrat and the point canopy intercept method's classifications

According to Tansley and Chipp (1926) "...the ultimate object of ecology is to evaluate the different factors of the habitat and to determine how far, singly or in combination, they affect the presence or abscence, the success or failure, the vigour or weakness, of the various species and communities of plants...". The relation between the habitat and the vegetation can also aid in the verification of a classification but is limited to those habitat factors which have been recorded or can be derived (Westfall 1992). Two methods of correlation of the relevé groups with habitat were used in this study, namely: (1) the construction of a hierarchical dendrogram in which different habitat factors are associated with the classified plant communties; and, (2) an ordination of the synoptic relevés representative of each community using the CANOCO version of detrended correspondence analysis (ter Braak 1987).

The first method involved arranging all the habitat parameters recorded in the field (see chapter 3) in their respective relevé groups as delimited for the QM and PCIM classifications. The geology and physiography for each relevé were derived from the 1:50 000 topographical map and the 1:50 000 geological map of the area. These data were then examined to see whether any of the environmental parameters formed discrete units within the relevé groups *i.e* could a relevé group be differentiated from the other relevé groups on the basis of environmental factors. The PCIM groups showed very little correlation with the environmental parameters recorded *i.e.* there was too much overlap of the ranges between relevé groups and no clear associations between habitat and relevé groups could be identified. The QM groups, on the other hand, had well-defined environmental ranges (Figure 5.1). For example, communities one, two, seven and three were differentiated from communities four, six and five on the basis of slope

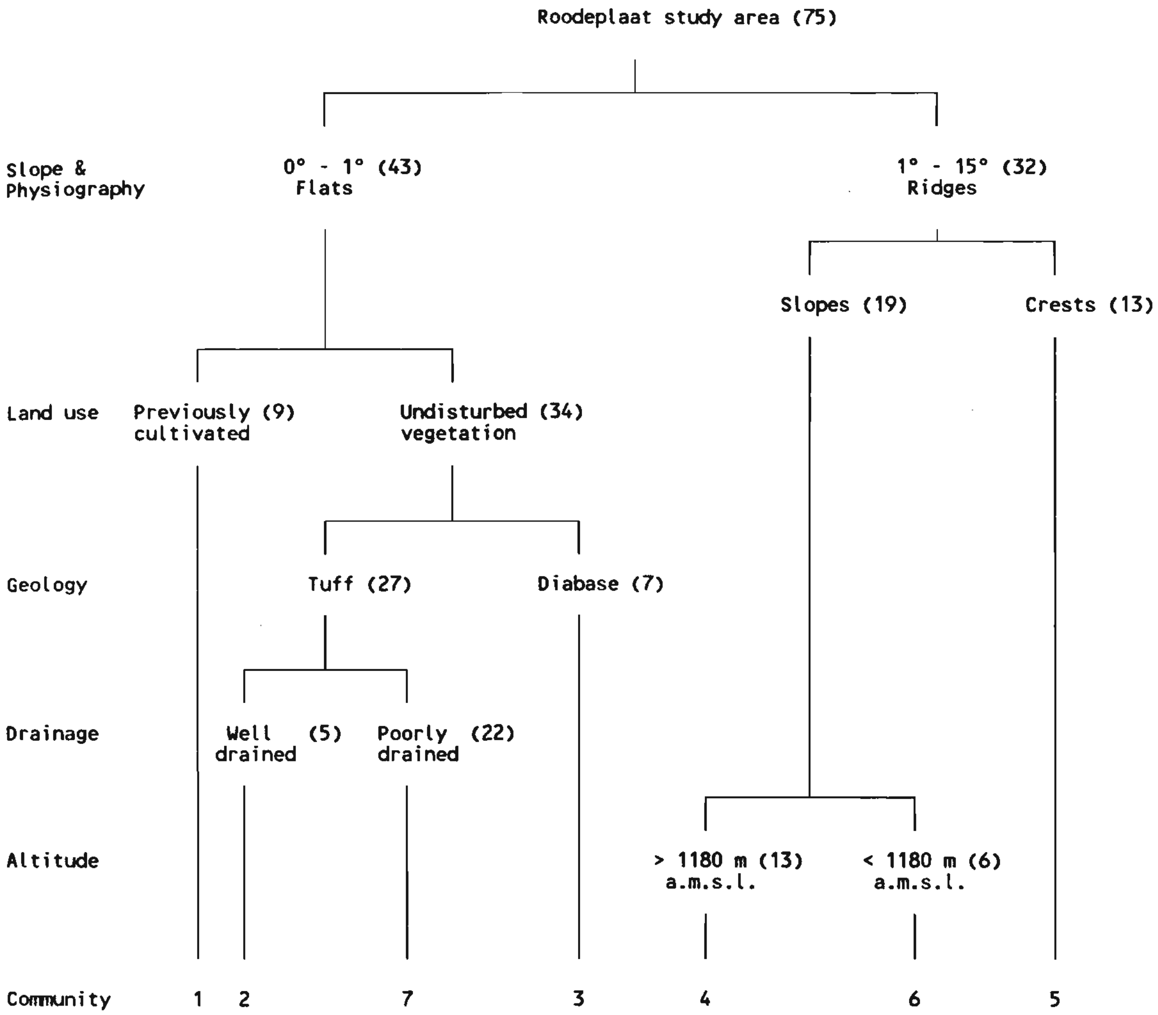

Figure 5.1 Dendrogram indicating the environmental parameters which differentiate the quadrat method relevé groups from each other (the figures in brackets indicate the number of relevés at each branch in the dendrogram).

and physiography. Thereafter, each of the communities could be differentiated using one or more of the quantifiable habitat parameters with the exception of communities two and seven which were differentiated by qualitative field observations.

In this way, a drainage gradient became evident for the seven QM plant communities ranging from well drained soils on the left of the classification (see Table 4.14) to poorly drained soils on the right of the table.

The second method used for habitat and floristic correlation involved PHYTOTAB-PC (Westfall 1992) and the CANOCO programme's version of detrended correspondence analysis (ter Braak 1987). Tests on matrices (Westfall 1992) have shown that detrended correspondence analysis cannot be used to adequately classify floristic data but is useful when explaining any correspondence between the classified relevé groups (communities) and environmental gradients. Experience has shown that the best method of doing this is by using synoptic relevés since a synoptic relevé consists of all the species in the community with a mean cover for each species.

In a community by species ordination the total SD's relate to the total variation shown for that particular data set and Van Staden (1991) has shown that a data set having high SD values has a better classification efficiency than a data set with low SD values. A comparison of the Eigenvalues and SD units for the QM and PCIM matrices using all their species shows the PCIM to have a higher SD unit value for all four axes (48.7% greater than the QM) and that the Eigenvalues for axes one and two cover 51.4% more variation than the QM's values for axes one and two (Table 5.3).

Ordinations using only the diagnostic species effectively reduces noise in the form of non-diagnostic species (Van Staden 1991) and accordingly the two community by diagnostic species matrices (QM and PCIM) were ordinated. Once again, a trend similar to the one shown above (all species) was evident. The PCIM's Eigenvalues for the first two axes covered 19.6% more variation than the QM's Eigenvalues and the total for the SD units on all four axes was greater by 25.5% for the PCIM (Table 5.4).

That the PCIM ordinations had better SD unit values and Eigenvalues could be attributable to the fewer number of species in the PCIM matrix which resulted in less noise. The QM ordination, on the other hand, had low

Table 5.3 A comparison of the Eigenvalues and SD units derived from a detrended correspondence analysis ordinations of the quadrat and point canopy intercept method's matrices using all the species

	QM	PCIM	QM	PCIM
	Eigenvalues	Eigenvalues	SD units	SD units
Axis 1	0.250 43.4% *	0.608 94.8% *	1.72	4.46
Axis 2	0.184	0.340	1.35	1.86
Axis 3	0.084	0.207	1.03	1.67
Axis 4	0.000	0.000	0.00	0.00
Total			4.10	7.99
			Diff. =	48.7%

* the percentage variation covered by the first two axes

Table 5.4 A comparison of the Eigenvalues and SD units derived from a detrended correspondence analysis ordinations of the quadrat and point canopy intercept method's matrices using only the diagnostic species

	QM	PCIM	QM	PCIM
	Eigenvalues	Eigenvalues	SD units	SD units
Axis 1	0.322 59.9% *	0.518 79.5% *	2.03	4.10
Axis 2	0.277	0.277	1.46	2.08
Axis 3	0.156	0.144	2.15	1.39
Axis 4	0.000	0.000	0.00	0.00
Total			5.64	7.57
			Diff. =	25.5%

* the percentage variation covered by the first two axes

values probably due to the inappropriate sampling scale resulting in too much noise.

In any event, these two ordinations could not be compared directly due to the different number of species present in each matrix (212 and 353) and in order to make a direct comparison, the PCIM matrix was re-classified using the QM relevé sequence as described in Chapter 4. Ordinations were once again carried out on the community by species matrices of the PCIM and the re-classified PCIM with all the species (212 for both matrices) and the diagnostic species only. The results of these ordinations showed that the sum of the SD unit values for all four axes of the PCIM ordination (for all species) was 12.2% greater than the sum of the SD unit values for the re-classified PCIM ordination but that the Eigenvalues for the first two axes for both these ordinations were very similar (Table 5.5). A similar trend was evident in the scores for the ordinations of the PCIM and re-classified PCIM matrices using only the diagnostic species (Table 5.6).

The PCIM SD unit values are marginally higher than the re-classified PCIM SD unit values also probably because the PCIM ordination has less noise. In the case of the re-classified PCIM the noise is not attributable to the difference in species (both matrices had species totaling 212) but is rather due to the superimposition of the PCIM species on the QM relevé sequence - a sequence which was classified using the 353 species in the QM matrix. This causes larger gaps between the occurrences of the species in the matrix which in turn results in a low classification efficiency and more noise.

Since most of the variation was accounted for by the first two axes in all but two of the ordinations, the matrices discussed above were compared for environmental correlation with the QM classification by means of ordination diagrams using only the first two axes (Figures 5.2 to 5.7). The QM classification (Table 4.14) showed a drainage gradient from good drainage (Community 1) through to poor drainage (Community 7) and a confirmatory pattern in the ordination diagrams was sought.

From these ordination diagrams the following interpretations can be made:

(1) quadrat method (all species) (Figure 5.2) - there is a weak indication of the drainage gradient linearly along axis one although this is confused by community four being placed on the extreme right. No pattern is discernable along axis two;

Table 5.5 A comparison of the Eigenvalues and SD units derived from a detrended correspondence analysis ordinations of the re-classified point canopy intercept and the point canopy intercept method's matrices using all the species

	Re-cl. PCIM	PCIM	Re-cl. PCIM	PCIM
	Eigenvalues	Eigenvalues	SD units	SD units
Axis 1	0.611 93.4% *	0.608 94.8% *	3.58	4.46
Axis 2	0.323	0.340	1.66	1.86
Axis 3	0.279	0.207	1.88	1.67
Axis 4	0.000	0.000	0.00	0.00
Total			7.12	7.99
			Diff. =	12.2%

* the percentage variation covered by the first two axes

Table 5.6 A comparison of the Eigenvalues and SD units derived from a detrended correspondence analysis ordinations of the re-classified point canopy intercept and the point canopy intercept method's matrices using only the diagnostic species

	Re-cl. PCIM	PCIM	Re-cl. PCIM	PCIM
	Eigenvalues	Eigenvalues	SD units	SD units
Axis 1	0.423 80.5% *	0.518 79.5% *	2.46	4.10
Axis 2	0.377	0.277	2.89	2.08
Axis 3	0.160	0.144	1.16	1.39
Axis 4	0.000	0.000	0.00	0.00
Total			6.51	7.57
			Diff. =	16.3%

* the percentage variation covered by the first two axes

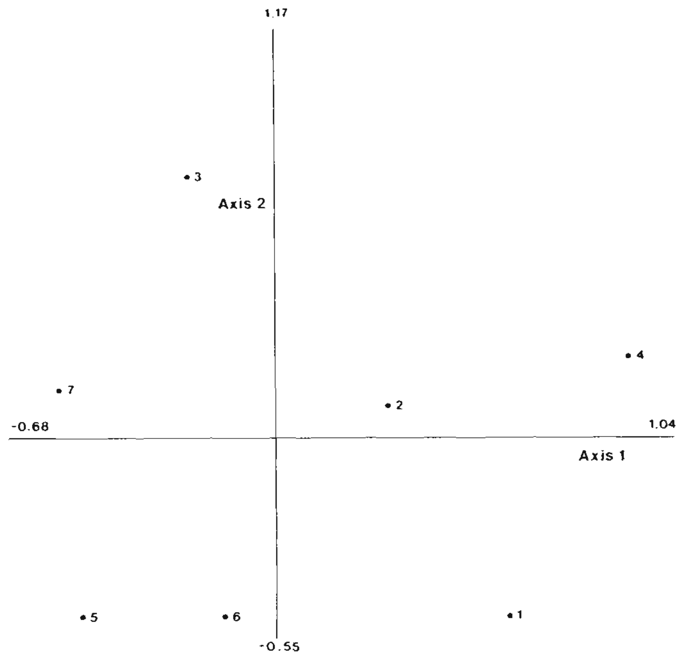

Figure 5.2 A detrended correspondence analysis ordination diagram of the seven quadrat method's communities with all the species (the axes indicate SD units).

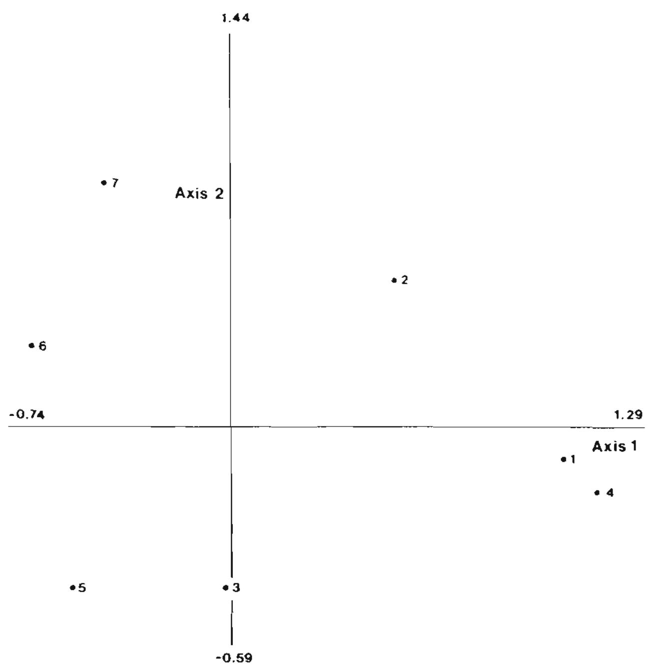

Figure 5.3 A detrended correspondence analysis ordination diagram of the seven quadrat method's communities (indicated by dots and the community number) with only the diagnostic species (the axes indicate SD units).

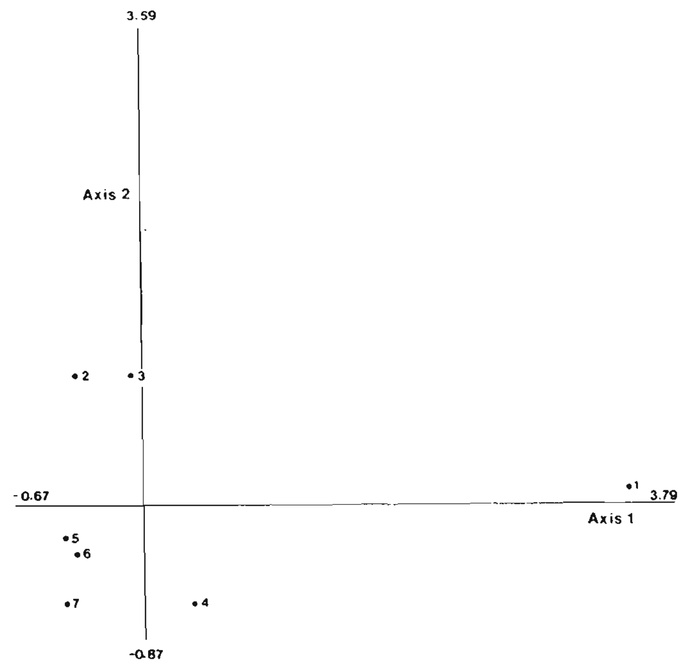

Figure 5.4 A detrended correspondence analysis ordination diagram of the seven point canopy intercept method's communities (indicated by dots and the community number) with all species (the axes indicate SD units).

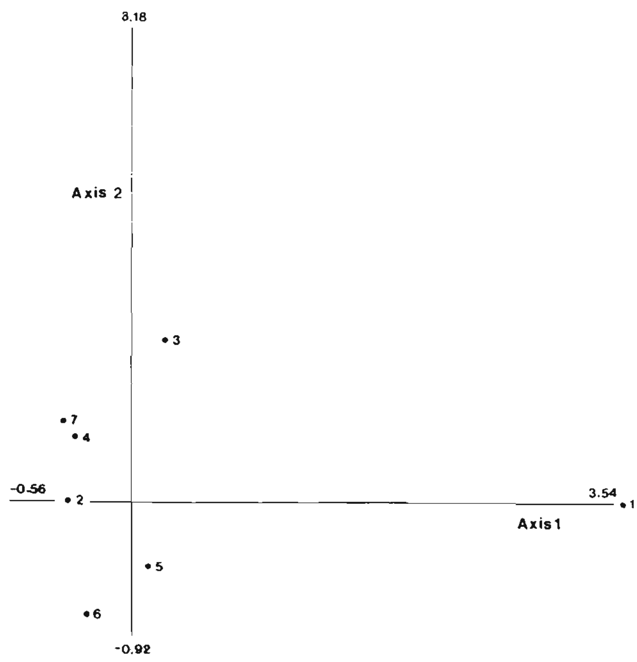

Figure 5.5 A detrended correspondence analysis ordination diagram of the seven point canopy intercept method's communities (indicated by dots and the community number) with only the diagnostic species (the axes indicate SD units).

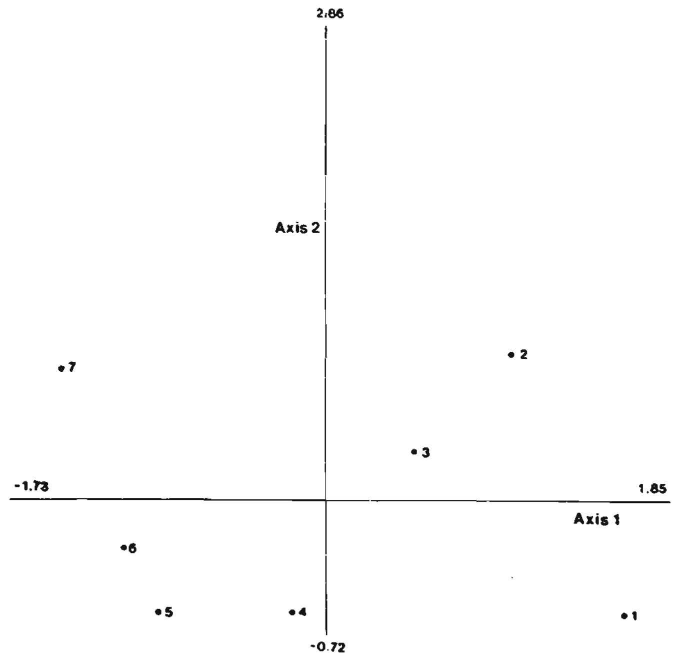

Figure 5.6 A detrended correspondence analysis ordination diagram of the seven re-classified point canopy intercept method's communities (indicated by dots and the community number) with all the species (the axes indicate SD units).

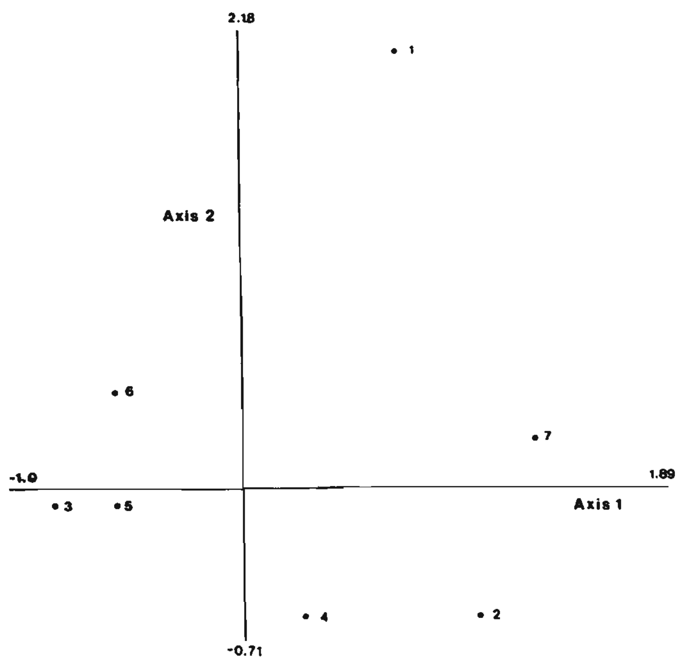

Figure 5.7 A detrended correspondence analysis ordination diagram of the seven re-classified point canopy intercept method's communities (indicated by dots and the community number) with only the diagnostic species (the axes indicate SD units).

(2) quadrat method (diagnostic species only) (Figure 5.3) - a better reflection of the drainage gradient shown by the classification linearly along axis one but still confused by the position of community four on the extreme right. No pattern is discernable along axis two;

(3) point canopy intercept method (all species) (Figure 5.4) - no indication of the drainage gradient linearly along axis one but distinct clustering is evident *i.e.* community one on the extreme right on its own, communities two and three together and communities four, five, six and seven together. These three groups could be interpreted to represent the gradient from well drained terrain (1)through less well drained terrain (2 & 3) to poorly drained terrian (4, 5, 6 & 7);

(4) point canopy intercept method (diagnostic species only) (Figure 5.5) - as for (3) above, community one is placed at the extreme right but unlike (3) no clear indication of a linear gradient along axis one and no clustering is evident;

(5) re-classified point canopy intercept method (all species) (Figure 5.6) - good correspondence between the gradient evident in the classification and the positions of the communities along axis one. No pattern is evident along axis two; and

(6) re-classified point canopy intercept method (diagnostic species only) (Figure 5.7) - no indication of the drainage gradient and no clear clustering evident.

That the re-classified PCIM ordination, using all the species (Figure 5.6), gave the best confirmation of the gradient indicated by the QM classification, is most probably due to it having least noise (fewer species). The weak indication of the gradient shown by both the QM ordinations is probably due to the increase in noise (relative to the PCIM) and the positioning of community four. Closer examination of the species recorded in community four indicates an affinity of this community towards Acocks (1988) Veldtype 20 (Sour Bushveld) while the rest of the farm is Sourish-Mixed Bushveld. For example, *Celtis africana* (the diagnostic woody component of community four's name) is listed as a principle species for Sour Bushveld (see Table 4.14). *Eragrostis gummiflua* is a species which occurs very infrequently in community four but with a higher frequency for the rest of the study area and is listed as an important grass in the Sourish-Mixed Bushveld but not listed for Sour Bushveld. This affinity of community four, towards Sour Bushveld, could possibly be the reason for its position on axis one (Figures 5.2 & 5.3). The gradient shown by the other six Sourish-Mixed Bushveld communities corresponds quite well with the gradient shown by the classification.

5.1.1.4 Ground-truthing

Since it was not possible to produce a meaningful vegetation map of the PCIM classification, ground truthing was done for the QM vegetation map only (Figure 4.1). The following assessments were made visually, in the field, using the QM classification table (Table 4.14) and the vegetation map (Figure 4.1):

1) the degree to which the plant species in each relevé group are representative of the mapped unit;
2) the value of the diagnostic plant species in identifying the mapped community;
3) the reliability of the floristic and habitat relations; and
4) the validity of the mapped units' borders.

Subsequent to the ground truthing exercise, two minor changes were made to the map *viz.*on the northern side of the Pienaars river, community four had its boundary extended slighty to include a portion of the ridge which had been excluded in the stratification and a discrete portion of the same community (four) in the north-western corner of the study area was incorporated with community seven. The latter was classified with community four (a short closed woodland) on the basis of one relevé situated amongst a number of very densely vegetated termitaria. In other words, the stratification and the sample indicated that this relevé belonged to a short closed woodland (community four) but the ground truthing exercise indicated the species in the rest of the unit were better suited to community seven (a low open woodland).

The drainage gradient indicated by the classification was validated by the ground truthing exercise. For example, community one consisted mainly of previously cultivated lands which had been ploughed in the past, as evidenced by the contour walls encountered in the field. The ploughing action would have resulted in the weakening of the plinthic layer present in the Westleigh soil forms, causing an increase in drainage. Further evidence for this phenomenon was indicated by the spread of woody species in the area which can be seen on the aerial photograph and on the ground.

In contrast, at the other end of the drainage gradient, community seven was characterised by the woody species being confined to termitaria. The presence of woody species mainly on termitaria, coupled to the soil samples augered in the field in this community, indicate a high water table - the water being trapped by the shallow Mispah soils and the plinthic layer found in the Westleigh soils, both soil forms being characteristic of this community.

5.1.1.5 Summary of the verification of the classifications

Having tested the classifications for validity with the procedures discussed above, it might, at this stage, be advantageous to summarize the salient points of each classification (Table 5.7). Based on the comparison of the verification of each of the matrices the QM classification is superior to the PCIM classification.

Table 5.7 A summary of the performance of the quadrat, the point canopy intercept and the re-classified point canopy intercept method's classifications with regard to the verification procedures enacted on each

	Classification efficiency	Spatial integrity	Floristic and habitat correspondence		Ground truthing
			Dendrogram	Ordination (DCA)	
QM	54% (satisfactory)	satisfactory	satisfactory	satisfactory	satisfactory
PCIM	64% (good)	weak	weak	weak	weak
Re-class. PCIM	50% (weak)	NA	NA	good	NA

5.1.2 *Interpretation of the derivatives of the quadrat and the point canopy intercept method's classifications*

5.1.2.1 Primary derivatives

5.1.2.1.1 Plant communities and community definition derived from the quadrat and the point canopy intercept method's classifications

By placing the two classifications side by side (Tables 4.14 and 4.15) the differences between the two classifications becomes obvious. The QM classification is superior to the PCIM classification in every respect *viz.* more species were recorded and as a result it had more diagnostic species, more high constancy species and fewer single occurrences. The low constancy species in the PCIM classification were shown to be important species (diagnostic and high constancy) in the QM classification.

5.1.2.1.2 Environmental gradients derived from the quadrat and the point canopy intercept method's classifications

The PHYTOTAB-PC package (Westfall 1992) arranges the relevés so that relevés which are least similar are placed at either extreme of the table since very different plant communities should reflect very_ different habitat conditions with a gradient between the extremes. A drainage gradient was shown by the QM relevé order and all seven communities could be differentiated from one another using a different habitat parameter. This was not possible for the PCIM classification.

The break with tradition with regards to the arrangment of the phytosociological tables (4.14 and 4.15) enhances any environmental gradients present in the classification. For example, the main environmental gradient in the QM classification (Table 4.14) is depicted by species groups *u*, *v*, *w*, *x*, and *y* which reflects the drainage gradient indicated by the community arrangment. By comparing the growth forms in these groups (Table 5.8) the plants in species group *u* (common to both communities 6 and 7) are not adversely affected by a high water table (*i.e.* shallow root systems), indicated by the low number of woody species. The increase in woody species (trees, shrubs and dwarf shrubs) from species group *u* through to species group *y* reflects the drainage gradient since these plants have deeper root systems which are not tolerant of a high water table. Communities two to seven are represented along this gradient - community one is not (even though it is the best drained community) simply because this community consisted mainly of previously cultivated lands where the woody species had been cleared. Thus, this drainage gradient reflects the relevé and community arrangment.

Table 5.8 The frequency of growth forms present in species groups *u* to *y* in the quadrat method classification.

	Forbs	Grasses	Dwarf shrubs	Shrubs	Trees
Group *u*	2	1	1	0	0
Group *v*	6	1	2	0	0
Group *w*	4	7	5	0	0
Group *x*	14	4	2	0	2
Group *y*	4	0	2	2	0

Similarly, the interpretation of the gradient indicated by species groups *h*, *i*, *j* and *k* is that of a mirror image of the main gradient (species groups *u* to *y*). The former gradient represents plant species tolerant of poorly drained soils and the latter represents plants with varying degrees of tolerance to poorly drained soils. The gradient indicated by species groups *l*, *m*, *n*, *o*, *p*, *q*, *r*, *s*, and *t* and common to communities two through to six is more than likely indicative of changes in a soil parameter such as soil depth or percentage clay but is most likely linked to a factor limiting root growth such as minimum soil depth (Figure 5.8).

The environmental gradients depicted in the PCIM classification (Table 4.15 - species groups *h* to *q*) could not be interpreted.

5.1.2.2 Secondary derivatives

5.1.2.2.1 Community composition analysis, community cover and structure of the quadrat and the point canopy intercept method's classifications

Since the PCIM classification could not be validated in terms of spatial integrity or environmental correlation, the community composition analysis (CCA) for this matrix is meaningless. However, a number of inadequacies of the PCIM were highlighted by the CCA, the most important of which was the low number of species recorded compared with the QM (nearly 40% less). Added to this, was the large number of low constancy species (120) recorded using the PCIM of which 88 were important in the QM classification in terms of being either diagnostic or high constancy species. The effect of these two factors on the PCIM CCA was twofold (a) species which in reality are strong competitors are not always designated as such; and (b) unrealistically low cover values are derived for the communities due to the low frequency with which species are recorded. The direct comparison of the CCA's for the QM and the re-classified PCIM matrices confirmed these effects.

Even if the PCIM data had produced exactly the same classification as the QM in terms of relevé sequence arrangment, communities and environmental gradients, the information regarding community cover as well as species cover and competitor status would have been fundamentally flawed since the PCIM consistently underestimated cover and the constancy with which a species occurred.

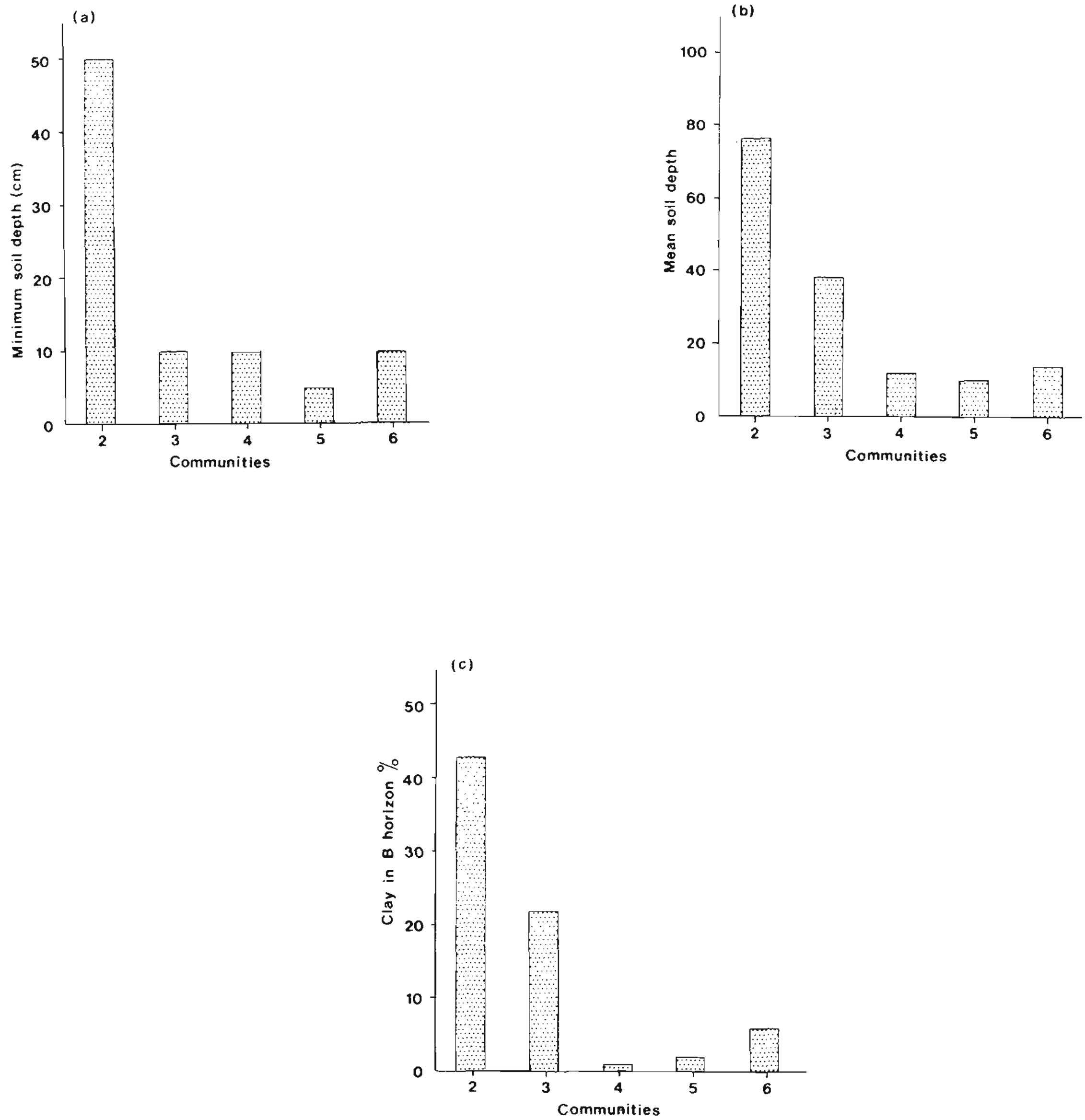

Figure 5.8 The variation in measured soil parameters between communities two, three, four, five and six in the QM classification where (a) is the minimum soil depth for the five communities, (b) is the mean soil depth and (c) is the % clay in the B-horizon.

The very high number of low constancy species in the PCIM matrix (56% of the species in the matrix) causes the interpretation of the CCA for this matrix to be erroneous since it was shown that these species occur in greater numbers than is indicated by the CCA. Eighty two of the 120 low constancy species were recorded as single occurrences which, even with the aid of geo-referenced stands and compass bearings of the transect direction, would make the relocation of these single species extremely difficult and, as such, places the repeatability of the PCIM in grave doubt.

The combined effect of low cover and low constancy values makes the CCA for the PCIM useless because any management decisions based on composition, frequency, cover and competitor status would be erroneous since too few species with too little cover are recorded and these species would thus be incorrectly placed in competitor groups to which they do not belong.

Surprisingly, the community structure of the vegetation in the QM and re-classified PCIM classifications corresponded much better than did the community cover, with the exception of the shrub growth form. This would seem to indicate that, although the cover and constancy values were grossly underestimated using the PCIM, this technique nevertheless reflected the structure quite well and this is most probabaly due to the parameters of canopy cover and growth form being incorporated with a point method.

5.2 *COMPARISON OF THE SAMPLING EFFICIENCY OF THE TWO METHODS*

The models developed to determine time spent in the field (see 5.2.1) were developed in the context of this study, *i.e.* one operator was used for the quadrat method, two operators conducted the point canopy intercept method and both operators had a good knowledge of Sourish-Mixed Bushveld flora (just under half of the genera recorded were known to either one or both the operators). Bearing this in mind, variables which influence the cost of vegetation surveying include:

1. the degree of vegetation heterogeneity;
2. survey design or field methodology;
3. working scale or size of area to be surveyed;
4. terrain and accessability;
5. transport;
6. field equipment; and
7. staff salaries and subsistence.

points one and two can be costed using the regressions generated from the data collected for the Roodeplaat survey and are dealt with under 5.2.1. Points three to six are not catered in the models and additional calculations with regard to costs (time and expertise) must be made (see 5.2.2.1 to 5.2.2.4). Point seven is fixed and can be calculated (see 5.2.2.5).

5.2.1 *Models for determining time spent in the field*

The degree of vegetation heterogeneity and the method employed to record vegetation are the two factors which most influence the time spent at a sample site.

To be cost-effective, careful consideration must be given to the design of a vegetation survey. Bonham (1989) states that the selection of units and measurement techniques requires a knowledge of the floristic composition, community growth-forms and patterns of species distribution. Locally, various techniques for field sampling have been compared for repeatability, accuracy and rapidity (McNeill *et al.* 1977, Mentis 1981, Hardy & Mentis 1985, Heard *et al.* 1986, Hardy & Hurt 1989, Hobson & Baarnhoorn 1989, Hurt & Bosch 1991 and Ivy & Stuart-Hill 1991).

The effectiveness of the point canopy intercept method versus the quadrat method in classifiying vegetation has been shown to be deficient at large sampling scales (in this case 1:8 000) since too few species are recorded using the PCIM to make any sense of the classification. However, the PCIM could still prove to be more efficient than the QM at smaller scales where more points would be used *eg.* at a sampling scale of 1: 250 000, a circular stand would have a diameter of 500m *i.e.* 500 points, one meter apart. At the same scale the QM would require a minimum of four subquadrats (size would depend on the vegetation being sampled *eg.* smaller in grassland than in savanna) to adequately sample the variation and since the QM requires a separate measure of cover (as opposed to the PCIM which has a built-in species cover determination) it could take longer to complete a survey using the QM rather than the PCIM. This hypothesis requires testing at small scales. However, the quadrat method is easier to use in dense vegetation than the point canopy intercept method employing a wheel. A tape measure might overcome some of the problems experienced with the wheel *eg.* tall grass canopies becoming entangled in the spokes. Another possible advantage of the quadrat method is, that at large scales, where the whole stand is sampled, greater species variation is recorded and when vegetation cover is low, recording is quick. The advantages and disadvantages of the two techniques, as applied in the Roodeplaat survey, are summarized in Table 5.9.

Table 5.9 The advantages and disadvantages associated with the sampling efficiency of the point canopy intercept and the quadrat method, as applied in the Roodeplaat survey

ADVANTAGES	DISADVANTAGES
QUADRAT: 1. Classification efficiency high 2. One operator - low cost 3. More efficient use of manpower 4. Ease of use in dense vegetation and irregular terrain (rocks) 5. Less time required per species	QUADRAT: 1. Separate cover technique 2. Overall, less cost-effective, since more species recorded
POINT CANOPY INTERCEPT: 1. Cover incorporated in technique 2. Classification efficiency ? 3. Overall, more cost-effective, since fewer species recorded	POINT CANOPY INTERCEPT: 1. Two operators - high cost 2. Less efficient use of manpower (1 & 2 can be overcome by using one operator and a tape) 3. Difficult to use in dense vegetation and irregular terrain 4. More time required per species

Implicit in using a model which estimates time as a function of the number of species in the area to be sampled, is a fair estimate of the species richness of the study area. Estimates could be obtained during a reconnaissance of the area or by making use of available predictive species - area relations information (Westfall *et al*. 1987).

The following models, based on the results of the Roodeplaat survey, can be used to determine the time spent sampling vegetation:

1. Time required for the beginning of the survey (approximately 13 stands) using either method is given by:

$$t = 0.844(x) + 10.484$$

where y = time (in minutes) and
x = number of species per stand;

2. Time required for the middle and end of survey using either method is given by:

$$t = 0.607(x) + 7.611$$

where t = time (in minutes) and
x = number of species per stand;

3. Time required for dense vegetation having relatively few species using the point canopy intercept method is given by:

$$t = 0.545(x) + 20.312$$

where t = time (in minutes) and
x = number of species per stand; and

4. Time required for vegetation with low cover but relativley many species using the quadrat method is given by:

$$t = 0.248(x) + 21.092$$

where t = time (in minutes) and
x = number of species per stand.

Using the above models, examples of the differences in time required to record 20 species per stand for the four situations are: 1) 27.4 minutes, 2) 19.5 minutes 3) 31.2 minutes and 4) 26.1 minutes.

Time required for any necessary environmental recordings must be added on since the model does not take these measurements into consideration.

5.2.2 *Variables not accounted for in the models*

5.2.2.1 Scale

The effect scale has on sampling efficiency is important and should not be overlooked in survey cost estimation (Figure 5.9). The appropriate stand area for a scale of 1:8 000 is 201 m^2. The entire stand was sampled using the quadrat method whereas with the point canopy intercept method only 160 points were used to sample the stand. The plant number scale (Westfall & Panagos 1988) was used to sample cover using the quadrat method which can entail transect lengths of up to 240 m per species. Decreasing scale with increasing stand area is likely to cause a corresponding increase in the number of subsamples required to sample the stand because sampling the entire stand is impracticable at small scales. For example, had the Roodeplaat Experimental Farm been stratified using a 1:50 000 aerial photograph mosaic, fewer samples would have been required since fewer stands would fit into the stratified units (Westfall 1992). The number of stratified units would also have decreased for the smaller scale. However, the stands would have been bigger (a radius of 50 m), necessitating a subsampling approach and a probable increase in the number of species, resulting in an increase in the time spent at each stand. Sampling cover could therefore be prohibitive (in terms of time and therefore cost) and the point canopy intercept method used in this study would be advantageous.

In Figure 5.9 the line segment at 'a' separates, what in vegetation sampling terms, could be called large scales and small scales. At scales of 1:10 000 and larger, the entire stand, or very close to the entire stand, can be sampled using the quadrat method and thus all the species variation within the stand would be recorded. For scales between line segments 'a' and 'b' the stand could still be sampled using one 200 m^2 quadrat, placed judiciously, and most of the variation would likely be recorded. For scales smaller than 1:25 000, a sub-sampling approach would need to be used with the resultant inability to record all the variation within the stand. In contrast, the point canopy intercept method can be applied at all scales but since it merely samples the stand, species variation for the whole stand remains unknown.

The working scale of a study affects the distances between samples *i.e.* the distance between stands must be taken into account when calculating time spent in the field. For example, Van Staden (1991) surveyed an area of approximately 2300 km^2 around Steenbokpan in the north-western Transvaal. At a scale of 1:250 000, Van Staden (1991) identified 26 stratified units in the area and sampled 139 stands. The approximate straight line distance between stand centres was 4 km. The Roodeplaat survey, by comparison, covered an area of 27.5 km^2 and had 75 stands placed in 10 stratified units at 1: 8000 scale. The straight line distance between stand centres was approximately 0.37 km.

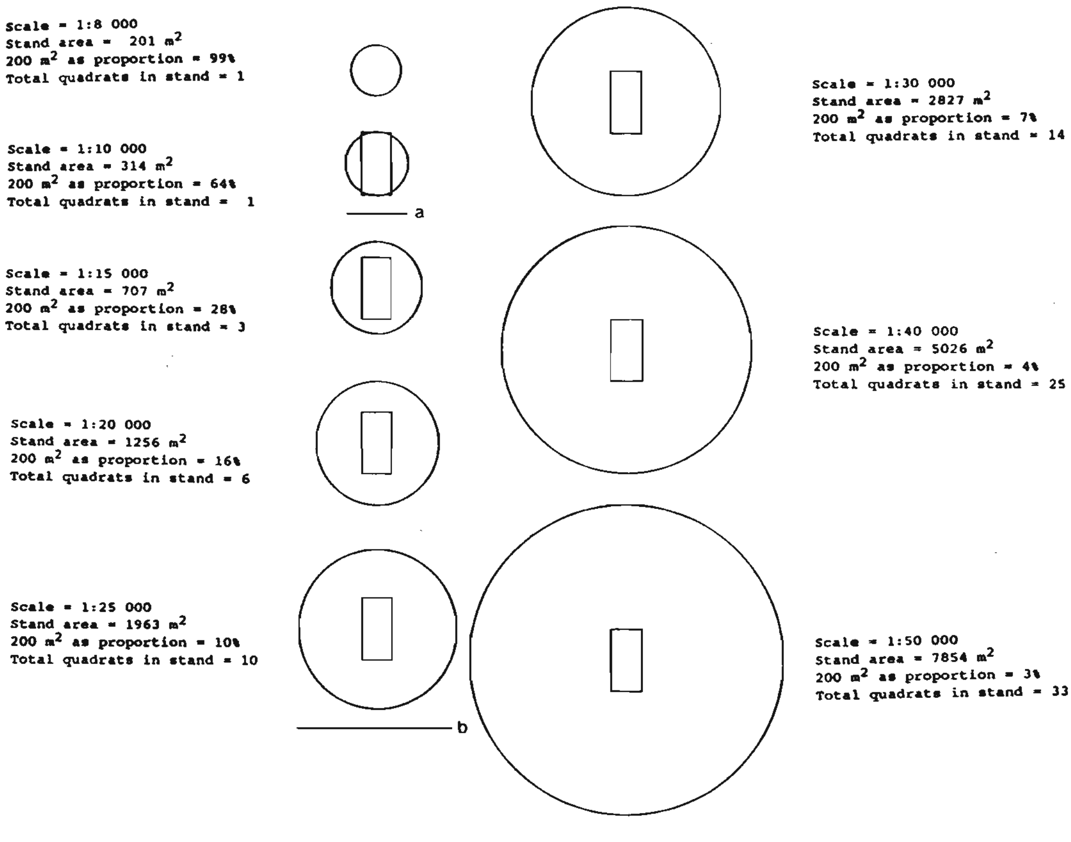

Figure 5.9 The influence of scale on stand area and the relationship between a single, most commonly used, 10 m x 20 m sampling quadrat and stand area, drawn to scale.

5.2.2.2 Stand accessability

Terrain can influence the accessibility of the stand. For example, much time is lost when approaching the sample site on foot rather than by vehicle. Random stand placement, as used by Van Staden (1991) and Westfall (1992), increases objectivity in vegetation sampling but could also result in an increase in the cost of the study, since stands would not be selected with accessibility in mind

The remoteness of a study area can increase the cost of a survey substantially. An example is given by Burbidge (1991) for a study conducted in the Kimberley area, Western Australia, over a period of 3.8 years. Survey staff were flown from Perth to Kimberley (1200 km) and from there to the study sites (20 000 000 ha) by helicopter. The cost in 1988 Australian dollars for air fares alone was $228 140. Thus the terrain and the distance to and from the study area affects costs and these variables must be taken into account when planning vegetation surveys.

5.2.2.3 Transport

Most vegetation surveys are carried out with the use of motor vehicles. The terrain of the study area and the number of staff and amount of equipment to be transported will determine the choice of vehicle and thus the costs of transport.

Based on experience, a wagon or combi type vehicle is recommended for the following reasons:

1. A canopy is necessary on a pick-up type vehicle because rain is likely to occur in the growing season when most field work is done. Getting equipment in and out of a pick-up with canopy is frustrating.;

2. Both the pick-up and panelvan type vehicles are restrictive in terms of seating and usually are less comfortable for long distances.;

3. The wagon type vehicle has the option of removing the middle seat for equipment space and is still able to convey four workers. The sliding side door and flip-up rear door allow easy access to the equipment, much of which can be used and left in the vehicle *eg*. a transportable map cabinet (Westfall & Panagos 1989).; and

4. The option of using a modified trailer (Panagos & Westfall 1989a) is

open to all three types of vehicles but a roofrack could only be used by the wagon or panelvan type vehicles.

5.2.2.4 Equipment

The kind of equipment required for field work is dependent on the aim of the study. What is not so obvious however, is the economic implications equipment can have on a survey. A pencil and clipboard is probably quicker to use in the field for floristic data recording and is much cheaper than a hand-held computer, but the latter method has the advantage that once transferred to a PC the data is ready for synthesis. A good example of computerized field data capture is that of on-site herbarium specimen labels (Westfall 1989). Terrain and vegetation structure will also affect the choice of field apparatus. For example, a bridgepoint apparatus, as described by Morris and Muller (1970), would not be suitable for the steep slopes of the Drakensberg. A wheelpoint (Tidmarsh & Havenga 1955) would be unsuitable for rocky terrain. A quadrat method is more suitable for dense stands of trees and shrubs than a point method (McNeill *et al.* 1977).

Equipment can affect the psyche and physical state of the field worker, which in turn affects the efficiency and reliability of his/her work. The size and weight of equipment affects the mobility of the worker and bulky, heavy equipment will adversely affect the efficiency of sampling, especially when stands have to be approached on foot. For example, a portable plant press (Panagos & Westfall 1989b) is lighter and less cumbersome to carry than the standard wooden slat press. Time consuming tasks, such as changing drying paper, can be eliminated by using a top-loading plant press (Westfall *et al.* 1989) in conjunction with a drier transporter (Panagos & Westfall 1989a).

Equipment depreciation must also be budgeted for. Consumables such as batteries, auger heads, drying paper, secateurs *etc.* can be incorporated directly into the costing for a contract. More expensive items such as a GPS receiver could be bought on the understanding that the funding organization retains the equipment after completion of field work. Still more expensive items, such as an electron scanning microscope, could be bought by the worker's employer or it could be leased from an organization already in possession of such an apparatus, in which case the cost could be recouped.

5.2.2.5 Staff salaries and subsistence

Fixed costs to be taken into account when budgeting for a vegetation survey are salaries (professional or technical) and, coupled to this, the number of workers required for the job and their subsistence allowance. Staff costs could be reduced by using students and non-research staff to do field work.

Burbidge (1991) states that the most limiting factors on the number and thoroughness of biogeographic and ecological surveys are staff and money. Lack of suitably trained manpower limits the amount of contract work a research organization can accept, which in turn reduces the organization's income. Staff training is an aspect Stuart-Hill (1991) studied. He was able to show that teams of field workers, previously unexposed to assessing the ecological status of vegetation, were able to visually estimate the vegetation status more cost-effectively than they would have using current objective methods. The visual method has the advantage of being able to assess more sites per day than the objective method but the latter requires fewer staff and vehicles.

5.3 *DISCONTINUITIES IN THE SCALE CONTINUUM*

The discontinuity analysis of the 7 752 point continuous transect provided unique information for scale-related sampling in that, for the first time, a basis for the decision as to what scale to sample at in Sourish-Mixed Bushveld can be taken with a fair degree of certainty.

Vegetation classified at scales of 1:50 000 (Myburgh 1993) and 1:250 000 (Van Staden 1991) have provided "good" correlations with stratification and community boundary recognition. The second and third discontinuity analysis sequences corroborate these scales *i.e.* 1:45 000 and 1:250 000 respectively (see 4.3).

Prior to the Roodeplaat study, sampling at "farm" scale was an arbitrary exercise dependent on the availability of aerial photographs. Recent scale-related sampling of bushveld farms has been carried out using 1:8 000 aerial photographs but the unsatisfactory correlation of the classifications with stratification and difficulty experienced in community boundary recognition has led workers to believe that the appropriate scale for sampling farms should be somewhere between 1:10 000 and 1:12 000

(J.M. Van Staden, pers. comm., Roodeplaat Grassland Institute, Private Bag X05, *Lynn* East, Pretoria 0039.). The 1:12 000 scale obtained by the first discontinuity analysis (332 relevés) supports this "gut-feeling" as do the results of the classification of Roodeplaat, *i.e.* a better classification in terms of stronger community definition (fewer communities and less noise) and a better correlation with the stratification would have been obtained had a sampling scale smaller than 1:8 000 been used.

CHAPTER 6

6. CONCLUSIONS

6.1 *CONCLUSIONS REGARDING THE CLASSIFICATION EFFICACY OF THE TWO METHODS*

The capacity to produce a desired result, the result being a classification which represents the vegetation in a practical way and portrays as much information about the vegetation in an easily understandable manner as possible, was tested for the two classifictions of the Roodeplaat experimental farm. The quadrat method classification (QM) had a greater correspondence with the vegetation, verified by better spatial and environmental correlation. The derivatives generated from the QM classification also showed greater validity than the PCIM classification. The large number of single species occurrences in the PCIM classification (see 5.1.2.1.1 & 5.1.2.2.1) would make this method difficult to repeat. The PCIM is thus not recommended for use as a classificatory tool at large scales (> 1:25 000). Further, the PCIM is flawed because it underestimates cover and provides imprecise data on species frequency.

6.2 *CONCLUSIONS REGARDING THE SAMPLING EFFICIENCY OF THE TWO METHODS*

The comparison of the sampling efficiency of the two methods at the same scale revealed that the QM is faster than the PCIM in terms of time required per species. This is especially true in dense vegetation and irregular terrain. However, the overall time required to complete the sampling of a stand using the PCIM is less than for the QM since fewer species are recorded using the former method.

The affect of scale on the efficiency of the two sampling techniques can be summarized as follows:

1) At scales of 1:10 000 and greater the QM represents an entire or nearly entire sample of the stand;
2) At scales of between 1:10 000 to 1:25 000 subjective placement of a single 10 m x 20 m quadrat within the stand can cover most of the variation present in the stand;
3) With the QM, at scales of less than 1:25 000, the stand should be sub-sampled. The efficiency of the sample, whether the PCIM or the QM, will determine which method is likely to include more species;

4) The point canopy intercept method is likely to be increasingly more efficient than the quadrat method for scales less than 1:25 000 and thus more suitable for regional or national vegetation surveys; and
5) The regression models presented in this thesis can be used to assess time required per species for scales larger than 1:25 000 for either the PCIM or the QM.

Although less time per stand is spent recording plants with the PCIM than with the QM, the PCIM is less efficient than the QM at large scales (> 1:25 000) since the data recorded are insufficient (too few species recorded) and erroneous results, in terms of cover and frequency, are obtained. However, the PCIM could be more efficient than the QM at smaller scales where more than 160 points are used (eg. 1000). An increase in the number of points would make the data more useful. The PCIM would still be quicker to carry out than a subsampling QM approach necessitated by an increase in stand area with a reduction in scale.

6.3 *CONCLUSIONS REGARDING OPTIMUM SAMPLING SCALES*

The sampling scales at which Sourish-Mixed Bushveld should correlate best with the stratification and at which optimum community boundary definition should be evident are:

1) 1:12 000 using a circular stand with radius of 12 m;
2) 1:50 000 using a circular stand with radius of 50 m; and
3) 1:250 000 using a circular stand with radius of 250 m.

6.4 *PRIMARY HYPOTHESES*

None of the three primary hypotheses listed earlier (see 1.4) can be accepted unequivocally. Complete correspondence of the stratified vegetation units with the relevé groups produced by either classification did not occur since the sampling scale employed was inappropriate. However, it was possible to amalgamate stratified units to correlate with the QM classification. Future sampling at the scales indicated by the discontinuity analysis should enhance the correspondence of stratifications with relevé groups and improve community boundary recognition. Thus the hypothesis that the stratified vegetation units would correspond to the relevé groups produced by the classifications at the scale of 1:8 000 is rejected.

There was a poor correspondence between the classifications produced by the QM and the PCIM. Although, both matrices had seven relevé groups and both displayed three species groups indicating environmental gradients,for the most part however, the PCIM was uninterpretable, either on the basis of spatial integrity or by means of environmental correlation. The derivatives generated from this classification also did not make much sense. The fundamental problem with the PCIM classification was the low number of species recorded - this facet of the method is the root cause of its deficiency as a sampling technique for classificatory purposes. The second hypothesis, namely the classifications produced by the QM and the PCIM would correspond at the scale of 1:8 000 is thus rejected.

The sampling scales derived from the discontinuity analysis of the 7 752 point transect have yet to be fully tested. It appears, however, that the smaller scales (1:50 000 and 1:250 000) detected by the analysis correspond well with previous work. Also, the scale of 1:12 000 appears to conform to previous ideas about the correct scale for farm sampling as well as the results of this study. However, since the hypothesis that discontinuities corresponding to scale differences would be evident in the repeated classifications of a continuous transect has yet to be fully tested (especially the 1:12 000 scale) this hypothesis cannot be yet accepted or refuted.

The study also showed that an inappropriate choice of sampling scale detracts from the efficacy of a classification *i.e.* the quadrat method produced a classification with only a 52% classification efficiency at a scale of 1:8000. It is probable that this efficiency would have improved had a larger sampling unit been used *eg.* a stand having a radius of 12 m, since a better sample of species heterogeneity would have been obtained, resulting in an improved classification.

Further testing arising from the results of this study, would include: (1) area-based methods at large scales (> 1:25 000) but using a sampling scale of 1:12 000 to determine whether this is the optimum "farm" sampling scale; (2) the use of the point canopy intercept method at small scales (*eg.* 1:50 000 & 1:250 000) for the classification of vegetation since it is the author's opinion that, at small scales, this method will be more cost effective than an area-based method and the classification efficacy of the point canopy intercept method would improve with a larger sample size at small scales; and (3) testing the accuracy of the PCIM to measure species cover and the precision of the PCIM at various sample sizes.

CHAPTER 7

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APPENDIX A

Location, direction of line, date sampled and vegetation unit for the stands sampled on the Roodeplaat Experimental Farm.

Stand number	Precise locality (Degrees, minutes & seconds)		Magnetic compass bearing (degrees)	Date sampled	Vegetation unit no.
1	25 34 23 S	28 21 44 E	115	93.02.03	1
2	25 32 59 S	28 21 44 E	295	93.02.08	1
3	25 34 48 S	28 22 22 E	350	93.02.10	1
4	25 34 35 S	28 22 17 E	350	93.02.11	1
5	25 33 56 S	28 22 33 E	135	93.02.12	1
6	25 35 07 S	28 21 03 E	150	93.02.15	1
7	25 35 25 S	28 21 16 E	360	93.02.15	1
8	25 35 15 S	28 21 38 E	190	93.02.16	1
9	25 35 30 S	28 21 21 E	330	93.02.16	1
10	25 35 23 S	28 21 55 E	068	93.02.19	1
11	25 35 37 S	28 22 23 E	095	93.02.22	1
12	25 35 32 S	28 22 47 E	240	93.02.22	1
13	25 34 47 S	28 22 49 E	230	93.02.16	1
14	25 34 22 S	28 23 11 E	300	93.02.18	1
15	25 34 30 S	28 23 40 E	335	93.02.18	1
16	25 34 51 S	28 23 23 E	320	93.02.19	1
17	25 33 53 S	28 21 33 E	260	93.02.22	2
18	25 33 26 S	28 21 53 E	262	93.02.23	2
19	25 33 38 S	28 22 04 E	295	93.02.23	2
20	25 33 40 S	28 21 32 E	351	93.02.25	2
21	25 33 53 S	28 21 54 E	340	93.02.25	2
22	25 34 05 S	28 21 58 E	315	93.02.25	2
23	25 34 27 S	28 21 36 E	288	93.02.26	2
24	25 34 23 S	28 29 59 E	320	93.02.26	2
25	25 33 50 S	28 22 25 E	200	93.03.03	2
26	25 34 14 S	28 23 30 E	320	93.03.03	2
27	25 34 32 S	28 23 26 E	335	93.03.04	2
28	25 33 58 S	28 22 13 E	335	93.03.04	3
29	25 34 09 S	28 22 14 E	290	93.03.04	3
30	25 34 08 S	28 22 30 E	298	93.03.05	3
31	25 34 21 S	28 22 23 E	237	93.03.05	3
32	25 34 16 S	28 21 19 E	190	93.03.08	4
33	25 34 43 S	28 21 21 E	055	93.03.08	4
34	25 35 04 S	28 21 51 E	045	93.03.08	4
35	25 34 51 S	28 22 19 E	025	93.03.09	4
36	25 35 17 S	28 22 33 E	072	93.03.09	4
37	25 34 39 S	28 22 43 E	040	93.03.10	4
38	25 34 02 S	28 22 47 E	182	93.03.10	4
39	25 34 41 S	28 22 55 E	145	93.03.10	4
40	25 35 02 S	28 23 07 E	144	93.03.11	4
41	25 34 33 S	28 23 55 E	199	93.03.11	4
42	25 34 43 S	28 21 17 E	240	93.03.11	5
43	25 34 18 S	28 21 34 E	080	93.03.12	5
44	25 34 25 S	28 22 16 E	150	93.03.12	5
45	25 34 30 S	28 22 34 E	211	93.03.15	5
46	25 34 53 S	28 21 33 E	063	93.03.15	5
47	25 33 51 S	28 21 24 E	280	93.03.16	5
48	25 33 30 S	28 21 33 E	345	93.03.16	5
49	25 33 40 S	28 21 53 E	007	93.03.16	5
50	25 34 41 S	28 20 59 E	037	93.03.18	6
51	25 34 58 S	28 21 11 E	286	93.03.18	6
52	25 35 19 S	28 21 29 E	178	93.03.18	6
53	25 35 38 S	28 21 31 E	160	93.03.19	6
54	25 35 28 S	28 22 09 E	245	93.03.19	6
55	25 34 39 S	28 23 14 E	320	93.03.31	2
56	25 35 57 S	28 20 11 E	354	93.03.31	7
57	25 35 45 S	28 20 22 E	305	93.04.01	7
58	25 36 28 S	28 20 37 E	007	93.04.01	7
59	25 36 09 S	28 20 21 E	015	93.04.01	7
60	25 36 14 S	28 19 56 E	345	93.04.02	8
61	25 36 36 S	28 20 00 E	205	93.04.05	8
62	25 36 37 S	28 20 31 E	338	93.04.02	8
63	25 36 44 S	28 20 33 E	300	93.04.07	8
64	25 36 48 S	28 20 58 E	293	93.04.02	8
65	25 36 18 S	28 19 32 E	337	93.04.07	9
66	25 36 30 S	28 19 41 E	331	93.04.08	9
67	25 36 33 S	28 19 52 E	330	93.04.08	9
68	25 36 33 S	28 19 54 E	340	93.04.14	9
69	25 36 29 S	28 19 20 E	151	93.04.14	10
70	25 36 30 S	28 19 39 E	327	93.04.14	10
71	25 36 40 S	28 19 55 E	335	93.04.15	10
72	25 36 43 S	28 20 13 E	330	93.04.15	10
73	25 36 48 S	28 20 29 E	320	93.04.15	10
74	25 36 49 S	28 21 04 E	320	93.04.16	10
75	25 36 39 S	28 21 27 E	157	93.04.16	8

The starting position and distance travelled along each compass bearing during the 7.752 km continuous transect.

Precise locality (Degrees, minutes & seconds)		Magnetic compass bearing (degrees)	Distance (metres)
25 34 32 S	28 19 13 E	075	200
25 36 27 S	28 19 18 E	086	50
25 36 26 S	28 19 20 E	117	100
25 36 26 S	28 19 14 E	109	50
25 36 26 S	28 19 26 E	101	100
25 36 25 S	28 19 27 E	083	50
25 36 26 S	28 19 29 E	085	50
25 36 22 S	28 19 34 E	099	100
25 36 22 S	28 19 38 E	039	100
25 36 18 S	28 19 36 E	032	150
25 36 15 S	28 19 35 E	070	50
25 36 13 S	28 19 36 E	020	50
25 36 12 S	28 19 36 E	048	50
25 36 10 S	28 19 38 E	068	600
25 35 58 S	28 19 54 E	090	50
25 35 58 S	28 19 15 E	085	200
25 35 57 S	28 20 00 E	105	350
25 35 54 S	28 20 15 E	085	100
25 35 50 S	28 20 18 E	055	100
25 35 51 S	28 20 20 E	092	100
25 35 49 S	28 20 25 E	083	350
25 35 17 S	28 21 12 E	096	300
25 35 16 S	28 21 24 E	119	150
25 35 14 S	28 21 29 E	070	50
25 35 15 S	28 21 30 E	090	100
25 35 12 S	28 21 33 E	077	150
25 35 09 S	28 21 38 E	070	1100
25 34 51 S	28 22 11 E	090	100
25 34 49 S	28 22 13 E	062	150
25 34 46 S	28 22 17 E	122	100
25 34 45 S	28 22 21 E	088	300
25 34 42 S	28 22 31 E	070	100
25 34 41 S	28 22 34 E	095	150
25 34 39 S	28 22 40 E	082	400
25 34 33 S	28 22 55 E	083	250
25 34 32 S	28 22 59 E	066	1402
25 34 04 S	28 23 41 E	Final position	7752 pts

APPENDIX B

SPECIES CHECKLIST FOR THE FARM ROODEPLAAT 293JR

The genera listed alphabetically below are the plants collected during the sampling of the farm Roodeplaat 293JR during the growing seasons of 1993 and 1994. The checklist is not a complete list of all the genera occurring on the farm since, by the very nature of sampling, species will have been missed.

The checklist is arranged as follows:

1) genus and species (where possible - sometimes only genus);
2) the species author (both i. and ii. were obtained from the National Herbarium, Private Bag X101, Pretoria);
3) the specimen number (Nos. 1284 - 1696 were collected by JM Van Staden and Nos. 196 - 414 were collected by MD Panagos);
4) the growth form for each species following Westfall's (1992) definitions derived from Edwards (1983) and Rutherford & Westfall (1986); and
5) the constancy with which the species occurred throughout the study area for each of the methods where A = QM, B = PCIM and C = continuous transect.

