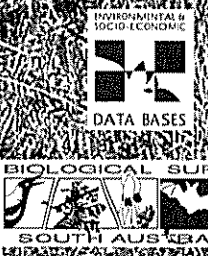
A BIOLOGICAL SURVEY OF GRASSLANDS AND GRASSY WOODLANDS OF THE LOFTY BLOCK BIOREGION SOUTH AUSTRALIA

by

M.A. Robertson



Bushcare

Department for Environment
Heritage and Aboriginal Affairs

A BIOLOGICAL SURVEY OF GRASSLANDS AND GRASSY WOODLANDS OF THE LOFTY BLOCK BIOREGION SOUTH AUSTRALIA 1995-1996

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BIOLOGICAL SURVEY SOUTH AUSTRALIA

ENVIRONMENTAL & SOCIO-ECONOMIC DATA BASES

by
M.A. Robertson

Biological Survey and Research
Heritage and Biodiversity Division
Department for Environment, Heritage and Aboriginal Affairs, South Australia

1998

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The views and opinions expressed in this report are those of the author and do not reflect those of the Commonwealth Government, the Minister for the Environment, Sport and Territories, the Secretary of Environment Australia or the South Australian Government.

AUTHOR
M.A. Robertson

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Cover Photograph:
***Lomandra multiflora* ssp. *dura* tussock grasslands, Burra Hills**
Photo: R.J. Davies

Abstract

In the spring/summer seasons of 1995 and 1996, native grassland and grassy woodland was surveyed in the Lofty Block Bioregion. The vegetation and general landform of seventy four sites were surveyed in total, including a complete plant species list. A total of 3,774 plant records (427 native taxa and 147 alien taxa) were added to the South Australian Environmental Database, with 1,813 plant voucher specimens being lodged in the State Herbarium of South Australia. One hundred and sixty six records are of particular conservation significance at the regional level. These comprise 149 plant taxa, of which seven plant species are of national conservation significance and 36 plant species are rated as of conservation significance in South Australia.

Sites representing native grasslands and grassy woodlands of the Lofty Block Bioregion, sampled in previous surveys were selected from the South Australian biological survey database (439 sites). Added to the Lofty Block Grassland dataset, a total of 884 taxa, of which 241 are alien, occurred at 513 grassy sites. These data were included in a composite vegetation analysis, resulting in recognition of 15 vegetation groups. Several of these groups consisted of semi-sclerophyllous vegetation, or marginal grasslands. Remnants of native grassland and grassy woodland in the bioregion are generally small and all grassy vegetation is modified to some extent. Alien plant species are always present and often form a significant component of the flora, even in the grassy vegetation of highest quality. Plants of regional conservation significance were recorded at the majority of grassy sites.

The original land survey records of the 19th and early 20th century were inspected for locations sampled during the current survey. They indicate that the northern plains (eg. Willochra Plain) grasslands were originally chenopod shrublands, while the general structure of present day vegetation at other grassy sites is consistent with the early surveyors' remarks.

Grassland and grassy woodland sites of high conservation significance were identified and included some remnants of less than one hectare as well as remnants that are more extensive. The conservation status of grassy floristic groups was assessed and recommendations have been made for conserving important vegetation types that are not yet represented in the reserve system. Important remnants of grassland and grassy woodland occur on public and private land, including major conservation reserves and minor public reserves such as road reserves. A range of strategies is therefore recommended for the conservation of grassy ecosystems in the bioregion.

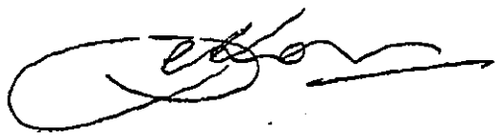
Preface

A Biological Survey of Grasslands and Grassy Woodlands of the Lofty Block Bioregion, South Australia is a further component of the Biological Survey of South Australia.

The program of systematic biological surveys to cover the whole of South Australia arose out of a realisation that an effort was needed to increase our knowledge of the remaining vascular plants and vertebrate fauna of the state and to encourage its conservation.

Over the last fifteen years, there has been a strong commitment to the Biological Survey by Government and an impressive dedication from hundreds of volunteer biologists.

It is anticipated that the Biological Survey will achieve complete statewide coverage by 2015 and will be an achievement of which we can be very proud. Biologists in the future will be able to measure the direction of long-term ecological change, and we will have substantially improved our knowledge of the biodiversity of South Australia and our ability to adequately manage nature conservation into the future.



MRS DOROTHY KOTZ MP
MINISTER FOR ENVIRONMENT AND HERITAGE

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Figure 12 photograph by Michael Hyde, Figure 17 photograph by Jason van Weenen, the remaining photographs are from the files in the Department of Environment, Heritage and Aboriginal Affairs or Planning South Australia, including those by the author.

Many private landowners kindly gave permission to locate sites on their properties.
Government agencies SA Water and PIRSA Forestry and local governments provided access to their properties.
The Northern Region of the National Parks and Wildlife Service provided park access and accommodation and Central Region provided advice and park access.

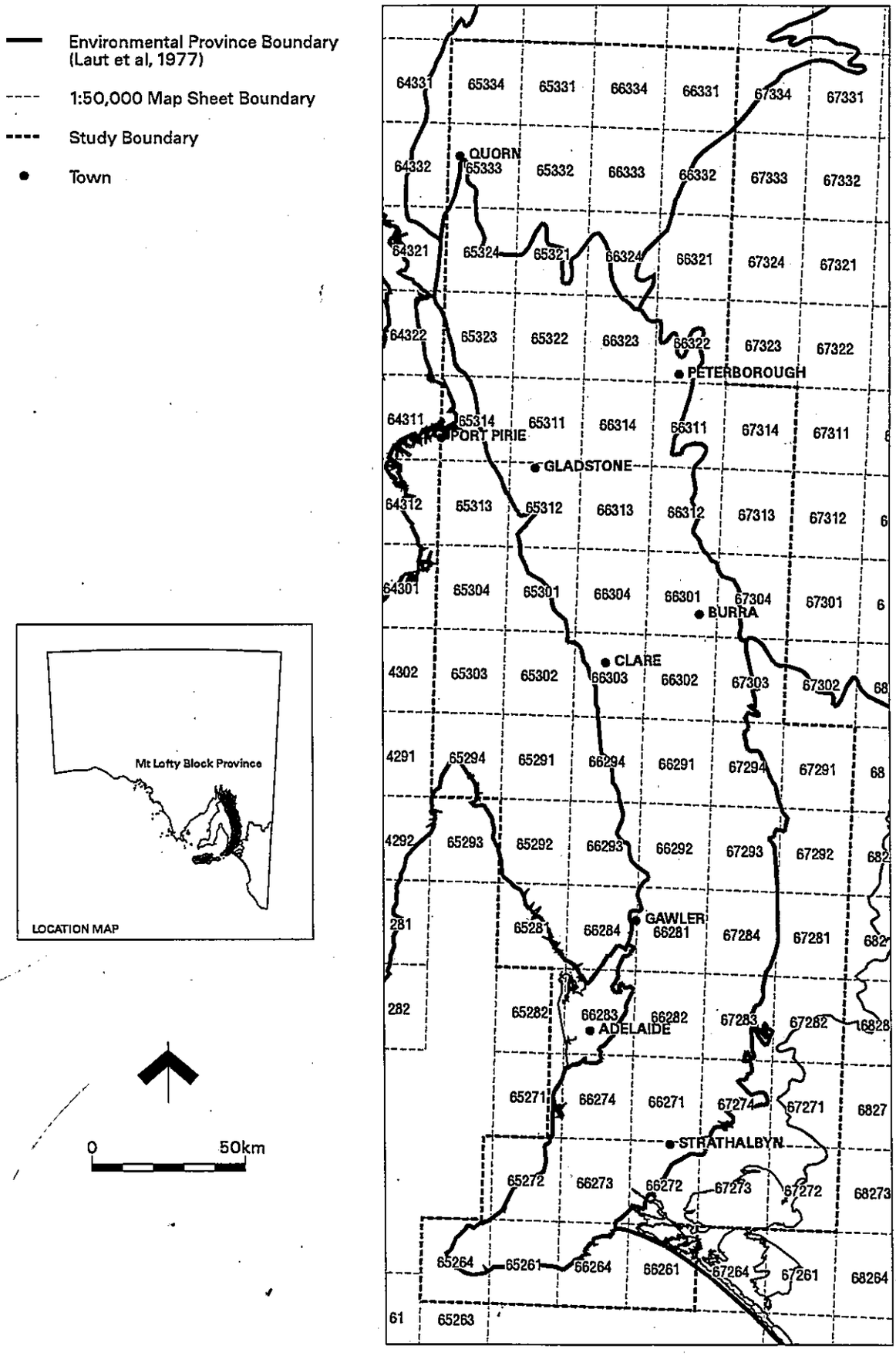


Figure 1. Lofty Block Bioregion - Study Area showing 1:50 000 mapsheet number

Introduction

BACKGROUND

The South Australian Department of Environment, Heritage and Aboriginal Affairs (DEHAA) and Department of Transport, Urban Planning and the Arts (DTUPA) with the support of the State Herbarium of South Australia and the South Australian Museum have been progressively undertaking a baseline biological inventory, the Biological Survey of South Australia, through regional surveys of vegetation and vertebrate fauna of South Australia. For the northern part of the State in the arid zone, DEHAA conducts regional surveys of flora and fauna simultaneously, generally following regional boundaries defined in Laut *et al.* (1977). The Environmental Provinces of Laut *et al.* (1977) have been largely adopted as regions in South Australia for the Interim Bioregionalisation of Australia (Thackway & Cresswell, 1995) as a basis for national biological inventory and planning. For the southern part of the State in the agricultural zone, vegetation survey generally precedes fauna survey and is coordinated by DTUPA. For logistical reasons, survey region boundaries in the agricultural region generally follow 1:50000 mapsheet boundaries. The progress of the Biological Survey of South Australia to date is summarised in Playfair and Robinson (1997).

The sampling intensity and site selection methodology - based on aerial photography - generally used in the southern regional surveys inevitably leads to minimal representation of rare vegetation types, particularly grasslands and grassy woodlands. A number of specialised surveys have been conducted to complement the coverage from regional surveys. Some of these have been initiated by non-government organisations and individuals with resources from government programs. Examples from the agricultural region are the surveys of the disused rail corridors of the Mid-North (Hyde, 1994), the newly created Mount Brown Conservation Park (Oppermann, 1995), temperate grasslands of South Australia (Hyde, 1995) and an investigation of *Eucalyptus odorata* woodlands of South Australia (Hyde, 1996,). Some small scale vegetation surveys using the standard data collection methodology have also been initiated by local government.

This survey of grassy ecosystems of the Lofty Block Bioregion continues the process of complementing the regional coverage, focussing on some of the vegetation types which are of particular conservation significance. The survey boundary was defined as the Mount Lofty Block Bioregion. (Figure 1)

Lowland temperate native grasslands and grassy woodlands are the most threatened natural ecosystems in Australia (Kirkpatrick *et al.*, 1996) and have become a national conservation priority. Once widespread, they have been cleared extensively for agriculture and the areas that survive have been greatly modified by grazing, fertiliser, aerial seeding and intermittent ploughing, resulting in the replacement of native plants by alien plants.

The conservation status of major plant associations in South Australia, described in Specht (1972) has been evaluated by Neagle (1995), updating Davies (1982). Conservation priority rankings were assigned to each association based on the extent to which the association is included in National Parks and Wildlife Service reserves or other permanently protected land (such as Heritage Agreement Areas). Table 1 summarises the conservation status of plant associations with a grassy understorey that occur in the Lofty Block Bioregion.

Table 1. Conservation status of Lofty Block grassy ecosystems in South Australia and interstate (Neagle, 1995)

1. High priority plant associations

Plant Association	Priority	SA status	Interstate
Lomandra multiflora ssp dura - L. effusa Tussock Grassland	PRIORITY 1 (Nil conservation)	Very rare and endangered	not known from outside SA
Danthonia spp, *Themeda triandra* Tussock Grassland	PRIORITY 2 (poorly conserved)	Very rare and endangered	poorly conserved
Eucalyptus odorata+/- E. porosa Low Woodland	PRIORITY 3 (poorly conserved)	Most examples small and/or degraded and/or atypical	poorly/not conserved
Eucalyptus microcarpa Woodland	PRIORITY 4 (poorly conserved)	Much depleted but a few large examples in SA (southern Flinders Ranges). *	poorly conserved
E. odorata, E. leucoxylon, +/- E. fasciculosa Low Woodland	PRIORITY 9 (poorly conserved)	Similar association categories moderately conserved	

*Status improved since Davies (1982) by the addition of some southern Flinders Ranges forest reserves to the NPWS reserve system

Table 1. (continued)
Conservation status of Lofty Block grassy ecosystems in South Australia and interstate (Neagle, 1995)

2. High priority plant associations with many similarities to grassy ecosystems (shrubs in understorey sparse)

Plant Association	Priority	SA status	Interstate
Eucalyptus behriana +/- *E. odorata* +/- *E.dumosa* Open Scrub with sparse sclerophyllous shrubs	PRIORITY 1 (poorly conserved)	Very rare and endangered -not reserved in Lofty Block	moderate in Victoria
Eucalyptus macrorhyncha Low Open Forest (listed as having a heath understorey but grades into grassy understorey)	PRIORITY 9 (poorly conserved)	Similar association categories (*Eucalyptus macrorhyncha* Open Forest) moderately conserved	

3. Other plant associations in the Lofty Block with grassy understorey

Plant Association	SA status	Reservation in Lofty Block (Neagle 1995)	comments
Eucalyptus camaldulensis Woodland	moderate	Minor occurrence in numerous reserves in Lofty Block, mostly degraded	very widespread as dominant, various understorey
E. leucoxylon Woodland	moderate	Minor occurrence in 5 reserves	
E. cladocalyx Woodland	moderate	Occurrence in 2 reserves, one with atypical understorey	Flinders Ranges
Allocasuarina verticillata +/- *Melaleuca lanceolata* Low Woodland	reasonable	Minor occurrence in 2 reserves, also atypical and degraded examples	
Melaleuca lanceolata Low Woodland	moderate	Not reserved	
Callitris preissii Low Woodland	moderate	Atypical occurrences in 2 reserves	
Callitris columellaris Low Woodland	reasonable	Occurs in NP, also atypical occurrence	Flinders Ranges
Stipa sp., *Danthonia* sp. Grassland	uncertain-reasonable if conserved in Flinders R NP	Not reserved	[status unclear as it can result from clearance]
**E. porosa* Woodland	PRIORITY 5 (poorly conserved)	Numerous moderately large examples but many examples have degraded under-storeys and /or are currently under threat.	*E. porosa* **Low** Woodland is **moderately conserved**
**E. fasciculosa* Woodland	moderate	Occurs in 5 reserves	
**E. largiflorens* Woodland	moderate	Not reserved	

*plant associations not targeted in this study

Native grasslands and grassy woodlands in South Australia are protected from clearance by the Native Vegetation Act, although the Act's exemptions allow a pre-existing grazing regime in native vegetation to continue, which can amount to clearance in the long term. No grasslands and only several small areas of grassy woodland in the Lofty Block have been given permanent protection under Heritage Agreement.

Previous comprehensive assessments of conservation status in South Australia have used plant associations as vegetation units (Davies, 1982; Neagle, 1995). The basis for such classification is overstorey composition and structure, and the structure of the dominant understorey stratum (Specht, 1972).

To assess further the adequacy of current conservation effort it is important to establish whether the grey box woodlands of the Adelaide Hills are significantly different from the grey box woodlands of the southern Flinders Ranges, whether changes in overstorey dominants in woodlands are reflected in the understorey, and how distinct native grasslands are from the understorey of woodlands. Floristic vegetation analysis, by giving equal weight to both overstorey and understorey species is designed to assist in answering such questions. A more rigorous assessment of the adequacy and comprehensiveness of the reserve system in conserving major habitats and therefore the maximum possible range of species, should then be possible.

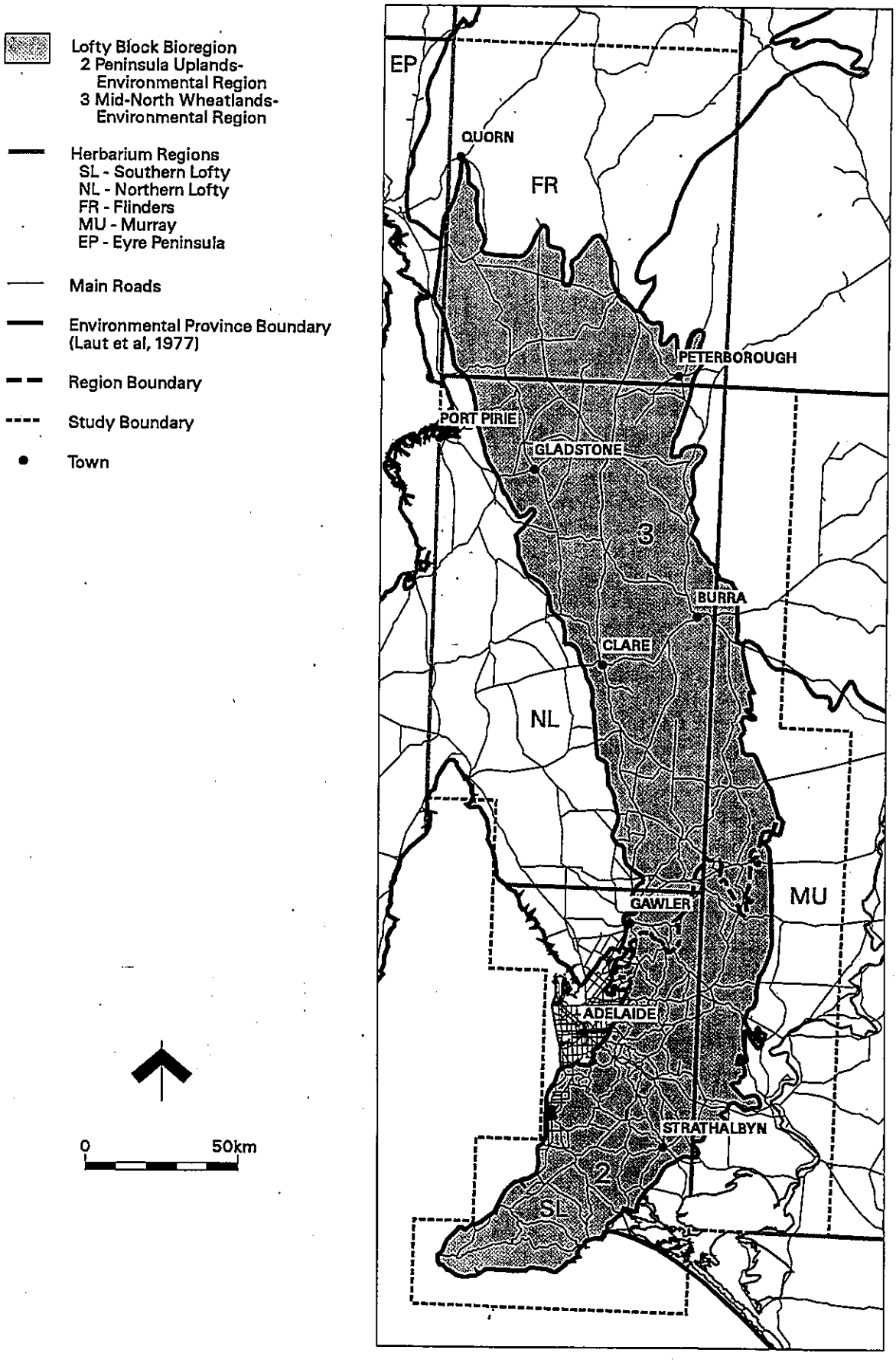


Figure 2. Flora Regions and Laut *et al.* (1977) Environmental Regions in Study Area

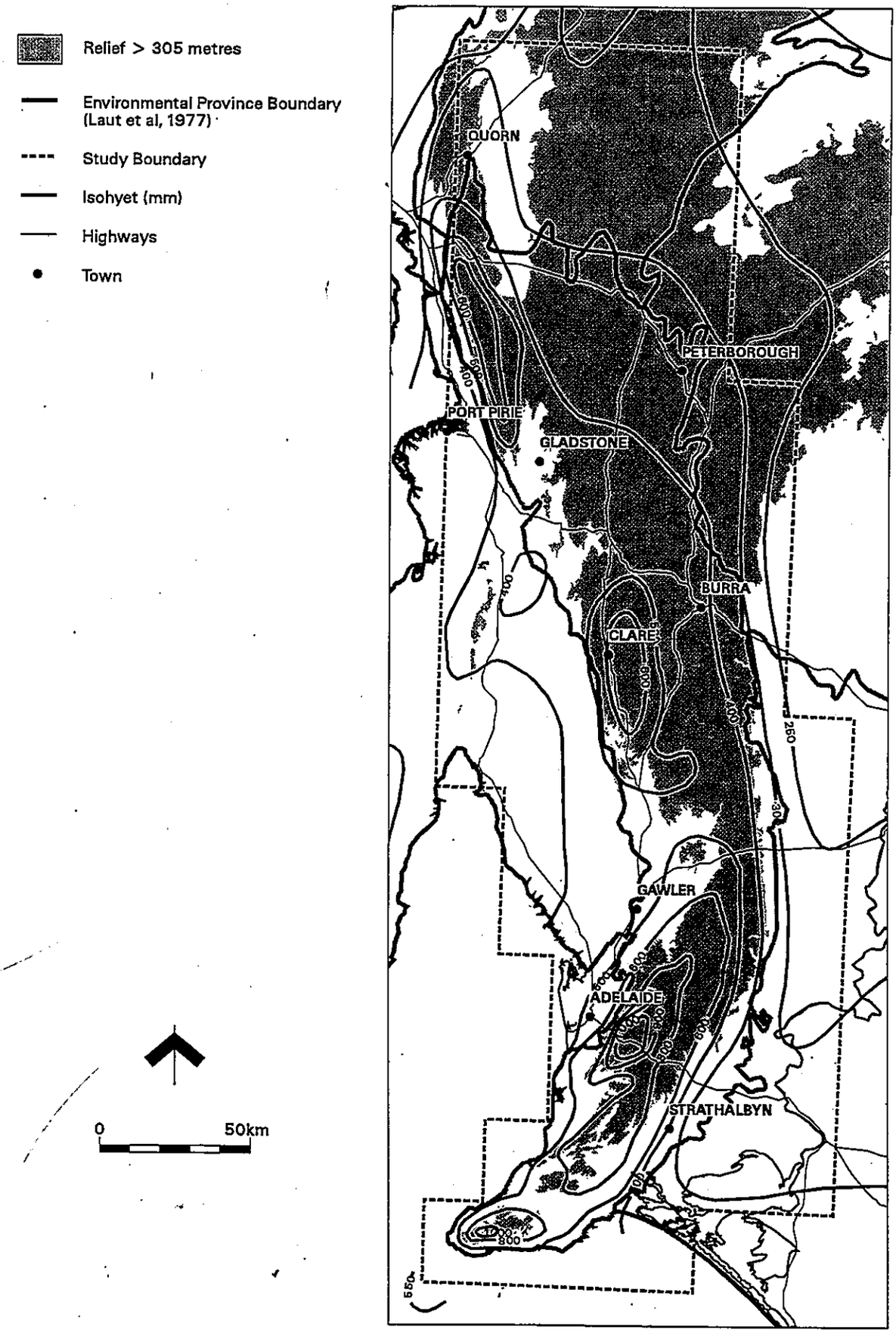


Figure 3. Relief and Annual Rainfall Isohyets - Lofty Block Bioregion

Williams and Goodwins (1988) used floristic groups as the unit of vegetation for an assessment of conservation of biological diversity on the Fleurieu Peninsula. This and other recent floristic classifications of grassland and grassy woodland in South Australia, and their limitations have been reviewed by Davies (1997).

The current study of grasslands and grassy woodlands in the Lofty Block Bioregion involved collection of field data together with the compilation and careful screening of existing data from many previous surveys. Remnant grassy woodlands and grasslands (the "savannah land systems" of Specht (1972)) were identified and sampled and data combined with selected data from previous surveys to construct a floristic classification of grassy vegetation of the bioregion. An overview of the Biological Survey of SA vegetation survey coverage in the Lofty Block Bioregion is included in Appendix I. Early land survey records were researched for the locations sampled in the field component.

THE LOFTY BLOCK BIOREGION

The mainland environmental regions (Figure 2) of the Lofty Block Province - the Peninsula Uplands Region and the Mid-North Wheatlands Region - cover an area of 19,030 sq. km (Laut *et al.*, 1977). The bioregion boundary reflects the limit of the Mount Lofty and Flinders Ranges uplands and climate, approximating the 300 mm annual isohyet (Figure 3). The climate of the bioregion is described in Laut *et al.* (1977). Altitude is greatest towards the north, being more than 900 metres at Mount Remarkable and at Mount Brown on the west of the region and at Mount Bryan on the east. The Lofty Block originated from uplift along faults with a roughly north-south orientation, now greatly eroded. The main ranges reflect this orientation. The uplands incorporate numerous minor ranges which also generally have a north-south orientation. The bioregion (including Kangaroo Island) is among the most diverse in the State in terms of number of plant associations and number of native vertebrate species (Environment Protection Council of South Australia, 1988), as well as being one of the most extensively cleared.

Conservation on the mainland Lofty Block was found to be poor and highly biassed when evaluated by Laut *et al.* (1977). Twenty four of 39 of the environmental associations (Figure 4) did not include any NPWS reserves, with the percentage area reserved at the time being 0.9% in the Peninsula Uplands Region (no conservation in 8 of 20 associations) and 0.8% in the Mid-North Wheatlands Region (no conservation in 16 of 19 associations). Most of the area reserved was located in a few of the environmental associations. Current estimates of native vegetation remnancy within environmental associations do not include native grasslands.

Average annual rainfall varies from less than 300 mm to 1100 mm. Grasslands and grassy woodlands occupy the lower part of this range being confined to the areas receiving less than 700 mm annually but occurring predominantly in areas receiving less than 600 mm. Specht (1972) cited a mean annual index of evapotranspiration of between 0.7 and 0.3 for savannah land systems. Grassy vegetation is restricted to the more fertile soils of the region; clays and loams to sandy loams. Distribution of the major soil types is shown in Figure 5.

PREVIOUS VEGETATION STUDIES

Little detailed previous research on the native vegetation in the Lofty Block Bioregion has been applied to the region as a whole. However, several parts of the region have been researched in some detail and existing data have been collated to present a statewide (Wood, 1937; Specht, 1972) or bioregional perspective (Laut *et al.*, 1977). The original ecological research collated for Specht's Lofty Block vegetation mapping included Specht and Perry (1948), Jessup (1946 and 1948), Stevens *et al.* (1945) and Todd (1965). Specht and Perry (1948) found that in the south central Mount Lofty Ranges south of Adelaide, the occurrence of savannah woodland understorey and distribution of dominant eucalypts reflected the combined influence of rainfall, aspect and soil nutrient status. As indicated by Davies (1982), the taxonomy of the South Australian box eucalypts has been clarified since the early studies, when *Eucalyptus microcarpa* and *E. porosa* were sometimes included in *E. odorata*.

Many of the National Parks and Wildlife Reserves were surveyed in the 1970s and 1980s during the rapid development of the park system, and biological resource inventories were included as part of park management plans. Rowett *et al.* (1981) studied native vegetation remnants (outside NPWS reserves) of the Mid-North and Western Murray Flats, with field sampling in February to April. Due to seasonal unfavourability and survey constraints, the herbaceous flora was poorly represented in this latter study.

The vegetation and fauna of the southern Flinders Ranges was studied by Kaczan (1981), who prepared an inventory and of plant associations and their general distribution. Kaczan found savannah woodlands in the Mount Brown, Willowie and western Wirrabara Forest Reserves and adjoining lands, including Beetaloo Water Reserve. Details of previous botanical studies in the region are also provided in Kaczan's report. The grasslands in the eastern section of Mt Brown Forest Reserve were assumed to have been cleared and were not included in the field research, although they have a substantial native component. Kaczan's recommendations have been partly implemented with recent additions of forest reserves to Mount Remarkable National Park and the creation of Mount Brown Conservation Park. Previously only the least fertile, most rugged lands had been included in NPWS reserves in the southern Flinders Ranges, as is often the case elsewhere.

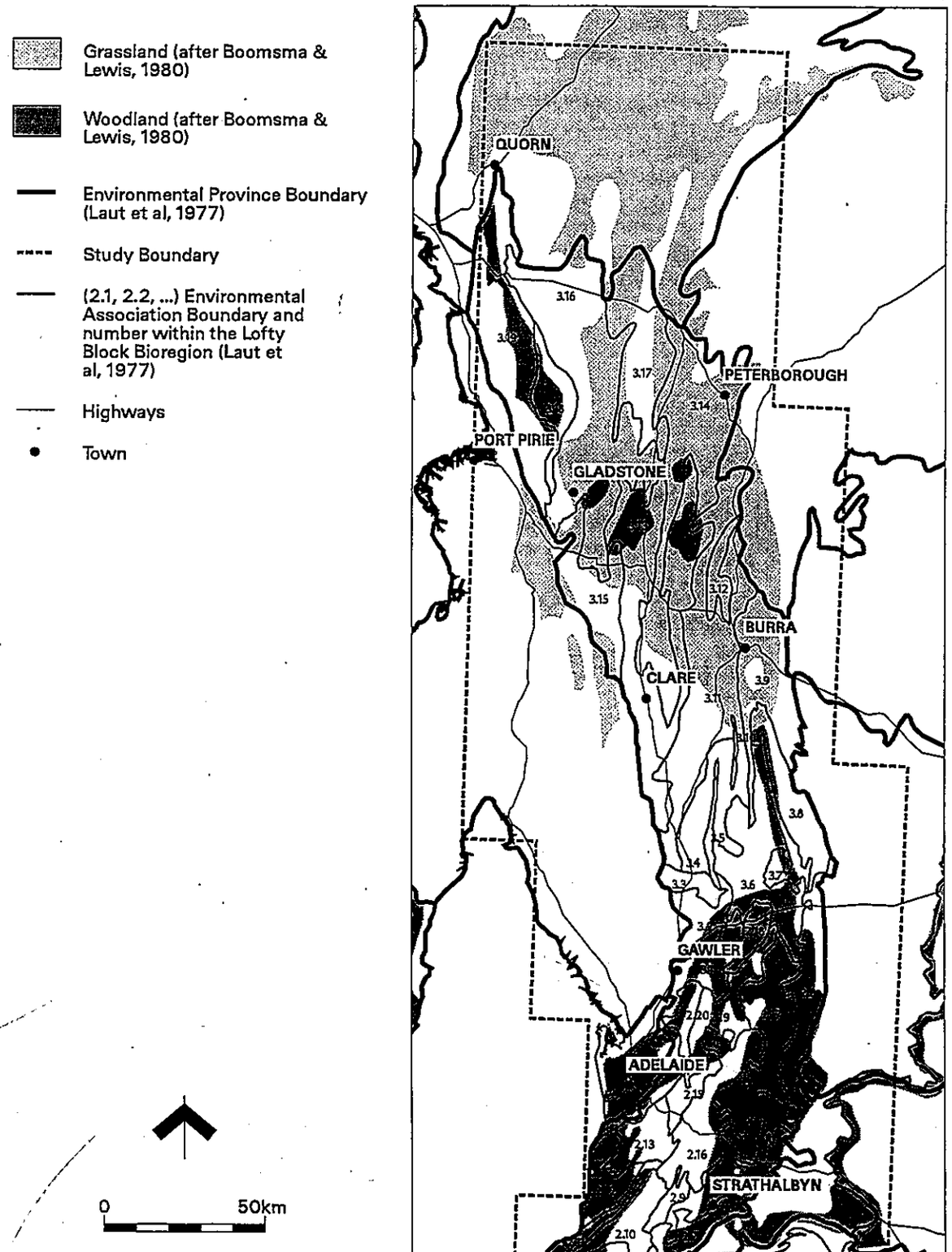


Figure 4. Environmental Associations (Laut *et al.*,1977) and Grassland and Woodland Vegetation Formations (Boomsma & Lewis, 1980) in the Lofty Block Bioregion

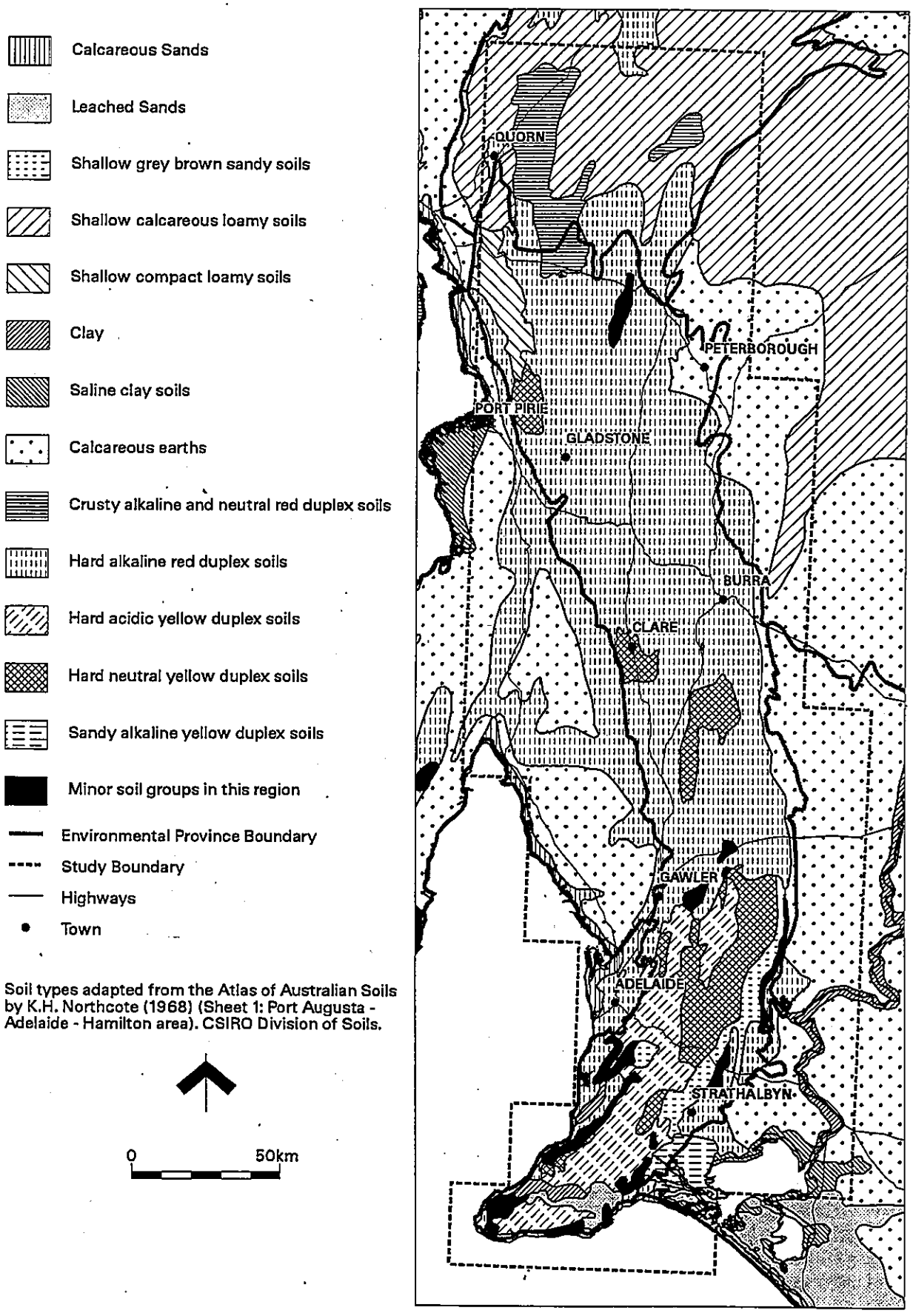


Figure 5. Soil Types in the Study Area

The vegetation of Mount Brown Conservation Park, including the eastern grassland section, was surveyed using the Biological Survey of SA methodology in October 1994 (Oppermann, 1995). The park has had a long history of grazing as a forest reserve and was still being grazed at the date of survey. The survey followed an unusually dry winter and spring, leading to difficulty in identification of grasses. The herbaceous flora is likely to have been under-represented due to the dry conditions.

Davies (1983) documented surviving examples of South Australia's most threatened plant communities and for the Lofty Block considered the priority 1 plant associations *Lomandra multiflora ssp dura - L. effusa* tussock grassland and *Eucalyptus behriana +/- E. odorata +/- E.dumosa* Open Scrub with sparse sclerophyllous shrubs. Davies identified locations of 7 significant remnants of *Lomandra* spp. grassland, and 18 locations where degraded examples of the community occurred in the Mid-North. However, due to the survey season, drought year, and the fact that time only allowed survey from roads, documentation of the flora was incomplete and the northern part of the historical grassland distribution was not surveyed. Only two examples of Open Scrub containing *Eucalyptus behriana w*ere found in the Mid-North, and these were very disturbed, minor occurrences of the community. However, a number of blocks of vegetation containing *E. odorata* were identified. One other Mid-North occurrence of *E. behriana* open scrub was reported in Davies (1982).

Hyde (1994) surveyed the disused rail corridors of the Mid-North and Yorke Peninsula, including many grassland and grassy woodland sites. As the rail corridors followed valleys and plains where possible, they carry remnant vegetation types that have all but disappeared from the surrounding agricultural lands. Nevertheless, as linear remnants and transport corridors they have also been subjected to many disturbances.

Hyde (1995) sampled native grasslands throughout the State's temperate region and analysed 51 temperate grassland quadrats along with selected quadrats from other surveys in the Lofty Block and the Murray Mallee, defining 10 grassland communities from 115 quadrats. Four major grassland communities that occur in the Lofty Block Bioregion were described: *Lomandra effusa* grasslands, *Lomandra multiflora* ssp. *dura* tussock grass complex, *Stipa* grasslands and southern *Triodia* hummock grasslands. Most of these communities were found to be widespread and very variable in structure. The analysis included some vegetation sampled out of season or that was very degraded, with only a few native species recorded in the quadrat. Problems encountered in interpreting the data were discussed by the author. Mapping of native grassland remnants from low level aerial flights was trialled as part of this project. The method has been found to have severe limitations because only *Lomandra* tussocks are sufficiently large and distinct to be detected. Reliable evaluation of condition of inter-tussock flora is not possible without ground based survey and such data are available for few of the areas that were mapped as grassland.

Hyde (1996) targeted vegetation containing *Eucalyptus odorata* and collected data from 22 quadrats, mainly in the Lofty Block and the Flinders Ranges. One hundred and forty eight quadrats including *Eucalyptus odorata* were extracted from the biological survey database and classified by PATN analysis. Five major plant communities that occur in the Lofty Block were described; *E. odorata* Mallee Heath, *E. odorata/ E. leucoxylon* Woodlands, *E. odorata* Open Woodlands, *E. odorata/ Allocasuarina verticillata* Woodlands and *E. odorata* "Dense Woodlands" (referring to woodlands with a relatively dense understorey).

Collection of baseline vegetation data for the Biological Survey of South Australia has recently been completed for the whole of the bioregion. Floristic analysis and mapping of vegetation of the Southern Lofty region (almost entirely within the Lofty Block) and the Western Murray Flats (partly within the Lofty Block) has been undertaken, and the composition of floristic groups corresponding to savannah plant associations has been described (Department of Environment and Planning, 1988; Lock & Goodwins, 1993). Grasses were apparently under-represented as components of these associations in the Southern Lofty survey. Both of these surveys were conducted in the autumn, when native grasses such as *Danthonia* spp. and most *Stipa* spp. are generally in an almost dormant state and do not carry fruiting material from which they could be identified to species. A similar situation existed for the Southern Olary Plains Survey (Forward & Robinson, 1996), which overlaps the north-east of the Lofty Block and was conducted in winter. Fortunately, the recent Mid-North and Burra Hills regional surveys have been carried out in Spring, enabling recording of seasonal flora. Information on vegetation in the Burra Hills, including grasslands has been presented and summarised (Playfair & Heard, 1995), but the vegetation has not been classified using PATN analysis. These data had not been available to be included in the Temperate Grasslands analysis. The Burra Hills area is a key area for native grassland remnants because earlier studies have identified much of it as originally grassland and it is marginal or unviable for agriculture. The predominant land use has therefore been "rough grazing" of undeveloped pasture and many pockets of land have not been continuously cropped.

The current study was able to include new sites and sites that had not been included in previous analyses (Burra Hills, Mount Brown) and a wider range of grassy vegetation types than had previously been analysed, for example, in the temperate grassland and *Eucalyptus odorata* surveys. More than 500 quadrats were included in the analysis.

Methods

AIMS

The current project had the following aims:

1. To collate existing information on the distribution, flora and conservation of grassland and grassy woodland of the Lofty Block Bioregion;
2. To identify gaps in the existing survey coverage of grassy ecosystems in the Lofty Block Bioregion. To plan and carry out a vegetation survey using standard Biological Survey of South Australia methodology, to complement previous survey in the Lofty Block and improve survey coverage of grassy vegetation types across the region. To provide the State Herbarium with voucher specimens of the vascular plants collected during the survey and to enter all data into the South Australian Survey Database;
3. To include survey of grassy ecosystems in protected areas such as heritage agreement areas and NPWS reserves, and other public lands;
4. To provide feedback to landholders whose properties were included in the field survey;
5. To select grassland and grassy woodland vegetation survey sites from the existing survey database and classify grassy vegetation according to floristic attributes using multivariate analysis (PATN). To describe the composition of these floristic communities and their distribution and environmental attributes from the published literature and the standard dataset;
6. To investigate early land survey records relevant to grassland and grassy woodland vegetation in the Lofty Block in comparison with present day vegetation;
7. To upgrade mapping of grassy remnants initiated by the Geographical Analysis and Research Unit of DTUPA in the State Environmental Database;
8. To identify significant sites, species and threatening processes;
9. To recommend conservation and management priorities for grassland and grassy woodland vegetation based on the need for conservation of the range of major vegetation communities in the Lofty Block with recommendations for specific sites where appropriate; and
10. To make recommendations for fauna survey and further investigations in the region.

STUDY AREA AND COLLATION OF EXISTING SURVEY DATA

The study area, based on Province 3, Mt. Lofty Block (Laut *et al.*, 1977) was extended to the north and west to include areas mapped by Specht (1972) and Boomsma and Lewis (1980) as originally grassland (Figure 4). Kangaroo Island (Environmental Region 1 of Lofty Block) was not included in the project because of its different history, predominantly sclerophyllous vegetation and isolation. The environmental and biological database and Geographic Information System (GIS) enabled the collation of much background information on a single series of maps. For an initial overview of the bioregion, working maps of the province and surrounding mapsheets were produced by DTUPA for this project at 1:200,000 showing

- Boundary of Province 3- Mount Lofty Block.
- All survey site locations in the database with site identifiers and patch numbers.
- Heritage Agreement boundaries.
- National Park and Wildlife reserve names and boundaries.
- Outline, name and number of 1:50,000 scale mapsheets.
- Original extent of *Lomandra effusa* +/- *Lomandra multiflora* ssp. *dura* open tussock grassland as mapped by Specht (1972) - the original published scale of mapping was smaller, so at 1:200,000 the distribution must be regarded as approximate only.
- Vegetation Cover, where available (boundaries are derived from aerial photo interpretation and therefore biassed towards wooded areas). In this initial mapping phase, vegetation cover had been classified as:
  1. "Natural Vegetation"- with relatively dark, dense native understorey visible on aerial photo; or
  2. "Vegetation - condition uncertain/unknown (generally referred to as modified)"- native tree canopy but apparently sparser, less dense understorey which could be native or exotic or both; or
  3. "Vegetation-modified semi-arid/ arid chenopod shrublands/native grasslands" - lacking a continuous identifiable native tree canopy or dense native shrub layer; occurring mainly in marginal agricultural/pastoral areas.

  Grassy vegetation is most likely to be represented in categories 2 and 3.

For selected 1:50,000 mapsheets, mostly in the Burra Hills, working maps at 1:50,000 scale were also produced from the GIS with the above features, as well as rainfall isohyets, Laut *et al.* (1977) environmental association and Specht's (1972) vegetation boundaries and grassland remnants identified by Hyde (1995) to aid in site selection and analysis.

FIELD SURVEY STRATEGY

Because the Lofty Block Bioregion is very extensive and has been the subject of vegetation surveys in the past, (Figure 6) the field survey aimed to fill gaps in the existing survey coverage while locating and sampling sites with a reasonable complement of native species in a wide range of vegetation types and a broad geographic spread.

It was an aim of this project to produce a definitive classification of grassland and grassy woodland vegetation communities in the region by PATN Analysis of all suitable vegetation sites in the Biological Survey Database, supplemented by sites from additional field survey. An initial assessment of the existing geographical coverage of these communities was undertaken to determine priorities for field survey.

CHARACTERISTICS OF GRASSY ECOSYSTEMS

The broadest structural criterion distinguishing a grassland or allied vegetation type in this region is the absence of a well developed medium height (0.5 - 2 m) native shrub layer. However, the density of medium shrubs may be reduced by grazing, or increased by the presence of alien plants or other disturbance. For example, Specht (1972) referred to dense regrowth of *Acacia* species following fire in savannah understorey, and invasion by woody alien species after removal of grazing stock, from the savannah woodlands in the Adelaide Hills. Therefore it is desirable to allow some latitude in the density of the shrub stratum.

Previous attempts to extract grassland or grassy woodland sites from the database (eg. Moore, 1994) had resulted in inclusion of some non-grassy sites and exclusion of some grassy sites. Indicators used in these previous attempts were:

- presence of common genera of native grasses or *Lomandra* spp. and box grassy woodland eucalypts within the broad distribution of grassland and grassy woodland (Boomsma & Lewis, 1980)
- presence of 3 or more out of a list of taxa compiled by botanists (P. Lang and R. Davies, pers. comm.) as typical of grassy ecosystems
- vegetation structural description by surveyors in the field

Therefore, existing vegetation samples were initially classified as "grassy" or "not grassy" using a combination of criteria. The characteristics of both the overstorey and the understorey were considered. Although a shorthand description of individual site vegetation (dominant overstorey and understorey species and overstorey vegetation structure description) was available, in most cases, it was still necessary to refer to a complete species list to achieve a consistent classification. Both the species present and their cover/abundance ratings were used for classification of sites, drawing on experience and literature (eg. Specht, 1972; DEP, 1988) in the case of indicator/contra indicator species.

Positive indicators for grassland and allied vegetation communities were

- Presence of woodland eucalypts as dominant or codominant (*Eucalyptus odorata, E. microcarpa, E. leucoxylon, E. camaldulensis*)
- High cover/abundance rating of low growing species; native grasses, *Lomandra* species, other native herbs, low sedges, mosses or lichens.

In the case of understorey species, a cover/abundance score of 2 (cover 5% to 25%) or higher was considered to be "high".

Negative indicators were

- Presence of a well developed stratum of native species that form medium to tall shrubs, particularly those that are characteristic of semi-arid chenopod shrublands, and shrub-like species such as *Xanthorrhoea* spp.
- Presence of forest eucalypt species (eg. *Eucalyptus obliqua*) or mallee species such as *E. leptophylla*
- High cover/abundance of *Triodia* spp., thus focussing the survey on tussock rather than hummock grasslands.

In the case of understorey species, a cover/abundance score of 3 (cover 25% to 50%) or higher was considered to be "high".

LOFTY BLOCK GRASSLANDS FIELD SURVEY

The northern boundary of the Lofty Block is within the original distribution of grassland as mapped by Specht (1972) and Boomsma and Lewis (1980), adjoins grassland in the Burra Hills, and was found to include areas of grassland in recent searching for Plains Wanderer habitat for the RAOU (Webster, 1996). The northern plains were therefore identified as the highest priority area for field survey in the 1995-1996 field season.

Few examples of grassland and grassy woodland had been sampled in the Southern Lofty and Western Murray Flats surveys (Figure 6). Wooded vegetation was emphasised in the regional survey coverage. This bias had been addressed to some extent in the east by the Burra Hills and Temperate Grassland Surveys. Of the regional surveys, only the Burra Hills survey sampled extensively in native grassland. Priority areas for field survey in the spring -summer 1996 field season were the upper Mid-North and southern Flinders Ranges, and the eastern Mount Lofty Ranges/ Western Murray Flats.

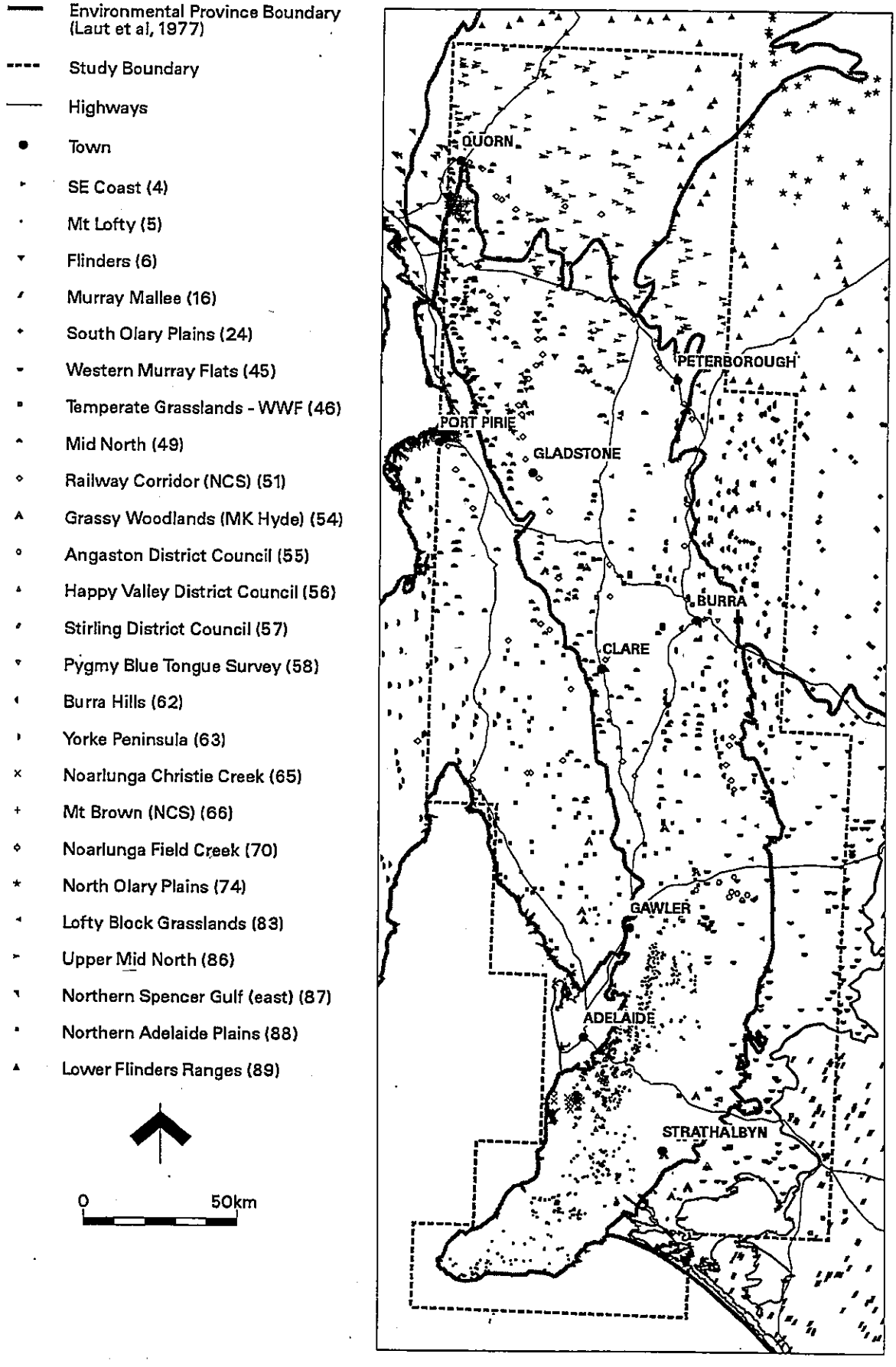


Figure 6. Location of Vegetation Survey Sites in the Study Area

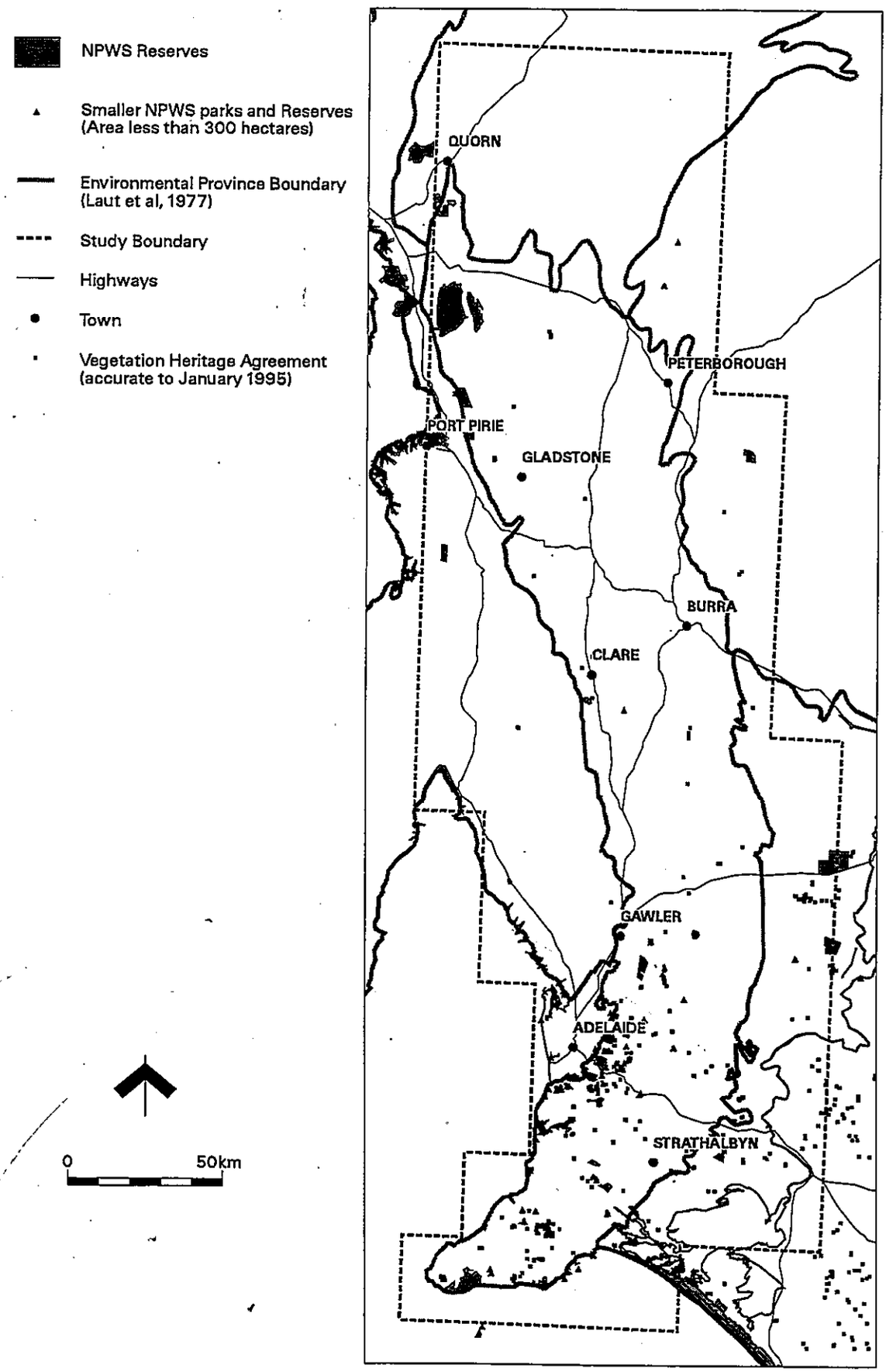


Figure 7. Locations of Parks and Heritage Agreements within the Study Area

SITE SELECTION AND NOMENCLATURE

Standard Biological Survey of SA methodology for vegetation survey is described in Heard and Channon (1997). The same field recording and specimen collection protocol has largely been followed for specialist surveys (eg. Hyde, 1994, 1995) and was followed in the Lofty Block Grassland Survey. In the current survey, the strategy for selecting survey sample sites was somewhat different to the regional survey methodology, as described below.

Important determinants of site selection procedures were the low native vegetation remnancy in the Lofty Block Region, the need to sample grasslands with little or no tree canopy, the large size of the region and the fact that only one survey team was usually available. Emphasis was placed on finding remnants in parts of the region not well covered in previous surveys, and logistically it was necessary to focus on a few relatively compact subregions.

To minimise bias against remnant native vegetation that had been overlooked in previous land cover mapping, there was emphasis on ground reconnaissance, review of literature and existing survey data in addition to aerial photography interpretation.

Heritage Agreements and conservation reserves in the Lofty Block (Figure 7) are important potential survey sampling sites. Neagle (1995) lists all major plant associations in National Parks and Wildlife Reserves and larger Heritage Agreements and is a source for specific information on plant associations of conservation significance recorded during park resource inventories or assessment of private land for Heritage Agreement. NPWS Reserves and a number of Heritage Agreement areas had already been sampled during regional and specialist surveys. This information, together with biological data in files of the Native Vegetation Conservation Section and knowledge of individual departmental officers and others enabled selection of heritage vegetation and reserves for field sampling.

The conventional wisdom on sampling in regional surveys is to avoid obvious vegetation boundaries, and remnant edges where practical. In the case of the Lofty Block Grassland Survey, where most vegetation sampled had a history of disturbance, or was currently grazed, quadrats were placed in order to sample the least disturbed native grassy vegetation in the remnant. This often meant sampling in grassy vegetation on the outskirts of a sclerophyllous remnant after selective clearance almost to the edge of the more fertile land. It also resulted in sampling near vegetation type boundaries for the same reasons. Quadrat size, generally 30 x 30 metres for the agricultural region, was extended to 50 x 50 metres in sparse vegetation.

Because the Lofty Block Grassland Survey sampled over a broad region, a system was used for identifying quadrats that indicated both the survey (denoted by the prefix LBG) and the mapsheet name (the first three letters of the mapsheet followed LBG). The seventh and eighth characters of the site identifier consisted of a two digit sequential number, starting with 01 for the first quadrat on each mapsheet.

DATA COLLECTION

Data were collected on physical environment, vegetation structure and plant species cover/abundance as described in previous surveys (eg. Playfair & Heard, 1995) and a quadrat photo was taken at each site. Survey from October to December is generally optimal in this region to maximise identification of native grasses to species, especially *Stipa* and *Danthonia* spp. In the 1995-1996 season, the commencement of major field sampling began at the start of summer although three opportunistic sites were surveyed in mid-spring. This had an effect on data quality for some sites surveyed, with the field work extending into early March in the Northern Lofty Region. In the 1995-1996 field season, 45 vegetation sites were sampled with most sites in the northern part of the Lofty Block Bioregion. In the 1996-1997 season, field work commenced in October as part of the DTUPA Upper Mid-North survey, with a number of grassland sites selected on the basis of reconnaissance the previous year and others found during the standard reconnaissance for the regional survey. Field work extended through to the end of December 1996 with sampling in the southern Flinders Ranges, south eastern Mount Lofty Ranges and the Adelaide Hills. A total of 74 sites were sampled during the Lofty Block Grassland Survey. The number of quadrats in the herbarium regions were: Flinders Ranges Region (FR): 29 quadrats; Murray Region (MU): 13 quadrats; Northern Lofty Region (NL): 23 quadrats; Southern Lofty Region (SL): 9 quadrats.

VEGETATION ANALYSIS

DATA PREPARATION

Data from the field component of the study were combined with data from sites selected as described above for floristic analysis. The density of grassy quadrats sampled across the region varied greatly, from intensive sampling of a small area such as in Mount Brown Conservation Park and the grey box woodlands of the Adelaide Hills, to sparse sampling across a large area, such as in DTUPA regional surveys. The sites in the initial site selection process were reviewed prior to analysis. When in doubt, the site was included in the initial dataset with the expectation that the initial analysis would indicate sites that were atypical and these could be removed from subsequent analysis.

The vegetation quadrat data were analysed by classification techniques using PATN exploratory analysis software (Belbin, 1987, 1991) to detect trends and patterns in the data. The vegetation data were extracted for the selected quadrats as listings of sites and species on which taxonomic standardisations were performed. These data were imported into PATN as a

fixed width text file list of records comprising site number (object), species number (attribute), cover code (value), along with corresponding label files for sites and species.

Ordination

Three dimensional ordination of quadrats and group centroids was undertaken but did not show any clear trends. This could be due to variability within groups, the large number of sites, sampling of ecotones and or the relatively narrow range in environmental parameters such as soil types within grassy vegetation in the region.

LABELS

A maximum eight character format is allowed for by PATN site and species labels. To aid in interpretation of results that include quadrats from different surveys, some site identifiers were prefixed by a letter or number. Site identifiers from regional surveys in the agricultural region generally include the first three letters of the 1:50,000 mapsheet. To distinguish between sites on the Hallett mapsheet in the Burra Hills survey from sites on the Halbury mapsheet in the Mid-North survey, a "B" was prefixed to the Burra Hills site number. Other Burra Hills sites in the area of overlap between surveys were also given this prefix. To ensure that sites from the Flinders Ranges Survey were readily distinguished, they were prefixed "F".

Specialist surveys, such as the Mount Brown and Temperate Grassland survey have site identifiers that indicate the survey. Sites from the Rail Corridor Survey, the Temperate Grassland Survey and the *Eucalyptus odorata* survey had been classified previously using PATN (Hyde, 1994, 1995, 1996) and in these cases the site number was given an integer prefix indicating into which floristic group the site had been allocated.

Plant species were given an eight letter label constructed from the first four letters of the genus and species names. Any distinct taxa that had the same abbreviated code were given different amended codes. The resulting complete list of species from the selected database was examined with the taxonomic assistance of Dr. Peter Lang. Records that were not identified to species level were omitted from the analysis unless the genus was represented by only one species in the region. The same rule was applied to species not identified to subspecific, varietal or form level. Where it was considered that closely related taxa could not or would not be reliably distinguished in the field they were lumped together into a single taxon code. The decisions made are recorded along with the full species name and abbreviated code in Appendix III.

COVER/ABUNDANCE VALUES

The third component of the data was a scale derived from cover/abundance rating. Cover/abundance of all vascular plant species occurring in a quadrat had been rated using 7 classes, as follows.

- Cover less than 5%:
  - **N** (up to 10 plants);
  - **T** (sparsely present);
  - **1** (plentiful).
- Cover more than 5%:
  - **2** (5%-25% cover);
  - **3** (25-50% cover);
  - **4** (50-75% cover);
  - **5** (75-100%cover).

Examination of the dataset showed that most cover-abundance scores in Lofty Block grassy ecosystems have been estimated to be less than 5% cover. PATN assumes a ratio scale, which may be species presence or a scale representing cover. Ranked numeric values based on cover/abundance scores have been used in previous PATN analyses, and can be coded to reflect actual percentage cover score. The inclusion of a cover-abundance scale gives more weight to large species and species which tend to occur as strata dominants. The fragmentary nature of grassland and grassy woodland communities of the Lofty Block and the disturbances to which they have been subjected would be expected to influence native species cover as well as species present. Estimates of cover/abundance are subject to some observer bias. The Lofty Block grassland PATN analysis included many surveys, undertaken in different years, each of which had multiple observers, a potential source of additional variability. Presence/absence data may be used in PATN as a means of minimising the impact of observer bias. However, in the Lofty Block grassy communities, some important native species, such as *Lomandra multiflora* ssp. *dura* are almost ubiquitous, varying from sparse understorey species in woodlands to top stratum dominants in grasslands. The scale that was used for the final analysis grouped non-dominant species (less than 5% cover) and dominants (5%-75% cover) and weighted dominant species, as follows. All cover/abundance classes representing less than 5% cover were given a value of 1.0; classes 2 to 4 with 5%-75% cover a value of 3.0; class 5 with a cover/abundance of more than 75% was given a value of 4.0.

SPECIES CODING (TAGGING)

All species were coded initially from existing tables derived during previous studies as perennial or annual, native or alien, or incompletely identified. Some corrections were needed and the native taxa were further classified as perennial, orchid, mistletoe, seasonal (summer dormant geophytes) or true annual.