Abrus laevigatus E. Mey. 1683 dwarf shrub (A=1, B=0, C=0)
Abutilon grandifolium (Willd.) Sweet 1542 forb (A=16, B=1, C=0)
Acacia caffra (Thunb.) Willd. 1486 291 tree (A=27, B=11, C=108)
Acacia karroo Hayne 1564 1342 236 tree (A=28, B=11, C=173)
Acacia mellifera (Vahl) Benth. subsp.*mellifera* 1613 tree (A=1, B=1, C=0)
Acacia nilotica (L.) Willd. ex Del. subsp.*kraussiana* (Benth.) Brenan 1577 238 tree (A=19, B=7, C=287)
Acacia robusta Burch. subsp. *robusta* 1350 245 tree (A=25, B=8, C=130)
Acacia tortilis (Forssk.) Hayne subsp.*heteracantha* (Burch.) Brenan 1370 234 tree (A=39, B=5, C=367)
Acalypha angustata Sond. var. *glabra* Sond. 1520 404 dwarf shrub (A=3, B=1, C=9)
Acalypha segetalis Muell. Arg. 1402 forb (A=11, B=1, C=0)
Acalypha villicaulis Hochst. 1600 367 forb (A=4, B=1, C=2)
Achyranthes aspera L. var. *aspera* 1655 forb (A=5, B=1, C=0)
Achyranthes aspera L. var. *sicula* L. 1562 forb (A=7, B=1, C=0)
Achyropsis leptostachya (E. Mey. ex Meisn.) Bak. & C.B. Cl. 1349 376 dwarf shrub (A=12, B=1, C=4)
Adenia digitata (Harv.) Engl. 1639 forb (A=1, B=0, C=0)
Agathisanthemum bojeri Klotzsch subsp. *bojeri* 1497 1477 dwarf shrub (A=7, B=1, C=0)
Alloteropsis semialata (R. Br.) Hitchc. subsp. *eckloniana* (Nees) Gibbs Russell 1401 grass (A=10, B=0, C=0)
Aloe greatheadii Schonl. var. *davyana* (Schonl.) Glen & Hardy 1317 dwarf shrub (A=72, B=56, C=311)
Alternanthera pungens H.B.K. 304 forb (A=0, B=0, C=1)
Amaranthus thunbergii Moq. 1551 forb (A=7, B=0, C=0)
Andropogon chinensis (Nees) Merr. 1646 grass (A=1, B=1, C=0)
Anthephora pubescens Nees 1288 402 grass (A=19, B=8, C=9)
Anthericum cooperi Bak. 1355 forb (A=19, B=3, C=0)
Anthericum longistylum Bak. 1379 forb (A=20, B=8, C=0)
Anthospermum galioides Reichb. f. subsp. *reflexifolium* (Kuntze) Puff 1672 forb (A=1, B=0, C=0)
Anthospermum rigidum Eckl. & Zeyh. subsp. *pumilum* (Sond.) Puff 1384 261 forb (A=14, B=1, C=1)
Aptosimum indivisum Burch. ex Benth. 1660 forb (A=1, B=0, C=0)
Aristida adscensionis L. 1513 332 grass (A=1, B=0, C=26)
Aristida bipartita (Nees) Trin. & Rupr. 1488 grass (A=14, B=2, C=0)
Aristida canescens Henr. subsp. *canescens* 1354 1285 226 grass (A=60, B=33, C=82)

Aristida congesta Roem. & Schult. subsp. *congesta* 1493 1300 grass (A=62, B=35 C=0)
Aristida congesta Roem. & Schult. subsp. *barbicollis* (Trin. & Rupr.) de Winter 232 239 grass (A=0, B=0, C=195)
Aristida diffusa Trin. subsp. *burkei* (Stapf) Meld. 1517 grass (A=10, B=1, C=0)
Aristida junciformis Trin. & Rupr. subsp. *junciformis* 253 grass (A=0, B=0, C=33)
Aristida scabrivalvis Hack. subsp. *contracta* (De Winter) Meld. 282 grass (A=0, B=0, C=37)
Aristida scabrivalvis Hack. subsp. *scabrivalvis* 1474 grass (A=22, B=2, C=0)
Asclepias burchellii Schltr. 1601 forb (A=1, B=0, C=0)
Asclepias glaucophylla (Schltr.) Schltr. 1651 shrub (A=1, B=0, C=0)
Asclepias stellifera Schltr. 1332 forb (A=4, B= 0, C=0)
Barleria macrostegia Nees 1629 1621 forb (A=2, B=1, C=0)
Becium grandiflorum (Lam.) Pichi-Serm. var. *galpinii* (Guerke) Sebald 1323 forb (A=27, B=14, C=0)
Becium grandiflorum (Lam.) Pichi-Serm. var. *obovatum* (E. Mey. ex Benth.) Sebald 255 forb (A=0, B=0, C=12)
Berchemia zeyheri (Sond.) Grubov 1571 369 shrub, tree (A=9, B=1, C=12)
Bergia decumbens Planch. ex Harv. 1365 forb (A=5, B=0, C=0)
Berkheya radula (Harv.) De Wild. 1444 221 forb (A=5, B=2, C=15)
Bewsia biflora (Hack.) Goossens 1374 212 grass (A=7, B=0, C=3)
Bidens bipinnata L. 1434 202 forb (A=36, B=5, C=176)
Boophane disticha (L.f.) Herb. 1568 forb (A=3, B=0, C=0)
Bothriochloa bladhii (Retz.) S.T. Blake 1475 grass (A=3, B=1, C=0)
Bothriochloa insculpta (A. Rich.) A. Camus 1487 242 grass (A=12, B=5, C=134)
Brachiaria brizantha (A. Rich.) Stapf 164 grass (A=1, B=0, C=0)
Brachiaria eruciformis (J.E. Sm.) Griseb. 1565 331 grass (A=6, B=2, C=29)
Brachiaria nigropedata (Fical. & Hiern) Stapf 1319 322 grass (A=11, B=1, C=15)
Brachiaria serrata (Thunb.) Stapf 1294 264 grass (A=33, B=16, C=14)
Bulbostylis burchellii (Fical. & Hiern) C. B. Cl. 271 grass (A=0, B=0, C=20)
Bulbostylis contexta (Nees) Bodard 1377 199 grass (A=22, B=11, C=6)
Carissa bispinosa (L.) Desf. ex Brenan subsp. *bispinosa* 1530 347 dwarf shrub (A=10, B=1, C=4)
Cassine aethiopica Thunb. 1540 shrub (A=5, B=0, C=0)
Celtis africana Burm. f. 1647 tree (A=3, B=0, C=0)
Ceropegia sp. 1623 1612 forb (A=4, B=0, C=0)
Ceropegia racemosa N.E. Br. subsp. *setifera* (Schltr.) Huber 1652 forb (A=2, B=0, C=0)
Chaetacanthus costatus Nees 1447 252 forb (A=28, B=6, C=1)
Chamaecrista biensis (Steyaert) Lock 1301 forb (A=24, B=6, C=0)
Chamaecrista mimosoides (L.) Greene 352 forb (A=0, B=0, C=1)
Chamaecrista stricta E. Mey. 274 forb (A=0, B=0, C=7)
Chamaesyce inaequilatera (Sond.) Sojak 1345 forb (A=26, B=7, C=0)
Cheilanthes viridis (Forssk.) Swartz var. *viridis* 1471 forb (A=6, B=1, C=0)
Chenopodium album L. 1624 1523 303 forb (A=9, B=3, C=2)
Chloris virgata Swartz 288 grass (A=0, B=0, C=10)
Chrysanthemoides monilifera (L.) T. Norl. subsp. *canescens* (DC.) T. Norl. 1586 dwarf shrub (A=2, B=0, C=0)
Clematis brachiata Thunb. 1529 340 forb (A=10, B=1, C=9)
Cleome monophylla L. 1408 forb (A=17, B=2, C=0)
Cleome rubella Burch. 1522 forb (A=4, B=0, C=0)
Clerodendrum sp. 280 forb (A=0, B=0, C=3)
Clerodendrum triphyllum (Harv.) H. Pearson var. *triphyllum* 1372 forb (A=17, B=7, C=0)
Combretum apiculatum Sond. subsp. *apiculatum* 1591 310 tree (A=4, B=1, C=2)
Combretum imberbe Waura 306 tree (A=0, B=0, C=2)
Combretum molle R. Br. ex G. Don 1675 1537 305 323 shrub, tree (A=12, B=2, C=74)
Commelina africana L. var. *africana* 1329 forb (A=28, B=10, C=0)

Commelina africana L. var. *krebsiana* (Kunth) C.B. Cl. 1443 378 forb (A=14, B=2, C=2)
Commelina erecta L. 1516 337 forb (A=11, B=0, C=9)
Convolvulus sagittatus Thunb. subsp. *sagittatus* var. *hirtellus* (Hallier f.) A Meeuse 1453 forb (A=17, B=1, C=0)
Convolvulus sagittatus Thunb. var. *aschersonii* (Engl.) Verdc. 1556 forb (A=4, B=2, C=0)
Conyza albida Spreng. 1468 1433 forb (A=1, B=1, C=0)
Corbichonia decumbens (Forssk.) Exell 1602 1405 forb (A=12, B=1, C=0)
Corbichonia rubriviolacea (Friedr.) Jeffrey 368 forb (A=0, B=0, C=2)
Corchorus asplenifolius Burch. 1439 forb (A=20, B=2, C=0)
Crabbea angustifolia Nees 1325 364 forb (A=32, B=1, C=1)
Crabbea hirsuta Harv. 349 forb (A=0, B=0, C=2)
Crotalaria brachycarpa (Benth.) Burtt Davy ex Verdoorn 1403 forb (A=3, B=1, C=0)
Crotalaria lotoides Benth. 1469 dwarf shrub (A=1, B=0, C=0)
Crotalaria sphaerocarpa Perr. ex DC. subsp. *sphaerocarpa* 1491 forb (A=3, B=0, C=0)
Cryptolepis oblongifolia (Meisn.) Schltr. 1682 shrub (A=1, B=0, C=0)
Cucumis sp. 384 forb (A=0, B=0, C=3)
Cucumis zeyheri Sond. 1625 1376 forb (A=21, B=0, C=0)
Cymbopogon excavatus (Hochst.) Stapf ex Burtt Davy 1456 1407 217 380 grass (A=15, B=5, C=19)
Cymbopogon plurinodis (Stapf) Stapf ex Burtt Davy 1299 328 grass (A=15, B=6, C=24)
Cynodon dactylon (L.) Pers. 1347 244 grass (A=19, B=7, C=53)
Cyperus obtusiflorus Vahl var. *obtusiflorus* 1314 220 grass (A=9, B=3, C=1)
Cyperus rubicundus Vahl 1546 grass (A=1, B=1, C=0)
Cyperus semitrifidus Schrad. var. *multiglumis* (Turrill) Kuekenth. 1485 grass (A=2, B=0, C=0)
Cyperus sphaerospermus Schrad. 1525 grass (A=1, B=0, C=0)
Cyphostemma lanigerum (Harv.) Descoings ex Wild & Drum. 1610 forb (A=3, B=0, C=0)
Dactyloctenium aegyptium (L.) Willd. 1559 416 grass (A=1, B=0, C=2)
Datura stramonium L. 1492 forb (A=2, B=0, C=0)
Dicerocaryum eriocarpum (Decne) Abels 1348 forb (A=7, B=1, C=0)
Dichrostachys cinerea (L.) Wight & Arn. subsp. *africana* Brenan & Brumm. var. *africana* 1631 278 shrub, tree (A=5, B=1, C=14)
Dicoma anomala Sond. subsp. *anomala* 1570 1438 1318 dwarf shrub (A=43, B=6, C=0)
Dicoma gerrardii Harv ex Wilson 284 forb (A=0, B=0, C=2)
Dicoma zeyheri Sond. 1576 forb (A=2, B=0, C=0)
Digitaria argyrograpta (Nees) Stapf 1555 1399 394 grass (A=2, B=0, C=1)
Digitaria eriantha Steud. 1346 230 grass (A=35, B=25, C=484)
Digitaria monodactyla (Nees) Stapf 1512 grass (A=2, B=1, C=0)
Digitaria ternata (A. Rich.) Stapf 382 grass (A=0, B=0, C=1)
Diheteropogon amplectens (Nees) Clayton 1290 205 grass (A=36, B=21, C=86)
Diheteropogon filifolius (Nees) Clayton 1442 307 grass (A=13, B=1, C=18)
Diospyros lycioides Desf. subsp. *lyciodes* 302 411 dwarf shrub, shrub (A=0, B=0, C=13)
Diospyros lycioides Desf. subsp. *sericea* (Bernh.) de Winter 1585 dwarf shrub (A=4, B=0, C=0)
Dipcadi viride (L.) Moench 1464 forb (A=8, B=1, C=0)
Dodonaea sp. 1645 dwarf shrub (A=1, B=1, C=0)
Dombeya rotundifolia (Hochst.) Planch. var. *rotundifolia* 1598 308 tree (A=17, B=4, C=39)
Dovyalis rhamnoides (Burch. ex DC.) Harv. 1592 dwarf shrub (A=3, B=0, C=0)
Ehretia rigida (Thunb.) Druce 1654 1545 1519 318 shrub, tree (A=32, B=5, C=86)
Elephantorrhiza elephantina (Burch.) Skeels 1391 406 dwarf shrub (A=10, B=5, C=27)
Elionurus muticus (Spreng.) Kunth 1287 241 377 grass (A=40, B=29, C=263)

Emilia transvaalensis (H. Bol.) C. Jeffrey 1681 398 forb (A=1, B=0, C=1)
Enneapogon cenchroides (Roem. & Schult.) C.E. Hubb. 1637 292 grass (A=9, B=1, C=15)
Enneapogon scoparius Stapf 1521 301 grass (A=16, B=7, C=29)
Eragrostis capensis (Thunb.) Trin. 1478 grass (A=1, B=0, C=0)
Eragrostis chloromelas Steud. 1597 1508 1296 338 grass (A=56, B=28, C=2)
Eragrostis cilianensis (All.) F.T. Hubb. 1632 1599 grass (A=1, B=0, C=0)
Eragrostis curvula (Schrad.) Nees 227 359 410 grass (A=0, B=0, C=268)
Eragrostis gummiflua Nees 1284 215 grass (A=40, B=18, C=185)
Eragrostis nindensis Fical. & Hiern 1400 grass (A=3, B=1, C=0)
Eragrostis obtusa Munro ex Fical. & Hiern 1587 grass (A=1, B=0, C=0)
Eragrostis plana Nees 1658 361 grass (A=1, B=0, C=2)
Eragrostis pseudosclerantha Chiov. 1515 grass (A=10, B=1, C=0)
Eragrostis racemosa (Thunb.) Steud. 1292 249 grass (A=19, B=4, C=3)
Eragrostis rigidior Pilg. 1482 343 grass (A=18, B=1, C=13)
Eragrostis superba Peyr. 1286 409 grass (A=15, B=1, C=5)
Eragrostis trichophora Coss. & Dur. 1357 342 grass (A=13, B=4, C=8)
Eriochloa fatmensis (Hochst. & Steud.) Clayton 333 grass (A=0, B=0, C=2)
Eriosema burkei Benth. 1390 405 forb (A=5, B=0, C=1)
Eriospermum abyssinicum Bak. 1544 forb (A=4, B=0, C=0)
Eriospermum cooperi Bak. 1609 forb (A=1, B=0, C=0)
Euclea undulata Thunb. var. *myrtina* (Burch.) Hiern 1343 315 dwarf shrub, shrub (A=26, B=5, C=14)
Eustachys paspaloides (Vahl) Lanza & Mattei 1427 228 grass (A=10, B=2, C=2)
Evolvulus alsinoides (L.) L. var. *linifolius* (L.) Bak. 1313 275 forb (A=31, B=3, C=6)
Felicia mossamedensis (Hiern) Mendonca 1553 1547 forb (A=4, B=0, C=0)
Felicia muricata (Thunb.) Nees subsp. *cinerascens* Grau 1368 320 forb (A=21, B=4, C=2)
Felicia muricata (Thunb.) Nees subsp. *muricata* 1310 forb (A=1, B=0, C=0)
Fingerhuthia africana Lehm. 1566 grass (A=1, B=0, C=0)
Fuirena hirsuta (Berg.) P.L. Forbes 1470 grass (A=1, B=0, C=0)
Fuirena pubescens (Poir.) Kunth 356 grass (A=0, B=0, C=9)
Gazania krebsiana Less. subsp. *krebsiana* 1514 279 forb (A=12, B=1, C=2)
Geigeria burkei Harv. subsp. *burkei* var. *burkei* 1307 266 forb (A=23, B=1, C=2)
Gerbera sp. 1476 forb (A=5, B=1, C=0)
Gerbera viridifolia (DC.) Sch. Bip. subsp. *viridifolia* 1589 dwarf shrub (A=2, B=1, C=0)
Gladiolus permeabilis Delaroche subsp. *permeabilis* 1382 forb (A=16, B=0, C=0)
Gnidia capitata L. f. 1326 408 forb (A=14, B=1, C=5)
Gnidia sericocephala (Meisn.) Gilg ex Engl. 1605 forb (A=7, B=0, C=0)
Gomphrena celosioides Mart. 1395 375 forb (A=13, B=1, C=1)
Graderia subintegra Mast. 1335 263 forb (A=4, B=1, C=3)
Grewia flava DC. 1533 319 330 shrub (A=26, B=3, C=18)
Grewia flavescens Juss. var. *flavescens* 1590 shrub (A=2, B=0, C=0)
Guilleminea densa (Willd.) Moq. 1561 forb (A=1, B=0, C=0)
Habenaria epipactidea Reichb. f. 1608 forb (A=9, B=0, C=0)
Helichrysum athrixiifolium (Kuntze) Moeser 1412 287 387 dwarf shrub (A=1, B=0, C=19)
Helichrysum sp.1465 forb (A=2, B=0, C=0)
Helichrysum coriaceum Harv. 222 forb (A=0, B=0, C=4)
Helichrysum harveyanum Wild 286 forb (A=0, B=0, C=1)
Helichrysum nudifolium (L.) Less. 1328 385 forb (A=19, B=5, C=7)
Helichrysum oxyphyllum DC. 1306 forb (A=9, B=2, C=0)
Helichrysum pilosellum (L. f.) Less. 1662 forb (A=2, B=0, C=0)
Helichrysum rugulosum Less. 1446 forb (A=21, B=5, C=0)
Heliotropium strigosum Willd. 1581 forb (A=4, B=3, C=0)
Hermannia depressa N.E. Br. 1367 201 forb (A=17, B=4, C=14)
Hermannia parvula Burtt Davy 1671 forb (A=7, B=3, C=0)
Heteropogon contortus (L.) Roem. & Schult. 1321 206 grass (A=66, B=44, C=397)

Hibiscus calyphyllus Cav. 1667 327 forb (A=1, B=0, C=1)
Hibiscus cannabinus L. 1634 forb (A=1, B=0, C=0)
Hibiscus malacospermus (Turcz.) E. Mey. ex Harv. 1541 forb (A=1, B=0, C=0)
Hibiscus microcarpus Garcke 289 forb (A=0, B=0, C=1)
Hibiscus pusillus Thunb. 1500 1452 1359 277 forb (A=50, B=14, C=13)
Hibiscus trionum L. 1435 forb (A=25, B=5, C=0)
Hyparrhenia filipendula (Hochst.) Stapf var. *pilosa* (Hochst.) Stapf 1633 1472 1362 297 grass (A=19, B=1, C=2)
Hypericum lalandii Choisy 219 dwarf shrub (A=0, B=0, C=1)
Hyperthelia dissoluta (Nees ex Steud.) Clayton 1410 326 grass (A=3, B=1, C=14)
Hypoxis argentea Harv. ex Bak. var. *argentea* 1327 forb (A=21, B=11, C=0)
Hypoxis hemerocallidea Fisch. & Mey. 1336 395 forb (A=11, B=2, C=1)
Hypoxis rigidula Bak. var. *rigidula* 1572 forb (A=3, B=1, C=0)
Indigofera cryptantha Benth. ex Harv. var. *cryptantha* 341 forb (A=0, B=0, C=1)
Indigofera daleoides Benth. ex Harv. var. *daleoides* 1635 250 276 forb (A=2, B=1, C=20)
Indigofera filipes Benth. ex Harv. 309 forb (A=0, B=0, C=2)
Indigofera hedyantha Eckl. & Zeyh. 223 forb (A=0, B=0, C=2)
Indigofera heterotricha DC. 1364 365 dwarf shrub (A=18, B=4, C=2)
Indigofera parviflora Heyne ex Wight & Arn. var. *parviflora* 1481 dwarf shrub (A=13, B=1, C=0)
Indigofera rhytidocarpa Benth. ex Harv. subsp. *rhytidocarpa* 1330 391 forb (A=48, B=30, C=1)
Indigofera sp. 1422 dwarf shrub (A=1, B=0, C=0)
Indigofera vicioides Jaub. & Spach var. *vicioides* 1489 forb (A=2, B=1, C=0)
Ipomoea bathycolpos Hallier f. var. *bathycolpos* 1563 forb (A=3, B=1, C=0)
Ipomoea bolusiana Schinz subsp. *bolusiana* 1458 forb (A=11, B=4, C=0)
Ipomoea cairica (L.) Sweet 1490 forb (A=1, B=0, C=0)
Ipomoea coscinosperma Hochst. ex Choisy 1657 forb (A=2, B=0, C=0)
Ipomoea hochstetteri House 1616 forb (A=4, B=0, C=0)
Ipomoea obscura (L.) Ker-Gawl. var. *obscura* 1414 407 forb (A=13, B=1, C=2)
Ipomoea papilio Hallier f. 1567 forb (A=1, B=0, C=0)
Ipomoea sp. 257 forb (A=0, B=0, C=2)
Justicia anagalloides (Nees) T. Anders. 1360 211 forb (A=21, B=7, C=61)
Justicia betonica L. 1358 362 dwarf shrub (A=9, B=2, C=9)
Justicia flava (Vahl) Vahl 1528 1409 329 dwarf shrub (A=11, B=3, C=1)
Kalanchoe rotundifolia (Haw.) Haw. 1535 forb (A=8, B=0, C=0)
Kedrostis foetidissima (Jacq.) Cogn. 1622 forb (A=7, B=0, C=0)
Kohautia amatymbica Eckl. & Zeyh. 1334 1501 forb (A=12, B=1, C=0)
Kohautia virgata (Willd.) Brem. 247 forb (A=0, B=0, C=37)
Kyllinga alba Nees 1339 383 grass (A=8, B=0, C=1)
Kyllinga erecta Schumach. 1473 grass (A=6, B=2, C=0)
Kyphocarpa angustifolia (Moq.) Lopr. 1322 forb (A=12, B=1, C=0)
Lactuca capensis Thunb. 1378 forb (A=3, B=0, C=0)
Lantana rugosa Thunb. 1392 265 dwarf shrub (A=46, B=4, C=13)
Ledebouria sp. 1511 forb (A=6, B=0, C=0)
Ledebouria sp. 1509 forb (A=4, B=0, C=0)
Ledebouria sp. 1356 forb (A=20, B=8, C=0)
Ledebouria sp. 396 forb (A=0, B=0, C=3)
Lepidium africanum (Burm. f.) DC. subsp. *africanum* 1684 forb (A=1, B=0, C=0)
Leucas martinicensis (Jacq.) R. Br. 403 forb (A=0, B=0, C=2)
Lippia rehmanii H. Pearson 248 dwarf shrub (A=0, B=0, C=18)
Lippia scaberrima Sond. 1375 dwarf shrub (A=23, B=7, C=0)
Lithospermum flexuosum Lehm. 1315 forb (A=26, B=6, C=0)
Lotononis calycina (E.Mey.) Benth. 267 forb (A=0, B=0, C=5)
Lotononis listii Polhill 1333 forb (A=16, B=6, C=0)
Lotononis sp. 390 forb (A=0, B=0, C=1)
Loudetia flavida (Stapf) C.E. Hubb. 1291 204 grass (A=39, B=30, C=71)
Lycium cinereum Thunb. (*sens. lat.*) 1615 dwarf shrub (A=2, B=1, C=0)

Litogyne gariepina (DC.) A. Anderb. 246 forb (A=0, B=0, C=7)
Manulea sp 1460 forb (A=1, B=0, C=0)
Mariscus albomarginatus C.B. Cl. 1484 grass (A=5, B=0, C=0)
Mariscus rehmannianus C.B. Cl. 1498 1383 grass (A=15, B=1, C=0)
Mariscus uitenhagensis Steud. 1397 grass (A=3, B=0, C=0)
Maytenus heterophylla (Eckl. & Zeyh.) N.K.B. Robson 1430 1387 314 shrub (A=30, B=4, C=25)
Maytenus tenuispina (Sond.) Marais 1670 321 dwarf shrub, shrub (A=2, B=0, C=11)
Melhania prostrata DC. 1421 313 dwarf shrub (A=20, B=0, C=15)
Melia azedarach L. 1648 tree (A=1, B=0, C=0)
Melinis nerviglumis (Franch.) Zizka 1441 213 400 grass (A=23, B=8, C=7)
Melinis repens (Willd.) Zizka subsp. *grandiflora* (Hochst.) Zizka 1289 209 grass (A=65, B=41, C=395)
Menodora africana Hook. 1450 forb (A=17, B=1, C=0)
Merremia palmata Hallier f. 1454 forb (A=7, B=1, C=0)
Merremia tridentata (L.) Hallier f. subsp. *angustifolia* (Jacq.) van Ooststr. var. *angustifolia* 1413 262 forb (A=14, B=5, C=4)
Microchloa caffra Nees 1320 363 grass (A=28, B=9, C=66)
Momordica balsamina L. 1638 forb (A=2, B=0 C=0)
Monsonia angustifolia E. Mey. ex A. Rich. 1303 240 360 forb (A=51, B=23, C=25)
Mundulea sericea (Willd.) A. Chev. 1467 258 dwarf shrub, shrub (A=7, B=0, C=8)
Nesaea rigidula (Sond.) Koehne 1506 forb (A=1, B=0, C=0)
Nidorella hottentotica DC. 1308 forb (A=8, B=0, C=0)
Nidorella resedifolia DC. subsp. *resedifolia* 235 237 forb (A=0, B=0, C=3)
Nolletia rarifolia (Turcz.) Steetz 1678 forb (A=2, B=0, C=0)
Ocimum canum Sims 351 forb (A=0, B=0, C=2)
Ocimum urticifolium Roth subsp. *urticifolium* 1620 forb (A=2, B=0, C=0)
Oldenlandia herbacea (L.) Roxb. var. *herbacea* 1331 forb (A=46, B=23, C=0)
Orbeopsis lutea (N.E. Br.) Leach subsp. *lutea* 1552 forb (A=7, B=0, C=0)
Ornithogalum tenuifolium Delaroche subsp. *tenuifolium* 1340 forb (A=12, B=0, C=0)
Oxalis sp. 1549 1337 forb (A=15, B=3, C=0)
Ozoroa sphaerocarpa R. & A. Fernandes 1641 373 tree (A=2, B=0, C=2)
Pachycarpus concolor E. Mey. 1526 forb (A=2, B=0, C=0)
Panicum coloratum L. var. *coloratum* 1554 339 grass (A=3, B=1, C=66)
Panicum maximum Jacq. 1406 1352 216 grass (A=37, B=12, C=216)
Panicum volutans J.G. Anders. 1642 grass (A=2, B=0, C=0)
Pappea capensis Eckl. & Zeyh. 1650 1431 317 tree (A=14, B=1, C=2)
Pavetta gardeniifolia A. Rich. var. *gardeniifolia* 1596 316 shrub (A=10, B=1, C=2)
Pavetta zeyheri Sond. 1665 shrub (A=1, B=0, C=0)
Pearsonia sessilifolia (Harv.) Duemmer subsp. *marginata* (Schinz) Polhill 1404 forb (A=6, B=2, C=0)
Pearsonia sessilifolia (Harv.) Duemmer subsp. *sessilifolia* 259 forb (A=0, B=0, C=3)
Pelargonium luridum (Andr.) Sweet 1580 forb (A=1, B=0, C=0)
Pellaea calomelanos (Swartz) Link var. *calomelanos* 1386 325 forb (A=21, B=2, C=1)
Pennisetum sphacelatum (Nees) Dur. & Schinz 1644 grass (A=2, B=1, C=0)
Pentarrhinum insipidum E. Mey. 1393 203 forb (A=33, B=7, C=16)
Pentzia lanata Hutch. 1618 dwarf shrub (A=1, B=0, C=0)
Perotis patens Gand 414 grass (A=0, B=0, C=1)
Phyllanthus humilis Pax 1429 forb (A=15, B=3, C=0)
Phyllanthus incurvus Thunb. 1679 374 forb (A=2, B=0, C=1)
Phyllanthus maderaspatensis L. 1338 295 forb (A=39, B=12, C=8)
Physalis angulata L. 1584 forb (A=1, B=0, C=0)
Piriqueta capensis (Harv.) Urb. 1604 dwarf shrub (A=4, B=0, C=0)
Plectranthus neochilus Schltr. 1630 forb (A=1, B=0, C=0)
Plexipus hederaceus (Sond.) R. Fernandes var. *hederaceus* 1304 268 forb (A=39,

B=8, C=3)
Pogonarthria squarrosa (Roem. & Schult.) Pilg. 1495 415 grass (A=6, B=0, C=2)
Pollichia campestris Ait. 1550 dwarf shrub (A=13, B=3, C=0)
Polycarpaea corymbosa (L.) Lam. 1680 forb (A=1, B=0, C=0)
Polygala amatymbica Eckl. & Zeyh. 1366 dwarf shrub (A=17, B=2, C=0)
Polygala hottentotta Presl 1436 dwarf shrub (A=12, B=0, C=0)
Polygala sp. 1575 forb (A=1, B=0, C=0)
Portulaca oleracea L. 1311 forb (A=6, B=0, C=0)
Protasparagus setaceus (Kunth) Oberm. 1656 dwarf shrub (A=4, B=1, C=0)
Protasparagus suaveolens (Burch.) Oberm. 1309 300 dwarf shrub (A=57, B=10, C=63)
Ptycholobium plicatum (Oliv.) Harms 1351 dwarf shrub (A=9, B=4, C=0)
Raphionacme hirsuta (E. Mey.) R.A. Dyer ex Phill. 1398 401 forb (A=11, B=1, C=3)
Rhoicissus tridentata (L. f.) Wild & Drum. subsp. *cuneifolia* (Eckl. & Zeyh.) R. Urton 1538 372 dwarf shrub (A=3, B=1, C=2)
Rhus gracillima Engl. 1385 399 dwarf shrub (A=8, B=1, C=1)
Rhus lancea L. f. 1394 298 shrub, tree (A=23, B=1, C=24)
Rhus leptodictya Diels 1316 294 shrub, tree (A=39, B=6, C=50)
Rhus pyroides Burch. var. *gracilis* (Engl.) Burtt Davy 1664 1558 336 shrub (A=9, B=0, C=29)
Rhus zeyheri Sond. 1582 dwarf shrub (A=1, B=0, C=0)
Rhynchosia minima (L.) DC. var. *prostrata* Harv. Meikle 354 forb (A=0, B=0, C=3)
Rhynchosia sp. 197 forb (A=0, B=0, C=1)
Rhynchosia totta (Thunb.) DC. var. *totta* 1673 1415 1363 forb (A=34, B=5, C=0)
Ruellia cordata Thunb. 1569 1502 1418 285 311 348 forb (A=22, B=10, C=26)
Salvia runcinata L. f. 1451 forb (A=4, B=0, C=0)
Sansevieria aethiopica Thunb. 1606 dwarf shrub (A=2, B=0, C=0)
Sarcostemma viminale (L.) R. Br. 1510 dwarf shrub (A=5, B=2, C=0)
Scabiosa columbaria L. 1445 forb (A=3, B=0, C=0)
Schizachyrium sanguineum (Retz.) Alst. 1428 207 grass (A=29, B=10, C=33)
Schkuhria pinnata (Lam.) Cabr. 1432 210 forb (A=25, B=6, C=75)
Scolopia zeyheri (Nees) Harv. 1560 1539 dwarf shrub (A=2, B=0, C=0)
Seddera capensis (E. Mey. ex Choisy) Hallier f. 1455 forb (A=2, B=2, C=0)
Seddara sp. 1614 forb (A=1, B=0, C=0)
Senecio barbertonicus Klatt 1459 forb (A=10, B=3, C=0)
Senecio lygodes Hiern 1457 224 forb (A=1, B=1, C=2)
Senecio venosus Harv. 1371 412 forb (A=12, B=2, C=1)
Senna italica Mill. subsp. *arachoides* (Burch.) Lock 1499 312 forb (A=2, B=0, C=2)
Sesamum capense Burm. f. 1578 forb (A=2, B=0, C=0)
Setaria incrassata (Hochst.) Hack. 350 grass (A=0, B=0, C=7)
Setaria lindenbergiana (Nees) Stapf 1668 grass (A=3, B=3, C=0)
Setaria nigrirostris (Nees) Dur. & Schinz 1619 grass (A=2, B=0, C=0)
Setaria pallide-fusca (Schumach.) Stapf & C.E. Hubb. 1494 379 grass (A=2, B=0, C=1)
Setaria sp. 1594 grass (A=1, B=0, C=0)
Setaria sphacelata (Schumach.) Moss var. *torta* (Stapf) Clayton 1295 198 243 grass (A=49, B=43, C=491)
Setaria verticillata (L.) Beauv. 1579 293 grass (A=7, B=0, C=20)
Sida alba L. 1369 forb (A=42, B=2, C=0)
Sida rhombifolia L. 389 forb (A=0, B=0, C=2)
Solanum coccineum Jacq. 1503 dwarf shrub (A=12, B=0, C=0)
Solanum incanum L. 1389 272 dwarf shrub (A=19, B=3, C=1)
Solanum panduriforme E. Mey. 1462 269 dwarf shrub (A=28, B=8, C=23)
Solanum supinum Dun. 1305 231 forb (A=14, B=0, C=1)
Sphedamnocarpus pruriens (Juss.) Szyszyl. subsp. *galphimiifolius* (Juss.) de Villiers & C.J. Botha 1588 dwarf shrub (A=3, B=1, C=0)

Sporobolus ioclados (Trin.) Nees 1659 345 grass (A=1, B=1, C=4)
Sporobolus nitens Stent 1505 344 grass (A=9, B=1, C=11)
Sporobolus pyramidalis Beauv 353 grass (A=0, B=0, C=2)
Sporobolus stapfianus Gand. 1344 218 grass (A=17, B=6, C=63)
Striga asiatica (L.) Kuntze 1480 355 forb (A=3, B=0, C=1)
Stylosanthes fruticosa (Retz.) Alston 1532 1419 1373 290 dwarf shrub (A=14, B=1, C=9)
Tagetes minuta L. 1416 196 forb (A=36, B=3, C=296)
Talinum caffrum (Thunb.) Eckl. & Zeyh. 1636 forb (A=2, B=0, C=0)
Tarchonanthus camphoratus L. 1626 1507 334 shrub (A=2, B=1, C=15)
Tephrosia elongata E. Mey. var. *elongata* 1423 366 forb (A=12, B=2, C=2)
Tephrosia longipes Meisn. subsp. *longipes* 1424 1396 forb (A=1, B=1, C=0)
Tephrosia purpurea (L.) Pers. subsp. *leptostachya* (DC.) Brummitt var. *delagoensis* (H.M. Forbes) Brummitt 1312 229 forb (A=54, B=20, C=42)
Teucrium trifidum Retz. 1440 1425 299 forb (A=23, B=0, C=18)
Themeda triandra Forssk. 1293 200 grass (A=58, B=45, C=325)
Thesium magalismontanum Sond. 1420 forb (A=8, B=0, C=0)
Thunbergia atriplicifolia E. Mey. ex Nees x *T. capensis* Retz. 1666 397 forb (A=2, B=0, C=1)
Trachypogon spicatus (L. f.) Kuntze 1426 225 grass (A=14, B=11, C=66)
Tragia rupestris Sond. 1603 forb (A=7, B=4, C=5)
Tragus berteronianus Schult. 1297 283 grass (A=48, B=17, C=45)
Triaspis hypericoides (DC.) Burch. subsp. *nelsonii* (Oliv.) Immelman 1661 forb (A=3, B=0, C=0)
Tricholaena monachne (Trin.) Stapf & C.E. Hubb. 1483 grass (A=7, B=1, C=0)
Trichoneura grandiglumis (Nees) Ekman var. *grandiglumis* 1298 273 grass (A=33, B=4, C=5)
Tripogon minimus (A. Rich.) Steud. 1353 358 grass (A=18, B=3, C=3)
Tristachya biseriata Stapf 1380 254 grass (A=4, B=2, C=55)
Triumfetta sonderi Ficalho & Hiern 1388 256 dwarf shrub (A=13, B=2, C=12)
Tulbaghia acutiloba Harv. 1504 forb (A=2, B=0, C=0)
Tulbaghia sp. 1557 forb (A=2, B=2, C=0)
Turbina oblongata (E. Mey. ex Choisy) A. Meeuse 1574 260 381 forb (A=4, B=1, C=7)
Unidentifiable sp. 1437 forb (A=8, B=0, C=0)
Unidentifiable sp. 1548 forb (A=1, B=0, C=0)
Unidentifiable sp. 1583 forb (A=3, B=0, C=0)
Unidentifiable sp. 1685 shrub (A=31, B=6, C=0)
Unidentifiable sp. 1686 shrub (A=9, B=1, C=0)
Unidentifiable sp. 1687 shrub (A=17, B=0, C=0)
Unidentifiable sp. 1688 grass (A=4, B=0, C=0)
Unidentifiable sp. 1689 forb (A=2, B=0, C=0)
Unidentifiable sp. 1690 tree (A=11, B=0, C=0)
Unidentifiable sp. 1691 forb (A=5, B=0, C=0)
Unidentifiable sp. 1692 forb (A=2, B=0, C=0)
Unidentifiable sp. 1693 grass (A=1, B=0, C=0)
Unidentifiable sp. 1694 forb (A=5, B=0, C=0)
Unidentifiable sp. 1695 shrub (A=4, B=0, C=0)
Unidentifiable sp. 1696 shrub (A=1, B=0, C=0)
Unidentifiable sp. 214 forb (A=0, B=0, C=15)
Unidentifiable sp. 346 forb (A=0, B=0, C=2)
Unidentifiable sp. 388 forb (A=0, B=0, C=2)
Unidentifiable sp. 393 forb (A=0, B=0, C=3)
Unidentifiable sp. 413 grass (A=0, B=0, C=13)
Urelytrum agropyroides (Hack.) Hack. 1527 grass (A=2, B=1, C=0)
Urochloa mosambicensis (Hack.) Dandy 335 grass (A=0, B=0, C=18)
Urochloa panicoides Beauv. 1361 281 grass (A=20, B=2, C=28)
Vahlia capensis (L. f.) Thunb. subsp. *vulgaris* Bridson var. *linearis* E. Mey. ex Bridson 1324 forb (A=25, B=5, C=0)
Vangueria infausta Burch. subsp. *infausta* 1653 371 shrub, tree (A=5, B=1, C=3)

Verbena bonariensis L. 357 forb (A=0, B=0, C=1)
Verbena officinalis L. 1463 forb (A=2, B=0, C=0)
Vernonia oligocephala (DC.) Sch. Bip. ex Walp. 1302 296 386 forb (A=38, B=12, C=92)
Vernonia poskeana Vatke & Hildebr. subsp. *botswanica* Pope 1677 1573 1466 forb (A=5, B=0, C=0)
Vernonia sp. 1461 forb (A=11, B=3, C=0)
Vigna unguiculata (L.) Walp. subsp. *stenophylla* (Harv.) Marechal et al. 1524 forb (A=1, B=0, C=0)
Vigna vexillata (L.) A. Rich. var. *angustifolia* (Schumach. & Thonn.) Bak. 1448 forb (A=5, B=0, C=0)
Vigna vexillata (L.) A. Rich. var. *vexillata* 1449 forb (A=6, B=2, C=0)
Vitex obovata E. Mey. 1676 1669 tree (A=3, B=2, C=0)
Wahlenbergia undulata (L. f.) A. DC. 1381 forb (A=4, B=0, C=0)
Waltheria indica L. 1628 dwarf shrub (A=5, B=0, C=0)
Xerophyta retinervis Bak. 1674 324 dwarf shrub (A=1, B=1, C=3)
Ximenia caffra Sond. var. *caffra* 1663 370 shrub, tree (A=2, B=0, C=1)
Zanthoxylum capense (Thunb.) Harv. 1593 dwarf shrub (A=2, B=1, C=0)
Zinnia peruviana (L.) L. 1417 233 forb (A=25, B=0, C=47)
Ziziphus mucronata Willd. subsp. *mucronata* 251 tree (A=0, B=0, C=71)
Ziziphus zeyheriana Sond. 1341 392 dwarf shrub (A=14, B=5, C=23)
Zornia linearis E. Mey. 1518 270 forb (A=6, B=1, C=2)

Footnote: Only one plant collected in the Roodpelaat study area namely; *Lithospermum flexuosum*, a forb, is listed in the Red Data Book for plants (Hall *et. al*. 1980).

APPENDIX C

COMMUNITY COMPOSITION ANALYSIS FOR THE QUADRAT METHOD DATA SET GROUPED ACCORDING TO GROWTH FORMS

Community number: 1

Trees

Correlation coefficient = +0.94
Standard error of the mean = 0.65

Species	(F)	Actual cover	Pred. cover	Difference
Normal competition range:				
Acacia nilotica subsp. *kraussiana*	1	0.49	-0.13	+0.63
Acacia tortilis subsp. *heteracantha*	7	3.85	3.54	+0.31
Acacia robusta subsp. *robusta*	1	0.09	-0.13	+0.23
Acacia caffra	2	0.02	0.48	-0.46
Weak competitors:				
Acacia karroo	3	0.38	1.09	-0.71
Total cover for species in group:	4.84%			

Shrubs

Correlation coefficient = +0.94
Standard error of the mean = 0.04

Species	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Rhus leptodictya	4	0.26	0.20	+0.06
Normal competition range:				
Maytenus heterophylla	1	0.04	0.01	+0.03
Rhus lancea	4	0.22	0.20	+0.02
Cassine aethiopica	1	0.00	0.01	-0.01
Grewia flava	1	0.00	0.01	-0.01
Unidentifiable sp. 1685	5	0.22	0.26	-0.04
Weak competitors:				
Ehretia rigida	3	0.09	0.14	-0.05
Total cover for species in group:	0.84%			

Dwarf Shrubs

Correlation coefficient = +0.78
Standard error of the mean = 0.11

Species	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Aloe greatheadii var. *davyana*	9	0.74	0.50	+0.24
Elephantorrhiza elephantina	1	0.16	-0.02	+0.18
Normal competition range:				
Justicia flava	1	0.04	-0.02	+0.06
Ziziphus zeyheriana	1	0.04	-0.02	+0.06
Protasparagus setaceus	1	0.00	-0.02	+0.02
Rhus zeyheri	1	0.00	-0.02	+0.02
Solanum panduriforme	1	0.00	-0.02	+0.02
Solanum incanum	1	0.00	-0.02	+0.02
Polygala amatymbica	1	0.00	-0.02	+0.02
Dicoma anomala subsp. *anomala*	1	0.00	-0.02	+0.02
Indigofera parviflora var. *parviflora*	3	0.10	0.11	-0.01
Euclea undulata var. *myrtina*	2	0.01	0.04	-0.03
Chrysanthemoides monilifera subsp. *canescens*	2	0.00	0.04	-0.04
Pollichia campestris	2	0.00	0.04	-0.04
Indigofera heterotricha	2	0.00	0.04	-0.04
Weak competitors:				
Protasparagus suaveolens	4	0.05	0.17	-0.12
Polygala hottentotta	4	0.01	0.17	-0.17
Lantana rugosa	5	0.02	0.24	-0.22
Total cover for species in group:	1.19%			

Grasses

Correlation coefficient = +0.48
Standard error of the mean = 1.58

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Digitaria eriantha	6	8.98	1.53	+7.45
Elionurus muticus	7	7.15	1.87	+5.27
Normal competition range:				
Schizachyrium sanguineum	1	0.04	-0.18	+0.22
Eragrostis obtusa	1	0.01	-0.18	+0.19
Eragrostis plana	1	0.00	-0.18	+0.18
Panicum coloratum var. *coloratum*	1	0.00	-0.18	+0.18
Aristida bipartita	1	0.00	-0.18	+0.18
Cyperus semitrifidus var. *multiglumis*	1	0.00	-0.18	+0.18
Tricholaena monachne	1	0.00	-0.18	+0.18
Eragrostis trichophora	1	0.00	-0.18	+0.18
Kyllinga alba	1	0.00	-0.18	+0.18
Cymbopogon plurinodis	1	0.00	-0.18	+0.18
Melinis nerviglumis	2	0.34	0.16	+0.18
Themeda triandra	3	0.66	0.50	+0.15
Eragrostis pseudosclerantha	2	0.05	0.16	-0.11
Eragrostis racemosa	2	0.01	0.16	-0.15
Pogonarthria squarrosa	2	0.00	0.16	-0.16
Setaria pallide-fusca	2	0.00	0.16	-0.16
Tripogon minimus	2	0.00	0.16	-0.16
Mariscus rehmannianus	2	0.00	0.16	-0.16
Microchloa caffra	2	0.00	0.16	-0.16
Eragrostis superba	2	0.00	0.16	-0.16
Bothriochloa insculpta	3	0.16	0.50	-0.34
Eragrostis rigidior	3	0.16	0.50	-0.34
Aristida canescens subsp. *canescens*	5	0.79	1.19	-0.40
Aristida congesta subsp. *congesta*	8	1.80	2.21	-0.42
Urochloa panicoides	3	0.04	0.50	-0.46
Tragus berteronianus	3	0.02	0.50	-0.48
Bothriochloa bladhii	3	0.01	0.50	-0.49
Hyparrhenia filipendula var. *pilosa*	3	0.01	0.50	-0.49
Trichoneura grandiglumis var. *grandiglumis*	3	0.01	0.50	-0.49
Aristida scabrivalvis subsp. *scabrivalvis*	3	0.01	0.50	-0.50
Kyllinga erecta	3	0.01	0.50	-0.50
Mariscus albomarginatus	3	0.01	0.50	-0.50
Melinis repens subsp. *grandiflora*	8	1.62	2.21	-0.59
Cymbopogon excavatus	5	0.51	1.19	-0.68
Eragrostis chloromelas	9	1.74	2.56	-0.82
Panicum maximum	6	0.34	1.53	-1.19
Eragrostis gummiflua	9	1.03	2.56	-1.52
Weak competitors:				
Heteropogon contortus	8	0.49	2.21	-1.73
Cynodon dactylon	7	0.06	1.87	-1.81

Total cover for species in group: 26.11%

Forbs

Correlation coefficient = +0.30
Standard error of the mean = 0.12

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Heliotropium strigosum	3	0.65	0.05	+0.60
Tephrosia purpurea subsp. *leptostachya*	4	0.66	0.07	+0.59
Monsonia angustifolia	7	0.47	0.13	+0.33
Indigofera vicioides var. *vicioides*	1	0.16	0.01	+0.15
Normal competition range:				
Indigofera rhytidocarpa subsp. *rhytidocarpa*	5	0.15	0.09	+0.05
Crotalaria sphaerocarpa subsp. *sphaerocarpa*	1	0.04	0.01	+0.03
Berkheya radula	3	0.05	0.05	+0.00
Turbina oblongata	1	0.01	0.01	-0.00
Verbena officinalis	1	0.01	0.01	-0.00
Ipomoea cairica	1	0.00	0.01	-0.01
Gerbera sp. 1476	1	0.00	0.01	-0.01
Vernonia poskeana subsp. *botswanica*	1	0.00	0.01	-0.01
Vigna vexillata var. *angustifolia*	1	0.00	0.01	-0.01
Chaetacanthus costatus	1	0.00	0.01	-0.01
Datura stramonium	1	0.00	0.01	-0.01
Convolvulus sagittatus subsp. *sagittatus*	1	0.00	0.01	-0.01
Menodora africana	1	0.00	0.01	-0.01
Corchorus asplenifolius	1	0.00	0.01	-0.01
Teucrium trifidum	1	0.00	0.01	-0.01
Gladiolus permeabilis subsp. *permeabilis*	1	0.00	0.01	-0.01
Chamaesyce inaequilatera	1	0.00	0.01	-0.01
Wahlenbergia undulata	1	0.00	0.01	-0.01
Bergia decumbens	1	0.00	0.01	-0.01

Justicia anagalloides	1	0.00	0.01	-0.01
Kyphocarpa angustifolia	1	0.00	0.01	-0.01
Lithospermum flexuosum	1	0.00	0.01	-0.01
Nidorella hottentotica	1	0.00	0.01	-0.01
Geigeria burkei subsp. *burkei* var. *burkei*	1	0.00	0.01	-0.01
Lotononis listii	4	0.05	0.07	-0.02
Vernonia sp. 1461	2	0.01	0.03	-0.02
Cleome monophylla	2	0.01	0.03	-0.02
Hibiscus trionum	7	0.11	0.13	-0.02
Sesamum capense	2	0.00	0.03	-0.03
Striga asiatica	2	0.00	0.03	-0.03
Zinnia peruviana	2	0.00	0.03	-0.03
Cucumis zeyheri	2	0.00	0.03	-0.03
Ledebouria sp. 1356	2	0.00	0.03	-0.03
Acalypha segetalis	3	0.02	0.05	-0.03
Vahlia capensis subsp. *vulgaris* var. *linearis*	5	0.06	0.09	-0.04
Hermannia depressa	3	0.01	0.05	-0.04
Felicia muricata subsp. *cinerascens*	3	0.01	0.05	-0.04
Cheilanthes viridis var. *viridis*	3	0.01	0.05	-0.05
Dipcadi viride	3	0.01	0.05	-0.05
Schkuhria pinnata	3	0.01	0.05	-0.05
Tagetes minuta	3	0.01	0.05	-0.05
Pentarrhinum insipidum	3	0.01	0.05	-0.05
Helichrysum nudifolium	3	0.01	0.05	-0.05
Sida alba	3	0.01	0.05	-0.05
Rhynchosia totta var. *totta*	4	0.02	0.07	-0.05
Oxalis sp. 1337	4	0.01	0.07	-0.06
Hibiscus pusillus	4	0.01	0.07	-0.06
Ornithogalum tenuifolium subsp. *tenuifolium*	4	0.01	0.07	-0.06
Commelina africana var. *africana*	4	0.01	0.07	-0.06
Bidens bipinnata	5	0.01	0.09	-0.08
Vernonia oligocephala	5	0.01	0.09	-0.08
Oldenlandia herbacea var. *herbacea*	7	0.04	0.13	-0.09
Helichrysum rugulosum	6	0.01	0.11	-0.10
Phyllanthus maderaspatensis	6	0.01	0.11	-0.10

Weak competitors:

Hypoxis argentea var. *argentea*	7	0.01	0.13	-0.12

Total cover for species in group: 2.78%

Total class cover = 35.77%
Grass proportion = 73.00%
Forb proportion = 7.78%
Dwarf shrub proportion = 3.33%
Shrub proportion = 2.36%
Tree proportion = 13.53%

Community number: 2
===================

Trees

Correlation coefficient = +0.26
Standard error of the mean = 2.39

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Acacia mellifera subsp. *mellifera*	1	5.82	1.43	+4.40
Normal competition range:				
Acacia tortilis subsp. *heteracantha*	4	4.06	2.89	+1.17
Acacia nilotica subsp. *kraussiana*	1	1.29	1.43	-0.14
Acacia karroo	3	1.55	2.40	-0.85
Acacia robusta subsp. *robusta*	1	0.08	1.43	-1.35
Unidentifiable sp. 1690	1	0.00	1.43	-1.42
Dichrostachys cinerea subsp. *africana* var. *africana*	2	0.10	1.91	-1.81

Total cover for species in group: 12.91%

Shrubs

Correlation coefficient = -0.28
Standard error of the mean = 1.21

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Tarchonanthus camphoratus	1	3.95	1.25	+2.70
Normal competition range:				
Unidentifiable sp. 1685	5	1.19	0.21	+0.98
Rhus lancea	3	0.91	0.73	+0.18
Ehretia rigida	4	0.61	0.47	+0.14
Maytenus heterophylla	4	0.30	0.47	-0.17
Rhus pyroides var. *gracilis*	3	0.38	0.73	-0.35
Rhus leptodictya	3	0.16	0.73	-0.57
Grewia flava	3	0.03	0.73	-0.70
Unidentifiable sp. 1686	2	0.01	0.99	-0.98

Weak competitors:

Unidentifiable sp. 1695	1	0.02	1.25	-1.23
Total cover for species in group:	7.56%			

Dwarf Shrubs

Correlation coefficient = +0.64
Standard error of the mean = 0.78

	(F)	Actual cover	Pred. cover	Differ-ence
Strong competitors:				
Aloe greatheadii var. *davyana*	5	3.81	1.71	+2.10
Solanum panduriforme	2	1.29	0.26	+1.03
Normal competition range:				
Lycium cinereum	1	0.02	-0.22	+0.24
Sarcostemma viminale	1	0.00	-0.22	+0.23
Pentzia lanata	1	0.00	-0.22	+0.23
Agathisanthemum bojeri subsp. *bojeri*	1	0.00	-0.22	+0.23
Polygala amatymbica	1	0.00	-0.22	+0.23
Carissa bispinosa subsp. *bispinosa*	2	0.02	0.26	-0.24
Protasparagus setaceus	2	0.01	0.26	-0.25
Diospyros lycioides subsp. *sericea*	2	0.01	0.26	-0.25
Solanum coccineum	2	0.01	0.26	-0.25
Dicoma anomala subsp. *anomala*	2	0.01	0.26	-0.25
Justicia flava	3	0.12	0.74	-0.62
Euclea undulata var. *myrtina*	3	0.10	0.74	-0.64
Lantana rugosa	3	0.03	0.74	-0.71
Weak competitors:				
Protasparagus suaveolens	5	0.64	1.71	-1.06
Total cover for species in group:	6.09%			

Grasses

Correlation coefficient = +0.47
Standard error of the mean = 1.27

	(F)	Actual cover	Pred. cover	Differ-ence
Strong competitors:				
Eragrostis chloromelas	5	7.32	2.01	+5.30
Digitaria eriantha	3	3.81	1.04	+2.77
Enneapogon scoparius	2	2.76	0.55	+2.21
Normal competition range:				
Sporobolus ioclados	1	1.29	0.07	+1.22
Fingerhuthia africana	1	0.18	0.07	+0.12
Cynodon dactylon	1	0.08	0.07	+0.01
Trichoneura grandiglumis var. *grandiglumis*	1	0.08	0.07	+0.01
Elionurus muticus	2	0.51	0.55	-0.04
Panicum coloratum var. *coloratum*	1	0.02	0.07	-0.05
Enneapogon cenchroides	1	0.02	0.07	-0.05
Hyparrhenia filipendula var. *pilosa*	1	0.02	0.07	-0.05
Setaria sphacelata var. *torta*	1	0.02	0.07	-0.05
Cyperus rubicundus	1	0.00	0.07	-0.06
Pogonarthria squarrosa	1	0.00	0.07	-0.06
Aristida bipartita	1	0.00	0.07	-0.06
Eragrostis pseudosclerantha	1	0.00	0.07	-0.06
Tricholaena monachne	1	0.00	0.07	-0.06
Setaria verticillata	1	0.00	0.07	-0.06
Mariscus rehmannianus	1	0.00	0.07	-0.06
Eragrostis trichophora	1	0.00	0.07	-0.06
Brachiaria serrata	1	0.00	0.07	-0.06
Aristida scabrivalvis subsp. *scabrivalvis*	2	0.34	0.55	-0.21
Aristida congesta subsp. *congesta*	3	0.69	1.04	-0.35
Sporobolus nitens	2	0.19	0.55	-0.37
Themeda triandra	3	0.58	1.04	-0.45
Brachiaria eruciformis	2	0.08	0.55	-0.47
Eragrostis gummiflua	2	0.02	0.55	-0.53
Kyllinga alba	2	0.01	0.55	-0.54
Heteropogon contortus	4	0.93	1.52	-0.60
Bothriochloa insculpta	5	1.09	2.01	-0.92
Melinis repens subsp. *grandiflora*	3	0.06	1.04	-0.98
Urochloa panicoides	4	0.29	1.52	-1.24
Weak competitors:				
Aristida canescens subsp. *canescens*	4	0.18	1.52	-1.34
Panicum maximum	5	0.62	2.01	-1.39
Cymbopogon excavatus	4	0.03	1.52	-1.49
Total cover for species in group:	21.26%			

Forbs

Correlation coefficient = +0.15
Standard error of the mean = 0.04

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Ipomoea bathycolpos var. *bathycolpos*	1	0.18	0.02	+0.16
Rhynchosia totta var. *totta*	1	0.18	0.02	+0.16
Salvia runcinata	2	0.10	0.03	+0.07
Chaetacanthus costatus	2	0.10	0.03	+0.07
Bidens bipinnata	4	0.11	0.04	+0.07
Seddera capensis	1	0.08	0.02	+0.06
Oxalis sp. 1337	3	0.09	0.03	+0.06
Normal competition range:				
Oldenlandia herbacea var. *herbacea*	2	0.04	0.03	+0.01
Hibiscus pusillus	4	0.05	0.04	+0.01
Kedrostis foetidissima	1	0.02	0.02	+0.00
Seddera sp. 1614	1	0.02	0.02	+0.00
Ipomoea bolusiana subsp. *bolusiana*	1	0.02	0.02	+0.00
Teucrium trifidum	1	0.02	0.02	+0.00
Zinnia peruviana	2	0.02	0.03	-0.00
Indigofera rhytidocarpa subsp. *rhytidocarpa*	2	0.02	0.03	-0.00
Ornithogalum tenuifolium subsp. *tenuifolium*	3	0.03	0.03	-0.00
Aptosimum indivisum	1	0.00	0.02	-0.02
Ceropegia racemosa subsp. *setifera*	1	0.00	0.02	-0.02
Habenaria epipactidea	1	0.00	0.02	-0.02
Tragia rupestris	1	0.00	0.02	-0.02
Unidentifiable sp. 1691	1	0.00	0.02	-0.02
Tulbaghia sp. 1557	1	0.00	0.02	-0.02
Orbeopsis lutea subsp. *lutea*	1	0.00	0.02	-0.02
Gerbera sp. 1476	1	0.00	0.02	-0.02
Vigna vexillata var. *vexillata*	1	0.00	0.02	-0.02
Convolvulus sagittatus subsp. *sagittatus*	1	0.00	0.02	-0.02
Striga asiatica	1	0.00	0.02	-0.02
Menodora africana	1	0.00	0.02	-0.02
Helichrysum rugulosum	1	0.00	0.02	-0.02
Unidentifiable sp. 1437	1	0.00	0.02	-0.02
Schkuhria pinnata	1	0.00	0.02	-0.02
Raphionacme hirsuta	1	0.00	0.02	-0.02
Gladiolus permeabilis subsp. *permeabilis*	1	0.00	0.02	-0.02
Vahlia capensis subsp. *vulgaris* var. *linearis*	1	0.00	0.02	-0.02
Hermannia depressa	1	0.00	0.02	-0.02
Phyllanthus maderaspatensis	1	0.00	0.02	-0.02
Commelina africana var. *africana*	1	0.00	0.02	-0.02
Becium grandiflorum var. *galpinii*	1	0.00	0.02	-0.02
Lithospermum flexuosum	1	0.00	0.02	-0.02
Evolvulus alsinoides var. *linifolius*	1	0.00	0.02	-0.02
Solanum supinum	1	0.00	0.02	-0.02
Vernonia oligocephala	1	0.00	0.02	-0.02
Ipomoea coscinosperma	2	0.01	0.03	-0.02
Abutilon grandifolium	2	0.01	0.03	-0.02
Tagetes minuta	2	0.01	0.03	-0.02
Pentarrhinum insipidum	2	0.01	0.03	-0.02
Crabbea angustifolia	2	0.01	0.03	-0.02
Tephrosia purpurea subsp. *leptostachya*	2	0.01	0.03	-0.02
Monsonia angustifolia	2	0.01	0.03	-0.02
Kalanchoe rotundifolia	3	0.01	0.03	-0.02
Commelina erecta	3	0.01	0.03	-0.02
Corchorus asplenifolius	3	0.01	0.03	-0.02
Acalypha segetalis	3	0.01	0.03	-0.02
Chamaesyce inaequilatera	3	0.01	0.03	-0.02
Ledebouria sp. 1356	3	0.01	0.03	-0.02
Sida alba	4	0.02	0.04	-0.02
Hibiscus trionum	5	0.02	0.04	-0.02
Total cover for species in group:	1.35%			

Total class cover = 49.18%
Grass proportion = 43.23%
Forb proportion = 2.75%
Dwarf shrub proportion = 12.39%
Shrub proportion = 15.38%
Tree proportion = 26.24%

Community number: 3

Trees

Correlation coefficient = +0.54
Standard error of the mean = 2.69

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Acacia nilotica subsp. *kraussiana*	5	7.65	3.33	+4.32

Normal competition range:

Acacia robusta subsp. *robusta*	4	4.41	2.41	+1.99
Acacia caffra	1	0.06	-0.33	+0.39
Unidentifiable sp. 1690	2	0.11	0.58	-0.47
Acacia karroo	4	0.63	2.41	-1.78
Acacia tortilis subsp. *heteracantha*	6	2.19	4.24	-2.05
Pappea capensis	4	0.01	2.41	-2.40

Total cover for species in group: 15.06%

Shrubs

Correlation coefficient = +0.65
Standard error of the mean = 0.28

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Rhus lancea	4	0.79	0.28	+0.52
Rhus leptodictya	7	1.15	0.66	+0.49
Normal competition range:				
Tarchonanthus camphoratus	1	0.00	-0.11	+0.11
Grewia flavescens var. *flavescens*	1	0.00	-0.11	+0.11
Unidentifiable sp. 1685	4	0.33	0.28	+0.06
Rhus pyroides var. *gracilis*	2	0.06	0.02	+0.04
Maytenus heterophylla	5	0.43	0.40	+0.03
Berchemia zeyheri	3	0.01	0.15	-0.14
Unidentifiable sp. 1686	3	0.01	0.15	-0.14
Ehretia rigida	6	0.34	0.53	-0.19
Unidentifiable sp. 1687	4	0.03	0.28	-0.24
Grewia flava	5	0.15	0.40	-0.26
Weak competitors:				
Pavetta gardeniifolia var. *gardeniifolia*	5	0.01	0.40	-0.39

Total cover for species in group: 3.32%

Dwarf Shrubs

Correlation coefficient = +0.41
Standard error of the mean = 3.00

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Aloe greatheadii var. *davyana*	7	17.10	3.23	+13.88
Normal competition range:				
Waltheria indica	1	0.00	-0.42	+0.43
Lycium cinereum	1	0.00	-0.42	+0.43
Piriqueta capensis	1	0.00	-0.42	+0.43
Dovyalis rhamnoides	1	0.00	-0.42	+0.43
Scolopia zeyheri	1	0.00	-0.42	+0.43
Mundulea sericea	1	0.00	-0.42	+0.43
Indigofera parviflora var. *parviflora*	1	0.00	-0.42	+0.43
Stylosanthes fruticosa	1	0.00	-0.42	+0.43
Rhus gracillima	1	0.00	-0.42	+0.43
Lippia scaberrima	1	0.00	-0.42	+0.43
Achyropsis leptostachya	1	0.00	-0.42	+0.43
Diospyros lycioides subsp. *sericea*	2	0.19	0.18	+0.00
Sarcostemma viminale	2	0.02	0.18	-0.17
Melhania prostrata	2	0.02	0.18	-0.17
Solanum incanum	2	0.02	0.18	-0.17
Polygala hottentotta	2	0.01	0.18	-0.18
Polygala amatymbica	2	0.01	0.18	-0.18
Indigofera heterotricha	2	0.01	0.18	-0.18
Carissa bispinosa subsp. *bispinosa*	3	0.02	0.79	-0.77
Solanum coccineum	3	0.01	0.79	-0.78
Solanum panduriforme	4	0.08	1.40	-1.32
Pollichia campestris	5	0.03	2.01	-1.98
Dicoma anomala subsp. *anomala*	5	0.01	2.01	-1.99
Euclea undulata var. *myrtina*	6	0.38	2.62	-2.24
Ptycholobium plicatum	6	0.04	2.62	-2.58
Protasparagus suaveolens	7	0.55	3.23	-2.67
Weak competitors:				
Lantana rugosa	7	0.04	3.23	-3.18