DATA ANALYSIS

The initial dataset, consisting of cover code values for 1132 lumped taxa at 747 quadrats by was entered into PATN. There were initially 20901 records. The matrix was further pared after an initial analysis of native species at all sites . To enable inclusion of seasonal vegetation (but not true annuals), quadrats from autumn/winter surveys - Flinders Ranges, Western Murray Flats, South Mount Lofty Ranges and Southern

Olary Plains - were excluded. A group of "wetland" sites that formed a distinct group from PATN analysis was excluded (a description of the Mid-North grassy wetland community was included in Hyde, 1995). The criteria for selecting "grassy" sites were more strictly applied to exclude northern hummock grasslands and mallee communities. Within PATN, true annuals and orchids were masked from the dataset to allow for yearly climatic variation and mistletoes were also masked out.

Table 2. Source of quadrat data included in the Lofty Block composite grassy vegetation analysis

SURVEY NAME	SURVEY NO	Survey identifier prefix	No. of quadrats
TEMPERATE GRASSLANDS	046	TG	27
MID-NORTH	049	map code	109
RAIL CORRIDOR	051	NCS	36
E ODORATA WOODLAND	054	GWL	13
ANGASTON DC	055	ADC	5
HAPPY VALLEY	056	HV,MIT	4
PYGMY BLUE TONGUE	058		4
BURRA HILLS	062	map code	62
YORKE PENINSULA	063	map code	6
NOARLUNGA CHRISTIES CK	065	NCC	8
MOUNT BROWN CONS PARK	066	MBS	53
NOARLUNGA FIELD CK	070	NFC	7
LOFTY BLOCK GRASSLANDS	083	LBG	72
UPPER MID-NORTH	086	map code	78
NORTHERN ADELAIDE PLAINS	088	map code	29
ALL SURVEYS			513

The PATN modules of PRAM and LABN were used to initialise the matrix and MASK to select the species and quadrats required for analysis. To reduce the influence of species-poor quadrats and rare species, quadrats were excluded if they had fewer than 10 native species and species were excluded if they were recorded in fewer than 10 quadrats. The final matrix analysed in PATN included cover values for 216 taxa at 513 quadrats, a total of 11,133 records (Figure 8). Surveys from which quadrats were selected for inclusion in the final PATN analysis, are shown in Table 2.

The default values within PATN (Belbin, 1987) were used for the analysis until the interpretation of the dendrogram. An association matrix was created with the PATN module ASO, using the Bray Curtis coefficient of dissimilarity, then clustered with FUSE using flexible UPGMA (unweighted pair group arithmetic averaging) with a beta value of -0.1. The DEND routine displays a dendrogram that summarises the results of the hierachical clustering, showing the relationship of all quadrats to each other. The dendrogram can be cut at any level of dissimilarity to display a desired number of groupings and should be cut at a level where the vegetation types represented by the quadrats in these groupings reflected ecologically meaningful groups. The purpose of the classification is to identify vegetation types in which many species commonly and repeatedly occur together due to particular environmental factors.

The GDEF module was used to define the composition of the chosen groupings, listing the quadrats in each group. The data was transposed using DATN and the species were analysed as objects using the 2 step option within ASO. The dendrogram ordering and grouping of both the species and the sites specified in the original and transposed GDEF files was imported into TWAY to create a two way table of species by quadrats. The two way table can assist with decision making on the number of groups.

MERG was used to append the dendrogram order and the group definition to the list of quadrats and further processing, including calculation of statistics on species' distribution within and across groups was carried out using Microsoft EXCEL and ACCESS. From a matrix of species frequency by site group, EXCEL was used to calculate a partial chi-square value for each species frequency within each group using Yates correction factor (Zar, 1984). This value was used as a relative indicator of the species' importance in defining the group. As well as species that had a low frequency in many groups and a relatively high frequency within a few groups, species which had a high frequency in many groups and a low frequency in a few groups had high chi-square values. A well defined group was considered to have some dominant species that showed high proportion of occurrence within the group and a relatively high number of cover/abundance values greater than 5% and some species, not necessarily dominant species, that had a low frequency in other groups and also a relatively high frequency within the group. These latter species, that particularly characterised a group, were defined as indicator species.

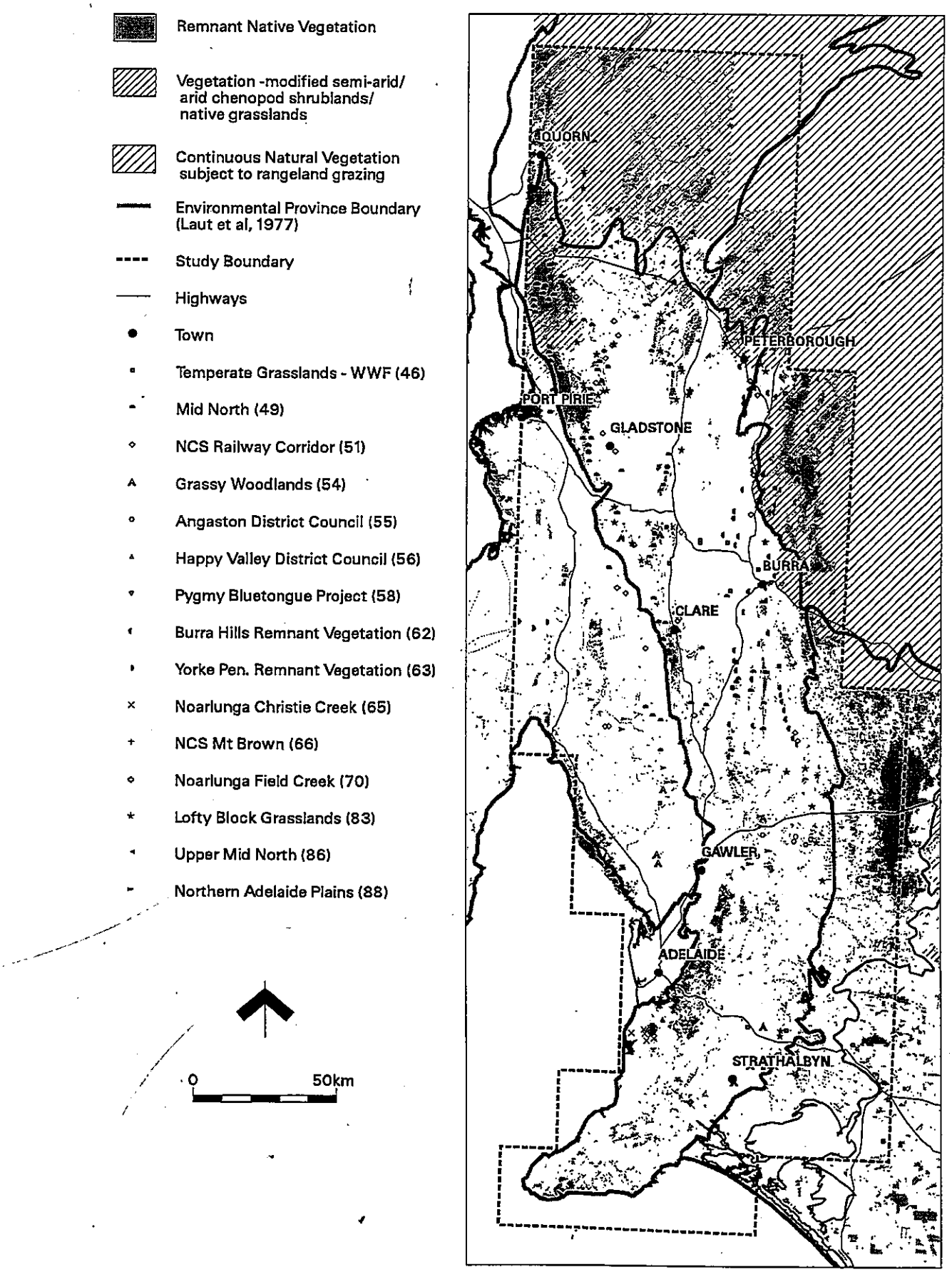


Figure 8. Grassy Vegetation Survey Sites included in Analysis

Each floristic group was named using overstorey dominant species and structure, and further described using sub-dominant overstorey species, understorey dominant species and indicator species, if any.

DOMINANT SPECIES (generally overstorey) are perennial native species that frequently occurred with a cover/abundance score of 2 or higher, (>5% cover) and were present in 50% or more of quadrats in the group.

STRUCTURE of the overstorey dominant stratum at each quadrat is contained in the vegetation structure field in the database. This parameter is calculated from the cover/abundance and lifeform of the overstorey dominant species and named from the vegetation structural formation table in Appendix II. There is variation in structure within floristic groups and the modal structure class was named for each floristic group.

SUB DOMINANT AND UNDERSTOREY DOMINANT SPECIES are native perennial overstorey and understorey species that occur frequently and commonly have a cover/abundance of more than 5%.

INDICATOR SPECIES were native plant species whose occurrence in the group was relatively significant as indicated by a high chi-square value within the group (indicated by ## (chi-square value of greater than 10.83) or # (chi-square value of greater than 7.88)) that occur relatively commonly in the group, (frequency usually >30%) and were relatively uncommon in most other groups.

Floristic group allocations from PATN were added to the original matrix for further interpretation. The original taxonomic names were used for analysis of rare species distribution and frequency, while "lumped" species codes for were used in descriptions of floristic group composition including alien, annual, orchid and mistletoe taxa not included in the PATN analysis.

In general, records not identified to species level were not included in the PATN analysis. Grass taxa such as *Stipa* spp. and *Danthonia* spp. were relatively common and can be important structural components of grassy vegetation. Therefore the distribution and cover/abundance values of *Stipa* spp. and *Danthonia* spp. across the floristic groups was considered in interpreting the floristic communities. Conversely, species that were lumped together in the analysis due to problems with field identification, notably *Danthonia eriantha* and *D. laevis* that had been lumped with *D. caespitosa,* were considered separately in relation to their distribution across floristic groups.

The array of environmental parameters were extracted from the survey database and stored in a Microsoft ACCESS database, where they could be related to the floristic information. Continuous data such as altitude and slope was transformed into classes to enable trends to be discerned. Annual rainfall was estimated from isohyets to the nearest 50 mm for each map sheet, allowing for distribution of quadrats within mapsheets. These estimates may be less accurate in the steeper parts of the ranges due to the steep gradient of rainfall over short distances. Soil texture classes were related to a scale of estimated percent clay content, that enabled them to be categorised to assist with group comparisons.

Land tenure information is stored in a different statewide database from environmental data on the DTUPA geographic infomation system. The possibility for generating land tenure information for all grassland and grassy woodland sites automatically was investigated. Quadrats occurring within National Parks and Wildlife Reserves or Forest Reserves were readily identified, however, there is incomplete coverage of water and minor reserve boundaries in the environmental database. Locations within major water reserves had to be identified individually and information on minor reserves such as local government reserves was obtained on an ad hoc basis. The land tenure information is therefore incomplete in relation to minor reserves. Quadrats located within Heritage Agreements were also identified individually from maps.

The plant species that are largely confined to grassy vegetation types in the region were identified as follows. Species that were recorded in the selected 513 grassy quadrats were considered as the species that occur within grassy vegetation in the region. The full complement of mainly regional survey sites; the Mid-North, Burra Hills, Upper Mid-North, Northern Adelaide Plains, Rail Corridor, Mount Brown, southern council surveys, part of grassy woodland and temperate grassland surveys comprised a total number of 1039 sites in the region. The frequency of the species in 513 grassy sites was therefore compared with their frequency in 526 non-grassy sites.

Results

VEGETATION ANALYSIS

LOFTY BLOCK GRASSLANDS SURVEY

Quadrat location, environmental data and land tenure for the Lofty Block Grassland Survey are summarised in Appendix VIII.

Total Species

A total of 3774 plant records were made during the Lofty Block Grassland survey, with 427 native taxa and 147 alien taxa being recorded at 74 quadrats. All species are listed in Appendix IV with their overall and regional frequency. Alien taxa comprised 25% of the taxa recorded and contributed 30% of the total plant records.

COMPOSITE VEGETATION DATA

Vegetation structure and location

The site screening and data masking procedures described in the methodology identified 513 grassland and grassy woodland quadrats in the study area, each with 10 or more native species present. Vegetation structure and composition at all 513 sites are summarised in Appendix VII. Vegetation structure, based on dominant life form/height class (Appendix II) was classified as grassland or "sedgeland" in about one fifth of the quadrats (Table 3) and the most common vegetation structure was low woodland. Most dominant life forms had estimated projected foliage cover between 10% and 70%.

Total Species

After excluding incomplete and redundant data, 884 taxa were recorded in the 513 grassland and grassy woodland sites. Fifty two, or 5.9% of species occurred at 20% or more of sites (106 sites), including 19 alien taxa. More than a third of these most common species are alien, and 241, or 27% of taxa overall were alien. Most indigenous grass species were perennials, whereas most alien grass species were annuals. (Table 4).

Table 4. Floristic diversity within life form groups recorded from grassy quadrats

Life form or group	indigenous taxa	alien taxa	all taxa
perennial grass	58	12	70
perennial (not grass)	367	51	418
orchids	31	1	32
annual grass	5	36	41
annual or seasonal (not grass or orchid)	182	141	323
TOTAL	643	241	884

Representation of alien species in the set of most frequently sampled species is only slightly higher than their representation overall. The most frequent species, wild oats (**Avena barbata*) and more than half of the 10 most frequently recorded taxa were alien (Table 5). The six most frequent species occurred at more than half of the quadrats and the 20 most frequent taxa occurred at more than 30% of quadrats. On the other hand, 230 species occurred only once.

Table 3. Frequency of quadrats in each vegetation structure class based on dominant life form/cover.
(Vegetation structure categories and life form definitions in Appendix II)

Vegetation Structure	Quadrats	Cover class: >70% dense	30-70% mid dense	10-30% sparse	<10% very sparse
grassland/herbland	59	2	43	12	2
"sedgeland" (mainly *Lomandra* spp.)	41		10	26	5
hummock grassland	4		2	2	
low shrubland	29		10	13	6
shrubland	31		10	18	3
tall shrubland	22		8	13	1
mallee/low mallee	49		21	23	5
very low woodland/forest	34		10	17	7
low woodland/forest	195		48	114	33
woodland/forest	48		8	31	9
total (quadrats)	512	2	170	269	71

Table 5. The twenty most frequently recorded species recorded in grassy quadrats

Species	Common name	Life form	Frequency	% Occurrence
**Avena barbata*	wild oats	AG	322	63
Danthonia caespitosa group	common wallaby grass	PG	319	62
Oxalis perennans	native oxalis	S	313	61
**Vulpia* sp.		AG	299	58
**Echium plantagineum*	Salvation Jane	A++	277	53
Arthropodium strictum	common vanilla-lily	S	263	51
Lomandra multiflora ssp. *dura*	hard mat-rush	P	240	46
**Hypochaeris glabra*	smooth catsear	A	232	45
**Sonchus oleraceus*	sow thistle	A	226	44
**Bromus rubens*	red brome	AG	212	41
Dianella revoluta	black anther flax-lily	P	211	41
Wahlenbergia luteola	yellow-wash bluebell	S	203	39
Bursaria spinosa	sweet bursaria	P	194	37
Maireana enchylaenoides	wingless bluebush	P	191	37
**Medicago minima* var. *minima*	small burr-medic	A	179	34
**Bromus diandrus/rigidus*	rigid brome	AG	170	33
Acacia pycnantha	golden wattle	P	169	32
Goodenia pinnatifida	cut-leaf goodenia	S	169	32
Daucus glochidiatus	native carrot	A	164	31
**Trifolium angustifolium*	narrow-leaf clover	A	160	31

* denotes alien; ++ This species is biennial but has been included with annuals
Life Form code: A=annual, P=perennial, S=seasonal (perennial root system), PG=perennial grass, AG= annual grass

Dominant Plant Families

There was high diversity of both native and alien species in the three most frequently recorded families (Table 6); Gramineae (grasses), Compositae (daisies) and Leguminosae (peas). This contrasts with the preponderance of native species and records in the Liliaceae (lilies). The remaining important native families with more than 400 records (Chenopodiaceae, Goodeniaceae and Myrtaceae) were not represented by any alien taxa. Families that were represented by more alien than native taxa were Cruciferae, Iridaceae (irises) and Caryophyllaceae. Other families represented by more than 10 native species were the Orchidaceae (orchids, 35 native, 1 alien), Cyperaceae (sedges, 20 native), Zygophyllaceae (12 native), Thymelaceae (11 native), Malvaceae (10 native, 1 alien).

Table 6. Plant species records within the most abundant families

Family	Records:			Species:		
	native	alien	all species	native	alien	all species
GRAMINEAE	2337	2268	4605	63	49	112
COMPOSITAE	1847	1192	3039	99	30	129
LEGUMINOSAE	874	944	1818	60	27	87
LILIACEAE	1464	87	1551	30	2	32
CHENOPODIACEAE	936		936	49		49
GOODENIACEAE	496		496	17		17
MYRTACEAE	416		416	26		26
OXALIDACEAE	318	53	371	2	3	5
BORAGINACEAE	34	326	360	5	5	10
CAMPANULACEAE	346		346	7		7
CRUCIFERAE	25	309	334	7	12	19
IRIDACEAE	2	300	302		10	10
LABIATAE	65	214	279	8	5	13
GERANIACEAE	120	153	273	4	5	9
CONVOLVULACEAE	266	2	268	4	1	5
CARYOPHYLLACEAE	17	246	263	2	18	20
PRIMULACEAE		138	138		1	1

Table 7. Native species occurring predominantly (75% or more of quadrat records) in grassy vegetation in Lofty Block Bioregion

G: frequency in grassy sites, **B:** total frequency in bioregion, **% grassy** = G/B, **Sig.:** significance level [** P<0.001; * P<0.01; ns not significant P> 0.01] based on chi-squared with Yates correction factor (Zar, 1989)]

SPECIES	Species frequency G	Species frequency B	% grassy	Sig.
Number of quadrats	513	1039	49	
Danthonia carphoides var.	19	19	100	**
Cryptandra amara var. amara	10	10	100	*
Cassinia arcuata	8	8	100	*
Danthonia pilosa var. pilosa	7	7	100	*
Eryngium rostratum	6	6	100	ns
Psoralea australasicum	6	6	100	ns
Rhodanthe floribunda	6	6	100	ns
Vittadinia australasica var.	6	6	100	ns
Prasophyllum occidentale	5	5	100	ns
Stipa hemipogon	5	5	100	ns
Velleia paradoxa	26	27	96	**
Leptorhynchos tetrachaetus	35	37	95	**
Amphipogon caricinus var. caricinus	14	15	93	**
Danthonia pilosa var. paleacea	12	13	92	*
Cryptandra amara var. longiflora	32	35	91	**
Cymbonotus preissianus	21	23	91	**
Danthonia auriculata	70	78	90	**
Calocephalus citreus	46	51	90	**
Eucalyptus microcarpa	68	77	88	**
Lomandra micrantha ssp. micrantha	15	17	88	*
Pimelea glauca	15	17	88	*
Rumex dumosus var.	14	16	88	*
Eucalyptus leucoxylon ssp. leucoxylon	7	8	88	ns
Vittadinia blackii	41	47	87	**
Minuria leptophylla	71	83	86	**
Drosera glanduligera	6	7	86	ns
Rhodanthe troedelii	6	7	86	ns
Solenogyne dominii	6	7	86	ns
Aristida behriana	129	151	85	**
Elymus scabrus var. scabrus	94	111	85	**
Lomandra effusa	125	148	84	**
Leptorhynchos squamatus	56	67	84	**
Velleia arguta	21	25	84	**
Templetonia aculeata	16	19	84	*
Acaena echinata var.	92	111	83	**
Chrysocephalum apiculatum	91	110	83	**
Hypoxis glabella var. glabella	24	29	83	**
Stipa flavescens	24	29	83	**
Spyridium phlebophyllum	10	12	83	ns
Oxalis radicosa	5	6	83	ns
Pseudognaphalium luteoalbum	5	6	83	ns
Sclerolaena uniflora	5	6	83	ns
Swainsona stipularis	5	6	83	ns
Zygophyllum aurantiacum	5	6	83	ns
Euphorbia drummondii	98	119	82	**
Danthonia eriantha	40	49	82	**
Stipa setacea	27	33	82	**
Stipa blackii	156	192	81	**
Bulbine bulbosa	97	120	81	**
Asperula conferta	83	102	81	**
Enneapogon nigricans	68	84	81	**
Themeda triandra	105	132	80	**
Triptilodiscus pygmaeus	88	110	80	**
Vittadinia cuneata var. cuneata forma cuneata	53	66	80	**
Eutaxia microphylla var. microphylla	49	61	80	**
Isoetopsis graminifolia	36	45	80	**
Enteropogon acicularis	16	20	80	*
Brachycome ciliaris var. subintegrifolia	12	15	80	ns
Pimelea curviflora var. gracilis	8	10	80	ns
Lomandra densiflora	140	178	79	**
Lagenifera huegelii	80	101	79	**
Calostemma purpureum	49	62	79	**
Eucalyptus leucoxylon ssp. pruinosa	42	53	79	**
Scleranthus pungens	15	19	79	*
Goodenia pinnatifida	169	216	78	**
Hyalosperma demissum	18	23	78	*
Pimelea humilis	14	18	78	ns
Derwentia decorosa	7	9	78	ns
Eutaxia diffusa	7	9	78	ns
Hydrocotyle foveolata	7	9	78	ns
Panicum effusum var. effusum	7	9	78	ns
Vittadinia cuneata var.	85	111	77	**
Wurmbea dioica ssp. dioica	79	103	77	**
Arthropodium fimbriatum	44	57	77	**
Levenhookia dubia	23	30	77	*
Lomandra multiflora ssp. dura	240	316	76	**
Plantago varia complex	111	146	76	**
Lepidosperma viscidum	63	83	76	**
Actinobole uliginosum	32	42	76	**
Stipa gibbosa	19	25	76	*
Vittadinia megacephala	19	25	76	*
Cynoglossum suaveolens	13	17	76	ns
Stackhousia monogyna	123	163	75	**
Danthonia setacea var. setacea	105	140	75	**
Scaevola albida	43	57	75	**
Atriplex semibaccata	42	56	75	**
Acacia acinacea	21	28	75	*
Teucrium racemosum	21	28	75	*
Maireana lobiflora	12	16	75	ns
Ptilotus erubescens	12	16	75	ns
Cotula australis	6	8	75	ns
Danthonia geniculata	6	8	75	ns
Hymenanthera dentata	6	8	75	ns

Species occurring predominantly in grassy vegetation in Lofty Block Bioregion

Ninety three taxa occurring at five or more grassy sites, with 75% or more of records occurring in grassy vegetation are listed in Table 7. Five hundred and thirteen quadrats were classified as grassy, of 1039 quadrats from the following surveys: 46(part), 49, 51, 54(part), 55, 56, 58, 62, 63(part), 65, 66, 70, 83, 86, 88. The Southern Lofty Survey (5) was excluded because of difficulty in classifying vegetation sampled in autumn as grassy or non-grassy and few grassy sites had been included in this survey.

SPECIES OF PARTICULAR CONSERVATION SIGNIFICANCE

Composite Vegetation Data

Two hundred and thirty eight taxa of regional conservation significance (assigned ratings of E(endangered), V(vulnerable), T(threatened), K(likely threatened or rare), R(rare), U(uncommon), or Q(possible significance) at the regional level by Lang & Kraehenbuehl (1997)) were recorded and are listed in Appendix V, together with conservation rating definitions. One or more of such species occurred in 446 of the 513 grassland and grassy woodland sites included in the final PATN analysis in the Flinders Ranges, Northern Lofty, Murray and Southern Lofty Regions. Of these, 16 taxa are of conservation significance or possible significance at the national level, and 94 of significance in South Australia. The distribution of quadrats by flora region is shown in Table 8. Overall, the Northern Lofty region had a relatively higher proportion of species of significance than the other regions (Table 8). Of 1642 records, 377 were of species classified as uncommon at the regional level and not of particular significance at the state level. Excluding these records, 383 sites included species of greater conservation significance than regionally uncommon (shaded section of Table 9). The average number of significant plant species recorded per site was highest in the Southern Lofty Region and lowest in the Flinders Ranges Region. Of the 238 significant taxa, 53 are annual or seasonal perennial plants and 185 are perennial.

Forty eight of the regionally significant taxa were recorded in a region where they are not known to be conserved, including 4 that were recorded fairly frequently: *Maireana aphylla*, (NL V, MU R); *Stipa blackii* (MU T); *Stipa gibbosa* (NL T); *Senecio tenuifolia* (FR R - listed as not conserved in the Flora database but it occurs at Mt Brown Conservation Park).

Eriochlamys behrii is listed as extinct in the Northern Lofty Region, but was recorded in the region during the Lofty Block Grassland and other recent surveys.

Table 8. Number of taxa of conservation significance in Lofty Block study area by flora region

		Number of taxa									No. of records
		Regional status:									
Region	sites	all	X	E	V	T	K	R	U	Q	
Flinders Ranges (FR)	208	93		1	4	4	12	44	27	1	460
Murray (MU)	48	57		2	2	4	14	22	12	1	175
Northern Lofty (NL)	208	137	3	8	9	12	14	56	29	6	793
Southern Lofty (SL)	45	66		3	10	2	6	22	22	1	211
Yorke Peninsula (YP)	4	3			1				2		3
all regions	513	356	3	14	26	22	46	144	92	9	1642

Table 9. Number of taxa of regional conservation significance in all regions in the Lofty Block study area and their South Australian status

SA status	No. of taxa - all regions									No. of records
	Regional status:									
	total	X	E	V	T	K	R	U	Q	
E	3		2		1					4
V	8		2	5	1					25
K	9		1		1	7				40
R	65	1	2	5	8	9	40			213
U	58		2	5	2	4	19	25	1	288
Q	10					1	1	5	3	125
None	203	2	5	11	9	25	84	62	5	947

Nationally significant Taxa recorded in Lofty Block Grassland Survey

Festuca benthamiana, (Bentham's fescue) (FR), **Aust - 3RCa, SA- R,** SA endemic, (1 specimen).
Festuca benthamiana, a nationally rare South Australian endemic grass (Briggs & Leigh, 1995), was recorded in quadrat LBGMEL05 near the southern boundary of the Mount Remarkable section of the Mount Remarkable National Park (Figure 9). The park boundary fence nearby was not stock proof at the time of survey, with the steep terrain being the main limitation on wandering sheep. The understorey at the quadrat location was open and grassy, however, dense regeneration of sugar gum and other eucalypt seedlings was occurring a few metres distant following wildfires. The species was previously recorded from the Alligator Gorge section of Mount Remarkable National Park (Davies, 1986, 1995) and is also known from a few unreserved sites in the Mid-North of the Lofty Block (Davies 1986 and 1995) and from grassy vegetation remnants on Mount Bryan (P.Lang, pers. comm.).

Stipa multispiculis, (small-seed spear-grass) (SL), **Aust - 3RC-, SA- R,** (3 specimens).
Stipa multispiculis was recorded from Lofty Block Grassland quadrats in low woodland in the vicinity of Adelaide at Cobbler Creek Recreation Park under *Eucalyptus porosa* (mallee box) and Mitcham Council Reserves under *Eucalyptus microcarpa* (grey box). This South Australian endemic grass species is regarded as nationally rare (Briggs and Leigh 1995), and its distribution and habitat are described in Davies (1986 and 1995).

Wurmbea latifolia ssp. *latifolia,* (broad-leaf star-lily) (FR), **Aust - V, SA- V** (1 specimen).
Wurmbea latifolia ssp. *latifolia* occurs on flats near the eastern edge of Mount Remarkable National Park, in *Eucalyptus odorata* woodland with a very sparse understorey. Distribution: FR E, NL V, SA endemic.

Ptilotus erubescens, (hairy-tails) (MU,NL), **Aust - Q, SA- R** (3 specimens) recorded in *Lomandra multiflora* ssp. *dura* tussock grassland in the Mid-North in this and previous surveys, also in various communities in the western Murray region. Regional distribution: MU R, NL T, SE E, SL R. Victoria, New South Wales on relatively fertile soil.

Maireana rohrlachii, (Rohrlach's bluebush) (NL), **Aust - 3RC-, SA- R** (2 specimens) near the south-eastern edge of the southern Flinders Ranges, previous surveys have recorded it from the northern Burra Hills *Lomandra effusa* grasslands. Regional distribution: EP K, FR R, GT K, MU R, NL V, SL V, YP K. Victoria (not conserved).

Two prostrate herbaceous native legumes which have a well developed perennial tap root and are of state or national conservation significance were found opportunistically in grassy vegetation during this survey:

- *Psoralea parva,* small scurf-pea (nationally endangered) occurs in *Lomandra multiflora* ssp. *dura* tussock grassland near Mount Cone, and adjacent to site TG 046 also near Burra near Porters Lagoon (Hyde 1995). It is also known from a few sites in the Adelaide Hills (Davies, 1995, 1986). Distribution: EA E, FR E, NL E, SL E, Victoria (mainly in grassland and grassy woodland).
- *Glycine tabacina,* variable glycine (threatened in South Australia) was collected opportunistically during reconnaissance for the Lofty Block Grassland Survey in the Wirrabara Forest Reserve, adjacent to an internal forest track in SA blue gum woodland. The species is morphologically variable and has been given various taxonomic treatments; in 1993 it was regarded as not recorded in SA (Jessop 1993), but it has been recorded from the Adelaide Hills, also in grassy woodland and its occurrence in SA is acknowledged in the recent flora of Victoria (Walsh & Entwhistle, 1996). Distribution: Victoria, New South Wales, Western Australia, Queensland, Asia and Pacific Islands.

Senecio macrocarpus (large fruit groundsel - nationally vulnerable) occurs amongst native grasses under SA blue gum in the Tarcowie Parklands, but is not known to occur in the section dedicated as flora reserve. (Sighting by R.Bates, recently confirmed). This is one of only two known populations in South Australia outside the South-east (Davies, 1992). This habitat appears to resemble the species' grassland habitat in Victoria more than that of the other South Australian populations. Its range is greatly reduced in Victoria and it is extinct in Tasmania.

Nationally significant taxa recorded in previous surveys

Nationally significant species (Briggs & Leigh 1995), that were recorded in grassland and grassy woodland in the Lofty Block in previous surveys are listed below. Status codes are defined in Appendix V.

Acacia glandulicarpa, 2 records, **Aust - 3VCa, SA- E** recorded in grasslands on road reserves in the Mid-North (Hyde,1995). The species also occurs in the Burra Creek Gorge (Davies, 1986). Distribution: NL E, SE E, Victoria.

Acacia gracilifolia, 4 records, **Aust - 3RCa, SA- R** recorded in Mid-North regional survey sites in the Southern Flinders Ranges. Distribution: FR R, NL R, SA endemic.

Acacia iteaphylla, 3 records, **Aust - 3RCa, SA- R** is present in Telowie Gorge Conservation Park and is not confined to grassy communities in the southern Flinders Ranges. It is weedy in the Adelaide Hills where it is a common garden plant. Distribution: EP R, FR R, NL R, SA endemic.

Derwentia decorosa, 7 records, **Aust - 3RC-, SA- R** occurs at Mount Brown CP (Oppermann, 1995). Distribution: EP K, FR R, MU T, NL K, SA endemic.

Dodonaea procumbens, 1 record, **Aust - 3V, SA- E** occurs in Holm Hill plantation reserve (Hyde, 1995) and private land, restricted in SA to Northern Lofty Region. Also occurs in New South Wales, Victoria.

Olearia pannosa ssp. pannosa, 1 record, **Aust - 3VCa, SA- V** recorded in Mount Brown CP (Oppermann, 1995). Distribution: EP T, FR V, MU V, NL V, SE T, SL V, YP V, Victoria.

Poa drummondiana, 2 records, **Aust - Q, SA- R, NL - X** recorded on disused rail corridor north of Clare (records were not reported in Hyde (1994) because vouchers were not initially identified). Distribution: EP R, NL X, MU X, YP K, Western Australia, Victoria.

Prasophyllum pallidum, 2 records, **Aust - 3VCa, SA- V** Mount Remarkable National Park, and small populations in Southern Lofty parks and forest reserves (Davies, 1986). Distribution: FR V, NL V, SL V, SA endemic.

Prasophyllum validum, **Aust - 2VCa, SA- V** has not been recorded in a quadrat but occurs in grey box woodlands over spinifex in Mount Remarkable National Park (Davies 1986, 1995). Endemic to Flinders Ranges.

Stipa breviglumis, 7 records, **Aust - 3RC-, SA- R** occurs at Mount Brown CP (Oppermann, 1995). Distribution: EP R, FR R, NL R, SL R, Victoria.

Swainsona tephrotricha, 2 records, **Aust - 3RCa, SA- R** was recorded in the Burra Hills survey (Playfair & Heard, 1995) and Rail Corridor survey (Hyde, 1995). Distribution: EA K, EP K, FR R, MU E, NL T, SA endemic.

Species of South Australian or Regional Conservation Significance recorded in the Lofty Block Grassland Survey

Taxa of state significance recorded in the Lofty Block Grassland Survey 83 are listed in Table 10. Two species are rated vulnerable, 4 likely to be threatened or rare, 12 rare, 16 uncommon and 2 of possible significance, in South Australia.

An opportunistic record was made of *Danthonia carphoides* var. *carphoides* (short wallaby grass) (SA - K, vulnerable in the Southern Lofty Region) in southern grey box woodland in the Waite Hills proposed Heritage Agreement area. (R. Davies, pers. comm.). This species was recorded in quadrats during the Lofty Block Grasslands and Burra Hills Surveys in the Northern Lofty Region, where it is more common (Table 10).

One hundred and sixty six records of 149 taxa of regional conservation significance were recorded in the Lofty Block Grasslands Survey (83) (Appendix IV).

Figure 9. Habitat of nationally rare grass *Festuca benthamiana* at Mount Remarkable National Park. Quadrat LBGMEL05. *Eucalyptus camaldulensis var. camaldulensis* Open woodland over alien and native grasses.

Table 10. Taxa of South Australian significance recorded in Lofty Block Grassland Survey
(excluding nationally significant species)

TAXON	Significant Records in Survey 83 (Lofty Block Grasslands) and regions	Total no. of records: 513 sites	No. of sig. records	State and regional conservation status*				
				SA	FR	MU	NL	SL
Acacia pravifolia	1(FR)	5	5	U	U		R	
Brachycome ciliaris var. subintegrifolia	1(NL)	12	3	K			K	
Calocephalus citreus	17(FR,NL,SL)	46	46	U	U	V	U	R
Carex inversa var. inversa	1(FR)	1	1	R	K			
Cryptandra amara var. longiflora	8(FR,MU,NL)	32	32	R	R	K	R	
Danthonia carphoides var. carphoides	1(NL)	5	3	K			K	
Danthonia eriantha	16(FR,MU,NL)	39	39	R	R	K	R	
Danthonia linkii var. fulva	1(FR)	2	2	R	R		K	
Daviesia genistifolia	1(FR)	6	6	U	U		U	
Dianella longifolia var. grandis	1(FR)	3	3	R	R		T	V
Elachanthus pusillus	2(FR)	17	17	U	R		R	
Eryngium rostratum	2(FR,NL)	6	6	V	V		V	
Eucalyptus albens	2(FR)	3	3	R	R			
Eutaxia microphylla var. diffusa	1(FR)	7	7	U	R		E	V
Goodenia albiflora	1(NL)	25	25	U	U		U	
Goodenia pinnatifida	10(MU,NL,SL)	168	91	Q		U	U	U
Hymenanthera dentata	1(FR)	6	6	U	U		R	
Leptorhynchos tetrachaetus	10(FR,MU,NL)	35	35	U	U	K	U	
Lomandra nana	5(MU,SL)	13	13	U		T	K	U
Lomandra sororia	3(SL)	20	20	U		K	V	U
Microtis parviflora	1(NL)	1	1	U			R	
Ozothamnus scaber	2(FR)	3	2	K	K			
Podolepis muelleri	1(FR)	4	4	K	K		K	
Scutellaria humilis	1(FR)	1	1	R	K			
Solenogyne dominii	2(MU,SL)	6	6	U		R	R	U
Stipa curticoma	1(NL)	18	14	V			T	V
Stipa gibbosa	1(SL)	19	16	R	K		T	R
Stipa puberula	1(MU)	7	1	R		K		
Stipa setacea	11(FR,MU,NL,SL)	27	27	R	R	K	R	R
Stipa tenuifolia	1(MU)	4	3	R		T	E	V
Templetonia aculeata	3(FR,NL)	16	16	U	U		R	
Thelymitra grandiflora	1(FR)	1	1	U	R			
Thysanotus tenellus	3(FR)	12	11	R	R		R	
Trymalium wayae	1(NL)	5	4	U			U	
Velleia paradoxa	5(MU,NL,SL)	26	26	Q		Q	Q	U
Wurmbea biglandulosa ssp. flindersica	1(NL)	1	1	U			R	

* Update of Lang and Kraehenbuehl (1987) September 1997). Flora region codes defined in Table 8.
Conservation status codes defined in Appendix V.

VEGETATION CLASSIFICATION

Floristic analysis

The pattern analysis was conducted on 216 native perennial species from 513 quadrats. Of these species, 35 were perennial grasses and 50 were other seasonal (summer-dormant) species.

Twelve main floristic vegetation types were recognised. Some of these groups were well defined, remaining consistent in dominant species and site composition through various analyses. However, group 8, the largest group of 110 members could not be clearly defined floristically or structurally at this level. A separate analysis was run on these 110 group 8 sites. Five subgroups were defined, but the fifth consisted mainly of depauperate sites with few species in common, and did not warrant further consideration.

The floristic groups and subgroups derived from the dendrogram are shown in a simplified dendrogram in Figure 10. The frequency of occurrence of both native and alien taxa in all floristic groups is shown in Appendix III.

Individual descriptions of all the floristic groups follow, with a distribution map, the most frequently occurring native and alien species, environmental data and statistics based on presence data.

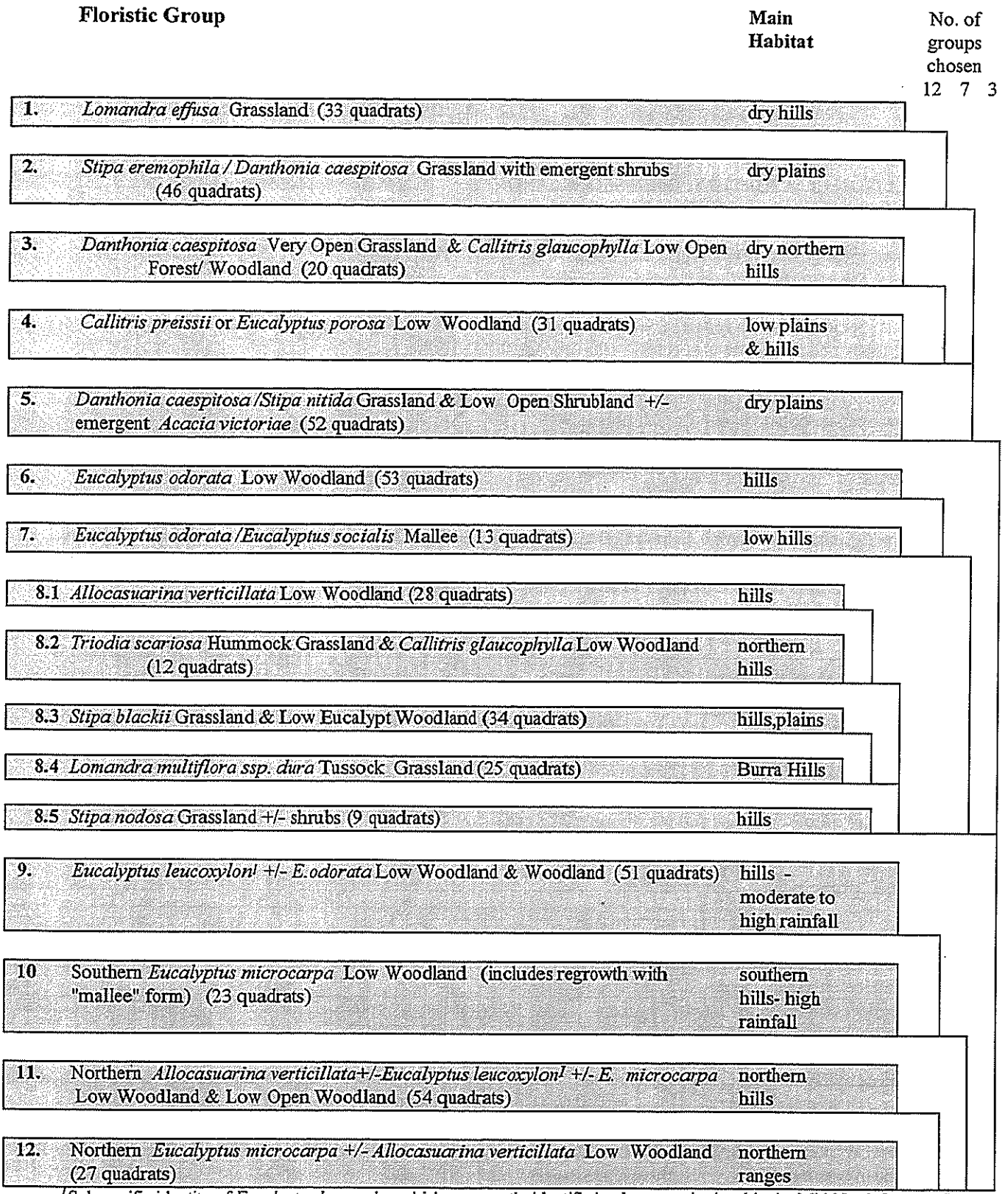
Excepting group 8, woodlands tended towards the lower part of the dendrogram and were more clearly defined floristically than the grasslands which occurred towards the top. Groups 1 to 5 consisted of grasslands, sparse shrublands and arid low woodlands. Groups 6 to 8 represented various tussock and hummock grasslands, low peppermint box woodlands and mallee. Groups 9 to 12 comprised grey box and SA blue gum low woodlands and woodlands. Within group 8, there was particularly broad variation in vegetation structure. Almost half (30) of the Lofty Block Grassland survey sites were classified in this group. Greater consistency in structure and floristics was achieved by dividing group 8 into subgroups. Groups 8.3 and 8.4 included most of the Mid-North *Lomandra multiflora ssp. dura* dominated tussock grasslands.

Most groups were mainly represented by quadrats in locations with moderate annual rainfall, except group 5, with a mostly northern distribution having 300 mm of annual rainfall, and representatives of groups 9 and 10 in locations with up to 600 mm.

Species occurrence in floristic groups

The most common species were present in all groups and at more than 30% proportional occurrence within many groups and were therefore not of importance in defining floristic groups. Species clusters in the original two way table were small, and the table is too large to be presented in its raw form. A matrix of groups by species' occurrence in more than 30% of sites within a group was sorted to create a simplified two way table for native species and for alien species (Appendix VI).

Some species of conservation significance (eg. *Danthonia carphoides*, short wallaby grass) were included in the floristic analysis and had some influence on the classification of the groups, occurring predominantly in one or a few groups (commonly group 8, the largest group of sites).



[1] Subspecific identity of *Eucalyptus leucoxylon*, which was mostly identified only to species level in the Mid-North Survey. In groups 6 and 8 this taxon mainly represents *E. leucoxylon* ssp. *pruinosa*, in groups 9 and 11 substantially subspecies *pruinosa*, as otherwise subspecies not identified. *E. leucoxylon* ssp *leucoxylon* was mainly represented in group 10 (Southern *Eucalyptus microcarpa* Low Woodland).

Figure 10. Floristic vegetation groups and subgroups resulting from the PATN analysis - Simplified dendrogram (12, 7, or 3 groups recognised).

Lomandra effusa TUSSOCK GRASSLAND

Floristic Group 1 33 members

VEGETATION DESCRIPTION: OPEN SEDGELAND
Open "sedgeland", dominated by *Lomandra effusa* (scented mat-rush) over herbaceous native species, particularly wallaby and spear grasses (*Danthonia caespitosa, Stipa eremophila, Stipa nitida*). *Ptilotus spathulatus forma spathulatus* (pussy-tails) is the most frequent of the herbaceous species. *Bursaria spinosa* (sweet bursaria) is the most frequently occurring woody species. *Allocasuarina verticillata* (drooping sheoak), *Acacia pycnantha* (golden wattle) and *Callitris preissii* (southern cypress pine) may form a low open woodland to tall open shrubland.
Dominant life forms: "sedge-type plants" 30-70% cover
Trees or tall shrubs dominant in 18% of quadrats

DISTRIBUTION: This community occurs predominantly on loams with some surface stone, being calcrete and shales, up to 600 m altitude towards the east of the Lofty Block on gentle slopes of low hills and hills from Peterborough extending further east in the south near Tailem Bend.

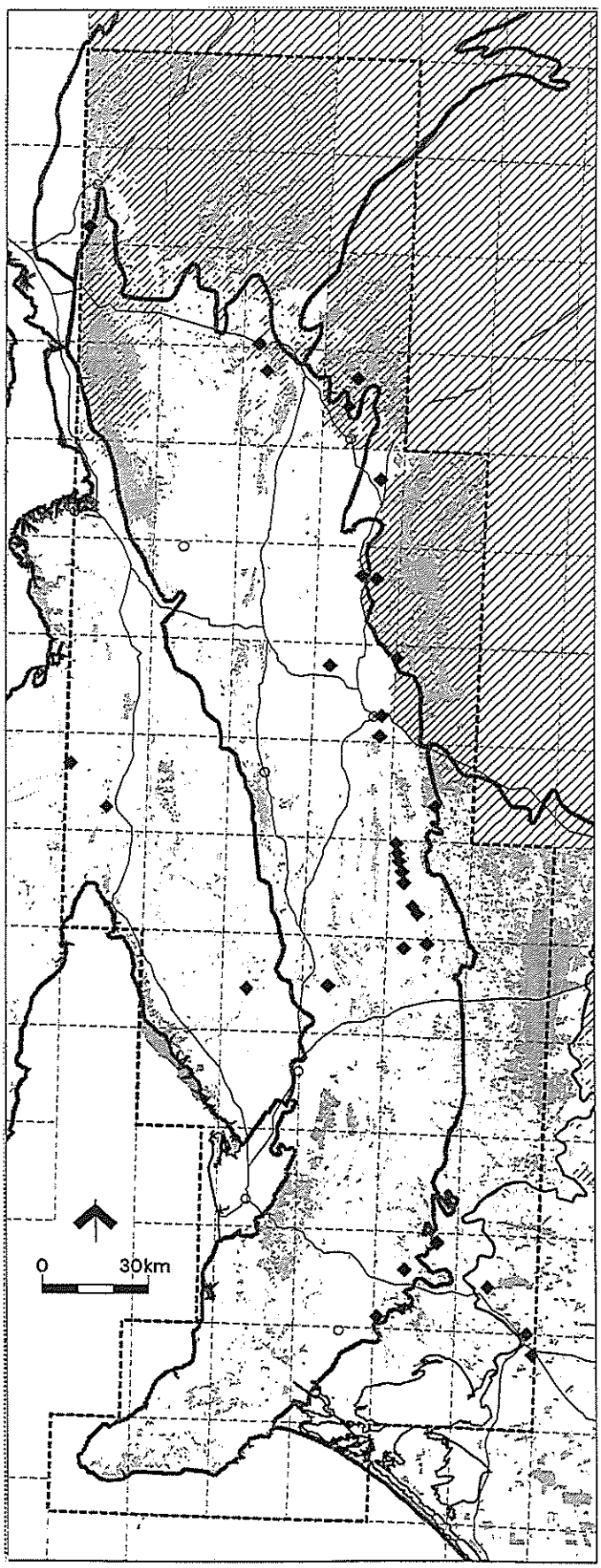
FLORISTIC COMPOSITION
Dominant native species: *Lomandra effusa*
Subdominant species
Danthonia caespitosa group
Stipa eremophila
Stipa nitida
Average no. of native species (and maximum): 22.5 (45)

REPRESENTATIVE QUADRATS (Figures 11 and 12)
LBGTRU03, LBGTRU04

ENVIRONMENTAL PARAMETERS (dominant)
Landform patterns /systems: Low hills,Hills
Landform elements: Hill slope
Surface Soil Texture: Sandy loam, Clay loam
estimated clay content: **30-35%,** (10-35%)
Surface strew: cobble (51-250mm), <10% cover
Rock outcrop: NIL
Lithology: Calcareous, shale

LAND USE AND DISTURBANCE: The land is generally used for sheep pasture. Herbaceous species, particularly wild oats are the major alien species, with horehound sparsely present at some sites.

COMMENTS:
The original vegetation structure appears to have generally included tall shrubs, mallee or low trees, including sheoak low woodlands along the south eastern fringe of the Lofty Block (Specht, 1972) and in the Eudunda area. Hyde (1995) referred to the related mallee and pine communities in the Murray region. However, such dominants may have been largely absent in the Burra Hills.



Most frequently occurring perennial native species in the *Lomandra effusa* TUSSOCK GRASSLAND - percentage frequency and cover abundance values. Indicator species based on chi-square value from species frequency of occurrence within group (# = probability 0.5%, ## =0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Lomandra effusa	P	96	##		1	9	18	4		
Ptilotus spathulatus forma spathulatus	P	75	##		14	11				
Convolvulus erubescens	S	69	##	1	16	6				
Danthonia caespitosa group	PG	69			5	14	4			
Stipa eremophila	PG	66	##		5	11	5	1		
Oxalis perennans	P	63		1	11	9				
Stipa nitida	PG	54			4	12	2			
Aristida behriana	PG	48			9	6	1			
Enneapogon nigricans	PG	48	##	1	9	5	1			
Vittadinia gracilis	P	45		2	8	4	1			
Wahlenbergia luteola	S	45			9	6				
Euphorbia drummondii	S	42	#	4	10					
Goodenia pinnatifida	S	42		1	8	5				
Vittadinia cuneata var.	P	36			10	2				
Glycine clandestina var. sericea	S	33		2	4	5				
Lomandra multiflora ssp. dura	P	33		1	5	2	3			
Bursaria spinosa	P	30		3	5	2				
Maireana enchylaenoides	P	30		2	7	1				

Frequently occurring native annual species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Rhodanthe pygmaea	A	30			6	4				
Goodenia pusilliflora	A	54	##		5	11	2			

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
**Avena barbata*	A	72			2	16	4	2		
**Bromus rubens*	A	72			6	15	2	1		
**Hypochaeris glabra*	A	66			6	15		1		
**Medicago minima var. minima*	A	66	#		6	13	2	1		
**Vulpia sp.*	A	63			5	15	1			
**Gynandriris setifolia*	A	60	#		6	13	1			
**Erodium botrys*	A	54	##		5	13				
**Carthamus lanatus*	A	51			9	8				
**Echium plantagineum*	A	51		1	12	4				
**Salvia verbenaca form A*	A	51	#		9	8				
**Rostraria cristata*	A	45	##		7	8				
**Bromus diandrus/rigidus*	A	33			7	4				
**Marrubium vulgare*	P	33		2	8	1				
**Romulea minutiflora*	A	33			2	8	1			
**Sonchus oleraceus*	A	33			8	3				

Figure 11. *Lomandra effusa* Grassland in the south-eastern Mount Lofty Ranges
Quadrat LBGTRU03. *Acacia retinodes var. retinodes* (hill form) Tall shrubland over *Lomandra effusa.*

Figure 12. *Lomandra effusa* Grassland on the western Murray Flats
Quadrat TG017. *Lomandra effusa* Sedgeland over *Stipa acrociliata,* other herbs and grasses.

Stipa eremophila /Danthonia caespitosa GRASSLAND WITH EMERGENT SHRUBS

Floristic Group 2

46 members

VEGETATION DESCRIPTION

This community includes disclimax grasslands with emergent shrubs, low woodlands and *Senna artemisioides* nothossp. *coriacea* (desert senna) shrublands. A mid dense grass ground stratum dominated by *Stipa eremophila,* (desert spear grass) and *Danthonia caespitosa* (common wallaby grass) is present. The dominant shrub species are *Maireana brevifolia* (short-leaf bluebush), *Acacia* spp, particularly *Acacia victoriae* (elegant wattle), *Bursaria spinosa,* (sweet bursaria) and *Enchylaena tomentosa* (ruby saltbush). Box and mallee eucalypts and *Callitris* species (native pines) may be present forming a low open woodland, mallee to low open forest.

Dominant life forms: Tussock grass ; 30-70% cover
Sites with trees or tall shrubs dominant: 48%

DISTRIBUTION: Disclimax grasslands occur on the Willochra Plains, where chenopod shrublands were cleared in the last century. Various shrublands and low woodlands occur on plains and gentle hill slopes in the Mid-North, mainly on rail reserves.

FLORISTIC COMPOSITION

Dominant native species: *Stipa eremophila, Danthonia caespitosa* group
Subdominant species
Enchylaena tomentosa var. tomentosa
Maireana brevifolia
Vittadinia gracilis
Senna artemisioides nothossp. coriacea
Lomandra effusa

REPRESENTATIVE QUADRATS (Figures 13 and 14)
LBGANG01, LBGQUO05
Average no. of native species (and maximum): 26.59(52)

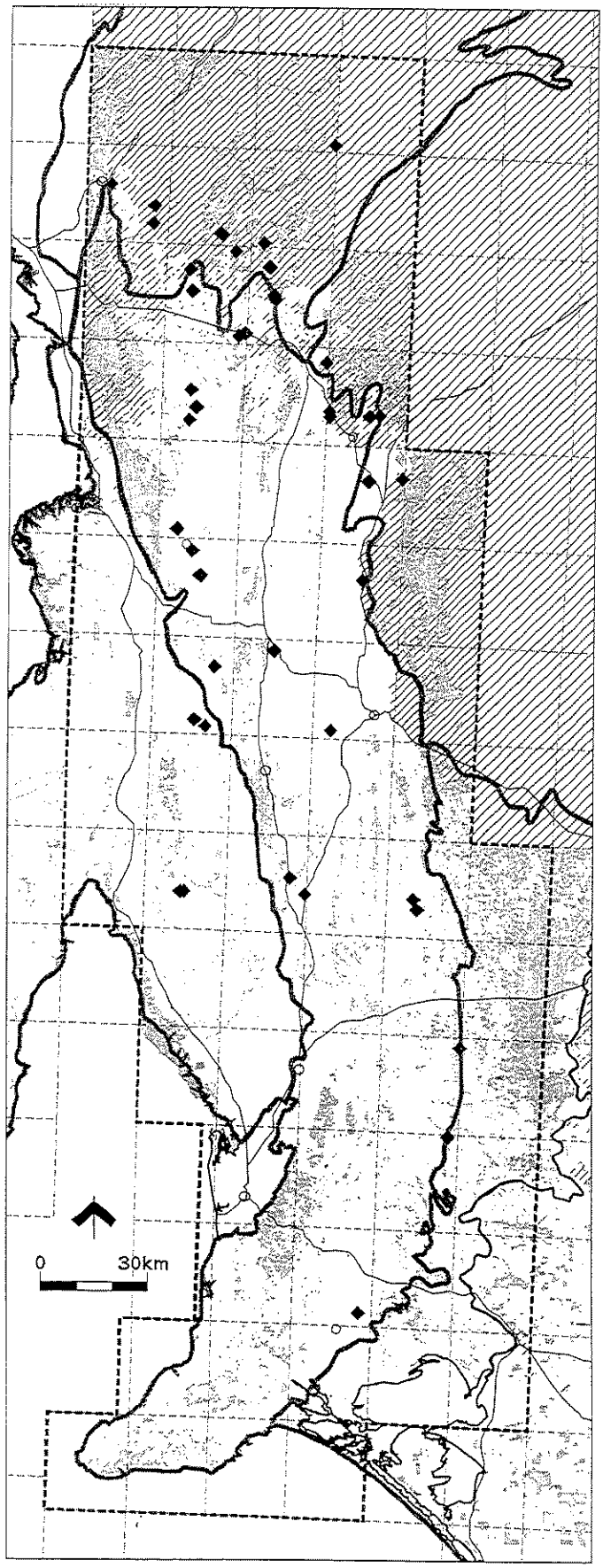
ENVIRONMENTAL PARAMETERS (dominant)

Landform patterns /systems: Plain,Low hills
Landform elements: Plain, Hill footslope
Surface Soil Texture: Clay loam, Medium clay
estimated clay content: **30-35%,** (20-35%)
Surface strew: pebble (5-50mm), <10% cover
Rock outcrop: NIL

LAND USE AND DISTURBANCE: Disused rail reserves and private land. The non rail reserve locations are generally grazed by sheep. Herbaceous species, particularly *Avena barbata* (wild oats) are the major alien species.

COMMENTS:

As many examples occurred on linear disused rail reserves and disclimax grassland pasture, this community appears generally to have resulted from past clearance or modification of various low woodlands and shrublands.



Most frequently occurring native perennial species in the *Stipa eremophila /Danthonia caespitosa* GRASSLAND WITH EMERGENT SHRUBS - percentage frequency and cover abundance. Indicator species based on chi-square value from species frequency of occurrence within group (# = probability 0.5%, ##=0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Danthonia caespitosa group	PG	93			4	13	25	1		
Stipa eremophila	PG	84	##		1	4	28	6		
Enchylaena tomentosa var. tomentosa	P	60	##		16	12				
Goodenia pinnatifida	S	56			12	8	6			
Vittadinia gracilis	P	56	#	1	13	8	4			
Oxalis perennans	P	52			18	1	5			
Senna artemisioides nothossp. coriacea	P	50	##	2	11	5	3	2		
Lomandra effusa	P	5	##	1	10	11	1			
Stipa nitida	PG	47			6	11	5			
Dianella revoluta var.	P	43			10	8	2			
Maireana brevifolia	P	43	##	1	13	4	2			
Minuria leptophylla	P	43	##		14	3	3			
Convolvulus erubescens	S	36			12	4	1			
Stipa drummondii	PG	36	##		3	5	9			
Sida corrugata var.	P	36			11	4	2			
Arthropodium strictum	S	34		1	8	6	1			
Atriplex semibaccata	P	32	##	2	5	8				
Pimelea micrantha	P	32	##	1	10	1	3			
Wahlenbergia luteola	S	30		2	6	5	1			
Rhagodia parabolica	P	30		1	6	7				
Lomandra multiflora ssp. dura	P	30		1	7	5	1			
Bursaria spinosa	P	30		4	9	1				

Frequently occurring native annual species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Goodenia pusilliflora	A	36	#		4	9	4			
Rhodanthe pygmaea	A	39	##	1	8	8	1			
Erodium cygnorum ssp./cicutarium	A	34	##		8	3	5			
Salsola kali	A	30	##	1	12		1			

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
**Avena barbata*	A	76			6	10	13	3	3	
**Bromus rubens*	A	76	##		13	13	9			
**Gynandriris setifolia*	A	69	##		8	3	21			
**Carrichtera annua*	A	65	##		11	12	7			
**Salvia verbenaca form A*	A	65	##	1	10	7	12			
**Echium plantagineum*	A	56			19	5	2			
**Sonchus oleraceus*	A	54			22	1	2			
**Medicago minima var. minima*	A	52			6	10	6	2		
**Vulpia sp.*	A	52			3	11	10			
**Bromus diandrus/rigidus*	A	47			4	8	10			
**Critesion murinum*	A	43			9	8	2	1		
**Asphodelus fistulosus*	P*	41	##	1	10	5	3			
**Medicago polymorpha var. polymorpha*	A	36	##		6	5	5	1		
**Rapistrum rugosum ssp. rugosum*	A	30	##		9	2	3			
**Oxalis pes-caprae*	A	30	##		5	4	5			
**Erodium cicutarium*	A	30	##	1	9	3	1			
**Marrubium vulgare*	P*	30		1	12	1				

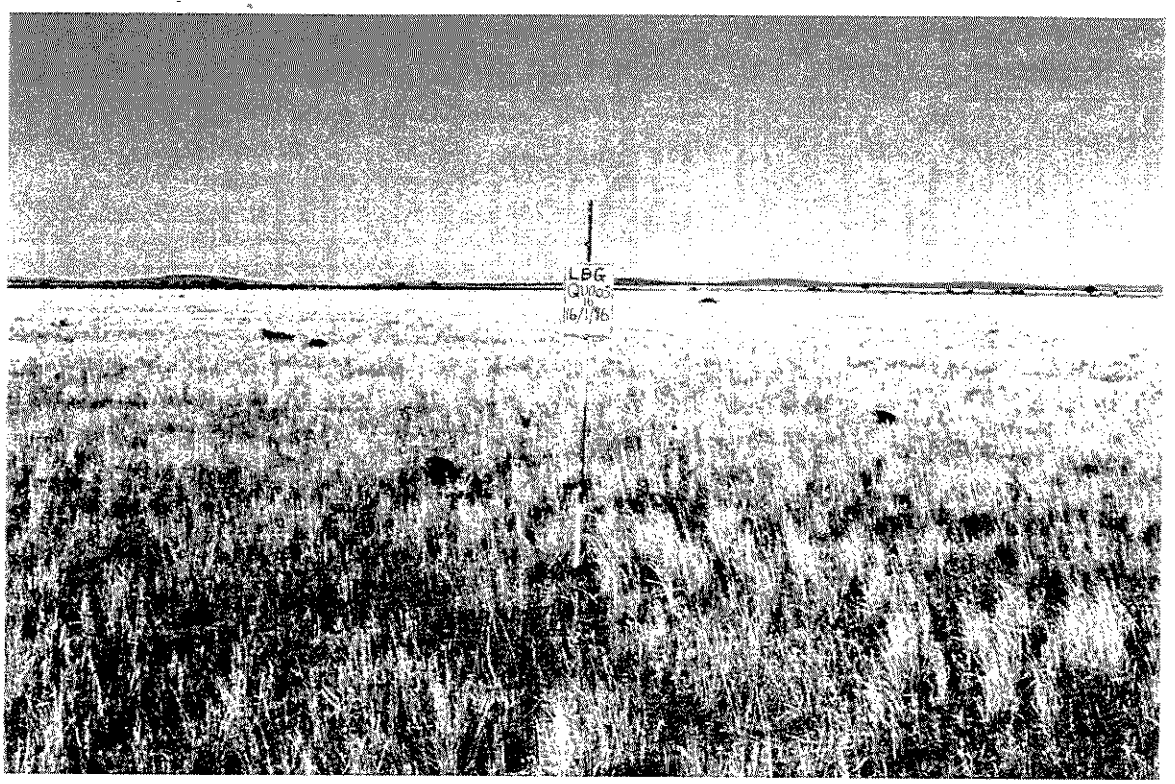


Figure 13. ***Stipa eremophila / Danthonia caespitosa*** **Grassland with emergent shrubs on the south Willochra Plains**
Quadrat LBGQUO05. (Tussock) grassland - *Maireana georgei* over *Stipa eremophila/Danthonia caespitosa*

Figure 14. ***Stipa eremophila / Danthonia caespitosa*** **Grassland with emergent shrubs on the western Murray Flats**
LBGANG01. Low open woodland - *Callitris preissii* over *Stipa eremophila/Senna artemisioides ssp. petiolaris*

Callitris glaucophylla +/- Acacia calamifolia LOW OPEN FOREST & OPEN SHRUBLAND

Floristic Group 3

20 members

VEGETATION DESCRIPTION: LOW OPEN FOREST
Generally this community consists of *Callitris glaucophylla* (white cypress-pine) with a sparse understorey dominated by *Danthonia caespitosa* over alien herbs such as *Rhodanthe pygmaea* (pygmy sunray). An open shrub stratum may be present, mostly consisting of of *Acacia calamifolia* (wallowa) and *Rhagodia parabolica* (mealy saltbush). In the Mount Brown Conservation Park a variant occurs as mallee dominated by *Eucalyptus socialis* (beaked red mallee) and *E. gracilis* and as shrubland .
Dominant life forms: Low trees or mallee; 5-10m; 30-70% cover
Sites with trees or tall shrubs dominant: 75%

DISTRIBUTION: This community occurs at the arid northern limit of the Lofty Block, on predominantly calcareous loams on relatively stony hills above 350m altitude.