Total cover for species in group: 18.55%

Grasses

Correlation coefficient = +0.42
Standard error of the mean = 0.82

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Cymbopogon plurinodis	4	5.10	0.59	+4.51
Panicum maximum	4	2.02	0.59	+1.43
Heteropogon contortus	7	2.52	1.16	+1.36
Panicum coloratum var. *coloratum*	1	1.17	0.01	+1.16
Setaria sphacelata var. *torta*	6	2.10	0.97	+1.13
Normal competition range:				
Loudetia flavida	1	0.06	0.01	+0.04
Aristida scabrivalvis subsp. *scabrivalvis*	1	0.01	0.01	+0.00
Bothriochloa insculpta	1	0.01	0.01	+0.00
Schizachyrium sanguineum	1	0.01	0.01	+0.00
Dactyloctenium aegyptium	1	0.00	0.01	-0.01
Aristida bipartita	1	0.00	0.01	-0.01
Eragrostis nindensis	1	0.00	0.01	-0.01
Diheteropogon filifolius	1	0.00	0.01	-0.01
Melinis nerviglumis	1	0.00	0.01	-0.01
Bulbostylis contexta	1	0.00	0.01	-0.01
Brachiaria nigropedata	1	0.00	0.01	-0.01
Brachiaria serrata	1	0.00	0.01	-0.01
Eragrostis racemosa	1	0.00	0.01	-0.01
Diheteropogon amplectens	1	0.00	0.01	-0.01
Anthephora pubescens	1	0.00	0.01	-0.01
Digitaria argyrograpta	2	0.14	0.20	-0.06
Brachiaria eruciformis	2	0.13	0.20	-0.07
Enneapogon scoparius	2	0.13	0.20	-0.07
Eragrostis rigidior	5	0.67	0.78	-0.11
Aristida canescens subsp. *canescens*	5	0.66	0.78	-0.11
Eragrostis gummiflua	3	0.25	0.40	-0.15
Eragrostis superba	2	0.02	0.20	-0.19
Eragrostis chloromelas	4	0.39	0.59	-0.20
Pogonarthria squarrosa	2	0.01	0.20	-0.20
Mariscus albomarginatus	2	0.01	0.20	-0.20
Tripogon minimus	2	0.01	0.20	-0.20
Setaria verticillata	2	0.01	0.20	-0.20
Mariscus rehmannianus	2	0.01	0.20	-0.20
Sporobolus stapfianus	2	0.01	0.20	-0.20
Kyllinga alba	2	0.01	0.20	-0.20
Cyperus obtusiflorus var. *obtusiflorus*	2	0.01	0.20	-0.20
Melinis repens subsp. *grandiflora*	7	0.95	1.16	-0.21
Cynodon dactylon	3	0.13	0.40	-0.27
Aristida congesta subsp. *congesta*	7	0.81	1.16	-0.35
Eragrostis pseudosclerantha	4	0.14	0.59	-0.45
Digitaria eriantha	5	0.31	0.78	-0.47
Elionurus muticus	6	0.48	0.97	-0.49
Tragus berteronianus	4	0.09	0.59	-0.50
Eragrostis trichophora	4	0.07	0.59	-0.52
Trichoneura grandiglumis var. *grandiglumis*	4	0.02	0.59	-0.56
Themeda triandra	5	0.06	0.78	-0.72
Sporobolus nitens	5	0.03	0.78	-0.75
Microchloa caffra	5	0.01	0.78	-0.76
Weak competitors:				
Urochloa panicoides	6	0.04	0.97	-0.93

Total cover for species in group: 18.61%

Forbs

Correlation coefficient = +0.33
Standard error of the mean = 0.28

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Indigofera rhytidocarpa subsp. *rhytidocarpa*	7	2.68	0.31	+2.37
Helichrysum rugulosum	5	0.58	0.20	+0.38
Vernonia sp. 1461	2	0.36	0.03	+0.33
Normal competition range:				
Ocimum urticifolium subsp. *urticifolium*	2	0.23	0.03	+0.20
Justicia anagalloides	3	0.24	0.08	+0.15
Unidentifiable sp. 1692	1	0.06	-0.03	+0.09
Anthericum longistylum	1	0.01	-0.03	+0.04
Hypoxis argentea var. *argentea*	1	0.01	-0.03	+0.04
Unidentifiable sp. 1691	2	0.06	0.03	+0.03
Corchorus asplenifolius	2	0.06	0.03	+0.03
Eriospermum cooperi	1	0.00	-0.03	+0.03
Gnidia sericocephala	1	0.00	-0.03	+0.03
Turbina oblongata	1	0.00	-0.03	+0.03
Tulbaghia sp. 1557	1	0.00	-0.03	+0.03
Kalanchoe rotundifolia	1	0.00	-0.03	+0.03
Convolvulus sagittatus var. *aschersonii*	1	0.00	-0.03	+0.03
Clematis brachiata	1	0.00	-0.03	+0.03
Chenopodium album	1	0.00	-0.03	+0.03
Ledebouria sp. 1509	1	0.00	-0.03	+0.03
Ledebouria sp. 1511	1	0.00	-0.03	+0.03

Senna italica subsp. *arachoides*	1	0.00	-0.03	+0.03
Cheilanthes viridis var. *viridis*	1	0.00	-0.03	+0.03
Senecio barbertonicus	1	0.00	-0.03	+0.03
Crotalaria sphaerocarpa subsp. *sphaerocarpa*	1	0.00	-0.03	+0.03
Convolvulus sagittatus subsp. *sagittatus*	1	0.00	-0.03	+0.03
Dipcadi viride	1	0.00	-0.03	+0.03
Unidentifiable sp. 1437	1	0.00	-0.03	+0.03
Zinnia peruviana	1	0.00	-0.03	+0.03
Phyllanthus humilis	1	0.00	-0.03	+0.03
Merremia tridentata subsp. *angustifolia*	1	0.00	-0.03	+0.03
Acalypha segetalis	1	0.00	-0.03	+0.03
Pellaea calomelanos var. *calomelanos*	1	0.00	-0.03	+0.03
Cucumis zeyheri	1	0.00	-0.03	+0.03
Helichrysum nudifolium	1	0.00	-0.03	+0.03
Becium grandiflorum var. *galpinii*	1	0.00	-0.03	+0.03
Portulaca oleracea	1	0.00	-0.03	+0.03
Nidorella hottentotica	1	0.00	-0.03	+0.03
Merremia palmata	2	0.02	0.03	-0.01
Oxalis sp. 1337	2	0.02	0.03	-0.01
Hibiscus trionum	2	0.02	0.03	-0.01
Vahlia capensis subsp. *vulgaris* var. *linearis*	2	0.02	0.03	-0.01
Lithospermum flexuosum	2	0.02	0.03	-0.01
Kedrostis foetidissima	2	0.01	0.03	-0.02
Barleria macrostegia	2	0.01	0.03	-0.02
Habenaria epipactidea	2	0.01	0.03	-0.02
Unidentifiable sp. 1583	2	0.01	0.03	-0.02
Achyranthes aspera var. *sicula*	2	0.01	0.03	-0.02
Commelina erecta	2	0.01	0.03	-0.02
Ipomoea bolusiana subsp. *bolusiana*	2	0.01	0.03	-0.02
Commelina africana var. *krebsiana*	2	0.01	0.03	-0.02
Schkuhria pinnata	2	0.01	0.03	-0.02
Cleome monophylla	2	0.01	0.03	-0.02
Raphionacme hirsuta	2	0.01	0.03	-0.02
Gomphrena celosioides	2	0.01	0.03	-0.02
Hermannia depressa	2	0.01	0.03	-0.02
Ledebouria sp. 1356	2	0.01	0.03	-0.02
Rhynchosia totta var. *totta*	2	0.01	0.03	-0.02
Anthericum cooperi	2	0.01	0.03	-0.02
Lotononis listii	2	0.01	0.03	-0.02
Geigeria burkei subsp. *burkei var.* burkei	2	0.01	0.03	-0.02
Chamaecrista biensis	2	0.01	0.03	-0.02
Vernonia oligocephala	3	0.02	0.08	-0.06
Cyphostemma lanigerum	3	0.01	0.08	-0.08
Orbeopsis lutea subsp. *lutea*	3	0.01	0.08	-0.08
Felicia mossamedensis	3	0.01	0.08	-0.08
Hypoxis hemerocallidea	3	0.01	0.08	-0.08
Gladiolus permeabilis subsp. *permeabilis*	3	0.01	0.08	-0.08
Felicia muricata subsp. *cinerascens*	3	0.01	0.08	-0.08
Abutilon grandifolium	4	0.02	0.14	-0.12
Tagetes minuta	4	0.02	0.14	-0.12
Chamaesyce inaequilatera	4	0.02	0.14	-0.12
Commelina africana var. *africana*	4	0.02	0.14	-0.12
Kyphocarpa angustifolia	4	0.02	0.14	-0.12
Ceropegia sp. 1612	4	0.01	0.14	-0.13
Menodora africana	4	0.01	0.14	-0.13
Ornithogalum tenuifolium subsp. *tenuifolium*	4	0.01	0.14	-0.13
Oldenlandia herbacea var. *herbacea*	4	0.01	0.14	-0.13
Crabbea angustifolia	4	0.01	0.14	-0.13
Chaetacanthus costatus	5	0.03	0.20	-0.17
Pentarrhinum insipidum	5	0.03	0.20	-0.17
Bidens bipinnata	6	0.07	0.25	-0.18
Teucrium trifidum	5	0.01	0.20	-0.18
Evolvulus alsinoides var. *linifolius*	5	0.01	0.20	-0.18
Monsonia angustifolia	7	0.11	0.31	-0.20
Tephrosia purpurea subsp. *leptostachya*	7	0.10	0.31	-0.21
Plexipus hederaceus var. *hederaceus*	6	0.03	0.25	-0.22
Hibiscus pusillus	6	0.02	0.25	-0.24
Phyllanthus maderaspatensis	6	0.02	0.25	-0.24
Weak competitors:				
Sida alba	7	0.02	0.31	-0.29

Total cover for species in group: 5.25%

Total class cover = 60.78%
Grass proportion = 30.62%
Forb proportion = 8.63%
Dwarf shrub proportion = 30.52%
Shrub proportion = 5.46%
Tree proportion = 24.77%

Community number: 4
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Trees

Correlation coefficient = +0.63
Standard error of the mean = 1.15

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Acacia caffra	12	5.29	2.63	+2.66
Normal competition range:				
Acacia tortilis subsp. *heteracantha*	3	1.43	0.36	+1.08
Combretum apiculatum subsp. *apiculatum*	3	0.76	0.36	+0.41
Acacia nilotica subsp. *kraussiana*	3	0.54	0.36	+0.19
Dichrostachys cinerea subsp. *africana* var. *africana*	1	0.01	-0.15	+0.16
Melia azedarach	1	0.00	-0.15	+0.15
Ozoroa sphaerocarpa	2	0.01	-0.10	-0.09
Unidentifiable sp. 1690	4	0.40	0.61	-0.21
Acacia karroo	5	0.57	0.86	-0.29
Celtis africana	3	0.00	0.36	-0.35
Acacia robusta subsp. *robusta*	5	0.50	0.86	-0.36
Weak competitors:				
Pappea capensis	8	0.02	1.62	-1.59
Dombeya rotundifolia var. *rotundifolia*	11	0.63	2.38	-1.74

Total cover for species in group: 10.18%

Shrubs

Correlation coefficient = +0.68
Standard error of the mean = 0.33

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Rhus lancea	3	1.04	0.17	+0.87
Ehretia rigida	10	1.30	0.71	+0.59
Combretum molle	4	0.71	0.25	+0.46
Normal competition range:				
Maytenus heterophylla	12	0.99	0.86	+0.13
Grewia flavescens var. *flavescens*	1	0.03	0.02	+0.01
Pavetta zeyheri	1	0.00	0.02	-0.02
Asclepias glaucophylla	1	0.00	0.02	-0.02
Rhus leptodictya	8	0.53	0.55	-0.03
Unidentifiable sp. 1685	11	0.74	0.78	-0.05
Cassine aethiopica	2	0.03	0.10	-0.06
Vangueria infausta subsp. *infausta*	2	0.01	0.10	-0.09
Ximenia caffra var. *caffra*	2	0.00	0.10	-0.09
Unidentifiable sp. 1686	2	0.00	0.10	-0.09
Unidentifiable sp. 1695	3	0.00	0.17	-0.17
Berchemia zeyheri	4	0.02	0.25	-0.22
Rhus pyroides var. *gracilis*	4	0.01	0.25	-0.24
Unidentifiable sp. 1687	11	0.50	0.78	-0.28
Pavetta gardeniifolia var. *gardeniifolia*	5	0.01	0.33	-0.32
Weak competitors:				
Grewia flava	9	0.26	0.63	-0.37

Total cover for species in group: 6.18%

Dwarf Shrubs

Correlation coefficient = +0.65
Standard error of the mean = 0.18

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Aloe greatheadii var. *davyana*	12	1.28	0.49	+0.79
Solanum panduriforme	11	0.63	0.44	+0.19
Normal competition range:				
Elephantorrhiza elephantina	2	0.20	0.02	+0.18
Scolopia zeyheri	1	0.07	-0.03	+0.10
Indigofera parviflora var. *parviflora*	4	0.20	0.11	+0.09
Ziziphus zeyheriana	3	0.14	0.06	+0.08
Sphedamnocarpus pruriens subsp. *galphimiifolius*	3	0.13	0.06	+0.06
Protasparagus setaceus	1	0.00	-0.03	+0.03
Dodonaea sp. 1645	1	0.00	-0.03	+0.03
Waltheria indica	1	0.00	-0.03	+0.03
Gerbera viridifolia subsp. *viridifolia*	1	0.00	-0.03	+0.03
Acalypha angustata var. *glabra*	1	0.00	-0.03	+0.03
Agathisanthemum bojeri subsp. *bojeri*	1	0.00	-0.03	+0.03
Mundulea sericea	1	0.00	-0.03	+0.03
Polygala hottentotta	1	0.00	-0.03	+0.03
Polygala amatymbica	1	0.00	-0.03	+0.03
Sansevieria aethiopica	2	0.01	0.02	-0.01
Solanum incanum	2	0.01	0.02	-0.01
Sarcostemma viminale	2	0.00	0.02	-0.01
Piriqueta capensis	2	0.00	0.02	-0.01

Zanthoxylum capense	2	0.00	0.02	-0.01
Dovyalis rhamnoides	2	0.00	0.02	-0.01
Stylosanthes fruticosa	2	0.00	0.02	-0.01
Indigofera heterotricha	2	0.00	0.02	-0.01
Carissa bispinosa subsp. *bispinosa*	3	0.03	0.06	-0.03
Pollichia campestris	3	0.00	0.06	-0.06
Rhoicissus tridentata subsp. *cuneifolia*	3	0.00	0.06	-0.06
Achyropsis leptostachya	4	0.04	0.11	-0.08
Euclea undulata var. *myrtina*	4	0.04	0.11	-0.08
Justicia flava	4	0.01	0.11	-0.10
Solanum coccineum	4	0.01	0.11	-0.10
Lippia scaberrima	5	0.01	0.16	-0.14
Dicoma anomala subsp. *anomala*	5	0.01	0.16	-0.14
Weak competitors:				
Melhania prostrata	8	0.09	0.30	-0.21
Lantana rugosa	10	0.08	0.40	-0.31
Protasparagus suaveolens	12	0.10	0.49	-0.40
Total cover for species in group:	3.12%			

Grasses

Correlation coefficient = +0.60
Standard error of the mean = 0.66

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Enneapogon scoparius	9	3.78	1.10	+2.68
Setaria sphacelata var. *torta*	10	3.19	1.24	+1.94
Heteropogon contortus	12	3.08	1.53	+1.55
Aristida scabrivalvis subsp. *scabrivalvis*	7	2.14	0.81	+1.33
Panicum maximum	9	2.11	1.10	+1.01
Cynodon dactylon	1	0.63	-0.06	+0.68
Normal competition range:				
Loudetia flavida	8	1.45	0.96	+0.49
Eragrostis gummiflua	2	0.35	0.09	+0.26
Eragrostis pseudosclerantha	1	0.19	-0.06	+0.25
Trachypogon spicatus	2	0.31	0.09	+0.22
Setaria nigrirostris	2	0.29	0.09	+0.20
Setaria lindenbergiana	1	0.07	-0.06	+0.13
Setaria sp. 1594	1	0.03	-0.06	+0.09
Setaria verticillata	1	0.01	-0.06	+0.06
Brachiaria nigropedata	1	0.01	-0.06	+0.06
Andropogon chinensis	1	0.00	-0.06	+0.06
Brachiaria brizantha	1	0.00	-0.06	+0.06
Hyperthelia dissoluta	1	0.00	-0.06	+0.06
Unidentifiable sp. 1693	1	0.00	-0.06	+0.06
Eragrostis ciliarensis	1	0.00	-0.06	+0.06
Urelytrum agropyroides	1	0.00	-0.06	+0.06
Unidentifiable sp. 1688	1	0.00	-0.06	+0.06
Aristida diffusa subsp. *burkei*	1	0.00	-0.06	+0.06
Eragrostis nindensis	1	0.00	-0.06	+0.06
Alloteropsis semialata subsp. *eckloniana*	1	0.00	-0.06	+0.06
Cymbopogon excavatus	1	0.00	-0.06	+0.06
Mariscus uitenhagensis	1	0.00	-0.06	+0.06
Bewsia biflora	1	0.00	-0.06	+0.06
Eragrostis racemosa	1	0.00	-0.06	+0.06
Eragrostis superba	1	0.00	-0.06	+0.06
Cymbopogon plurinodis	3	0.29	0.23	+0.06
Elionurus muticus	2	0.08	0.09	-0.01
Urochloa panicoides	2	0.07	0.09	-0.02
Brachiaria eruciformis	2	0.04	0.09	-0.05
Microchloa caffra	2	0.01	0.09	-0.08
Panicum volutans	2	0.00	0.09	-0.09
Mariscus rehmannianus	2	0.00	0.09	-0.09
Diheteropogon filifolius	4	0.20	0.38	-0.17
Hyparrhenia filipendula var. *pilosa*	3	0.01	0.23	-0.22
Brachiaria serrata	3	0.01	0.23	-0.22
Bothriochloa insculpta	3	0.00	0.23	-0.23
Tricholaena monachne	3	0.00	0.23	-0.23
Anthephora pubescens	5	0.24	0.52	-0.29
Aristida bipartita	5	0.23	0.52	-0.29
Enneapogon cenchroides	4	0.08	0.38	-0.30
Trichoneura grandiglumis var. *grandiglumis*	4	0.01	0.38	-0.37
Eragrostis rigidior	5	0.08	0.52	-0.44
Schizachyrium sanguineum	5	0.05	0.52	-0.47
Melinis repens subsp. *grandiflora*	9	0.53	1.10	-0.57
Melinis nerviglumis	6	0.08	0.67	-0.58
Bulbostylis contexta	6	0.05	0.67	-0.62
Tragus berteronianus	10	0.62	1.24	-0.62
Digitaria eriantha	7	0.18	0.81	-0.63
Themeda triandra	11	0.75	1.39	-0.64
Eustachys paspaloides	6	0.02	0.67	-0.65

Weak competitors:

	(F)	Actual cover	Pred. cover	Difference
Diheteropogon amplectens	7	0.10	0.81	-0.71
Eragrostis chloromelas	10	0.30	1.24	-0.94
Aristida canescens subsp. *canescens*	11	0.24	1.39	-1.15
Aristida congesta subsp. *congesta*	11	0.22	1.39	-1.17

Total cover for species in group: 22.15%

Forbs

Correlation coefficient = +0.52
Standard error of the mean = 0.08

	(F)	Actual cover	Pred. cover	Differ-ence
Strong competitors:				
Zinnia peruviana	9	0.58	0.13	+0.45
Bidens bipinnata	8	0.54	0.11	+0.42
Schkuhria pinnata	8	0.44	0.11	+0.32
Tragia rupestris	5	0.23	0.06	+0.16
Cleome monophylla	4	0.13	0.05	+0.08
Normal competition range:				
Tephrosia purpurea subsp. *leptostachya*	9	0.20	0.13	+0.07
Becium grandiflorum var. *galpinii*	2	0.08	0.01	+0.06
Achyranthes aspera var. *aspera*	4	0.10	0.05	+0.06
Convolvulus sagittatus var. *aschersonii*	3	0.07	0.03	+0.04
Achyranthes aspera var. *sicula*	4	0.07	0.05	+0.03
Plectranthus neochilus	1	0.01	-0.00	+0.01
Hibiscus cannabinus	1	0.01	-0.00	+0.01
Heliotropium strigosum	1	0.01	-0.00	+0.01
Vigna vexillata var. *vexillata*	1	0.01	-0.00	+0.01
Abutilon grandifolium	9	0.14	0.13	+0.01
Lepidium africanum subsp. *africanum*	1	0.00	-0.00	+0.01
Hibiscus calyphyllus	1	0.00	-0.00	+0.01
Seddera capensis	1	0.00	-0.00	+0.01
Ceropegia racemosa subsp. *setifera*	1	0.00	-0.00	+0.01
Adenia digitata	1	0.00	-0.00	+0.01
Indigofera daleoides var. *daleoides*	1	0.00	-0.00	+0.01
Unidentifiable sp. 1692	1	0.00	-0.00	+0.01
Gnidia sericocephala	1	0.00	-0.00	+0.01
Unidentifiable sp. 1691	1	0.00	-0.00	+0.01
Turbina oblongata	1	0.00	-0.00	+0.01
Ipomoea bathycolpos var. *bathycolpos*	1	0.00	-0.00	+0.01
Kalanchoe rotundifolia	1	0.00	-0.00	+0.01
Orbeopsis lutea subsp. *lutea*	1	0.00	-0.00	+0.01
Eriospermum abyssinicum	1	0.00	-0.00	+0.01
Hibiscus malacospermus	1	0.00	-0.00	+0.01
Pachycarpus concolor	1	0.00	-0.00	+0.01
Ledebouria sp. 1511	1	0.00	-0.00	+0.01
Tulbaghia acutiloba	1	0.00	-0.00	+0.01
Gazania krebsiana subsp. *krebsiana*	1	0.00	-0.00	+0.01
Senecio barbertonicus	1	0.00	-0.00	+0.01
Datura stramonium	1	0.00	-0.00	+0.01
Crotalaria sphaerocarpa subsp. *sphaerocarpa*	1	0.00	-0.00	+0.01
Menodora africana	1	0.00	-0.00	+0.01
Oxalis sp. 1337	1	0.00	-0.00	+0.01
Helichrysum rugulosum	1	0.00	-0.00	+0.01
Dicerocaryum eriocarpum	1	0.00	-0.00	+0.01
Thesium magalismontanum	1	0.00	-0.00	+0.01
Pearsonia sessilifolia subsp. *marginata*	1	0.00	-0.00	+0.01
Acalypha segetalis	1	0.00	-0.00	+0.01
Anthericum longistylum	1	0.00	-0.00	+0.01
Vahlia capensis subsp. *vulgaris* var. *linearis*	1	0.00	-0.00	+0.01
Helichrysum nudifolium	1	0.00	-0.00	+0.01
Bergia decumbens	1	0.00	-0.00	+0.01
Gnidia capitata	1	0.00	-0.00	+0.01
Nidorella hottentotica	1	0.00	-0.00	+0.01
Helichrysum oxyphyllum	1	0.00	-0.00	+0.01
Chenopodium album	3	0.03	0.03	+0.00
Commelina africana var. *krebsiana*	3	0.03	0.03	+0.00
Phyllanthus humilis	3	0.03	0.03	+0.00
Lithospermum flexuosum	6	0.08	0.08	+0.00
Tephrosia elongata var. *elongata*	2	0.02	0.01	+0.00
Helichrysum pilosellum	2	0.01	0.01	-0.00
Unidentifiable sp. 1694	2	0.01	0.01	-0.00
Commelina africana var. *africana*	7	0.09	0.10	-0.01
Thunbergia atriplicifolia	2	0.00	0.01	-0.01
Ipomoea hochstetteri	2	0.00	0.01	-0.01
Momordica balsamina	2	0.00	0.01	-0.01
Talinum caffrum	2	0.00	0.01	-0.01
Dicoma zeyheri	2	0.00	0.01	-0.01
Commelina erecta	2	0.00	0.01	-0.01
Cleome rubella	2	0.00	0.01	-0.01
Gerbera sp. 1476	2	0.00	0.01	-0.01
Vernonia sp. 1461	2	0.00	0.01	-0.01
Merremia palmata	2	0.00	0.01	-0.01
Gomphrena celosioides	2	0.00	0.01	-0.01
Senecio venosus	2	0.00	0.01	-0.01
Justicia anagalloides	2	0.00	0.01	-0.01
Anthericum cooperi	2	0.00	0.01	-0.01

Hypoxis argentea var. *argentea*	2	0.00	0.01	-0.01
Portulaca oleracea	2	0.00	0.01	-0.01
Vernonia oligocephala	6	0.07	0.08	-0.01
Clerodendrum triphyllum var. *triphyllum*	7	0.08	0.10	-0.02
Triaspis hypericoides subsp. *nelsonii*	3	0.01	0.03	-0.02
Chaetacanthus costatus	3	0.01	0.03	-0.02
Hypoxis hemerocallidea	3	0.01	0.03	-0.02
Kedrostis foetidissima	3	0.00	0.03	-0.03
Vigna vexillata var. *angustifolia*	3	0.00	0.03	-0.03
Unidentifiable sp. 1437	3	0.00	0.03	-0.03
Merremia tridentata subsp. *angustifolia*	3	0.00	0.03	-0.03
Chamaesyce inaequilatera	3	0.00	0.03	-0.03
Phyllanthus maderaspatensis	3	0.00	0.03	-0.03
Kyphocarpa angustifolia	3	0.00	0.03	-0.03
Chamaecrista biensis	3	0.00	0.03	-0.03
Hibiscus trionum	4	0.02	0.05	-0.03
Crabbea angustifolia	4	0.01	0.05	-0.03
Monsonia angustifolia	6	0.04	0.08	-0.04
Clematis brachiata	4	0.01	0.05	-0.04
Corchorus asplenifolius	4	0.01	0.05	-0.04
Cucumis zeyheri	4	0.01	0.05	-0.04
Ledebouria sp. 1356	4	0.01	0.05	-0.04
Felicia muricata subsp. *cinerascens*	4	0.01	0.05	-0.04
Teucrium trifidum	6	0.04	0.08	-0.04
Plexipus hederaceus var. *hederaceus*	6	0.04	0.08	-0.04
Tagetes minuta	10	0.10	0.15	-0.05
Convolvulus sagittatus subsp. *sagittatus*	5	0.01	0.06	-0.06
Oldenlandia herbacea var. *herbacea*	5	0.01	0.06	-0.06
Corbichonia decumbens	8	0.05	0.11	-0.06
Hibiscus pusillus	6	0.02	0.08	-0.06
Evolvulus alsinoides var. *linifolius*	6	0.02	0.08	-0.06
Pentarrhinum insipidum	11	0.09	0.16	-0.07
Amaranthus thunbergii	6	0.01	0.08	-0.07
Ipomoea obscura var. *obscura*	6	0.01	0.08	-0.07
Weak competitors:				
Ruellia cordata	11	0.08	0.16	-0.08
Pellaea calomelanos var. *calomelanos*	8	0.01	0.11	-0.10
Indigofera rhytidocarpa subsp. *rhytidocarpa*	9	0.02	0.13	-0.11
Rhynchosia totta var. *totta*	10	0.02	0.15	-0.13
Sida alba	12	0.04	0.18	-0.14
Total cover for species in group:	3.90%			

Total class cover = 45.52%
Grass proportion = 48.65%
Forb proportion = 8.57%
Dwarf shrub proportion = 6.86%
Shrub proportion = 13.58%
Tree proportion = 22.35%

Community number: 5
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Trees

Correlation coefficient = +0.84
Standard error of the mean = 0.58

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Acacia caffra	10	3.47	2.35	+1.12
Normal competition range:				
Acacia tortilis subsp. *heteracantha*	1	0.07	-0.27	+0.34
Vitex obovata	3	0.64	0.31	+0.33
Combretum apiculatum subsp. *apiculatum*	1	0.01	-0.27	+0.28
Acacia karroo	2	0.15	0.02	+0.13
Dichrostachys cinerea subsp. *africana* var. *africana*	2	0.04	0.02	+0.02
Pappea capensis	2	0.00	0.02	-0.02
Unidentifiable sp. 1690	4	0.27	0.60	-0.33
Acacia robusta subsp. *robusta*	6	0.80	1.18	-0.39
Acacia nilotica subsp. *kraussiana*	7	0.97	1.48	-0.51
Weak competitors:				
Dombeya rotundifolia var. *rotundifolia*	6	0.20	1.18	-0.98
Total cover for species in group:	6.62%			

Shrubs

Correlation coefficient = +0.73
Standard error of the mean = 0.18

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Combretum molle	8	0.92	0.52	+0.40
Normal competition range:				

Unidentifiable sp. 1687	2	0.13	0.02	+0.12
Unidentifiable sp. 1685	2	0.10	0.02	+0.09
Cryptolepis oblongifolia	1	0.00	-0.07	+0.07
Unidentifiable sp. 1696	1	0.00	-0.07	+0.07
Cassine aethiopica	1	0.00	-0.07	+0.07
Berchemia zeyheri	2	0.07	0.02	+0.06
Vangueria infausta subsp. *infausta*	3	0.04	0.10	-0.06
Rhus lancea	4	0.09	0.18	-0.10
Rhus leptodictya	6	0.20	0.35	-0.15
Ehretia rigida	4	0.02	0.18	-0.17
Weak competitors:				
Grewia flava	4	0.01	0.18	-0.18
Maytenus heterophylla	5	0.05	0.27	-0.22

Total cover for species in group: 1.63%

Dwarf Shrubs

Correlation coefficient = +0.16
Standard error of the mean = 0.37

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Ziziphus zeyheriana	1	1.74	0.07	+1.68
Aloe greatheadii var. *davyana*	11	1.21	0.25	+0.96
Normal competition range:				
Triumfetta sonderi	4	0.20	0.12	+0.07
Acalypha angustata var. *glabra*	1	0.03	0.07	-0.04
Justicia betonica	2	0.04	0.09	-0.05
Abrus laevigatus	1	0.01	0.07	-0.06
Xerophyta retinervis	1	0.01	0.07	-0.06
Gerbera viridifolia subsp. *viridifolia*	1	0.01	0.07	-0.06
Elephantorrhiza elephantina	1	0.01	0.07	-0.06
Piriqueta capensis	1	0.00	0.07	-0.06
Pollichia campestris	1	0.00	0.07	-0.06
Justicia flava	1	0.00	0.07	-0.06
Carissa bispinosa subsp. *bispinosa*	1	0.00	0.07	-0.06
Solanum coccineum	1	0.00	0.07	-0.06
Crotalaria lotoides	1	0.00	0.07	-0.06
Achyropsis leptostachya	1	0.00	0.07	-0.06
Maytenus tenuispina	2	0.01	0.09	-0.08
Euclea undulata var. *myrtina*	2	0.01	0.09	-0.08
Polygala hottentotta	2	0.00	0.09	-0.08
Dicoma anomala subsp. *anomala*	9	0.12	0.22	-0.09
Mundulea sericea	5	0.04	0.14	-0.10
Waltheria indica	3	0.00	0.10	-0.10
Rhus gracillima	6	0.05	0.16	-0.11
Solanum panduriforme	4	0.01	0.12	-0.11
Indigofera parviflora var. *parviflora*	4	0.01	0.12	-0.12
Solanum incanum	5	0.01	0.14	-0.13
Indigofera heterotricha	5	0.01	0.14	-0.13
Melhania prostrata	6	0.01	0.16	-0.15
Stylosanthes fruticosa	6	0.01	0.16	-0.15
Lantana rugosa	7	0.02	0.18	-0.16
Lippia scaberrima	10	0.08	0.24	-0.16
Protasparagus suaveolens	11	0.05	0.25	-0.21

Total cover for species in group: 3.72%

Grasses

Correlation coefficient = +0.57
Standard error of the mean = 0.28

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Setaria sphacelata var. *torta*	8	1.57	0.38	+1.19
Trachypogon spicatus	5	0.94	0.22	+0.71
Melinis repens subsp. *grandiflora*	13	1.28	0.65	+0.63
Tristachya biseriata	3	0.68	0.12	+0.57
Loudetia flavida	11	0.96	0.54	+0.42
Normal competition range:				
Heteropogon contortus	10	0.73	0.49	+0.24
Enneapogon scoparius	3	0.34	0.12	+0.22
Hyperthelia dissoluta	2	0.22	0.06	+0.16
Eragrostis chloromelas	7	0.48	0.33	+0.15
Diheteropogon amplectens	11	0.62	0.54	+0.08
Urelytrum agropyroides	1	0.07	0.01	+0.06
Aristida diffusa subsp. *burkei*	6	0.33	0.28	+0.05
Elionurus muticus	3	0.16	0.12	+0.05
Eragrostis superba	1	0.03	0.01	+0.02
Pennisetum sphacelatum	2	0.08	0.06	+0.01
Eustachys paspaloides	4	0.18	0.17	+0.01
Anthephora pubescens	2	0.07	0.06	+0.01
Eragrostis trichophora	1	0.01	0.01	-0.00
Pogonarthria squarrosa	1	0.00	0.01	-0.01

Eragrostis pseudosclerantha	1	0.00	0.01	-0.01
Alloteropsis semialata subsp. *eckloniana*	1	0.00	0.01	-0.01
Kyllinga erecta	1	0.00	0.01	-0.01
Cyperus semitrifidus var. *multiglumis*	1	0.00	0.01	-0.01
Cymbopogon excavatus	1	0.00	0.01	-0.01
Setaria verticillata	1	0.00	0.01	-0.01
Digitaria eriantha	1	0.00	0.01	-0.01
Bewsia biflora	1	0.00	0.01	-0.01
Cyperus obtusiflorus var. *obtusiflorus*	1	0.00	0.01	-0.01
Setaria lindenbergiana	2	0.04	0.06	-0.02
Cynodon dactylon	2	0.03	0.06	-0.03
Eragrostis gummiflua	2	0.03	0.06	-0.03
Sporobolus stapfianus	5	0.17	0.22	-0.05
Unidentifiable sp. 1688	2	0.00	0.06	-0.06
Enneapogon cenchroides	2	0.00	0.06	-0.06
Tricholaena monachne	2	0.00	0.06	-0.06
Eragrostis rigidior	2	0.00	0.06	-0.06
Tripogon minimus	2	0.00	0.06	-0.06
Mariscus rehmannianus	2	0.00	0.06	-0.06
Urochloa panicoides	2	0.00	0.06	-0.06
Aristida canescens subsp. *canescens*	12	0.53	0.60	-0.07
Tragus berteronianus	9	0.36	0.44	-0.07
Panicum maximum	3	0.00	0.12	-0.11
Eragrostis racemosa	3	0.00	0.12	-0.11
Microchloa caffra	4	0.04	0.17	-0.13
Aristida bipartita	6	0.05	0.28	-0.23
Bulbostylis contexta	6	0.04	0.28	-0.24
Aristida scabrivalvis subsp. *scabrivalvis*	8	0.13	0.38	-0.25
Diheteropogon filifolius	7	0.08	0.33	-0.25
Weak competitors:				
Brachiaria serrata	8	0.09	0.38	-0.30
Hyparrhenia filipendula var. *pilosa*	7	0.02	0.33	-0.31
Trichoneura grandiglumis var. *grandiglumis*	7	0.01	0.33	-0.32
Themeda triandra	12	0.25	0.60	-0.34
Aristida congesta subsp. *congesta*	10	0.13	0.49	-0.36
Melinis nerviglumis	10	0.08	0.49	-0.41
Schizachyrium sanguineum	10	0.04	0.49	-0.44

Total cover for species in group: 10.94%

Forbs

Correlation coefficient = +0.42
Standard error of the mean = 0.05

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Wahlenbergia undulata	1	0.38	0.00	+0.38
Schkuhria pinnata	8	0.30	0.07	+0.24
Tagetes minuta	9	0.24	0.08	+0.16
Bidens bipinnata	5	0.17	0.04	+0.14
Ruellia cordata	11	0.22	0.09	+0.13
Clerodendrum triphyllum var. *triphyllum*	7	0.13	0.06	+0.08
Normal competition range:				
Vernonia oligocephala	6	0.08	0.05	+0.04
Oldenlandia herbacea var. *herbacea*	6	0.08	0.05	+0.03
Corbichonia decumbens	3	0.03	0.02	+0.01
Verbena officinalis	1	0.01	0.00	+0.01
Dipcadi viride	1	0.01	0.00	+0.01
Chenopodium album	4	0.04	0.03	+0.01
Helichrysum rugulosum	2	0.02	0.01	+0.00
Emilia transvaalensis	1	0.00	0.00	+0.00
Polycarpaea corymbosa	1	0.00	0.00	+0.00
Anthospermum galioides subsp. *reflexifolium*	1	0.00	0.00	+0.00
Achyranthes aspera var. *aspera*	1	0.00	0.00	+0.00
Indigofera daleoides var. *daleoides*	1	0.00	0.00	+0.00
Kedrostis foetidissima	1	0.00	0.00	+0.00
Asclepias burchellii	1	0.00	0.00	+0.00
Tragia rupestris	1	0.00	0.00	+0.00
Turbina oblongata	1	0.00	0.00	+0.00
Polygala sp. 1575	1	0.00	0.00	+0.00
Ipomoea papilio	1	0.00	0.00	+0.00
Ipomoea bathycolpos var. *bathycolpos*	1	0.00	0.00	+0.00
Orbeopsis lutea subsp. *lutea*	1	0.00	0.00	+0.00
Commelina erecta	1	0.00	0.00	+0.00
Cleome rubella	1	0.00	0.00	+0.00
Gerbera sp. 1476	1	0.00	0.00	+0.00
Fuirena hirsuta	1	0.00	0.00	+0.00
Conyza albida	1	0.00	0.00	+0.00
Helichrysum sp. 1465	1	0.00	0.00	+0.00
Vernonia sp. 1461	1	0.00	0.00	+0.00
Senecio barbertonicus	1	0.00	0.00	+0.00
Menodora africana	1	0.00	0.00	+0.00
Ipomoea bolusiana subsp. *bolusiana*	1	0.00	0.00	+0.00
Oxalis sp. 1337	1	0.00	0.00	+0.00
Hypoxis hemerocallidea	1	0.00	0.00	+0.00
Dicerocaryum eriocarpum	1	0.00	0.00	+0.00
Unidentifiable sp. 1437	1	0.00	0.00	+0.00

Vahlia capensis subsp. *vulgaris* var. *linearis*	1	0.00	0.00	+0.00
Lactuca capensis	1	0.00	0.00	+0.00
Chamaesyce inaequilatera	1	0.00	0.00	+0.00
Sida alba	1	0.00	0.00	+0.00
Graderia subintegra	1	0.00	0.00	+0.00
Asclepias stellifera	1	0.00	0.00	+0.00
Nidorella hottentotica	1	0.00	0.00	+0.00
Unidentifiable sp. 1694	2	0.01	0.01	-0.00
Kyphocarpa angustifolia	2	0.01	0.01	-0.00
Pearsonia sessilifolia subsp. *marginata*	3	0.02	0.02	-0.00
Monsonia angustifolia	6	0.04	0.05	-0.00
Becium grandiflorum var. *galpinii*	8	0.06	0.07	-0.01
Nolletia rarifolia	2	0.00	0.01	-0.01
Phyllanthus incurvus	2	0.00	0.01	-0.01
Ipomoea hochstetteri	2	0.00	0.01	-0.01
Boophane disticha	2	0.00	0.01	-0.01
Clematis brachiata	2	0.00	0.01	-0.01
Cheilanthes viridis var. *viridis*	2	0.00	0.01	-0.01
Merremia palmata	2	0.00	0.01	-0.01
Vigna vexillata var. *vexillata*	2	0.00	0.01	-0.01
Teucrium trifidum	2	0.00	0.01	-0.01
Acalypha segetalis	2	0.00	0.01	-0.01
Hermannia depressa	2	0.00	0.01	-0.01
Ledebouria sp. 1356	2	0.00	0.01	-0.01
Anthericum cooperi	2	0.00	0.01	-0.01
Hypoxis argentea var. *argentea*	2	0.00	0.01	-0.01
Gnidia capitata	2	0.00	0.01	-0.01
Helichrysum oxyphyllum	2	0.00	0.01	-0.01
Solanum supinum	2	0.00	0.01	-0.01
Hypoxis rigidula var. *rigidula*	3	0.01	0.02	-0.01
Lithospermum flexuosum	6	0.04	0.05	-0.01
Hibiscus trionum	3	0.00	0.02	-0.02
Gladiolus permeabilis subsp. *permeabilis*	3	0.00	0.02	-0.02
Cucumis zeyheri	3	0.00	0.02	-0.02
Phyllanthus maderaspatensis	3	0.00	0.02	-0.02
Kohautia amatymbica	3	0.00	0.02	-0.02
Commelina africana var. *africana*	3	0.00	0.02	-0.02
Geigeria burkei subsp. *burkei* var. *burkei*	3	0.00	0.02	-0.02
Acalypha villicaulis	4	0.01	0.03	-0.02
Felicia muricata subsp. *cinerascens*	4	0.01	0.03	-0.02
Pellaea calomelanos var. *calomelanos*	7	0.04	0.06	-0.02
Senecio venosus	5	0.02	0.04	-0.02
Plexipus hederaceus var. *hederaceus*	8	0.05	0.07	-0.02
Evolvulus alsinoides var. *linifolius*	8	0.05	0.07	-0.02
Indigofera rhytidocarpa subsp. *rhytidocarpa*	6	0.03	0.05	-0.02
Habenaria epipactidea	4	0.01	0.03	-0.02
Vernonia poskeana subsp. *botswanica*	4	0.01	0.03	-0.02
Chaetacanthus costatus	4	0.01	0.03	-0.02
Commelina africana var. *krebsiana*	4	0.01	0.03	-0.02
Thesium magalismontanum	4	0.01	0.03	-0.02
Cleome monophylla	4	0.01	0.03	-0.02
Crabbea angustifolia	4	0.01	0.03	-0.02
Convolvulus sagittatus subsp. *sagittatus*	5	0.01	0.04	-0.02
Zinnia peruviana	5	0.01	0.04	-0.02
Anthericum longistylum	5	0.01	0.04	-0.02
Chamaecrista biensis	5	0.01	0.04	-0.02
Gnidia sericocephala	5	0.01	0.04	-0.03
Gazania krebsiana subsp. *krebsiana*	5	0.01	0.04	-0.03
Corchorus asplenifolius	5	0.01	0.04	-0.03
Helichrysum nudifolium	5	0.01	0.04	-0.03
Ipomoea obscura var. *obscura*	6	0.02	0.05	-0.03
Tephrosia elongata var. *elongata*	7	0.02	0.06	-0.03
Zornia linearis	6	0.01	0.05	-0.04
Anthospermum rigidum subsp. *pumilum*	6	0.01	0.05	-0.04
Tephrosia purpurea subsp. *leptostachya*	10	0.05	0.09	-0.04
Pentarrhinum insipidum	7	0.02	0.06	-0.04
Hermannia parvula	7	0.02	0.06	-0.04
Rhynchosia totta var. *totta*	10	0.04	0.09	-0.04
Merremia tridentata subsp. *angustifolia*	7	0.01	0.06	-0.05
Phyllanthus humilis	8	0.02	0.07	-0.05
Weak competitors:				
Hibiscus pusillus	11	0.04	0.09	-0.05
Total cover for species in group:	2.63%			

Total class cover = 25.54%
Grass proportion = 42.84%
Forb proportion = 10.29%
Dwarf shrub proportion = 14.56%
Shrub proportion = 6.39%
Tree proportion = 25.93%

Community number: 6

Trees

Correlation coefficient = +0.13
Standard error of the mean = 1.19

	(F)	Actual cover	Pred. cover	Difference
Normal competition range:				
Acacia tortilis subsp. *heteracantha*	3	1.90	1.06	+0.84
Acacia robusta subsp. *robusta*	2	0.87	0.87	+0.00
Acacia karroo	3	0.22	1.06	-0.84
Total cover for species in group:	3.00%			

Shrubs

Correlation coefficient = +0.32
Standard error of the mean = 0.11

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Grewia flava	1	0.27	0.07	+0.20
Normal competition range:				
Unidentifiable sp. 1685	2	0.16	0.15	+0.00
Rhus leptodictya	1	0.07	0.07	-0.00
Cassine aethiopica	1	0.00	0.07	-0.07
Rhus lancea	1	0.00	0.07	-0.07
Maytenus heterophylla	1	0.00	0.07	-0.07
Total cover for species in group:	0.50%			

Dwarf Shrubs

Correlation coefficient = +0.42
Standard error of the mean = 1.48

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Aloe greatheadii var. *davyana*	6	7.69	1.64	+6.05
Normal competition range:				
Pollichia campestris	1	0.61	-0.23	+0.84
Ptycholobium plicatum	1	0.00	-0.23	+0.23
Agathisanthemum bojeri subsp. *bojeri*	1	0.00	-0.23	+0.23
Indigofera sp. 1422	1	0.00	-0.23	+0.23
Helichrysum athrixiifolium	1	0.00	-0.23	+0.23
Justicia betonica	1	0.00	-0.23	+0.23
Rhus gracillima	1	0.00	-0.23	+0.23
Achyropsis leptostachya	1	0.00	-0.23	+0.23
Indigofera heterotricha	2	0.07	0.14	-0.07
Elephantorrhiza elephantina	2	0.02	0.14	-0.12
Solanum incanum	2	0.02	0.14	-0.12
Polygala amatymbica	2	0.01	0.14	-0.14
Euclea undulata var. *myrtina*	2	0.01	0.14	-0.14
Lippia scaberrima	3	0.07	0.52	-0.45
Ziziphus zeyheriana	3	0.04	0.52	-0.48
Solanum panduriforme	3	0.02	0.52	-0.50
Stylosanthes fruticosa	3	0.02	0.52	-0.50
Melhania prostrata	4	0.01	0.89	-0.88
Triumfetta sonderi	6	0.57	1.64	-1.07
Lantana rugosa	5	0.09	1.27	-1.18
Dicoma anomala subsp. *anomala*	5	0.02	1.27	-1.25
Weak competitors:				
Protasparagus suaveolens	6	0.02	1.64	-1.62
Total cover for species in group:	9.32%			

Grasses

Correlation coefficient = +0.48
Standard error of the mean = 0.85

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Schizachyrium sanguineum	3	4.00	0.47	+3.53
Themeda triandra	6	4.37	1.24	+3.12

Normal competition range:

Trachypogon spicatus	1	0.61	-0.05	+0.65
Loudetia flavida	6	1.61	1.24	+0.37
Melinis nerviglumis	1	0.07	-0.05	+0.11
Panicum maximum	1	0.02	-0.05	+0.06
Cynodon dactylon	1	0.02	-0.05	+0.06
Enneapogon cenchroides	1	0.00	-0.05	+0.05
Cyperus sphaerospermus	1	0.00	-0.05	+0.05
Aristida diffusa subsp. *burkei*	1	0.00	-0.05	+0.05
Alloteropsis semialata subsp. *eckloniana*	1	0.00	-0.05	+0.05
Eragrostis rigidior	1	0.00	-0.05	+0.05
Diheteropogon filifolius	1	0.00	-0.05	+0.05
Tristachya biseriata	1	0.00	-0.05	+0.05
Sporobolus stapfianus	1	0.00	-0.05	+0.05
Microchloa caffra	1	0.00	-0.05	+0.05
Brachiaria nigropedata	1	0.00	-0.05	+0.05
Eragrostis superba	1	0.00	-0.05	+0.05
Setaria sphacelata var. *torta*	6	1.25	1.24	+0.01
Cymbopogon plurinodis	2	0.08	0.21	-0.13
Anthephora pubescens	2	0.07	0.21	-0.14
Eragrostis gummiflua	2	0.07	0.21	-0.14
Tripogon minimus	2	0.01	0.21	-0.20
Mariscus rehmannianus	2	0.01	0.21	-0.20
Cyperus obtusiflorus var. *obtusiflorus*	2	0.01	0.21	-0.20
Trichoneura grandiglumis var. *grandiglumis*	2	0.01	0.21	-0.20
Digitaria eriantha	3	0.22	0.47	-0.25
Brachiaria serrata	5	0.69	0.98	-0.29
Eragrostis chloromelas	3	0.17	0.47	-0.30
Elionurus muticus	4	0.34	0.73	-0.38
Bewsia biflora	3	0.02	0.47	-0.44
Hyparrhenia filipendula var. *pilosa*	3	0.01	0.47	-0.46
Eragrostis racemosa	3	0.01	0.47	-0.46
Heteropogon contortus	6	0.66	1.24	-0.58
Diheteropogon amplectens	6	0.66	1.24	-0.58
Aristida congesta subsp. *congesta*	4	0.09	0.73	-0.64
Aristida canescens subsp. *canescens*	4	0.05	0.73	-0.67
Tragus berteronianus	4	0.04	0.73	-0.69
Bulbostylis contexta	4	0.03	0.73	-0.70
Melinis repens subsp. *grandiflora*	5	0.14	0.98	-0.84

Total cover for species in group: 15.37%

Forbs

Correlation coefficient = +0.66
Standard error of the mean = 0.01

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Bidens bipinnata	3	0.07	0.02	+0.05
Plexipus hederaceus var. *hederaceus*	5	0.08	0.04	+0.04
Pearsonia sessilifolia subsp. *marginata*	2	0.03	0.01	+0.02
Tephrosia purpurea subsp. *leptostachya*	5	0.06	0.04	+0.02
Tagetes minuta	3	0.04	0.02	+0.02
Crotalaria brachycarpa	1	0.02	0.00	+0.01
Monsonia angustifolia	4	0.04	0.03	+0.01
Normal competition range:				
Cleome monophylla	2	0.02	0.01	+0.01
Vahlia capensis subsp. *vulgaris* var. *linearis*	2	0.02	0.01	+0.01
Lithospermum flexuosum	2	0.02	0.01	+0.01
Oldenlandia herbacea var. *herbacea*	3	0.02	0.02	+0.00
Becium grandiflorum var. *galpinii*	3	0.02	0.02	+0.00
Geigeria burkei subsp. *burkei* var. *burkei*	3	0.02	0.02	+0.00
Achyranthes aspera var. *sicula*	1	0.00	0.00	+0.00
Guilleminea densa	1	0.00	0.00	+0.00
Kalanchoe rotundifolia	1	0.00	0.00	+0.00
Commelina erecta	1	0.00	0.00	+0.00
Chenopodium album	1	0.00	0.00	+0.00
Vigna unguiculata subsp. *stenophylla*	1	0.00	0.00	+0.00
Pachycarpus concolor	1	0.00	0.00	+0.00
Cleome rubella	1	0.00	0.00	+0.00
Ledebouria sp. 1509	1	0.00	0.00	+0.00
Gazania krebsiana subsp. *krebsiana*	1	0.00	0.00	+0.00
Scabiosa columbaria	1	0.00	0.00	+0.00
Menodora africana	1	0.00	0.00	+0.00
Oxalis sp. 1337	1	0.00	0.00	+0.00
Unidentifiable sp. 1437	1	0.00	0.00	+0.00
Schkuhria pinnata	1	0.00	0.00	+0.00
Corbichonia decumbens	1	0.00	0.00	+0.00
Ipomoea obscura var. *obscura*	1	0.00	0.00	+0.00
Merremia tridentata subsp. *angustifolia*	1	0.00	0.00	+0.00
Wahlenbergia undulata	1	0.00	0.00	+0.00
Ledebouria sp. 1356	1	0.00	0.00	+0.00
Asclepias stellifera	1	0.00	0.00	+0.00
Kyphocarpa angustifolia	1	0.00	0.00	+0.00
Nidorella hottentotica	1	0.00	0.00	+0.00
Vernonia oligocephala	1	0.00	0.00	+0.00
Hibiscus pusillus	4	0.03	0.03	-0.00
Rhynchosia totta var. *totta*	4	0.03	0.03	-0.00

Crabbea angustifolia	4	0.03	0.03	-0.00
Clematis brachiata	2	0.01	0.01	-0.00
Chaetacanthus costatus	2	0.01	0.01	-0.00
Dicerocaryum eriocarpum	2	0.01	0.01	-0.00
Corchorus asplenifolius	2	0.01	0.01	-0.00
Teucrium trifidum	2	0.01	0.01	-0.00
Commelina africana var. *krebsiana*	2	0.01	0.01	-0.00
Zinnia peruviana	2	0.01	0.01	-0.00
Phyllanthus humilis	2	0.01	0.01	-0.00
Tephrosia elongata var. *elongata*	2	0.01	0.01	-0.00
Thesium magalismontanum	2	0.01	0.01	-0.00
Pentarrhinum insipidum	2	0.01	0.01	-0.00
Eriosema burkei	2	0.01	0.01	-0.00
Gladiolus permeabilis subsp. *permeabilis*	2	0.01	0.01	-0.00
Anthericum longistylum	2	0.01	0.01	-0.00
Senecio venosus	2	0.01	0.01	-0.00
Lactuca capensis	2	0.01	0.01	-0.00
Helichrysum nudifolium	2	0.01	0.01	-0.00
Hermannia depressa	2	0.01	0.01	-0.00
Justicia anagalloides	2	0.01	0.01	-0.00
Felicia muricata subsp. *cinerascens*	2	0.01	0.01	-0.00
Lotononis listii	2	0.01	0.01	-0.00
Indigofera rhytidocarpa subsp. *rhytidocarpa*	2	0.01	0.01	-0.00
Evolvulus alsinoides var. *linifolius*	2	0.01	0.01	-0.00
Helichrysum oxyphyllum	2	0.01	0.01	-0.00
Cucumis zeyheri	5	0.03	0.04	-0.01
Clerodendrum triphyllum var. *triphyllum*	3	0.01	0.02	-0.01
Gomphrena celosioides	3	0.01	0.02	-0.01
Anthospermum rigidum subsp. *pumilum*	3	0.01	0.02	-0.01
Sida alba	3	0.01	0.02	-0.01
Anthericum cooperi	3	0.01	0.02	-0.01
Commelina africana var. *africana*	3	0.01	0.02	-0.01
Solanum supinum	3	0.01	0.02	-0.01
Weak competitors:				
Pellaea calomelanos var. *calomelanos*	4	0.01	0.03	-0.01
Chamaecrista biensis	4	0.01	0.03	-0.01
Phyllanthus maderaspatensis	5	0.02	0.04	-0.02
Chamaesyce inaequilatera	6	0.02	0.04	-0.02
Total cover for species in group:	0.95%			

Total class cover = 29.14%
Grass proportion = 52.75%
Forb proportion = 3.26%
Dwarf shrub proportion = 31.99%
Shrub proportion = 1.72%
Tree proportion = 10.28%

Community number: 7

Trees

Correlation coefficient = +0.89
Standard error of the mean = 0.78

	(F)	Actual cover	Pred. cover	Difference
Normal competition range:				
Acacia robusta subsp. *robusta*	6	1.61	0.99	+0.62
Acacia tortilis subsp. *heteracantha*	15	3.49	3.16	+0.34
Acacia nilotica subsp. *kraussiana*	2	0.16	0.02	+0.13
Acacia caffra	2	0.08	0.02	+0.05
Weak competitors:				
Acacia karroo	8	0.33	1.47	-1.14
Total cover for species in group:	5.67%			

Shrubs

Correlation coefficient = +0.33
Standard error of the mean = 0.05

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Unidentifiable sp. 1685	2	0.13	0.04	+0.09
Normal competition range:				
Rhus leptodictya	10	0.10	0.09	+0.02
Rhus lancea	4	0.06	0.05	+0.01
Grewia flava	3	0.04	0.04	-0.01
Maytenus heterophylla	2	0.01	0.04	-0.03
Unidentifiable sp. 1686	2	0.00	0.04	-0.04
Ehretia rigida	5	0.00	0.06	-0.05
Total cover for species in group:	0.35%			

Dwarf Shrubs

Correlation coefficient = +0.66
Standard error of the mean = 0.21

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Aloe greatheadii var. *davyana*	22	1.32	0.67	+0.65
Ziziphus zeyheriana	6	0.43	0.11	+0.32
Normal competition range:				
Justicia flava	2	0.12	-0.03	+0.15
Acalypha angustata var. *glabra*	1	0.00	-0.07	+0.07
Triumfetta sonderi	3	0.07	-0.00	+0.07
Pollichia campestris	1	0.00	-0.07	+0.07
Carissa bispinosa subsp. *bispinosa*	1	0.00	-0.07	+0.07
Indigofera parviflora var. *parviflora*	1	0.00	-0.07	+0.07
Solanum panduriforme	3	0.04	0.00	+0.04
Ptycholobium plicatum	2	0.01	-0.03	+0.04
Solanum coccineum	2	0.00	-0.03	+0.04
Stylosanthes fruticosa	2	0.00	-0.03	+0.04
Elephantorrhiza elephantina	4	0.07	0.04	+0.03
Polygala hottentotta	3	0.00	0.00	+0.00
Agathisanthemum bojeri subsp. *bojeri*	4	0.00	0.04	-0.03
Lippia scaberrima	4	0.00	0.04	-0.03
Achyropsis leptostachya	5	0.02	0.07	-0.05
Justicia betonica	6	0.05	0.11	-0.06
Indigofera heterotricha	5	0.00	0.07	-0.07
Euclea undulata var. *myrtina*	7	0.03	0.14	-0.11
Solanum incanum	7	0.01	0.14	-0.13
Lantana rugosa	9	0.01	0.21	-0.20
Weak competitors:				
Polygala amatymbica	10	0.01	0.25	-0.24
Protasparagus suaveolens	12	0.01	0.32	-0.31
Dicoma anomala subsp. *anomala*	16	0.05	0.46	-0.41
Total cover for species in group: 2.28%				

Grasses

Correlation coefficient = +0.57
Standard error of the mean = 0.79

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Setaria sphacelata var. *torta*	18	4.85	1.32	+3.53
Panicum maximum	9	3.18	0.54	+2.64
Elionurus muticus	16	2.47	1.15	+1.32
Melinis repens subsp. *grandiflora*	20	2.50	1.49	+1.01
Normal competition range:				
Themeda triandra	18	1.97	1.32	+0.65
Digitaria eriantha	10	1.00	0.63	+0.37
Setaria verticillata	2	0.23	-0.06	+0.28
Unidentifiable sp. 1688	1	0.02	-0.14	+0.16
Enneapogon cenchroides	1	0.00	-0.14	+0.14
Eragrostis pseudosclerantha	1	0.00	-0.14	+0.14
Aristida adscensionis	1	0.00	-0.14	+0.14
Eragrostis nindensis	1	0.00	-0.14	+0.14
Aristida scabrivalvis subsp. *scabrivalvis*	1	0.00	-0.14	+0.14
Eragrostis capensis	1	0.00	-0.14	+0.14
Eragrostis chloromelas	18	1.45	1.32	+0.13
Aristida diffusa subsp. *burkei*	2	0.00	-0.06	+0.06
Digitaria monodactyla	2	0.00	-0.06	+0.06
Sporobolus nitens	2	0.00	-0.06	+0.06
Kyllinga erecta	2	0.00	-0.06	+0.06
Eragrostis rigidior	2	0.00	-0.06	+0.06
Mariscus uitenhagensis	2	0.00	-0.06	+0.06
Bewsia biflora	2	0.00	-0.06	+0.06
Hyparrhenia filipendula var. *pilosa*	2	0.00	-0.06	+0.06
Aristida canescens subsp. *canescens*	19	1.44	1.40	+0.03
Loudetia flavida	13	0.91	0.89	+0.02
Melinis nerviglumis	3	0.01	0.03	-0.02
Urochloa panicoides	3	0.00	0.03	-0.03
Kyllinga alba	3	0.00	0.03	-0.03
Cynodon dactylon	4	0.09	0.11	-0.03
Cymbopogon plurinodis	5	0.17	0.20	-0.03
Cymbopogon excavatus	4	0.00	0.11	-0.11
Mariscus rehmannianus	4	0.00	0.11	-0.11
Cyperus obtusiflorus var. *obtusiflorus*	4	0.00	0.11	-0.11
Bulbostylis contexta	5	0.02	0.20	-0.18
Trachypogon spicatus	6	0.11	0.29	-0.18
Schizachyrium sanguineum	9	0.29	0.54	-0.26
Eragrostis trichophora	6	0.01	0.29	-0.28
Anthephora pubescens	9	0.22	0.54	-0.32
Alloteropsis semialata subsp. *eckloniana*	7	0.01	0.37	-0.37
Diheteropogon amplectens	11	0.31	0.72	-0.40
Brachiaria nigropedata	8	0.05	0.46	-0.41

	(F)	Actual cover	Pred. cover	Difference
Eragrostis superba	8	0.01	0.46	-0.45
Sporobolus stapfianus	9	0.03	0.54	-0.52
Eragrostis racemosa	9	0.01	0.54	-0.53
Aristida congesta subsp. *congesta*	19	0.83	1.40	-0.58
Tripogon minimus	10	0.02	0.63	-0.61
Trichoneura grandiglumis var. *grandiglumis*	12	0.03	0.80	-0.77
Weak competitors:				
Eragrostis gummiflua	20	0.59	1.49	-0.90
Microchloa caffra	14	0.06	0.97	-0.92
Brachiaria serrata	15	0.10	1.06	-0.96
Heteropogon contortus	19	0.21	1.40	-1.19
Tragus berteronianus	18	0.10	1.32	-1.21

Total cover for species in group: 23.30%

Forbs

Correlation coefficient = +0.45
Standard error of the mean = 0.13

	(F)	Actual cover	Pred. cover	Differ-ence
Strong competitors:				
Indigofera rhytidocarpa subsp. *rhytidocarpa*	17	1.12	0.19	+0.92
Vernonia oligocephala	16	0.80	0.18	+0.62
Berkheya radula	2	0.30	-0.00	+0.30
Unidentifiable sp. 1689	2	0.17	-0.00	+0.17
Normal competition range:				
Helichrysum nudifolium	7	0.12	0.06	+0.06
Tephrosia purpurea subsp. *leptostachya*	17	0.25	0.19	+0.06
Tagetes minuta	5	0.08	0.04	+0.04
Unidentifiable sp. 1694	1	0.00	-0.02	+0.02
Senecio lygodes	1	0.00	-0.02	+0.02
Habenaria epipactidea	1	0.00	-0.02	+0.02
Unidentifiable sp. 1548	1	0.00	-0.02	+0.02
Amaranthus thunbergii	1	0.00	-0.02	+0.02
Orbeopsis lutea subsp. *lutea*	1	0.00	-0.02	+0.02
Felicia mossamedensis	1	0.00	-0.02	+0.02
Nesaea rigidula	1	0.00	-0.02	+0.02
Tulbaghia acutiloba	1	0.00	-0.02	+0.02
Senna italica subsp. *arachoides*	1	0.00	-0.02	+0.02
Helichrysum sp. 1465	1	0.00	-0.02	+0.02
Manulea sp. 1460	1	0.00	-0.02	+0.02
Merremia palmata	1	0.00	-0.02	+0.02
Vigna vexillata var. *angustifolia*	1	0.00	-0.02	+0.02
Indigofera vicioides var. *vicioides*	1	0.00	-0.02	+0.02
Unidentifiable sp. 1437	1	0.00	-0.02	+0.02
Phyllanthus humilis	1	0.00	-0.02	+0.02
Tephrosia elongata var. *elongata*	1	0.00	-0.02	+0.02
Thesium magalismontanum	1	0.00	-0.02	+0.02
Acalypha segetalis	1	0.00	-0.02	+0.02
Tephrosia longipes subsp. *longipes*	1	0.00	-0.02	+0.02
Pellaea calomelanos var. *calomelanos*	1	0.00	-0.02	+0.02
Wahlenbergia undulata	1	0.00	-0.02	+0.02
Ornithogalum tenuifolium subsp. *tenuifolium*	1	0.00	-0.02	+0.02
Kyphocarpa angustifolia	1	0.00	-0.02	+0.02
Felicia muricata subsp. *muricata*	1	0.00	-0.02	+0.02
Bidens bipinnata	5	0.05	0.04	+0.01
Salvia runcinata	2	0.01	-0.00	+0.01
Commelina africana var. *krebsiana*	2	0.01	-0.00	+0.01
Merremia tridentata subsp. *angustifolia*	2	0.01	-0.00	+0.01
Crotalaria brachycarpa	2	0.01	-0.00	+0.01
Kalanchoe rotundifolia	2	0.00	-0.00	+0.01
Commelina erecta	2	0.00	-0.00	+0.01
Ledebouria sp. 1509	2	0.00	-0.00	+0.01
Scabiosa columbaria	2	0.00	-0.00	+0.01
Vigna vexillata var. *vexillata*	2	0.00	-0.00	+0.01
Schkuhria pinnata	2	0.00	-0.00	+0.01
Asclepias stellifera	2	0.00	-0.00	+0.01
Vernonia sp. 1461	4	0.02	0.02	+0.00
Oxalis sp. 1337	3	0.01	0.01	-0.00
Hypoxis hemerocallidea	3	0.01	0.01	-0.00
Rhynchosia totta var. *totta*	3	0.01	0.01	-0.00
Vahlia capensis subsp. *vulgaris* var. *linearis*	13	0.14	0.14	-0.00
Eriospermum abyssinicum	3	0.00	0.01	-0.01
Dipcadi viride	3	0.00	0.01	-0.01
Dicerocaryum eriocarpum	3	0.00	0.01	-0.01
Corchorus asplenifolius	3	0.00	0.01	-0.01
Cleome monophylla	3	0.00	0.01	-0.01
Pentarrhinum insipidum	3	0.00	0.01	-0.01
Eriosema burkei	3	0.00	0.01	-0.01
Senecio venosus	3	0.00	0.01	-0.01
Bergia decumbens	3	0.00	0.01	-0.01
Graderia subintegra	3	0.00	0.01	-0.01
Portulaca oleracea	3	0.00	0.01	-0.01
Nidorella hottentotica	3	0.00	0.01	-0.01
Helichrysum oxyphyllum	4	0.01	0.02	-0.01
Zinnia peruviana	4	0.01	0.02	-0.01
Ledebouria sp. 1511	4	0.00	0.02	-0.02

Convolvulus sagittatus subsp. *sagittatus*	4	0.00	0.02	-0.02
Hibiscus trionum	4	0.00	0.02	-0.02
Felicia muricata subsp. *cinerascens*	5	0.01	0.04	-0.02
Monsonia angustifolia	19	0.20	0.22	-0.02
Hypoxis argentea var. *argentea*	9	0.06	0.09	-0.03
Helichrysum rugulosum	6	0.02	0.05	-0.03
Gazania krebsiana subsp. *krebsiana*	5	0.00	0.04	-0.03
Anthospermum rigidum subsp. *pumilum*	5	0.00	0.04	-0.03
Teucrium trifidum	6	0.01	0.05	-0.04
Commelina africana var. *africana*	6	0.01	0.05	-0.04
Gomphrena celosioides	6	0.01	0.05	-0.04
Gladiolus permeabilis subsp. *permeabilis*	6	0.01	0.05	-0.04
Cucumis zeyheri	6	0.01	0.05	-0.04
Ledebouria sp. 1356	6	0.01	0.05	-0.04
Chamaesyce inaequilatera	8	0.03	0.08	-0.05
Lithospermum flexuosum	8	0.03	0.08	-0.05
Becium grandiflorum var. *galpinii*	12	0.08	0.13	-0.05
Hermannia depressa	7	0.01	0.06	-0.05
Ipomoea bolusiana subsp. *bolusiana*	7	0.01	0.06	-0.05
Senecio barbertonicus	7	0.01	0.06	-0.06
Lotononis listii	8	0.02	0.08	-0.06
Kohautia amatymbica	9	0.03	0.09	-0.06
Evolvulus alsinoides var. *linifolius*	9	0.03	0.09	-0.06
Menodora africana	8	0.01	0.08	-0.06
Raphionacme hirsuta	8	0.01	0.08	-0.07
Solanum supinum	8	0.01	0.08	-0.07
Hibiscus pusillus	15	0.10	0.17	-0.07
Chamaecrista biensis	10	0.01	0.10	-0.09
Anthericum cooperi	10	0.01	0.10	-0.09
Gnidia capitata	11	0.02	0.12	-0.09
Chaetacanthus costatus	11	0.01	0.12	-0.10
Anthericum longistylum	11	0.01	0.12	-0.10
Sida alba	12	0.01	0.13	-0.12
Oldenlandia herbacea var. *herbacea*	19	0.10	0.22	-0.12
Weak competitors:				
Justicia anagalloides	13	0.01	0.14	-0.13
Plexipus hederaceus var. *hederaceus*	14	0.02	0.15	-0.13
Crabbea angustifolia	14	0.01	0.15	-0.14
Geigeria burkei subsp. *burkei* var. *burkei*	14	0.01	0.15	-0.14
Phyllanthus maderaspatensis	15	0.01	0.17	-0.15
Total cover for species in group:	4.15%			

Total class cover = 35.76%
Grass proportion = 65.17%
Forb proportion = 11.61%
Dwarf shrub proportion = 6.38%
Shrub proportion = 0.99%
Tree proportion = 15.86%

APPENDIX D

COMMUNITY COMPOSITION ANALYSIS FOR THE POINT CANOPY INTERCEPT METHOD DATA SET

GROUPED ACCORDING TO GROWTH FORMS

Community number: 1

Trees

All coordinates on one point - no variation
Total cover for species in group: 0.91%

Shrubs

All coordinates on one point - no variation
Total cover for species in group: 1.65%

Dwarf Shrubs

Correlation coefficient = +0.98
Standard error of the mean = 0.02

	(F)	Actual cover	Pred. cover	Difference
Normal competition range:				
Berchemia zeyheri	1	0.03	0.02	+0.01
Aloe greatheadii var. *davyana*	2	0.14	0.14	+0.00
Sarcostemma viminale	1	0.01	0.02	-0.01
Total cover for species in group: 0.18%				

Grasses

All coordinates on one point - no variation
Total cover for species in group: 7.91%

Forbs

Correlation coefficient = +0.72
Standard error of the mean = 0.01

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Acalypha segetalis	1	0.03	0.01	+0.02
Normal competition range:				
Cleome monophylla	2	0.04	0.04	+0.00
Abutilon grandifolium	1	0.01	0.01	-0.01
Pentarrhinum insipidum	1	0.01	0.01	-0.01
Berkheya radula	1	0.01	0.01	-0.01
Total cover for species in group: 0.09%				

Total class cover = 10.74%
Grass proportion = 73.67%
Forb proportion = 0.87%
Dwarf shrub proportion = 1.68%
Shrub proportion = 15.34%
Tree proportion = 8.44%

Community number: 2

Trees

Correlation coefficient = +0.48
Standard error of the mean = 0.14

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Acacia robusta subsp.*robusta*	3	0.34	0.15	+0.19
Normal competition range:				
Acacia nilotica subsp.*kraussiana*	4	0.31	0.18	+0.13
Combretum molle	2	0.16	0.12	+0.04
Acacia caffra	9	0.29	0.32	-0.03
Vitex obovata	2	0.04	0.12	-0.08

	(F)	Actual cover	Pred. cover	Difference
Acacia karroo	3	0.05	0.15	-0.10
Weak competitors:				
Dombeya rotundifolia var. *rotundifolia*	3	0.00	0.15	-0.15
Total cover for species in group:	1.19%			

Shrubs

All coordinates on one point - no variation
Total cover for species in group: 0.03%

Dwarf Shrubs

Correlation coefficient = +0.94
Standard error of the mean = 0.02

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Acalypha angustata var. *glabra*	1	0.02	-0.01	+0.02
Aloe greatheadii var. *davyana*	15	0.21	0.19	+0.02
Normal competition range:				
Lippia scaberrima	2	0.02	0.01	+0.01
Xerophyta retinervis	1	0.00	-0.01	+0.01
Rhoicissus tridentata subsp. *cuneifolia*	1	0.00	-0.01	+0.01
Stylosanthes fruticosa	1	0.00	-0.01	+0.01
Agathisanthemum bojeri subsp. *bojeri*	1	0.00	-0.01	+0.01
Rhus gracillima	1	0.00	-0.01	+0.01
Indigofera heterotricha	1	0.00	-0.01	+0.01
Solanum incanum	1	0.00	-0.01	+0.01
Triumfetta sonderi	2	0.01	0.01	+0.00
Pollichia campestris	2	0.01	0.01	-0.00
Weak competitors:				
Solanum panduriforme	3	0.00	0.02	-0.02
Dicoma anomala subsp. *anomala*	3	0.00	0.02	-0.02
Lantana rugosa	4	0.01	0.04	-0.03
Protasparagus suaveolens	5	0.01	0.05	-0.04
Total cover for species in group:	0.29%			

Grasses

Correlation coefficient = +0.64
Standard error of the mean = 0.10

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Setaria sphacelata var. *torta*	15	0.69	0.21	+0.48
Themeda triandra	18	0.38	0.26	+0.12
Normal competition range:				
Panicum maximum	2	0.07	-0.00	+0.07
Setaria lindenbergiana	2	0.04	-0.00	+0.04
Aristida scabrivalvis subsp. *scabrivalvis*	1	0.00	-0.02	+0.02
Aristida diffusa subsp. *burkei*	1	0.00	-0.02	+0.02
Cyperus rubicundus	1	0.00	-0.02	+0.02
Diheteropogon filifolius	1	0.00	-0.02	+0.02
Urelytrum agropyroides	1	0.00	-0.02	+0.02
Brachiaria nigropedata	1	0.00	-0.02	+0.02
Eragrostis superba	1	0.00	-0.02	+0.02
Cyperus obtusiflorus var. *obtusiflorus*	1	0.00	-0.02	+0.02
Schizachyrium sanguineum	6	0.08	0.06	+0.02
Tristachya biseriata	2	0.01	-0.00	+0.01
Enneapogon scoparius	3	0.02	0.01	+0.01
Digitaria eriantha	2	0.01	-0.00	+0.01
Eustachys paspaloides	2	0.00	-0.00	+0.00
Trichoneura grandiglumis var. *grandiglumis*	2	0.00	-0.00	+0.00
Anthephora pubescens	3	0.01	0.01	-0.00
Sporobolus stapfianus	3	0.01	0.01	-0.01
Eragrostis racemosa	3	0.01	0.01	-0.01
Trachypogon spicatus	4	0.02	0.03	-0.01
Eragrostis chloromelas	5	0.02	0.05	-0.02
Loudetia flavida	15	0.19	0.21	-0.02
Heteropogon contortus	14	0.16	0.19	-0.03
Elionurus muticus	6	0.03	0.06	-0.04
Melinis nerviglumis	5	0.01	0.05	-0.04
Bulbostylis contexta	7	0.01	0.08	-0.07
Aristida congesta subsp. *congesta*	7	0.01	0.08	-0.07
Brachiaria serrata	9	0.03	0.11	-0.08
Tragus berteronianus	10	0.04	0.13	-0.09

Weak competitors:

Melinis repens subsp. *grandiflora*	15	0.09	0.21	-0.12
Aristida canescens subsp. *canescens*	12	0.02	0.16	-0.14
Diheteropogon amplectens	14	0.03	0.19	-0.16
Total cover for species in group:	1.97%			

Forbs

Correlation coefficient = +0.51
Standard error of the mean = 0.02

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Clerodendrum triphyllum var. *triphyllum*	7	0.12	0.03	+0.09
Normal competition range:				
Achyranthes aspera var. *aspera*	1	0.00	-0.00	+0.00
Merremia palmata	1	0.00	-0.00	+0.00
Gerbera sp. 1476	1	0.00	-0.00	+0.00
Acalypha villicaulis	1	0.00	-0.00	+0.00
Ipomoea obscura var. *obscura*	1	0.00	-0.00	+0.00
Clematis brachiata	1	0.00	-0.00	+0.00
Chenopodium album	1	0.00	-0.00	+0.00
Anthospermum rigidum subsp. *pumilum*	1	0.00	-0.00	+0.00
Zornia linearis	1	0.00	-0.00	+0.00
Graderia subintegra	1	0.00	-0.00	+0.00
Rhynchosia totta var. *totta*	1	0.00	-0.00	+0.00
Kohautia amatymbica	1	0.00	-0.00	+0.00
Crotalaria brachycarpa	1	0.00	-0.00	+0.00
Ledebouria sp. 1356	1	0.00	-0.00	+0.00
Vigna vexillata var. *vexillata*	2	0.01	0.00	+0.00
Evolvulus alsinoides var. *linifolius*	2	0.01	0.00	+0.00
Bidens bipinnata	2	0.01	0.00	+0.00
Helichrysum oxyphyllum	2	0.01	0.00	+0.00
Pentarrhinum insipidum	2	0.00	0.00	-0.00
Tragia rupestris	2	0.00	0.00	-0.00
Tephrosia elongata var. *elongata*	2	0.00	0.00	-0.00
Vernonia oligocephala	2	0.00	0.00	-0.00
Tagetes minuta	2	0.00	0.00	-0.00
Justicia anagalloides	2	0.00	0.00	-0.00
Chamaecrista biensis	2	0.00	0.00	-0.00
Helichrysum nudifolium	2	0.00	0.00	-0.00
Pearsonia sessilifolia subsp. *marginata*	2	0.00	0.00	-0.00
Anthericum longistylum	3	0.01	0.01	-0.00
Hermannia parvula	3	0.00	0.01	-0.01
Merremia tridentata subsp. *angustifolia*	3	0.00	0.01	-0.01
Phyllanthus humilis	3	0.00	0.01	-0.01
Lithospermum flexuosum	3	0.00	0.01	-0.01
Plexipus hederaceus var. *hederaceus*	4	0.01	0.01	-0.01
Indigofera rhytidocarpa subsp. *rhytidocarpa*	5	0.01	0.02	-0.01
Ruellia cordata	6	0.02	0.02	-0.01
Phyllanthus maderaspatensis	4	0.00	0.01	-0.01
Commelina africana var. *africana*	4	0.00	0.01	-0.01
Monsonia angustifolia	4	0.00	0.01	-0.01
Becium grandiflorum var. *galpinii*	5	0.01	0.02	-0.01
Schkuhria pinnata	5	0.00	0.02	-0.01
Oldenlandia herbacea var. *herbacea*	5	0.00	0.02	-0.01
Hibiscus pusillus	6	0.01	0.02	-0.02
Weak competitors:				
Tephrosia purpurea subsp. *leptostachya*	6	0.01	0.02	-0.02
Total cover for species in group:	0.26%			

Total class cover = 3.75%
Grass proportion = 52.65%
Forb proportion = 6.96%
Dwarf shrub proportion = 7.85%
Shrub proportion = 0.72%
Tree proportion = 31.82%

Community number: 3
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Trees

Correlation coefficient = +0.85
Standard error of the mean = 0.48

	(F)	Actual cover	Pred. cover	Difference
Normal competition range:				
Acacia nilotica subsp. *kraussiana*	3	1.85	1.50	+0.35
Combretum apiculatum subsp. *apiculatum*	1	0.28	-0.02	+0.30
Dombeya rotundifolia var. *rotundifolia*	1	0.01	-0.02	+0.03
Acacia caffra	1	0.00	-0.02	+0.02

Weak competitors:

	(F)	Actual cover	Pred. cover	Difference
Acacia karroo	2	0.05	0.74	-0.69

Total cover for species in group: 2.19%

Shrubs

Correlation coefficient = +1.00
Standard error of the mean = 0.00

	(F)	Actual cover	Pred. cover	Differ-ence
Strong competitors:				
Grewia flava	1	0.01	-0.01	+0.01
Normal competition range:				
Unidentifiable sp. 1685	2	0.06	0.05	+0.00
Rhus leptodictya	3	0.10	0.10	-0.00
Unidentifiable sp. 1686	1	0.00	0.01	-0.00
Ehretia rigida	1	0.00	0.01	-0.00

Total cover for species in group: 0.17%

Dwarf Shrubs

Correlation coefficient = +0.90
Standard error of the mean = 0.10

	(F)	Actual cover	Pred. cover	Differ-ence
Strong competitors:				
Aloe greatheadii var. *davyana*	9	0.87	0.71	+0.16
Normal competition range:				
Carissa bispinosa subsp. *bispinosa*	1	0.01	-0.05	+0.06
Sarcostemma viminale	1	0.01	-0.05	+0.06
Dodonaea sp. 1645	1	0.00	-0.05	+0.05
Achyropsis leptostachya	1	0.00	-0.05	+0.05
Justicia flava	1	0.00	-0.05	+0.05
Pollichia campestris	1	0.00	-0.05	+0.05
Ptycholobium plicatum	1	0.00	-0.05	+0.05
Indigofera heterotricha	1	0.00	-0.05	+0.05
Euclea undulata var. *myrtina*	2	0.01	0.05	-0.04
Protasparagus suaveolens	2	0.00	0.05	-0.04
Weak competitors:				
Lippia scaberrima	3	0.02	0.14	-0.12
Maytenus heterophylla	3	0.01	0.14	-0.14
Solanum panduriforme	4	0.02	0.24	-0.22

Total cover for species in group: 0.97%

Grasses

Correlation coefficient = +0.16
Standard error of the mean = 0.29

	(F)	Actual cover	Pred. cover	Differ-ence
Strong competitors:				
Elionurus muticus	1	1.12	0.11	+1.01
Heteropogon contortus	6	0.78	0.23	+0.55
Schizachyrium sanguineum	2	0.55	0.13	+0.42
Normal competition range:				
Cymbopogon plurinodis	3	0.39	0.16	+0.24
Themeda triandra	5	0.35	0.21	+0.14
Tragus berteronianus	2	0.10	0.13	-0.03
Aristida scabrivalvis subsp. *scabrivalvis*	1	0.04	0.11	-0.06
Cymbopogon excavatus	1	0.01	0.11	-0.09
Pennisetum sphacelatum	1	0.00	0.11	-0.10
Andropogon chinensis	1	0.00	0.11	-0.10
Hyparrhenia filipendula var. *pilosa*	1	0.00	0.11	-0.10
Trichoneura grandiglumis var. *grandiglumis*	1	0.00	0.11	-0.10
Melinis nerviglumis	1	0.00	0.11	-0.10
Eragrostis trichophora	1	0.00	0.11	-0.10
Eragrostis gummiflua	1	0.00	0.11	-0.10
Aristida canescens subsp. *canescens*	1	0.00	0.11	-0.10
Enneapogon scoparius	3	0.05	0.16	-0.11
Diheteropogon amplectens	3	0.05	0.16	-0.11
Bulbostylis contexta	2	0.00	0.13	-0.13
Panicum maximum	5	0.07	0.21	-0.14
Digitaria eriantha	3	0.01	0.16	-0.15
Setaria sphacelata var. *torta*	4	0.02	0.18	-0.17

	(F)	Actual cover	Pred. cover	Difference
Loudetia flavida	4	0.01	0.18	-0.17
Aristida congesta subsp. *congesta*	5	0.03	0.21	-0.18
Melinis repens subsp. *grandiflora*	6	0.03	0.23	-0.20
Total cover for species in group:	3.64%			

Forbs

Correlation coefficient = +0.69
Standard error of the mean = 0.00

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Convolvulus sagittatus var. *aschersonii*	1	0.01	0.00	+0.01
Commelina africana var. *africana*	2	0.01	0.01	+0.01
Tephrosia purpurea subsp. *leptostachya*	2	0.01	0.01	+0.01
Indigofera rhytidocarpa subsp. *rhytidocarpa*	4	0.02	0.01	+0.01
Normal competition range:				
Barleria macrostegia	1	0.00	0.00	-0.00
Indigofera daleoides var. *daleoides*	1	0.00	0.00	-0.00
Corbichonia decumbens	1	0.00	0.00	-0.00
Kyphocarpa angustifolia	1	0.00	0.00	-0.00
Hibiscus trionum	1	0.00	0.00	-0.00
Tulbaghia sp. 1557	1	0.00	0.00	-0.00
Sida alba	1	0.00	0.00	-0.00
Evolvulus alsinoides var. *linifolius*	1	0.00	0.00	-0.00
Rhynchosia totta var. *totta*	1	0.00	0.00	-0.00
Commelina africana var. *krebsiana*	1	0.00	0.00	-0.00
Justicia anagalloides	1	0.00	0.00	-0.00
Chamaecrista biensis	1	0.00	0.00	-0.00
Chamaesyce inaequilatera	1	0.00	0.00	-0.00
Oldenlandia herbacea var. *herbacea*	1	0.00	0.00	-0.00
Monsonia angustifolia	1	0.00	0.00	-0.00
Pellaea calomelanos var. *calomelanos*	2	0.00	0.01	-0.00
Tragia rupestris	2	0.00	0.01	-0.00
Chenopodium album	2	0.00	0.01	-0.00
Senecio barbertonicus	2	0.00	0.01	-0.00
Helichrysum rugulosum	2	0.00	0.01	-0.00
Hibiscus pusillus	2	0.00	0.01	-0.00
Bidens bipinnata	2	0.00	0.01	-0.00
Plexipus hederaceus var. *hederaceus*	3	0.01	0.01	-0.00
Pentarrhinum insipidum	4	0.01	0.01	-0.00
Felicia muricata subsp. *cinerascens*	4	0.01	0.01	-0.00
Ruellia cordata	4	0.01	0.01	-0.00
Total cover for species in group:	0.15%			

Total class cover = 7.12%
Grass proportion = 51.11%
Forb proportion = 2.15%
Dwarf shrub proportion = 13.62%
Shrub proportion = 2.40%
Tree proportion = 30.72%

Community number: 4
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Trees

Correlation coefficient = -0.45
Standard error of the mean = 2.62

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Acacia tortilis subsp. *heteracantha*	1	5.16	2.16	+3.00
Normal competition range:				
Acacia karroo	2	0.02	0.02	+0.00
Acacia mellifera subsp. *mellifera*	1	0.99	2.16	-1.17
Rhus lancea	1	0.32	2.16	-1.83
Total cover for species in group:	6.49%			

Shrubs

Correlation coefficient = +0.39
Standard error of the mean = 0.01

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Tarchonanthus camphoratus	1	0.02	0.01	+0.01
Normal competition range:				
Ehretia rigida	2	0.02	0.02	+0.01
Pavetta gardeniifolia var. *gardeniifolia*	1	0.00	0.01	-0.01
Grewia flava	1	0.00	0.01	-0.01

Unidentifiable sp. 1685	2	0.01	0.02	-0.01
Total cover for species in group:	0.06%			

Dwarf Shrubs

Correlation coefficient = +0.80
Standard error of the mean = 0.24

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Aloe greatheadii var. *davyana*	4	1.21	0.81	+0.40
Normal competition range:				
Lycium cinereum	1	0.02	-0.04	+0.06
Protasparagus setaceus	1	0.00	-0.04	+0.05
Maytenus heterophylla	1	0.00	-0.04	+0.05
Ptycholobium plicatum	1	0.00	-0.04	+0.05
Lippia scaberrima	1	0.00	-0.04	+0.05
Dicoma anomala subsp. *anomala*	1	0.00	-0.04	+0.05
Euclea undulata var. *myrtina*	2	0.19	0.24	-0.05
Justicia flava	2	0.08	0.24	-0.16
Weak competitors:				
Protasparagus suaveolens	3	0.03	0.52	-0.50
Total cover for species in group:	1.55%			

Grasses

Correlation coefficient = +0.60
Standard error of the mean = 1.54

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Panicum maximum	4	7.48	3.03	+4.45
Normal competition range:				
Sporobolus ioclados	1	0.32	-0.28	+0.60
Enneapogon scoparius	1	0.32	-0.28	+0.60
Cymbopogon plurinodis	1	0.08	-0.28	+0.36
Eragrostis pseudosclerantha	1	0.02	-0.28	+0.30
Sporobolus nitens	1	0.00	-0.28	+0.28
Eragrostis trichophora	1	0.00	-0.28	+0.28
Tragus berteronianus	1	0.00	-0.28	+0.28
Aristida canescens subsp. *canescens*	1	0.00	-0.28	+0.28
Melinis repens subsp. *grandiflora*	1	0.00	-0.28	+0.28
Digitaria eriantha	2	0.33	0.83	-0.50
Themeda triandra	2	0.04	0.83	-0.79
Brachiaria eruciformis	2	0.02	0.83	-0.80
Weak competitors:				
Heteropogon contortus	3	0.10	1.93	-1.83
Bothriochloa insculpta	3	0.03	1.93	-1.90
Eragrostis chloromelas	3	0.03	1.93	-1.90
Total cover for species in group:	8.80%			

Forbs

Correlation coefficient = +0.75
Standard error of the mean = 0.01

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Convolvulus sagittatus var. *aschersonii*	1	0.02	0.01	+0.01
Normal competition range:				
Chaetacanthus costatus	3	0.03	0.02	+0.00
Hibiscus trionum	1	0.00	0.01	-0.00
Corchorus asplenifolius	1	0.00	0.01	-0.00
Ipomoea bolusiana subsp. *bolusiana*	1	0.00	0.01	-0.00
Hibiscus pusillus	1	0.00	0.01	-0.00
Bidens bipinnata	1	0.00	0.01	-0.00
Ledebouria sp. 1356	1	0.00	0.01	-0.00
Indigofera rhytidocarpa subsp. *rhytidocarpa*	1	0.00	0.01	-0.00
Weak competitors:				
Seddera capensis	2	0.01	0.02	-0.01
Total cover for species in group:	0.08%			

Total class cover = 16.98%
Grass proportion = 51.80%
Forb proportion = 0.49%
Dwarf shrub proportion = 9.12%
Shrub proportion = 0.35%
Tree proportion = 38.24%

Community number: 5

Trees

All coordinates on one point - no variation
Total cover for species in group: 0.41%

Shrubs

Correlation coefficient = -0.07
Standard error of the mean = 0.02

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Unidentifiable sp. 1685	1	0.04	0.02	+0.03
Normal competition range:				
Rhus leptodictya	2	0.01	0.01	+0.00
Zanthoxylum capense	1	0.00	0.02	-0.01
Grewia flava	1	0.00	0.02	-0.01

Total cover for species in group: 0.06%

Dwarf Shrubs

Correlation coefficient = +1.00
Standard error of the mean = 0.00

	(F)	Actual cover	Pred. cover	Difference
Normal competition range:				
Sphedamnocarpus pruriens subsp. *galphimiifolius*	1	0.00	0.00	+0.00
Euclea undulata var. *myrtina*	1	0.00	0.00	+0.00
Gerbera viridifolia subsp. *viridifolia*	1	0.00	0.00	+0.00
Polygala amatymbica	1	0.00	0.00	+0.00
Lippia scaberrima	1	0.00	0.00	+0.00
Indigofera heterotricha	1	0.00	0.00	+0.00
Dicoma anomala subsp. *anomala*	1	0.00	0.00	+0.00
Weak competitors:				
Aloe greatheadii var. *davyana*	6	0.15	0.15	-0.00

Total cover for species in group: 0.16%

Grasses

Correlation coefficient = +0.39
Standard error of the mean = 0.47

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Setaria sphacelata var. *torta*	7	2.05	0.60	+1.45
Digitaria eriantha	3	1.27	0.23	+1.03
Eragrostis chloromelas	5	1.24	0.41	+0.82
Diheteropogon amplectens	1	0.55	0.05	+0.50
Normal competition range:				
Elionurus muticus	4	0.43	0.32	+0.10
Aristida canescens subsp. *canescens*	3	0.30	0.23	+0.07
Setaria lindenbergiana	1	0.01	0.05	-0.04
Melinis nerviglumis	1	0.01	0.05	-0.04
Digitaria monodactyla	1	0.00	0.05	-0.05
Trichoneura grandiglumis var. *grandiglumis*	1	0.00	0.05	-0.05
Kyllinga erecta	1	0.00	0.05	-0.05
Tricholaena monachne	1	0.00	0.05	-0.05
Bulbostylis contexta	1	0.00	0.05	-0.05
Eragrostis racemosa	1	0.00	0.05	-0.05
Cyperus obtusiflorus var. *obtusiflorus*	1	0.00	0.05	-0.05
Cymbopogon excavatus	2	0.00	0.14	-0.14
Schizachyrium sanguineum	2	0.00	0.14	-0.14
Cynodon dactylon	2	0.00	0.14	-0.14
Loudetia flavida	3	0.03	0.23	-0.20
Eragrostis gummiflua	3	0.02	0.23	-0.21
Brachiaria serrata	3	0.02	0.23	-0.22
Tripogon minimus	3	0.01	0.23	-0.23
Themeda triandra	5	0.08	0.41	-0.33
Melinis repens subsp. *grandiflora*	6	0.12	0.50	-0.39
Trachypogon spicatus	5	0.01	0.41	-0.40

Weak competitors:

	(F)	Actual cover	Pred. cover	Difference
Heteropogon contortus	7	0.02	0.60	-0.57
Aristida congesta subsp. *congesta*	8	0.10	0.69	-0.58
Total cover for species in group:	6.29%			

Forbs

Correlation coefficient = +0.64
Standard error of the mean = 0.02

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Indigofera rhytidocarpa subsp. *rhytidocarpa*	5	0.10	0.04	+0.06
Vernonia sp. 1461	1	0.04	0.01	+0.04
Helichrysum nudifolium	3	0.05	0.02	+0.03
Monsonia angustifolia	5	0.06	0.04	+0.02
Normal competition range:				
Tephrosia purpurea subsp. *leptostachya*	1	0.01	0.01	+0.01
Vernonia oligocephala	2	0.01	0.01	-0.00
Heliotropium strigosum	1	0.00	0.01	-0.00
Tulbaghia sp. 1557	1	0.00	0.01	-0.00
Cheilanthes viridis var. *viridis*	1	0.00	0.01	-0.00
Corchorus asplenifolius	1	0.00	0.01	-0.00
Gomphrena celosioides	1	0.00	0.01	-0.00
Merremia tridentata subsp. *angustifolia*	1	0.00	0.01	-0.00
Vahlia capensis subsp. *vulgaris* var. *linearis*	1	0.00	0.01	-0.00
Chaetacanthus costatus	1	0.00	0.01	-0.00
Commelina africana var. *krebsiana*	1	0.00	0.01	-0.00
Ipomoea bolusiana subsp. *bolusiana*	1	0.00	0.01	-0.00
Hypoxis hemerocallidea	1	0.00	0.01	-0.00
Crabbea angustifolia	1	0.00	0.01	-0.00
Helichrysum rugulosum	1	0.00	0.01	-0.00
Hibiscus pusillus	1	0.00	0.01	-0.00
Tagetes minuta	1	0.00	0.01	-0.00
Justicia anagalloides	1	0.00	0.01	-0.00
Anthericum cooperi	1	0.00	0.01	-0.00
Geigeria burkei subsp. *burkei* var. *burkei*	1	0.00	0.01	-0.00
Plexipus hederaceus var. *hederaceus*	1	0.00	0.01	-0.00
Hypoxis argentea var. *argentea*	3	0.02	0.02	-0.01
Lithospermum flexuosum	3	0.02	0.02	-0.01
Phyllanthus maderaspatensis	2	0.00	0.01	-0.01
Commelina africana var. *africana*	2	0.00	0.01	-0.01
Lotononis listii	4	0.02	0.03	-0.01
Becium grandiflorum var. *galpinii*	3	0.01	0.02	-0.02
Weak competitors:				
Oldenlandia herbacea var. *herbacea*	8	0.03	0.07	-0.04
Total cover for species in group:	0.42%			

Total class cover = 7.35%
Grass proportion = 85.61%
Forb proportion = 5.68%
Dwarf shrub proportion = 2.22%
Shrub proportion = 0.85%
Tree proportion = 5.64%

Community number: 6

Trees

Correlation coefficient = -1.00
Standard error of the mean = 0.00

	(F)	Actual cover	Pred. cover	Difference
Normal competition range:				
Acacia robusta subsp. *robusta*	2	0.15	0.14	+0.00
Acacia karroo	3	0.05	0.05	+0.00
Acacia tortilis subsp. *heteracantha*	2	0.14	0.14	-0.00
Total cover for species in group:	0.33%			

Shrubs

No Shrubs

Total cover for species in group: 0.00%

Dwarf Shrubs

Correlation coefficient = +0.96
Standard error of the mean = 0.02

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Ziziphus zeyheriana	5	0.08	0.06	+0.02
Normal competition range:				
Solanum panduriforme	1	0.01	-0.00	+0.01
Indigofera parviflora var. *parviflora*	1	0.01	-0.00	+0.01
Aloe greatheadii var. *davyana*	15	0.21	0.20	+0.01
Polygala amatymbica	1	0.00	-0.00	+0.00
Solanum incanum	1	0.00	-0.00	+0.00
Dicoma anomala subsp. *anomala*	1	0.00	-0.00	+0.00
Ptycholobium plicatum	2	0.01	0.01	-0.01
Justicia betonica	2	0.00	0.01	-0.01
Weak competitors:				
Elephantorrhiza elephantina	5	0.01	0.06	-0.05
Total cover for species in group:	0.32%			

Grasses

Correlation coefficient = +0.61
Standard error of the mean = 0.24

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Setaria sphacelata var. *torta*	14	1.33	0.46	+0.86
Eragrostis chloromelas	11	0.89	0.35	+0.54
Normal competition range:				
Digitaria eriantha	11	0.50	0.35	+0.14
Melinis nerviglumis	1	0.09	-0.03	+0.12
Melinis repens subsp. *grandiflora*	8	0.32	0.24	+0.08
Bothriochloa insculpta	1	0.05	-0.03	+0.08
Cymbopogon excavatus	1	0.01	-0.03	+0.03
Cymbopogon plurinodis	1	0.00	-0.03	+0.03
Mariscus rehmannianus	1	0.00	-0.03	+0.03
Hyperthelia dissoluta	1	0.00	-0.03	+0.03
Eragrostis nindensis	1	0.00	-0.03	+0.03
Sporobolus stapfianus	1	0.00	-0.03	+0.03
Aristida bipartita	1	0.00	-0.03	+0.03
Bulbostylis contexta	1	0.00	-0.03	+0.03
Eragrostis trichophora	1	0.00	-0.03	+0.03
Cyperus obtusiflorus var. *obtusiflorus*	1	0.00	-0.03	+0.03
Trachypogon spicatus	2	0.01	0.01	-0.00
Tragus berteronianus	2	0.00	0.01	-0.01
Cynodon dactylon	3	0.00	0.05	-0.04
Diheteropogon amplectens	3	0.00	0.05	-0.04
Themeda triandra	13	0.37	0.43	-0.05
Brachiaria serrata	4	0.01	0.09	-0.08
Anthephora pubescens	5	0.01	0.12	-0.12
Loudetia flavida	8	0.06	0.24	-0.17
Elionurus muticus	12	0.19	0.39	-0.20
Microchloa caffra	9	0.07	0.27	-0.21
Weak competitors:				
Heteropogon contortus	9	0.02	0.27	-0.25
Eragrostis gummiflua	11	0.07	0.35	-0.28
Aristida congesta subsp. *congesta*	10	0.03	0.31	-0.28
Aristida canescens subsp. *canescens*	13	0.04	0.43	-0.39
Total cover for species in group:	4.07%			

Forbs

Correlation coefficient = +0.73
Standard error of the mean = 0.03

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Tephrosia purpurea subsp. *leptostachya*	9	0.23	0.10	+0.12
Indigofera rhytidocarpa subsp. *rhytidocarpa*	10	0.23	0.12	+0.11
Normal competition range:				
Berkheya radula	1	0.02	-0.01	+0.03
Indigofera vicioides var. *vicioides*	1	0.02	-0.01	+0.03
Gazania krebsiana subsp. *krebsiana*	1	0.01	-0.01	+0.01
Gnidia capitata	1	0.00	-0.01	+0.01
Heliotropium strigosum	1	0.00	-0.01	+0.01
Hibiscus trionum	1	0.00	-0.01	+0.01

Ipomoea bathycolpos var. *bathycolpos*	1	0.00	-0.01	+0.01
Sida alba	1	0.00	-0.01	+0.01
Senecio barbertonicus	1	0.00	-0.01	+0.01
Convolvulus sagittatus subsp. *sagittatus*	1	0.00	-0.01	+0.01
Dicerocaryum eriocarpum	1	0.00	-0.01	+0.01
Vernonia sp. 1461	1	0.00	-0.01	+0.01
Merremia tridentata subsp. *angustifolia*	1	0.00	-0.01	+0.01
Menodora africana	1	0.00	-0.01	+0.01
Raphionacme hirsuta	1	0.00	-0.01	+0.01
Senecio lygodes	1	0.00	-0.01	+0.01
Hypoxis hemerocallidea	1	0.00	-0.01	+0.01
Schkuhria pinnata	1	0.00	-0.01	+0.01
Tephrosia longipes subsp. *longipes*	1	0.00	-0.01	+0.01
Commelina africana var. *africana*	1	0.00	-0.01	+0.01
Rhynchosia totta var. *totta*	3	0.02	0.02	+0.00
Becium grandiflorum var. *galpinii*	6	0.06	0.06	+0.00
Oxalis sp. 1337	2	0.00	0.01	-0.00
Vahlia capensis subsp. *vulgaris* var. *linearis*	2	0.00	0.01	-0.00
Chaetacanthus costatus	2	0.00	0.01	-0.00
Ipomoea bolusiana subsp. *bolusiana*	2	0.00	0.01	-0.00
Senecio venosus	2	0.00	0.01	-0.00
Anthericum cooperi	2	0.00	0.01	-0.00
Lotononis listii	2	0.00	0.01	-0.00
Justicia anagalloides	3	0.00	0.02	-0.02
Chamaecrista biensis	3	0.00	0.02	-0.02
Hibiscus pusillus	4	0.01	0.03	-0.03
Hermannia depressa	4	0.00	0.03	-0.03
Hypoxis argentea var. *argentea*	4	0.00	0.03	-0.03
Weak competitors:				
Chamaesyce inaequilatera	6	0.03	0.06	-0.03
Anthericum longistylum	5	0.01	0.05	-0.04
Monsonia angustifolia	8	0.05	0.09	-0.04
Vernonia oligocephala	8	0.05	0.09	-0.04
Phyllanthus maderaspatensis	5	0.01	0.05	-0.04
Oldenlandia herbacea var. *herbacea*	6	0.01	0.06	-0.05
Ledebouria sp. 1356	6	0.01	0.06	-0.06
Total cover for species in group: 0.81%				

Total class cover = 5.54%
Grass proportion = 73.47%
Forb proportion = 14.69%
Dwarf shrub proportion = 5.85%
Shrub proportion = 0.00%
Tree proportion = 6.00%

Community number: 7
===================

Trees

All coordinates on one point - no variation
Total cover for species in group: 0.13%

Shrubs

No Shrubs
Total cover for species in group: 0.00%

Dwarf Shrubs

Correlation coefficient = +1.00
Standard error of the mean = 0.00

	(F)	Actual cover	Pred. cover	Differ-ence
Normal competition range:				
Indigofera heterotricha	1	0.00	0.00	+0.00
Solanum incanum	1	0.00	0.00	+0.00
Aloe greatheadii var. *davyana*	5	1.65	1.65	+0.00
Total cover for species in group: 1.65%				

Grasses

Correlation coefficient = +0.37
Standard error of the mean = 0.39

	(F)	Actual cover	Pred. cover	Differ-ence
Strong competitors:				
Digitaria eriantha	3	1.89	0.23	+1.67
Normal competition range:				
Elionurus muticus	6	0.66	0.53	+0.14
Bothriochloa insculpta	1	0.10	0.03	+0.07
Heteropogon contortus	4	0.35	0.33	+0.02
Panicum coloratum var. *coloratum*	1	0.04	0.03	+0.02
Cymbopogon plurinodis	1	0.01	0.03	-0.02

Eragrostis trichophora	1	0.01	0.03	-0.02
Enneapogon cenchroides	1	0.00	0.03	-0.03
Bothriochloa bladhii	1	0.00	0.03	-0.03
Eragrostis rigidior	1	0.00	0.03	-0.03
Aristida bipartita	1	0.00	0.03	-0.03
Cymbopogon excavatus	1	0.00	0.03	-0.03
Aristida canescens subsp. *canescens*	2	0.02	0.13	-0.11
Eragrostis gummiflua	3	0.11	0.23	-0.11
Urochloa panicoides	2	0.01	0.13	-0.12
Sporobolus stapfianus	2	0.00	0.13	-0.12
Cynodon dactylon	2	0.00	0.13	-0.12
Tragus berteronianus	2	0.00	0.13	-0.12
Themeda triandra	2	0.00	0.13	-0.12
Eragrostis chloromelas	4	0.16	0.33	-0.17
Setaria sphacelata var. *torta*	3	0.06	0.23	-0.17
Aristida congesta subsp. *congesta*	5	0.21	0.43	-0.21
Melinis repens subsp. *grandiflora*	5	0.07	0.43	-0.36
Total cover for species in group:	3.75%			

Forbs

Correlation coefficient = +0.57
Standard error of the mean = 0.08

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Indigofera rhytidocarpa subsp. *rhytidocarpa*	5	0.37	0.14	+0.23
Heliotropium strigosum	1	0.10	-0.00	+0.10
Normal competition range:				
Turbina oblongata	1	0.00	-0.00	+0.00
Achyranthes aspera var. *sicula*	1	0.00	-0.00	+0.00
Oxalis sp. 1337	1	0.00	-0.00	+0.00
Vernonia sp. 1461	1	0.00	-0.00	+0.00
Dipcadi viride	1	0.00	-0.00	+0.00
Conyza albida	1	0.00	-0.00	+0.00
Phyllanthus maderaspatensis	1	0.00	-0.00	+0.00
Commelina africana var. *africana*	1	0.00	-0.00	+0.00
Oldenlandia herbacea var. *herbacea*	3	0.06	0.07	-0.01
Hibiscus trionum	2	0.00	0.04	-0.03
Vahlia capensis subsp. *vulgaris* var. *linearis*	2	0.00	0.04	-0.03
Helichrysum rugulosum	2	0.00	0.04	-0.03
Tephrosia purpurea subsp. *leptostachya*	2	0.00	0.04	-0.03
Weak competitors:				
Hypoxis argentea var. *argentea*	4	0.01	0.11	-0.10
Monsonia angustifolia	5	0.03	0.14	-0.12
Total cover for species in group:	0.61%			

Total class cover = 6.14%
Grass proportion = 61.14%
Forb proportion = 9.87%
Dwarf shrub proportion = 26.94%
Shrub proportion = 0.00%
Tree proportion = 2.05%

APPENDIX E

COMMUNITY COMPOSITION ANALYSIS FOR THE RE-CLASSIFIED POINT CANOPY INTERCEPT METHOD DATA SET GROUPED ACCORDING TO GROWTH FORMS

Community number: 1
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Trees

All coordinates on one point - no variation
Total cover for species in group: 0.50%

Shrubs

All coordinates on one point - no variation
Total cover for species in group: 0.05%

Dwarf Shrubs

Correlation coefficient = +1.00
Standard error of the mean = 0.00

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Indigofera parviflora var. *parviflora*	1	0.01	0.00	+0.01
Normal competition range:				
Aloe greatheadii var. *davyana*	7	0.31	0.31	-0.00
Pollichia campestris	1	0.00	0.00	-0.00
Indigofera heterotricha	1	0.00	0.00	-0.00
Elephantorrhiza elephantina	1	0.00	0.00	-0.00
Solanum incanum	1	0.00	0.00	-0.00
Protasparagus suaveolens	1	0.00	0.00	-0.00

Total cover for species in group: 0.33%

Grasses

Correlation coefficient = +0.43
Standard error of the mean = 0.84

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Digitaria eriantha	7	3.45	1.15	+2.30
Aristida canescens subsp. *canescens*	2	2.28	0.23	+2.05
Normal competition range:				
Elionurus muticus	5	1.59	0.78	+0.81
Bothriochloa insculpta	1	0.09	0.05	+0.04
Bothriochloa bladhii	1	0.00	0.05	-0.05
Urochloa panicoides	1	0.00	0.05	-0.05
Hyparrhenia filipendula var. *pilosa*	1	0.00	0.05	-0.05
Kyllinga erecta	1	0.00	0.05	-0.05
Aristida bipartita	1	0.00	0.05	-0.05
Tricholaena monachne	1	0.00	0.05	-0.05
Microchloa caffra	1	0.00	0.05	-0.05
Tragus berteronianus	1	0.00	0.05	-0.05
Melinis nerviglumis	2	0.17	0.23	-0.06
Themeda triandra	2	0.01	0.23	-0.22
Eragrostis gummiflua	3	0.14	0.42	-0.27
Cymbopogon excavatus	4	0.02	0.60	-0.57
Cynodon dactylon	4	0.01	0.60	-0.59
Aristida congesta subsp. *congesta*	6	0.23	0.96	-0.73
Heteropogon contortus	5	0.04	0.78	-0.74
Eragrostis chloromelas	6	0.16	0.96	-0.81
Melinis repens subsp. *grandiflora*	6	0.14	0.96	-0.82

Total cover for species in group: 8.36%

Forbs

Correlation coefficient = +0.36
Standard error of the mean = 0.07

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				

	(F)	Actual cover	Pred. cover	Difference
Tephrosia purpurea subsp. *leptostachya*	3	0.37	0.06	+0.31
Normal competition range:				
Heliotropium strigosum	2	0.09	0.03	+0.06
Indigofera vicioides var. *vicioides*	1	0.04	0.01	+0.03
Acalypha segetalis	1	0.01	0.01	+0.00
Vernonia oligocephala	1	0.01	0.01	+0.00
Chenopodium album	1	0.00	0.01	-0.01
Sida alba	1	0.00	0.01	-0.01
Vernonia sp. 1461	1	0.00	0.01	-0.01
Vahlia capensis subsp. *vulgaris* var. *linearis*	1	0.00	0.01	-0.01
Cleome monophylla	1	0.00	0.01	-0.01
Berkheya radula	1	0.00	0.01	-0.01
Hermannia depressa	1	0.00	0.01	-0.01
Commelina africana var. *krebsiana*	1	0.00	0.01	-0.01
Hypoxis hemerocallidea	1	0.00	0.01	-0.01
Ledebouria sp. 1356	1	0.00	0.01	-0.01
Commelina africana var. *africana*	1	0.00	0.01	-0.01
Becium grandiflorum var. *galpinii*	1	0.00	0.01	-0.01
Monsonia angustifolia	4	0.06	0.08	-0.02
Oxalis sp. 1337	2	0.00	0.03	-0.03
Rhynchosia totta var. *totta*	2	0.00	0.03	-0.03
Phyllanthus maderaspatensis	2	0.00	0.03	-0.03
Hypoxis argentea var. *argentea*	2	0.00	0.03	-0.03
Lotononis listii	2	0.00	0.03	-0.03
Indigofera rhytidocarpa subsp. *rhytidocarpa*	4	0.03	0.08	-0.05
Hibiscus trionum	3	0.01	0.06	-0.05
Oldenlandia herbacea var. *herbacea*	4	0.02	0.08	-0.07
Total cover for species in group:	0.68%			

Total class cover = 9.92%

Grass proportion = 84.23%
Forb proportion = 6.85%
Dwarf shrub proportion = 3.31%
Shrub proportion = 0.52%
Tree proportion = 5.08%

Community number: 2

Trees

All coordinates on one point - no variation
Total cover for species in group: 1.21%

Shrubs

All coordinates on one point - no variation
Total cover for species in group: 0.04%

Dwarf Shrubs

Correlation coefficient = +0.89
Standard error of the mean = 0.10

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Euclea undulata var. *myrtina*	1	0.18	0.02	+0.16
Normal competition range:				
Aloe greatheadii var. *davyana*	4	0.57	0.51	+0.05
Lycium cinereum	1	0.02	0.02	-0.00
Solanum panduriforme	1	0.02	0.02	-0.00
Protasparagus setaceus	1	0.00	0.02	-0.02
Justicia flava	1	0.00	0.02	-0.02
Dicoma anomala subsp. *anomala*	1	0.00	0.02	-0.02
Weak competitors:				
Protasparagus suaveolens	2	0.02	0.18	-0.16
Total cover for species in group:	0.82%			

Grasses

Correlation coefficient = +0.75
Standard error of the mean = 0.28

	(F)	Actual cover	Pred. cover	Difference

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Eragrostis chloromelas	4	1.66	1.02	+0.65
Sporobolus ioclados	1	0.32	-0.01	+0.33
Enneapogon scoparius	1	0.32	-0.01	+0.33
Normal competition range:				
Urochloa panicoides	1	0.02	-0.01	+0.03
Elionurus muticus	1	0.02	-0.01	+0.03
Brachiaria eruciformis	1	0.00	-0.01	+0.02
Sporobolus nitens	1	0.00	-0.01	+0.02
Setaria sphacelata var. *torta*	1	0.00	-0.01	+0.02
Eragrostis trichophora	1	0.00	-0.01	+0.02
Aristida congesta subsp. *congesta*	1	0.00	-0.01	+0.02
Tragus berteronianus	1	0.00	-0.01	+0.02
Digitaria eriantha	2	0.33	¯0.33	-0.00
Panicum maximum	2	0.19	0.33	-0.14
Heteropogon contortus	2	0.08	0.33	-0.25
Weak competitors:				
Themeda triandra	2	0.04	0.33	-0.29
Aristida canescens subsp. *canescens*	2	0.01	0.33	-0.32
Bothriochloa insculpta	3	0.21	0.67	-0.47
Total cover for species in group:	3.22%			

Forbs

Correlation coefficient = -0.10
Standard error of the mean = 0.02

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Rhynchosia totta var. *totta*	1	0.08	0.01	+0.07
Normal competition range:				
Chaetacanthus costatus	3	0.01	0.01	+0.00
Seddera capensis	2	0.01	0.01	-0.00
Hibiscus pusillus	2	0.01	0.01	-0.00
Ledebouria sp. 1356	2	0.01	0.01	-0.00
Oxalis sp. 1337	1	0.00	0.01	-0.01
Ipomoea bathycolpos var. *bathycolpos*	1	0.00	0.01	-0.01
Hermannia depressa	1	0.00	0.01	-0.01
Ipomoea bolusiana subsp. *bolusiana*	1	0.00	0.01	-0.01
Chamaesyce inaequilatera	1	0.00	0.01	-0.01
Monsonia angustifolia	1	0.00	0.01	-0.01
Total cover for species in group:	0.14%			

Total class cover = 5.44%

Grass proportion = 59.27%
Forb proportion = 2.58%
Dwarf shrub proportion = 15.16%
Shrub proportion = 0.74%
Tree proportion = 22.26%

Community number: 3
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Trees

Correlation coefficient = +0.52
Standard error of the mean = 0.83

	(F)	Actual cover	Pred. cover	Difference
Normal competition range:				
Acacia nilotica subsp. *kraussiana*	2	1.67	0.84	+0.83
Rhus lancea	1	0.23	0.12	+0.11
Acacia robusta subsp. *robusta*	1	0.00	0.12	-0.11
Acacia karroo	2	0.02	0.84	-0.83
Total cover for species in group:	1.92%			

Shrubs

Correlation coefficient = +0.81
Standard error of the mean = 0.02

	(F)	Actual cover	Pred. cover	Difference

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Unidentifiable sp. 1685	2	0.06	0.04	+0.02
Normal competition range:				
Unidentifiable sp. 1686	1	0.00	0.00	+0.00
Pavetta gardeniifolia var. *gardeniifolia*	1	0.00	0.00	+0.00
Ehretia rigida	1	0.00	0.00	+0.00
Rhus leptodictya	1	0.00	0.00	+0.00
Weak competitors:				
Grewia flava	2	0.02	0.04	-0.02
Total cover for species in group:	0.09%			

Dwarf Shrubs

Correlation coefficient = +0.90
Standard error of the mean = 0.40

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Aloe greatheadii var. *davyana*	7	3.04	2.49	+0.54
Normal competition range:				
Carissa bispinosa subsp. *bispinosa*	1	.01	-0.18	+0.20
Sarcostemma viminale	1	0.01	-0.18	+0.20
Pollichia campestris	1	0.01	-0.18	+0.20
Maytenus heterophylla	1	0.00	-0.18	+0.19
Solanum panduriforme	1	0.00	-0.18	+0.19
Polygala amatymbica	1	0.00	-0.18	+0.19
Dicoma anomala subsp. *anomala*	1	0.00	-0.18	+0.19
Lippia scaberrima	2	0.02	0.26	-0.25
Ptycholobium plicatum	2	0.01	0.26	-0.26
Weak competitors:				
Euclea undulata var. *myrtina*	3	0.02	0.71	-0.69
Protasparagus suaveolens	3	0.02	0.71	-0.69
Total cover for species in group:	3.15%			

Grasses

Correlation coefficient = +0.43
Standard error of the mean = 0.16

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Setaria sphacelata var. *torta*	4	0.60	0.17	+0.42
Cymbopogon plurinodis	3	0.43	0.12	+0.31
Heteropogon contortus	4	0.39	0.17	+0.22
Normal competition range:				
Panicum coloratum var. *coloratum*	1	0.06	0.02	+0.04
Digitaria eriantha	1	0.06	0.02	+0.04
Eragrostis pseudosclerantha	1	0.01	0.02	-0.01
Brachiaria eruciformis	1	0.01	0.02	-0.01
Eragrostis rigidior	1	0.00	0.02	-0.02
Sporobolus stapfianus	1	0.00	0.02	-0.02
Bothriochloa insculpta	1	0.00	0.02	-0.02
Eragrostis trichophora	1	0.00	0.02	-0.02
Eragrostis gummiflua	1	0.00	0.02	-0.02
Themeda triandra	2	0.02	0.07	-0.05
Tragus berteronianus	2	0.01	0.07	-0.07
Panicum maximum	3	0.03	0.12	-0.09
Aristida canescens subsp. *canescens*	3	0.03	0.12	-0.09
Elionurus muticus	3	0.02	0.12	-0.10
Eragrostis chloromelas	3	0.01	0.12	-0.11
Weak competitors:				
Aristida congesta subsp. *congesta*	5	0.03	0.23	-0.20
Melinis repens subsp. *grandiflora*	5	0.03	0.23	-0.20
Total cover for species in group:	1.74%			

Forbs

Correlation coefficient = +0.81
Standard error of the mean = 0.06

(F)	Actual cover	Pred. cover	Difference

Strong competitors:

Indigofera rhytidocarpa subsp. *rhytidocarpa*	7	0.51	0.35	+0.16
Vernonia sp. 1461	1	0.06	-0.01	+0.06
Normal competition range:				
Lotononis listii	1	0.01	-0.01	+0.02
Pentarrhinum insipidum	1	0.00	-0.01	+0.01
Kyphocarpa angustifolia	1	0.00	-0.01	+0.01
Turbina oblongata	1	0.00	-0.01	+0.01
Achyranthes aspera var. *sicula*	1	0.00	-0.01	+0.01
Hibiscus trionum	1	0.00	-0.01	+0.01
Tulbaghia sp. 1557	1	0.00	-0.01	+0.01
Cheilanthes viridis var. *viridis*	1	0.00	-0.01	+0.01
Senecio barbertonicus	1	0.00	-0.01	+0.01
Corchorus asplenifolius	1	0.00	-0.01	+0.01
Evolvulus alsinoides var. *linifolius*	1	0.00	-0.01	+0.01
Vahlia capensis subsp. *vulgaris* var. *linearis*	1	0.00	-0.01	+0.01
Tagetes minuta	1	0.00	-0.01	+0.01
Bidens bipinnata	1	0.00	-0.01	+0.01
Justicia anagalloides	1	0.00	-0.01	+0.01
Phyllanthus maderaspatensis	1	0.00	-0.01	+0.01
Commelina africana var. *africana*	1	0.00	-0.01	+0.01
Hypoxis argentea var. *argentea*	1	0.00	-0.01	+0.01
Plexipus hederaceus var. *hederaceus*	1	0.00	-0.01	+0.01
Lithospermum flexuosum	1	0.00	-0.01	+0.01
Felicia muricata subsp. *cinerascens*	2	0.01	0.05	-0.05
Monsonia angustifolia	2	0.01	0.05	-0.05
Weak competitors:				
Helichrysum rugulosum	3	0.01	0.11	-0.10
Oldenlandia herbacea var. *herbacea*	3	0.01	0.11	-0.10
Hibiscus pusillus	4	0.01	0.17	-0.16
Total cover for species in group:	0.67%			

Total class cover = 7.58%

Grass proportion = 22.98%
Forb proportion = 8.90%
Dwarf shrub proportion = 41.62%
Shrub proportion = 1.17%
Tree proportion = 25.33%

Community number: 4
===================

Trees

Correlation coefficient = +0.12
Standard error of the mean = 0.21

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Acacia robusta subsp. *robusta*	1	0.50	0.18	+0.32
Acacia nilotica subsp. *kraussiana*	2	0.50	0.19	+0.31
Normal competition range:				
Acacia caffra	7	0.28	0.25	+0.03
Pappea capensis	1	0.19	0.18	+0.01
Combretum apiculatum subsp. *apiculatum*	1	0.19	0.18	+0.01
Acacia karroo	3	0.04	0.20	-0.16
Dichrostachys cinerea subsp. *africana* var. *africana*	1	0.01	0.18	-0.17
Combretum molle	1	0.01	0.18	-0.17
Dombeya rotundifolia var. *rotundifolia*	2	0.01	0.19	-0.18
Total cover for species in group:	1.74%			

Shrubs

Correlation coefficient = -0.50
Standard error of the mean = 0.19

	(F)	Actual cover	Pred. cover	Difference
Normal competition range:				
Ehretia rigida	1	0.38	0.19	+0.19
Rhus leptodictya	2	0.04	0.04	+0.00
Unidentifiable sp. 1685	2	0.03	0.04	-0.00
Zanthoxylum capense	1	0.00	0.19	-0.19
Total cover for species in group:	0.45%			

Dwarf Shrubs

Correlation coefficient = +0.91
Standard error of the mean = 0.03

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Aloe greatheadii var. *davyana*	12	0.25	0.21	+0.04
Normal competition range:				
Rhoicissus tridentata subsp. *cuneifolia*	1	0.01	-0.00	+0.01
Berchemia zeyheri	1	0.01	-0.00	+0.01
Agathisanthemum bojeri subsp. *bojeri*	1	0.00	-0.00	+0.01
Dodonaea sp. 1645	1	0.00	-0.00	+0.01
Achyropsis leptostachya	1	0.00	-0.00	+0.01
Sarcostemma viminale	1	0.00	-0.00	+0.01
Justicia flava	1	0.00	-0.00	+0.01
Sphedamnocarpus pruriens subsp. *galphimiifolius*	1	0.00	-0.00	+0.01
Euclea undulata var. *myrtina*	1	0.00	-0.00	+0.01
Gerbera viridifolia subsp. *viridifolia*	1	0.00	-0.00	+0.01
Ziziphus zeyheriana	1	0.00	-0.00	+0.01
Lippia scaberrima	3	0.01	0.03	-0.02
Weak competitors:				
Maytenus heterophylla	3	0.00	0.03	-0.03
Solanum panduriforme	6	0.02	0.09	-0.08
Total cover for species in group:	0.31%			

Grasses

Correlation coefficient = +0.77
Standard error of the mean = 0.10

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Setaria sphacelata var. *torta*	8	0.60	0.28	+0.32
Heteropogon contortus	11	0.63	0.40	+0.23
Normal competition range:				
Setaria lindenbergiana	1	0.07	-0.02	+0.09
Cymbopogon plurinodis	2	0.08	0.02	+0.05
Eragrostis chloromelas	2	0.08	0.02	+0.05
Setaria lindenbergiana	1	0.01	-0.02	+0.03
Panicum maximum	5	0.17	0.15	+0.02
Eustachys paspaloides	1	0.00	-0.02	+0.02
Pennisetum sphacelatum	1	0.00	-0.02	+0.02
Andropogon chinensis	1	0.00	-0.02	+0.02
Trichoneura grandiglumis var. *grandiglumis*	1	0.00	-0.02	+0.02
Trachypogon spicatus	1	0.00	-0.02	+0.02
Kyllinga erecta	1	0.00	-0.02	+0.02
Schizachyrium sanguineum	1	0.00	-0.02	+0.02
Cynodon dactylon	1	0.00	-0.02	+0.02
Elionurus muticus	1	0.00	-0.02	+0.02
Brachiaria serrata	1	0.00	-0.02	+0.02
Aristida scabrivalvis subsp. *scabrivalvis*	2	0.04	0.02	+0.02
Anthephora pubescens	2	0.01	0.02	-0.01
Eragrostis gummiflua	2	0.01	0.02	-0.01
Melinis nerviglumis	2	0.00	0.02	-0.02
Digitaria eriantha	4	0.07	0.11	-0.03
Bulbostylis contexta	3	0.01	0.07	-0.05
Aristida canescens subsp. *canescens*	3	0.00	0.07	-0.06
Tragus berteronianus	5	0.09	0.15	-0.06
Aristida congesta subsp. *congesta*	4	0.01	0.11	-0.09
Weak competitors:				
Enneapogon scoparius	6	0.07	0.19	-0.12
Loudetia flavida	7	0.11	0.23	-0.12
Melinis repens subsp. *grandiflora*	5	0.02	0.15	-0.13
Diheteropogon amplectens	5	0.01	0.15	-0.14
Themeda triandra	10	0.19	0.36	-0.17
Total cover for species in group:	2.31%			

Forbs

Correlation coefficient = +0.66
Standard error of the mean = 0.00

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				

	(F)	Actual cover	Pred. cover	Difference
Convolvulus sagittatus var. *aschersonii*	1	0.01	0.00	+0.01
Cleome monophylla	1	0.01	0.00	+0.01
Clerodendrum triphyllum var. *triphyllum*	2	0.01	0.00	+0.01
Becium grandiflorum var. *galpinii*	2	0.01	0.00	+0.01
Tephrosia purpurea subsp. *leptostachya*	2	0.01	0.00	+0.01
Commelina africana var. *africana*	4	0.01	0.01	+0.00
Normal competition range:				
Achyranthes aspera var. *aspera*	1	0.00	0.00	-0.00
Vigna vexillata var. *vexillata*	1	0.00	0.00	-0.00
Clematis brachiata	1	0.00	0.00	-0.00
Abutilon grandifolium	1	0.00	0.00	-0.00
Barleria macrostegia	1	0.00	0.00	-0.00
Indigofera daleoides var. *daleoides*	1	0.00	0.00	-0.00
Corbichonia decumbens	1	0.00	-0.00	-0.00
Heliotropium strigosum	1	0.00	0.00	-0.00
Hibiscus trionum	1	0.00	0.00	-0.00
Tulbaghia acutiloba	1	0.00	0.00	-0.00
Senecio barbertonicus	1	0.00	0.00	-0.00
Evolvulus alsinoides var. *linifolius*	1	0.00	0.00	-0.00
Commelina africana var. *krebsiana*	1	0.00	0.00	-0.00
Vernonia oligocephala	1	0.00	0.00	-0.00
Helichrysum rugulosum	1	0.00	0.00	-0.00
Felicia muricata subsp. *cinerascens*	1	0.00	0.00	-0.00
Chamaecrista biensis	1	0.00	0.00	-0.00
Chamaesyce inaequilatera	1	0.00	0.00	-0.00
Hypoxis argentea var. *argentea*	1	0.00	0.00	-0.00
Monsonia angustifolia	1	0.00	0.00	-0.00
Pellaea calomelanos var. *calomelanos*	2	0.00	0.00	-0.00
Chenopodium album	2	0.00	0.00	-0.00
Schkuhria pinnata	2	0.00	0.00	-0.00
Justicia anagalloides	2	0.00	0.00	-0.00
Oldenlandia herbacea var. *herbacea*	2	0.00	0.00	-0.00
Plexipus hederaceus var. *hederaceus*	2	0.00	0.00	-0.00
Tragia rupestris	3	0.00	0.01	-0.00
Bidens bipinnata	3	0.00	0.01	-0.00
Indigofera rhytidocarpa subsp. *rhytidocarpa*	3	0.00	0.01	-0.00
Ruellia cordata	4	0.01	0.01	-0.00
Pentarrhinum insipidum	6	0.01	0.01	-0.00
Total cover for species in group:	0.13%			

Total class cover = 4.94%

Grass proportion = 46.76%
Forb proportion = 2.71%
Dwarf shrub proportion = 6.26%
Shrub proportion = 9.15%
Tree proportion = 35.12%

Community number: 5

Trees

Correlation coefficient = +0.16
Standard error of the mean = 0.12

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Combretum molle	1	0.28	0.09	+0.19
Normal competition range:				
Acacia caffra	4	0.24	0.14	+0.10
Vitex obovata	2	0.08	0.11	-0.03
Acacia karroo	2	0.08	0.11	-0.03
Acacia nilotica subsp. *kraussiana*	2	0.04	0.11	-0.07
Acacia robusta subsp. *robusta*	2	0.04	0.11	-0.07
Dombeya rotundifolia var. *rotundifolia*	2	0.00	0.11	-0.10
Total cover for species in group:	0.75%			

Shrubs

All coordinates on one point - no variation
Total cover for species in group: 0.04%

Dwarf Shrubs

Correlation coefficient = +0.78
Standard error of the mean = 0.01

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				

	(F)	Actual cover	Pred. cover	Difference
Lippia scaberrima	1	0.03	0.01	+0.03
Normal competition range:				
Aloe greatheadii var. *davyana*	5	0.05	0.04	+0.00
Xerophyta retinervis	1	0.01	0.01	+0.00
Ziziphus zeyheriana	1	0.01	0.01	+0.00
Triumfetta sonderi	2	0.02	0.02	+0.00
Stylosanthes fruticosa	1	0.00	0.01	-0.00
Rhus gracillima	1	0.00	0.01	-0.00
Elephantorrhiza elephantina	1	0.00	0.01	-0.00
Dicoma anomala subsp. *anomala*	1	0.00	0.01	-0.00
Lantana rugosa	2	0.01	0.02	-0.01
Weak competitors:				
Protasparagus suaveolens	2	0.00	0.02	-0.01
Total cover for species in group:	0.13%			