FLORISTIC COMPOSITION
Dominant native species: *Callitris glaucophylla*
Subdominant species
Acacia calamifolia
Enchylaena tomentosa var. tomentosa
Rhagodia parabolica
Dominant understorey species
Danthonia caespitosa group

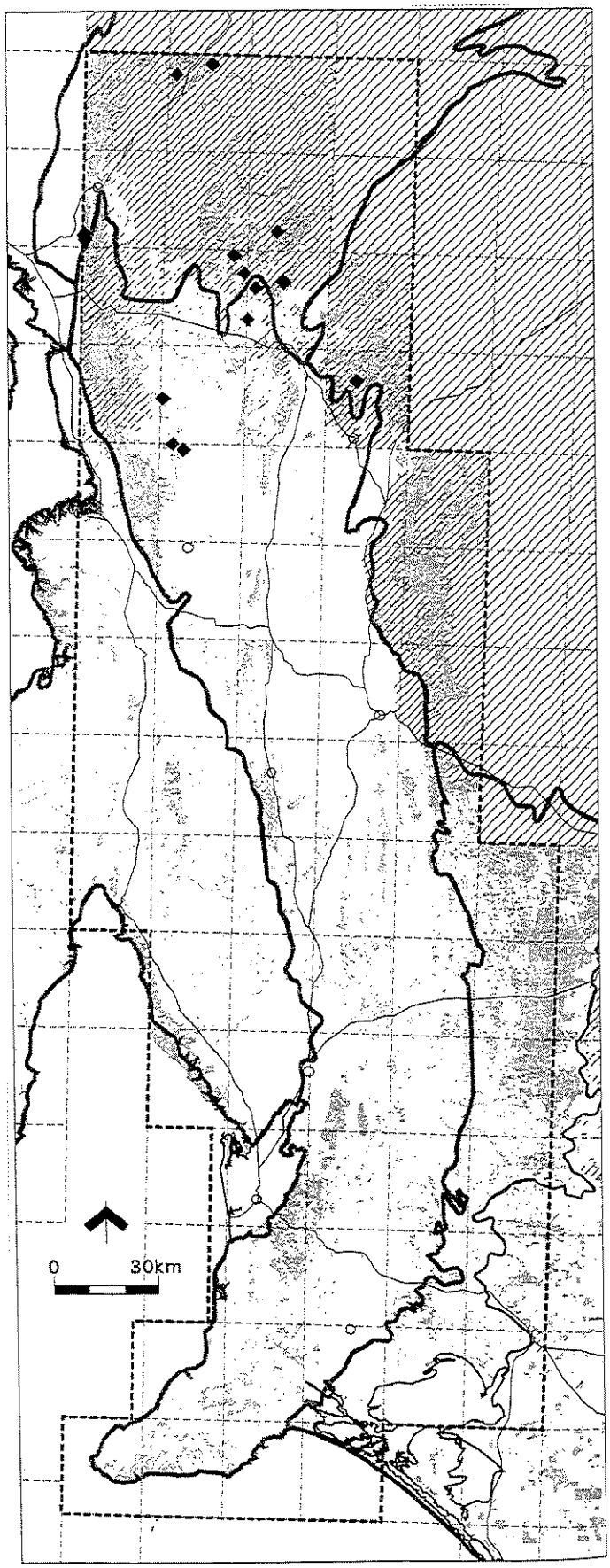
REPRESENTATIVE QUADRATS (Figure 15)
KAN00701 (Upper Mid-North survey)
Average number of native plant species (and range): 23(14-39)

ENVIRONMENTAL PARAMETERS (dominant)

Landform patterns /systems: Low hills, hills
Landform elements: Hill slope
Surface Soil Texture: 3, Clay loam, Sandy loam
Estimated clay content: **20-30%,** (10-35%)
Surface strew: cobble (51-250mm), pebble (5-50mm) <10% cover
Rock outcrop: <10% cover
Lithology: calcareous

LAND USE AND DISTURBANCE: The land is generally used for sheep grazing. Herbaceous species, particularly *Medicago minima var. minima* (little medic) and annual grasses are the major alien species.

COMMENTS:
Occurs in the Flinders and Olary Ranges Bioregion as well as the Lofty Block. Conservation status was not assessed for Lofty Block



Most frequently occurring native perennial species in the *Callitris glaucophylla* +/- *Acacia calamifolia* LOW OPEN FOREST& OPEN SHRUBLAND - percentage frequency and cover abundance values. Indicator species based on chi-square value from species frequency of occurrence within group (# = probability 0.5%, ## =0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Danthonia caespitosa group	PG	90		1	10	7				
Oxalis perennans	P	85			17					
Ptilotus spathulatus forma spathulatus	P	65		5	7		1			
Goodenia pinnatifida	S	60		2	9	1				
Callitris glaucophylla	P	55	##	1			4	5	1	
Maireana enchylaenoides	P	55		4	6	1				
Wahlenbergia luteola	S	55		4	7					
Sida petrophila	P	50	##	4	3	3				
Enchylaena tomentosa var. tomentosa	P	50		4	4	1	1			
Arthropodium strictum	S	50		3	6	1				
Acacia calamifolia	P	45	##	1	3	2	2	1		
Rhagodia parabolica	P	40		4	1	1	2			
Stipa nodosa	PG	40			6	1	1			
Stipa elegantissima	PG	40		2	6					
Vittadinia gracilis	P	35		3	4					
Stipa drummondii	PG	35	##		4	3				
Goodenia albiflora	S	35	##	2	5					
Convolvulus erubescens	S	35			7					

Figure 15. *Danthonia caespitosa* Very open grassland & *Callitris glaucophylla* Low open forest/ Woodland in the south-central Flinders Ranges
Quadrat KAN00701 *Callitris glaucophylla* Low open forest over *Enchylaena tomentosa,* grasses and herbs

Frequently occurring native annual species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Rhodanthe pygmaea	A	55	##		9	2				
Daucus glochidiatus	A	45		1	7	1				
Brachycome lineariloba	A	35		2	5					
Crassula colorata var.	A	35		2	3	2				
Erodium cygnorum ssp./cicutarium	A	30		1	4	1				

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
**Medicago minima var. minima*	A	75	#		7	6	2			
**Bromus rubens*	A	65			3	8	2			
**Avena barbata*	A	65			8	3	1	1		
**Vulpia sp.*	A	55			5	5		1		
**Carthamus lanatus*	A	50			10					
**Sonchus oleraceus*	A	50			10					
**Hypochaeris glabra*	A	50		1	5	4				
**Erodium cicutarium*	A	45	##	2	6	1				
**Critesion murinum*	A	45			4	2	2	1		
**Echium plantagineum*	A	45		2	6	1				
**Lycium ferocissimum*	P*	45		7	2					
**Carduus tenuiflorus*	A	40	##	2	6					
**Silene nocturna*	A	40			6	2				
**Rostraria cristata*	A	40		1	4	3				
**Marrubium vulgare*	P*	40		2	5		1			
**Carrichtera annua*	A	35			3	2	1	1		
**Sisymbrium erysimoides*	A	30			3	2	1			

Callitris preisii or *Eucalyptus porosa* LOW WOODLAND

Floristic Group 4 31 members

VEGETATION DESCRIPTION: LOW WOODLAND
Low woodland and low open forest dominated by *Callitris preissii* (southern cypress pine) and/or *Eucalyptus porosa* (mallee box) over open chenopod shrubs (*Enchylaena tomentosa,* (ruby saltbush) *Rhagodia parabolica* (mealy saltbush). Native ground cover dominants are *Danthonia caespitosa* and *Stipa* spp., but annual alien grasses - wild oats and Vulpia - often dominate. Alternative dominants are peppermint box, red mallee or other mallee species.
Dominant life forms: Low trees or mallee; 5-10m; 30-70% cover
Sites with trees or tall shrubs dominant: 97%

DISTRIBUTION: The community generally occurs on low lying plains in the southern and western Northern Lofty region and on gentle hill slopes in the Flinders Ranges region. Surface soils are sandy to clay loams, rarely with surface stone consisting of quartzite or sandstone.

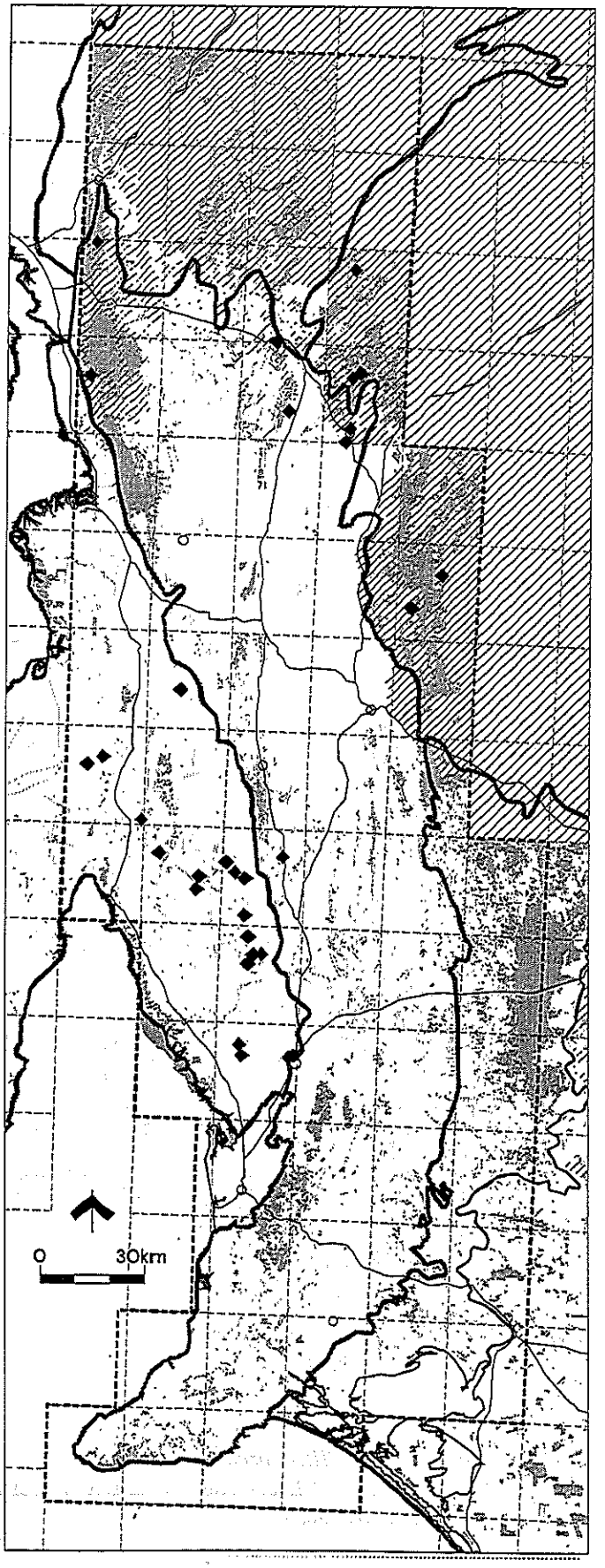
FLORISTIC COMPOSITION
Dominant native species: *Callitris preisii, Eucalyptus porosa*
Dominant understorey species
Enchylaena tomentosa var. tomentosa
Danthonia caespitosa group
Rhagodia parabolica

REPRESENTATIVE QUADRATS (Figure 16)
ORR01601 (Upper Mid-North Survey)
Average number of native plant species (and maximum): 23(-34)

ENVIRONMENTAL PARAMETERS (dominant)
Landform patterns /systems: Plain,Low hills
Landform elements: Plain, Hill slope
Surface Soil Texture: Sandy loam, Clay loam
Estimated clay content: **10-20%,** (range 10-35%)
Surface strew: none apparent
Rock outcrop: NIL
Lithology: quartzite (minor)

LAND USE AND DISTURBANCE: The land is used for sheep pasture in about half of quadrats. Herbaceous species, particularly annual grasses are the major alien species but *Lycium ferocissimum* (African boxthorn) and *Myrsiphyllum asparagoides* (bridal creeper) commonly are present.

COMMENTS:
The main distribution is north and west of the Lofty Block Bioregion, but the vegetation type may be more widespread in the bioregion, with many more sites dominated by *Eucalyptus porosa* with a denser understorey having been screened out of this study. Conservation status in the Lofty Block was therefore not assessed.



Most frequently occurring native perennial species in the *Callitris preisii or Eucalyptus porosa* LOW WOODLAND - percentage frequency and cover abundance values. Indicator species based on chi-square value from species frequency of occurrence within group (# = probability 0.5%, ##=0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Enchylaena tomentosa var. tomentosa	P	83	##	4	9	10	3			
Danthonia caespitosa group	PG	74		2	11	8	1	1		
Rhagodia parabolica	P	67	##	4	10	3	4			
Einadia nutans ssp. nutans	P	64	##	7	11	2				
Stipa elegantissima	PG	58		3	10	5				
Callitris preissii	P	51	##	2	3	3	4	4		
Pittosporum phylliraeoides var. microcarpa	P	51	##	6	7	2	1			
Stipa nitida	PG	51			6	7	3			
Eucalyptus porosa	P	48	##	3		2	5	4	1	
Oxalis perennans	P	48		2	9	2	2			
Maireana enchylaenoides	P	45		2	11	1				
Arthropodium strictum	S	45		4	8	2				
Ptilotus spathulatus forma spathulatus	P	38		4	5	3				
Dianella revoluta var.	P	38		3	7	2				
Maireana brevifolia	P	35	##	2	4	3	2			
Stipa eremophila	PG	35			2	5	2	1	1	

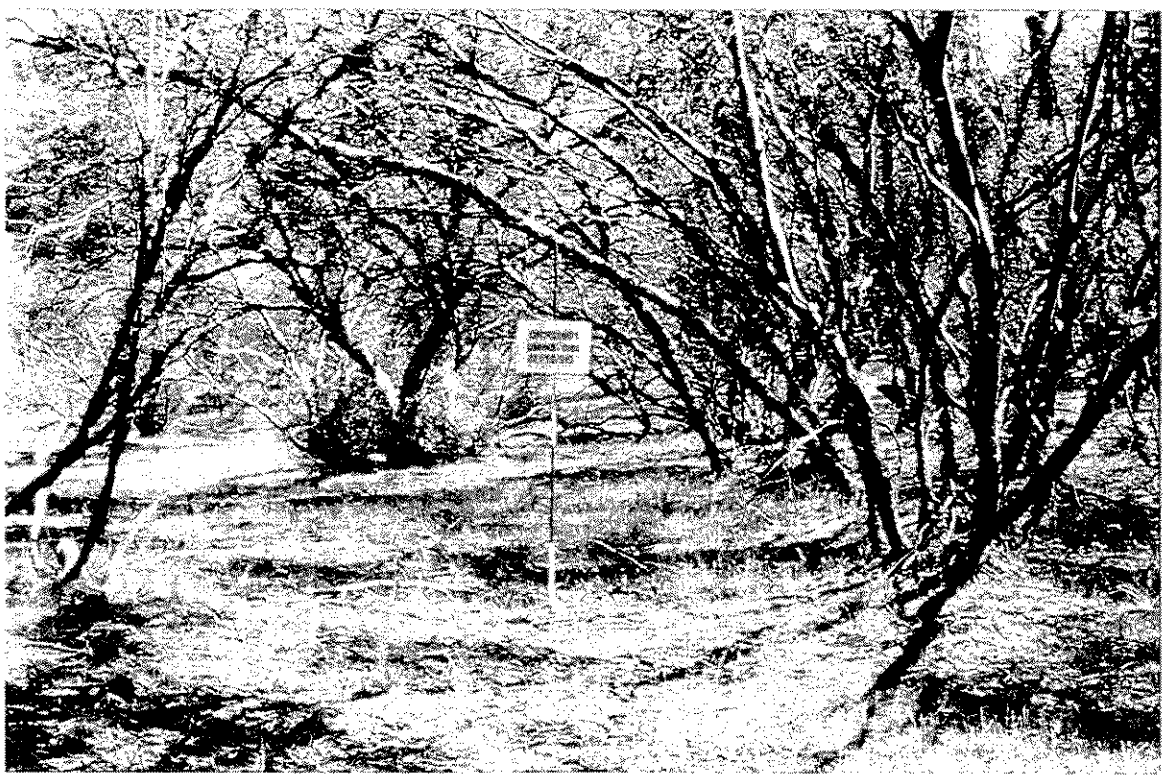


Figure 16. *Callitris preissii* or *Eucalyptus porosa* Low woodland in the south Flinders Ranges
Quadrat ORR01601 *Eucalyptus porosa* Low woodland over *Stipa curticoma, S. exilis, Senecio quadridentatus, Enchylaena tomentosa*

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
**Avena barbata*	A	67		1	8	5	4	2	1	
**Vulpia sp.*	A	64			9	8	3			
**Lycium ferocissimum*	P	54	##	5	10	1	1			
**Critesion murinum*	A	51	#		11	3	2			
**Sisymbrium erysimoides*	A	48	##	2	9	4				
**Bromus rubens*	A	45			11	3				
**Sonchus oleraceus*	A	45		2	11	1				
**Echium plantagineum*	A	41		4	5	3	1			
**Bromus diandrus/rigidus*	A	35			5	5	1			
**Myrsiphyllum asparagoides*	A	32	##	3	3	3	1			
**Rostraria cristata*	A	32			7	3				
**Medicago minima var. minima*	A	32			5	5				
**Gynandriris setifolia*	A	32		1	3	6				

Danthonia caespitosa / Stipa nitida +/- emergent *Acacia victoriae* GRASSLAND & OPEN SHRUBLAND

Floristic Group 5 52 members

VEGETATION DESCRIPTION: LOW/ SHRUBLAND
Ground stratum dominated by *Danthonia caespitosa, Stipa eremophila* (desert spear grass), *S. nitida* (Balcarra grass) with a very variable overstorey. The community includes *Eucalyptus camaldulensis* (red gum) over *Cymbopogon obtectus* (lemongrass) in creeklines in the Flinders Ranges and shrublands dominated by *Dodonaea lobulata,* (lobed hop-bush) *Enchylaena tomentosa var. tomentosa,*(ruby saltbush) *Maireana aphylla* (cottony bluebush), or *Senna artemisioides. Acacia victoriae* (elegant wattle) is frequently present as an emergent.
Dominant life forms: Low shrubs; shrubs; 0-2m; 30-70% cover
Sites with trees or tall shrubs dominant: 25%

DISTRIBUTION: Northern Lofty Block - Plains and gentle slopes of hills generally 300-400m altitude. Soils clay loam and sandy clay loam with some surface stone consisting of shale or siltstone.

FLORISTIC COMPOSITION
Dominant native species: *Danthonia caespitosa, Stipa nitida, Stipa eremophila*
Subdominant species
Enchylaena tomentosa var. tomentosa, Acacia victoriae

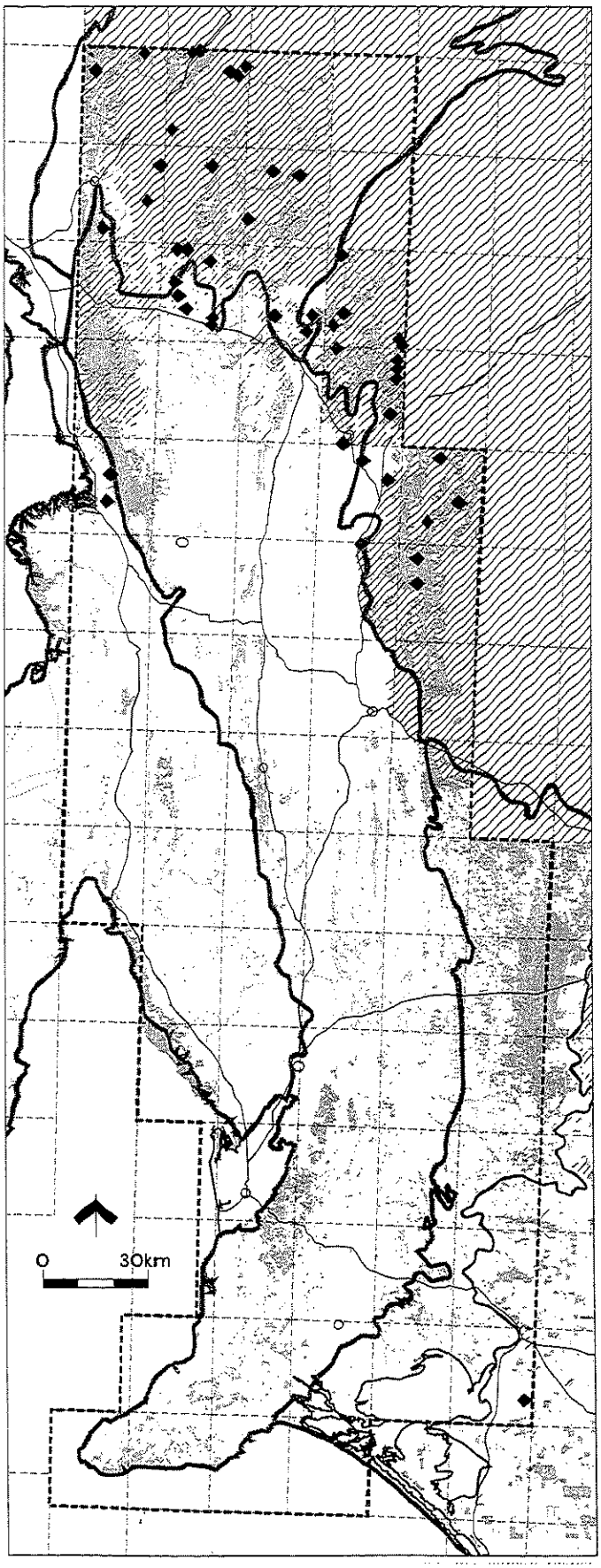
REPRESENTATIVE QUADRATS (Figure 17,18)
LBGQUO01, LBGQUO03
Average number of native plant species (and maximum): 22.04(-43)

ENVIRONMENTAL PARAMETERS (dominant)

Landform patterns /systems: Plain,Low hills
Landform elements: Plain, Hill slope
Surface Soil Texture: 5, Clay loam, Sandy clay loam estimated clay content: **30-35%,** (range 5-35%)
Surface strew: cobble (51-250mm), pebble (5-50mm) <10% cover
Rock outcrop: NIL
Lithology: shale/siltstone

LAND USE AND DISTURBANCE: The land is generally used for sheep or cattle pasture. Herbaceous species, particularly the forbs **Medicago minima var. minima,* (little medic) **Carrichtera annua* (wards weed) and annual grasses **Bromus rubens* (red brome) and **Critesion murinum* (barley grass) are the major alien species and often dominate the ground stratum.

COMMENTS:
Main distribution is north of Lofty Block. May have been formerly widespread in southern part of pastoral zone but cropped or ground cover replaced by alien grasses or herbs over most of its former range. May include disclimax shrublands.



Most frequently occurring native perennial species in the *Danthonia caespitosa / Stipa nitida* +/- *emergent Acacia victoriae* GRASSLAND & OPEN SHRUBLAND - percentage frequency and cover abundance values. Indicator species based on chi-square value from species frequency of occurrence within group (# = probability 0.5%, ##=0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Danthonia caespitosa group	PG	67		1	24	9	1			
Sida corrugata var.	P	57	##	6	24					
Stipa nitida	PG	53	#		14	8	4	2		
Enchylaena tomentosa var. tomentosa	P	51	##	9	7	11				
Acacia victoriae ssp. victoriae	P	46	##	18	4	1	1			
Convolvulus remotus	S	44	##	6	17					
Stipa eremophila	PG	42		2	9	8	2	1		
Goodenia fascicularis	P	40	##	2	16	3				
Oxalis perennans	P	38		5	15					
Vittadinia gracilis	P	34		2	14	2				
Stipa nodosa	PG	34		1	9	6	2			
Vittadinia cuneata var.	P	30		3	8	4	1			

Frequently occurring native annual species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Rhodanthe pygmaea	A	53	##		19	9				
Brachycome lineariloba	A	34	##	3	10	4	1			
Goodenia pusilliflora	A	34		1	13	4				

Figure 17. *Danthonia caespitosa /Stipa nitida* Grassland & Low open shrubland +/-emergent *Acacia victoriae* in eastern Mount Brown Conservation Park

Quadrat LBGQUO01 Open (tussock) grassland. *Stipa scabra ssp. falcata/Danthonia caespitosa* over *Ptilotus nobilis /Hyalosperma semisterile/Maireana trichoptera*

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
**Medicago minima var. minima*	A	82	##		4	24	11	4		
**Carrichtera annua*	A	80	##		14	11	15	1	1	
**Bromus rubens*	A	78	##		17	14	6	4		
**Critesion murinum*	A	69	##		16	9	7	3	1	
**Sonchus oleraceus*	A	69		10	24	2				
**Echium plantagineum*	A	61		3	23	5	1			
**Avena barbata*	A	61			17	8	4	1	2	
**Carthamus lanatus*	A	57	##	3	23	4				
**Vulpia sp.*	A	50		1	10	12		3		
**Hypochaeris glabra*	A	44		1	20	2				
**Medicago truncatula*	A	40	##	2	13	6				
**Sisymbrium erysimoides*	A	38	##	2	12	6				
**Limonium lobatum*	A	32	##	3	8	4	2			
**Asphodelus fistulosus*	P	30	##	2	7	5	2			

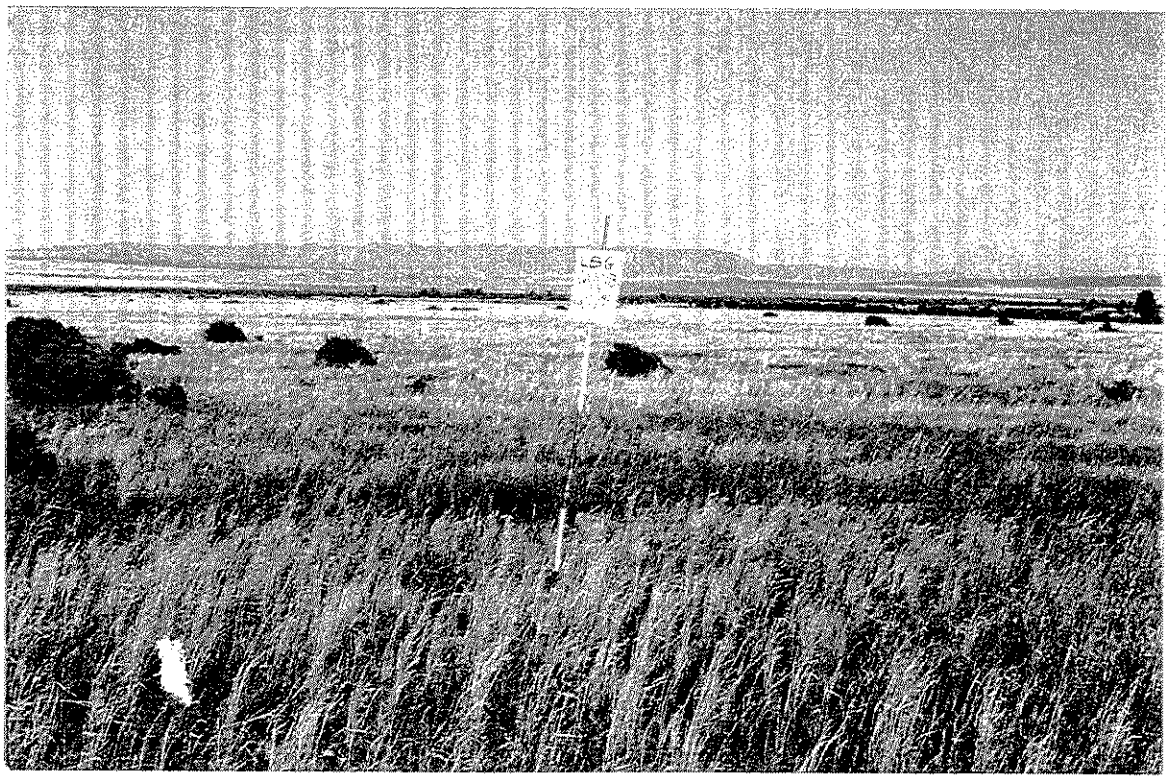


Figure 18. ***Danthonia caespitosa /Stipa nitida*** **Grassland & Low open shrubland +/-emergent** ***Acacia victoriae*** on the south Willochra Plains

Quadrat LBGQUO03. *Danthonia caespitosa /Stipa nodosa/ Podolepis muelleri* Open tussock grassland with emergent *Maireana pyramidata*

Eucalyptus odorata LOW WOODLAND

Floristic Group 6

53 members

VEGETATION DESCRIPTION: LOW WOODLAND dominated by *Eucalyptus odorata* (peppermint box) over an open shrub stratum and a herbaceous ground stratum dominated by wallaby and spear grasses. *Acacia pycnantha* (golden wattle) and *Bursaria spinosa* (sweet bursaria) are the most frequently occurring shrubs. *Callitris preissii* (southern cypress pine), *Eucalyptus leucoxylon* ssp *pruinosa* (inland South Australian blue gum) or *Eucalyptus porosa* (mallee box) may be codominant.
Dominant life forms: Low trees; 5-10m; 30-70% cover
Sites with trees dominant: 98%

DISTRIBUTION: Widespread, on gently to moderately sloping land from the Flinders Ranges extending to the Southern Lofty region. Surface soil is sandy loam to loam with some surface stone as cobbles or pebbles of quartzite or related type.

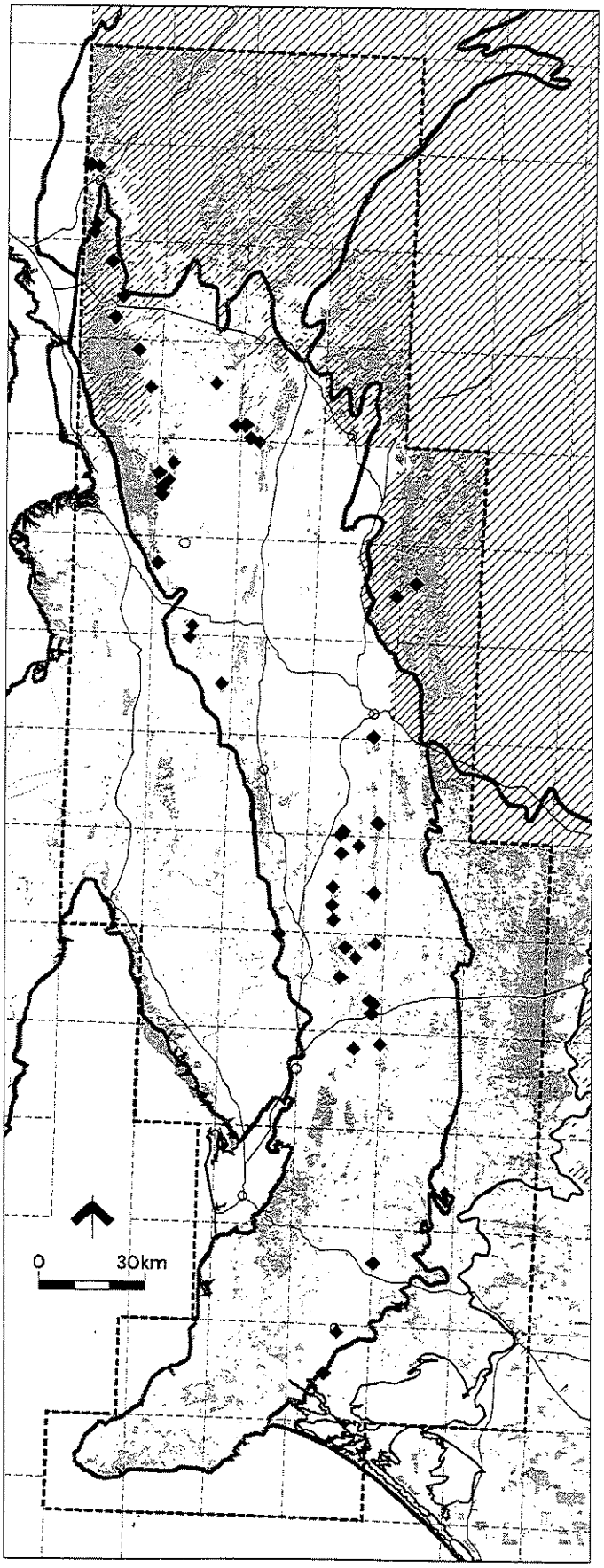
FLORISTIC COMPOSITION
Dominant native species: *Eucalyptus odorata*
Dominant understorey species
Danthonia caespitosa group
Stipa scabra ssp.
Stipa blackii
Danthonia setacea var. setacea
REPRESENTATIVE QUADRATS (Figure 19)
LBGMEL01
Average number of native plant species (and range): 35.49(13-68)

ENVIRONMENTAL PARAMETERS (dominant)

Landform patterns /systems: Low hills,
Landform elements: Hill slope, Hill footslope
Surface Soil Texture: Sandy loam, Loam
estimated clay content: **20-30%,** (range 10-35%)
Surface strew: cobble (51-250mm), <10% cover
Rock outcrop: NIL
Lithology: quartzite

LAND USE AND DISTURBANCE: The land is commonly used for sheep or cattle pasture. Herbaceous species, particularly annual grasses and Salvation Jane are the major alien species. Wild oats frequently occurs as a codominant in the ground stratum.

COMMENTS:
Understorey may be very sparse, with much soil bare but for a soil lichen crust in some high quality examples.



Most frequently occurring native perennial species in the *Eucalyptus odorata* LOW WOODLAND - percentage frequency and cover abundance values. Indicator species based on chi-square value from species frequency of occurrence within group (# = probability 0.5%, ##=0.1%) *M: mistletoe excluded from analysis

	life*	%		Cover/Abundance						
Species	form	Occur.		N	T	1	2	3	4	5
Eucalyptus odorata	P	98	##	1	1		25	23	2	
Oxalis perennans	P	73		2	32	5				
Danthonia caespitosa group	PG	67			17	14	5			
Arthropodium strictum	S	66		6	20	6	3			
Stipa elegantissima	PG	64	##	8	20	4	2			
Maireana enchylaenoides	P	62	#	5	21	6	1			
Einadia nutans ssp. nutans	P	60	##	9	18	5				
Lomandra multiflora ssp. dura	P	56		9	19	2				
Wahlenbergia luteola	S	56		2	18	10				
Stipa scabra ssp.	PG	54	##	1	10	13	5			
Goodenia pinnatifida	S	54		2	21	6				
Acacia pycnantha	P	52		7	10	5	5	1		
Bursaria spinosa	P	52		5	16	2	4	1		
Stipa blackii	PG	52	#	1	7	14	5	1		
Danthonia setacea var. setacea	PG	50	##	1	7	11	6	2		
Plantago varia complex	P	43	##	4	12	6	1			
Elymus scabrus var. scabrus	PG	43	##	3	17	3				
Lagenifera huegelii	S	43	##	2	18	3				
Asperula conferta	S	39	##	3	15	3				
Stipa nitida	PG	37			9	9	2			
Enchylaena tomentosa var. tomentosa	P	35		3	13	3				
Vittadinia cuneata var.	P	35		2	12	5				
Dianella revoluta var.	P	35		4	12	3				
Amyema miquelii	M	33	##	4	9	3	2			
Ptilotus spathulatus forma spathulatus	P	33		4	12	2				
Sida corrugata var.	P	32		4	10	3				
Lomandra densiflora	P	32		5	8	4				
Stackhousia sp.	S	32		2	12	3				
Eutaxia microphylla var. microphylla	P	30	#	8	8					
Cheilanthes austrotenuifolia	S	30			13	3				

Frequently occurring native annual species (not included in group definition analysis) - percentage frequency and cover abundance values

	life	%		Cover/Abundance						
Species	form	Occur.		N	T	1	2	3	4	5
Crassula colorata var.	A	60	##	2	22	8				
Daucus glochidiatus	A	52		3	22	2		1		
Crassula sieberiana ssp.	A	50	##		20	7				
Crassula decumbens var. decumbens	A	33	##	1	16	1				

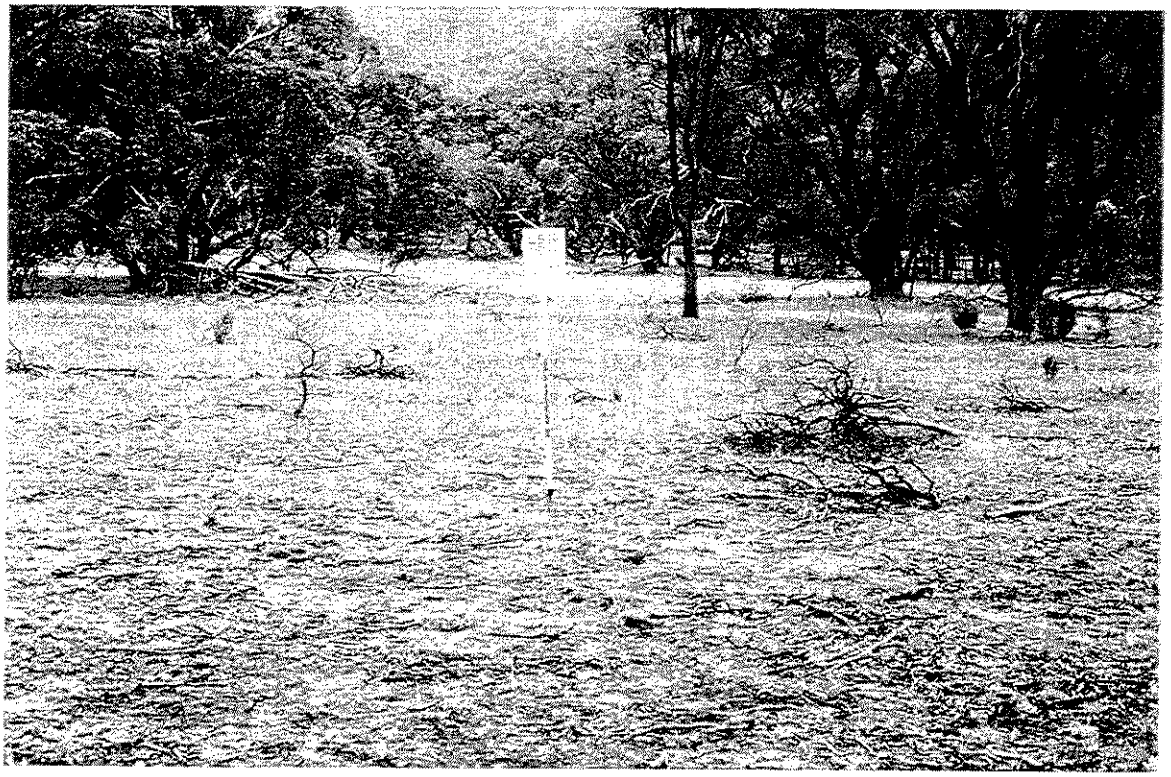


Figure 19. ***Eucalyptus odorata*** **Low woodland in eastern Mount Remarkable National Park**
Quadrat LBGMEL01 Woodland - *Eucalyptus odorata* over *Hyalosperma semisterile/Danthonia auriculata*

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
**Vulpia sp.*	A	81			22	17	3	1		
**Avena barbata*	A	71			12	11	14	1		
**Echium plantagineum*	A	69		6	23	4	4			
**Trifolium arvense var. arvense*	A	60	##		24	8				
**Sonchus oleraceus*	A	54		7	19	2		1		
**Hypochaeris glabra*	A	54		3	18	8				
**Bromus diandrus/rigidus*	A	50		2	11	9	5			
**Pentaschistis airoides*	A	49	##		21	5				
**Trifolium angustifolium*	A	47			18	5	2			
**Arctotheca calendula*	A	45	#	2	20	2				
**Romulea minutiflora*	A	41	##		11	11				
**Brachypodium distachyon*	A	41		1	8	12	1			
**Hedypnois rhagadioloides*	A	37	#	2	12	5	1			
**Galium murale*	A	35	##	1	10	7	1			
**Anagallis arvensis*	A	35		2	12	5				
**Trifolium glomeratum*	A	33	##	1	13	3	1			
**Briza maxima*	A	33			8	4	3	3		
**Aira sp.*	A	33		1	9	7		1		
**Lepidium africanum*	A	32	##	5	12					
**Bromus rubens*	A	32			10	4	2	1		
**Gynandriris setifolia*	A	32		4	8	5				
**Trifolium campestre*	A	30			10	5		1		

Eucalyptus odorata / Eucalyptus socialis MALLEE

Floristic Group 7 13 members

VEGETATION DESCRIPTION: MALLEE to open mallee dominated by *Eucalyptus odorata* (peppermint box) and *E. socialis* (beaked red mallee) over an open shrub stratum commonly consisting of *Bursaria spinosa* (sweet bursaria). *Lepidosperma viscidum* (sticky sword-sedge) frequently dominates the ground stratum and *Triodia scariosa* (spinifex) may be present. Includes tall open shrubland dominated by *Melaleuca lanceolata* (dryland tea-tree).
Dominant life forms: Mallee; >3m; 30-70% cover
Sites with trees or tall shrubs dominant: 100%

DISTRIBUTION: western Northern Lofty and Flinders Ranges regions, usually between 300 and 400m altitude, on gently to moderately sloping hills. Soil generally sandy loam with surface stone, being mainly quartzite.

FLORISTIC COMPOSITION
Dominant native species: *Eucalyptus odorata, Eucalyptus socialis*
Dominant understorey species
Lepidosperma viscidum

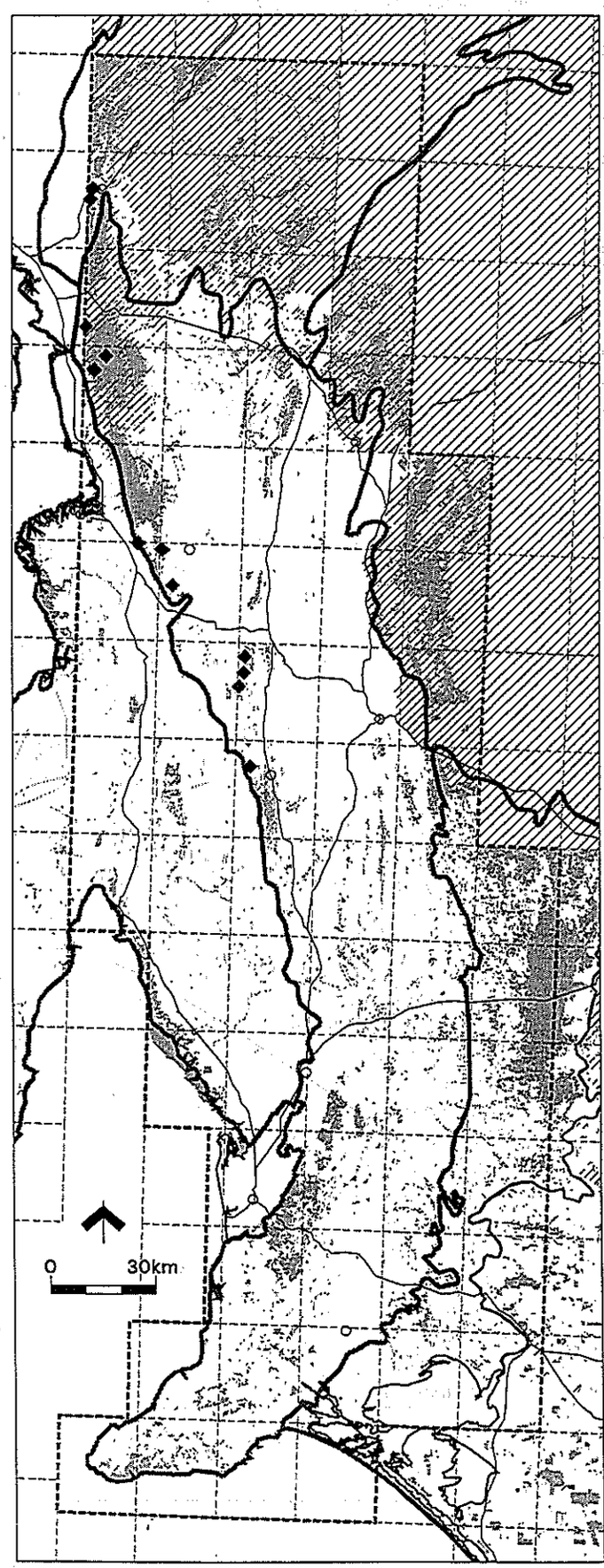
REPRESENTATIVE QUADRATS (Figure 20)
GLA0101 (Mid-North Survey)
Average number of native plant species (and range): 28.85 (18-42)

ENVIRONMENTAL PARAMETERS (dominant)

Landform patterns /systems: ,
Landform elements: Hill slope
Surface Soil Texture: Sandy loam
Estimated clay content: **10-20%,** (10-20%)
Surface strew: cobble (51-250mm), pebble (5-50mm) 10-30% cover
Rock outcrop: NIL
Lithology: quartzite

LAND USE AND DISTURBANCE: The land is often used for sheep or cattle pasture. The major alien species are herbaceous and generally sparse.

COMMENTS:
Minor community in this survey - conservation not assessed for Lofty Block, as Mid-North survey results currently being analysed will enable a thorough assessment.



Most frequently occurring native species in the *Eucalyptus odorata/Eucalyptus socialis* MALLEE - percentage frequency and cover abundance values.. Indicator species based on chi-square value from species frequency of occurrence within group (# = probability 0.5%, ##=0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Dianella revoluta var.	P	92			7	5				
Eutaxia microphylla var. microphylla	P	76	##	1	3	6				
Eucalyptus socialis	P	69	##	1	2	3	2	1		
Eucalyptus odorata	P	69	##			4	2	3		
Lepidosperma viscidum	P	61	##		2	1	5			
Maireana enchylaenoides	P	61		1	6	1				
Bursaria spinosa	P	61			2	3	3			
Rhagodia parabolica	P	46		2	4					
Oxalis perennans	P	46			5	1				
Triodia scariosa	PG	46			3		2	1		
Danthonia setacea var. setacea	PG	46			3	2	1			
Arthropodium strictum	S	46			4	2				
Melaleuca lanceolata	P	38	##	1	3		1			
Acacia calamifolia	P	38	#		1	2	2			
Phyllanthus saxosus	P	30	##	1	2	1				
Pomaderris paniculosa ssp. paniculosa	P	30	##		2	2				
Astroloma humifusum	P	30			3	1				
Acacia pycnantha	P	30		1		2	1			
Lomandra effusa	P	30			2	2				
Einadia nutans ssp. nutans	P	30			3	1				
Vittadinia cuneata var.	P	30			3	1				
Stipa acrociliata	PG	30	##	1	1	2				
Stipa flavescens	PG	30	##			1	3			
Danthonia caespitosa group	PG	30			1	3				
Stipa nitida	PG	30			1	2	1			
Stipa scabra ssp.	PG	30			2	2				
Goodenia albiflora	S	30	##		3		1			
Stackhousia sp.	S	30			2	2				

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
**Anagallis arvensis*	A	84	##		5	6				
**Avena barbata*	A	76			2	7	1			
**Vulpia sp.*	A	69			5	4				
**Trifolium campestre*	A	53			2	4	1			
**Hypochaeris glabra*	A	53		1	4	2				
**Echium plantagineum*	A	53			5	2				
**Rostraria cristata*	A	46			6					
**Pentaschistis airoides*	A	38			2	3				
**Hedypnois rhagadioloides*	A	38			3	2				
**Sonchus oleraceus*	A	38			5					
**Trifolium angustifolium*	A	38			3	2				
**Bromus diandrus/rigidus*	A	38		1	4					
**Lolium rigidum*	A	30			3	1				
**Bromus rubens*	A	30			3	1				
**Medicago minima var. minima*	A	30			4					
**Gynandriris setifolia*	A	30			3	1				
**Trifolium arvense var. arvense*	A	30			2	2				
**Arctotheca calendula*	A	30			2	2				
**Brachypodium distachyon*	A	30			3		1			
**Lycium ferocissimum*	P	30		1	2	1				

Frequently occurring native annual species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Daucus glochidiatus	A	53			5	2				
Wahlenbergia gracilenta	A	38	#		3	2				

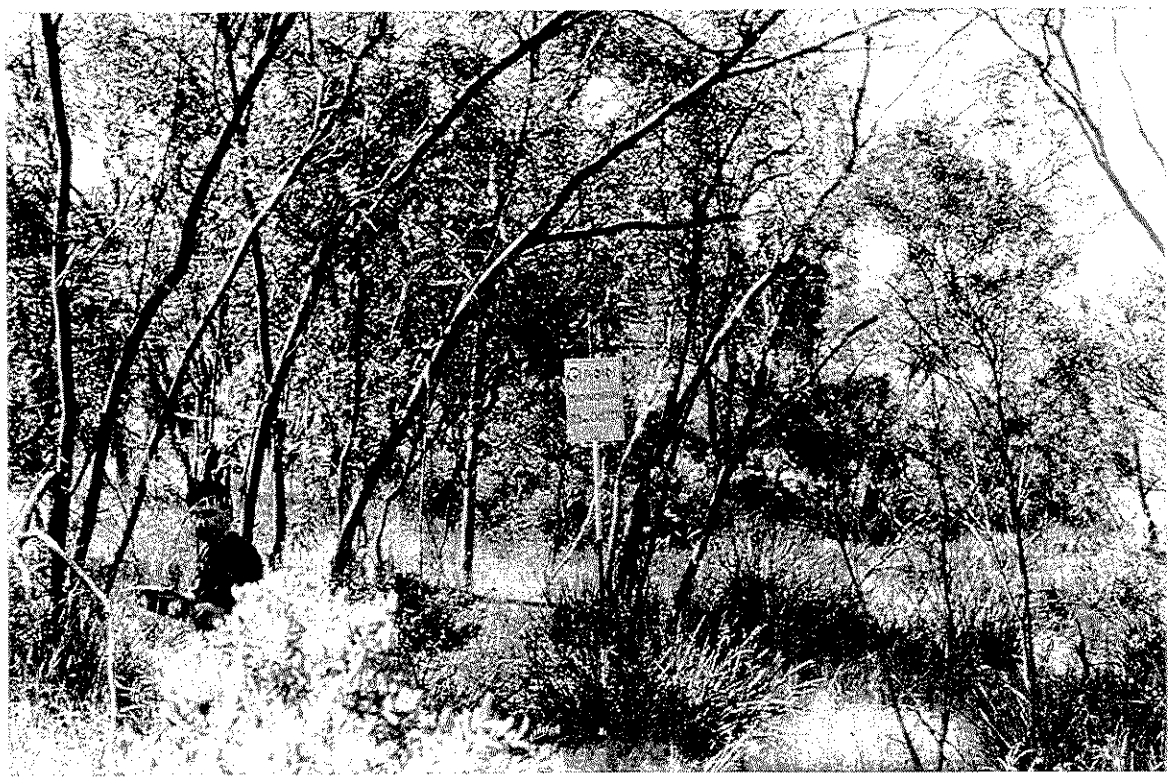


Figure 20. ***Eucalyptus odorata /Eucalyptus socialis*** **Mallee east of the Southern Flinders Ranges**
Quadrat GLA0101. *Eucalyptus odorata* Mallee over *Lepidosperma viscidum/ Acacia ligulata*

Lomandra multiflora ssp *dura* TUSSOCK GRASSLAND & LOW WOODLAND

Floristic Group 8 110 members

VEGETATION DESCRIPTION: TUSSOCK GRASSLAND/OPEN SEDGELAND, hummock grassland, low woodland, in which 4 subcommunities were recognised, being

- **8.1** *Allocasuarina verticillata* Low Woodland;
- **8.2** *Triodia scariosa +/- Callitris glaucophylla* Hummock Grassland & Low Woodland;
- **8.3** *Stipa blackii* Grassland & Low Eucalypt Woodland;
- **8.4** *Lomandra multiflora ssp. dura* Tussock Grassland
- **8.5** Species-poor sites

Dominant life forms: Grass 30-70% cover /"Sedge-type plants" (*Lomandra* sp.) 10-30% cover
Sites with trees or tall shrubs dominant: 44%

DISTRIBUTION: eastern Lofty Block in the south, the Burra Hills and throughout the Mid-North including the foothills of the southern Flinders Ranges, environment variable mainly gentle to moderate slopes, including plains and high altitudes. Generally with surface stone and often with rock outcropping.

FLORISTIC COMPOSITION
Dominant native species: *Lomandra multiflora ssp dura Stipa blackii, Aristida behriana, Danthonia caespitosa*
Subdominant overstorey/ dominant understorey species described below for each subcommunity

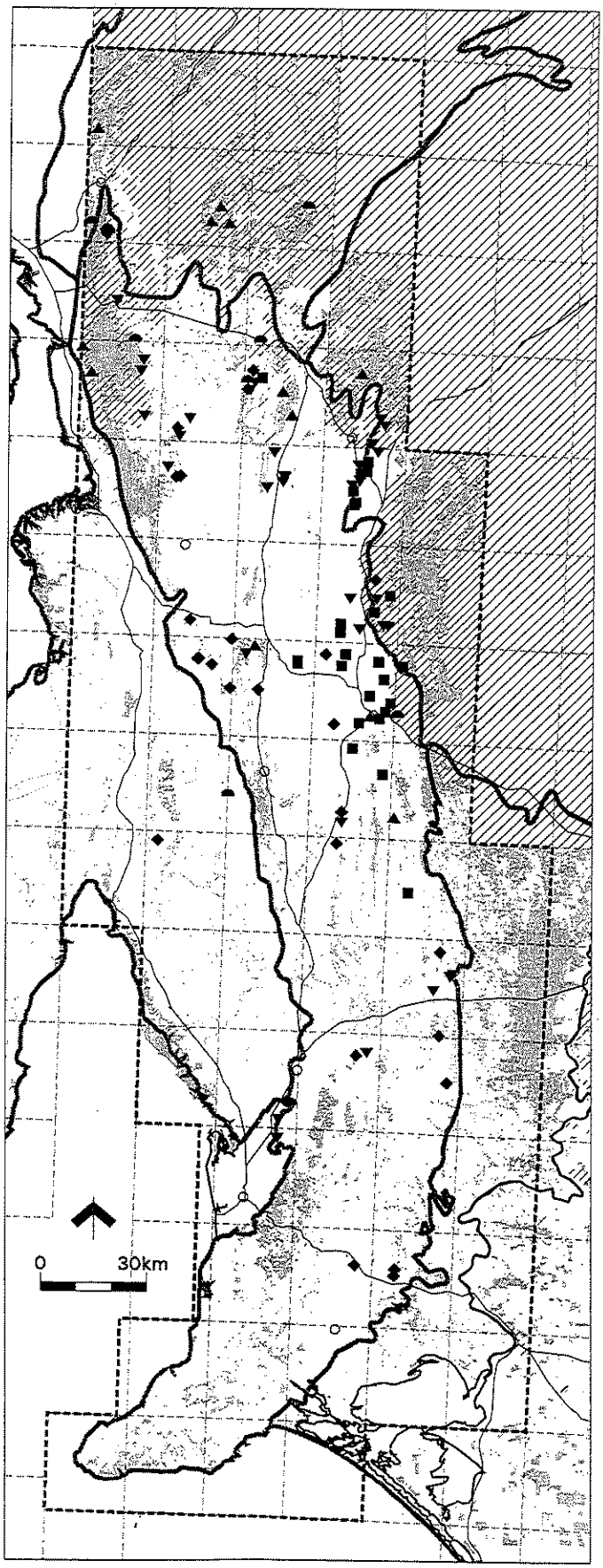
REPRESENTATIVE QUADRATS (Figures 21-27)
8.1: LBGLAU02, LBGTRU02
8.2: MOO01801, PEK00601
8.3: LBGJAM01,LBGJAM05
8.4: LBGBUR01

Average number of native plant species (and maximum): 27.75(-63)

ENVIRONMENTAL PARAMETERS (dominant)

Landform patterns /systems: Low hills,Hills
Landform elements: Hill slope, Hill footslope
Surface Soil Texture: 8, Clay loam, Sandy loam
estimated clay content: **30-35%,** (5->45%)
Surface strew: cobble (51-250mm), pebble (5-50mm), <10% cover
Rock outcrop: NIL
Lithology: shale, sandstone, quartzite

LAND USE AND DISTURBANCE: The land is generally used for sheep pasture. Herbaceous species, particularly wild oats are the major alien species.



Allocasuarina verticillata LOW WOODLAND

Floristic Group 8.1 28 members

VEGETATION DESCRIPTION: LOW WOODLAND dominated by *Allocasuarina verticillata*, often with an open shrub stratum of *Bursaria spinosa* (sweet bursaria) over a ground stratum dominated by *Themeda triandra* (kangaroo grass), *Gonocarpus elatus* (hill raspwort), *Lomandra multiflora ssp. dura* (hard mat-rush), and *Stipa blackii*, (crested spear-grass). *Triodia scariosa* (spinifex) is occasionally present. Includes grasslands without tree stratum.
Dominant life forms: Low trees; trees; >5m; 30-70% cover. Sites with trees or tall shrubs dominant: 71%

DISTRIBUTION: widespread on clay loams with surface strew of quartzite or sandstone in the hills of the Lofty Block from the eastern section of Mount Brown to the Monarto region.

FLORISTIC COMPOSITION
Dominant native species: *Allocasuarina verticillata*
Dominant understorey species
Themeda triandra,Gonocarpus elatus, Lomandra multiflora ssp. dura, Stipa blackii

REPRESENTATIVE QUADRATS (Figure 21,22) LBGLAU02, LBGTRU02
Maximum number of native plant species : 53

ENVIRONMENTAL PARAMETERS (dominant)
Landform patterns /systems: Low Hills
Landform elements: Hill slope
Surface Soil Texture: Clay loam; estimated clay content: **20-30%**
Surface strew: cobble;30-70%
Rock outcrop: <10%

LAND USE AND DISTURBANCE: The land is generally used for sheep pasture. Herbaceous species, particularly Salvation Jane, Vulpia, wild oats and clover are the major alien species.

Most frequently occurring native species in the *Allocasuarina verticillata* LOW WOODLAND - percentage frequency and cover abundance values. Indicator species based on chi-square value (# = probability 0.5%, ##=0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Gonocarpus elatus	S	82	##	2	6	6	8	1		
Themeda triandra	PG	82	#	2	4	3	10	4		
Lomandra multiflora ssp. dura	P	82		1	13	9				
Stipa blackii	PG	71		1	5	8	6			
Allocasuarina verticillata	P	71	#	2	2		15	1		
Bursaria spinosa	P	67			6	6	6	1		
Arthropodium strictum	S	64		5	9	4				
Aristida behriana	PG	64		1	7	5	5			
Danthonia caespitosa group	PG	64		1	2	9	6			
Dianella revoluta var.	P	57		2	7	7				
Oxalis perennans	P	53			11	4				
Acacia pycnantha	P	50		6	4	3	1			
Stipa elegantissima	PG	46		3	8	2				
Convolvulus remotus	S	42		2	6	4				
Lomandra densiflora	P	42		2	7	2		1		
Danthonia setacea var. setacea	PG	39			3	4	4			
Maireana enchylaenoides	P	39		2	6	3				
Arthropodium fimbriatum	S	35		4	4	2				
Stackhousia sp.	S	35		2	5	3				
Stipa scabra ssp.	PG	35			2	6	2			
Triodia scariosa	PG	35				3	6		1	
Cryptandra amara var. longiflora	P	35			3	4	3			
Glycine clandestina var. sericea	S	32		1	8					
Wahlenbergia luteola	S	32			8	1				
Vittadinia cuneata var.	P	32		1	5	3				

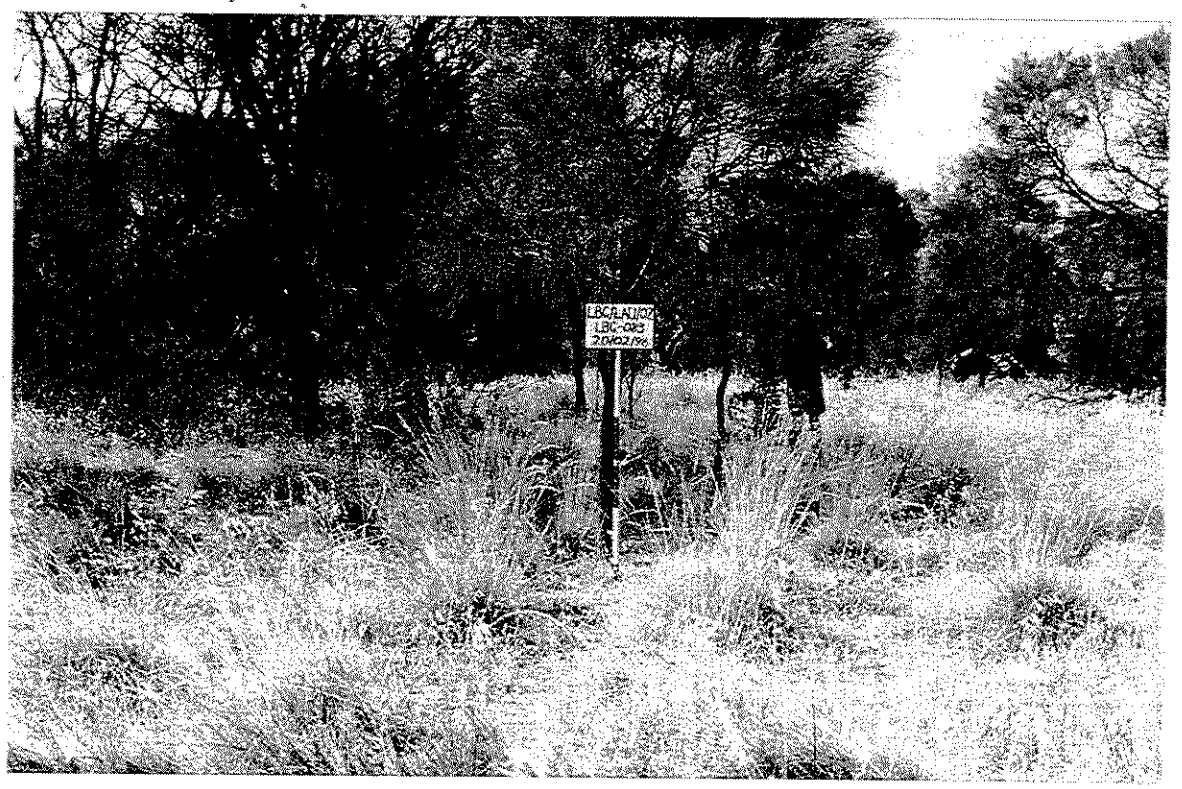


Figure 21. ***Allocasuarina verticillata*** **Low woodland in the southern Flinders Ranges**
Quadrat LBGLAU02 Low woodland *Allocasuarina verticillata* over *Triodia scariosa/Bursaria spinosa*

Figure 22. ***Allocasuarina verticillata*** **Low woodland in the south-eastern Mount Lofty Ranges**
Quadrat LBGTRU02. Very low woodland *Allocasuarina verticillata* over *Acacia paradoxa/Stipa blackii/Bursaria spinosa/Gonocarpus elatus/Stipa setacea*

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.	Cover/Abundance N	T	1	2	3	4	5
**Echium plantagineum*	A	89	1	16	8				
**Vulpia sp.*	A	82		6	16		1		
**Avena barbata*	A	67		2	11	5			1
**Trifolium angustifolium*	A	64		5	9	4			
**Trifolium arvense var. arvense*	A	64		6	12				
**Aira sp.*	A	57		4	12				
**Brachypodium distachyon*	A	53		3	8	3			1
**Trifolium campestre*	A	53		4	11				
**Bromus diandrus/rigidus*	A	50	1	5	6	1	1		
**Hypochaeris glabra*	A	50		4	10				
**Sonchus oleraceus*	A	42	6	6					
**Hypochaeris radicata*	P	39	3	6	2				
**Arctotheca calendula*	A	35	3	6	1				
**Romulea minutiflora*	S	32		3	5	1			
**Anagallis arvensis*	A	32	3	5	1				

group 8 subcommunities

Triodia scariosa +/- Callitris glaucophylla HUMMOCK GRASSLAND AND LOW WOODLAND

Floristic Group 8.2 12 members

VEGETATION DESCRIPTION: HUMMOCK GRASSLAND, *Triodia scariosa* (spinifex) often with emergent *Callitris glaucophylla (*white cypress-pine) forms a LOW WOODLAND with an open shrub stratum of *Bursaria spinosa* (sweet bursaria) over a sparse ground stratum of *Lomandra multiflora ssp. dura* (hard mat-rush), *Danthonia caespitosa* (common wallaby-grass) and *Stipa nodosa*, (smooth spear-grass). *Allocasuarina verticillata* (drooping sheoak) may be present.
Dominant life forms: Low trees; trees; >5m; 30-70% cover
Sites with trees or tall shrubs dominant: 42%

DISTRIBUTION: hills of the northern Lofty Block on clay loams with surface strew of sandstone or quartzite

FLORISTIC COMPOSITION
Dominant native species: *Triodia scariosa +/- Callitris glaucophylla*
Dominant understorey species
Lomandra multiflora ssp. dura, Stipa blackii.
REPRESENTATIVE QUADRATS (Figure 23,24) MOO01801, PEK00601
Maximum number of native plant species : 63

ENVIRONMENTAL PARAMETERS (dominant)

Landform patterns /systems:, Low Hills
Landform elements: Hill slope
Surface Soil Texture: Clay loam; estimated clay content: **30-35%**
Surface strew: cobble; 10 - 30% cover
Rock outcrop: <10% cover

LAND USE AND DISTURBANCE: The land is generally used for sheep pasture. Herbaceous species, particularly wild oats are the major alien species.