Grasses

Correlation coefficient = +0.75
Standard error of the mean = 0.03

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Heteropogon contortus	6	0.18	0.07	+0.11
Setaria sphacelata var. *torta*	8	0.19	0.10	+0.09
Loudetia flavida	7	0.14	0.09	+0.05
Normal competition range:				
Eragrostis trichophora	1	0.01	-0.01	+0.01
Aristida diffusa subsp. *burkei*	1	0.00	-0.01	+0.01
Cyperus rubicundus	1	0.00	-0.01	+0.01
Eustachys paspaloides	1	0.00	-0.01	+0.01
Diheteropogon filifolius	1	0.00	-0.01	+0.01
Enneapogon cenchroides	1	0.00	-0.01	+0.01
Setaria lindenbergiana	1	0.00	-0.01	+0.01
Urelytrum agropyroides	1	0.00	-0.01	+0.01
Mariscus rehmannianus	1	0.00	-0.01	+0.01
Aristida bipartita	1	0.00	-0.01	+0.01
Eragrostis gummiflua	1	0.00	-0.01	+0.01
Eragrostis chloromelas	1	0.00	-0.01	+0.01
Tristachya biseriata	2	0.02	0.01	+0.01
Anthephora pubescens	2	0.01	0.01	-0.00
Elionurus muticus	2	0.01	0.01	-0.00
Trachypogon spicatus	4	0.04	0.04	-0.01
Trichoneura grandiglumis var. *grandiglumis*	2	0.00	0.01	-0.01
Schizachyrium sanguineum	2	0.00	0.01	-0.01
Sporobolus stapfianus	3	0.01	0.03	-0.01
Tragus berteronianus	3	0.01	0.03	-0.01
Melinis repens subsp. *grandiflora*	9	0.10	0.12	-0.02
Bulbostylis contexta	3	0.00	0.03	-0.02
Melinis nerviglumis	4	0.01	0.04	-0.03
Brachiaria serrata	4	0.01	0.04	-0.03
Weak competitors:				
Aristida congesta subsp. *congesta*	4	0.01	0.04	-0.03
Aristida canescens subsp. *canescens*	5	0.01	0.06	-0.04
Diheteropogon amplectens	6	0.02	0.07	-0.05
Themeda triandra	9	0.06	0.12	-0.06
Total cover for species in group:	0.86%			

Forbs

Correlation coefficient = +0.47
Standard error of the mean = 0.03

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Clerodendrum triphyllum var. *triphyllum*	4	0.20	0.04	+0.16
Normal competition range:				
Vernonia oligocephala	2	0.03	0.01	+0.02
Oldenlandia herbacea var. *herbacea*	2	0.03	0.01	+0.02
Vigna vexillata var. *vexillata*	1	0.01	-0.00	+0.01
Merremia palmata	1	0.00	-0.00	+0.00
Gerbera sp. 1476	1	0.00	-0.00	+0.00
Acalypha villicaulis	1	0.00	-0.00	+0.00
Ipomoea obscura var. *obscura*	1	0.00	-0.00	+0.00
Tragia rupestris	1	0.00	-0.00	+0.00
Convolvulus sagittatus subsp. *sagittatus*	1	0.00	-0.00	+0.00
Dipcadi viride	1	0.00	-0.00	+0.00

Conyza albida	1	0.00	-0.00	+0.00
Rhynchosia totta var. *totta*	1	0.00	-0.00	+0.00
Tagetes minuta	1	0.00	-0.00	+0.00
Schkuhria pinnata	1	0.00	-0.00	+0.00
Chamaecrista biensis	1	0.00	-0.00	+0.00
Helichrysum nudifolium	1	0.00	-0.00	+0.00
Pearsonia sessilifolia subsp. *marginata*	1	0.00	-0.00	+0.00
Senecio venosus	1	0.00	-0.00	+0.00
Ledebouria sp. 1356	1	0.00	-0.00	+0.00
Hypoxis argentea var. *argentea*	1	0.00	-0.00	+0.00
Plexipus hederaceus var. *hederaceus*	2	0.01	0.01	-0.01
Tephrosia elongata var. *elongata*	2	0.00	0.01	-0.01
Merremia tridentata subsp. *angustifolia*	2	0.00	0.01	-0.01
Phyllanthus humilis	2	0.00	0.01	-0.01
Commelina africana var. *africana*	2	0.00	0.01	-0.01
Indigofera rhytidocarpa subsp. *rhytidocarpa*	2	0.00	0.01	-0.01
Monsonia angustifolia	2	0.00	0.01	-0.01
Lithospermum flexuosum	2	0.00	0.01	-0.01
Anthericum longistylum	3	0.01	0.03	-0.02
Hibiscus pusillus	3	0.01	0.03	-0.02
Hermannia parvula	3	0.00	0.03	-0.02
Tephrosia purpurea subsp. *leptostachya*	3	0.00	0.03	-0.02
Weak competitors:				
Ruellia cordata	5	0.03	0.06	-0.03
Becium grandiflorum var. *galpinii*	4	0.01	0.04	-0.04

Total cover for species in group: 0.40%

Total class cover = 2.17%

Grass proportion = 39.36%
Forb proportion = 18.19%
Dwarf shrub proportion = 5.95%
Shrub proportion = 1.77%
Tree proportion = 34.73%

Community number: 6
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Trees

All coordinates on one point - no variation
Total cover for species in group: 0.16%

Shrubs

No Shrubs
Total cover for species in group: 0.00%

Dwarf Shrubs

Correlation coefficient = +0.94
Standard error of the mean = 0.08

	(F)	Actual cover	Pred. cover	Differ-ence
Strong competitors:				
Acalypha angustata var. *glabra*	1	0.07	-0.03	+0.10
Normal competition range:				
Aloe greatheadii var. *davyana*	6	0.63	0.58	+0.05
Pollichia campestris	1	0.00	-0.03	+0.03
Lippia scaberrima	1	0.00	-0.03	+0.03
Protasparagus suaveolens	1	0.00	-0.03	+0.03
Weak competitors:				
Lantana rugosa	2	0.01	0.09	-0.08
Indigofera heterotricha	2	0.01	0.09	-0.08
Solanum incanum	2	0.01	0.09	-0.08

Total cover for species in group: 0.72%

Grasses

Correlation coefficient = +0.56
Standard error of the mean = 0.45

	(F)	Actual cover	Pred. cover	Differ-ence
Strong competitors:				
Setaria sphacelata var. *torta*	5	2.06	0.63	+1.43
Schizachyrium sanguineum	3	0.84	0.29	+0.55

Normal competition range:

Themeda triandra	6	1.20	0.80	+0.40
Eragrostis gummiflua	1	0.02	-0.05	+0.06
Panicum maximum	1	0.00	-0.05	+0.05
Sporobolus stapfianus	1	0.00	-0.05	+0.05
Anthephora pubescens	1	0.00	-0.05	+0.05
Cynodon dactylon	1	0.00	-0.05	+0.05
Aristida congesta subsp. *congesta*	1	0.00	-0.05	+0.05
Eragrostis racemosa	1	0.00	-0.05	+0.05
Tragus berteronianus	2	0.07	0.12	-0.05
Brachiaria serrata	2	0.07	0.12	-0.05
Digitaria eriantha	2	0.02	0.12	-0.10
Bulbostylis contexta	2	0.01	0.12	-0.11
Melinis repens subsp. *grandiflora*	3	0.04	0.29	-0.25
Elionurus muticus	3	0.02	0.29	-0.27
Diheteropogon amplectens	4	0.10	0.46	-0.35
Aristida canescens subsp. *canescens*	4	0.01	0.46	-0.44
Weak competitors:				
Heteropogon contortus	5	0.11	0.63	-0.52
Loudetia flavida	6	0.19	0.80	-0.60
Total cover for species in group:	4.78%			

Forbs

Correlation coefficient = +1.00
Standard error of the mean = 0.00

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Anthospermum rigidum subsp. *pumilum*	1	0.00	0.00	+0.00
Hibiscus pusillus	1	0.00	0.00	+0.00
Phyllanthus humilis	1	0.00	0.00	+0.00
Tagetes minuta	1	0.00	0.00	+0.00
Schkuhria pinnata	1	0.00	0.00	+0.00
Felicia muricata subsp. *cinerascens*	1	0.00	0.00	+0.00
Ruellia cordata	1	0.00	0.00	+0.00
Helichrysum nudifolium	1	0.00	0.00	+0.00
Crotalaria brachycarpa	1	0.00	0.00	+0.00
Clerodendrum triphyllum var. *triphyllum*	1	0.00	0.00	+0.00
Pearsonia sessilifolia subsp. *marginata*	1	0.00	0.00	+0.00
Senecio venosus	1	0.00	0.00	+0.00
Chamaesyce inaequilatera	1	0.00	0.00	+0.00
Ledebouria sp. 1356	1	0.00	0.00	+0.00
Commelina africana var. *africana*	1	0.00	0.00	+0.00
Becium grandiflorum var. *galpinii*	1	0.00	0.00	+0.00
Indigofera rhytidocarpa subsp. *rhytidocarpa*	1	0.00	0.00	+0.00
Plexipus hederaceus var. *hederaceus*	1	0.00	0.00	+0.00
Monsonia angustifolia	1	0.00	0.00	+0.00
Normal competition range:				
Phyllanthus maderaspatensis	2	0.01	0.01	+0.00
Chamaecrista biensis	2	0.01	0.01	+0.00
Tephrosia purpurea subsp. *leptostachya*	2	0.01	0.01	+0.00
Total cover for species in group:	0.08%			

Total class cover = 5.74%

Grass proportion = 83.25%
Forb proportion = 1.45%
Dwarf shrub proportion = 12.60%
Shrub proportion = 0.00%
Tree proportion = 2.70%

Community number: 7
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Trees

Correlation coefficient = +0.98
Standard error of the mean = 0.17

	(F)	Actual cover	Pred. cover	Difference
Normal competition range:				
Acacia robusta subsp. *robusta*	2	0.28	0.16	+0.12
Acacia tortilis subsp. *heteracantha*	3	1.29	1.29	-0.00
Acacia karroo	2	0.04	0.16	-0.12
Total cover for species in group:	1.60%			

Shrubs

Correlation coefficient = +1.00
Standard error of the mean = 0.00

	(F)	Actual cover	Pred. cover	Difference
Normal competition range:				
Rhus leptodictya	2	0.01	0.01	+0.00
Grewia flava	1	0.00	0.00	+0.00
Unidentifiable spp. 1685	1	0.00	0.00	+0.00
Total cover for species in group:	0.01%			

Dwarf Shrubs

Correlation coefficient = +0.96
Standard error of the mean = 0.02

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Ziziphus zeyheriana	3	0.06	0.03	+0.03
Justicia flava	1	0.02	-0.00	+0.02
Normal competition range:				
Aloe greatheadii var. *davyana*	15	0.19	0.19	+0.00
Polygala amatymbica	1	0.00	-0.00	+0.00
Indigofera heterotricha	1	0.00	-0.00	+0.00
Protasparagus suaveolens	1	0.00	-0.00	+0.00
Ptycholobium plicatum	2	0.01	0.01	-0.01
Justicia betonica	2	0.00	0.01	-0.01
Weak competitors:				
Elephantorrhiza elephantina	3	0.01	0.03	-0.02
Dicoma anomala subsp. *anomala*	3	0.00	0.03	-0.02
Total cover for species in group:	0.29%			

Grasses

Correlation coefficient = +0.35
Standard error of the mean = 0.37

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Panicum maximum	1	1.65	0.04	+1.61
Setaria sphacelata var. *torta*	17	1.46	0.46	+1.00
Eragrostis chloromelas	12	0.83	0.33	+0.50
Normal competition range:				
Diheteropogon amplectens	6	0.23	0.17	+0.06
Themeda triandra	14	0.39	0.38	+0.01
Cymbopogon plurinodis	1	0.00	0.04	-0.04
Digitaria monodactyla	1	0.00	0.04	-0.04
Trichoneura grandiglumis var. *grandiglumis*	1	0.00	0.04	-0.04
Hyperthelia dissoluta	1	0.00	0.04	-0.04
Eragrostis nindensis	1	0.00	0.04	-0.04
Sporobolus stapfianus	1	0.00	0.04	-0.04
Cymbopogon excavatus	1	0.00	0.04	-0.04
Cynodon dactylon	1	0.00	0.04	-0.04
Eragrostis trichophora	1	0.00	0.04	-0.04
Brachiaria nigropedata	1	0.00	0.04	-0.04
Eragrostis superba	1	0.00	0.04	-0.04
Elionurus muticus	14	0.34	0.38	-0.04
Schizachyrium sanguineum	4	0.08	0.12	-0.05
Melinis repens subsp. *grandiflora*	13	0.29	0.36	-0.07
Eragrostis racemosa	3	0.01	0.09	-0.09
Tripogon minimus	3	0.00	0.09	-0.09
Bulbostylis contexta	3	0.00	0.09	-0.09
Anthephora pubescens	3	0.00	0.09	-0.09
Tragus berteronianus	3	0.00	0.09	-0.09
Cyperus obtusiflorus var. *obtusiflorus*	3	0.00	0.09	-0.09
Digitaria eriantha	9	0.11	0.25	-0.14
Trachypogon spicatus	6	0.01	0.17	-0.16
Microchloa caffra	8	0.05	0.23	-0.17
Loudetia flavida	10	0.06	0.28	-0.22
Aristida canescens subsp. *canescens*	14	0.16	0.38	-0.22
Brachiaria serrata	9	0.02	0.25	-0.24
Eragrostis gummiflua	10	0.04	0.28	-0.24
Heteropogon contortus	11	0.01	0.30	-0.29
Aristida congesta subsp. *congesta*	14	0.04	0.38	-0.34
Total cover for species in group:	5.81%			

Forbs

Correlation coefficient = +0.66
Standard error of the mean = 0.02

	(F)	Actual cover	Pred. cover	Difference
Strong competitors:				
Indigofera rhytidocarpa subsp. *rhytidocarpa*	13	0.22	0.08	+0.14
Normal competition range:				
Becium grandiflorum var. *galpinii*	6	0.05	0.03	+0.02
Berkheya radula	1	0.02	-0.00	+0.02
Helichrysum nudifolium	3	0.02	0.01	+0.01
Convolvulus sagittatus var. *aschersonii*	1	0.00	-0.00	+0.01
Gazania krebsiana subsp. *krebsiana*	1	0.00	-0.00	+0.01
Evolvulus alsinoides var. *linifolius*	1	0.00	-0.00	+0.01
Bidens bipinnata	1	0.00	-0.00	+0.01
Gnidia capitata	1	0.00	-0.00	+0.00
Sida alba	1	0.00	-0.00	+0.00
Senecio barbertonicus	1	0.00	-0.00	+0.00
Dicerocaryum eriocarpum	1	0.00	-0.00	+0.00
Vernonia sp. 1461	1	0.00	-0.00	+0.00
Corchorus asplenifolius	1	0.00	-0.00	+0.00
Zornia linearis	1	0.00	-0.00	+0.00
Graderia subintegra	1	0.00	-0.00	+0.00
Gomphrena celosioides	1	0.00	-0.00	+0.00
Menodora africana	1	0.00	-0.00	+0.00
Raphionacme hirsuta	1	0.00	-0.00	+0.00
Senecio lygodes	1	0.00	-0.00	+0.00
Rhynchosia totta var. *totta*	1	0.00	-0.00	+0.00
Hypoxis hemerocallidea	1	0.00	-0.00	+0.00
Crabbea angustifolia	1	0.00	-0.00	+0.00
Helichrysum rugulosum	1	0.00	-0.00	+0.00
Kohautia amatymbica	1	0.00	-0.00	+0.00
Tephrosia longipes subsp. *longipes*	1	0.00	-0.00	+0.00
Commelina africana var. *africana*	1	0.00	-0.00	+0.00
Geigeria burkei subsp. *burkei* var. *burkei*	1	0.00	-0.00	+0.00
Chamaesyce inaequilatera	4	0.02	0.02	+0.00
Helichrysum oxyphyllum	2	0.01	0.00	+0.00
Hermannia depressa	2	0.00	0.00	-0.00
Schkuhria pinnata	2	0.00	0.00	-0.00
Chamaecrista biensis	2	0.00	0.00	-0.00
Plexipus hederaceus var. *hederaceus*	2	0.00	0.00	-0.00
Chaetacanthus costatus	3	0.01	0.01	-0.00
Lithospermum flexuosum	3	0.01	0.01	-0.00
Merremia tridentata subsp. *angustifolia*	3	0.00	0.01	-0.01
Vahlia capensis subsp. *vulgaris* var. *linearis*	3	0.00	0.01	-0.01
Ipomoea bolusiana subsp. *bolusiana*	3	0.00	0.01	-0.01
Ledebouria sp. 1356	3	0.00	0.01	-0.01
Anthericum cooperi	3	0.00	0.01	-0.01
Lotononis listii	3	0.00	0.01	-0.01
Hibiscus pusillus	4	0.01	0.02	-0.01
Justicia anagalloides	4	0.00	0.02	-0.01
Anthericum longistylum	5	0.01	0.02	-0.02
Hypoxis argentea var. *argentea*	6	0.01	0.03	-0.02
Monsonia angustifolia	12	0.05	0.07	-0.02
Vernonia oligocephala	8	0.02	0.04	-0.02
Weak competitors:				
Tephrosia purpurea subsp. *leptostachya*	10	0.03	0.06	-0.03
Phyllanthus maderaspatensis	7	0.01	0.04	-0.03
Oldenlandia herbacea var. *herbacea*	12	0.02	0.07	-0.05
Total cover for species in group:	0.56%			

Total class cover = 8.28%

Grass proportion = 70.18%
Forb proportion = 6.77%
Dwarf shrub proportion = 3.53%
Shrub proportion = 0.13%
Tree proportion = 19.38%

APPENDIX F

LISTING OF STAND TRANSECT DATA FOR THE POINT CANOPY INTERCEPT METHOD

Format: species abbreviation; canopy cover; number of individuals; absolute frequency for trees, shrubs, dwarf shrubs, grasses, forbs; relative cover; mean spacing; mean crown diameter; individuals/ha; *point spacing inadequate for crown and density.

Stand/relevé number: 1

1296	0.287%	8	9	0	0	0	8	0	7.247%	1.89 m	0.11 m	842
1289	0.510%	11	12	0	0	0	11	0	12.879%	1.35 m	0.11 m	1624
1315	0.004%	1	1	0	0	0	0	1	0.101%	15.90 m	0.10 m*	13
1316	0.057%	1	4	0	0	1	0	0	1.439%	15.60 m	0.40 m	13
1291	0.599%	10	13	0	0	0	10	0	15.126%	1.47 m	0.13 m	1351
1309	0.004%	1	1	0	0	1	0	0	0.101%	15.90 m	0.10 m*	13
1290	0.032%	2	3	0	0	0	2	0	0.808%	7.85 m	0.15 m	51
1303	0.004%	1	1	0	0	0	0	1	0.101%	15.90 m	0.10 m*	13
1314	0.032%	3	3	0	0	0	3	0	0.808%	5.23 m	0.10 m	114
1293	1.562%	16	21	0	0	0	16	0	39.444%	0.87 m	0.13 m	3646
1292	0.089%	5	5	0	0	0	5	0	2.247%	3.10 m	0.10 m*	321
1286	0.014%	1	2	0	0	0	1	0	0.354%	15.80 m	0.20 m	13
1318	0.014%	1	2	0	0	0	0	1	0.354%	15.80 m	0.20 m	13
1306	0.057%	2	4	0	0	0	0	2	1.439%	7.80 m	0.20 m	51
1294	0.004%	1	1	0	0	0	1	0	0.101%	15.90 m	0.10 m*	13
1287	0.599%	10	13	0	0	0	10	0	15.126%	1.47 m	0.13 m	1351
1285	0.089%	5	5	0	0	0	5	0	2.247%	3.10 m	0.10 m*	321
1319	0.004%	1	1	0	0	0	1	0	0.101%	15.90 m	0.10 m*	13
1297	0.004%	1	1	0	0	0	1	0	0.101%	15.90 m	0.10 m*	13
1304	0.004%	1	1	0	0	0	0	1	0.101%	15.90 m	0.10 m*	13
1312	0.004%	1	1	0	0	0	0	1	0.101%	15.90 m	0.10 m*	13
Totals	3.968	83	104	0	0	2	74	7				

Total points: 160
SOIL 15.43
ROCK 0.00

Stand/relevé number: 2

1296	9.580%	36	52	0	0	0	36	0	92.650%	0.30 m	0.14 m	22974
1284	0.032%	3	3	0	0	0	3	0	0.309%	5.23 m	0.10 m	114
1300	0.014%	2	2	0	0	0	2	0	0.135%	7.90 m	0.10 m*	50
1330	0.287%	6	9	0	0	0	0	6	2.776%	2.52 m	0.15 m	474
1287	0.057%	3	4	0	0	0	3	0	0.551%	5.20 m	0.13 m	115
1307	0.004%	1	1	0	0	0	0	1	0.039%	15.90 m	0.10 m*	13
1333	0.014%	2	2	0	0	0	0	2	0.135%	7.90 m	0.10 m*	50
1318	0.004%	1	1	0	0	0	0	1	0.039%	15.90 m	0.10 m*	13
1327	0.014%	2	2	0	0	0	0	2	0.135%	7.90 m	0.10 m*	50
1323	0.032%	2	3	0	0	0	0	2	0.309%	7.85 m	0.15 m	51
1331	0.004%	1	1	0	0	0	0	1	0.039%	15.90 m	0.10 m*	13
1303	0.287%	7	9	0	0	0	0	7	2.776%	2.16 m	0.13 m	645
1315	0.014%	1	2	0	0	0	0	1	0.135%	15.80 m	0.20 m	13
1329	0.004%	1	1	0	0	0	0	1	0.039%	15.90 m	0.10 m*	13
Totals	10.345	68	92	0	0	0	44	24				

Total points: 160
SOIL 20.46
ROCK 0.00

Stand/relevé number: 3

1285	0.032%	3	3	0	0	0	3	0	0.541%	5.23 m	0.10 m	114
1330	0.227%	6	8	0	0	0	6	0	3.834%	2.53 m	0.13 m	471
1291	0.014%	2	2	0	0	0	2	0	0.236%	7.90 m	0.10 m*	50
1296	4.340%	32	35	0	0	0	32	0	73.311%	0.39 m	0.11 m	16052
1320	0.510%	12	12	0	0	0	12	0	8.615%	1.23 m	0.10 m*	1933
1355	0.004%	1	1	0	0	0	0	1	0.068%	15.90 m	0.10 m*	13
1321	0.004%	1	1	0	0	0	1	0	0.068%	15.90 m	0.10 m*	13
1300	0.014%	2	2	0	0	0	2	0	0.236%	7.90 m	0.10 m*	50
1356	0.004%	1	1	0	0	0	0	1	0.068%	15.90 m	0.10 m*	13
1333	0.032%	2	3	0	0	0	0	2	0.541%	7.85 m	0.15 m	51
1293	0.014%	1	2	0	0	0	1	0	0.236%	15.80 m	0.20 m	13
1289	0.057%	4	4	0	0	0	4	0	0.963%	3.90 m	0.10 m*	204
1287	0.287%	9	9	0	0	0	9	0	4.848%	1.68 m	0.10 m	1066
1285	0.287%	7	9	0	0	0	7	0	4.848%	2.16 m	0.13 m	645
1357	0.004%	1	1	0	0	0	1	0	0.068%	15.90 m	0.10 m*	13
1284	0.089%	5	5	0	0	0	5	0	1.503%	3.10 m	0.10 m*	321
1303	0.004%	1	1	0	0	0	0	1	0.068%	15.90 m	0.10 m*	13
Totals	5.920	90	99	0	0	0	85	5				

Total points: 160
SOIL 16.87
ROCK 0.00

Stand/relevé number: 4

1285	0.014%	2	2	0	0	0	2	0	0.335%	7.90 m	0.10 m*	50
1329	0.004%	1	1	0	0	0	0	1	0.096%	15.90 m	0.10 m*	13
1295	3.628%	22	32	0	0	0	22	0	86.794%	0.58 m	0.15 m	7430
1323	0.032%	3	3	0	0	0	0	3	0.766%	5.23 m	0.10 m	114
1346	0.128%	5	6	0	0	0	5	0	3.062%	3.08 m	0.12 m	323
1287	0.057%	4	4	0	0	0	4	0	1.364%	3.90 m	0.10 m*	204
1342	0.014%	1	2	0	0	1	0	0	0.335%	15.80 m	0.20 m	13
1293	0.032%	2	3	0	0	0	2	0	0.766%	7.85 m	0.15 m	51
1389	0.004%	1	1	0	0	1	0	0	0.096%	15.90 m	0.10 m*	13
1303	0.004%	1	1	0	0	0	0	1	0.096%	15.90 m	0.10 m*	13
1291	0.128%	5	6	0	0	0	5	0	3.062%	3.08 m	0.12 m	323
1345	0.004%	1	1	0	0	0	0	1	0.096%	15.90 m	0.10 m*	13
1285	0.014%	1	2	0	0	0	1	0	0.335%	15.80 m	0.20 m	13
1347	0.032%	3	3	0	0	0	3	0	0.766%	5.23 m	0.10 m	114
1312	0.014%	1	2	0	0	0	0	1	0.335%	15.80 m	0.20 m	13
1321	0.004%	1	1	0	0	0	1	0	0.096%	15.90 m	0.10 m*	13
1371	0.004%	1	1	0	0	0	0	1	0.096%	15.90 m	0.10 m*	13
1284	0.057%	3	4	0	0	0	2	0	1.364%	5.20 m	0.13 m	115
1317	0.014%	1	2	0	0	1	0	0	0.335%	15.80 m	0.20 m	13
Totals	4.184	59	77	0	0	3	47	8				

Total points: 160
SOIL 28.70
ROCK 0.00

Stand/relevé number: 5

1284	0.004%	1	1	0	0	0	1	0	0.070%	15.90 m	0.10 m*	13
1295	4.850%	33	37	0	0	0	33	0	84.790%	0.37 m	0.11 m	17313
1294	0.004%	1	1	0	0	0	1	0	0.070%	15.90 m	0.10 m*	13
1323	0.089%	4	5	0	0	0	0	4	1.556%	3.88 m	0.13 m	205
1320	0.004%	1	1	0	0	0	1	0	0.070%	15.90 m	0.10 m*	13
1291	0.032%	2	3	0	0	0	2	0	0.559%	7.85 m	0.15 m	51
1293	0.287%	7	9	0	0	0	7	0	5.017%	2.16 m	0.13 m	645
1287	0.032%	3	3	0	0	0	3	0	0.559%	5.23 m	0.10 m	114
1296	0.032%	2	3	0	0	0	2	0	0.559%	7.85 m	0.15 m	51
1290	0.004%	1	1	0	0	0	1	0	0.070%	15.90 m	0.10 m*	13
1317	0.174%	5	7	0	0	5	0	0	3.042%	3.06 m	0.14 m	325
1312	0.057%	2	4	0	0	0	0	2	0.997%	7.80 m	0.20 m	51
1391	0.089%	5	5	0	0	5	0	0	1.556%	3.10 m	0.10 m*	321
1288	0.032%	2	3	0	0	0	2	0	0.559%	7.85 m	0.15 m	51
1396	0.004%	1	1	0	0	0	0	1	0.070%	15.90 m	0.10 m*	13
1285	0.032%	2	3	0	0	0	2	0	0.559%	7.85 m	0.15 m	51
1318	0.004%	1	1	0	0	0	0	1	0.070%	15.90 m	0.10 m*	13
1341	0.004%	1	1	0	0	1	0	0	0.070%	15.90 m	0.10 m*	13
Totals	5.729	74	89	0	0	11	55	8				

Total points: 160
SOIL 23.25
ROCK 0.00

Stand/relevé number: 6

1293	4.592%	26	36	0	0	0	26	0	86.805%	0.48 m	0.14 m	10671
1294	0.014%	2	2	0	0	0	2	0	0.265%	7.90 m	0.10 m*	50
1295	0.089%	4	5	0	0	0	4	0	1.682%	3.88 m	0.13 m	205
1290	0.174%	5	7	0	0	0	5	0	3.289%	3.06 m	0.14 m	325
1321	0.014%	1	2	0	0	0	1	0	0.265%	15.80 m	0.20 m	13
1285	0.004%	1	1	0	0	0	1	0	0.076%	15.90 m	0.10 m*	13
1317	0.354%	7	10	0	0	7	0	0	6.692%	2.14 m	0.14 m	649
1404	0.014%	2	2	0	0	0	0	2	0.265%	7.90 m	0.10 m*	50
1372	0.004%	1	1	0	0	0	0	1	0.076%	15.90 m	0.10 m*	13
1403	0.014%	1	2	0	0	0	0	1	0.265%	15.80 m	0.20 m	13
1291	0.004%	1	1	0	0	0	1	0	0.076%	15.90 m	0.10 m*	13
1356	0.004%	1	1	0	0	0	0	1	0.076%	15.90 m	0.10 m*	13
1328	0.014%	1	2	0	0	0	0	1	0.265%	15.80 m	0.20 m	13
Totals	5.293	53	72	0	0	7	40	6				

Total points: 160
SOIL 28.06
ROCK 0.06

Stand/relevé number: 7

1293	0.694%	11	14	0	0	0	11	0	9.788%	1.33 m	0.13 m	1645
1317	1.562%	18	21	0	0	18	0	0	22.031%	0.77 m	0.12 m	4614
1428	4.340%	27	35	0	0	0	27	0	61.213%	0.46 m	0.13 m	11427
1291	0.032%	2	3	0	0	0	2	0	0.451%	7.85 m	0.15 m	51
1290	0.429%	9	11	0	0	0	9	0	6.051%	1.66 m	0.12 m	1080
1301	0.004%	1	1	0	0	0	0	1	0.056%	15.90 m	0.10 m*	13
1418	0.014%	2	2	0	0	0	0	2	0.197%	7.90 m	0.10 m*	50
1295	0.004%	1	1	0	0	0	1	0	0.056%	15.90 m	0.10 m*	13
1368	0.014%	2	2	0	0	0	0	2	0.197%	7.90 m	0.10 m*	50
1364	0.004%	1	1	0	0	0	0	1	0.056%	15.90 m	0.10 m*	13
Totals	7.097	74	91	0	0	18	50	6				

Total points: 160
SOIL 11.51
ROCK 0.91

Stand/relevé number: 8

1287	0.128%	3	6	0	0	0	3	0	2.984%	5.13 m	0.20 m	116
1295	2.041%	21	24	0	0	0	21	0	47.576%	0.65 m	0.11 m	6409
1290	0.032%	2	3	0	0	0	2	0	0.746%	7.85 m	0.15 m	51
1338	0.004%	1	1	0	0	0	0	1	0.093%	15.90 m	0.10 m*	13
1428	1.715%	18	22	0	0	0	18	0	39.977%	0.77 m	0.12 m	4645
1289	0.004%	1	1	0	0	0	1	0	0.093%	15.90 m	0.10 m*	13
1331	0.032%	3	3	0	0	0	0	3	0.746%	5.23 m	0.10 m	114
1346	0.089%	4	5	0	0	0	4	0	2.075%	3.88 m	0.13 m	205
1360	0.004%	1	1	0	0	0	0	1	0.093%	15.90 m	0.10 m*	13
1334	0.014%	2	2	0	0	0	0	2	0.326%	7.90 m	0.10 m*	50
1303	0.004%	1	1	0	0	0	0	1	0.093%	15.90 m	0.10 m*	13
1321	0.004%	1	1	0	0	0	1	0	0.093%	15.90 m	0.10 m*	13
1434	0.057%	4	4	0	0	0	0	4	1.329%	3.90 m	0.10 m*	204
1377	0.004%	1	1	0	0	0	0	1	0.093%	15.90 m	0.10 m*	13
1285	0.128%	4	6	0	0	0	4	0	2.984%	3.85 m	0.15 m	207
1432	0.004%	1	1	0	0	0	0	1	0.093%	15.90 m	0.10 m*	13
1317	0.032%	2	3	0	0	2	0	0	0.746%	7.85 m	0.15 m	51
1296	0.004%	1	1	0	0	0	1	0	0.093%	15.90 m	0.10 m*	13
Totals	4.294	71	86	0	0	2	55	14				

Total points: 160
SOIL 21.56
ROCK 0.91

Stand/relevé number: 9

1294	0.510%	8	12	0	0	0	8	0	11.972%	1.85 m	0.15 m	859
1392	0.014%	1	2	0	0	1	0	0	0.329%	15.80 m	0.20 m	13
1321	0.287%	5	9	0	0	0	5	0	6.737%	3.02 m	0.18 m	329
1290	0.089%	3	5	0	0	0	3	0	2.089%	5.17 m	0.17 m	115
1317	1.417%	13	20	0	0	13	0	0	33.263%	1.08 m	0.15 m	2391
1416	0.014%	2	2	0	0	0	0	2	0.329%	7.90 m	0.10 m*	50
1293	0.429%	7	11	0	0	0	7	0	10.070%	2.13 m	0.16 m	653
1375	0.014%	1	2	0	0	1	0	0	0.329%	15.80 m	0.20 m	13
1429	0.004%	1	1	0	0	0	0	1	0.094%	15.90 m	0.10 m*	13
1428	0.227%	5	8	0	0	0	5	0	5.329%	3.04 m	0.16 m	327
1289	0.057%	2	4	0	0	0	2	0	1.338%	7.80 m	0.20 m	51
1359	0.014%	1	2	0	0	0	0	1	0.329%	15.80 m	0.20 m	13
1309	0.004%	1	1	0	0	1	0	0	0.094%	15.90 m	0.10 m*	13
1291	1.148%	9	18	0	0	0	9	0	26.948%	1.58 m	0.20 m	1131
1338	0.004%	1	1	0	0	0	0	1	0.094%	15.90 m	0.10 m*	13
1377	0.014%	2	2	0	0	0	0	2	0.329%	7.90 m	0.10 m*	50
1364	0.014%	2	2	0	0	0	0	2	0.329%	7.90 m	0.10 m*	50
1389	0.004%	1	1	0	0	0	0	1	0.094%	15.90 m	0.10 m*	13
1304	0.004%	1	1	0	0	0	0	1	0.094%	15.90 m	0.10 m*	13
Totals	4.266	66	104	0	0	16	39	11				

Total points: 160
SOIL 11.92
ROCK 0.51

Stand/relevé number: 10

1295	3.189%	22	30	0	0	0	22	0	69.781%	0.59 m	0.14 m	7328
1328	0.354%	8	10	0	0	0	0	8	7.746%	1.88 m	0.13 m	848
1285	0.227%	5	8	0	0	0	5	0	4.967%	3.04 m	0.16 m	327
1296	0.089%	3	5	0	0	0	3	0	1.947%	5.17 m	0.17 m	115
1446	0.014%	1	2	0	0	0	0	1	0.306%	15.80 m	0.20 m	13
1321	0.032%	1	3	0	0	0	0	0	0.700%	15.70 m	0.30 m	13
1289	0.057%	3	4	0	0	0	3	0	1.247%	5.20 m	0.13 m	115
1317	0.089%	3	5	0	0	3	0	0	1.947%	5.17 m	0.17 m	115
1302	0.089%	4	5	0	0	0	0	4	1.947%	3.88 m	0.13 m	205
1303	0.014%	2	2	0	0	0	0	2	0.306%	7.90 m	0.10 m*	50
1284	0.128%	3	6	0	0	0	3	0	2.801%	5.13 m	0.20 m	116
1325	0.004%	1	1	0	0	0	0	1	0.088%	15.90 m	0.10 m*	13
1287	0.032%	1	3	0	0	0	1	0	0.700%	15.70 m	0.30 m	13
1364	0.004%	1	1	0	0	0	0	1	0.088%	15.90 m	0.10 m*	13
1331	0.032%	3	3	0	0	0	0	3	0.700%	5.23 m	0.10 m	114
1300	0.004%	1	1	0	0	0	1	0	0.088%	15.90 m	0.10 m*	13
1336	0.014%	1	2	0	0	0	0	1	0.306%	15.80 m	0.20 m	13
1458	0.004%	1	1	0	0	0	0	1	0.088%	15.90 m	0.10 m*	13
1292	0.004%	1	1	0	0	0	1	0	0.088%	15.90 m	0.10 m*	13
1291	0.174%	6	7	0	0	0	6	0	3.807%	2.55 m	0.12 m	468
1333	0.014%	1	2	0	0	0	0	1	0.306%	15.80 m	0.20 m	13
1353	0.014%	2	2	0	0	0	2	0	0.306%	7.90 m	0.10 m*	50
Totals	4.578	74	104	0	0	3	47	23				

Total points: 160
SOIL 16.38
ROCK 0.51

Stand/relevé number: 11

1346	10.717%	48	55	0	0	0	49	0	84.121%	0.22 m	0.11 m	41773
1443	0.032%	2	3	0	0	0	0	2	0.251%	7.85 m	0.15 m	51
1317	1.024%	10	17	0	0	10	0	0	8.038%	1.43 m	0.17 m	1387
1407	0.004%	1	1	0	0	0	1	0	0.031%	15.90 m	0.10 m*	13
1289	0.429%	9	11	0	0	0	9	0	3.367%	1.66 m	0.12 m	1080
1483	0.004%	1	1	0	0	0	1	0	0.031%	15.90 m	0.10 m*	13
1347	0.014%	2	2	0	0	0	2	0	0.110%	7.90 m	0.10 m*	50
1300	0.354%	8	10	0	0	0	8	0	2.779%	1.88 m	0.13 m	848
1296	0.004%	1	1	0	0	0	1	0	0.031%	15.90 m	0.10 m*	13
1333	0.014%	2	2	0	0	0	0	2	0.110%	7.90 m	0.10 m*	50
1331	0.014%	2	2	0	0	0	0	2	0.110%	7.90 m	0.10 m*	50
1441	0.128%	4	6	0	0	0	4	0	1.005%	3.85 m	0.15 m	207
1321	0.004%	1	1	0	0	0	1	0	0.031%	15.90 m	0.10 m*	13
Totals	12.741	91	112	0	0	10	76	6				

Total points: 160
SOIL 10.33
ROCK 0.51

Stand/relevé number: 12

1347	0.014%	2	2	0	0	0	2	0	0.175%	7.90 m	0.10 m*	50
1289	0.354%	9	10	0	0	0	9	0	4.436%	1.67 m	0.11 m	1073
1321	0.227%	8	8	0	0	0	8	0	2.845%	1.90 m	0.10 m*	837
1489	0.429%	10	11	0	0	0	0	10	5.376%	1.49 m	0.11 m	1334
1312	3.405%	16	31	0	0	0	0	16	42.669%	0.81 m	0.19 m	3903
1338	0.004%	1	1	0	0	0	0	1	0.050%	15.90 m	0.10 m*	13
1331	0.004%	1	1	0	0	0	0	1	0.050%	15.90 m	0.10 m*	13
1487	1.148%	17	18	0	0	0	17	0	14.386%	0.84 m	0.11 m	4035
1346	0.004%	1	1	0	0	0	1	0	0.050%	15.90 m	0.10 m*	13
1317	0.510%	6	12	0	0	6	0	0	6.391%	2.47 m	0.20 m	483
1441	1.562%	18	21	0	0	0	18	0	19.574%	0.77 m	0.12 m	4614
1367	0.032%	2	3	0	0	0	0	2	0.401%	7.85 m	0.15 m	51
1296	0.014%	2	2	0	0	0	2	0	0.175%	7.90 m	0.10 m*	50
1407	0.089%	4	5	0	0	0	4	0	1.115%	3.88 m	0.13 m	205
1488	0.004%	1	1	0	0	0	1	0	0.050%	15.90 m	0.10 m*	13
1330	0.128%	4	6	0	0	0	0	4	1.604%	3.85 m	0.15 m	207
1333	0.004%	1	1	0	0	0	0	1	0.050%	15.90 m	0.10 m*	13
1363	0.004%	1	1	0	0	0	0	1	0.050%	15.90 m	0.10 m*	13
1481	0.057%	4	4	0	0	0	0	4	0.714%	3.90 m	0.10 m*	204
Totals	7.989	108	139	0	0	6	62	40				

Total points: 160
SOIL 2.78
ROCK 0.51

Stand/relevé number: 13

1296	2.583%	25	27	0	0	0	25	0	42.907%	0.53 m	0.11 m	9269
1367	0.014%	2	2	0	0	0	0	2	0.233%	7.90 m	0.10 m*	50
1317	0.287%	3	9	0	0	3	0	0	4.767%	5.03 m	0.30 m	118
1312	0.057%	1	4	0	0	0	0	1	0.947%	15.60 m	0.40 m	13
1287	2.214%	20	25	0	0	0	20	0	36.777%	0.68 m	0.13 m	5852
1302	0.057%	4	4	0	0	0	0	4	0.947%	3.90 m	0.10 m*	204
1444	0.354%	5	10	0	0	0	0	5	5.880%	3.00 m	0.20 m	331
1330	0.014%	1	2	0	0	0	0	1	0.233%	15.80 m	0.20 m	13
1300	0.014%	1	2	0	0	0	1	0	0.233%	15.80 m	0.20 m	13
1356	0.004%	1	1	0	0	0	0	1	0.066%	15.90 m	0.10 m*	13
1447	0.032%	2	3	0	0	0	0	2	0.532%	7.85 m	0.15 m	51
1321	0.014%	2	2	0	0	0	2	0	0.233%	7.90 m	0.10 m*	50
1284	0.057%	2	4	0	0	0	2	0	0.947%	7.80 m	0.20 m	51
1295	0.227%	7	8	0	0	0	7	0	3.771%	2.17 m	0.11 m	641
1360	0.004%	1	1	0	0	0	0	2	0.066%	15.90 m	0.10 m*	13
1363	0.032%	3	3	0	0	0	0	3	0.532%	5.23 m	0.10 m	114
1457	0.004%	1	1	0	0	0	0	1	0.066%	15.90 m	0.10 m*	13
1346	0.057%	4	4	0	0	0	4	0	0.947%	3.90 m	0.10 m*	204
1323	0.004%	1	1	0	0	0	0	1	0.066%	15.90 m	0.10 m*	13
Totals	6.027	86	113	0	0	3	61	23				

Total points: 160
SOIL 9.95
ROCK 0.51

Stand/relevé number: 14

1287	0.089%	4	5	0	0	0	4	0	5.205%	3.88 m	0.13 m	205
1398	0.004%	1	1	0	0	0	0	1	0.234%	15.90 m	0.10 m*	13
1346	0.429%	7	11	0	0	0	7	0	25.088%	2.13 m	0.16 m	653
1295	0.797%	12	15	0	0	0	12	0	46.608%	1.21 m	0.13 m	1971
1302	0.174%	4	7	0	0	0	0	4	10.175%	3.83 m	0.17 m	208
1284	0.089%	4	5	0	0	0	4	0	5.205%	3.88 m	0.13 m	205
1391	0.004%	1	1	0	0	1	0	0	0.234%	15.90 m	0.10 m*	13
1377	0.004%	1	1	0	0	0	0	1	0.234%	15.90 m	0.10 m*	13
1331	0.032%	2	3	0	0	0	0	2	1.871%	7.85 m	0.15 m	51
1320	0.089%	5	5	0	0	0	5	0	5.205%	3.10 m	0.10 m*	321
1327	0.004%	1	1	0	0	0	0	1	0.234%	15.90 m	0.10 m*	13
1293	0.004%	1	1	0	0	0	1	0	0.234%	15.90 m	0.10 m*	13
1458	0.004%	1	1	0	0	0	0	1	0.234%	15.90 m	0.10 m*	13
Totals	1.718	44	57	0	0	1	33	10				

Total points: 160
SOIL 38.32
ROCK 0.51

Stand/relevé number: 15

1289	0.004%	1	1	0	0	0	1	0	0.430%	15.90 m	0.10 m*	13
1433	0.004%	1	1	0	0	0	0	1	0.430%	15.90 m	0.10 m*	13
1287	0.174%	4	7	0	0	0	4	0	18.710%	3.83 m	0.17 m	208
1344	0.004%	1	1	0	0	0	1	0	0.430%	15.90 m	0.10 m*	13
1295	0.227%	4	8	0	0	0	4	0	24.409%	3.80 m	0.20 m	209
1357	0.057%	4	4	0	0	0	4	0	6.129%	3.90 m	0.10 m*	204
1464	0.032%	3	3	0	0	0	0	3	3.441%	5.23 m	0.10 m	114
1331	0.429%	8	11	0	0	0	0	8	46.129%	1.86 m	0.14 m	853
1284	0.004%	1	1	0	0	0	1	0	0.430%	15.90 m	0.10 m*	13
1327	0.004%	1	1	0	0	0	0	1	0.430%	15.90 m	0.10 m*	13
Totals	0.935	28	38	0	0	0	15	13				

Total points: 160
SOIL 54.48
ROCK 0.51

Stand/relevé number: 16

1285	22.112%	40	79	0	0	0	40	0	95.146%	0.20 m	0.20 m	35075
1346	1.024%	11	17	0	0	0	11	0	4.406%	1.30 m	0.15 m	1678
1317	0.032%	2	3	0	0	2	0	0	0.138%	7.85 m	0.15 m	51
1402	0.057%	2	4	0	0	0	0	2	0.245%	7.80 m	0.20 m	51
1444	0.014%	1	2	0	0	0	0	1	0.060%	15.80 m	0.20 m	13
1408	0.004%	1	1	0	0	0	0	1	0.017%	15.90 m	0.10 m*	13
1473	0.004%	1	1	0	0	0	0	1	0.017%	15.90 m	0.10 m*	13
Totals	23.245	58	107	0	0	2	51	5				

Total points: 160
SOIL 12.33
ROCK 0.51

Stand/relevé number: 17

1294	0.089%	5	5	0	0	0	5	0	1.029%	3.10 m	0.10 m*	321
1285	0.057%	4	4	0	0	0	4	0	0.659%	3.90 m	0.10 m*	204
1295	7.826%	39	47	0	0	0	39	0	90.474%	0.29 m	0.12 m	25984
1290	0.004%	1	1	0	0	0	1	0	0.046%	15.90 m	0.10 m*	13
1324	0.004%	1	1	0	0	0	0	1	0.046%	15.90 m	0.10 m*	13
1291	0.287%	6	9	0	0	0	6	0	3.318%	2.52 m	0.15 m	474
1296	0.004%	1	1	0	0	0	1	0	0.046%	15.90 m	0.10 m*	13
1331	0.128%	4	6	0	0	0	0	4	1.480%	3.85 m	0.15 m	207
1303	0.014%	2	2	0	0	0	0	2	0.162%	7.90 m	0.10 m*	50
1338	0.004%	1	1	0	0	0	0	1	0.046%	15.90 m	0.10 m*	13
1312	0.089%	4	5	0	0	0	0	4	1.029%	3.88 m	0.13 m	205
1400	0.004%	1	1	0	0	0	1	0	0.046%	15.90 m	0.10 m*	13
1321	0.014%	1	2	0	0	0	1	0	0.162%	15.80 m	0.20 m	13
1426	0.128%	2	6	0	0	0	2	0	1.480%	7.70 m	0.30 m	52
1345	0.004%	1	1	0	0	0	0	1	0.046%	15.90 m	0.10 m*	13
1301	0.004%	1	1	0	0	0	0	1	0.046%	15.90 m	0.10 m*	13
Totals	8.655	74	93	0	0	0	60	14				

Total points: 160
SOIL 17.36
ROCK 0.51

Stand/relevé number: 18

1289	0.057%	4	4	0	0	0	4	0	3.353%	3.90 m	0.10 m*	204
1317	0.599%	7	13	0	0	7	0	0	35.235%	2.10 m	0.19 m	662
1426	0.032%	1	3	0	0	0	1	0	1.882%	15.70 m	0.30 m	13
1291	0.089%	5	5	0	0	0	5	0	5.235%	3.10 m	0.10 m*	321
1314	0.032%	3	3	0	0	0	0	3	1.882%	5.23 m	0.10 m	114
1346	0.004%	1	1	0	0	0	1	0	0.235%	15.90 m	0.10 m*	13
1312	0.004%	1	1	0	0	0	0	1	0.235%	15.90 m	0.10 m*	13
1359	0.128%	6	6	0	0	0	0	6	7.529%	2.57 m	0.10 m*	465
1379	0.128%	4	6	0	0	0	0	4	7.529%	3.85 m	0.15 m	207
1450	0.014%	1	2	0	0	0	0	1	0.824%	15.80 m	0.20 m	13
1294	0.004%	1	1	0	0	0	1	0	0.235%	15.90 m	0.10 m*	13
1351	0.089%	2	5	0	0	2	0	0	5.235%	7.75 m	0.25 m	51
1285	0.004%	1	1	0	0	0	1	0	0.235%	15.90 m	0.10 m*	13
1345	0.004%	1	1	0	0	0	0	1	0.235%	15.90 m	0.10 m*	13
1302	0.057%	2	4	0	0	0	0	2	3.353%	7.80 m	0.20 m	51
1358	0.032%	2	3	0	0	2	0	0	1.882%	7.85 m	0.15 m	51
1355	0.004%	1	1	0	0	1	0	0	0.235%	15.90 m	0.10 m*	13
1295	0.004%	1	1	0	0	0	1	0	0.235%	15.90 m	0.10 m*	13
1342	0.429%	1	11	1	0	0	0	0	25.235%	14.90 m	1.10 m	13
Totals	1.708	45	72	1	0	12	14	18				

Total points: 160
SOIL 34.72
ROCK 0.51

Stand/relevé number: 19

1287	0.174%	7	7	0	0	0	7	0	5.289%	2.19 m	0.10 m	637
1294	0.004%	1	1	0	0	0	1	0	0.122%	15.90 m	0.10 m*	13
1291	0.014%	2	2	0	0	0	2	0	0.426%	7.90 m	0.10 m*	50
1366	0.004%	1	1	0	0	1	0	0	0.122%	15.90 m	0.10 m*	13
1300	0.128%	6	6	0	0	0	6	0	3.891%	2.57 m	0.10 m*	465
1346	0.694%	13	14	0	0	0	13	0	21.094%	1.12 m	0.11 m	2298
1295	1.148%	16	18	0	0	0	16	0	34.894%	0.89 m	0.11 m	3574
1284	0.354%	7	10	0	0	0	7	0	10.760%	2.14 m	0.14 m	649
1341	0.354%	6	10	0	0	6	0	0	10.760%	2.50 m	0.17 m	477
1285	0.032%	2	3	0	0	0	2	0	0.973%	7.85 m	0.15 m	51
1312	0.004%	1	1	0	0	0	0	1	0.122%	15.90 m	0.10 m*	13
1410	0.004%	1	1	0	0	0	1	0	0.122%	15.90 m	0.10 m*	13
1342	0.287%	1	9	0	0	1	0	0	8.723%	15.10 m	0.90 m	13
1327	0.032%	2	3	0	0	0	0	2	0.973%	7.85 m	0.15 m	51
1330	0.004%	1	1	0	0	0	0	1	0.122%	15.90 m	0.10 m*	13
1338	0.004%	1	1	0	0	0	0	1	0.122%	15.90 m	0.10 m*	13
1331	0.004%	1	1	0	0	0	0	1	0.122%	15.90 m	0.10 m*	13
1320	0.004%	1	1	0	0	0	1	0	0.122%	15.90 m	0.10 m*	13
1293	0.014%	1	2	0	0	0	1	0	0.426%	15.80 m	0.20 m	13
1302	0.014%	2	2	0	0	0	0	2	0.426%	7.90 m	0.10 m*	50
1359	0.004%	1	1	0	0	0	0	1	0.122%	15.90 m	0.10 m*	13
1358	0.004%	1	1	0	0	1	0	0	0.122%	15.90 m	0.10 m*	13
1317	0.014%	1	2	0	0	1	0	0	0.426%	15.80 m	0.20 m	13
Totals	3.295	76	98	0	0	10	57	9				

Total points: 160
SOIL 14.97
ROCK 0.51

Stand/relevé number: 20

1294	0.014%	1	2	0	0	0	1	0	0.132%	15.80 m	0.20 m	13
1289	0.032%	2	3	0	0	0	2	0	0.301%	7.85 m	0.15 m	51
1300	0.014%	2	2	0	0	0	2	0	0.132%	7.90 m	0.10 m*	50
1298	0.004%	1	1	0	0	0	1	0	0.038%	15.90 m	0.10 m*	13
1426	0.004%	1	1	0	0	0	1	0	0.038%	15.90 m	0.10 m*	13
1360	0.004%	1	1	0	0	0	0	1	0.038%	15.90 m	0.10 m*	13
1295	6.859%	33	44	0	0	0	33	0	64.464%	0.35 m	0.13 m	18202
1291	0.057%	4	4	0	0	0	4	0	0.536%	3.90 m	0.10 m*	204
1328	0.004%	1	1	0	0	0	0	1	0.038%	15.90 m	0.10 m*	13
1350	3.405%	2	31	2	0	0	0	0	32.002%	6.45 m	1.55 m	61
1321	0.014%	1	2	0	0	0	1	0	0.132%	15.80 m	0.20 m	13
1317	0.032%	3	3	0	0	3	0	0	0.301%	5.23 m	0.10 m	114
1353	0.004%	1	1	0	0	0	1	0	0.038%	15.90 m	0.10 m*	13
1316	0.057%	1	4	0	1	0	0	0	0.536%	15.60 m	0.40 m	13
1331	0.128%	4	6	0	0	0	0	4	1.203%	3.85 m	0.15 m	207
1330	0.004%	1	1	0	0	0	0	1	0.038%	15.90 m	0.10 m*	13
1355	0.004%	1	1	0	0	0	0	1	0.038%	15.90 m	0.10 m*	13
1293	0.004%	1	1	0	0	0	1	0	0.038%	15.90 m	0.10 m*	13
Totals	10.640	61	109	2	1	3	47	8				

Total points: 160
SOIL 15.43
ROCK 0.51

Stand/relevé number: 21

1330	0.510%	3	12	0	0	0	0	3	16.776%	4.93 m	0.40 m	121
1295	1.279%	12	19	0	0	0	12	0	42.072%	1.18 m	0.16 m	2024
1327	0.227%	8	8	0	0	0	0	8	7.467%	1.90 m	0.10 m*	837
1303	0.089%	4	5	0	0	0	0	4	2.928%	3.88 m	0.13 m	205
1331	0.032%	2	3	0	0	0	0	2	1.053%	7.85 m	0.15 m	51
1294	0.089%	3	5	0	0	0	3	0	2.928%	5.17 m	0.17 m	115
1312	0.128%	4	6	0	0	0	0	4	4.211%	3.85 m	0.15 m	207
1413	0.014%	1	2	0	0	0	0	1	0.461%	15.80 m	0.20 m	13
1315	0.128%	2	6	0	0	0	0	2	4.211%	7.70 m	0.30 m	52
1289	0.089%	3	5	0	0	0	3	0	2.928%	5.17 m	0.17 m	115
1304	0.032%	3	3	0	0	0	0	3	1.053%	5.23 m	0.10 m	114
1353	0.032%	3	3	0	0	0	3	0	1.053%	5.23 m	0.10 m	114
1395	0.004%	1	1	0	0	0	0	1	0.132%	15.90 m	0.10 m*	13
1426	0.032%	2	3	0	0	0	2	0	1.053%	7.85 m	0.15 m	51
1293	0.287%	4	9	0	0	0	4	0	9.441%	3.78 m	0.22 m	211
1317	0.057%	2	4	0	0	2	0	0	1.875%	7.80 m	0.20 m	51
1321	0.004%	1	1	0	0	0	1	0	0.132%	15.90 m	0.10 m*	13
1338	0.004%	1	1	0	0	0	0	1	0.132%	15.90 m	0.10 m*	13
1512	0.004%	1	1	0	0	0	1	0	0.132%	15.90 m	0.10 m*	13
1302	0.004%	1	1	0	0	0	0	1	0.132%	15.90 m	0.10 m*	13
1300	0.004%	1	1	0	0	0	1	0	0.132%	15.90 m	0.10 m*	13
1428	0.004%	1	1	0	0	0	1	0	0.132%	15.90 m	0.10 m*	13
Totals	3.047	63	100	0	0	2	31	30				

Total points: 160
SOIL 16.38
ROCK 0.51

Stand/relevé number: 22

1330	0.174%	6	7	0	0	0	0	6	9.305%	2.55 m	0.12 m	468
1331	0.004%	1	1	0	0	0	0	1	0.214%	15.90 m	0.10 m*	13
1295	0.907%	16	16	0	0	0	16	0	48.503%	0.90 m	0.10 m*	3527
1300	0.014%	1	2	0	0	0	1	0	0.749%	15.80 m	0.20 m	13
1291	0.227%	8	8	0	0	0	8	0	12.139%	1.90 m	0.10 m*	837
1313	0.057%	2	4	0	0	0	0	2	3.048%	7.80 m	0.20 m	51
1338	0.004%	1	1	0	0	0	0	1	0.214%	15.90 m	0.10 m*	13
1302	0.032%	1	3	0	0	0	0	1	1.711%	15.70 m	0.30 m	13
1294	0.004%	1	1	0	0	0	1	0	0.214%	15.90 m	0.10 m*	13
1323	0.089%	3	5	0	0	0	0	3	4.759%	5.17 m	0.17 m	115
1335	0.004%	1	1	0	0	0	0	1	0.214%	15.90 m	0.10 m*	13
1293	0.227%	5	8	0	0	0	5	0	12.139%	3.04 m	0.16 m	327
1518	0.004%	1	1	0	0	0	0	1	0.214%	15.90 m	0.10 m*	13
1312	0.004%	1	1	0	0	0	0	1	0.214%	15.90 m	0.10 m*	13
1292	0.004%	1	1	0	0	0	1	0	0.214%	15.90 m	0.10 m*	13
1289	0.004%	1	1	0	0	0	1	0	0.214%	15.90 m	0.10 m*	13
1413	0.004%	1	1	0	0	0	0	1	0.214%	15.90 m	0.10 m*	13
1297	0.004%	1	1	0	0	0	1	0	0.214%	15.90 m	0.10 m*	13
1290	0.057%	3	4	0	0	0	3	0	3.048%	5.20 m	0.13 m	115
1287	0.004%	1	1	0	0	0	1	0	0.214%	15.90 m	0.10 m*	13
1306	0.032%	2	3	0	0	0	0	2	1.711%	7.85 m	0.15 m	51
1359	0.004%	1	1	0	0	0	0	1	0.214%	15.90 m	0.10 m*	13
1428	0.014%	1	2	0	0	0	1	0	0.749%	15.80 m	0.20 m	13
Totals	1.871	60	74	0	0	0	39	21				

Total points: 160
SOIL 28.70
ROCK 0.01

Stand/relevé number: 23

1291	0.128%	4	6	0	0	0	4	0	1.226%	3.85 m	0.15 m	207
1295	8.507%	45	49	0	0	0	46	0	81.485%	0.25 m	0.11 m	35107
1289	0.014%	2	2	0	0	0	2	0	0.134%	7.90 m	0.10 m*	50
1321	0.057%	4	4	0	0	0	4	0	0.546%	3.90 m	0.10 m*	204
1384	0.004%	1	1	0	0	0	0	1	0.038%	15.90 m	0.10 m*	13
1350	1.024%	1	17	0	1	0	0	0	9.808%	14.30 m	1.70 m	14
1287	0.004%	1	1	0	0	0	1	0	0.038%	15.90 m	0.10 m*	13
1317	0.014%	1	2	0	0	1	0	0	0.134%	15.80 m	0.20 m	13
1288	0.032%	3	3	0	0	0	3	0	0.307%	5.23 m	0.10 m	114
1392	0.004%	1	1	0	0	1	0	0	0.038%	15.90 m	0.10 m*	13
1285	0.004%	1	1	0	0	0	1	0	0.038%	15.90 m	0.10 m*	13
1377	0.004%	1	1	0	0	0	0	1	0.038%	15.90 m	0.10 m*	13
1292	0.004%	1	1	0	0	0	1	0	0.038%	15.90 m	0.10 m*	13
1338	0.004%	1	1	0	0	0	0	1	0.038%	15.90 m	0.10 m*	13
1301	0.004%	1	1	0	0	0	0	1	0.038%	15.90 m	0.10 m*	13
1428	0.004%	1	1	0	0	0	1	0	0.038%	15.90 m	0.10 m*	13
1293	0.032%	3	3	0	0	0	3	0	0.307%	5.23 m	0.10 m	114
1297	0.599%	10	13	0	0	0	10	0	5.738%	1.47 m	0.13 m	1351
1344	0.004%	1	1	0	0	0	1	0	0.038%	15.90 m	0.10 m*	13
Totals	10.441	83	109	0	1	2	77	4				

Total points: 160
SOIL 14.97
ROCK 0.00

Stand/relevé number: 24

1291	0.128%	6	6	0	0	0	6	0	1.893%	2.57 m	0.10 m*	465
1289	0.599%	12	13	0	0	0	12	0	8.861%	1.23 m	0.11 m	1945
1317	0.128%	3	6	0	0	3	0	0	1.893%	5.13 m	0.20 m	116
1287	4.096%	26	34	0	0	0	26	0	60.592%	0.48 m	0.13 m	10523
1293	0.128%	6	6	0	0	0	6	0	1.893%	2.57 m	0.10 m*	465
1295	1.279%	18	19	0	0	0	18	0	18.920%	0.78 m	0.11 m	4553
1300	0.287%	9	9	0	0	0	9	0	4.246%	1.68 m	0.10 m	1066
1439	0.014%	1	2	0	0	0	0	1	0.207%	15.80 m	0.20 m	13
1303	0.014%	2	2	0	0	0	0	2	0.207%	7.90 m	0.10 m*	50
1330	0.004%	1	1	0	0	0	0	1	0.059%	15.90 m	0.10 m*	13
1314	0.004%	1	1	0	0	0	0	1	0.059%	15.90 m	0.10 m*	13
1426	0.032%	2	3	0	0	0	2	0	0.473%	7.85 m	0.15 m	51
1407	0.014%	1	2	0	0	0	1	0	0.207%	15.80 m	0.20 m	13
1294	0.004%	1	1	0	0	0	1	0	0.059%	15.90 m	0.10 m*	13
1321	0.032%	2	3	0	0	0	2	0	0.473%	7.85 m	0.15 m	51
Totals	6.760	91	108	0	0	3	83	5				

Total points: 160
SOIL 12.33
ROCK 0.00

Stand/relevé number: 25

1367	0.004%	1	1	0	0	0	0	1	0.055%	15.90 m	0.10 m*	13
1330	0.227%	5	8	0	0	0	0	5	3.114%	3.04 m	0.16 m	327
1461	0.004%	1	1	0	0	0	0	1	0.055%	15.90 m	0.10 m*	13
1320	0.174%	7	7	0	0	0	7	0	2.387%	2.19 m	0.10 m	637
1293	5.389%	23	39	0	0	0	23	0	73.923%	0.53 m	0.17 m	8530
1360	0.032%	2	3	0	0	0	0	2	0.439%	7.85 m	0.15 m	51
1317	0.057%	2	4	0	0	2	0	0	0.782%	7.80 m	0.20 m	51
1348	0.004%	1	1	0	0	0	0	1	0.055%	15.90 m	0.10 m*	13
1323	0.694%	5	14	0	0	0	0	5	9.520%	2.92 m	0.28 m	340
1312	0.227%	6	8	0	0	0	0	6	3.114%	2.53 m	0.13 m	471
1321	0.227%	6	8	0	0	0	6	0	3.114%	2.53 m	0.13 m	471
1432	0.014%	1	2	0	0	0	0	1	0.192%	15.80 m	0.20 m	13
1514	0.089%	3	5	0	0	0	0	3	1.221%	5.17 m	0.17 m	115
1324	0.014%	1	2	0	0	0	0	1	0.192%	15.80 m	0.20 m	13
1302	0.032%	3	3	0	0	0	0	3	0.439%	5.23 m	0.10 m	114
1303	0.032%	2	3	0	0	0	0	2	0.439%	7.85 m	0.15 m	51
1413	0.014%	2	2	0	0	0	0	2	0.192%	7.90 m	0.10 m*	50
1284	0.004%	1	1	0	0	0	1	0	0.055%	15.90 m	0.10 m*	13
1331	0.004%	1	1	0	0	0	0	1	0.055%	15.90 m	0.10 m*	13
1295	0.032%	1	3	0	0	0	1	0	0.439%	15.70 m	0.30 m	13
1379	0.014%	1	2	0	0	0	0	1	0.192%	15.80 m	0.20 m	13
1285	0.004%	1	1	0	0	0	1	0	0.055%	15.90 m	0.10 m*	13
1289	0.004%	1	1	0	0	0	1	0	0.055%	15.90 m	0.10 m*	13
1287	0.004%	1	1	0	0	0	1	0	0.055%	15.90 m	0.10 m*	13
1300	0.004%	1	1	0	0	0	1	0	0.055%	15.90 m	0.10 m*	13
Totals	7.299	79	122	0	0	2	42	35				

Total points: 160
SOIL 11.92
ROCK 0.00

Stand/relevé number: 26

1295	1.279%	18	19	0	0	0	18	0	59.213%	0.78 m	0.11 m	4553
1317	0.174%	3	7	0	0	3	0	0	8.056%	5.10 m	0.23 m	117
1341	0.057%	3	4	0	0	3	0	0	2.639%	5.20 m	0.13 m	115
1302	0.429%	7	11	0	0	0	0	7	19.861%	2.13 m	0.16 m	653
1288	0.014%	2	2	0	0	0	2	0	0.648%	7.90 m	0.10 m*	50
1391	0.014%	2	2	0	0	2	0	0	0.648%	7.90 m	0.10 m*	50
1371	0.014%	2	2	0	0	0	0	2	0.648%	7.90 m	0.10 m*	50
1356	0.014%	1	2	0	0	0	0	1	0.648%	15.80 m	0.20 m	13
1453	0.004%	1	1	0	0	0	0	1	0.185%	15.90 m	0.10 m*	13
1293	0.014%	1	2	0	0	0	1	0	0.648%	15.80 m	0.20 m	13
1383	0.004%	1	1	0	0	0	0	1	0.185%	15.90 m	0.10 m*	13
1289	0.004%	1	1	0	0	0	1	0	0.185%	15.90 m	0.10 m*	13
1291	0.128%	5	6	0	0	0	5	0	5.926%	3.08 m	0.12 m	323
1287	0.014%	2	2	0	0	0	2	0	0.648%	7.90 m	0.10 m*	50
Totals	2.161	49	62	0	0	8	29	12				

Total points: 160
SOIL 22.11
ROCK 1.56

Stand/relevé number: 27

1317	0.797%	7	15	0	0	7	0	0	20.228%	2.07 m	0.21 m	671
1295	2.395%	22	26	0	0	0	22	0	60.787%	0.61 m	0.12 m	7130
1293	0.174%	4	7	0	0	0	4	0	4.416%	3.83 m	0.17 m	208
1284	0.014%	2	2	0	0	0	2	0	0.355%	7.90 m	0.10 m*	50
1288	0.004%	1	1	0	0	0	1	0	0.102%	15.90 m	0.10 m*	13
1323	0.057%	3	4	0	0	0	0	3	1.447%	5.20 m	0.13 m	115
1291	0.429%	9	11	0	0	0	9	0	10.888%	1.66 m	0.12 m	1080
1360	0.004%	1	1	0	0	0	0	1	0.102%	15.90 m	0.10 m*	13
1285	0.032%	2	3	0	0	0	2	0	0.812%	7.85 m	0.15 m	51
1302	0.014%	2	2	0	0	0	0	2	0.355%	7.90 m	0.10 m*	50
1341	0.004%	1	1	0	0	1	0	0	0.102%	15.90 m	0.10 m*	13
1287	0.014%	2	2	0	0	0	2	0	0.355%	7.90 m	0.10 m*	50
1301	0.004%	1	1	0	0	0	0	1	0.102%	15.90 m	0.10 m*	13
1290	0.004%	1	1	0	0	0	1	0	0.102%	15.90 m	0.10 m*	13
Totals	3.943	58	77	0	0	8	43	7				

Total points: 160
SOIL 24.41
ROCK 0.03

Stand/relevé number: 28

1320	0.057%	4	4	0	0	0	4	0	1.508%	3.90 m	0.10 m*	204
1359	0.004%	1	1	0	0	0	0	1	0.106%	15.90 m	0.10 m*	13
1288	0.004%	1	1	0	0	0	1	0	0.106%	15.90 m	0.10 m*	13
1346	0.510%	10	12	0	0	0	10	0	13.492%	1.48 m	0.12 m	1342
1370	0.014%	1	2	0	0	1	0	0	0.370%	15.80 m	0.20 m	13
1296	0.174%	7	7	0	0	0	7	0	4.603%	2.19 m	0.10 m	637
1287	0.014%	2	2	0	0	0	2	0	0.370%	7.90 m	0.10 m*	50
1317	0.057%	3	4	0	0	3	0	0	1.508%	5.20 m	0.13 m	115
1300	0.057%	2	4	0	0	0	2	0	1.508%	7.80 m	0.20 m	51
1458	0.004%	1	1	0	0	0	0	1	0.106%	15.90 m	0.10 m*	13
1350	2.583%	2	27	1	0	1	0	0	68.333%	6.65 m	1.35 m	59
1295	0.227%	6	8	0	0	0	6	0	6.005%	2.53 m	0.13 m	471
1293	0.032%	2	3	0	0	0	2	0	0.847%	7.85 m	0.15 m	51
1330	0.032%	1	3	0	0	0	0	1	0.847%	15.70 m	0.30 m	13
1284	0.004%	1	1	0	0	0	1	0	0.106%	15.90 m	0.10 m*	13
1459	0.004%	1	1	0	0	0	0	1	0.106%	15.90 m	0.10 m*	13
1379	0.004%	1	1	0	0	0	0	1	0.106%	15.90 m	0.10 m*	13
1285	0.004%	1	1	0	0	0	1	0	0.106%	15.90 m	0.10 m*	13
Totals	3.780	47	83	1	0	5	36	5				

Total points: 160
SOIL 24.41
ROCK 0.01

Stand/relevé number: 29

1303	0.014%	1	2	0	0	0	0	1	0.227%	15.80 m	0.20 m	13
1293	1.148%	14	18	0	0	0	14	0	18.606%	1.01 m	0.13 m	2736
1327	0.032%	3	3	0	0	0	0	3	0.519%	5.23 m	0.10 m	114
1330	2.041%	16	24	0	0	0	0	16	33.079%	0.85 m	0.15 m	3720
1346	0.354%	9	10	0	0	0	9	0	5.737%	1.67 m	0.11 m	1073
1338	0.032%	2	3	0	0	0	0	2	0.519%	7.85 m	0.15 m	51
1289	0.014%	2	2	0	0	0	2	0	0.227%	7.90 m	0.10 m*	50
1296	0.014%	2	2	0	0	0	2	0	0.227%	7.90 m	0.10 m*	50
1285	0.014%	2	2	0	0	0	2	0	0.227%	7.90 m	0.10 m*	50
1379	0.014%	2	2	0	0	0	0	2	0.227%	7.90 m	0.10 m*	50
1321	0.004%	1	1	0	0	0	1	0	0.065%	15.90 m	0.10 m*	13
1300	0.057%	3	4	0	0	0	3	0	0.924%	5.20 m	0.13 m	115
1320	0.032%	3	3	0	0	0	3	0	0.519%	5.23 m	0.10 m	114
1370	2.214%	2	25	1	0	1	0	0	35.883%	6.75 m	1.25 m	59
1317	0.174%	4	7	0	0	4	0	0	2.820%	3.83 m	0.17 m	208
1351	0.004%	1	1	0	0	1	0	0	0.065%	15.90 m	0.10 m*	13
1299	0.014%	1	2	0	0	0	1	0	0.227%	15.80 m	0.20 m	13
Totals	6.175	68	111	1	0	6	37	24				

Total points: 160
SOIL 13.18
ROCK 0.01

Stand/relevé number: 30

1317	1.279%	10	19	0	0	10	0	0	35.528%	1.41 m	0.19 m	1405
1446	0.032%	2	3	0	0	0	0	2	0.889%	7.85 m	0.15 m	51
1300	0.057%	3	4	0	0	0	3	0	1.583%	5.20 m	0.13 m	115
1324	0.004%	1	1	0	0	0	0	1	0.111%	15.90 m	0.10 m*	13
1330	1.417%	12	20	0	0	0	0	12	39.361%	1.17 m	0.17 m	2037
1285	0.089%	3	5	0	0	0	3	0	2.472%	5.17 m	0.17 m	115
1299	0.227%	4	8	0	0	0	4	0	6.306%	3.80 m	0.20 m	209
1482	0.032%	1	3	0	0	0	1	0	0.889%	15.70 m	0.30 m	13
1554	0.429%	7	11	0	0	0	7	0	11.917%	2.13 m	0.16 m	653
1327	0.014%	2	2	0	0	0	0	2	0.389%	7.90 m	0.10 m*	50
1303	0.004%	1	1	0	0	0	0	1	0.111%	15.90 m	0.10 m*	13
1350	0.004%	1	1	0	0	1	0	0	0.111%	15.90 m	0.10 m*	13
1295	0.014%	2	2	0	0	0	2	0	0.389%	7.90 m	0.10 m*	50
Totals	3.600	49	80	0	0	11	20	18				

Total points: 160
SOIL 23.82
ROCK 0.01

Stand/relevé number: 31

1327	0.014%	2	2	0	0	0	0	2	0.201%	7.90 m	0.10 m*	50
1289	4.850%	29	37	0	0	0	29	0	69.584%	0.42 m	0.13 m	13370
1317	0.174%	4	7	0	0	4	0	0	2.496%	3.83 m	0.17 m	208
1345	0.287%	8	9	0	0	0	0	8	4.118%	1.89 m	0.11 m	842
1330	0.287%	7	9	0	0	0	0	6	4.118%	2.16 m	0.13 m	645
1303	0.354%	9	10	0	0	0	0	9	5.079%	1.67 m	0.11 m	1073
1288	0.004%	1	1	0	0	0	1	0	0.057%	15.90 m	0.10 m*	13
1356	0.004%	1	1	0	0	0	0	1	0.057%	15.90 m	0.10 m*	13
1300	0.032%	2	3	0	0	0	2	0	0.459%	7.85 m	0.15 m	51
1293	0.089%	3	5	0	0	0	3	0	1.277%	5.17 m	0.17 m	115
1346	0.004%	1	1	0	0	0	1	0	0.057%	15.90 m	0.10 m*	13
1295	0.797%	12	15	0	0	0	12	0	11.435%	1.21 m	0.13 m	1971
1312	0.004%	1	1	0	0	0	0	1	0.057%	15.90 m	0.10 m*	13
1301	0.004%	1	1	0	0	0	0	1	0.057%	15.90 m	0.10 m*	13
1285	0.032%	2	3	0	0	0	2	0	0.459%	7.85 m	0.15 m	51
1369	0.004%	1	1	0	0	0	0	1	0.057%	15.90 m	0.10 m*	13
1296	0.032%	3	3	0	0	0	3	0	0.459%	5.23 m	0.10 m	114
1379	0.004%	1	1	0	0	0	0	1	0.057%	15.90 m	0.10 m*	13
1347	0.004%	1	1	0	0	0	1	0	0.057%	15.90 m	0.10 m*	13

Totals 6.976 89 111 | 0 0 4 54 30 |
Total points: 160
SOIL 16.38
ROCK 0.01

Stand/relevé number: 32

1330	0.089%	3	5	0	0	0	0	3	1.735%	5.17 m	0.17 m	115
1289	0.032%	3	3	0	0	0	3	0	0.624%	5.23 m	0.10 m	114
1321	0.032%	2	3	0	0	0	2	0	0.624%	7.85 m	0.15 m	51
1317	0.089%	3	5	0	0	3	0	0	1.735%	5.17 m	0.17 m	115
1685	0.287%	1	9	0	1	0	0	0	5.595%	15.10 m	0.90 m	13
1316	0.014%	1	2	0	0	1	0	0	0.273%	15.80 m	0.20 m	13
1295	2.980%	19	29	0	0	0	19	0	58.090%	0.69 m	0.15 m	5428
1471	0.032%	3	3	0	0	0	0	3	0.624%	5.23 m	0.10 m	114
1300	0.032%	3	3	0	0	0	3	0	0.624%	5.23 m	0.10 m	114
1533	0.014%	1	2	0	0	1	0	0	0.273%	15.80 m	0.20 m	13
1315	0.004%	1	1	0	0	0	0	1	0.078%	15.90 m	0.10 m*	13
1331	0.032%	3	3	0	0	0	0	3	0.624%	5.23 m	0.10 m	114
1285	0.174%	5	7	0	0	0	5	0	3.392%	3.06 m	0.14 m	325
1557	0.004%	1	1	0	0	0	0	1	0.078%	15.90 m	0.10 m*	13
1285	0.057%	4	4	0	0	0	4	0	1.111%	3.90 m	0.10 m*	204
1293	0.227%	5	8	0	0	0	5	0	4.425%	3.04 m	0.16 m	327
1346	0.287%	8	9	0	0	0	8	0	5.595%	1.89 m	0.11 m	842
1303	0.032%	3	3	0	0	0	0	3	0.624%	5.23 m	0.10 m	114
1287	0.174%	4	7	0	0	0	4	0	3.392%	3.83 m	0.17 m	208
1366	0.004%	1	1	0	0	1	0	0	0.078%	15.90 m	0.10 m*	13
1333	0.089%	1	5	0	0	0	0	1	1.735%	15.50 m	0.50 m	13
1461	0.429%	8	11	0	0	0	0	8	8.363%	1.86 m	0.14 m	853
1359	0.004%	1	1	0	0	0	0	1	0.078%	15.90 m	0.10 m*	13
1296	0.014%	2	2	0	0	0	2	0	0.273%	7.90 m	0.10 m*	50
1416	0.004%	1	1	0	0	0	0	1	0.078%	15.90 m	0.10 m*	13
1338	0.004%	1	1	0	0	0	0	1	0.078%	15.90 m	0.10 m*	13

Totals 5.134 88 129 | 0 1 6 55 26 |
Total points: 160
SOIL 12.75
ROCK 0.01

Stand/relevé number: 33

1352	0.004%	1	1	0	0	0	1	0	0.203%	15.90 m	0.10 m*	13
1297	0.004%	1	1	0	0	0	1	0	0.203%	15.90 m	0.10 m*	13
1293	0.907%	9	16	0	0	0	9	0	46.041%	1.60 m	0.18 m	1116
1289	0.057%	4	4	0	0	0	4	0	2.893%	3.90 m	0.10 m*	204
1300	0.004%	1	1	0	0	0	1	0	0.203%	15.90 m	0.10 m*	13
1317	0.227%	4	8	0	0	4	0	0	11.523%	3.80 m	0.20 m	209
1290	0.014%	2	2	0	0	0	2	0	0.711%	7.90 m	0.10 m*	50
1432	0.004%	1	1	0	0	0	0	1	0.203%	15.90 m	0.10 m*	13
1295	0.287%	8	9	0	0	0	8	0	14.569%	1.89 m	0.11 m	842
1321	0.089%	5	5	0	0	0	5	0	4.518%	3.10 m	0.10 m*	321
1291	0.014%	1	2	0	0	0	1	0	0.711%	15.80 m	0.20 m	13
1283	0.004%	1	1	0	0	0	1	0	0.203%	15.90 m	0.10 m*	13
1330	0.004%	1	1	0	0	0	0	1	0.203%	15.90 m	0.10 m*	13
1312	0.004%	1	1	0	0	0	0	1	0.203%	15.90 m	0.10 m*	13
1520	0.287%	2	9	0	1	1	0	0	14.569%	7.55 m	0.45 m	53
1285	0.014%	1	2	0	0	0	1	0	0.711%	15.80 m	0.20 m	13
1287	0.004%	1	1	0	0	0	1	0	0.203%	15.90 m	0.10 m*	13
1346	0.032%	1	3	0	0	0	1	0	1.624%	15.70 m	0.30 m	13
1550	0.014%	1	2	0	0	1	0	0	0.711%	15.80 m	0.20 m	13

Totals 1.970 46 70 | 0 1 6 36 3 |
Total points: 160
SOIL 28.06
ROCK 0.13

Stand/relevé number: 34

1296	7.497%	29	46	0	0	0	29	0	79.755%	0.39 m	0.16 m	14263
1563	0.004%	1	1	0	0	0	0	1	0.043%	15.90 m	0.10 m*	13
1462	0.128%	4	6	0	0	4	0	0	1.362%	3.85 m	0.15 m	207
1363	0.287%	5	9	0	0	0	0	5	3.053%	3.02 m	0.18 m	329
1300	0.032%	2	3	0	0	0	2	0	0.340%	7.85 m	0.15 m	51
1356	0.014%	1	2	0	0	0	0	1	0.149%	15.80 m	0.20 m	13
1350	0.227%	3	8	0	0	3	0	0	2.415%	5.07 m	0.27 m	118
1367	0.014%	1	2	0	0	0	0	1	0.149%	15.80 m	0.20 m	13
1345	0.004%	1	1	0	0	0	0	1	0.043%	15.90 m	0.10 m*	13
1317	1.148%	8	18	0	0	8	0	0	12.213%	1.77 m	0.22 m	893
1447	0.004%	1	1	0	0	0	0	1	0.043%	15.90 m	0.10 m*	13
1285	0.014%	1	2	0	0	0	1	0	0.149%	15.80 m	0.20 m	13
1337	0.004%	1	1	0	0	0	0	1	0.043%	15.90 m	0.10 m*	13
1295	0.014%	1	2	0	0	0	1	0	0.149%	15.80 m	0.20 m	13
1285	0.014%	1	2	0	0	0	1	0	0.149%	15.80 m	0.20 m	13
1359	0.004%	1	1	0	0	0	0	1	0.043%	15.90 m	0.10 m*	13

Totals 9.407 61 105 | 0 0 15 34 12 |
Total points: 160
SOIL 14.97
ROCK 0.13

Stand/relevé number: 35

1372	1.148%	10	18	0	0	0	0	10	56.000%	1.42 m	0.18 m	1396
1294	0.004%	1	1	0	0	0	1	0	0.195%	15.90 m	0.10 m*	13
1527	0.032%	3	3	0	0	0	3	0	1.561%	5.23 m	0.10 m	114
1418	0.089%	5	5	0	0	0	0	5	4.341%	3.10 m	0.10 m*	321
1321	0.004%	1	1	0	0	0	1	0	0.195%	15.90 m	0.10 m*	13
1309	0.014%	2	2	0	0	2	0	0	0.683%	7.90 m	0.10 m*	50
1300	0.014%	1	2	0	0	0	1	0	0.683%	15.80 m	0.20 m	13
1423	0.004%	1	1	0	0	0	0	1	0.195%	15.90 m	0.10 m*	13
1291	0.354%	7	10	0	0	0	7	0	17.268%	2.14 m	0.14 m	649
1289	0.004%	1	1	0	0	0	1	0	0.195%	15.90 m	0.10 m*	13
1317	0.128%	3	6	0	0	3	0	0	6.244%	5.13 m	0.20 m	116
1330	0.004%	1	1	0	0	0	0	1	0.195%	15.90 m	0.10 m*	13
1295	0.032%	1	3	0	0	0	1	0	1.561%	15.70 m	0.30 m	13
1486	0.057%	1	4	0	0	1	0	0	2.780%	15.60 m	0.40 m	13
1426	0.032%	1	3	0	0	0	1	0	1.561%	15.70 m	0.30 m	13
1329	0.004%	1	1	0	0	0	0	1	0.195%	15.90 m	0.10 m*	13
1318	0.004%	1	1	0	0	1	0	0	0.195%	15.90 m	0.10 m*	13
1342	0.128%	1	6	0	0	1	0	0	6.244%	15.40 m	0.60 m	13
Totals	2.051	42	69	0	0	8	16	18				

Total points: 160
SOIL 9.22
ROCK 8.16

Stand/relevé number: 36

1287	9.215%	34	51	0	0	0	32	0	57.379%	0.32 m	0.15 m	20341
1317	1.279%	12	19	0	0	12	0	0	7.964%	1.18 m	0.16 m	2024
1289	0.032%	2	3	0	0	0	2	0	0.199%	7.85 m	0.15 m	51
1300	0.057%	3	4	0	0	0	3	0	0.355%	5.20 m	0.13 m	115
1407	0.057%	3	4	0	0	0	3	0	0.355%	5.20 m	0.13 m	115
1523	0.004%	1	1	0	0	0	0	1	0.025%	15.90 m	0.10 m*	13
1309	0.004%	1	1	0	0	1	0	0	0.025%	15.90 m	0.10 m*	13
1577	4.850%	1	37	1	0	0	0	0	30.199%	12.30 m	3.70 m	16
1685	0.089%	1	5	0	1	0	0	0	0.554%	15.50 m	0.50 m	13
1550	0.004%	1	1	0	0	1	0	0	0.025%	15.90 m	0.10 m*	13
1363	0.004%	1	1	0	0	0	0	1	0.025%	15.90 m	0.10 m*	13
1362	0.032%	2	3	0	0	0	2	0	0.199%	7.85 m	0.15 m	51
1519	0.004%	1	1	0	1	0	0	0	0.025%	15.90 m	0.10 m*	13
1369	0.004%	1	1	0	0	0	0	1	0.025%	15.90 m	0.10 m*	13
1316	0.429%	1	11	0	1	0	0	0	2.671%	14.90 m	1.10 m	13
Totals	16.060	65	143	1	3	14	42	3				

Total points: 160
SOIL 15.90
ROCK 8.16

Stand/relevé number: 37

1346	2.980%	25	29	0	0	0	25	0	37.722%	0.52 m	0.12 m	9397
1330	0.174%	5	7	0	0	0	0	5	2.203%	3.06 m	0.14 m	325
1300	1.417%	20	20	0	0	0	20	0	17.937%	0.70 m	0.10 m*	5659
1287	2.395%	16	26	0	0	0	16	0	30.316%	0.84 m	0.16 m	3771
1331	0.128%	5	6	0	0	0	0	5	1.620%	3.08 m	0.12 m	323
1289	0.510%	11	12	0	0	0	11	0	6.456%	1.35 m	0.11 m	1624
1321	0.057%	3	4	0	0	0	3	0	0.722%	5.20 m	0.13 m	115
1303	0.057%	4	4	0	0	0	0	4	0.722%	3.90 m	0.10 m*	204
1296	0.089%	4	5	0	0	0	4	0	1.127%	3.88 m	0.13 m	205
1364	0.014%	2	2	0	0	0	0	2	0.177%	7.90 m	0.10 m*	50
1312	0.004%	1	1	0	0	0	0	1	0.051%	15.90 m	0.10 m*	13
1347	0.032%	3	3	0	0	0	3	0	0.405%	5.23 m	0.10 m	114
1435	0.004%	1	1	0	0	0	0	1	0.051%	15.90 m	0.10 m*	13
1293	0.032%	3	3	0	0	0	3	0	0.405%	5.23 m	0.10 m	114
1338	0.004%	1	1	0	0	0	0	1	0.051%	15.90 m	0.10 m*	13
1389	0.004%	1	1	0	0	1	0	0	0.051%	15.90 m	0.10 m*	13
1327	0.004%	1	1	0	0	0	0	1	0.051%	15.90 m	0.10 m*	13
Totals	7.901	106	126	0	0	1	85	20				

Total points: 160
SOIL 8.16
ROCK 8.16

Stand/relevé number: 38

1346	6.859%	31	44	0	0	0	31	0	77.590%	0.37 m	0.14 m	16063
1435	0.004%	1	1	0	0	0	0	1	0.045%	15.90 m	0.10 m*	13
1330	0.227%	5	8	0	0	0	0	5	2.568%	3.04 m	0.16 m	327
1287	0.227%	6	8	0	0	0	6	0	2.568%	2.53 m	0.13 m	471
1303	0.429%	8	11	0	0	0	0	8	4.853%	1.86 m	0.14 m	853
1320	0.004%	1	1	0	0	0	1	0	0.045%	15.90 m	0.10 m*	13
1297	0.004%	1	1	0	0	0	1	0	0.045%	15.90 m	0.10 m*	13
1391	0.004%	1	1	0	0	1	0	0	0.045%	15.90 m	0.10 m*	13
1300	0.014%	1	2	0	0	0	1	0	0.158%	15.80 m	0.20 m	13
1296	0.057%	3	4	0	0	0	3	0	0.645%	5.20 m	0.13 m	115
1284	0.510%	10	12	0	0	0	10	0	5.769%	1.48 m	0.12 m	1342
1302	0.227%	4	8	0	0	0	0	4	2.568%	3.80 m	0.20 m	209
1356	0.004%	1	1	0	0	0	0	1	0.045%	15.90 m	0.10 m*	13
1581	0.004%	1	1	0	0	0	0	1	0.045%	15.90 m	0.10 m*	13
1321	0.128%	3	6	0	0	0	3	0	1.448%	5.13 m	0.20 m	116
1293	0.128%	5	6	0	0	0	5	0	1.448%	3.08 m	0.12 m	323
1336	0.004%	1	1	0	0	0	0	1	0.045%	15.90 m	0.10 m*	13
1317	0.004%	1	1	0	0	1	0	0	0.045%	15.90 m	0.10 m*	13
1323	0.004%	1	1	0	0	0	0	1	0.045%	15.90 m	0.10 m*	13
1337	0.004%	1	1	0	0	0	0	1	0.045%	15.90 m	0.10 m*	13
Totals	8.840	86	119	0	0	2	61	23				

Total points: 160
SOIL 9.95
ROCK 8.16

Stand/relevé number: 39

1287	1.279%	14	19	0	0	0	14	0	43.503%	1.01 m	0.14 m	2754
1581	0.694%	9	14	0	0	0	0	9	23.605%	1.62 m	0.16 m	1101
1346	0.032%	3	3	0	0	0	3	0	1.088%	5.23 m	0.10 m	114
1289	0.089%	4	5	0	0	0	4	0	3.027%	3.88 m	0.13 m	205
1300	0.057%	3	4	0	0	0	3	0	1.939%	5.20 m	0.13 m	115
1331	0.032%	3	3	0	0	0	0	3	1.088%	5.23 m	0.10 m	114
1284	0.089%	4	5	0	0	0	4	0	3.027%	3.88 m	0.13 m	205
1296	0.429%	5	11	0	0	0	5	0	14.592%	2.98 m	0.22 m	333
1303	0.128%	3	6	0	0	0	0	3	4.354%	5.13 m	0.20 m	116
1461	0.032%	2	3	0	0	0	0	2	1.088%	7.85 m	0.15 m	51
1329	0.032%	2	3	0	0	0	0	2	1.088%	7.85 m	0.15 m	51
1370	0.057%	1	4	0	0	1	0	0	1.939%	15.60 m	0.40 m	13
Totals	2.948	53	80	0	0	1	33	19				

Total points: 160
SOIL 28.06
ROCK 8.16

Stand/relevé number: 40

1300	0.174%	7	7	0	0	0	7	0	6.063%	2.19 m	0.10 m	637
1327	0.004%	1	1	0	0	0	0	1	0.139%	15.90 m	0.10 m*	13
1287	1.715%	17	22	0	0	0	17	0	59.756%	0.81 m	0.13 m	4144
1296	0.694%	8	14	0	0	0	8	0	24.181%	1.83 m	0.17 m	870
1330	0.032%	1	3	0	0	0	0	1	1.115%	15.70 m	0.30 m	13
1317	0.057%	2	4	0	0	2	0	0	1.986%	7.80 m	0.20 m	51
1435	0.004%	1	1	0	0	0	0	1	0.139%	15.90 m	0.10 m*	13
1289	0.128%	4	6	0	0	0	4	0	4.460%	3.85 m	0.15 m	207
1361	0.014%	1	2	0	0	0	1	0	0.488%	15.80 m	0.20 m	13
1407	0.014%	2	2	0	0	0	2	0	0.488%	7.90 m	0.10 m*	50
1347	0.004%	1	1	0	0	0	1	0	0.139%	15.90 m	0.10 m*	13
1337	0.004%	1	1	0	0	0	0	1	0.139%	15.90 m	0.10 m*	13
1303	0.014%	1	2	0	0	0	0	1	0.488%	15.80 m	0.20 m	13
1475	0.014%	1	2	0	0	0	1	0	0.488%	15.80 m	0.20 m	13
Totals	2.870	48	68	0	0	2	41	5				

Total points: 160
SOIL 33.34
ROCK 8.16

Stand/relevé number: 41

1589	0.014%	2	2	0	0	0	0	2	0.294%	7.90 m	0.10 m*	50
1593	0.004%	1	1	0	0	1	0	0	0.084%	15.90 m	0.10 m*	13
1594	0.057%	3	4	0	0	0	3	0	1.197%	5.20 m	0.13 m	115
1343	0.004%	1	1	0	0	1	0	0	0.084%	15.90 m	0.10 m*	13
1329	0.004%	1	1	0	0	0	0	1	0.084%	15.90 m	0.10 m*	13
1346	1.024%	11	17	0	0	0	11	0	21.513%	1.30 m	0.15 m	1678
1296	0.907%	10	16	0	0	0	10	0	19.055%	1.44 m	0.16 m	1378
1327	0.004%	1	1	0	0	0	0	1	0.084%	15.90 m	0.10 m*	13
1486	0.227%	3	8	0	2	1	0	0	4.769%	5.07 m	0.27 m	118
1295	2.214%	17	25	0	0	0	17	0	46.513%	0.79 m	0.15 m	4228
1321	0.057%	2	4	0	0	0	2	0	1.197%	7.80 m	0.20 m	51
1284	0.057%	3	4	0	0	0	3	0	1.197%	5.20 m	0.13 m	115
1331	0.004%	1	1	0	0	0	0	1	0.084%	15.90 m	0.10 m*	13
1347	0.014%	2	2	0	0	0	2	0	0.294%	7.90 m	0.10 m*	50
1581	0.004%	1	1	0	0	0	0	1	0.084%	15.90 m	0.10 m*	13
1300	0.004%	1	1	0	0	0	1	0	0.084%	15.90 m	0.10 m*	13
1473	0.014%	2	2	0	0	0	0	2	0.294%	7.90 m	0.10 m*	50
1375	0.004%	1	1	0	0	1	0	0	0.084%	15.90 m	0.10 m*	13
1293	0.089%	2	5	0	0	0	2	0	1.870%	7.75 m	0.25 m	51
1426	0.014%	1	2	0	0	0	1	0	0.294%	15.80 m	0.20 m	13
1323	0.014%	1	2	0	0	0	0	1	0.294%	15.80 m	0.20 m	13
1588	0.032%	1	3	0	0	1	0	0	0.672%	15.70 m	0.30 m	13

Totals	4.762	68	104	0	2	5	52	9				

Total points: 160
SOIL 33.34
ROCK 8.16

Stand/relevé number: 42

1352	35.430%	51	100	0	0	0	51	0	56.140%	0.12 m	0.20 m	68423
1370	24.999%	9	84	7	0	2	0	0	39.612%	0.84 m	0.93 m	1852
1447	0.057%	3	4	0	0	0	0	3	0.090%	5.20 m	0.13 m	115
1317	2.214%	9	25	0	0	9	0	0	3.508%	1.50 m	0.28 m	1185
1409	0.354%	6	10	0	0	0	0	6	0.561%	2.50 m	0.17 m	477
1556	0.057%	3	4	0	0	0	0	3	0.090%	5.20 m	0.13 m	115
1533	0.004%	1	1	0	1	0	0	0	0.006%	15.90 m	0.10 m*	13
1685	0.004%	1	1	0	1	0	0	0	0.006%	15.90 m	0.10 m*	13
Totals	63.118	83	229	7	2	11	51	12				

Total points: 160
SOIL 0.51
ROCK 8.16

Stand/relevé number: 43

1291	0.057%	2	4	0	0	0	2	0	1.052%	7.80 m	0.20 m	51
1519	0.057%	1	4	0	0	1	0	0	1.052%	15.60 m	0.40 m	13
1429	0.004%	1	1	0	0	0	0	1	0.074%	15.90 m	0.10 m*	13
1317	0.429%	8	11	0	0	8	0	0	7.915%	1.86 m	0.14 m	853
1289	0.057%	4	4	0	0	0	4	0	1.052%	3.90 m	0.10 m*	204
1285	0.004%	1	1	0	0	0	1	0	0.074%	15.90 m	0.10 m*	13
1385	0.004%	1	1	0	0	1	0	0	0.074%	15.90 m	0.10 m*	13
1392	0.004%	1	1	0	0	1	0	0	0.074%	15.90 m	0.10 m*	13
1290	0.004%	1	1	0	0	0	1	0	0.074%	15.90 m	0.10 m*	13
1537	4.096%	2	34	1	0	1	0	0	75.572%	6.30 m	1.70 m	62
1329	0.004%	1	1	0	0	0	0	1	0.074%	15.90 m	0.10 m*	13
1603	0.014%	1	2	0	0	0	0	1	0.258%	15.80 m	0.20 m	13
1342	0.694%	1	14	1	0	0	0	0	12.804%	14.60 m	1.40 m	14
Totals	5.424	25	79	2	0	12	8	3				

Total points: 160
SOIL 4.59
ROCK 11.11

Stand/relevé number: 44

1313	0.004%	1	1	0	0	0	0	1	0.099%	15.90 m	0.10 m*	13
1285	0.014%	2	2	0	0	0	2	0	0.347%	7.90 m	0.10 m*	50
1317	1.874%	17	23	0	0	17	0	0	46.386%	0.81 m	0.14 m	4172
1330	0.227%	6	8	0	0	0	0	6	5.619%	2.53 m	0.13 m	471
1342	0.057%	2	4	0	0	2	0	0	1.411%	7.80 m	0.20 m	51
1300	0.014%	2	2	0	0	0	2	0	0.347%	7.90 m	0.10 m*	50
1331	0.004%	1	1	0	0	0	0	1	0.099%	15.90 m	0.10 m*	13
1287	0.014%	2	2	0	0	0	2	0	0.347%	7.90 m	0.10 m*	50
1293	0.032%	3	3	0	0	0	3	0	0.792%	5.23 m	0.10 m	114
1295	1.562%	18	21	0	0	0	18	0	38.663%	0.77 m	0.12 m	4614
1296	0.004%	1	1	0	0	0	1	0	0.099%	15.90 m	0.10 m*	13
1289	0.032%	3	3	0	0	0	3	0	0.792%	5.23 m	0.10 m	114
1318	0.004%	1	1	0	0	0	0	1	0.099%	15.90 m	0.10 m*	13
1462	0.014%	1	2	0	0	1	0	0	0.347%	15.80 m	0.20 m	13
1550	0.057%	2	4	0	0	2	0	0	1.411%	7.80 m	0.20 m	51
1309	0.128%	4	6	0	0	4	0	0	3.168%	3.85 m	0.15 m	207
1359	0.004%	1	1	0	0	0	0	1	0.099%	15.90 m	0.10 m*	13
1297	0.004%	1	1	0	0	0	1	0	0.099%	15.90 m	0.10 m*	13
Totals	4.046	68	86	0	0	26	32	10				

Total points: 160
SOIL 22.67
ROCK 11.11

Stand/relevé number: 45

1321	2.395%	21	26	0	0	0	21	0	14.857%	0.64 m	0.12 m	6496
1446	0.032%	2	3	0	0	0	0	2	0.199%	7.85 m	0.15 m	51
1317	12.333%	36	59	0	0	38	0	0	76.507%	0.28 m	0.16 m	24223
1330	1.279%	8	19	0	0	0	0	8	7.934%	1.76 m	0.24 m	899
1287	0.004%	1	1	0	0	0	1	0	0.025%	15.90 m	0.10 m*	13
1562	0.004%	1	1	0	0	0	0	1	0.025%	15.90 m	0.10 m*	13
1289	0.004%	1	1	0	0	0	1	0	0.025%	15.90 m	0.10 m*	13
1296	0.032%	3	3	0	0	0	3	0	0.199%	5.23 m	0.10 m	114
1297	0.014%	2	2	0	0	0	2	0	0.087%	7.90 m	0.10 m*	50
1574	0.014%	2	2	0	0	0	0	2	0.087%	7.90 m	0.10 m*	50
1344	0.014%	2	2	0	0	0	2	0	0.087%	7.90 m	0.10 m*	50
Totals	16.124	79	119	0	0	38	30	13				

Total points: 160
SOIL 7.17
ROCK 11.11

Stand/relevé number: 46

1317	0.227%	5	8	0	0	5	0	0	3.105%	3.04 m	0.16 m	327
1521	1.715%	20	22	0	0	0	20	0	23.461%	0.69 m	0.11 m	5735
1309	0.057%	3	4	0	0	3	0	0	0.780%	5.20 m	0.13 m	115
1458	0.004%	1	1	0	0	0	0	1	0.055%	15.90 m	0.10 m*	13
1487	0.004%	1	1	0	0	0	1	0	0.055%	15.90 m	0.10 m*	13
1409	0.014%	2	2	0	0	0	0	2	0.192%	7.90 m	0.10 m*	50
1285	0.032%	3	3	0	0	0	3	0	0.438%	5.23 m	0.10 m	114
1296	0.014%	2	2	0	0	0	2	0	0.192%	7.90 m	0.10 m*	50
1613	5.116%	1	38	1	0	0	0	0	69.986%	12.20 m	3.80 m	16
1356	0.004%	1	1	0	0	0	0	1	0.055%	15.90 m	0.10 m*	13
1455	0.004%	1	1	0	0	0	0	1	0.055%	15.90 m	0.10 m*	13
1318	0.004%	1	1	0	0	0	0	1	0.055%	15.90 m	0.10 m*	13
1615	0.089%	5	5	0	0	5	0	0	1.218%	3.10 m	0.10 m*	321
1505	0.004%	1	1	0	0	0	1	0	0.055%	15.90 m	0.10 m*	13
1447	0.004%	1	1	0	0	0	0	1	0.055%	15.90 m	0.10 m*	13
1321	0.014%	2	2	0	0	0	2	0	0.192%	7.90 m	0.10 m*	50
1297	0.014%	1	2	0	0	0	1	0	0.192%	15.80 m	0.20 m	13
Totals	7.316	51	95	1	0	13	30	7				

Total points: 160
SOIL 7.17
ROCK 11.11

Stand/relevé number: 47

1299	0.429%	4	11	0	0	0	4	0	8.363%	3.73 m	0.28 m	213
1317	2.778%	18	28	0	0	18	0	0	54.152%	0.73 m	0.16 m	4838
1375	0.032%	2	3	0	0	2	0	0	0.624%	7.85 m	0.15 m	51
1330	0.032%	3	3	0	0	0	0	3	0.624%	5.23 m	0.10 m	114
1342	0.032%	2	3	0	1	1	0	0	0.624%	7.85 m	0.15 m	51
1351	0.032%	1	3	0	0	1	0	0	0.624%	15.70 m	0.30 m	13
1352	0.057%	3	4	0	0	1	2	0	1.111%	5.20 m	0.13 m	115
1439	0.004%	1	1	0	0	0	0	1	0.078%	15.90 m	0.10 m*	13
1565	0.089%	4	5	0	0	0	4	0	1.735%	3.88 m	0.13 m	205
1321	0.089%	3	5	0	0	0	3	0	1.735%	5.17 m	0.17 m	115
1515	0.128%	5	6	0	0	0	5	0	2.495%	3.08 m	0.12 m	323
1435	0.004%	1	1	0	0	0	0	1	0.078%	15.90 m	0.10 m*	13
1487	0.032%	2	3	0	0	0	2	0	0.624%	7.85 m	0.15 m	51
1596	0.014%	1	2	0	0	1	0	0	0.273%	15.80 m	0.20 m	13
1394	1.279%	3	19	1	1	1	0	0	24.932%	4.70 m	0.63 m	126
1309	0.014%	1	2	0	0	1	0	0	0.273%	15.80 m	0.20 m	13
1289	0.004%	1	1	0	0	0	1	0	0.078%	15.90 m	0.10 m*	13
1685	0.032%	1	3	0	0	1	0	0	0.624%	15.70 m	0.30 m	13
1519	0.004%	1	1	0	0	1	0	0	0.078%	15.90 m	0.10 m*	13
1343	0.032%	2	3	0	0	2	0	0	0.624%	7.85 m	0.15 m	51
1387	0.014%	1	2	0	0	1	0	0	0.273%	15.80 m	0.20 m	13
1434	0.004%	1	1	0	0	0	0	1	0.078%	15.90 m	0.10 m*	13
Totals	5.130	61	110	1	2	31	21	6				

Total points: 160
SOIL 7.17
ROCK 11.11

Stand/relevé number: 48

1368	0.004%	1	1	0	0	0	0	1	0.035%	15.90 m	0.10 m*	13
1330	0.174%	5	7	0	0	0	0	5	1.517%	3.06 m	0.14 m	325
1300	0.004%	1	1	0	0	0	1	0	0.035%	15.90 m	0.10 m*	13
1284	0.004%	1	1	0	0	0	1	0	0.035%	15.90 m	0.10 m*	13
1446	0.014%	1	2	0	0	0	0	1	0.122%	15.80 m	0.20 m	13
1321	0.174%	5	7	0	0	0	5	0	1.517%	3.06 m	0.14 m	325
1317	1.279%	13	19	0	0	13	0	0	11.151%	1.08 m	0.15 m	2375
1295	0.032%	2	3	0	0	0	2	0	0.279%	7.85 m	0.15 m	51
1352	0.227%	7	8	0	0	0	7	0	1.979%	2.17 m	0.11 m	641
1331	0.014%	2	2	0	0	0	0	2	0.122%	7.90 m	0.10 m*	50
1357	0.014%	1	2	0	0	0	1	0	0.122%	15.80 m	0.20 m	13
1359	0.014%	2	2	0	0	0	0	2	0.122%	7.90 m	0.10 m*	50
1309	0.014%	2	2	0	0	2	0	0	0.122%	7.90 m	0.10 m*	50
1533	0.057%	1	4	0	0	1	0	0	0.497%	15.60 m	0.40 m	13
1375	0.089%	1	5	0	0	1	0	0	0.776%	15.50 m	0.50 m	13
1510	0.057%	4	4	0	0	4	0	0	0.497%	3.90 m	0.10 m*	204
1577	9.215%	1	51	1	0	0	0	0	80.340%	10.90 m	5.10 m	18
1530	0.057%	1	4	0	0	1	0	0	0.497%	15.60 m	0.40 m	13
1343	0.014%	2	2	0	0	2	0	0	0.122%	7.90 m	0.10 m*	50
1686	0.004%	1	1	0	0	1	0	0	0.035%	15.90 m	0.10 m*	13
1322	0.004%	1	1	0	0	0	0	1	0.035%	15.90 m	0.10 m*	13
1329	0.014%	2	2	0	0	0	0	2	0.122%	7.90 m	0.10 m*	50
Totals	11.476	57	131	1	0	25	17	14				

Total points: 160
SOIL 11.11
ROCK 0.06

Stand/relevé number: 49

1577	1.279%	1	19	1	0	0	0	0	22.399%	14.10 m	1.90 m	14
1317	1.562%	13	21	0	0	13	0	0	27.356%	1.07 m	0.16 m	2407
1459	0.004%	1	1	0	0	0	0	1	0.070%	15.90 m	0.10 m*	13
1299	2.583%	19	27	0	0	0	19	0	45.236%	0.70 m	0.14 m	5354
1393	0.004%	1	1	0	0	0	0	1	0.070%	15.90 m	0.10 m*	13
1359	0.032%	3	3	0	0	0	0	3	0.560%	5.23 m	0.10 m	114
1330	0.004%	1	1	0	0	0	0	1	0.070%	15.90 m	0.10 m*	13
1289	0.057%	3	4	0	0	0	3	0	0.998%	5.20 m	0.13 m	115
1300	0.032%	3	3	0	0	0	3	0	0.560%	5.23 m	0.10 m	114
1360	0.004%	1	1	0	0	0	0	1	0.070%	15.90 m	0.10 m*	13
1304	0.004%	1	1	0	0	0	0	1	0.070%	15.90 m	0.10 m*	13
1351	0.014%	1	2	0	0	2	0	0	0.245%	15.80 m	0.20 m	13
1368	0.004%	1	1	0	0	0	0	1	0.070%	15.90 m	0.10 m*	13
1343	0.128%	1	6	1	0	0	0	0	2.242%	15.40 m	0.60 m	13
1352	0.004%	1	1	0	0	0	1	0	0.070%	15.90 m	0.10 m*	13
Totals	5.711	51	92	2	0	15	26	9				

Total points: 160
SOIL 23.82
ROCK 0.06

Stand/relevé number: 50

1462	0.032%	2	3	0	0	2	0	0	0.566%	7.85 m	0.15 m	51
1299	0.797%	10	15	0	0	0	10	0	14.106%	1.45 m	0.15 m	1369
1434	0.014%	2	2	0	0	0	0	2	0.248%	7.90 m	0.10 m*	50
1297	0.694%	12	14	0	0	0	12	0	12.283%	1.22 m	0.12 m	1958
1352	0.032%	3	3	0	0	0	3	0	0.566%	5.23 m	0.10 m	114
1321	3.405%	19	31	0	0	0	19	0	60.265%	0.68 m	0.16 m	5503
1300	0.174%	5	7	0	0	0	5	0	3.080%	3.06 m	0.14 m	325
1289	0.004%	1	1	0	0	0	1	0	0.071%	15.90 m	0.10 m*	13
1317	0.004%	1	1	0	0	1	0	0	0.071%	15.90 m	0.10 m*	13
1293	0.429%	9	11	0	0	0	9	0	7.593%	1.66 m	0.12 m	1080
1603	0.004%	1	1	0	0	0	0	1	0.071%	15.90 m	0.10 m*	13
1304	0.014%	2	2	0	0	0	0	2	0.248%	7.90 m	0.10 m*	50
1557	0.004%	1	1	0	0	0	0	1	0.071%	15.90 m	0.10 m*	13
1346	0.004%	1	1	0	0	0	1	0	0.071%	15.90 m	0.10 m*	13
1290	0.004%	1	1	0	0	0	1	0	0.071%	15.90 m	0.10 m*	13
1441	0.032%	3	3	0	0	0	3	0	0.566%	5.23 m	0.10 m	114
1386	0.004%	1	1	0	0	0	0	1	0.071%	15.90 m	0.10 m*	13
1393	0.004%	1	1	0	0	0	0	1	0.071%	15.90 m	0.10 m*	13
1418	0.004%	1	1	0	0	0	0	1	0.071%	15.90 m	0.10 m*	13
Totals	5.655	76	100	0	0	3	64	9				

Total points: 160
SOIL 5.12
ROCK 3.40

Stand/relevé number: 51

1293	0.694%	13	14	0	0	0	13	0	21.824%	1.12 m	0.11 m	2298
1375	0.004%	1	1	0	0	1	0	0	0.126%	15.90 m	0.10 m*	13
1321	0.599%	12	13	0	0	0	12	0	18.836%	1.23 m	0.11 m	1945
1291	0.032%	2	3	0	0	0	2	0	1.006%	7.85 m	0.15 m	51
1289	0.032%	3	3	0	0	0	3	0	1.006%	5.23 m	0.10 m	114
1349	0.004%	1	1	0	0	1	0	0	0.126%	15.90 m	0.10 m*	13
1523	0.004%	1	1	0	0	0	0	1	0.126%	15.90 m	0.10 m*	13
1317	0.287%	5	9	0	0	5	0	0	9.025%	3.02 m	0.18 m	329
1316	0.128%	1	6	0	0	1	0	0	4.025%	15.40 m	0.60 m	13
1352	0.128%	5	6	0	0	0	5	0	4.025%	3.08 m	0.12 m	323
1685	0.510%	1	12	1	0	0	0	0	16.038%	14.80 m	1.20 m	13
1368	0.014%	1	2	0	0	0	0	1	0.440%	15.80 m	0.20 m	13
1342	0.429%	4	11	1	0	3	0	0	13.491%	3.73 m	0.28 m	213
1603	0.004%	1	1	0	0	0	0	1	0.126%	15.90 m	0.10 m*	13
1387	0.032%	1	3	0	0	1	0	0	1.006%	15.70 m	0.30 m	13
1345	0.004%	1	1	0	0	0	0	1	0.126%	15.90 m	0.10 m*	13
1312	0.174%	7	7	0	0	0	0	7	5.472%	2.19 m	0.10 m	637
1462	0.057%	4	4	0	0	4	0	0	1.792%	3.90 m	0.10 m*	204
1405	0.004%	1	1	0	0	0	0	1	0.126%	15.90 m	0.10 m*	13
1290	0.004%	1	1	0	0	0	1	0	0.126%	15.90 m	0.10 m*	13
1435	0.004%	1	1	0	0	0	0	1	0.126%	15.90 m	0.10 m*	13
1298	0.004%	1	1	0	0	0	1	0	0.126%	15.90 m	0.10 m*	13
1297	0.004%	1	1	0	0	0	1	0	0.126%	15.90 m	0.10 m*	13
1377	0.004%	1	1	0	0	0	0	1	0.126%	15.90 m	0.10 m*	13
1521	0.004%	1	1	0	0	0	1	0	0.126%	15.90 m	0.10 m*	13
1313	0.004%	1	1	0	0	0	0	1	0.126%	15.90 m	0.10 m*	13
1393	0.014%	2	2	0	0	0	0	2	0.440%	7.90 m	0.10 m*	50
1428	0.004%	1	1	0	0	0	1	0	0.126%	15.90 m	0.10 m*	13
1635	0.004%	1	1	0	0	0	0	1	0.126%	15.90 m	0.10 m*	13
1409	0.004%	1	1	0	0	1	0	0	0.126%	15.90 m	0.10 m*	13
Totals	3.185	77	111	2	0	17	40	18				

Total points: 160
SOIL 14.97
ROCK 0.03

Stand/relevé number: 52

1317	1.148%	11	18	0	0	11	0	0	26.698%	1.29 m	0.16 m	1689
1474	0.510%	11	12	0	0	0	11	0	11.860%	1.35 m	0.11 m	1624
1342	0.004%	1	1	0	0	1	0	0	0.093%	15.90 m	0.10 m*	13
1293	1.024%	14	17	0	0	0	14	0	23.814%	1.02 m	0.12 m	2718
1462	0.004%	1	1	0	0	1	0	0	0.093%	15.90 m	0.10 m*	13
1330	0.004%	1	1	0	0	0	0	1	0.093%	15.90 m	0.10 m*	13
1621	0.004%	1	1	0	0	0	0	1	0.093%	15.90 m	0.10 m*	13
1289	0.057%	4	4	0	0	0	4	0	1.326%	3.90 m	0.10 m*	204
1346	0.004%	1	1	0	0	0	1	0	0.093%	15.90 m	0.10 m*	13
1321	0.510%	10	12	0	0	0	10	0	11.860%	1.48 m	0.12 m	1342
1352	0.354%	8	10	0	0	0	8	0	8.233%	1.88 m	0.13 m	848
1418	0.014%	2	2	0	0	0	0	2	0.326%	7.90 m	0.10 m*	50
1316	0.599%	1	13	1	0	0	0	0	13.930%	14.70 m	1.30 m	14
1459	0.004%	1	1	0	0	0	0	1	0.093%	15.90 m	0.10 m*	13
1303	0.004%	1	1	0	0	0	0	1	0.093%	15.90 m	0.10 m*	13
1434	0.004%	1	1	0	0	0	0	1	0.093%	15.90 m	0.10 m*	13
1375	0.057%	1	4	0	0	1	0	0	1.326%	15.60 m	0.40 m	13
1304	0.004%	1	1	0	0	0	0	1	0.093%	15.90 m	0.10 m*	13
Totals	4.305	71	101	1	0	14	48	8				

Total points: 160
SOIL 14.97
ROCK 0.09

Stand/relevé number: 53

1321	1.417%	10	20	0	0	0	10	0	25.394%	1.40 m	0.20 m	1415
1521	0.510%	7	12	0	0	0	7	0	9.140%	2.11 m	0.17 m	658
1598	0.174%	2	7	1	0	1	0	0	3.118%	7.65 m	0.35 m	52
1462	0.014%	2	2	0	0	2	0	0	0.251%	7.90 m	0.10 m*	50
1329	0.227%	5	8	0	0	0	0	5	4.068%	3.04 m	0.16 m	327
1386	0.004%	1	1	0	0	0	0	1	0.072%	15.90 m	0.10 m*	13
1291	0.032%	1	3	0	0	0	1	0	0.573%	15.70 m	0.30 m	13
1418	0.004%	1	1	0	0	0	0	1	0.072%	15.90 m	0.10 m*	13
1646	0.014%	1	2	0	0	0	1	0	0.251%	15.80 m	0.20 m	13
1556	0.057%	4	4	0	0	0	0	4	1.022%	3.90 m	0.10 m*	204
1295	0.128%	3	6	0	0	0	3	0	2.294%	5.13 m	0.20 m	116
1393	0.004%	1	1	0	0	0	0	1	0.072%	15.90 m	0.10 m*	13
1644	0.004%	1	1	0	0	0	1	0	0.072%	15.90 m	0.10 m*	13
1443	0.004%	1	1	0	0	0	0	1	0.072%	15.90 m	0.10 m*	13
1591	2.980%	2	29	2	0	0	0	0	53.405%	6.55 m	1.45 m	60
1387	0.004%	1	1	0	0	1	0	0	0.072%	15.90 m	0.10 m*	13
1645	0.004%	1	1	0	0	1	0	0	0.072%	15.90 m	0.10 m*	13
1446	0.004%	1	1	0	0	0	0	1	0.072%	15.90 m	0.10 m*	13
1317	0.004%	1	1	0	0	1	0	0	0.072%	15.90 m	0.10 m*	13
Totals	5.584	46	102	3	0	6	23	14				

Total points: 160
SOIL 2.40
ROCK 7.17

Stand/relevé number: 54

1571	0.089%	2	5	1	0	1	0	0	0.948%	7.75 m	0.25 m	51
1519	5.669%	4	40	0	4	0	0	0	60.373%	3.00 m	1.00 m	260
1431	2.583%	1	27	1	0	0	0	0	27.508%	13.30 m	2.70 m	15
1510	0.004%	1	1	0	0	1	0	0	0.043%	15.90 m	0.10 m*	13
1631	0.089%	1	5	1	0	0	0	0	0.948%	15.50 m	0.50 m	13
1342	0.227%	2	8	1	0	1	0	0	2.417%	7.60 m	0.40 m	52
1317	0.429%	6	11	0	0	6	0	0	4.569%	2.48 m	0.18 m	480
1408	0.174%	3	7	0	0	0	0	3	1.853%	5.10 m	0.23 m	117
1352	0.128%	4	6	0	0	0	4	0	1.363%	3.85 m	0.15 m	207
1321	0.004%	1	1	0	0	0	1	0	0.043%	15.90 m	0.10 m*	13
1393	0.004%	1	1	0	0	0	0	1	0.043%	15.90 m	0.10 m*	13
1542	0.004%	1	1	0	0	0	0	1	0.043%	15.90 m	0.10 m*	13
Totals	9.399	27	113	4	4	9	5	5				

Total points: 160
SOIL 6.25
ROCK 4.34

Stand/relevé number: 55

1330	1.874%	15	23	0	0	0	1	14	50.376%	0.91 m	0.15 m	3248
1345	0.004%	1	1	0	0	0	0	1	0.108%	15.90 m	0.10 m*	13
1331	0.004%	1	1	0	0	0	0	1	0.108%	15.90 m	0.10 m*	13
1300	0.174%	6	7	0	0	0	6	0	4.677%	2.55 m	0.12 m	468
1338	0.004%	1	1	0	0	0	0	1	0.108%	15.90 m	0.10 m*	13
1297	0.014%	1	2	0	0	0	1	0	0.376%	15.80 m	0.20 m	13
1346	0.089%	5	5	0	0	0	5	0	2.392%	3.10 m	0.10 m*	321
1296	0.032%	3	3	0	0	0	3	0	0.860%	5.23 m	0.10 m	114
1317	0.057%	2	4	0	0	2	0	0	1.532%	7.80 m	0.20 m	51
1287	0.032%	2	3	0	0	0	2	0	0.860%	7.85 m	0.15 m	51
1344	0.032%	3	3	0	0	0	3	0	0.860%	5.23 m	0.10 m	114
1321	0.004%	1	1	0	0	0	1	0	0.108%	15.90 m	0.10 m*	13
1391	0.014%	2	2	0	0	2	0	0	0.376%	7.90 m	0.10 m*	50
1289	0.128%	6	6	0	0	0	6	0	3.441%	2.57 m	0.10 m*	465
1293	0.004%	1	1	0	0	0	1	0	0.108%	15.90 m	0.10 m*	13
1341	0.797%	14	15	0	0	14	0	0	21.425%	1.04 m	0.11 m	2683
1303	0.004%	1	1	0	0	0	0	1	0.108%	15.90 m	0.10 m*	13
1295	0.014%	2	2	0	0	0	2	0	0.376%	7.90 m	0.10 m*	50
1284	0.004%	1	1	0	0	0	1	0	0.108%	15.90 m	0.10 m*	13
1320	0.429%	11	11	0	0	0	11	0	11.532%	1.35 m	0.10 m*	1614
1285	0.004%	1	1	0	0	0	1	0	0.108%	15.90 m	0.10 m*	13
1326	0.014%	1	2	0	0	1	0	0	0.376%	15.80 m	0.20 m	13
Totals	3.727	81	96	0	0	19	44	18				

Total points: 160
SOIL 17.36
ROCK 4.34

Stand/relevé number: 56

1361	0.174%	5	7	0	0	0	5	0	5.668%	3.06 m	0.14 m	325
1317	1.024%	10	17	0	0	10	0	0	33.355%	1.43 m	0.17 m	1387
1487	0.797%	12	15	0	0	0	0	13	0	25.961%	1.21 m	0.13 m	1971
1370	1.024%	2	17	0	2	0	0	0	33.355%	7.15 m	0.85 m	55
1287	0.057%	2	4	0	0	0	2	0	1.857%	7.80 m	0.20 m	51
1303	0.004%	1	1	0	0	0	0	1	0.130%	15.90 m	0.10 m*	13
Totals	3.079	32	61	0	2	10	20	1				

Total points: 160
SOIL 38.32
ROCK 4.34

Stand/relevé number: 57

1321	0.287%	6	9	0	0	0	6	0	7.906%	2.52 m	0.15 m	474
1293	0.089%	4	5	0	0	0	4	0	2.452%	3.88 m	0.13 m	205
1296	0.032%	2	3	0	0	0	2	0	0.882%	7.85 m	0.15 m	51
1346	1.279%	17	19	0	0	0	17	0	35.234%	0.83 m	0.11 m	4061
1342	0.089%	1	5	0	0	1	0	0	2.452%	15.50 m	0.50 m	13
1317	0.797%	10	15	0	0	10	0	0	21.956%	1.45 m	0.15 m	1369
1352	0.907%	12	16	0	0	0	12	0	24.986%	1.20 m	0.13 m	1984
1309	0.032%	1	3	0	0	1	0	0	0.882%	15.70 m	0.30 m	13
1487	0.089%	3	5	0	0	0	3	0	2.452%	5.17 m	0.17 m	115
1656	0.014%	1	2	0	0	1	0	0	0.386%	15.80 m	0.20 m	13
1565	0.004%	1	1	0	0	0	1	0	0.110%	15.90 m	0.10 m*	13
1447	0.014%	1	2	0	0	0	0	1	0.386%	15.80 m	0.20 m	13
Totals	3.632	59	85	0	0	13	45	1				

Total points: 160
SOIL 22.11
ROCK 4.34

Stand/relevé number: 58

1346	14.512%	57	64	0	0	0	57	0	91.906%	0.17 m	0.11 m	63122
1284	1.148%	13	18	0	0	0	13	0	7.270%	1.09 m	0.14 m	2359
1317	0.014%	1	2	0	0	1	0	0	0.089%	15.80 m	0.20 m	13
1324	0.004%	1	1	0	0	0	0	1	0.025%	15.90 m	0.10 m*	13
1321	0.057%	4	4	0	0	0	4	0	0.361%	3.90 m	0.10 m*	204
1285	0.057%	2	4	0	0	0	2	0	0.361%	7.80 m	0.20 m	51
1312	0.004%	1	1	0	0	0	0	1	0.025%	15.90 m	0.10 m*	13
Totals	15.795	79	94	0	0	1	76	2				

Total points: 160
SOIL 15.43
ROCK 0.00

Stand/relevé number: 59

1293	0.174%	7	7	0	0	0	7	0	5.210%	2.19 m	0.10 m	637
1296	0.174%	6	7	0	0	0	6	0	5.210%	2.55 m	0.12 m	468
1352	0.004%	1	1	0	0	0	1	0	0.120%	15.90 m	0.10 m*	13
1346	0.014%	2	2	0	0	0	2	0	0.419%	7.90 m	0.10 m*	50
1659	1.874%	23	23	0	0	0	23	0	56.108%	0.60 m	0.10 m*	7636
1455	0.004%	1	1	0	0	0	0	1	0.120%	15.90 m	0.10 m*	13
1359	0.004%	1	1	0	0	0	0	1	0.120%	15.90 m	0.10 m*	13
1343	0.694%	3	14	0	1	2	0	0	20.778%	4.87 m	0.47 m	122
1507	0.227%	1	8	0	1	0	0	0	6.796%	15.20 m	0.80 m	13
1357	0.004%	1	1	0	0	0	1	0	0.120%	15.90 m	0.10 m*	13
1519	0.174%	2	7	0	1	0	1	0	5.210%	7.65 m	0.35 m	52
Totals	3.345	48	72	0	3	2	41	2				

Total points: 160
SOIL 33.34
ROCK 0.00

Stand/relevé number: 60

1291	0.004%	1	1	0	0	0	1	0	0.052%	15.90 m	0.10 m*	13
1577	5.956%	4	41	0	3	1	0	0	77.856%	2.98 m	1.02 m	262
1295	1.417%	10	20	0	0	0	10	0	18.523%	1.40 m	0.20 m	1415
1321	0.057%	3	4	0	0	0	3	0	0.745%	5.20 m	0.13 m	115
1293	0.004%	1	1	0	0	0	1	0	0.052%	15.90 m	0.10 m*	13
1317	0.174%	6	7	0	0	6	0	0	2.275%	2.55 m	0.12 m	468
1462	0.004%	1	1	0	0	1	0	0	0.052%	15.90 m	0.10 m*	13
1521	0.004%	1	1	0	0	0	1	0	0.052%	15.90 m	0.10 m*	13
1603	0.004%	1	1	0	0	0	0	1	0.052%	15.90 m	0.10 m*	13
1486	0.004%	1	1	0	1	0	0	0	0.052%	15.90 m	0.10 m*	13
1529	0.014%	1	2	0	0	0	0	1	0.183%	15.80 m	0.20 m	13
1598	0.014%	1	2	0	0	1	0	0	0.183%	15.80 m	0.20 m	13
Totals	7.653	31	82	0	4	9	16	2				

Total points: 160
SOIL 9.58
ROCK 5.39

Stand/relevé number: 61

1486	2.214%	5	25	0	4	1	0	0	62.191%	2.70 m	0.50 m	366
1295	0.004%	1	1	0	0	0	1	0	0.112%	15.90 m	0.10 m*	13
1537	0.089%	2	5	0	1	1	0	0	2.500%	7.75 m	0.25 m	51
1317	0.032%	3	3	0	0	3	0	0	0.899%	5.23 m	0.10 m	114
1289	0.128%	5	6	0	0	0	5	0	3.596%	3.08 m	0.12 m	323
1377	0.128%	6	6	0	0	0	0	5	3.596%	2.57 m	0.10 m*	465
1432	0.014%	1	2	0	0	0	0	1	0.393%	15.80 m	0.20 m	13
1441	0.004%	1	1	0	0	0	1	0	0.112%	15.90 m	0.10 m*	13
1297	0.057%	3	4	0	0	0	3	0	1.601%	5.20 m	0.13 m	115
1329	0.014%	1	2	0	0	0	0	1	0.393%	15.80 m	0.20 m	13
1393	0.004%	1	1	0	0	0	0	1	0.112%	15.90 m	0.10 m*	13
1538	0.057%	2	4	0	0	2	0	0	1.601%	7.80 m	0.20 m	51
1668	0.694%	6	14	0	0	0	6	0	19.494%	2.43 m	0.23 m	490
1474	0.128%	5	6	0	0	0	5	0	3.596%	3.08 m	0.12 m	323
1290	0.004%	1	1	0	0	0	1	0	0.112%	15.90 m	0.10 m*	13
Totals	3.568	43	81	0	5	7	22	8				

Total points: 160
SOIL 12.75
ROCK 2.40

Stand/relevé number: 62

1299	0.057%	3	4	0	0	0	3	0	4.672%	5.20 m	0.13 m	115
1291	0.032%	2	3	0	0	0	2	0	2.623%	7.85 m	0.15 m	51
1321	1.024%	12	17	0	0	0	12	0	83.934%	1.19 m	0.14 m	1997
1377	0.014%	2	2	0	0	0	0	2	1.148%	7.90 m	0.10 m*	50
1486	0.014%	1	2	0	0	1	0	0	1.148%	15.80 m	0.20 m	13
1293	0.004%	1	1	0	0	0	1	0	0.328%	15.90 m	0.10 m*	13
1317	0.032%	2	3	0	0	2	0	0	2.623%	7.85 m	0.15 m	51
1330	0.004%	1	1	0	0	0	0	1	0.328%	15.90 m	0.10 m*	13
1285	0.004%	1	1	0	0	0	1	0	0.328%	15.90 m	0.10 m*	13
1521	0.004%	1	1	0	0	0	1	0	0.328%	15.90 m	0.10 m*	13
1312	0.004%	1	1	0	0	0	0	1	0.328%	15.90 m	0.10 m*	13
1300	0.014%	2	2	0	0	0	2	0	1.148%	7.90 m	0.10 m*	50
1346	0.004%	1	1	0	0	0	1	0	0.328%	15.90 m	0.10 m*	13
1295	0.004%	1	1	0	0	0	1	0	0.328%	15.90 m	0.10 m*	13
1387	0.014%	1	2	0	1	0	0	0	1.148%	15.80 m	0.20 m	13
1289	0.004%	1	1	0	0	0	1	0	0.328%	15.90 m	0.10 m*	13
Totals	1.229	33	43	0	1	3	25	4				