COMMENTS:
Also occurs in Flinders and Olary Ranges Bioregion. Related communities in Dutchman's Stern Conservation Park and Flinders Ranges National Park.

Most frequently occurring native species (percentage frequency >30), indicator species or species of particular conservation significnce in the *Triodia scariosa +/- Callitris glaucophylla* HUMMOCK GRASSLAND AND LOW WOODLAND - percentage frequency >30 and cover abundance values. Indicator species based on chi-square value (# = probability <0.5%, ## = 0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Lomandra multiflora ssp. dura	P	100			7	5				
Wahlenbergia luteola	S	83		1	8	1				
Danthonia caespitosa group	PG	83			6	4				
Stipa nodosa	PG	83		1	5	4				
Oxalis perennans	P	83		2	5	3				
Ptilotus spathulatus forma spathulatus	P	83		1	6	3				
Arthropodium strictum	S	75		1	4	4				
Triodia scariosa	PG	75	#	1	2	1	2	3		
Vittadinia cuneata var.	P	75		1	7	1				
Goodenia pinnatifida	S	66		1	3	4				
Stipa elegantissima	PG	66		2	6					
Bursaria spinosa	P	66		4	2	1	1			
Chrysocephalum apiculatum	P	66			4	3	1			
Maireana enchylaenoides	P	66		1	7					
Stipa blackii	PG	58		1	1	2	3			
Chrysocephalum semipapposum	P	58		1	2	2	1	1		
Glycine clandestina var. sericea	S	50		2	3	1				

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Stackhousia sp.	S	50			4	2				
Dianella revoluta var.	P	50		1	2	3				
Enchylaena tomentosa var. tomentosa	P	50			6					
Lomandra effusa	P	50			4	2				
Allocasuarina verticillata	P	41		2	2	1				
Callitris glaucophylla	P	41	##		1		2	1	1	
Olearia decurrens	P	41	##	1	1		1	2		
Cheilanthes austrotenuifolia	S	33		1	3					
Convolvulus erubescens	S	33			2	2				
Microseris lanceolata	S	33	##	2	1	1				
Acacia pycnantha	P	33		1	3					
Cassinia laevis	P	33	#	2	1		1			
Eutaxia microphylla var. microphylla	P	33			3	1				
Exocarpos aphyllus	P	33	##	2	1		1			
Minuria leptophylla	P	33		1	2	1				
Pimelea micrantha	P	33		1	2	1				
Rhagodia parabolica	P	33	##		2	1	1			
Xanthorrhoea quadrangulata	P	33	#		2	2				
Arthropodium minus	S	25	#	2	1					
Brachycome ciliaris var. subintegrifolia	S	25	#		3					
Geranium solanderi var. solanderi	S	25	#		3					
Pimelea microcephala ssp. microcephala	P	25	##		2		1			

Frequently occurring native annual or orchid species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Daucus glochidiatus	A	83	##		7	3				
Crassula colorata var.	A	66			8					
Triptilodiscus pygmaeus	A	66			6	2				
Crassula sieberiana ssp.	A	41	##		4	1				
Goodenia pusilliflora	A	41			2	3				
Rhodanthe pygmaea	A	41			4	1				
Wahlenbergia gracilenta	A	41	##		5					
Brachycome lineariloba	A	33	#		3	1				
Pterostylis biseta	O	25	#	3						
Millotia myosotidifolia	A	25	#		3					

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
**Avena barbata.*	A	91			5	4	1	1		
**Vulpia sp.*	A	91			4	6		1		
**Hypochaeris glabra*	A	75			2	7				
**Medicago minima var. minima*	A	66		2	2	4				
**Sonchus oleraceus*	A	66		2	5	1				
**Silene nocturna*	A	58		1	5	1				
**Bromus rubens*	A	50			3	2		1		
**Echium plantagineum*	A	50		1	3	2				
**Carthamus lanatus*	A	41		1	3	1				
**Galium murale*	A	41			1	4				
**Brachypodium distachyon*	A	33			1	3				
**Carrichtera annua*	A	33	#		4					
**Erodium cicutarium*	A	33	##	1	3					
**Rostraria cristata*	A	33		1	3					
**Trifolium arvense var. arvense*	A	33			4					
**Sisymbrium erysimoides*	A	25	#			2	1			

Figure 23. ***Triodia scariosa*** **Hummock Grassland &** ***Callitris glaucophylla*** **Low woodland east of the southern Flinders Ranges**

Quadrat PEK00601 *Bursaria spinosa* Open shrubland over *Triodia scariosa ssp. bunicola, Stipa drummondii, Calocephalus citreus, Danthonia caespitosa, Lomandra multiflora ssp. dura.*

Figure 24. ***Triodia scariosa*** **Hummock Grassland &** ***Callitris glaucophylla*** **Low woodland in the southern Flinders Ranges**

Quadrat MOO01801 *Callitris glaucophylla,* Low woodland over *Senna artemisioides, Stipa blackii.*

Stipa blackii GRASSLAND AND LOW EUCALYPT WOODLAND

Floristic Group 8.3 34 members

VEGETATION DESCRIPTION: TUSSOCK GRASSLAND, LOW WOODLAND very variable community; overstorey often present in a low woodland dominated by *Eucalyptus leucoxylon ssp. pruinosa* (inland South Australian blue gum) or box eucalypts. An open shrub stratum of *Bursaria spinosa* (sweet bursaria) may be present over a ground stratum dominated by *Stipa blackii*, (crested spear-grass), *Aristida behriana* (brush wire-grass), *Lomandra multiflora ssp. dura* (hard mat-rush) and *Danthonia caespitosa* (common wallaby-grass).
Dominant life forms: Low trees; trees; >5m; 30-70% cover
Sites with trees or tall shrubs dominant: 53%

DISTRIBUTION: widespread in the Lofty Block from the foothills of the southern Flinders Ranges to the Barossa Valley, generally on clay loams with light strew or rock outcropping of shale.

FLORISTIC COMPOSITION
Dominant native species: *Stipa blackii*
Dominant understorey species
Aristida behriana, Lomandra multiflora ssp. dura, Danthonia caespitosa
REPRESENTATIVE QUADRATS (FIGURE 25,26) LBGJAM01,LBGJAM05
Maximum number of native plant species : (52)

ENVIRONMENTAL PARAMETERS (dominant)

Landform patterns /systems: Low Hills
Landform elements: Hill slope
Surface Soil Texture: Clay loam, estimated clay content: **30-35%**
Surface strew: cobble; <10% cover
Rock outcrop: <10% cover

LAND USE AND DISTURBANCE: The land is generally used for sheep pasture. Major alien species are herbaceous, particularly annual grasses and clovers, along with Salvation Jane. Wild oats are often dominant in the ground stratum.

COMMENTS: Most remnants are isolated fragments. Overstorey dominants vary greatly. Understorey is relatively grassy. Includes grasslands in the Peterborough - Jamestown area and low woodlands in the Truro area.

Most frequently occurring native species in *Stipa blackii* GRASSLAND AND LOW EUCALYPT WOODLAND - percentage frequency and cover abundance values. Indicator species based on chi-square value (# = probability 0.5%, ##=0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Stipa blackii	PG	91			1	7	19	4		
Aristida behriana	PG	88		1	6	9	11	3		
Lomandra multiflora ssp. dura	P	85			14	11	3	1		
Danthonia caespitosa group	PG	76		1	7	12	6			
Maireana enchylaenoides	P	70		1	20	3				
Arthropodium strictum	S	64		3	11	5	3			
Euphorbia drummondii	S	64		5	17					
Wahlenbergia luteola	S	58		3	12	5				
Dianella revoluta var.	P	58		2	12	5	1			
Sida corrugata var.	P	58		1	14	5				
Vittadinia gracilis	P	52		3	11	4				
Elymus scabrus var. scabrus	PG	50	#	3	10	4				
Vittadinia cuneata var.	P	50		2	8	7				
Goodenia pinnatifida	S	47		4	7	5				
Stipa scabra ssp.	PG	47			2	7	7			
Oxalis perennans	P	47		1	14	1				
Ptilotus spathulatus forma spathulatus	P	47		6	9	1				

Species	life form	% Occur.	Cover/Abundance N	T	1	2	3	4	5
Lomandra effusa	P	44	1	8	3	3			
Convolvulus erubescens	S	41	1	12	1				
Bursaria spinosa	P	41	3	6	1	4			
Einadia nutans ssp. nutans	P	41	2	12					
Convolvulus remotus	S	38	4	8	1				
Themeda triandra	PG	38		3	4	2	4		
Acacia pycnantha	P	38	4	2	5	1	1		
Bulbine bulbosa	S	32	3	4	1	3			
Enneapogon nigricans	PG	32	2	6	2		1		
Stipa nodosa	PG	32	1	2	4	4			
Allocasuarina verticillata	P	32	3	3	3	2			
Chrysocephalum apiculatum	P	32		3	7	1			
Chrysocephalum semipapposum	P	32	1	6	1	1	2		

Frequently occurring native annual species (not included in group definition analysis)

Species	life form	% Occur.	Cover/Abundance N	T	1	2	3	4	5
Crassula colorata var.	A	35	1	10	1				
Triptilodiscus pygmaeus	A	35	2	3	6	1			

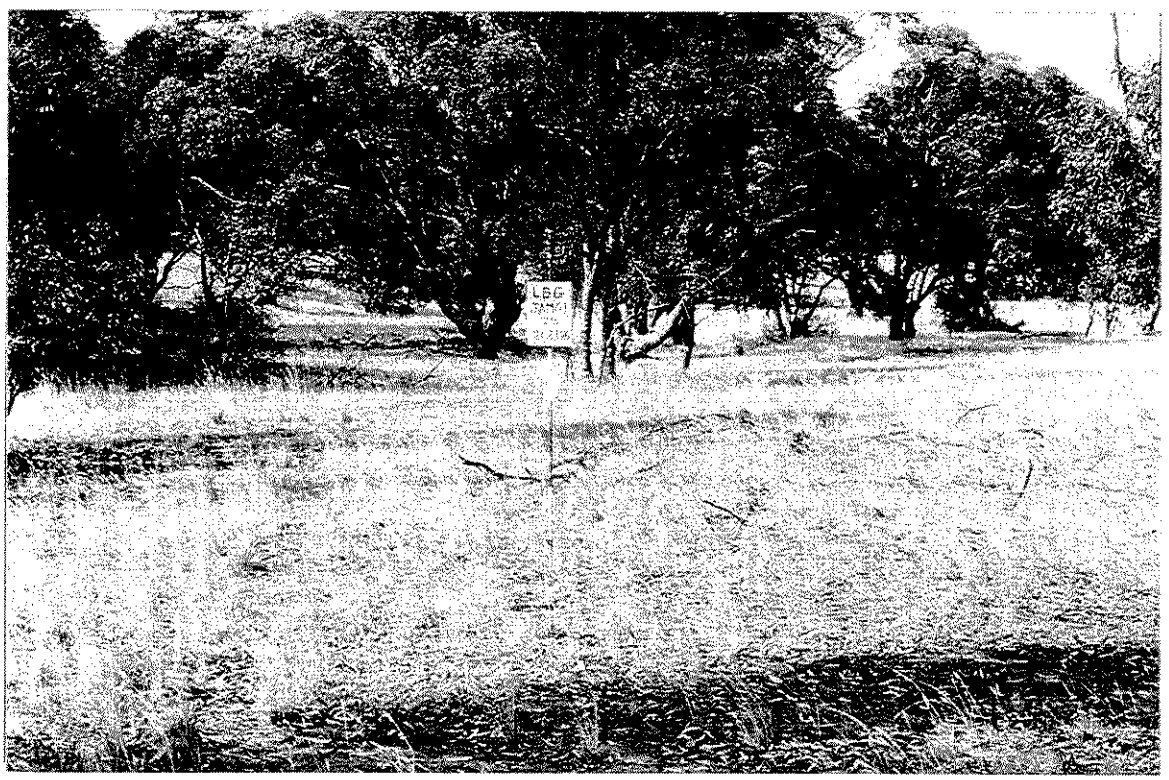


Figure 25. *Stipa blackii* Grassland & Low Eucalypt woodland on unmade road reserve in the Northern Lofty Region

Quadrat LBGJAM01. Woodland. *Eucalyptus microcarpa/Eucalyptus leucoxylon ssp. pruinosa* over *Danthonia setacea var. setacea/Stipa blackii*

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.	Cover/Abundance N	T	1	2	3	4	5
**Vulpia sp.*	A	76		8	17	1			
**Avena barbata*	A	67		3	9	5	3	3	
**Echium plantagineum*	A	64	4	13	1	4			
**Trifolium arvense var. arvense*	A	64	1	14	7				
**Trifolium angustifolium*	A	61		10	7	4			
**Hypochaeris glabra*	A	52		9	6	3			
**Trifolium campestre*	A	52		8	8	2			
**Bromus diandrus/rigidus*	A	50	1	9	6	1			
**Carthamus lanatus*	A	50	3	12	1	1			
**Salvia verbenaca form A*	A	50	3	7	4	3			
**Gynandriris setifolia*	S	44	2	7	3	3			
**Bromus rubens*	A	44		8	6	1			
**Trifolium glomeratum*	A	41		8	6				
**Hypochaeris radicata*	S	32	2	9					
**Brachypodium distachyon*	A	32		4	4	3			
**Hedypnois rhagadioloides*	A	32		10	1				
**Sonchus oleraceus*	A	32	4	6	1				

Figure 26. *Stipa blackii* Grassland & Low Eucalypt woodland on unmade road reserve in the Northern Lofty Region

Quadrat LBGJAM05. (Tussock) grassland *Stipa blackii/Themeda triandra* over *Aristida behriana/Stipa scabra ssp. falcata*

group 8 subcommunities

Lomandra multiflora ssp. dura TUSSOCK GRASSLAND

Floristic Group 8.4 25 members

VEGETATION DESCRIPTION: OPEN SEDGELAND/ TUSSOCK GRASSLAND dominated by *Lomandra multiflora ssp. dura* (hard mat-rush) over *Aristida behriana*, (brush wire-grass) *Danthonia caespitosa*, (common wallaby-grass) *Stipa blackii*, (crested spear-grass). The most frequently occurring native herbs are *Convolvulus erubescens* (Australian bindweed), *Euphorbia drummondii* (caustic weed), *Vittadinia gracilis* (woolly New Holland daisy), *Wahlenbergia luteola* (yellow-wash bluebell). *Cryptandra amara var. longiflora* (long-flower cryptandra) is the most frequently occurring woody species and occurs at a minority of sites.
Dominant life forms: "sedge type plants" (Lomandra sp.) 10-30% cover
Sites with trees or tall shrubs dominant: 4%

DISTRIBUTION: north eastern Lofty Block above 380m altitude, mainly in the Burra Hills on clay loams, generally with rock outcropping of shale or sandstone.

FLORISTIC COMPOSITION
Dominant native species: *Lomandra multiflora ssp. dura*
Subdominant species: *Aristida behriana, Danthonia caespitosa, Stipa blackii*

REPRESENTATIVE QUADRAT (Figure 27) LBGBUR01
Maximum number of native plant species : 41

ENVIRONMENTAL PARAMETERS (dominant)
Landform patterns /systems:, Low Hills
Landform elements: Hill slope
Surface Soil Texture: Clay loam, estimated clay content: 30 - 35%
Surface strew: pebble; <10% cover
Rock outcrop: 10-50%,<10% cover

LAND USE AND DISTURBANCE: The land is used for sheep pasture. Herbaceous species, particularly wild oats are the major alien species. Saffron thistle and Salvation Jane occurs at most sites.

COMMENTS: The community is not known outside South Australia. Relatively extensive examples remain on private grazing land in the Burra Hills. Most are heavily modified and depauperate in native species, but a few high quality remnants survive. Associated with habitat for pygmy bluetongue.

Most frequently occurring native species in the *Lomandra multiflora ssp dura* TUSSOCK GRASSLAND - percentage frequency and cover abundance values. Indicator species based on chi-square value (# = probability 0.5%, ##=0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Lomandra multiflora ssp. dura	P	81			2	10	9	1		
Convolvulus erubescens	S	77	#	2	17	2				
Aristida behriana	PG	74			13	6		1		
Danthonia caespitosa group	PG	70			9	9		1		
Wahlenbergia luteola	S	66		4	11	3				
Stipa blackii	PG	66			10	6	1	1		
Euphorbia drummondii	S	62		1	14	2				
Oxalis perennans	P	62			14	3				
Vittadinia gracilis	P	62			8	9				
Maireana enchylaenoides	P	59		1	13	2				
Goodenia pinnatifida	S	51		1	13					
Leptorhynchos squamatus	P	51	##		5	9				
Minuria leptophylla	P	51	#	1	10	3				
Ptilotus spathulatus forma spathulatus	P	51		1	10	3				
Vittadinia cuneata var.	P	51			9	5				
Stipa nitida	PG	48			2	8	2	1		
Rumex dumosus var.	S	44	##	1	11					
Danthonia carphoides var. carphoides	PG	37	##		6	4				
Sida corrugata var.	P	37		1	9					
Stackhousia sp.	S	33		1	7	1				
Calocephalus citreus	P	33		1	6	1	1			
Lomandra effusa	P	33			4	4	1			
Plantago varia complex	P	33			6	3				

Figure 27. *Lomandra multiflora ssp. dura* Tussock grassland in the Burra Hills
Quadrat LBGBUR01. (Tussock) grassland. *Stipa setacea/Stipa scabra ssp. falcata/Danthonia auriculata* over *Leptorhynchos tetrachaetus/Danthonia carphoides var. carphoides/Lomandra multiflora ssp. dura*

Frequently occurring native annual species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.	Cover/Abundance N	T	1	2	3	4	5
Triptilodiscus pygmaeus	A	37		7	3				

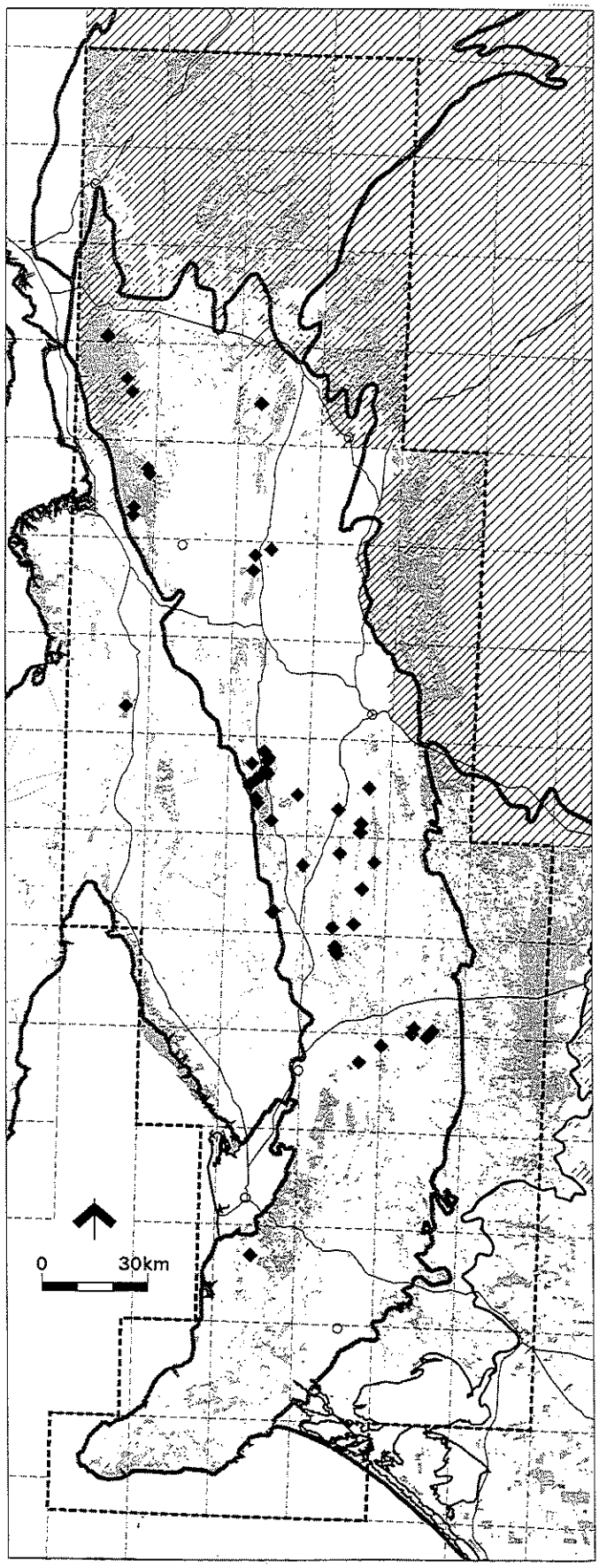
Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.	Cover/Abundance N	T	1	2	3	4	5
**Avena barbata*	A	85		4	10	6	2	1	
**Carthamus lanatus*	A	59	1	8	7				
**Echium plantagineum*	A	59		11	3	2			
**Erodium botrys*	A	59	1	7	7	1			
**Hypochaeris glabra*	A	51		8	6				
**Salvia verbenaca form A*	A	51		8	3	2	1		
**Hypochaeris radicata*	S	48		8	5				
**Bromus rubens*	A	48		11	2				
**Vulpia sp.*	A	48		7	5	1			
**Bromus hordeaceus ssp. hordeaceus*	A	44	1	3	5	2		1	
**Trifolium campestre*	A	40		6	4	1			
**Trifolium angustifolium*	A	37		5	4	1			
**Romulea minutiflora*	S	33		3	6				
**Medicago minima var. minima*	A	33		6	2		1		
**Trifolium arvense var. arvense*	A	33		6	1	1	1		

Eucalyptus leucoxylon +/- E. odorata LOW WOODLAND & WOODLAND

Floristic Group 9 51 members

VEGETATION DESCRIPTION: LOW WOODLAND and woodland mainly dominated by *Eucalyptus leucoxylon* (SA blue gum). *E. odorata* (peppermint box) may occur as a codominant and *Allocasuarina verticillata* (drooping sheoak) frequently occurs as a subdominant. The community includes *E. macrorhyncha* (red stringybark) low woodland and other eucalypts may occur as dominants. An open shrub stratum may be present, with *Bursaria spinosa*(sweet bursaria) the most frequently occurring native shrub species. The ground stratum is predominantly herbaceous, dominated by *Stipa scabra* (slender spear grass), *Danthonia caespitosa* (common wallaby-grass), *Gonocarpus elatus* (hill rasp wort) and *Lomandra densiflora* (soft tussock mat-rush). Seasonally, native herbs such as *Arthropodium strictum,* (common vanilla lily) become plentiful amongst alien grasses which often dominate the ground stratum.
Dominant life forms: Low trees; trees; >5m; 30-70% cover
Sites with trees or tall shrubs dominant: 94%



DISTRIBUTION: Low hills of the Mid-North from the Barossa Valley to the foothills of the southern Flinders Ranges, mainly on gentle to moderate slopes at 300m - 600m altitude with moderate to high rainfall. Soils are sandy loam to clay loam with light surface stone of quartzite or sandstone and occasional rock outcropping.

FLORISTIC COMPOSITION
Dominant native species: *Eucalyptus leucoxylon, E. odorata*
Subdominant native species: *Allocasuarina verticillata*
Dominant understorey species: *Acacia pycnantha, Stipa scabra ssp., Danthonia caespitosa, Gonocarpus elatus*
REPRESENTATIVE QUADRATS (Figures 28 and 29)
LBGPIR01,LBGMEL04
Average number of native plant species (and maximum): 24.78(49)

ENVIRONMENTAL PARAMETERS (*dominant)

Landform patterns /systems: Low hills
Landform elements: Hill slope
Surface Soil Texture: 9, Sandy loam, Clay loam
estimated clay content: **20-30%,** (10-35%)
Surface strew: cobble (51-250mm), <10% cover
Rock outcrop: NIL
Lithology: quartzite/sandstone

LAND USE AND DISTURBANCE: The land is generally used for sheep pasture. Herbaceous annual species, particularly wild oats are the major alien species. *Lavendula stoechas* (Topped lavender) is a localised alien species abundant in the Clare Hills.

COMMENTS:
Red Stringybark forest has been grouped with communities having a heathy understorey by Specht (1972)

Most frequently occurring native species in the *Eucalyptus leucoxylon +/- E. odorata* LOW WOODLAND & WOODLAND - percentage frequency and cover abundance values. Indicator species based on chi-square value from species frequency of occurrence within group (# = probability 0.5%, ##=0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Arthropodium strictum	S	88	##	1	18	22	4			
Acaena echinata var.	S	70	##	1	22	10	3			
Oxalis perennans	S	68		1	19	12	2		1	
Eucalyptus leucoxylon	P	62	##	3	3	4	13	6	3	
Acacia pycnantha	P	54		5	6	10	6		1	
Stipa scabra ssp.	PG	54	##		13	13	1	1		
Allocasuarina verticillata	P	47		7	10	5	1	1		
Danthonia caespitosa group	PG	47			11	9	4			
Gonocarpus elatus	S	47	#		9	12	3			
Bulbine bulbosa	S	45	##	3	13	3	4			
Lomandra densiflora	P	41		1	12	7	1			
Cheilanthes austrotenuifolia	S	41			9	7	4	1		
Bursaria spinosa	P	39		5	9	5		1		
Elymus scabrus var. scabrus	PG	39	##	3	11	5	1			
Dianella revoluta var.	P	37		4	10	3	2			
Stackhousia sp.	S	37		2	13	2	2			
Plantago varia complex	P	35			11	4	3			
Geranium retrorsum	S	33	##		12	4		1		
Eucalyptus odorata	P	31		1	4	5	1	5		

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
**Avena barbata*	A	74			6	18	9	4		1
**Briza maxima*	A	62	##		8	17	6		1	
**Aira sp.*	A	56	##		10	15	4			
**Trifolium angustifolium*	A	54	#		9	13	6			
**Bromus diandrus/rigidus*	A	47		1	14	7	2			
**Vulpia sp.*	A	47			6	11	7			
**Trifolium campestre*	A	45		1	11	10	1			
**Hypochaeris glabra*	A	43		2	12	7	1			
**Anagallis arvensis*	A	39		3	11	4	2			
**Hypochaeris radicata*	P	39	#	3	8	6	2	1		
**Romulea minutiflora*	A	37	#	1	10	4	4			
**Echium plantagineum*	A	37		2	15	1		1		
**Trifolium arvense var. arvense*	A	37		2	11	5	1			
**Sonchus oleraceus*	A	37		3	14	2				
**Arctotheca calendula*	A	33		2	13	1	1			
**Briza minor*	A	31	##	1	10	4	1			

Figure 28. ***Eucalyptus leucoxylon* +/- *E.odorata* Low woodland & woodland in Wirrabara Forest Reserve**

Quadrat LBGPIR01 Woodland. *Eucalyptus leucoxylon /Eucalyptus microcarpa* over *Bursaria spinosa/Danthonia setacea var. setacea/Danthonia pilosa var. paleacea*

Figure 29. ***Eucalyptus leucoxylon* +/- *E.odorata* Low woodland & woodland east of Mount Remarkable National Park**

Quadrat LBGMEL04. *Eucalyptus albens* Woodland over *Chrysocephalum apiculatum/Hibbertia exutiacies*

Eucalyptus microcarpa LOW WOODLAND (includes regrowth with "mallee"form)

Floristic Group 10

23 members

VEGETATION DESCRIPTION: LOW WOODLAND dominated by *Eucalyptus microcarpa* (grey box) over an open shrub stratum dominated by *Olearia ramulosa* (twiggy daisy-bush) and *Acacia paradoxa* (kangaroo thorn). *Lomandra densiflora* (soft tussock mat-rush) is generally present in the ground stratum, with alien and native grasses, herbs and low shrubs. Many of the grey box trees are multi-stemmed and mallee-like resulting from past logging.
Dominant life forms: Tree mallee; >3m; 10-70% cover
Sites with trees or tall shrubs dominant: 100%

DISTRIBUTION: Western foothills of the southern Lofty ranges, 150-350m altitude on gentle to moderate slopes, loams, often with quartzite surface stone and rock outcropping.

FLORISTIC COMPOSITION
Dominant native species: *Eucalyptus microcarpa*
Dominant understorey species
Olearia ramulosa
Acacia pycnantha
Acacia paradoxa

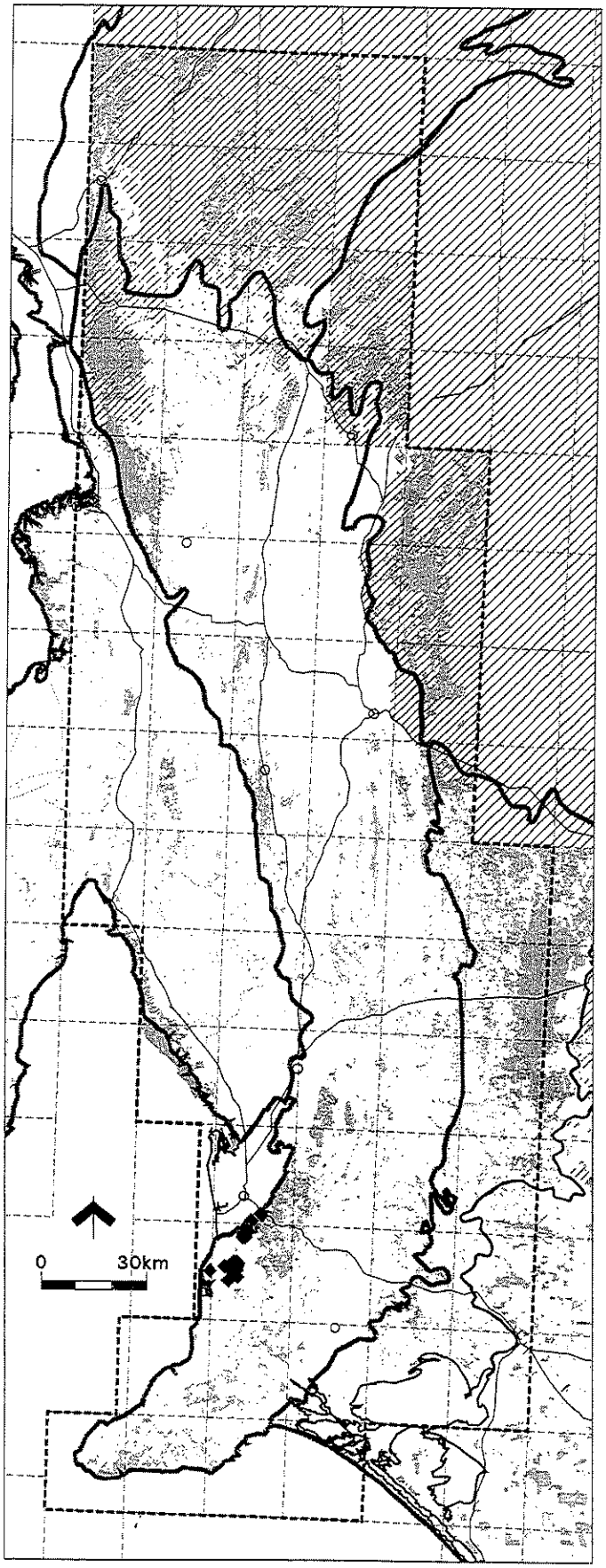
REPRESENTATIVE QUADRATS (Figure 30)
LBGNOA01
Average number of native plant species (and range): 28.35(16-54)

ENVIRONMENTAL PARAMETERS (dominant)

Landform patterns /systems: Low hills,Hills
Landform elements: Hill slope
Surface Soil Texture: 10, Loam
estimated clay content: **20-30%,** (10-30%)
Surface strew: cobble (51-250mm), <10% cover
Rock outcrop: NIL
Lithology: Quartzite

LAND USE AND DISTURBANCE: **Olea europaea ssp. europaea* (wild olive) is ubiquitous and can dominate the tall shrub stratum. **Myrsiphyllum asparagoides,* (bridal creeper) **Chrysanthemoides monilifera* (boneseed) are frequently occurring perennials which can come to dominate the community. The most frequent alien annual grasses are **Briza maxima* (quaking grass), **Ehrharta longiflora* (annual veldt grass) and **Brachypodium distachyon* (false brome). **Oxalis pes-caprae* (Soursob), *Sparaxis* spp. and **Romulea rosea* (Guildford grass) occur frequently.

COMMENTS:
While remnants of this community are low woodland in hilly areas with shallow soils, remnant trees attest to the former presence of grey box savannah woodland with larger trees on deeper soils on the lower slopes of the Adelaide foothills, and its extensive occurrence on the Adelaide Plains was also documented by Kraehenbuehl (1996).