Total points: 160
SOIL 36.14
ROCK 0.91

Stand/relevé number: 63

1295	0.694%	10	14	0	0	0	10	0	23.931%	1.46 m	0.14 m	1360
1293	0.014%	2	2	0	0	0	2	0	0.483%	7.90 m	0.10 m*	50
1486	0.014%	1	2	0	1	0	0	0	0.483%	15.80 m	0.20 m	13
1321	0.797%	10	15	0	0	0	10	0	27.483%	1.45 m	0.15 m	1369
1297	0.128%	5	6	0	0	0	5	0	4.414%	3.08 m	0.12 m	323
1329	0.032%	1	3	0	0	0	0	1	1.103%	15.70 m	0.30 m	13
1372	0.128%	5	6	0	0	0	0	5	4.414%	3.08 m	0.12 m	323
1317	0.004%	1	1	0	0	1	0	0	0.138%	15.90 m	0.10 m*	13
1291	1.024%	11	17	0	0	0	11	0	35.310%	1.30 m	0.15 m	1678
1290	0.014%	2	2	0	0	0	2	0	0.483%	7.90 m	0.10 m*	50
1360	0.004%	1	1	0	0	0	0	1	0.138%	15.90 m	0.10 m*	13
1331	0.004%	1	1	0	0	0	0	1	0.138%	15.90 m	0.10 m*	13
1285	0.032%	2	3	0	0	0	2	0	1.103%	7.85 m	0.15 m	51
1294	0.014%	1	2	0	0	0	1	0	0.483%	15.80 m	0.20 m	13
1477	0.004%	1	1	0	0	1	0	0	0.138%	15.90 m	0.10 m*	13
Totals	2.905	54	76	0	1	2	43	8				

Total points: 160
SOIL 20.46
ROCK 0.51

Stand/relevé number: 64

1288	0.057%	3	4	0	0	0	3	0	8.143%	5.20 m	0.13 m	115
1486	0.174%	1	7	0	1	0	0	0	24.857%	15.30 m	0.70 m	13
1330	0.004%	1	1	0	0	0	0	1	0.571%	15.90 m	0.10 m*	13
1300	0.014%	2	2	0	0	0	2	0	2.000%	7.90 m	0.10 m*	50
1317	0.014%	1	2	0	0	1	0	0	2.000%	15.80 m	0.20 m	13
1372	0.004%	1	1	0	0	0	0	1	0.571%	15.90 m	0.10 m*	13
1291	0.174%	6	7	0	0	0	6	0	24.857%	2.55 m	0.12 m	468
1293	0.014%	2	2	0	0	0	2	0	2.000%	7.90 m	0.10 m*	50
1321	0.057%	3	4	0	0	0	3	0	8.143%	5.20 m	0.13 m	115
1297	0.032%	3	3	0	0	0	3	0	4.571%	5.23 m	0.10 m	114
1432	0.032%	2	3	0	0	0	0	1	4.571%	7.85 m	0.15 m	51
1521	0.128%	4	6	0	0	0	4	0	18.286%	3.85 m	0.15 m	207
1393	0.004%	1	1	0	0	0	0	1	0.571%	15.90 m	0.10 m*	13
Totals	0.705	30	43	0	1	1	23	4				

Total points: 160
SOIL 31.98
ROCK 1.71

Stand/relevé number: 65

1330	0.014%	2	2	0	0	0	0	2	1.284%	7.90 m	0.10 m*	50
1297	0.014%	1	2	0	0	0	1	0	1.284%	15.80 m	0.20 m	13
1300	0.032%	3	3	0	0	0	3	0	2.936%	5.23 m	0.10 m	114
1488	0.032%	1	3	0	0	0	1	0	2.936%	15.70 m	0.30 m	13
1321	0.287%	6	9	0	0	0	6	0	26.330%	2.52 m	0.15 m	474
1295	0.510%	7	12	0	0	0	7	0	46.789%	2.11 m	0.17 m	658
1293	0.032%	2	3	0	0	0	2	0	2.936%	7.85 m	0.15 m	51
1350	0.174%	1	7	1	0	0	0	0	15.963%	15.30 m	0.70 m	13
1637	0.004%	1	1	0	0	0	1	0	0.367%	15.90 m	0.10 m*	13
Totals	1.098	24	42	1	0	0	21	2				

Total points: 160
SOIL 46.04
ROCK 0.17

Stand/relevé number: 66

1302	0.004%	1	1	0	0	0	0	1	0.120%	15.90 m	0.10 m*	13
1432	0.004%	1	1	0	0	0	0	1	0.120%	15.90 m	0.10 m*	13
1289	0.004%	1	1	0	0	0	1	0	0.120%	15.90 m	0.10 m*	13
1317	0.014%	1	2	0	0	1	0	0	0.422%	15.80 m	0.20 m	13
1293	0.004%	1	1	0	0	0	1	0	0.120%	15.90 m	0.10 m*	13
1328	0.014%	1	2	0	0	0	0	1	0.422%	15.80 m	0.20 m	13
1426	0.004%	1	1	0	0	0	1	0	0.120%	15.90 m	0.10 m*	13
1416	0.032%	3	3	0	0	0	0	3	0.964%	5.23 m	0.10 m	114
1418	0.032%	3	3	0	0	0	0	3	0.964%	5.23 m	0.10 m	114
1300	0.004%	1	1	0	0	0	1	0	0.120%	15.90 m	0.10 m*	13
1372	0.057%	3	4	0	0	0	0	3	1.717%	5.20 m	0.13 m	115
1449	0.057%	2	4	0	0	0	0	2	1.717%	7.80 m	0.20 m	51
1669	1.024%	1	17	1	0	0	0	0	30.843%	14.30 m	1.70 m	14
1392	0.128%	2	6	0	0	2	0	0	3.855%	7.70 m	0.30 m	52
1321	1.279%	14	19	0	0	0	14	0	38.524%	1.01 m	0.14 m	2754
1295	0.014%	1	2	0	0	0	1	0	0.422%	15.80 m	0.20 m	13
1375	0.287%	2	9	0	0	2	0	0	8.645%	7.55 m	0.45 m	53
1323	0.032%	1	3	0	0	0	0	1	0.964%	15.70 m	0.30 m	13
1290	0.032%	3	3	0	0	0	3	0	0.964%	5.23 m	0.10 m	114
1359	0.057%	4	4	0	0	0	0	4	1.717%	3.90 m	0.10 m*	204
1577	0.227%	1	8	0	1	0	0	0	6.837%	15.20 m	0.80 m	13
1414	0.014%	1	2	0	0	0	0	1	0.422%	15.80 m	0.20 m	13
Totals	3.320	49	97	1	1	5	22	20				

Total points: 160
SOIL 12.75
ROCK 2.40

Stand/relevé number: 67

1372	1.279%	9	19	0	0	0	0	9	38.065%	1.57 m	0.21 m	1138
1321	0.128%	3	6	0	0	0	3	0	3.810%	5.13 m	0.20 m	116
1669	0.174%	1	7	1	0	0	0	0	5.179%	15.30 m	0.70 m	13
1293	0.032%	3	3	0	0	0	3	0	0.952%	5.23 m	0.10 m	114
1363	0.004%	1	1	0	0	0	0	1	0.119%	15.90 m	0.10 m*	13
1312	0.014%	2	2	0	0	0	0	2	0.417%	7.90 m	0.10 m*	50
1486	0.599%	2	13	1	1	0	0	0	17.827%	7.35 m	0.65 m	54
1600	0.004%	1	1	0	0	0	0	1	0.119%	15.90 m	0.10 m*	13
1442	0.004%	1	1	0	0	0	1	0	0.119%	15.90 m	0.10 m*	13
1418	0.004%	1	1	0	0	0	0	1	0.119%	15.90 m	0.10 m*	13
1359	0.004%	1	1	0	0	0	0	1	0.119%	15.90 m	0.10 m*	13
1653	0.510%	1	12	0	1	0	0	0	15.179%	14.80 m	1.20 m	13
1428	0.004%	1	1	0	0	0	1	0	0.119%	15.90 m	0.10 m*	13
1577	0.599%	1	13	0	1	0	0	0	17.827%	14.70 m	1.30 m	14
1285	0.014%	1	2	0	0	0	1	0	0.417%	15.80 m	0.20 m	13
Totals	3.369	29	83	2	3	0	9	15				

Total points: 160
SOIL 11.51
ROCK 2.78

Stand/relevé number: 68

1598	0.004%	1	1	0	0	1	0	0	0.106%	15.90 m	0.10 m*	13
1293	0.014%	1	2	0	0	0	1	0	0.371%	15.80 m	0.20 m	13
1321	0.057%	2	4	0	0	0	2	0	1.512%	7.80 m	0.20 m	51
1427	0.032%	2	3	0	0	0	2	0	0.849%	7.85 m	0.15 m	51
1359	0.014%	1	2	0	0	0	0	1	0.371%	15.80 m	0.20 m	13
1668	0.004%	1	1	0	0	0	1	0	0.106%	15.90 m	0.10 m*	13
1289	0.128%	4	6	0	0	0	4	0	3.395%	3.85 m	0.15 m	207
1317	0.032%	1	3	0	0	1	0	0	0.849%	15.70 m	0.30 m	13
1486	2.395%	2	26	2	0	0	0	0	63.528%	6.70 m	1.30 m	59
1297	0.032%	2	3	0	0	0	2	0	0.849%	7.85 m	0.15 m	51
1295	0.227%	8	8	0	0	0	8	0	6.021%	1.90 m	0.10 m*	837
1323	0.014%	1	2	0	0	0	0	1	0.371%	15.80 m	0.20 m	13
1350	0.599%	1	13	1	0	0	0	0	15.889%	14.70 m	1.30 m	14
1377	0.004%	1	1	1	0	0	0	0	0.106%	15.90 m	0.10 m*	13
1296	0.032%	3	3	0	0	0	3	0	0.849%	5.23 m	0.10 m	114
1429	0.014%	2	2	0	0	0	0	2	0.371%	7.90 m	0.10 m*	50
1288	0.174%	3	7	0	0	0	3	0	4.615%	5.10 m	0.23 m	117
Totals	3.773	36	87	4	0	2	26	4				

Total points: 160
SOIL 11.51
ROCK 2.58

Stand/relevé number: 69

1290	4.850%	37	37	0	0	0	37	0	66.989%	0.33 m	0.10 m*	21764
1324	0.004%	1	1	0	0	0	0	1	0.055%	15.90 m	0.10 m*	13
1323	0.032%	3	3	0	0	0	0	3	0.442%	5.23 m	0.10 m	114
1285	2.214%	21	25	0	0	0	21	0	30.580%	0.64 m	0.12 m	6452
1447	0.004%	1	1	0	0	0	0	1	0.055%	15.90 m	0.10 m*	13
1377	0.032%	3	3	0	0	0	0	3	0.442%	5.23 m	0.10 m	114
1426	0.032%	3	3	0	0	0	3	0	0.442%	5.23 m	0.10 m	114
1331	0.004%	1	1	0	0	0	0	1	0.055%	15.90 m	0.10 m*	13
1428	0.004%	1	1	0	0	0	1	0	0.055%	15.90 m	0.10 m*	13
1328	0.014%	1	2	0	0	0	0	1	0.193%	15.80 m	0.20 m	13
1295	0.057%	3	4	0	0	0	3	0	0.787%	5.20 m	0.13 m	115
Totals	7.245	75	81	0	0	0	65	10				

Total points: 160
SOIL 22.67
ROCK 2.58

Stand/relevé number: 70

1388	0.057%	3	4	0	0	3	0	0	3.149%	5.20 m	0.13 m	115
1476	0.014%	1	2	0	0	0	0	1	0.773%	15.80 m	0.20 m	13
1426	0.354%	6	10	0	0	0	6	0	19.558%	2.50 m	0.17 m	477
1291	0.227%	7	8	0	0	0	7	0	12.541%	2.17 m	0.11 m	641
1380	0.089%	4	5	0	0	0	4	0	4.917%	3.88 m	0.13 m	205
1293	0.599%	10	13	0	0	0	10	0	33.094%	1.47 m	0.13 m	1351
1285	0.057%	2	4	0	0	0	2	0	3.149%	7.80 m	0.20 m	51
1304	0.057%	3	4	0	0	0	0	3	3.149%	5.20 m	0.13 m	115
1298	0.004%	1	1	0	0	0	1	0	0.221%	15.90 m	0.10 m*	13
1295	0.128%	4	6	0	0	0	4	0	7.072%	3.85 m	0.15 m	207
1418	0.174%	5	7	0	0	0	0	5	9.613%	3.06 m	0.14 m	325
1441	0.032%	3	3	0	0	0	3	0	1.768%	5.23 m	0.10 m	114
1290	0.014%	2	2	0	0	0	2	0	0.773%	7.90 m	0.10 m*	50
1323	0.004%	1	1	0	0	0	0	1	0.221%	15.90 m	0.10 m*	13
1404	0.004%	1	1	0	0	0	0	1	0.221%	15.90 m	0.10 m*	13
Totals	1.810	53	71	0	0	3	39	11				

Total points: 160
SOIL 16.87
ROCK 1.42

Stand/relevé number: 71

1289	0.694%	13	14	0	0	0	13	0	62.523%	1.12 m	0.11 m	2298
1379	0.128%	6	6	0	0	0	0	6	11.532%	2.57 m	0.10 m*	465
1377	0.032%	3	3	0	0	0	0	3	2.883%	5.23 m	0.10 m	114
1300	0.014%	2	2	0	0	0	2	0	1.261%	7.90 m	0.10 m*	50
1301	0.032%	2	3	0	0	0	0	2	2.883%	7.85 m	0.15 m	51
1304	0.004%	1	1	0	0	0	0	1	0.360%	15.90 m	0.10 m*	13
1290	0.089%	5	5	0	0	0	5	0	8.018%	3.10 m	0.10 m*	321
1285	0.004%	1	1	0	0	0	1	0	0.360%	15.90 m	0.10 m*	13
1291	0.089%	4	5	0	0	0	4	0	8.018%	3.88 m	0.13 m	205
1294	0.004%	1	1	0	0	0	1	0	0.360%	15.90 m	0.10 m*	13
1315	0.004%	1	1	0	0	0	0	1	0.360%	15.90 m	0.10 m*	13
1293	0.014%	2	2	0	0	0	2	0	1.261%	7.90 m	0.10 m*	50
1303	0.004%	1	1	0	0	0	0	1	0.360%	15.90 m	0.10 m*	13
1441	0.004%	1	1	0	0	0	1	0	0.360%	15.90 m	0.10 m*	13
1671	0.004%	1	1	0	0	0	0	1	0.360%	15.90 m	0.10 m*	13
Totals	1.116	44	47	0	0	0	29	15				

Total points: 160
SOIL 34.72
ROCK 0.69

Stand/relevé number: 72

1289	0.057%	4	4	0	0	0	4	0	12.667%	3.90 m	0.10 m*	204
1413	0.014%	1	2	0	0	0	1	0	3.111%	15.80 m	0.20 m	13
1294	0.032%	1	3	0	0	0	1	0	7.111%	15.70 m	0.30 m	13
1454	0.014%	2	2	0	0	0	0	2	3.111%	7.90 m	0.10 m*	50
1379	0.004%	1	1	0	0	0	0	1	0.889%	15.90 m	0.10 m*	13
1671	0.004%	1	1	0	0	0	0	1	0.889%	15.90 m	0.10 m*	13
1373	0.004%	1	1	0	0	1	0	0	0.889%	15.90 m	0.10 m*	13
1315	0.004%	1	1	0	0	0	0	1	0.889%	15.90 m	0.10 m*	13
1441	0.004%	1	1	0	0	0	1	0	0.889%	15.90 m	0.10 m*	13
1331	0.014%	2	2	0	0	0	0	2	3.111%	7.90 m	0.10 m*	50
1290	0.032%	3	3	0	0	0	3	0	7.111%	5.23 m	0.10 m	114
1295	0.089%	3	5	0	0	0	3	0	19.778%	5.17 m	0.17 m	115
1297	0.057%	2	4	0	0	0	2	0	12.667%	7.80 m	0.20 m	51
1546	0.004%	1	1	0	0	0	0	1	0.889%	15.90 m	0.10 m*	13
1517	0.004%	1	1	0	0	0	1	0	0.889%	15.90 m	0.10 m*	13
1323	0.032%	1	3	0	0	0	0	1	7.111%	15.70 m	0.30 m	13
1486	0.089%	1	5	0	1	0	0	0	19.778%	15.50 m	0.50 m	13
Totals	0.454	27	40	0	1	1	16	9				

Total points: 160
SOIL 34.72
ROCK 2.98

Stand/relevé number: 73

1291	0.174%	5	7	0	0	0	5	0	28.065%	3.06 m	0.14 m	325
1293	0.089%	3	5	0	0	0	3	0	14.355%	5.17 m	0.17 m	115
1379	0.004%	1	1	0	0	0	0	1	0.645%	15.90 m	0.10 m*	13
1312	0.032%	3	3	0	0	0	0	3	5.161%	5.23 m	0.10 m	114
1344	0.128%	5	6	0	0	0	5	0	20.645%	3.08 m	0.12 m	323
1303	0.004%	1	1	0	0	0	0	1	0.645%	15.90 m	0.10 m*	13
1377	0.004%	1	1	0	0	0	0	1	0.645%	15.90 m	0.10 m*	13
1598	0.004%	1	1	0	0	1	0	0	0.645%	15.90 m	0.10 m*	13
1289	0.004%	1	1	0	0	0	1	0	0.645%	15.90 m	0.10 m*	13
1285	0.014%	1	2	0	0	0	1	0	2.258%	15.80 m	0.20 m	13
1674	0.174%	1	7	0	0	1	0	0	28.065%	15.30 m	0.70 m	13
Totals	0.627	23	35	0	0	2	15	6				

Total points: 160
SOIL 1.42
ROCK 39.06

Stand/relevé number: 74

1294	0.227%	7	8	0	0	0	7	0	9.956%	2.17 m	0.11 m	641
1293	0.128%	5	6	0	0	0	5	0	5.614%	3.08 m	0.12 m	323
1291	1.148%	13	18	0	0	0	13	0	50.351%	1.09 m	0.14 m	2359
1413	0.004%	1	1	0	0	0	0	1	0.175%	15.90 m	0.10 m*	13
1309	0.004%	1	1	0	0	1	0	0	0.175%	15.90 m	0.10 m*	13
1372	0.032%	2	3	0	0	0	0	2	1.404%	7.85 m	0.15 m	51
1290	0.174%	7	7	0	0	0	7	0	7.632%	2.19 m	0.10 m	637
1344	0.004%	1	1	0	0	0	1	0	0.175%	15.90 m	0.10 m*	13
1441	0.128%	5	6	0	0	0	5	0	5.614%	3.08 m	0.12 m	323
1380	0.174%	5	7	0	0	0	5	0	7.632%	3.06 m	0.14 m	325
1671	0.004%	1	1	0	0	0	0	1	0.175%	15.90 m	0.10 m*	13
1321	0.089%	4	5	0	0	0	4	0	3.904%	3.88 m	0.13 m	205
1423	0.004%	1	1	0	0	0	0	1	0.175%	15.90 m	0.10 m*	13
1312	0.014%	1	2	0	0	0	0	1	0.614%	15.80 m	0.20 m	13
1418	0.057%	3	4	0	0	0	0	3	2.500%	5.20 m	0.13 m	115
1298	0.004%	1	1	0	0	0	1	0	0.175%	15.90 m	0.10 m*	13
1428	0.004%	1	1	0	0	0	1	0	0.175%	15.90 m	0.10 m*	13
1426	0.004%	1	1	0	0	0	1	0	0.175%	15.90 m	0.10 m*	13
1388	0.089%	2	5	0	0	2	0	0	3.904%	7.75 m	0.25 m	51
Totals	2.285	62	79	0	0	3	50	9				

Total points: 160
SOIL 15.43
ROCK 1.42

Stand/relevé number: 75

1352	1.715%	13	22	0	0	0	13	0	15.605%	1.06 m	0.17 m	2423
1577	0.057%	1	4	1	0	0	0	0	0.519%	15.60 m	0.40 m	13
1321	0.004%	1	1	0	0	0	1	0	0.036%	15.90 m	0.10 m*	13
1523	0.004%	1	1	0	0	0	0	1	0.036%	15.90 m	0.10 m*	13
1350	6.859%	3	44	2	1	0	0	0	62.411%	3.87 m	1.47 m	150
1296	0.057%	4	4	0	0	0	4	0	0.519%	3.90 m	0.10 m*	204
1293	0.004%	1	1	0	0	0	1	0	0.036%	15.90 m	0.10 m*	13
1434	0.014%	2	2	0	0	0	0	2	0.127%	7.90 m	0.10 m*	50
1655	0.032%	3	3	0	0	0	0	3	0.291%	5.23 m	0.10 m	114
1317	0.599%	9	13	0	0	9	0	0	5.450%	1.63 m	0.14 m	1094
1521	0.599%	9	13	0	0	0	9	0	5.450%	1.63 m	0.14 m	1094
1418	0.004%	1	1	0	0	0	0	1	0.036%	15.90 m	0.10 m*	13
1295	0.089%	4	5	0	0	0	4	0	0.810%	3.88 m	0.13 m	205
1427	0.004%	1	1	0	0	0	1	0	0.036%	15.90 m	0.10 m*	13
1449	0.014%	1	2	0	0	0	1	0	0.127%	15.80 m	0.20 m	13
1685	0.032%	1	3	0	1	0	0	0	0.291%	15.70 m	0.30 m	13
1486	0.907%	1	16	1	0	0	0	0	8.253%	14.40 m	1.60 m	14
1462	0.004%	1	1	0	0	1	0	0	0.036%	15.90 m	0.10 m*	13
Totals	10.994	57	137	4	2	10	34	7				

Total points: 160
SOIL 8.51
ROCK 0.03

Table 4.3 The quadrat method's working table showing relevé groups delimited programmatically. SD's: 0220, Eff.: 5x4 (a = specimen number; b = species code; c = species frequency; d = number of SD's; and, e = species frequency per relevé)

Relevé numbers

a	b	1413333513554534444 6028697814796608579	4366756 4240542	5 1	555 023	466 113	2 7	34 53	66 87	6677 5603	7772132 412653349	32221211 4 25622111 67152134878250599840932 1	c	d
1340	51	++ + ++ +1 +++	+									+	12	62
1402	108	11 +++ ++	+							+	+	+	11	53
1612	287	++++											4	0
1585	286	++ 23											4	3
1691	263	+ + 2+	+										5	16
1484	151	+ ++ +	+										5	14
1475	163	+1+											3	0
1480	154	+ + +											3	2
1581	260	+ + 8				1							4	26
1610	285	+++											3	0
1583	262	+ + +											3	11
1656	324	+ + +	+										4	15
1554	233	+ 1 9											3	9
1494	164	++											2	0
1586	259	+ +											2	1
1621	293	++											2	0
1620	295	+ 4											2	1
1578	255	+ +											2	4
1491	159	2 +		+									3	22
1657	326	++											2	0
1615	289	1 +											2	2
1507	296	E +											2	3
1661	332		1 +			+							3	7
1606	322		1+										2	0
1647	317		++		+								3	3
1596	272	++++	+ ++	+	+	+							10	6
1530	217	1+ 1+ +	2+				+				+	+	10	48
1515	202	2 1 + +3+	+		5			+				+	10	46
1562	245	++	+3+			+					+		7	26
1552	235	++ +	+ +					+				+	7	34
1495	218	+ + +	++								+		6	36
1622	294	1 + +	++		+					+			7	20
1471	183	+ ++	+						+		+		6	41
1510	297	+ 1 +	+		+								5	12
1550	243	++ + ++	1+ +	+		+				+	6	+	13	46
1556	236	+			++3								4	12
1638	311				++								2	0
1641	310				+1								2	0
1542	227	+ + + ++1+	+ 4++		+++	+	+						16	12
1558	242	33 1	+2+	+	++								9	11
1593	271					++							2	0
1588	267		+			4+							3	4
1662	335					+1							2	0
1666	337					++							2	0
1405	115		++2 1	1	+ +	+		2	+	+		+	12	19
1487	158	+4 + +4116 1			+	+ +							12	20
1431	226	++++	11+	+	+	++	+	+	+				14	9
1572	248							1+		+			3	4
1687	222	1+	+11 +2	1	41+	+26	1	14					17	3
1669	344								33	8			3	1
1410	308				+				25				3	7
1644	340									31			2	0
1378	81										+ ++		3	2
1678	347										++		2	0
1679	346										++		2	0
1605	280		+	+						+++	++		7	18
1518	277							+		++	+++		6	4
1380	76									46	6 +		4	7
1671	342								++	+ +	+1+		7	2
1385	89		+					2	1+	1+	+ +		8	22
1418	249		+21+1	1	11+	+1		12	+1	124+	1++		22	2
1474	185	++ + 4 1 1	1 2		5D5	64	1	+1	2+1	31	+		22	44

a	b	Relevé data	c	d
1326	42	+ + + 1 ++ ++ + + 11+ +	14	30
1319	36	+ 1 + +3 1 + ++ ++	11	44
1401	173	+ + + ++ + + ++ +	10	31
1459	174	+ + + +++ + +++	10	42
1511	201	+ + + + ++	6	46
1335	50	+ ++ +	4	28
1544	229	+ + ++	4	35
1403	111	1 + 1	3	6
1332	47	+ + + +	4	30
1445	169	+ ++	3	8
1512	200	++	2	0
1397	105	+ + +	3	35
1689	230	+ 6	2	5
1355	60	+ + + + + + ++ + +++ ++ +++ + +	19	38
1384	87	+ +++++ +++ + ++++	14	7
1305	22	+ + + +++ + +++ + + + +	14	52
1341	53	2 1 1 4 F 1+ 1 32 3 6 6 +	14	54
1358	101	21 + 3 + ++++	9	19
1371	84	+ + 1 + ++ 1 ++ ++ +	12	23
1391	92	4 + 5 1 + 1 2 3 1 +	10	59
1306	23	+ + + + + 1 1 1 +	9	35
1374	75	+ + ++1 + +	7	22
1390	97	++ + + +	5	11
1348	138	+ + + + ++ +	7	22
1477	189	+ + + + +++	7	45
1404	110	+ 1 1 + 11	6	17
1323	40	+ + 3 1 + + 111+ + 2 +1 + 1+31+ 1 1111 +1	27	36
1379	91	1 + + + 1++ ++ 1 + ++ +++ +++ +	20	38
1388	93	+4 3+ 2312 +4 + 4 +	13	9
1334	49	+++ + ++ +2 1 + ++	12	23
1426	135	6 2 4 68 2 1 6 + +21 3 3	14	23
1373	94	+ + + +++ +++ ++ 1 + +	14	34
1514	192	+ + ++ + + + + + + ++	12	22
1517	203	+ 1+1 62+ + ++	10	13
1423	125	1 1 1 + ++ +1+ + + +	12	16
1420	123	+ + ++ + + + +	8	15
1428	119	2 1 + 121 + + + ++2+ ++++ 2 3 F +12 2 +7 ++2	29	34
1290	7	+ 1 + + +11 3 21 1+ 242 543+ 21+5 +3 +41 +++1 + 7 ++	36	20
1375	88	+ + + 1+ + + +1 +21 +11 1 +2 + + ++ +	23	25
1291	8	2 21 2 2 1 +2 D 32 1+ 455 5313 3645 13++82 5261 15 61 +	39	17
1294	11	+ + + +1 + ++1+ 3++ ++6 21++22 1+3 +1+ +1 +++	33	32
1301	18	+++ + + + ++1+ + +++ +1 ++ ++ +++	24	32
1377	78	+ + 1 + 12 + 1 1+ 11 1+++ 1 + ++ 2 +	22	28
1307	24	+ ++ + ++ ++ 1 ++++++ + ++ ++ + ++	23	47
1386	96	+ + ++ +++ ++ ++ ++ 2 ++ + ++ + +	21	26
1317	34	223+3131626289BBIJ8 E124454 263 132 5 36 3 ++ + 1++A+52+D 2G3221355++3+72+681352+3	72	3
1321	38	124+115+25 14+3C24 1144127 8 78B +23 12 12 38 311 +31+5 +2+2++1++++ ++1 6+++1++	66	7
1289	6	442438+611 142322 25+1 1 263 41 + +2 85 1312 164+22 +2 ++F122+B813+ 29+41+231 +	65	9
1300	17	9123381343 332122 531++ 2 1 1++ 4 2 + 22 + 21 +1+1112+ + 352116 1+ +48 32++3+++	62	12
1285	2	74 3 +2 1+ 222 +1 45323 2 + +1 1+1 1 11 23 215+ 1332 111 + 2211 1+9 124A5138+1++	60	15
1293	10	1 8 + 243 +11 11311 1 4 47 1+1 1 1+ 11 2331 211+ 5115 C81J31+51+2 1+124++ 1 2	58	17
1309	26	+2+1 11251+2125 2+++1+1 + 2 + ++1 2 ++ 1 11++ 11++ ++++ ++ ++ ++ +++ ++ +++	57	14
1296	13	+62438353I25311 3 412+5 + 2+1 2+ + 2 2 ++ 3 6313+ 2++62 1+1 1 26+91891	56	19
1312	29	8 + 1+ + ++++21 1++2+ 4 12 ++ + ++ +111 1++1 1++ 113324++11 ++2+++ 3++	54	19
1303	20	4 4+321++ +1++11 +2 21+ ++ + + + +1+2 +1 1+43+1+1++1 +2 2++1++2+	51	23
1359	109	+ + ++1+1+ ++++ ++ ++ + + 1 + ++ 11 1+ 1+++ ++ 1+++++1+4+ ++++ 1+ 1	50	19
1295	12	1 122 3 88153 112 D12 E 6 423 2 2B36161 ++4+C8782BA D42 4BB7+ +	49	17
1297	14	11+ 1+ 1 2 3++ 1 3 52 44 + ++ 24 +1 + 34 11+ + 3+++ 31++++++ +1 ++++	48	26
1330	45	32+ +11+ 8+727 42+++ + +1+ + + 1 1+ 1 + +++ 8131+1++ + 18 92+ +4+	48	24
1392	103	+ 1+++ ++ 1+++11 ++++ + 3 + +++ + ++ 1 +1+ ++++ + ++ 1 +2 ++ + ++ ++ 1+	46	22
1331	46	1+ +11++11 ++ + +++ + + ++++3 +1 + 11+11+ 13+ +++++21+++	46	27
1318	35	+ ++ +++ + + 1 + + + + 2+ ++ +11 3+ ++ + ++++++ +3 + ++++++ ++ +	43	25
1369	63	+++ ++ ++++++ +++++++ 1 1++ +1 + + + ++ + ++++++ +++ + ++	42	28
1287	4	A15ID9 3+ 523++ 42 1 3 2 14+24 + 1111GD 2 1 7 1 3+25+4	40	34
1284	1	+2+41636+1 +1+ 4 3 6 +2 2+ + 2++123 ++ 1+1+1292411+	40	35
1304	21	1++ + ++ + + 2+ 2 ++ +++ +1 ++ + +2++++ + + + 1+ +1+++	39	22
1370	72	C1 B864+A+ 1A2484 46 4 5C 387+ 9945 3 L+14375 +3+	39	33
1316	33	+ 431 2 2+ 26113 52 +2 2 26 42 + 41 2 2+ 1 2 ++ ++ 2 1 +4 ++	39	35
1338	59	+ ++++++ ++ ++ ++ + + + + + +++ ++ +++++ ++ +++ +++ ++	39	33
1302	19	+ + ++ + + 1 + + + 2+ 2+1 + + 2 +++ +13 + ++11217 ++1 +A4+ ++	38	37
1352	150	3 241 2+34211 7193 1 84 D 33+ 2 + + + +1 +1 + 4 Q ++ +1	37	31
1416	121	+ ++ + + +1+ + 1 + ++ 2 +13 +++ ++ +52+ +++ + 1 1++ 14 +	36	34
1434	120	+ ++++ 12 +++ +2+ +++ 22+ 2 544 332 ++ 2 + + ++ 1+ 3	36	29
1346	77	4 7 1GDK4D2 1 2++ 4 3+ +21 3 + 2+3 2 1 3 6 2 774+7	35	37
1363	62	+1 1 +3 + + ++ + + + +++ +++ ++ +2 ++ ++++ + + 1+ 1 ++	34	38
1393	107	+++ + + +1++ + 1++++ 2 2 + +11 + ++ +1+ + ++ + ++	33	29
1298	15	1 ++ 2 1+ ++ + + + + + ++++ ++ ++++ + ++ ++ 2+ +	33	40
1325	41	+ + + + ++ + + +1 + + + + + + 1 ++ +++ ++ +++++++	32	33
1519	205	21 2 251+13+23 + +2C4 + +1 +11 + 1 + 1 ++ + ++	32	33
1685	124	12223 17221 323 111244 4 + 261 + 3 2 3 + 2 5	31	31

a	b	Relevé data	c	d
1313	30	+ +++ + + +1 + + ++ + ++ + +21 + + +2 + + + +++ +	31	34
1387	90	2 2311 2332 2 22+A 2 212 112 + 12 + 1 + + 1 1	30	27
1447	167	+ 1 2 +++ 1 + 1 + + ++ ++ ++++++ 1 + + + +	28	38
1462	131	+ 8+ 2 + 1+215+ 4 433 +1+ +1 + ++ 1 +3+	28	31
1342	54	3 2 5 645 153 3 2 8 2+ 1 42 + 32 252 +23 5 +	28	43
1329	44	+ +++ + 1 + 1 3 +1+ ++ + + + + + + + 1 + + +	28	44
1320	37	+ + +++ 1 + 2 + 1+ + ++ 1 + ++2 +21 ++1+	28	44
1486	153	1 1 2 A7938 843 8C9 1 7 A9 77 4 3367 4 1	27	24
1345	80	+++ ++ ++ 1 + + +++++ ++2++ + 1+ + +	26	34
1533	193	+ 1+ + 121+ 2+123 1 322 1 + + + 4 + 2 2	26	37
1315	32	+ + 1++ + 3 +1 + +++ 2 1 + +2 + + 2 1 + + ++	26	42
1343	55	+1 21+1+214 2 + 2+ + 1 + + + 2 1 +1 +	26	43
1350	188	3 2 G 5 43 24 5 2 4 65 2 61 1 46 7 5 9 9A 4	25	44
1432	129	+ + + + ++ 4 + 3 1 21 34 1 1522 + 2 ++	25	38
1324	85	+2 + +1 +1 + + +1 1233++ 1+ ++ 2 1 +	25	46
1417	128	++ + 1 + + ++1 + +83 + + 1+ ++ + + + 1 + 1	25	41
1435	130	+31+ ++++++++ +1 1 + 1 ++ + + ++	25	46
1425	134	+ 1 +++ + + +2 + + + + + +1 + + + +	23	36
1394	102	332+6 +3 152 2 B 3 13 + 1 + 1 3+2	23	37
1441	99	5 3 +++ 3 + +1 + ++ ++2 2+1+ 2 + + 1	23	46
1360	66	+ 4 ++ + ++ +++++ ++ + + +++ +	21	44
1368	65	++ 1 ++ + + + ++ +1 ++ ++ 1+ 1	21	48
1327	43	++++ ++ + 1 + + ++ 1+ 3 + 1+1 1 +	21	53
1446	142	++ +++ ++ 442 2 + + 1 1 2 + + + + +	21	49
1376	82	++ + +++ + + + + +++ +1+ + ++ ++	21	45
1421	116	1 + 13 1 + ++ ++ + + ++ ++ + + + +	20	18
1439	137	+ + + + 2 + ++ + + + + + + + +	20	38
1361	61	2+ + 2+131++1+ + 3 + + + + + +	20	52
1356	68	+ + ++ + + + + ++ + + + + + + + ++ +	20	50
1389	83	+ 1 + + 1 + +1 + 1 + 11 + + + + +	19	45
1577	254	7 8 D49B C 56 3 6 15 723 1 35	19	44
1288	5	51 ++ 2 3 + +2 4 + 5 1 + 2+1 1	19	42
1362	74	1+ + 1 ++ 1 + ++ 1 + + ++++ +	19	50
1292	9	+ 1 + ++ +++ + + ++ ++ + + + 1	19	54
1347	57	2++1 +++2 2 2 1 9 2 1 + 3 3 1	19	53
1328	73	+ + + ++ ++ + + + + 1++ +5 +	19	54
1364	64	+ + + + + + + + 1 ++ +2 + + + ++	18	51
1482	148	+ + 4 631 + + 1 2 + 1 2 + +	18	48
1353	139	++ ++ + ++ +11 + ++ ++++	18	46
1450	146	+ + ++ + + + + + + +1+ + + +	17	47
1453	157	++ ++ + + 1 + + + ++ + +	17	40
1598	268	6+32 + 213 +33 2 41 2 1+	17	5
1372	114	++ + + + +3 + 22 2+ 12 + ++	17	15
1344	56	++ 2 4 1 1+ + + ++ + 2 + + ++	17	41
1366	70	+ + + + ++ ++++ ++ ++ ++	17	51
1367	71	1+ + + + + + ++ +1 1 + +++	17	54
1408	117	+ 1 + + 4 + + + + +1+ + +	17	45
1382	95	++ + + + + ++ +++ + + +	16	44
1521	281	B4 3 + A3A2C 3 9 6 2 26 2	16	15
1333	48	+1 2 + + + + +1 1 1 + + ++	16	57
1429	126	+++ 2 + 1+ ++ + + + ++	15	19
1299	16	+ 7 4H + 1 6+ 21 ++ 6 1 +	15	53
1363	36	+ + + + + + + + + +++	15	47
1286	3	++ + 1 2 + ++ + + + + + +	15	54
1337	144	+ +++ 2+ + + 1 + ++ 1 ++	15	55
1407	140	+7 1+ ++1 ++ + + + + + +	15	55
1488	216	+ 3 4 21 + 1 1 2 +++	14	31
1413	112	++ + + + + ++++ + 1 +	14	23
1443	133	1 ++ 2++ + + + + ++ + 1	14	41
1395	104	++ + + + + + + + + + ++	13	33
1357	58	++ +++ 2 1 + ++1 + +	13	52
1481	152	++3 + + 5 1+ ++ ++ +	13	38
1414	113	+++ + + + +1+ ++ +	13	18
1442	136	+ +4 1 3 ++ ++22 1 +	13	20
1537	220	54 7 1 9 25 + 2 2++	12	12
1349	67	++ 2 + + + 2 + + +	12	46
1322	39	+ + ++ 1 + ++ 1 + + + +	12	58
1436	127	++ + + + + + + + +	12	49
1503	194	++ +++ + + + + + + +	12	41
1690	274	+ 2 2 7 1 + 1 3 5 1+	11	20
1398	106	+ + + + ++ + +++++	11	52
1336	141	1 ++ + + 1 + ++ + 1	11	57
1409	232	2 1 21 + + + + 5 +	11	50
1516	213	+++ ++ + + + + +	11	45
1461	176	1+ 4 3+ + + 2 + 1+	11	54
1458	145	1 + + + + ++1+	11	48
1427	215	1 ++ + + 3 3 2 1	10	13
1529	212	+ ++ + + + + ++	10	33
1608	284	+ + ++ + +++ +	9	51
1523	211	+ 2 + + 2 + + +	9	23
1571	251	+ + 1 1 1 + +3	9	11
1314	31	++ ++ ++ + +	9	47
1686	195	++ ++ + + ++	9	40
1505	197	3++ +1+ + ++	9	45
1351	190	+++11 + + 1	9	45
1637	214	1 + + 1 3 ++ + +	9	33
1464	143	+ + + + 1 + ++	8	64
1339	52	+++ + + + + +	8	58
1308	25	+ + + + + + + +	8	63
1437	132	+ + + + + + + +	8	43
1535	237	+ ++ + + + + +	8	45
1483	149	++ + + + +	7	26
1579	98	+ ++ 1 + +7	7	45
1454	172	+1 + + + +	7	35
1467	182	+ + + 2 +1 +	7	22
1551	238	+ + + + + + +	7	26
1603	278	+ 2 + 4 3+ +	7	18
1565	282	2 + +3 21	6	13
1473	156	++ + + + +	6	63
1449	168	+ 1 + ++	[illegible]	[illegible]
1311	28	+ + + + 1 + +	6	49
1694	307	1 + 1 + 1	5	36
1444	165	2 1 + 81	5	54
1631	303	2 1 1 2 1	5	28
1540	221	+ + 2 + +	5	37
1365	69	+ + + +	5	65
1476	186	+ + + + +	5	32
1448	170	+ + + + +	5	50
1653	319	1 + 12 +	5	10
1628	298	+ + + ++	5	17
1466	177	+ + + + +	5	37
1655	323	32+ + + +	5	11
1695	325	1 + ++	4	16
1688	231	+ ++ 2	4	33
1547	228	+ + + +	4	51
1509	207	+ + ++	4	37
1522	208	+ + + +	4	20
1451	171	12 1 +	4	47
1604	275	+ + + +	4	14
1574	257	1 + + +	4	36
1381	79	+ 7 + +	4	61
1616	333	+ + + +	4	16
1591	270	9 4 1 1	4	4
1600	276	+ 1 + +	4	6
1592	266	+ + +	3	13
1668	334	3 2 1	3	9
1520	204	+ 2 1	3	20
1563	246	3 + +	3	26
1400	187	+ + +	3	39
1568	250	+ + +	3	31
1538	225	+ + +	3	4
1642	314	+ +	2	1
1619	312	1 6	2	2
1576	224	+ +	2	5
1663	338	+ +	2	5
1399	234	1 3	2	4
1636	306	+ +	2	1
1670	341	1 +	2	1
1652	321	+ +	2	10
1557	240	+ +	2	10
1455	330	2 +	2	9
1465	179	+ +	2	8
1463	181	1 1	2	45
1635	305	+ +	2	13
1590	269	+ 2	2	13
1492	161	+ +	2	27
1504	196	+ +	2	43
1499	191	+ +	2	40
1589	273	+ 1	2	9
1526	209	+ +	2	19
1692	299	2 +	2	8
1489	162	4 +	2	57
1485	155	+ +	2	32
1527	247	+ 3	2	1
1539	223	+ 3	2	15
1524	210	+	1	0
1506	198	+	1	0
1599	300	+	1	0
1634	301	1	1	0
1630	302	1	1	0
1561	244	+	1	0
1693	304	+	1	0
1513	199	+	1	0
1310	27	+	1	0
1433	180	+	1	0
1478	147	+	1	0
1639	309	+	1	0
1490	160	1	1	0
1460	175	+	1	0
1470	184	+	1	0
[illegible]	313	+	1	0
1567	252	+	1	0
1646	315	+	1	0
1648	316	+	1	0
1575	253	+	1	0
1645	318	+	1	0
1601	279	+	1	0
1651	320	+	1	0
1541	219	+	1	0
1412	118	+	1	0
1580	256	+	1	0
1609	283	+	1	0
1525	206	+	1	0
1582	258	+	1	0
1658	327	+	1	0
1566	328	3	1	0
1659	329	8	1	0
1457	166	1	1	0
1660	331	+	1	0
1469	178	+	1	0
1614	288	1	1	0
1584	261	+	1	0
1618	290	+	1	0
1667	336	+	1	0
1613	291	H	1	0
1546	292	+	1	0
1665	339	+	1	0
1396	100	+	1	0
1548	239	+	1	0
1422	122	+	1	0
1672	343	[illegible]	1	0
1587	264	[illegible]	1	0
1696	345	[illegible]	1	0
[illegible]	265	[illegible]	1	0
1559	241	[illegible]	1	0
[illegible]	[illegible]	[illegible]	1	0
[illegible]	[illegible]	[illegible]	1	0
[illegible]	[illegible]	[illegible]	1	0
[illegible]	[illegible]	[illegible]	1	0
[illegible]	[illegible]	[illegible]	1	0
[illegible]	353	[illegible]	1	0
e		2444455446534567877 8756547 7 777 786 7 66 65 7874 766646864 4467764655445655355444433		
		3011136461843475612 1262789 4 221 527 2 05 85 1209 859008028 35363676419064532983399 7		

Table 4.2 The point canopy intercept method's working table showing relevé groups delimited programmatically. SU's = 3032, Eff. = 64% (*a* = specimen number; *b* = species code; *c* = species frequency; *d* = number of SU's; and *e* = species frequency per releve).

Relevé numbers

a	*b*	15 6777377 6463042513	36646462 667 3413048387659	2 5 212	36555 762103	44 98	545444321 977621241	221 6 01029	2131 11212 33 2152334631455 53423898775184645979050558 6	*c*	*d*
1671	206	++ +								3	1
1408	92	+1								2	0
1423	135	+ +								2	1
1388	203	11								2	0
1380	205	11								2	0
1404	48	+ +								2	1
1432	62		+++ + +						+	6	33
1392	63		+ + 1 +							4	6
1429	66		+ + +							3	7
1668	193		3 +							2	3
1449	196		1+							2	0
1669	197		13							2	0
1427	202		+ +							2	4
1550	130		+ 1		+					3	15
1537	153		16							2	0
1416	64		+ +				+			3	18
1486	136	+ 11	15 + 5 2 3		+		1			11	26
1372	49	+1 + 3	+ 41							7	12
1441	77	+1+ +	+		+		1		4	8	40
1306	14			+1						2	0
1387	166				++ +		+			4	4
1386	172				++					2	0
1523	137		+		+ +					3	6
1316	4			12	2 1		+	1		6	14
1462	132		++ +	+	1++				1	8	29
1521	157		1 + 2		++ 2		4			7	20
1418	54	11 1	+++	+	+ ++					10	18
1377	61	++	1 +++ +		++			+	+	11	45
1368	55				+ +	++				4	4
1409	150				+		+2			3	7
1565	162						1+			2	0
1455	159						+ +			2	2
1533	126					1	+ +			3	5
1439	112						+ +			2	5
1343	148					1+	3+ +			5	3
1352	128	1	+ 4	2	1+	+1	+13 J			12	26
1353	73							+++		3	0
1320	31								1 2 +1 + + 12+	9	9
1356	34	+					+		++ + ++ +	8	53
1345	40				+				+ + + 2 + +	7	29
1391	44								1 + +++	5	2
1341	47								2 ++ 1 3	5	6
1367	80								++++	4	0
1324	94							+	+ + + +	5	22
1370	118						G		+ 5 1 3	5	32
1337	133								+ + +	3	16
1371	42								++	2	0
1361	143								+ 1	2	5
1488	81								+ +	2	17
1358	100								++	2	0
1355	32							+	++	3	8
1389	39		+						+ +	3	42
1461	113						2		+ +	3	25
1581	142						+		+ 3	3	26
1284	22					+	1	1+	+1 1 2+ ++ 21 1+ 1 + 3	18	23
1302	69		+	+				+1	+1 1+ + 1 21	12	32
1327	27						+	1 +	+ + + ++ + ++	11	22
1347	41						+ +		+ + + + +	7	23
1447	85						++1	+	++	6	9
1333	26						1 +	++	++	6	7
1330	24	+	++ 1	1 +	+	+1	+ 1+	+2 2	1+ 11 ++ 21 441 ++4 4	30	36
1287	16		+ + +1	+2	A		16	+1	+5 2 1+ ++ 11+1+ 544 1+ 1	29	36
1296	1		++ + 1	2			1 ++ 3+ +	1A	59+7 1+ ++1 ++123 +	28	30
1346	37	3	+ 1	+	+ +		+ 4 32 A		1 + +32 +81 2125+ C	25	49
1359	67		++ +1 +	+		++	+ +		+ 1++	14	27
1317	43	+22+ 1	1++214+++ +24	3	44+2++	44	5315 113	+11	1232 2+1 311++1 11 1 4 B+3	56	19
1293	10	7+21 +1	3+ ++++ +++2	143	3 +32		1 1 111	+2	7 + ++ 1211++++3+ +	45	23
1321	33	++3 1 +	11 1 11+14+2	2	3264	1	12+ 1+++	+++	1+ 1+ + 1+ ++1 2 51	44	29
1295	36	131 1+	2 + 44194 +1	3	+ + 1	+	554	846 1	+1+ +319573 643+ 2+1	43	27
1289	2	1+3+	1 11 +1++ + 1	+21	++++	1	+ +22	+11	+ 211 7 + 1+211 ++	41	26
1300	23	++	++ + +	+	1+ 1	++	++22	++++	+++ + 11 ++ 11411+1	35	29
1285	17	F ++1 ++	+ + + +1+	1	+		+ 1	1 5	+ + 2+++1+++ + ++ 1 1	33	41
1291	5	+313 211	+1 1+ 1 3	12	+ ++ +		1	1 1	+1+ 22+ 11	30	31
1331	29	+ +	+ +	+		+	++ +	1++++	+ + + 1 ++ 1+ 2	23	46
1303	8	++	+	++			++	1+2	+ + + 22+ ++11+ + +	23	44
1290	7	1++1+ 1	+ ++ + + 1	1+	2 ++			7	+++	21	36
1312	21	+ +	+ +	++	+1			1	11 6 ++ 1 1+ + + +	20	49
1297	19	1 1	++1 ++2	++	+3		+		+ + + +	17	53
1294	15	++ 1+++	2	++			+	+1	++ 1 +	16	41
1323	28	+ +	+ +	1			+	++	3+ 11 ++	14	44
1338	57		++ +	+			+	+	+ + + +++	12	38
1342	38	1 1	3 1	+	2		+1		22 +	11	50
1426	96	2+ +	+				+ +	++ +	+ 1	11	42
1309	6	+ +	1 +	+	+	+	++1			10	23
1428	52	+	+4+ 1	+	7 +			+ +		10	33
1329	30	+ +	++		1	+	+	+	+ +	10	55
1379	97	+ 1+							+ 1 + + +	8	52
1350	104		23 8					6	1 5 1+	8	47
1288	45		1 1+						+ +++ +	8	44
1304	20	1 +	+	++	+	+		+		8	33
1577	138		8 211		7	4A				7	13
1375	65		2 +	1	+	1	+ +			7	13
1393	171	+	++		+++	+				7	25
1360	58	+	+			+		+	++ +	7	48
1344	89	+ 1	+						+ ++	6	62
1315	3	+ +		+			+	1 +		6	35
1299	120				1 3	5	2		+ 1	6	37
1685	124		+		1 2		+ + 2			6	14
1318	13	+	+	+			+	+	+	6	46
1301	53	+	+		+				++ +	6	46
1519	140	7	1		+		1+			5	30
1435	141				+		+		+ + +	5	35
1363	82		+		+				+2+	5	28
1487	79						+1+		3 3	5	35
1446	68				+	+		+	+ +	5	37
1434	60		1 +	+	+		+			5	13
1328	51	+	+					+ 2 +		5	41
1407	75				1		++		1 +	5	37
1413	105	++		+				+	+	5	39
1351	99					+	+		1 +	4	30
1298	103	++			+			+		4	36
1364	56		+		+			+	+	4	41
1357	35					+	+		+ 1	4	35
1292	11		+	+1				+		4	25
1598	178	+	+ +		1					4	19
1603	154		++		++					4	14
1458	72						+	+	+ +	4	23
1459	119			+		+			+	3	28
1314	9			+			+		+	3	27
1313	108		+	1	+					3	12
1510	167	+				1				2	31
1444	84	+							2	2	48
1473	93	+					+			2	38
1366	101						+		+	2	13
1474	176		1	2						2	12
1556	151				1		1			2	6
1557	127				+		+			2	9
1443	74				+		+			2	10
1336	71							+	+	2	14
1369	123				+				+	2	31
1563	131								+	1	0
1307	25							+		1	0
1403	50	+								1	0
1527	134	+								1	0
1433	88								+	1	0
1483	76						+			1	0
1464	90								+	1	0
1395	106							+		1	0
1362	139				+					1	0
1512	107							+		1	0
1402	91	1								1	0
1335	109			+						1	0
1518	110			+						1	0
1475	144								+	1	0
1589	145						+			1	0
1593	146						+			1	0
1594	147						1			1	0
1384	111		+							1	0
1588	149						+			1	0
1319	18			+						1	0
1489	78								2	1	0
1385	152		+							1	0
1286	12			+						1	0
1348	114								+	1	0
1562	155								+	1	0
1574	156								+	1	0
1514	115								1	1	0
1613	158						7			1	0
1453	116								+	1	0
1615	160						1			1	0
1505	161						+			1	0
1383	117								+	1	0
1515	163						1			1	0
1596	164						+			1	0
1394	165						4			1	0
1481	83								1	1	0
1400	95								+	1	0
1530	168					1				1	0
1686	169					+				1	0
1322	170					+				1	0
1325	70							+		1	0
1482	121								+	1	0
1349	173				+					1	0
1405	174				+					1	0
1635	175				+					1	0
1554	122								2	1	0
1621	177			+						1	0
1334	59		+							1	0
1646	179				+					1	0
1644	180				+					1	0
1591	181				5					1	0
1645	182				+					1	0
1571	183	1								1	0
1431	184	5								1	0
1631	185	1								1	0
1542	186	+								1	0
1326	187								+	1	0
1656	188						+			1	0
1659	189						4			1	0
1507	190						1			1	0
1529	191		+							1	0
1538	192		1							1	0
1450	98								+	1	0
1477	194	+								1	0
1637	195								+	1	0
1471	125						+			1	0
1457	86								+	1	0
1414	198		+							1	0
1600	199		+							1	0
1442	200		+							1	0
1653	201		2							1	0
1396	46								+	1	0
1398	87								+	1	0
1476	204	+								1	0
1520	129		2							1	0
1410	102								+	1	0
1454	207	+								1	0
1373	208	+								1	0
1546	209	+								1	0
1517	210	+								1	0
1674	211	1								1	0
1655	212		+							1	0
e		111111111 7235597851	11111111111211 8353287985289	221 318	111311 056099	12 52	1211 2211 122782553	12211 82241	2111112111112111121111 111 595969386489084327724930176		

Table 4.5 The quadrat method's working table showing relevé groups adjusted for scale. SU's = 8228, Eff. = 54% (a = specimen number; b = species code; c = species frequency; d = number of SU's; and e = species frequency per relevé).

a	b	Relevé numbers	c	d
1581	260	[illegible]	4	26
1475	163	[illegible]	3	0
1480	154	[illegible]	3	2
1494	164	[illegible]	2	0
1586	259	[illegible]	2	1
1578	255	[illegible]	2	4
1657	326	[illegible]	2	0
1351	190	[illegible]	9	45
1612	287	[illegible]	4	0
1547	228	[illegible]	4	51
1610	285	[illegible]	3	0
1621	293	[illegible]	2	0
1620	295	[illegible]	2	1
1399	234	[illegible]	2	4
1583	262	[illegible]	3	11
1585	286	[illegible]	4	3
1340	51	[illegible]	12	62
1515	202	[illegible]	10	46
1551	238	[illegible]	7	26
1603	278	[illegible]	7	18
1655	323	[illegible]	5	11
1647	317	[illegible]	3	3
1538	225	[illegible]	3	4
1588	267	[illegible]	3	4
1661	332	[illegible]	3	7
1556	236	[illegible]	4	12
1591	270	[illegible]	4	4
1695	325	[illegible]	4	16
1638	311	[illegible]	2	0
1593	271	[illegible]	2	0
1606	322	[illegible]	2	0
1641	310	[illegible]	2	0
1662	335	[illegible]	2	0
1666	337	[illegible]	2	0
1592	266	[illegible]	3	13
1576	224	[illegible]	2	5
1636	306	[illegible]	2	1
1663	338	[illegible]	2	5
1619	312	[illegible]	2	2
1642	314	[illegible]	2	1
1596	272	[illegible]	10	6
1562	245	[illegible]	7	26
1622	294	[illegible]	7	20
1510	297	[illegible]	5	12
1542	227	[illegible]	16	12
1503	194	[illegible]	12	41
1558	242	[illegible]	9	11
1530	217	[illegible]	10	48
1565	282	[illegible]	6	13
1685	124	[illegible]	31	31
1487	158	[illegible]	12	20
1550	243	[illegible]	13	46
1385	89	[illegible]	8	22
1671	342	[illegible]	7	2
1518	277	[illegible]	6	4
1605	280	[illegible]	7	18
1467	182	[illegible]	7	22
1600	276	[illegible]	4	6
1466	177	[illegible]	5	37
1380	76	[illegible]	4	7
1572	248	[illegible]	3	4
1669	344	[illegible]	3	1
1670	341	[illegible]	2	1
1568	250	[illegible]	3	31
1410	308	[illegible]	3	7
1679	346	[illegible]	2	0
1668	334	[illegible]	3	9
1678	347	[illegible]	2	0
1644	340	[illegible]	2	0
1486	153	[illegible]	27	24
1418	249	[illegible]	22	2
1598	268	[illegible]	17	5
1414	113	[illegible]	13	18
1537	220	[illegible]	12	12
1442	136	[illegible]	13	20
1405	115	[illegible]	12	19
1488	216	[illegible]	14	31
1427	215	[illegible]	10	13
1523	211	[illegible]	9	23
1637	214	[illegible]	9	33
1653	319	[illegible]	5	10
1483	149	[illegible]	7	26
1628	298	[illegible]	5	17
1694	307	[illegible]	5	36
1616	333	[illegible]	4	16
1687	222	[illegible]	17	3
1431	226	[illegible]	14	9
1322	39	[illegible]	12	58
1690	274	[illegible]	11	20
1571	251	[illegible]	9	11
1608	284	[illegible]	9	51
1454	172	[illegible]	7	35
1521	281	[illegible]	16	15
1474	185	[illegible]	22	44
1481	152	[illegible]	13	38
1402	108	[illegible]	11	53
1378	81	[illegible]	3	2
1420	123	[illegible]	8	15
1404	110	[illegible]	6	17
1386	96	[illegible]	21	26
1372	114	[illegible]	[illegible]	[illegible]
1429	126	[illegible]	[illegible]	[illegible]
1425	125	[illegible]	[illegible]	[illegible]
1529	212	[illegible]	[illegible]	[illegible]
1421	116	[illegible]	[illegible]	[illegible]
1363	62	[illegible]	[illegible]	[illegible]
1393	107	[illegible]	[illegible]	[illegible]
1326	42	[illegible]	[illegible]	[illegible]
1319	36	[illegible]	[illegible]	[illegible]
1398	106	[illegible]	[illegible]	[illegible]
1401	173	[illegible]	[illegible]	[illegible]
1459	174	[illegible]	[illegible]	[illegible]
1511	201	[illegible]	[illegible]	[illegible]
1335	50	[illegible]	[illegible]	[illegible]
1544	229	[illegible]	[illegible]	[illegible]
1512	200	[illegible]	[illegible]	[illegible]
1689	230	[illegible]	[illegible]	[illegible]
1445	169	[illegible]	[illegible]	[illegible]
1403	111	[illegible]	[illegible]	[illegible]
1397	105	[illegible]	[illegible]	[illegible]
1374	75	[illegible]	[illegible]	[illegible]
1348	138	[illegible]	[illegible]	[illegible]
1477	189	[illegible]	[illegible]	[illegible]
1390	97	[illegible]	[illegible]	[illegible]
1379	91	[illegible]	[illegible]	[illegible]
1384	87	[illegible]	[illegible]	[illegible]
1305	22	[illegible]	[illegible]	[illegible]
1388	93	[illegible]	[illegible]	[illegible]
1334	49	[illegible]	[illegible]	[illegible]
1514	192	[illegible]	[illegible]	[illegible]
1358	101	[illegible]	[illegible]	[illegible]
1517	203	[illegible]	[illegible]	[illegible]
1306	23	[illegible]	[illegible]	[illegible]
1291	8	[illegible]	[illegible]	[illegible]
1290	7	[illegible]	[illegible]	[illegible]
1294	11	[illegible]	[illegible]	[illegible]
1428	119	[illegible]	[illegible]	[illegible]
1323	40	[illegible]	[illegible]	[illegible]
1375	88	[illegible]	[illegible]	[illegible]
1377	78	[illegible]	[illegible]	[illegible]
1288	5	[illegible]	[illegible]	[illegible]
1426	135	[illegible]	[illegible]	[illegible]
1453	157	[illegible]	[illegible]	[illegible]
1413	112	[illegible]	[illegible]	[illegible]
1341	94	[illegible]	[illegible]	[illegible]
1353	53	[illegible]	[illegible]	[illegible]
1371	84	[illegible]	[illegible]	[illegible]
1349	67	[illegible]	[illegible]	[illegible]
1391	92	[illegible]	[illegible]	[illegible]
1295	12	[illegible]	[illegible]	[illegible]
1304	21	[illegible]	[illegible]	[illegible]
1313	30	[illegible]	[illegible]	[illegible]
1301	18	[illegible]	[illegible]	[illegible]
1315	32	[illegible]	[illegible]	[illegible]
1350	188	[illegible]	[illegible]	[illegible]
1307	24	[illegible]	[illegible]	[illegible]
1435	134	[illegible]	[illegible]	[illegible]
1360	66	[illegible]	[illegible]	[illegible]
1355	60	[illegible]	[illegible]	[illegible]
1389	83	[illegible]	[illegible]	[illegible]
1577	254	[illegible]	[illegible]	[illegible]
1344	56	[illegible]	[illegible]	[illegible]
1366	70	[illegible]	[illegible]	[illegible]
1450	146	[illegible]	[illegible]	[illegible]
1382	95	[illegible]	[illegible]	[illegible]
1299	16	[illegible]	[illegible]	[illegible]
1443	133	[illegible]	[illegible]	[illegible]
1395	104	[illegible]	[illegible]	[illegible]
1357	58	[illegible]	[illegible]	[illegible]
1336	141	[illegible]	[illegible]	[illegible]
1458	145	[illegible]	[illegible]	[illegible]
1318	35	[illegible]	[illegible]	[illegible]
1325	41	[illegible]	[illegible]	[illegible]
1387	90	[illegible]	[illegible]	[illegible]
1447	167	[illegible]	[illegible]	[illegible]
1462	131	[illegible]	[illegible]	[illegible]
1345	80	[illegible]	[illegible]	[illegible]
1533	193	[illegible]	[illegible]	[illegible]
1439	137	[illegible]	[illegible]	[illegible]
1317	34	[illegible]	[illegible]	[illegible]
1321	38	[illegible]	[illegible]	[illegible]
1289	6	[illegible]	[illegible]	[illegible]
1300	17	[illegible]	[illegible]	[illegible]
1285	2	[illegible]	[illegible]	[illegible]
1293	10	[illegible]	[illegible]	[illegible]
1309	26	[illegible]	[illegible]	[illegible]
1296	13	[illegible]	[illegible]	[illegible]
1312	29	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1437	132	[illegible]	8	43
1535	237	[illegible]	8	45
1464	143	[illegible]	8	64
1339	52	[illegible]	8	58
1308	25	[illegible]	8	63
1552	235	[illegible]	7	34
1579	98	[illegible]	7	45
1495	218	[illegible]	6	36
1471	183	[illegible]	6	41
1473	156	[illegible]	6	63
1449	168	[illegible]	6	39
1311	28	[illegible]	6	49
1691	263	[illegible]	5	16
1484	151	[illegible]	5	14
1444	165	[illegible]	5	54
1631	303	[illegible]	5	28
1540	221	[illegible]	5	37
1365	69	[illegible]	5	65
1476	186	[illegible]	5	32
1448	170	[illegible]	5	50
1656	324	[illegible]	4	15
1688	231	[illegible]	4	33
1332	47	[illegible]	4	30
1509	207	[illegible]	4	37
1522	208	[illegible]	4	20
1451	171	[illegible]	4	47
1604	275	[illegible]	4	14
1574	257	[illegible]	4	36
1381	79	[illegible]	4	61
1491	159	[illegible]	3	22
1554	233	[illegible]	3	9
1520	204	[illegible]	3	20
1563	246	[illegible]	3	26
1400	187	[illegible]	3	39
1615	289	[illegible]	2	2
1507	296	[illegible]	2	3
1652	321	[illegible]	2	10
1557	240	[illegible]	2	10
1455	330	[illegible]	2	9
1465	179	[illegible]	2	8
1463	181	[illegible]	2	45
1635	305	[illegible]	2	13
1590	269	[illegible]	2	13
1492	161	[illegible]	2	27
1504	196	[illegible]	2	43
1499	191	[illegible]	2	40
1589	273	[illegible]	2	9
1526	209	[illegible]	2	19
1692	299	[illegible]	2	8
1489	162	[illegible]	2	57
1485	155	[illegible]	2	32
1527	247	[illegible]	2	1
1539	223	[illegible]	2	15
1524	210	[illegible]	1	0
1506	198	[illegible]	1	0
1599	300	[illegible]	1	0
1634	301	[illegible]	1	0
1630	302	[illegible]	1	0
1561	244	[illegible]	1	0
1693	304	[illegible]	1	0
1513	199	[illegible]	1	0
1310	27	[illegible]	1	0
1433	180	[illegible]	1	0
1478	147	[illegible]	1	0
1639	309	[illegible]	1	0
1490	160	[illegible]	1	0
1460	175	[illegible]	1	0
1470	184	[illegible]	1	0
1643	313	[illegible]	1	0
1567	252	[illegible]	1	0
1646	315	[illegible]	1	0
1648	316	[illegible]	1	0
1575	253	[illegible]	1	0
1645	318	[illegible]	1	0
1601	279	[illegible]	1	0
1651	320	[illegible]	1	0
1541	219	[illegible]	1	0
1412	118	[illegible]	1	0
1580	256	[illegible]	1	0
1609	283	[illegible]	1	0
1525	206	[illegible]	1	0
1582	258	[illegible]	1	0
1658	327	[illegible]	1	0
1566	328	[illegible]	1	0
1659	329	[illegible]	1	0
1457	166	[illegible]	1	0
1660	331	[illegible]	1	0
1469	178	[illegible]	1	0
1614	288	[illegible]	1	0
1584	261	[illegible]	1	0
1618	290	[illegible]	1	0
1667	336	[illegible]	1	0
1613	291	[illegible]	1	0
1546	292	[illegible]	1	0
1665	339	[illegible]	1	0
1396	100	[illegible]	1	0
1548	239	[illegible]	1	0
1422	122	[illegible]	1	0
1672	343	[illegible]	1	0
1587	264	[illegible]	1	0
1696	345	[illegible]	1	0
1594	265	[illegible]	1	0
1559	241	[illegible]	1	0
1674	348	[illegible]	1	0
1680	349	[illegible]	1	0
1681	350	[illegible]	1	0
1683	351	[illegible]	1	0
1682	352	[illegible]	1	0
1684	353	[illegible]	1	0
e		[illegible] …565355444433 / [illegible] …545329833997		

Table 4.6 The point canopy intercept method's working table showing relevé groups adjusted for scale. SU's = 3032, Eff. = 64% (*a* = specimen number; *b* = species code; *c* = species frequency; *d* = number of SU's; and *e* = species frequency per releve).

Relevé numbers

a	*b*	15 64	677737736646462 667 2 63042513341304838765921	5 3655544 276210398	54544 97762	4321221 6 124101029	2131 11212 33 2152 534238987751846459	334631455 790505586	*c*	*d*
1408	92	+1							2	0
1486	136		+ 11 15 + 5 2 3	+		1			11	26
1372	49		+1 + 3 + 41						7	12
1432	62		+++ + +				+		6	33
1441	77		+1+ + +	+		1	4		8	40
1392	63		+ + 1 +						4	6
1671	206		++ +						3	1
1598	178		+ + +	1					4	19
1429	66		+ + +						3	7
1292	11		+ +1			+			4	25
1668	193		3 +						2	3
1449	196		1+						2	0
1669	197		13						2	0
1427	202		+ +						2	4
1423	135		+ +						2	1
1388	203		11						2	0
1380	205		11						2	0
1550	130		+ 1	+					3	15
1404	48		+ +						2	1
1313	108		+ 1	+					3	12
1306	14		+1						2	0
1537	153		16						2	0
1416	64		+ +			+			3	18
1368	55			+ + ++					4	4
1387	166			++ +	+				4	4
1386	172			++					2	0
1459	119			+ +			+		3	28
1523	137		+	+ +					3	6
1418	54		11 1 +++	++ ++					10	18
1377	61		++ 1 +++ +	++		+	+		11	45
1304	20		1 + + +	+ + +		+			8	33
1577	138		8 211	7 4A					7	13
1462	132		++ +	+ 1++			1		8	29
1521	157		1 + 2	++ 2	4				7	20
1393	171	+	++	++++					7	25
1375	65		2 +	1 + 1	+	+			7	13
1603	154		++	++					4	14
1434	60		1 +	+ +	+				5	13
1409	150			+	+2				3	7
1565	162				1+				2	0
1455	159				+ +				2	2
1343	148			1+	3+	+			5	3
1685	124		+	1 2	+ +	2			6	14
1299	120			1 3 5	2		+	1	6	37
1352	128	1	+ 4	2 1+ +1	+13 J				12	26
1309	6		+ + 1 + +	+ +	++1				10	23
1353	73					+++			3	0
1328	51		+ +			+ 2 +			5	41
1428	52		+ +4+ 1+	7 +		+ +			10	33
1329	30		+ + ++	1 +		+ +	+	+	10	55
1320	31						1 2 +1 + + 12+		9	9
1356	34		+		+		++ + ++ +		8	53
1345	40			+			+ + + 2 + +		7	29
1391	44						1 + +++		5	2
1341	47						2 ++ 1 3		5	6
1367	80						++++		4	0
1355	32					+	++		3	8
1358	100						++		2	0
1337	133						+ +	+	3	16
1371	42						++		2	0
1333	26					1 + ++	++		6	7
1447	85				++1	+	++		6	9
1291	5		+313 211+1 1+ 1 312	+ ++ +		1 1 1	+1+ 22+ 11		30	31
1290	7		1++1+ 1 + ++ + + 11+	2 ++		7	+++		21	36
1294	15		++ 1+++ 2++			+ +1	++ 1 +		16	41
1359	67		++ +1 ++	++	+	+	+ 1++		14	27
1323	28		+ + + + 1			+ ++	3+ 11 ++		14	44
1302	69		+ +			+1	+1 1+ + 1 21		12	32
1338	57		++ ++			+ +	+ + + ++	+	12	38
1426	96		2+ + +			+ + ++ +	+ 1		11	42
1342	38	1	1 3 1	+ 2	+1		22 +		11	50
1361	143							+ 1	2	5
1324	94					+	+ +	+ +	5	22
1370	118				G		+ 5	1 3	5	32
1284	22			+		1 1+	+1 1 2+ ++ 21 1+	1 + 3	18	23
1327	27					+ 1 +	+ + + +	+ + ++	11	22
1347	41					+ +	+ + +	+ +	7	23
1293	10		7+21 +13+ ++++ +++214	33 +32	1 1	111 +2	7 + ++ 1211++++3	+ +	45	23
1321	33	+	+3 1 + 11 1 11+14+2	2 3264 1	12+	1++++++	1+ 1+ + 1+ ++	1 2 51	44	29
1295	36		131 1+ 2 + 44194 +1 3	+ + 1 +		554 846 1	+1+ +319573 643+	2+1	43	27
1289	2		1+3+1 11 +1++ + 1+2	1 ++++ 1	+	+22+11	+ 211 7 + 1+	211 ++	41	26
1300	23		++ ++ + + +	1+ 1 ++		++22++++	+++ + 11 ++ 11	411+1	35	29
1285	17	F	++1 +++ + + +1+ 1	+	+	1 1 5	+ + 2+++1+++ + ++	1 1	33	41
1330	24		+ ++ 1 1	+ + +1	+	1+ +2 2	1+ 11 ++ 21 44	1 ++4 4	30	36
1287	16		+ + +1 +2	A		16 +1	+5 2 1+ ++ 11+1+	544 1+ 1	29	36
1296	1		++ + 1 2		1 ++	3+ + 1A	59+7 1+ ++1 ++	123 +	28	30
1346	37	3	+ 1	+ + +	+ 4	32 A	1 + +32 +81 212	5+ C	25	49
1303	8		++ + +	+		++ 1+2	+ + + 22+ ++	11+ + +	23	44
1313	29		+ + + + + + + +			++ +1++++	+ + 1	1+ 2	23	46
1312	21		+ ++ + + +	+1		1	11 6 ++ 1 1+ +	2+ ++	20	49
1297	19		1 1 ++1 ++2 ++	+3			+ 1		17	53
1317	43	+2	2+ 1 1++214+++ +24	344+2++44	5315	113+11	1232 2+1 311++1 11	1 4 8+3	56	19
1350	104		23 8			6	1 5	1+	8	47
1288	45		1 1+				+ +++ +		8	44
1379	97		+ 1+			+ +	1 + + + +		8	52
1360	58		+ +			+	++ +		7	48
1316	4		1	2 2 1		+ 1	+		6	14
1318	13		+ + +			+	+	+	6	46
1301	53		+ + +				+++		6	46
1344	89		+ 1 +	+		+		++	6	62
1315	3		++ +			1 +	+		6	35
1407	75			1		++	1		5	37
1413	105		++ +	+			+		5	39
1519	140	7	1		1+			+	5	30
1435	141			+	+			+ +	5	35
1363	82		+	+			+2+		5	28
1487	79			+	+1+		3	3	5	35
1446	68			++		+	+	++	5	37
1458	72		+	+		+	+		4	23
1351	99			+		+	1 +		4	30
1298	103		++	+		+	+		4	36
1364	56		+ +			+	+		4	41
1357	95		+	+			+	1	4	35
1389	39		+	+			+	+	3	42
1533	126			1	+		+		3	5
1461	113			+		2		1	3	25
1581	142			+		+		3	3	26
1314	9		+			+	+		3	27
1439	112		+				+		2	5
1366	101			+			+		2	13
1474	176		1	2					2	12
1556	151			1	1				2	6
1557	127			+		+			2	9
1443	74			+			+		2	10
1336	71			+			+		2	14
1444	84	+					2		2	48
1488	81						+	+	2	17
1473	93	+				+			2	38
1510	167	+		1					2	31
1369	123			+			+		2	31
1563	131						+		1	0
1307	25					+			1	0
1403	50		+						1	0
1527	134		+						1	0
1433	88							+	1	0
1483	76					+			1	0
1464	90							+	1	0
1395	106					+			1	0
1362	139			+					1	0
1512	107					+			1	0
1402	91	1							1	0
1335	109		+						1	0
1518	110		+						1	0
1475	144						+		1	0
1589	145					+			1	0
1593	146					+			1	0
1594	147					1			1	0
1384	111		+						1	0
1588	149					+			1	0
1319	18		+						1	0
1489	78						2		1	0
1385	152		+						1	0
1286	12		+						1	0
1348	114						+		1	0
1562	155							+	1	0
1574	156							+	1	0
1514	115						1		1	0
1613	158				7				1	0
1453	116						+		1	0
1615	160				1				1	0
1505	161				+				1	0
1383	117						+		1	0
1515	163				1				1	0
1596	164				+				1	0
1394	165				4				1	0
1481	83						1		1	0
1400	95						+		1	0
1530	168			1					1	0
1686	169			+					1	0
1322	170			+					1	0
1325	70					+			1	0
1482	121							+	1	0
1349	173			+					1	0
1405	174			+					1	0
1635	175			+					1	0
1554	122							2	1	0
1621	177			+					1	0
1334	59		+						1	0
1646	179			+					1	0
1644	180			+					1	0
1591	181			5					1	0
1645	182			+					1	0
1571	183	1							1	0
1431	184	5							1	0
1631	185	1							1	0
1542	186	+							1	0
1326	187						+		1	0
1656	188				+				1	0
1659	189				4				1	0
1507	190				1				1	0
1529	191		+						1	0
1538	192		1						1	0
1450	98						+		1	0
1477	194		+						1	0
1637	195							+	1	0
1471	125					+			1	0
1457	86						+		1	0
1414	198		+						1	0
1600	199		+						1	0
1442	200		+						1	0
1653	201		2						1	0
1396	46						+		1	0
1398	87						+		1	0
1476	204		+						1	0
1520	129		2						1	0
1410	102						+		1	0
1454	207		+						1	0
1373	208		+						1	0
1546	209		+						1	0
1517	210		+						1	0
1674	211		1						1	0
1655	212		+						1	0
	e	1 72	11111111111111111121122 35597851835328798528931	111131112 805609952	1211 12278	221112211 255382241	211111211111211121 595969386489084327	111 111 724930176		

Table 4.10 The transformed point canopy intercept method's working table. SU's = 4284, Eff. = 50%. (*a* = specimen number; *b* = species code; *c* = species frequency; *d* = number of SU's; and *e* = species frequency per relevé).

Relevé number

a	b	141333351 602869781	35545 47966	3444443 0857942	66756555554662 4054210231137	3466667777721 5387560341265	32 334967	32221211 4 25622111 15213487825059984093 21	c	d
1407	75	+1 1 +						+	5	53
1337	133	+ +	+						3	6
1581	142	+ 3			+				3	25
1455	159		++						2	0
1487	79	3	1 +3	+					5	11
1533	126			1 +				+	3	45
1343	148		3	+ +1	+				5	15
1462	132		1	+	++ 1+++				8	13
1521	157		4		1+2 ++ 2				7	11
1393	171			+	+ + ++ + +				7	7
1387	166			+	++ +				4	9
1603	154				+ +	+			4	10
1386	172				+ +				2	1
1523	137	+			+ +				3	20
1474	176				2 1				2	2
1375	65			1 +	+ 1 +	2	+		7	29
1299	120			1 25	1 3				6	48
1685	124	1		+ 2	+ 2			+	6	53
1434	60			+	+ ++			1	5	40
1446	68			+++	+			+	5	52
1368	55			+ +	+		+		4	34
1352	128		3+	1 1+	41 1+2		+	J	12	41
1671	206					+++			3	0
1380	205					1 1			2	1
1429	66					++	+		3	13
1669	197					1 3			2	1
1388	203					1 1			2	1
1423	135					+ +			2	7
1486	136				1+3 + 15+	1 52 1	+		11	13
1418	54				+ +++	1 + +1 1	+		10	20
1372	49				+ 1	3 4 1 +	+		7	24
1598	178				+ 1	+ +			4	16
1329	30	+		+	1+++	++	+	+	10	59
1577	138	7		A 4	81	2 1			7	29
1389	39	+					++		3	42
1392	63					+ 1	+ +		4	12
1344	89			+		1+ +	+		6	44
1320	31	+						1 + 2 +11 +2	9	61
1353	73							+ + +	3	12
1355	32		+					+ + +	3	11
1458	72							+++	4	55
1314	9							++ +	3	14
1292	11						+	+ + 1	4	23
1391	44	+				+		1 + +	5	62
1358	100							+ +	2	11
1306	14							+ 1	2	18
1338	57	+ +	+				+ +	++ ++ + + +	12	58
1345	40				+		+	2 ++ +	7	50
1328	51					+	+	+ + + 2	5	27
1301	53				+	+	+ +	+ +	6	22
1294	15				+	+ 1++	2+	+1 ++1 ++ +	16	27
1302	69	1			+	+ 2	+	++1 1 11+	12	57
1426	96				+ +	+2 +		+ ++1 ++ +	11	26
1428	52				+	+ +		++ 4 +	10	31
1379	97					+ 1+		++ 1 ++	8	20
1293	10	1 +	11	+1	+++ +323 1 +1	++++211+ +	3++273	1712 1 2++ 3++ ++ 4	45	27
1291	5				1+ ++ + 32	21 1131 1	+113++	1 112 +1 1++ 2	30	24
1290	7				++ +++ +	++ + 11+	+ 112	1 ++ + 7 +	21	28
1323	28	+			+ 1	+ ++ +	+	31+ 1 + +	14	57
1377	61				++ 1	+ ++ +	+	+ + +	11	34
1288	45				1 +	1 + +	+	+ +	8	40
1295	36		+	++ 45	41 + 15+35	+ 1 2+1 141	296 1+	3+3414+94 78+1 1363	43	20
1297	19	+	+	+ + +	+3 11	++ + 1	+2	+ + +	17	55
1342	38		1	+ 1	1 2 +	13	+	2 2	11	51
1359	67		+ +	+ +++		++ 1		+ 1 + +	14	49
1317	43	+12+4 +3	33 13	4485441	+122+2+3+ ++3	12+ + 1	1+424	11 1212 +51+1 11 1+	56	16
1321	33	11 11+	2 +	151 +	11++326241 3	+ 1124 1	11+2+	1 +++ ++ ++ + + +	44	27
1289	2	12 +12 2		++1++	+++1 1	+11 + + 31++	1+ 1	7++1 21 + +1 + 1 1 2	41	33
1300	23	1 +114 2	+	1+ +++	+ 1 +	++ 1+ +	+++ +	+++++2 +1 11 +1++	35	38
1285	17	F 1 +	+	1 +1	+ + +	+	+	++ +11 + +5++ 1+2 1	33	42
1330	24	+11 1		414+++11	+ +			2112++ +4 4+ +12	30	43
1287	16	4 1A45	1	+ +1			+1 ++1	++ 56 1 + + +1+1212	29	45
1296	1	3+1 21 +	9+1+	+ ++	1 3	+		+ 5 ++ + + +1 1 7A2	28	46
1346	37	3 +8 +5CA	4+	2	+ ++ 3		+ 1	+ 1 + 1 1 222 3	25	47
1331	29	+ +1 +		+		+ 2		+++ 1+ 1++ +++ +	23	49
1303	8	+ 2 11	+	+	+	++ +	+	2+ 1 + ++ + + + +2+	23	51
1312	21	6 ++		+	+1	+ ++	+	+1+11 +1 1 +	20	53
1284	22	2 1 3		+	1 +	+	1	+ 1 + + +1121+	18	53
1327	27	+ +		+	+	+		+ 1 + + + +	11	62
1309	6	+	+ 1	+ + 1		+ +	+	+	10	61
1304	20			+	++	1 +	+	+ +	8	49
1356	34	+	+ +			+	+	+ + +	8	62
1350	104		1	+	8	2 1	3	6 5	8	52
1441	77	4 1			+ +	+ 1++			8	35
1360	58			+	++			+ + + +	7	40
1347	41	++ + +			+		+	+	7	46
1333	26	+ +		1				+ ++	6	66
1447	85		++ +					+ 1 +	6	52
1316	4	2		+	1 2			1 1	6	65
1318	13		+	+		+		+ ++	6	57
1315	3			+		++		1 ++	6	49
1432	62				+ +	+	+	+ +	6	35
1324	94	+		+				+ + +	5	55
1370	118	1	3					G 5+	5	59
1341	47				+	1		+ 3 2	5	34
1413	105					+ +		+++	5	10
1519	140	+	1	+	7	1			5	27
1435	141	+ + +		+	+				5	21
1363	82	+ +	2			+		+	5	51
1351	99			++				1 +	4	47
1298	103				+	+ +		+	4	35
1364	56	+					+ +	+	4	61
1357	35		+	+		1		+	4	58
1367	80	+	+					+ +	4	52
1416	64			+		+	+		3	28
1459	119			+	+			+	3	48
1550	130	+		1			+		3	41
1409	150		+		+			2	3	48
1313	108			+	+			1	3	34
1461	113	+		2				+	3	47
1427	202				+	+			2	12
1510	167			1	+				2	8
1537	153				1	6			2	3
1473	93	+			+				2	29
1565	162		+	1					2	6
1361	143	+	1						2	11
1408	92	+			1				2	23
1488	81	+				+			2	35
1371	42					+	+		2	3
1449	196				+	1			2	15
1444	84	+						2	2	56
1668	193				3	+			2	4
1439	112			+				+	2	40
1366	101			+				+	2	50
1404	48					+	+		2	10
1556	151				1			1	2	32
1557	127			+	+				2	6
1443	74	+			+				2	20
1336	71	+						+	2	66
1369	123	+						+	2	48
1563	131		+						1	0
1307	25							+	1	0
1403	50						+		1	0
1527	134					+			1	0
1433	88					+			1	0
1483	76	+							1	0
1464	90					+			1	0
1395	106							+	1	0
1362	139	+							1	0
1512	107							+	1	0
1402	91	1							1	0
1335	109							+	1	0
1518	110							+	1	0
1475	144	+							1	0
1589	145				+				1	0
1593	146				+				1	0
1594	147				1				1	0
1384	111						+		1	0
1588	149				+				1	0
1319	18							+	1	0
1489	78	2							1	0
1385	152					+			1	0
1286	12							+	1	0
1348	114							+	1	0
1562	155			+					1	0
1574	156			+					1	0
1514	115							1	1	0
1613	158		7						1	0
1453	116					+			1	0
1615	160		1						1	0
1505	161		+						1	0
1383	117					+			1	0
1515	163			1					1	0
1596	164			+					1	0
1394	165			4					1	0
1481	83	1							1	0
1400	95							+	1	0
1530	168			1					1	0
1686	169			+					1	0
1322	170			+					1	0
1325	70							+	1	0
1482	121			+					1	0
1349	173				+				1	0
1405	174				+				1	0
1635	175				+				1	0
1554	122			2					1	0
1621	177				+				1	0
1334	59							+	1	0
1646	179				+				1	0
1644	180				+				1	0
1591	181				5				1	0
1645	182				+				1	0
1571	183				1				1	0
1431	184				5				1	0
1631	185				1				1	0
1542	186				+				1	0
1326	187							+	1	0
1656	188		+						1	0
1659	189		4						1	0
1507	190		1						1	0
1529	191				+				1	0
1538	192				1				1	0
1450	98							+	1	0
1477	194				+				1	0
1637	195					+			1	0
1471	125			+					1	0
1457	86							+	1	0
1414	198					+			1	0
1600	199					+			1	0
1442	200					+			1	0
1653	201					2			1	0
1396	46							+	1	0
1398	87							+	1	0
1476	204					+			1	0
1520	129						2		1	0
1410	102							+	1	0
1454	207					+			1	0
1373	208					+			1	0
1546	209					+			1	0
1517	210					+			1	0
1674	211					1			1	0
1655	212				+				1	0
e		112111 1 749052773	1111 52176	1212112 3212585	1111131112111 3282609892554	1111 21111111 8375925195740	111111 898930	122211111 1121111122112 95329596888821783236 41		

Table 4.14 The phytosociological classification of the quadrat method data set

Diagnostic species

Community number	1 2 3 4 5.1 5.2 6 7
Relevé number	141333351 35545 3444443 6675655554662 346666 7777721 32 32221211 4 25622111
	602869781 47966 0857942 4054210231137 538756 0341265 334967 15213487825059984093321

Acacia tortilis subsp. *heteracantha* - *Bothriochloa bladhii* low open woodland

a.

Species	Relevés
Heliotropium strigosum	+ + 8 1
Bothriochloa bladhii	+1+
Striga asiatica	+ + +
Setaria pallide-fusca	++
Chrysanthemoides monilifera subsp. *canescens*	+ +
Sesamum capense	+ +

Acacia tortilis subsp. *heteracantha* - *Ipomoea coscinosperma* low thicket

b.

Species	Relevés
Ipomoea coscinosperma	++

Acacia tortilis subsp. *heteracantha* - *Digitaria argyropgrapta* short thicket

c.

Species	Relevés
Ptycholobium plicatum	+++11+ + 1 +
Ceropegia sp. 1612	++++
Felicia mossamedensis	+ ++ +
Cyphostemma lanigerum	+++
Barleria macrostegia	++
Ocimum urticifolium subsp. *urticifolium*	+ 4
Digitaria argyrograpta	1 3
Unidentifiable sp. 1583	+ + +

Celtis africana - *Diheteropogon filifolius* short closed woodland

d.

Species	Relevés
Amaranthus thunbergii	+ + + ++ + +
Tragia rupestris	+ 2 +43+ +
Achyranthes aspera var. *aspera*	32+ + +
Celtis africana	++ +
Rhoicissus tridentata subsp. *cuneifolia*	+ + +
Sphedamnocarpus pruriens subsp. *galphimiifolius*	+ 4+
Triaspis hypericoides subsp. *nelsonii*	1 + +
Convolvulus sagittatus var. *aschersonii*	+ ++3
Combretum apiculatum subsp. *apiculatum*	94 1 1
Unidentifiable spp. 1695	1 + ++
Momordica balsamina	++
Zanthoxylum capense	++
Sansevieria aethiopica	1+
Ozoroa sphaerocarpa	+1
Helichrysum pilosellum	+1
Thunbergia atriplicifolia	++
Dovyalis rhamnoides	+ + +
Dicoma zeyheri	+ +
Talinum caffrum	+ +
Ximenia caffra var. *caffra*	+ +
Setaria nigrirostris	1 6
Panicum volutans	+ +

Rhus gracillima - *Diheteropogon filifolius* low open woodland

e.

Species	Relevés
Rhus gracillima	+ 21+ 1:+ + +
Hermannia parvula	++ +: ++1+
Zornia linearis	+ +:+ +++
Gnidia sericocephala	+ + +:++++
Mundulea sericea	+ + + 2 : +1 +
Acalypha villicaulis	+1 :+ +
Vernonia poskeana subsp. *botswanica*	+ + :+ + +
Tristachya biseriata	4:6 6 +
Hypoxis rigidula var. *rigidula*	1+ :+
Vitex obovata	33 8:
Maytenus tenuispina	1 +:

Acacia tortilis subsp. *heteracantha* - *Lactuca capensis* low open woodland

f.

Species	Relevés
Lactuca capensis	+ ++

Acacia tortilis subsp. *heteracantha* - *Brachiaria nigropedata* low open woodland

g.

Species	Relevés
Gnidia capitata	+ + + 1 ++ ++ + + 11+ +
Brachiaria nigropedata	+ 1 + +3 1 + ++ ++
Raphionacme hirsuta	+ + + ++ + +++++
Alloteropsis semialata subsp. *eckloniana*	+ + + ++ + + ++ +
Senecio barbertonicus	+ + + +++ + +++
Ledebouria sp. 1511	+ + + + ++
Graderia subintegra	+ ++ +
Eriospermum abyssinicum	+ + ++
Digitaria monodactyla	++
Unidentifiable sp. 1689	+ 6
Scabiosa columbaria	+ ++
Crotalaria brachycarpa	1 + 1
Mariscus uitenhagensis	+ + +

Environmental gradients indicated by species groupings

Species common to communities 1, 2 & 3

h.

Species	Relevés
Ornithogalum tenuifolium subsp. *tenuifolium*	++ + + + +1 +++ + +
Eragrostis pseudosclerantha	2 1 + +3+ + 5 + +

Species common to communities 1, 2, 3 & 4

i.

Species	Relevés
Bothriochloa insculpta	+4 + +4116 1 + + +
Unidentifiable sp. 1685	12223 17221 323 1 112444 +261+ 3 2 3 + 2 5
Pollichia campestris	++ + ++1+ + + + + 6 +

Species common to communities 1, 2, 3, 4 & 5

j.

Species	Relevés
Aristida scabrivalvis subsp. *scabrivalvis*	++ + 4 1 1 1 2 5D5 64 1+12+ 1 31 +
Indigofera parviflora var. *parviflora*	++3 + + 5 1+ ++ ++ +
Acalypha segetalis	11 + ++ + + + + + +

Species common to communities 1, 2, 3, 4, 5 & 6

k.

Species	Relevés
Rhynchosia totta var. *totta*	+1 1 + 3 + + ++ ++++++++ +++2 + + ++++ + +1+ 1 ++
Pentarrhinum insipidum	+++ + + +1+++ 1++++22 ++11 ++++1 + + ++ + + +

Species common to communities 2 & 3

l.

Species	Relevés
Diospyros lycioides subsp. *sericea*	++ 23

Species common to communities 2, 3 & 4

m.

Species	Relevés
Abutilon grandifolium	+ + + ++1+ + 4++ +++ + +
Solanum coccineum	++ +++ ++ + + + + +
Rhus pyroides var. *gracilis*	33 1 +2 + +++
Carissa bispinosa subsp. *bispinosa*	1+ 1+ + 2+ + + +
Brachiaria eruciformis	2 + +3 21

Species common to communities 2, 3, 4 & 5

n.

Species	Relevés
Enneapogon scoparius	B4 3 + A3A2C39 6 2 26 2

Species common to communities 3 & 4

o.

Species	Relevés
Pavetta gardeniifolia var. *gardeniifolia*	+++++ ++++ +
Achyranthes aspera var. *sicula*	++ +3+ + +
Kedrostis foetidissima	1 + + ++ + +
Sarcostemma viminale	+ 1 + + +

Species common to communities 3, 4 & 5

p.

Species	Relevés
Pappea capensis	++++ 11++ + +++ + +
Unidentifiable sp. 1687	1+ +1 1 +2 141++261 14
Kyphocarpa angustifolia	+ + ++1 + ++ 1 + + +
Unidentifiable sp. 1690	+ 2 2 7 1 + 1 3 5 1+
Berchemia zeyheri	+ ++ 1 1 1 + +3
Habenaria epipactidea	+ + ++ ++ + + +
Merremia palmata	+1 + + + + +

Species common to communities 3, 4, 5 & 6

q.

Species	Relevés
Melhania prostrata	1 + 13 1+ ++++ +++++ + + +++

Species common to communities 4 & 5

r.

Species	Relevés
Acacia caffra	1 1 2 A7938 8438C91 7 A977 43367 4 1
Ruellia cordata	+21+1111+ +1 12+112 4+1++
Dombeya rotundifolia var. *rotundifolia*	6+32+213+33 241 21+
Ipomoea obscura var. *obscura*	+++ ++ + + + 1+ ++ +
Combretum molle	54 7 1 925+ 22++
Diheteropogon filifolius	+ +4 1 3 ++++ 221 +
Corbichonia decumbens	++2 11+ + + 2+ + +
Aristida bipartita	+ + + 3 4 21+ 1 12 +++
Eustachys paspaloides	1 +++ ++ 33 2 1
Chenopodium album	+ 2 + + 2 + + + +
Enneapogon cenchroides	1 + + 1 3 ++ + +
Vangueria infausta subsp. *infausta*	1 + 12+
Tricholaena monachne	+ + + + + + +
Waltheria indica	+ + + ++
Unidentifiable sp. 1694	1 + 1 + 1
Ipomoea hochstetteri	+ + + +

Species common to communities 4, 5 & 6

s.

Species	Relevés
Pellaea calomelanos var. *calomelanos*	+ + ++ +++ ++ ++++ 2 ++ + ++ + +
Clerodendrum triphyllum var. *triphyllum*	++ ++ + +3 +22 2 + 12 +++
Phyllanthus humilis	+ ++ 2 +1+++ ++ + + + +
Tephrosia elongata var. *elongata*	1 1 1 + + + +1+ + + +
Clematis brachiata	+ + ++ + + + + ++

Species common to communities 5 & 6

t.

Species	Relevés
Thesium magalismontanum	+ + + + + + + +
Pearsonia sessilifolia subsp. *marginata*	+ 1 1 + 11

Species common to communities 6 & 7

u.

Species	Relevés
Bewsia biflora	+ + ++1 + +
Dicerocaryum eriocarpum	+ + + + ++ +
Agathisanthemum bojeri subsp. *bojeri*	+ + + + +++
Eriosema burkei	++ + + +

Species common to communities 5, 6 & 7

v.

Species	Relevés
Anthericum longistylum	1 + + + 1++ ++ 1 + ++ +++ +++ +
Anthospermum rigidum subsp. *pumilum*	+ +++++ +++ + ++++
Solanum supinum	+ + + +++ + +++ + + + +
Triumfetta sonderi	+ 4 3+ 2312+4 + 4 +
Kohautia amatymbica	+ ++ + ++ +2 1 + ++
Gazania krebsiana subsp. *krebsiana*	+ + + + + + + + + + ++
Justicia betonica	21 + 3 + ++++
Aristida diffusa subsp. *burkei*	+ 1 +162+ + ++
Helichrysum oxyphyllum	+ + + + + 1 1 1 +

Species common to communities 4, 5, 6 & 7

w.

Species	Relevés
Loudetia flavida	2 21 22 1 +2D 321+ 4 555313 364513 ++82 5261 15 61 +
Diheteropogon amplectens	+ 1+ ++113 211+ 2 42543+ 21+5+3 +41 +++1 + 7 ++
Brachiaria serrata	+ + + +1 + ++ 1+3++ ++621 ++22 1+3 +1+ +1 +++
Schizachyrium sanguineum	2 1 + 121+ + +++ 2+++++ 2 3 F +12 2 +7 ++2
Becium grandiflorum var. *galpinii*	+ + 3 1 + + 11 1++ 2 +1 + 1+31+ 1 1111 +1
Lippia scaberrima	+ ++ 1++ + +1+2 1 +11 1 +2 + + ++ +
Bulbostylis contexta	+ + 1+ 12+ 11+ 11 1 +++ 1 + ++ 2 +
Anthephora pubescens	+ 51 ++ 2 3 + +2 4 + 5 1 + 2+1 1
Trachypogon spicatus	6 2 4 6 8 2 1 6 + +21 3 3
Convolvulus sagittatus subsp. *sagittatus*	+ + + ++ + + + + 1 + + + ++ + +
Merremia tridentata subsp. *angustifolia*	+ + + + ++ +++++ + 1 +
Stylosanthes fruticosa	+ + + + +++++ ++ 1 + +
Ziziphus zeyheriana	2 1 1 4 F 1+ 1 32 3 6 6 +
Senecio venosus	+ + 1 + ++ 1 ++ ++ +
Achyropsis leptostachya	+ ++ 2 + + + + 2 + + +
Elephantorrhiza elephantina	4 + 5 1 + 1 2 3 1 +

Species common to communities 3, 4, 5, 6 & 7

x.

Species	Relevés
Setaria sphacelata var. *torta*	1 122 388 153 112D12E 6 42 3 2 2B3 6161++ 4+C8782BA D42 4BB7+ +
Plexipus hederaceus var. *hederaceus*	1++ +++ + ++2+ + 2++ + +++1 ++ ++2 ++++ + + + 1+ +1+++
Evolvulus alsinoides var. *linifolius*	+ +++ ++ +1 + + ++ ++++ ++21 + + +2 + + + +++ +
Chamaecrista biensis	++ + + + + + +1+ ++ ++ + +1 ++ ++ +++
Lithospermum flexuosum	+ + +1 ++ +3 +1 + ++++ 2 1 + +2 + + 1 + ++
Acacia robusta subsp. *robusta*	3 2 G 5 43 24 5 24 652 61 1 46 7 5 9 9A 4
Geigeria burkei subsp. *burkei* var. *burkei*	+ ++ + ++ ++ 1 ++++++ + ++ ++ + ++
Teucrium trifidum	+ 1 +++ ++ +2 ++ ++ + + + + +1 + + + +
Justicia anagalloides	+ 4 ++ ++ ++ +++++ ++ + + +++ +
Anthericum cooperi	+ + + + + + ++ + +++ ++ +++ + +
Solanum incanum	+ 1 + + 1 + + + 1 + 1 + 11 + + + + +
Acacia nilotica subsp. *kraussiana*	7 8 D49BC 56 3 61572 3 1 35
Sporobolus stapfianus	++ 2 41 1+ + + ++ + 2 + + ++
Polygala amatymbica	+ + + + + ++ ++++ ++ ++ ++
Menodora africana	+ + ++ ++ + + + + + +1+ + + +
Gladiolus permeabilis subsp. *permeabilis*	+ + + + + + + + ++ +++ + + +
Cymbopogon plurinodis	+ 7 4H+ 1 6+ 21 ++ 6 1 +
Commelina africana var. *krebsiana*	1 ++ 2++ ++ + + + + + 1
Gomphrena celosioides	++ + + + + + + + + + ++
Eragrostis trichophora	+ + +++ 2 1 + ++1 + +
Hypoxis hemerocallidea	1 ++ + + 1 + + + + 1
Ipomoea bolusiana subsp. *bolusiana*	1 + + + ++ + ++1+

Species common to communities 2, 3, 4, 5, 6 & 7

y.

Species	Relevés
Dicoma anomala subsp. *anomala*	+ ++ +++ ++ 1 ++ + + 2++++1 1 3+ ++ +++ ++++ +3 + ++++++ ++ +
Crabbea angustifolia	+ + + +++ ++ +1 + + + + ++ + 1 ++ +++ ++ +++++++
Maytenus heterophylla	2 2311 23322 22+A 2212112+ 12 + 1 + + 1 1
Chaetacanthus costatus	+ 1 2 +++ 1+ 1 + + + + ++ ++ ++++++ 1 + + + +
Solanum panduriforme	+ 8+ 2 + 1+ 215+ 4433+1+ + +1 + ++ 1 +3+
Chamaesyce inaequilatera	+ ++ + + ++ 1 + + + + ++++++ 2++ + 1+ + +
Grewia flava	+ 1+ + 121+ 2 +123 13221 ++ + + 4 + 2 2
Corchorus asplenifolius	+ + + + 2 + ++ + + +++ + + + + + + +

Common and rare plants arranged according to constancy values

z.

Species	Relevés
Aloe greatheadii var. *davyana*	223+31316 26289 BBIJ8E1 24454 2631325 363 ++ +1++A+ 52+D2G 3221355++3+72+681352+3
Heteropogon contortus	124+115+ 25 14 +3C2411 44127878B+23 121238 311 + 31+5+2 +2++1++++ ++1 6+++1++
Melinis repens subsp. *grandiflora*	442438+6 11 1 4232225 +1 1 263 41+ +28513 12164+2 2 +2++ F122+B813+ 29+41+231 +
Aristida congesta subsp. *congesta*	91233813 43 3 3212253 1++ 211++4 2+ 22+ 21 +1+11 12+ + 352116 1+ +48 32++3+++
Aristida canescens subsp. *canescens*	74 3 +2 1+ 22 2 +1 45 323 2+ +11+11 112321 5+1332 111 + 2211 1+9 124A5138+1++
Themeda triandra	1 8 + 243 +11 11 311 1447 1+11 1+1123 31211+ 5115C8 1J31+51+2 1+124++ 1 2
Protasparagus suaveolens	+2+1 11251 +21252+ ++1+1+2 +++12 ++1 11 ++11++ ++++++ ++ ++ +++ ++ +++
Eragrostis chloromelas	+62438353 12531 1 3 41 2+5 + 2+12+ + 22 ++ 3 63 13+ 2+++62 1+1 1 26+91891
Tephrosia purpurea subsp. *leptostachya*	8 + 1+ + + +++211+ +2+ 412 +++ +++1 111++1 1++ 11 3324++11 ++2+++ 3++
Monsonia angustifolia	4 4+321+ + + 1++11+2 21+++ + + + +1+2 +1 1+ 43+1+1++1 +2 2++1++2+
Hibiscus pusillus	+ + ++ 1+1+ ++++++ ++ ++ 1+ ++11+1 + +1++ ++ 1+ ++++1+4+ ++++ 1+ 1
Tragus berteronianus	11+ 1+ 12 3++ 1352 44+ ++24+1 + 34 11+ + 3+++ 31++++++ +1 ++++
Indigofera rhytidocarpa subsp. *rhytidocarpa*	32+ +1 1+ 8+72742 +++ + +1+ ++ 1 1+ 1 + + ++ 8131+1++ + 18 92+ +4+
Lantana rugosa	+ 1+++ ++ 1 +++11++ ++ ++3 +++++ ++1 +1 + + ++ 1+2 ++ + ++ ++ 1+
Oldenlandia herbacea var. *herbacea*	1+ +11++ 11 ++ + + ++ + ++ + ++++3 +1 + 11+11+ 13+ +++++21+++
Sida alba	+++ ++ ++ +++++++ +++++11+++1 + + + + + ++++++ +++ + ++
Elionurus muticus	A151D9 3 + 5 23++ 42 1 3 2 14 +24 + 1111GD 2 1 7 1 3+25+4
Eragrostis gummiflua	+2+41636+ 1 + 1+ 4 3 6 +2 2+ 2++123 ++ 1+1+1292411+
Acacia tortilis subsp. *heteracantha*	C1 B864+ A+ 1A 2484 46 45C 3 87+ 9945 3 L+14375 +3+
Rhus leptodictya	+ 431 2 2+ 2611352 +2 226 42 + 41 22+ 1 2 ++ ++ 2 1 +4 ++
Phyllanthus maderaspatensis	+ +++++ + ++ ++++ + ++ + + + +++++ +++++ ++ +++ +++ ++
Vernonia oligocephala	+ + ++ + + 1 + + + 2+ + +2 ++ + +13 + ++11217 ++1 +A4+ ++
Panicum maximum	3 241 2+ 34211 7193 1 84 D33+2 + + + + 1 +1 + 4 Q ++ +1
Tagetes minuta	+ ++ + + +1+ + 1 + +++13+++ +++5 2++++ + 1 1 ++ 14 +
Bidens bipinnata	+ ++++ 12 ++ + +2+++ + 22+2544 33 2 ++ 2 + + ++ 1+ 3
Digitaria eriantha	4 7 1GDK 4D2 1 2++ 4 3+ +213 + + 2+3 2 1 3 6 2 774+7
Trichoneura grandiglumis var. *grandiglumis*	1 ++ 2 1+ ++ ++ + + + + + + ++++ ++ ++++ + ++ ++ 2+ +
Ehretia rigida	21 2 251+ 13+23+ +2C4+ +1+11 + 1+ 1 ++ + ++
Acacia karroo	3 2 5 645 153 3 2 8 2+ 1 42 + 32 252 +23 5 +
Commelina africana var. *africana*	+ +++ + 1 +++ + 1 3+1++ ++ + + + + + + + 1 + +
Microchloa caffra	+ + +++ ++ 1 + 2 + 1+ + ++ 1 + ++2 +21 ++1+
Euclea undulata var. *myrtina*	+1 21+ 1+2142 + 2++ 1 + ++ + + 2 1 +1 +
Schkuhria pinnata	+ + + + ++ 4 + 3121 34 1 15 22+ 2 + + ++
Wahlia capensis subsp. *vulgaris*	+2 + +1 + 1 + + + +1 1233++ 1+ ++ 2 1 +
Zinnia peruviana	++ + 1 + + ++1++83 + + 1 + ++ + + + 1 + 1
Hibiscus trionum	+31+ +++ +++++ +1 + 1+ 1 +++ + + ++
Rhus lancea	332+ 6 +3 1525 2 B 3 13 + 1 + 1 3+2
Melinis nerviglumis	5 3 + ++ 3+ +1 + ++ + +22+1+ 2 + + 1

Table 4.15 The phytosociological classification of the point canopy intercept method data set

Diagnostic species

Community number: 1 | 2 | 3 | 4 | 5 | 6 | 7

Relevé number:
15 677737736646462 667 2 5 3655544 54544 4321221 6 2131 11212 33 2152 334631455
64 63042513341304838765921 276210398 97762 124101029 53423898775l846459 790505586

Species	Cover values (relevés in printed order)
Species group a.	
Cleome monophylla	+1
Species group b.	
Acacia caffra	+ 11 15 + 5 2 3 + 1
Clerodendrum triphyllum var. *triphyllum*	+1 + 3 + 41
Schkuhria pinnata	+++ + + +
Melinis nerviglumis	+1+ + + + 1 4
Lantana rugosa	+ + 1 +
Hermannia parvula	++ +
Dombeya rotundifolia var. *rotundifolia*	+ + + 1
Phyllanthus humilis	+ + +
Eragrostis racemosa	+ +1 +
Setaria lindenbergiana	3 +
Vigna vexillata var. *vexillata*	1+
Vitex obovata	13
Eustachys paspaloides	+ +
Tephrosia elongata var. *elongata*	+ +
Triumfetta sonderi	11
Tristachya biseriata	11
Pollichia campestris	+ 1 +
Pearsonia sessilifolia subsp. *marginata*	+ +
Evolvulus alsinoides var. *linifolius*	+ 1 +
Helichrysum oxyphyllum	+1
Combretum molle	16
Tagetes minuta	+ + +
Species group c.	
Felicia muricata subsp. *cinerascens*	+ + ++
Maytenus heterophylla	++ + +
Pellaea calomelanos var. *calomelanos*	++
Senecio barbertonicus	+ + +
Chenopodium album	+ + +
Species group d.	
Justicia flava	+ +2
Brachiaria eruciformis	1+
Seddera capensis	+ +
Species group e.	
Tripogon minimus	+++
Helichrysum nudifolium	+ + + 2 +
Species group f.	
Microchloa caffra	1 2 +1 + + 12+
Ledebouria sp. 1356	+ + ++ + ++ +
Chamaesyce inaequilatera	+ + + + 2 + +
Elephantorrhiza elephantina	1 + +++
Ziziphus zeyheriana	2 ++ 1 3
Hermannia depressa	++++
Anthericum cooperi	+ ++
Justicia betonica	++
Oxalis	+ + +
Senecio venosus	++
Species group g.	
Urochloa panicoides	+ 1

Environmental gradients indicated by species groupings

Species	Cover values (relevés in printed order)
Species common to communities 1, 2 & 3	
h.	
Ruellia cordata	11 1 +++ ++ ++
Bulbostylis contexta	++ 1 +++ + ++ + +
Plexipus hederaceus var. *hederaceus*	1 + + + + + + +
Acacia nilotica subsp. *kraussiana*	8 211 7 4A
Solanum panduriforme	++ + + 1++ 1
Enneapogon scoparius	1 + 2 ++ 2 4
Pentarrhinum insipidum	+ ++ ++++
Lippia scaberrima	2 + 1 + 1 + +
Tragia rupestris	++ ++
Bidens bipinnata	1 + + + +
Species common to communities 1, 2, 3, & 4	
i.	
Panicum maximum	1 + 4 2 1+ +1 +13 J
Protasparagus suaveolens	+ + 1 + + + + ++1
Species common to communities 1, 2, 3, 4 & 5	
j.	
Schizachyrium sanguineum	+ +4+ 1+ 7 + + +
Commelina africana var. *africana*	+ + ++ 1 + + + + +
Species common to communities 1, 2, 3, 4, 5 & 6	
k.	
Loudetia flavida	+313 211+1 1+ 1 312 + ++ + 1 1 1 +1+ 22+ 11
Diheteropogon amplectens	1++1+ 1 + ++ + + 11+ 2 ++ 7 +++
Brachiaria serrata	++ 1+++ 2++ + +1 ++ 1 +
Hibiscus pusillus	++ +1 ++ ++ + + + 1++
Becium grandiflorum var. *galpinii*	+ + + + 1 + ++ 3+ 11 ++
Vernonia oligocephala	+ + +1 +1 1+ + 1 21
Phyllanthus maderaspatensis	++ ++ + + + + + ++ +
Trachypogon spicatus	2+ + + + + ++ + + 1
Acacia karroo	1 1 3 1 + 2 +1 22 +
Species common to communities 3 & 4	
l.	
Euclea undulata var. *myrtina*	1+ 3+ +
Unidentifiable sp. 1685	+ 1 2 + + 2
Cymbopogon plurinodis	1 3 5 2 + 1
Species common to communities 4, 5 & 6	
m.	
Chaetacanthus costatus	++1 + ++
Species common to communities 5 & 6	
n.	
Lotononis listii	1 + ++ ++
Species common to communities 6 & 7	
o.	
Vahlia capensis subsp. *vulgaris* var. *linearis*	+ + + + +
Acacia tortilis subsp. *heteracantha*	G + 5 1 3
Species common to communities 5, 6 & 7	
p.	
Eragrostis gummiflua	+ 1 1+ +1 1 2+ ++ 21 1+ 1 + 3
Hypoxis argentea var. *argentea*	+ 1 + + + + + + + ++
Cynodon dactylon	+ + + + + +
Species common to communities 2, 3, 4, 5, 6 & 7	
q.	
Themeda triandra	7+21 +1+ ++++ ++214 33 +32 1 1 111 +2 7 + + 1211++++3 + +
Heteropogon contortus	+3 1 + 11 1 11+1+2 2 3264 1 12+ 1+++++ 1+ 1+ + 1+ + + 1 2 51
Setaria sphacelata var. *torta*	131 1+ 2 + 44194 +1 3 + + 1+ 554 846 1 +1+ +31957 3 643+ 2+1
Melinis repens subsp. *grandiflora*	1+3+1 11 +1++ + 1+2 1 ++++ 1 + +22+11 + 211 7 + 1+ 211 ++
Aristida congesta subsp. *congesta*	++ ++ + + + 1+ 1 ++ +22+++ +++ + 11 ++ 11 +11+1
Aristida canescens subsp. *canescens*	F ++1 +++ + + +1+ 1 + + + 1 5 + + 2+++1+++ + + 1 1
Indigofera rhytidocarpa subsp. *rhytidocarpa*	+ ++ 1 1 + + + +1 + 1+ +2 2 1+ 11 ++ 21 44 1 +++ 4
Elionurus muticus	+ +1 +2 A 16 +1 +5 2 1+ ++ 11+1+ 544 1+ 1
Eragrostis chloromelas	++ 1 2 1 ++ 1+ + 1A 59+7 1+ ++1 ++ 123 +
Digitaria eriantha	3 1 + +++ +4 32 A 1 + +32 +81 212 5+ C
Monsonia angustifolia	++ + + + + ++ 1+2 + + 22+ ++ 11+ + +
Oldenlandia herbacea var. *herbacea*	+ + ++ ++ + ++ +1++++ + + + 1 ++ 1+ 2
Tephrosia purpurea subsp. *leptostachya*	+ ++ ++ +1 1 11 6 ++ 1 1+ + + +
Tragus berteronianus	1 1 ++1 ++2 ++ +3 +

Common and rare plants arranged according to constancy values

Species	Cover values (relevés in printed order)
Species group r.	
Aloe greatheadii var. *davyana*	+2 2+ 1 1++214+++ +24 344+2++44 5315 113+11 1232 2+1 311++1 11 1 4 8+3
Acacia robusta subsp. *robusta*	23 8 6 1 5 1+
Anthephora pubescens	1 1+
Anthericum longistylum	+ 1+ + + + + +
Justicia anagalloides	+ + + + + + +
Rhus leptodictya	1 2 2 1 + 1
Dicoma anomala subsp. *anomala*	+ + + + + + +
Chamaecrista biensis	+ + + + + +
Sporobolus stapfianus	+ 1 + + + +
Lithospermum flexuosum	+ + + + 1 +
Cymbopogon excavatus	+ + 1 + +
Merremia tridentata subsp. *angustifolia*	+ + + + +
Ehretia rigida	7 1 + 1+ +
Hibiscus trionum	+ + + + +
Rhynchosia totta* var. *totta	+ + +2+
Bothriochloa insculpta	+ +1+ 3 3
Helichrysum rugulosum	+ + + +
Ipomoea bolusiana subsp. *bolusiana*	+ + + + +
Ptycholobium plicatum	+ + 1
Trichoneura grandiglumis var. *grandiglumis*	++ + +
Indigofera heterotricha	+ + +
Eragrostis trichophora	+ + + 1
Solanum incanum	+ + +
Grewia flava	1 + +
Vernonia	2 +
Heliotropium strigosum	+ 3 + 3
Cyperus obtusiflorus var. *obtusiflorus*	+ + +
Corchorus asplenifolius	+ + +
Polygala amatymbica	+ + + +
Aristida scabrivalvis subsp. *scabrivalvis*	1 2
Convolvulus sagittatus var. *aschersonii*	1 1
Tulbaghia	+ +
Commelina africana var. *krebsiana*	+ + +
Hypoxis hemerocallidea	+ +
Berkheya radula	+ 2
Aristida bipartita	+ + +
Kyllinga erecta	+ +
Sarcostemma viminale	+ 1
Sida alba	+ +
Ipomoea bathycolpos var. *bathycolpos*	+ +
Geigeria burkei subsp. *burkei* var. *burkei*	+ +
Crotalaria brachycarpa	+
Urelytrum agropyroides	+
Conyza albida	+
Tricholaena monachne	+
Dipcadi viride	+
Gomphrena celosioides	+
Hyparrhenia filipendula var. *pilosa*	+ +
Digitaria monodactyla	+
Acalypha segetalis	1
Graderia subintegra	+
Zornia linearis	+
Bothriochloa bladhii	+
Gerbera viridifolia subsp. *viridifolia*	+
Xanthoxylum capense	+
Setaria lindenbergiana	+
Anthospermum rigidum subsp. *pumilum*	+
Sphedamnocarpus pruriens	+
Brachiaria nigropedata	+
Indigofera vicioides var. *vicioides*	2
Rhus gracillima	+
Eragrostis superba	+
Dicerocaryum eriocarpum	+
Achyranthes aspera var. *sicula*	+
Turbina oblongata	+
Gazania krebsiana subsp. *krebsiana*	1
Acacia mellifera subsp. *mellifera*	7
Convolvulus sagittatus subsp. *sagittatus*	+
Lycium cinereum	+
Sporobolus nitens	+
Mariscus rehmannianus	+
Eragrostis pseudosclerantha	1
Pavetta gardeniifolia var. *gardeniifolia*	+
Rhus lancea	+
Indigofera parviflora var. *parviflora*	1
Eragrostis nindensis	+
Carissa bispinosa subsp. *bispinosa*	1
Unidentifiable sp. 1686	+
Kyphocarpa angustifolia	+
Crabbea angustifolia	+
Eragrostis rigidior	+
Achyropsis leptostachya	+
Corbichonia decumbens	+
Indigofera daleoides var. *daleoides*	+
Panicum coloratum var. *coloratum*	2
Barleria macrostegia	+
Kohautia amatymbica	+
Andropogon chinensis	+
Pennisetum sphacelatum	+
Combretum apiculatum* subsp. *apiculatum	5
Dodonaea	5
Berchemia zeyheri	1
Pappea capensis	5
Dichrostachys cinerea* subsp. *africana	1
Abutilon grandifolium	+
Gnidia capitata	+
Protasparagus setaceus	+
Sporobolus iocladus	4
Tarchonanthus camphoratus	1
Clematis brachiata	+
Rhoicissus tridentata subsp. *cuneifolia*	1
Menodora africana	+
Agathisanthemum bojeri* subsp. *bojeri	+
Enneapogon cenchroides	+
Cheilanthes viridis var. *viridis*	+
Senecio lygodes	+
Ipomoea obscura* var. *obscura	+
Acalypha villicaulis	+
Diheteropogon filifolius	+
Vangueria infausta* subsp. *infausta	2
Tephrosia longipes* subsp. *longipes	+
Raphionacme hirsuta	+
Gerbera	+
Acalypha angustata* var. *glabra	2
Hyperthelia dissoluta	+
Merremia palmata	+
Stylosanthes fruticosa	+
Cyperus rubicundus	+
Aristida diffusa* subsp. *burkei	+
Xerophyta retinervis	1
Achyranthes aspera* var. *aspera	+

Table 4.16 The phytosociological classification of the transformed point canopy intercept method data set

Diagnostic species	
Community number	1 2 3 4 5.1 5.2 6 7
Relevé number	141333351 35545 3444443 6675655554662 346666 7777721 32 32221211 4 25622111
	602869781 47966 0857942 4054210231137 538756 0341265 334967 15213487825059998409321
Species group a.	
Cymbopogon excavatus	+1 1 + +
Oxalis	+ + +
Heliotropium strigosum	+ 3 +
Species group b.	
Seddera capensis	++
Species group c.	
Grewia flava	1 + +
Species group d.	
Solanum panduriforme	1 + ++ 1+++
Enneapogon scoparius	4 1+2 ++ 2
Pentarrhinum insipidum	+ + + ++ + +
Maytenus heterophylla	+ ++ +
Tragia rupestris	+ ++ +
Pellaea calomelanos var. *calomelanos*	+ +
Chenopodium album	+ + +
Aristida scabrivalvis subsp. *scabrivalvis*	2 1
Species group e.	
Hermannia parvula	: +++
Tristachya biseriata	:1 1
Phyllanthus humilis	++ : +
Vitex obovata	1 3:
Triumfetta sonderi	:1 1
Tephrosia elongata var. *elongata*	+ : +
Species group f.	
Solanum incanum	+ ++
Species group g.	
Microchloa caffra	+ 1 + 2 +11 +2
Tripogon minimus	+ + +
Anthericum cooperi	+ + +
Ipomoea bolusiana subsp. *bolusiana*	+ +++
Cyperus obtusiflorus var. *obtusiflorus*	++ +
Eragrostis racemosa	+ + + 1
Elephantorrhiza elephantina	+ + 1 + +
Justicia betonica	+ +
Helichrysum oxyphyllum	+ 1

Environmental gradients indicated by species groupings	
Species common to communities 1 & 2	
h.	
Bothriochloa insculpta	3 1 +3 +
Species common to communities 2 & 3	
i.	
Euclea undulata var. *myrtina*	3 + +1 +
Species common to communities 2, 3 & 4	
j.	
Panicum maximum	3+ 1 1+ 41 1+2 + J
Species common to communities 3 & 4	
k.	
Lippia scaberrima	1 + + 1 + 2 +
Cymbopogon plurinodis	1 25 1 3 +
Unidentifiable sp. 1685	1 + 2 + 2 +
Bidens bipinnata	+ + ++ 1
Helichrysum rugulosum	+++ + +
Felicia muricata subsp. *cinerascens*	+ + + +
Species common to communities 3, 4 & 5	
l.	
Commelina africana var. *africana*	+ + 1+++ ++ + +
Acacia nilotica subsp. *kraussiana*	7 A 4 81 2 1
Species common to communities 4 & 5	
m.	
Acacia caffra	1+3 + 15+ 1 52 1
Ruellia cordata	+ +++ 1 + + 1 1 +
Clerodendrum triphyllum var. *triphyllum*	+ 1 3 4 1 + +
Dombeya rotundifolia var. *rotundifolia*	+ 1 + +
Species common to communities 5 & 6	
n.	
Lantana rugosa	+ 1 + +
Sporobolus stapfianus	+ 1+ + + +
Species common to communities 6 & 7	
o.	
Phyllanthus maderaspatensis	+ + + + + ++ ++ + + +
Chamaesyce inaequilatera	+ + + 2 ++ +
Helichrysum nudifolium	+ + + + 2
Chamaecrista biensis	+ + + + + +
Species common to communities 5, 6 & 7	
p.	
Brachiaria serrata	+ + 1++ 2+ +1 ++1 ++ +
Vernonia oligocephala	1 + + 2 +++1 1 11+
Trachypogon spicatus	+ + + 2 + + ++1 + +
Schizachyrium sanguineum	+ + + + 1 7 ++ 4 +
Anthericum longistylum	+ 1+ ++ 1 ++
Species common to communities 4, 5, 6 & 7	
q.	
Themeda triandra	1 + 11 +1 +++ +323 1 +1 ++++ 211+ + 3++273 1712 1 2++ 3++ ++ 4
Loudetia flavida	1+ ++ + 32 21 1131 1 +113++ 1 112 +1 1++ 2
Diheteropogon amplectens	++ +++ + + + 11+ + 112 1 ++ + 7 +
Becium grandiflorum var. *galpinii*	+ + 1 + + + + + 31 + 1 + +
Bulbostylis contexta	++ 1 + + + + + + + +
Anthephora pubescens	1 + 1 + + + + +
Species common to communities 3, 4, 5, 6 & 7	
r.	
Setaria sphacelata var. *torta*	+ ++ 45 41 + 15+35 + 1 2+ 1 141 296 1+ 3+3414+94 78+1 1363
Tragus berteronianus	+ + + + + +3 11 + + 1 +2 + + +
Acacia karroo	1 + 1 1 2 + 13 + 2 2
Species common to communities 2, 3, 4, 5, 6 & 7	
s.	
Hibiscus pusillus	+ + + +++ ++ 1 + + 1 + +

Common and rare species arranged according to constancy values	
t.	
Aloe greatheadii var. *davyana*	+12+4 +3 33 13 44B5441 +122+2+3+ ++3 12+ + 1 1++424 11 1212 +51+1 11 1+
Heteropogon contortus	11 11+ 2 + 151 + 11++326241 3 + 1124 1 11+2+ 1 +++ ++ ++ + + +
Melinis repens subsp. *grandiflora*	12 +12 2 ++1++ +++1 1 +11 + + 31++ 1+ 1 7++1 21 + +1 + 1 1 2
Aristida congesta subsp. *congesta*	1 +114 2 + 1+ +++ + + 1 + + ++ + + +++++2 +1 11 +1++
Aristida canescens subsp. *canescens*	F 1 + + 1 +1 + ++ + + 1+ + +++ + ++ +11 + +5++ 1+2 1
Indigofera rhytidocarpa subsp. *rhytidocarpa*	+11 1 414++11 + + + + + + 2112++ +4 4+ +12
Elionurus muticus	4 1A45 1 + +1 + +1 ++1 ++ 56 1 + + +1+1212
Eragrostis chloromelas	3+1 21 + 9+1+ + ++ 1 3 + + 5 ++ + + +1 1 7A2
Digitaria eriantha	3 +8 +5CA 4+ 2 + ++ 3 + 1 + 1 + 1 1 222 3
Oldenlandia herbacea var. *herbacea*	+ +1 + + ++ + + + 2 +++ 1+ 1++ +++ +
Monsonia angustifolia	+ 2 11 + + + + + + + 2+ 1 + ++ + + + +2+
Tephrosia purpurea subsp. *leptostachya*	6 ++ +1 + ++ + + +1+11 +1 1 + +
Eragrostis gummiflua	2 1 3 + 1 + + 1 + 1 + + +1121+
Hypoxis argentea var. *argentea*	+ + + + + + 1 + + + +
Protasparagus suaveolens	+ + 1 + + 1 + + + +
Plexipus hederaceus var. *hederaceus*	+ ++ 1 + + + +
Ledebouria sp. 1356	+ + + + + + + +
Acacia robusta subsp. *robusta*	1 + 8 2 1 3 6 5
Melinis nerviglumis	4 1 + + + 1++
Justicia anagalloides	+ ++ + + + +
Cynodon dactylon	++ + + + + +
Lotononis listii	+ + 1 + ++
Chaetacanthus costatus	++ + + 1 +
Rhus leptodictya	2 + 1 2 1 1
Dicoma anomala subsp. *anomala*	+ + + + ++
Lithospermum flexuosum	+ ++ 1 ++
Schkuhria pinnata	+ + + + + +
Vahlia capensis subsp. *vulgaris*	+ + + + +
Acacia tortilis subsp. *heteracantha*	1 3 G 5+
Ziziphus zeyheriana	+ 1 + 3 2
Merremia tridentata subsp. *angustifolia*	+ + +++
Ehretia rigida	+ 1 + 7 1
Hibiscus trionum	+ + + + +
Rhynchosia totta var. *totta*	+ + 2 + +
Ptycholobium plicatum	++ 1 +
Trichoneura grandiglumis var. *grandiglumis*	+ + + +
Indigofera heterotricha	+ + + +
Eragrostis trichophora	+ + 1 +
Hermannia depressa	+ + + +
Tagetes minuta	+ + +
Senecio barbertonicus	+ + +
Pollichia campestris	+ 1 +
Justicia flava	+ + 2
Evolvulus alsinoides var. *linifolius*	+ + 1
Vernonia	+ 2 +
Eustachys paspaloides	+ +
Sarcostemma viminale	1 +
Combretum molle	1 6
Kyllinga erecta	+ +
Brachiaria eruciformis	+ 1
Urochloa panicoides	+ 1
Cleome monophylla	+ 1
Aristida bipartita	+ +
Senecio venosus	+ +
Vigna vexillata var. *vexillata*	+ 1
Berkheya radula	+ 2
Setaria lindenbergiana	3 +
Corchorus asplenifolius	+ +
Polygala amatymbica	+ +
Pearsonia sessilifolia subsp. *marginata*	+ +
Convolvulus sagittatus var. *aschersonii*	1 1
Tulbaghia	+ +
Commelina africana var. *krebsiana*	+ +
Hypoxis hemerocallidea	+ +
Sida alba	+ +
Ipomoea bathycolpos var. *bathycolpos*	+
Geigeria burkei subsp. *burkei*	+
Crotalaria brachycarpa	+
Urelytrum agropyroides	+
Conyza albida	+
Tricholaena monachne	+
Dipcadi viride	+
Gomphrena celosioides	+
Hyparrhenia filipendula var. *pilosa*	+
Digitaria monodactyla	+
Acalypha segetalis	1
Graderia subintegra	+
Zornia linearis	+
Bothriochloa bladhii	+
Gerbera viridifolia subsp. *viridifolia*	+
Zanthoxylum capense	+
Setaria lindenbergiana	1
Anthospermum rigidum subsp. *pumilum*	+
Sphedamnocarpus pruriens	+
Brachiaria nigropedata	+
Indigofera vicioides var. *vicioides*	2
Rhus gracillima	+
Eragrostis superba	+
Dicerocaryum eriocarpum	+
Achyranthes aspera var. *sicula*	+
Turbina oblongata	+
Gazania krebsiana subsp. *krebsiana*	1
Acacia mellifera subsp. *mellifera*	7
Convolvulus sagittatus subsp. *sagittatus*	+
Lycium cinereum	1
Sporobolus nitens	+
Mariscus rehmannianus	+
Eragrostis pseudosclerantha	1
Pavetta gardeniifolia var. *gardeniifolia*	+
Rhus lancea	4
Indigofera parviflora var. *parviflora*	1
Eragrostis nindensis	+
Carissa bispinosa subsp. *bispinosa*	1
Unidentifiable sp. 1686	+
Kyphocarpa angustifolia	+
Crabbea angustifolia	+
Eragrostis rigidior	+
Achyropsis leptostachya	+
Corbichonia decumbens	+
Indigofera daleoides var. *daleoides*	+
Panicum coloratum var. *coloratum*	2
Barleria macrostegia	+
Kohautia amatymbica	+
Andropogon chinensis	+
Pennisetum sphacelatum	+
Combretum apiculatum subsp. *apiculatum*	5
Dodonaea	+
Berchemia zeyheri	1
Pappea capensis	5
Dichrostachys cinerea subsp. *africana*	1
Abutilon grandifolium	+
Gnidia capitata	+
Protasparagus setaceus	+
Sporobolus ioclados	4
Tarchonanthus camphoratus	1
Clematis brachiata	+
Rhoicissus tridentata subsp. *cuneifolia*	1
Menodora africana	+
Agathisanthemum bojeri subsp. *bojeri*	+
Enneapogon cenchroides	+
Cheilanthes viridis var. *viridis*	+
Senecio lygodes	+
Ipomoea obscura var. *obscura*	+
Acalypha villicaulis	+
Diheteropogon filifolius	+
Vangueria infausta subsp. *infausta*	2
Tephrosia longipes subsp. *longipes*	+
Raphionacme hirsuta	+
Gerbera	+
Acalypha angustata var. *glabra*	2
Hyperthelia dissoluta	+
Merremia palmata	+
Stylosanthes fruticosa	+
Cyperus rubicundus	+
Aristida diffusa subsp. *burkei*	+
Xerophyta retinervis	1
Achyranthes aspera var. *aspera*	+