Most frequently occurring native species in the *Eucalyptus microcarpa* LOW WOODLAND (includes regrowth with "mallee"form) - percentage frequency and cover abundance values.. Indicator species based on chi-square value from species frequency of occurrence within group (# = probability 0.5%,## = 0.1%)

	life	%		Cover/Abundance						
Species	form	Occur.		N	T	1	2	3	4	5
Eucalyptus microcarpa	P	100	##		1		12	10		
Dianella revoluta var.	P	91	##	1	19	1				
Olearia ramulosa	P	86	##	1	14	1	4			
Lomandra densiflora	P	86	##		15	4	1			
Acacia pycnantha	P	78	##		9	6	3			
Acacia paradoxa	P	73	##	1	3	4	6	3		
Astroloma humifusum	P	73	##	2	14	1				
Oxalis perennans	P	73		1	16					
Acaena echinata var.	S	69	##	3	12	1				
Bulbine bulbosa	S	60	##	3	10	1				
Scaevola albida	P	52	##	4	8					
Arthropodium strictum	S	52		1	6	5				
Hibbertia exutiacies	P	47	##	1	6	4				
Themeda triandra	PG	43			5	3	2			
Caesia calliantha	S	43	##		7	1	2			
Lagenifera huegelii	S	43	#	2	8					
Gonocarpus elatus	S	43			4	6				
Lomandra sororia	P	39	##	4	5					
Lomandra multiflora ssp. dura	P	39		1	7	1				
Allocasuarina verticillata	P	39		2	2	5				
Danthonia caespitosa group	PG	39			5	4				
Hibbertia sericea var.	P	34	##		5	3				
Carex breviculmis	P	34	##	2	6					
Exocarpos cupressiformis	P	34	##	5	3					
Plantago varia complex	P	34		2	6					
Wahlenbergia stricta ssp. stricta	S	34		3	4	1				
Cheilanthes austrotenuifolia	S	34			6	2				
Hardenbergia violacea	P	30	##	3	4					
Dichondra repens	P	30	##		7					
Bursaria spinosa	P	30		1	3	2	1			
Stipa mollis group	PG	30	##		4	2	1			
Elymus scabrus var. scabrus	PG	30			6	1				
Danthonia setacea var. setacea	PG	30			3	4				
Stipa elegantissima	PG	30		1	4	2				
Galium gaudichaudii	S	30	##	2	5					
Calostemma purpureum	S	30	#	2	3		2			

Figure 30. Southern *Eucalyptus microcarpa* Low woodland in a Heritage Agreement near Adelaide
Quadrat LBGNOA01. Low open forest. *Eucalyptus microcarpa* over *Bursaria spinosa/Stipa hemipogon/Danthonia caespitosa/Lomandra densiflora*

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
**Olea europaea ssp. europaea*	S	100	##	2	12	5	2	2		
**Briza maxima*	A	95	##		2	14	6			
**Plantago lanceolata var. lanceolata*	P	82	##	1	11	7				
**Myrsiphyllum asparagoides*	S	65	##	1	9	1	3	1		
**Ehrharta longiflora*	A	60	##		10	4				
**Brachypodium distachyon*	A	60			2	10	2			
**Chrysanthemoides monilifera*	P	60	##	2	8	3	1			
**Anagallis arvensis*	A	52			11	1				
**Senecio pterophorus var. pterophorus*	P	52	##	3	9					
**Romulea rosea*	S	43	##		3	7				
**Oxalis pes-caprae*	S	39	##		3	4	1		1	
**Vulpia sp.*	A	34			6	2				
**Sparaxis sp.*	S	30	##		4	3				
**Cynosurus echinatus*	A	30	##	2	4	1				
**Echium plantagineum*	A	30		1	6					
**Trifolium angustifolium*	A	30			7					
**Asclepias rotundifolia*	P	30	##	3	4					
**Hypochaeris radicata*	P	30		2	5					

Allocasuarina verticillata+/-Eucalyptus leucoxylon+/-E. microcarpa LOW WOODLAND & LOW OPEN WOODLAND

Floristic Group 11 54 members

VEGETATION DESCRIPTION: LOW WOODLAND & LOW OPEN WOODLAND, generally with *Allocasuarina verticillata* (drooping sheoak), *Eucalyptus leucoxylon* (SA blue gum), or *E. microcarpa* (grey box) occurring as codominants. The open or mid dense shrub stratum is characteristically dominated by *Xanthorrhoea quadrangulata* (rock grass-tree) and or *Bursaria spinosa* (sweet bursaria). *Cassinia laevis* (curry bush) may be subdominant in the shrub stratum. *Triodia scariosa*, (spinifex) generally forms an open hummock grassland ground stratum and *Lepidosperma viscidum* (sticky sword-sedge) may be subdominant.
Dominant life forms: Low trees; 5-10m; 30-70% or 10-30% cover
Sites with trees or tall shrubs dominant: 98%

DISTRIBUTION: Gentle to steep slopes and ridges, up to more than 650m altitude, particularly in the southern Flinders Ranges, on loam and sandy loam with quartzite cobbles, sometimes with rock outcropping.

FLORISTIC COMPOSITION
Dominant native overstorey species: *Allocasuarina verticillata, Eucalyptus leucoxylon, E. microcarpa*
Dominant understorey species
Xanthorrhoea quadrangulata
Bursaria spinosa
Triodia scariosa

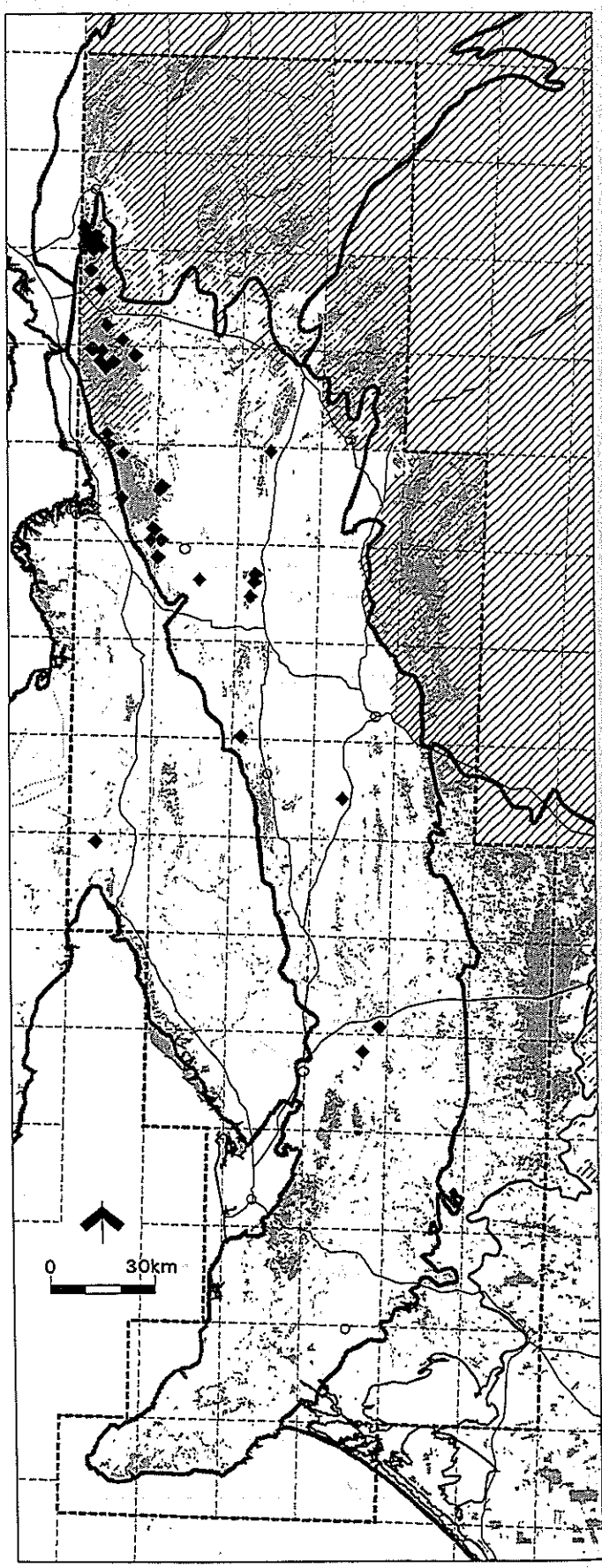
REPRESENTATIVE QUADRATS (Figure 31)
LBGPIR03
Average number of native plant species (and maximum): 31.52(-62)

ENVIRONMENTAL PARAMETERS (dominant)

Landform patterns /systems: Hills
Landform elements: Hill slope, Ridge
Surface Soil Texture: 11, Loam, Sandy loam
estimated clay content: **20-30%,** (10-35%)
Surface strew: cobble (51-250mm), 10-30% cover
Rock outcrop: NIL
Lithology: Quartzite

LAND USE AND DISTURBANCE: The land is used for sheep pasture in about half of quadrats. Herbaceous species, particularly wild oats are the major alien species.

COMMENTS:
Understorey semi-grassy, with hummock grasses, sedges and shrubs present in varying proportions.



Most frequently occurring native species in the *Allocasuarina verticillata+/-Eucalyptus leucoxylon+/-E. microcarpa* LOW WOODLAND & LOW OPEN WOODLAND - percentage frequency and cover abundance values. Indicator species based on chi-square value from species frequency of occurrence within group (# = probability 0.5%, ##=0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Allocasuarina verticillata	P	90	##	1	9	7	19	11	2	
Arthropodium strictum	S	88	##	1	35	11	1			
Lomandra multiflora ssp. dura	P	75	#	4	25	11	1			
Cheilanthes austrotenuifolia	S	75	##		24	17				
Astroloma humifusum	P	72	##	5	28	6				
Oxalis perennans	P	72		2	22	11	4			
Xanthorrhoea quadrangulata	P	66	##	2	4	11	16	3		
Bursaria spinosa	P	64	#	4	11	11	6	1	2	
Triodia scariosa	PG	62	##		11	5	13	4	1	
Gonocarpus elatus	S	62	##	2	17	11	4			
Lomandra densiflora	P	61	##	1	19	10	2	1		
Dianella revoluta var.	P	61		2	24	7				
Acacia continua	P	51	##	5	16	5	2			
Cassinia laevis	P	51	##	2	11	8	6	1		
Lepidosperma viscidum	P	48	##	2	12	3	5	3	1	
Stackhousia sp.	S	48	#	4	14	7	1			
Goodenia robusta	S	46	##		15	10				
Acacia pycnantha	P	40		4	10	3	2	2		1
Thysanotus patersonii	S	40	##	4	15	3				
Eucalyptus leucoxylon	P	38	##	1	5	5	8	2		
Wahlenbergia stricta ssp. stricta	S	38	##	3	14	4				
Glycine clandestina var. sericea	S	37	#	2	17	1				
Dodonaea viscosa ssp.	P	35	##	4	10	4		1		
Microseris lanceolata	S	35	##	5	11	2		1		
Calytrix tetragona	P	33	##	4	10	4				
Danthonia caespitosa group	PG	33			14	4				
Eucalyptus microcarpa	P	31	##	1	5	4	7			
Wahlenbergia luteola	S	31		3	12	2				

Frequently occurring native annual species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Daucus glochidiatus	A	62	##	2	27	5				

Figure 31. Northern *Allocasuarina verticillata* +/- *Eucalyptus leucoxylon* +/- *E. microcarpa* Low woodland & Low open woodland in the southern Flinders Ranges

Quadrat LBGPIR03. *Allocasuarina verticillata/Eucalyptus leucoxylon ssp. pruinosa* Low woodland over *Triodia scariosa/Stipa flavescens/Xanthorrhoea quadrangulata/Acacia wattsiana*

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
**Anagallis arvensis*	A	64	##	2	23	10				
**Hypochaeris glabra*	A	59		2	17	12	1			
**Avena barbata*	A	59		2	14	8	4	4		
**Vulpia sp.*	A	50			20	7				
**Aira sp.*	A	48	#		14	8	3	1		
**Sonchus oleraceus*	A	48		1	24	1				
**Echium plantagineum*	A	40		1	15	6				
**Trifolium campestre*	A	37			13	6	1			
**Trifolium arvense var. arvense*	A	31			13	3	1			

Eucalyptus microcarpa +/- Allocasuarina verticillata LOW WOODLAND

Floristic Group 12

27 members

VEGETATION DESCRIPTION: LOW WOODLAND dominated by *Eucalyptus microcarpa* (grey box). *Allocasuarina verticillata* (drooping sheoak) may be present as a codominant or subdominant overstorey. In the northwestern section of Mount Brown CP the community consists of *Callitris glaucophylla* (white cypress pine) low woodland, and also may have red gum as dominant. *Cassinia laevis* (curry bush) forms the characteristic open shrub stratum over *Lomandra multiflora ssp. dura* (hard mat-rush) and *Lomandra densiflora* (soft tussock mat-rush). *Bursaria spinosa* (sweet bursaria) and *Triodia scariosa* (spinifex) may be subdominant in the understorey.
Dominant life forms: Low trees; 5-10m; 30-70% cover
Sites with trees or tall shrubs dominant: 96%

DISTRIBUTION: Ridge slopes of the southern Flinders Ranges above 350m altitude, particularly Mount Brown Conservation Park, on sandy loam with quartzite cobbles, sometimes with rock outcropping.

FLORISTIC COMPOSITION
Dominant native overstorey species: *Eucalyptus microcarpa*
Subdominant overstorey species
Allocasuarina verticillata
Dominant understorey species
Stipa sp.
Cassinia laevis

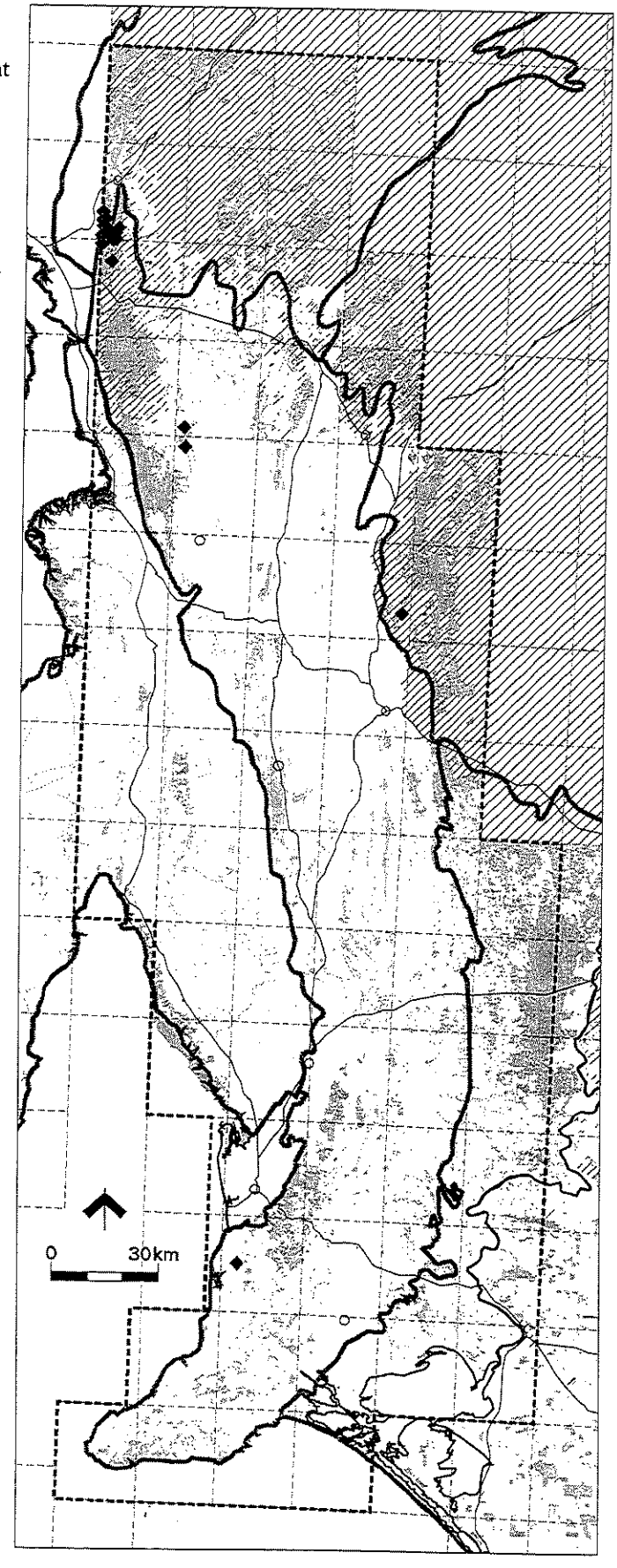
REPRESENTATIVE QUADRATS (Figure 32)
LBGBOO02
Average number of native plant species (and range): 26.67 (15-54)

ENVIRONMENTAL PARAMETERS (dominant)

Landform patterns /systems: Hills
Landform elements: Hill slope
Surface Soil Texture: 12, Sandy loam, Loam
estimated clay content: **10-20%,** (10-35%)
Surface strew: cobble (51-250mm), 10-30% cover
Rock outcrop: NIL
Lithology: Quartzite

LAND USE AND DISTURBANCE: The land is generally used for sheep pasture. Herbaceous species, particularly wild oats are the major alien species.

COMMENTS:
This community is floristically similar to *Allocasuarina verticillata +/- Eucalyptus leucoxylon +/- E. microcarpa* LOW WOODLAND (floristic group 11) but with shrub and hummock grass strata less developed.



Most frequently occurring native species in the *Eucalyptus microcarpa +/- Allocasuarina verticillata* LOW WOODLAND - percentage frequency and cover abundance values. Indicator species based on chi-square value from species frequency of occurrence within group (# = probability 0.5% ##=0.1%)

Species	life form	% Occur.		Cover/Abundance N	T	1	2	3	4	5
Lomandra multiflora ssp. dura	P	85		3	11	8		1		
Maireana enchylaenoides	P	70		2	14	3				
Eucalyptus microcarpa	P	66	##		6	1	9	2		
Lomandra densiflora	P	66	##	1	13	4				
Oxalis perennans	P	66			15	3				
Cassinia laevis	P	62	##	1	11	2	3			
Einadia nutans ssp. nutans	P	59	#	3	11	2				
Acacia pycnantha	P	59		3	6	6	1			
Plantago varia complex	P	55	##	3	12					
Dianella revoluta var.	P	55		6	3	5	1			
Glycine clandestina var. sericea	S	55	##	2	10	3				
Cheilanthes austrotenuifolia	S	55	#		8	5	1	1		
Wahlenbergia luteola	S	51		1	13					
Rhagodia parabolica	P	48	##	1	10	2				
Stackhousia sp.	S	48		3	10					
Bursaria spinosa	P	44		1	5	2	4			
Allocasuarina verticillata	P	40		4	3	1	3			
Arthropodium strictum	S	40		2	8	1				
Goodenia pinnatifida	S	40		1	10					
Clematis microphylla	P	37	##	2	8					
Vittadinia cuneata var.	P	37		1	8	1				
Triodia scariosa	PG	37			6	2	2			
Rumex brownii	S	37	##	1	8	1				
Dodonaea viscosa ssp.	P	33		1	7		1			
Danthonia caespitosa group	PG	33		1	5	3				
Wahlenbergia stricta ssp. stricta	S	33			9					
Lagenifera huegelii	S	33		1	7	1				

Frequently occurring native annual species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.	Cover/Abundance N	T	1	2	3	4	5
Daucus glochidiatus	A	48		10	3				

Frequently occurring alien species (not included in group definition analysis) - percentage frequency and cover abundance values

Species	life form	% Occur.	Cover/Abundance N	T	1	2	3	4	5
**Avena barbata*	A	44		5	5	1	1		
**Anagallis arvensis*	A	40	1	9	1				
**Echium plantagineum*	A	40		9	2				
**Brachypodium distachyon*	A	40	1	7	2	1			
**Medicago minima var. minima*	A	40	1	7	3				
**Hypochaeris glabra*	A	33		6	2	1			
**Sonchus oleraceus*	A	33	1	7		1			
**Trifolium angustifolium*	A	33	1	6	1	1			

Figure 32. Northern *Eucalyptus microcarpa +/- Allocasuarina verticillata* Low woodland east of the southern Flinders Ranges

Quadrat LBGBOO02. Open woodland. *Eucalyptus microcarpa* over *Bursaria spinosa/Triodia scariosa ssp. bunicola*

GRASSLAND AND GRASSY WOODLAND FLORISTIC GROUPS

Table 11 shows comparisons of the Lofty Block Grassland floristic group classification with groups identified by other studies of the region, namely:

- Mount Brown Conservation Park (Oppermann, 1995) vegetation mapping units;
- Western Murray Flats (Lock & Goodwins, 1993)- the comparison is based on dominant species;
- Temperate grasslands (Hyde,1995) and *E odorata* woodlands (Hyde, 1996) - the comparison is based where possible on similar allocation of sites to groups;
- Southern Lofty (DEP, 1988) - the comparison is based on dominants, and indicator species.

SOUTHERN LOFTY SURVEY ANALYSIS

A number of savannah woodland types were described in Department of Environment and Planning (1988), in which the characteristic overstorey dominants were generally red gum or box, but most of the quadrats sampled in this region were not grassy vegetation. To supplement the Lofty Block grassland analysis, these data were examined. Many of the native grasses were not identified due to lack of fertile material, limiting the comparison of floristic groups based on native species composition.

Savannah woodlands with red gum (*Eucalyptus camaldulensis*) as a dominant were not well represented in the survey and the understorey was very degraded. Mallee box and peppermint box (*E. porosa* and *E. odorata*) were sampled at a few sites. Of these, one *E. odorata* woodland site supported 32 native species, but three sites containing *E. odorata* were mallee with chenopod understorey and fewer than 10 native species, considered not relevant to this study. *E. porosa* occurred in various mallee communities at 5 sites which had few understorey species in common. Therefore only two savannah woodlands in the Southern Lofty survey were of importance to the Lofty Block analysis; grey box savannah woodland (group 40) and grey box/pink gum savannah woodland (group 39). The latter has much greater development of shrub understorey. Floristic Group 10 of the Lofty Block Grassland Analysis; grey box low woodland with *Acacia paradoxa* and *Olearia ramulosa* as common dominant understorey and indicator species appears to have much in common with group 40. Group 39 (*Eucalyptus microcarpa - E. fasciculosa* savannah woodland) was therefore considered as an additional group for the Lofty Block grassy woodlands conservation assessment.

TEMPERATE GRASSLAND ANALYSIS

Three communities from the Temperate Grassland Survey are comparable to floristic groups from the Lofty Block analysis. The temperate grassland communities *Lomandra effusa* Grasslands (group 5) and *Stipa* Grasslands (group 8) are comparable to Lofty Block groups 1 and 2 respectively. The *L. multiflora* ssp. *dura* Tussock grass complex (group 7) from the temperate grassland analysis is broadly defined, and is comparable to the closely related Lofty Block subgroups 8.3 and 8.4.

ALIEN PLANT SPECIES

Alien plant species were not included in the PATN analysis, but were added to the floristic classification so that trends across groups could be observed. Of the 20,901 plant records at 513 sites, approximately one third were alien species, varying across groups from 39% in group 1, to 23% and 24% in groups 11 and 12 respectively. Most occurrences of alien species were recorded as "sparsely present" (T) and "plentiful but <5% cover" (1) was generally the next most common cover score. Sites having a much greater cover of alien compared with native species would often have been removed during the initial screening process. Of alien species records, the proportion given a cover code of more than 5% cover (2 or more) was highest (more than 10%) in groups 2, 5, 8.3, 8.4, 8.5 and 9. The same trend was observed in alien species occurring in 30% or more of individual groups.

Of the 236 alien species (Appendix III), the 23 most frequently recorded are herbaceous. The most common woody species is African boxthorn (**Lycium ferocissimum*) followed by olive (**Olea europaea* ssp. *europaea*), ranked 24th and 38th respectively. In all floristic groups, annual species predominate among the records of aliens, but in group 2, 9 and 10, perennial and seasonal alien species are also relatively important. Annual grasses are important in all vegetation types.

Wild oats, **Avena barbata* was the most frequently recorded species overall, had the highest proportion of records with cover of 5% or higher (33%), and was recorded across all floristic groups. The alien grasses **Bromus diandrus/rigidus* and **Vulpia* sp. were also widespread and frequent, while Wards weed **Carrichtera annua* and quaking grass **Briza maxima* were frequent and often recorded with a cover of 5% or more, although more restricted in range of vegetation types. Salvation Jane **Echium plantagineum*, catsear **Hypochoeris glabra* and sow thistle **Sonchu+s oleraceus* were commonly recorded but rarely reached an estimated cover of 5%.

The distribution of alien species occurring at 30% or more of sites within a group is shown in Appendix VI. Group 10 (southern grey box low woodlands) has the most distinctive weed flora, with 9 species that were not recorded in more than 30% of any other groups and relatively more woody species.

Table 11. Comparison of Floristic Groups with those from other analyses of "grassy" vegetation in the region

	Lofty Block Grasslands (Main regions)	Mount Brown Conservation Park	Western Murray Flats (MU)	Temperate Grasslands	E odorata	Southern Lofty (SL)
1.	*Lomandra effusa* Grassland (MU & eastern Lofty block)		possibly *L. effusa* +/- *Helichrysum leucopsideum* Tussock Grassland (group 13)	*L. effusa* grasslands (group 5)		
2.	*Stipa eremophila / Danthonia caespitosa* Grassland with emergent shrubs (NL & FR (plains))			*Stipa* grasslands (group 8)		
3.	*Danthonia caespitosa* Very Open Grassland & *Callitris glaucophylla* Low Open Forest/ Woodland (FR)					
4.	*Callitris preissii* or *Eucalyptus porosa* Low Woodland (all regions (low plains & hills))		possibly *E porosa*+/- *Lomandra effusa* Tall open shrubland (group 11) *Callitris preissii* Low woodland (group 12)			
5.	*Danthonia caespitosa /Stipa nitida* Grassland & Low Open Shrubland +/- emergent *Acacia victoriae* (FR)	*Acacia victoriae* Tall Open Shrubland over *Stipa* spp., *Danthonia caespitosa*				
6.	*Eucalyptus odorata* Low Woodland (FR,NL)		possibly *Eucalyptus odorata +/- Dianella revoluta* woodland (group 14)		*E odorata* open woodlands (gp 4) poss. *E odorata /Allocasuarina* woodlands (gp 6)	
7.	*Eucalyptus odorata /Eucalyptus socialis* Mallee (NL,FR)					
8.1	*Allocasuarina verticillata* Low Woodland					
8.2	*Triodia scariosa* Hummock Grassland & *Callitris glaucophylla* Low Woodland (northern)	*Callitris glaucophylla* Low Woodland to Low Open Woodland over *Cassinia laevis, Triodia scariosa*				
8.3	*Stipa blackii* Grassland & Low Eucalypt Woodland (hills,plains)			*Lomandra multiflora ssp dura* Tussock grass complex (group 7)		
8.4	*Lomandra multiflora ssp. dura* Tussock Grassland (Burra Hills)			*Lomandra multiflora ssp dura* Tussock grass complex (group 7)		
8.5	*Stipa nodosa* Grassland +/- shrubs					
9.	*Eucalyptus leucoxylon* +/- *E.odorata* Low Woodland & Woodland (NL,FR)				*E odorata / E leucoxylon* woodlands (gp 2)	
10.	Southern *E. microcarpa* Low Woodland (SL)					*E. microcarpa* savannah woodland (gp 40)
11.	Northern *Allocasuarina verticillata*+/-*Eucalyptus leucoxylon* +/- *E. microcarpa* Low Woodland & Low Open Woodland (FR,NL)	*Eucalyptus microcarpa* Woodland to Low Open Woodland over *Allocasuarina verticillata, Xanthorrhoea quadrangulata*				
12.	Northern *Eucalyptus microcarpa* +/- *Allocasuarina verticillata* Low Woodland (FR)	*Eucalyptus microcarpa* Woodland to Low Open Woodland over variable understorey				

INDICATORS OF VEGETATION MANAGEMENT

Land tenure/ownership

Land tenure was determined for Lofty Block Grassland sites at the time of site selection and is indicated in Appendix VIII for these 74 sites (9 in NPWS reserves, 2 in Forest Reserve, 1 on SA Water Reserve, 9 on Council Reserve, 2 on Crown land, 5 on Pastoral or Crown lease, 8 on road reserve, 37 private freehold).

In the case of the composite data, grassland and grassy woodland quadrats located in NPWS reserves and Forest Reserves were extracted by Planning SA from the database. Seventy four quadrats out of 513 were in such reserves. The most intensively sampled area in the bioregion, Mount Brown Conservation Park, contained 48 woodland and grassland quadrats, while the largest park in the bioregion, Mount Remarkable National Park, contained 19 woodland quadrats (Table 12). The floristic groups that had been sampled most frequently in reserves were *Allocasuarina verticillata +/-Eucalyptus leucoxylon +/- E. microcarpa* Low Woodland / Low Open Woodland (Mount Brown and Mt Remarkable) and *Eucalyptus microcarpa +/- Allocasuarina verticillata* Low Woodland (Mount Brown). *Callitris glaucophylla* low open forest was present in Mount Brown CP, *Eucalyptus leucoxylon +/- E. odorata* low woodland/woodland was present in Wirrabara Forest Reserve, Spring Gully Conservation Park (with red stringybark as dominant) and Mount Remarkable National Park.

The Beetaloo Reservoir land contained *Eucalyptus leucoxylon +/- E. odorata* woodland vegetation similar to the lowlands of Wirrabara Forest. Grassy woodlands also occur on SA Water lands in the Southern Lofty Region.

Table 12. Floristic Group and number of grassy quadrats occurring in NPWS Reserves and Forest Reserves in the Lofty Block
(Southern Lofty survey sites not included)

Reserve name	Quadrats in reserve	Floristic group: 1	3	4	5	6	7	8.1	8.2	8.3	8.5	9	11	12
Wirrabara Forest Reserve	4											3	1	
Spring Gully Conservation Park	2											2		
Mount Brown Conservation Park	48	1	6	1	2	1		1			3		15	18
Mount Remarkable National Park	19			1		1	2		1			3	11	
Cobbler Creek Recreation Park	1									1				
Total	74	1	6	2	2	2	2	1	1	1	3	8	27	18

A total of 22 quadrats were identified as being located on small, non-NPWS/Forest reserves, most of which are managed by local government (Table 13), but this list is not exhaustive other than for survey 83. All 36 sites from survey 51 were on disused rail corridors, some sections of which have been divested to adjacent private landowners. Of 20 sites identified as located on road reserves, at least 2 were on unmade road reserves.

Table 13. Floristic Group and number of grassy quadrats occurring on minor public or leasehold private land

Landuse grouping	Total	Floristic Group 2	4	5	6	8.3	8.4	9	10
Cemetery including disused sites	5	2		1	1	1			
Council Reserve including parkland	17	4	1	2	2	2	1	1	4
Crown Leasehold (private)	5	4		1					
Road Reserve (unmade)	2					2			
Disused rail reserve*	35	25				6		4	
Total	64	35	1	4	3	11	1	5	4

Land use data from survey 83 and DTUPA Northern Lofty land valuation database. Data not available for all quadrats.
* Some disused rail reserves may have been divested to adjoining land owner since survey.

Grazing

Evidence of vertebrate presence was recorded at standard quadrats and provides an indication of current or recent grazing by native herbivores, stock or feral large non-native herbivores.

Vertebrate presence data were available for 440 of the 513 quadrats included in the grassland analysis. Evidence of macropods was recorded at 314 sites, being

71% of sites with vertebrate presence data. This indicates that kangaroos and related common species are widespread in grassy ecosystems, apart from southern grey box woodlands in the near-urban environment.

Sixty nine percent of sites had evidence of one or more of the main large non-native species; sheep, cattle, goats and horses. Evidence of sheep was most frequently recorded, this was mainly in the form of dung. Evidence of both sheep and cattle, or of cattle only were also commonly seen. All floristic groups were represented by a third or more of sites at which stock were present. In the *Lomandra multiflora* ssp. *dura* grasslands of the Burra Hills, (group 8.4) all examples had evidence of stock. The lowest percentage of grazed sites (34%) within a group occurred in the southern grey box woodlands, close to Adelaide.

Evidence of rabbits was commonly recorded, ranging from about one quarter of sites in *Lomandra effusa* tussock grasslands (group 1) to more than half of sites in groups 4 and 6.

CONSERVATION ASSESSMENT

Site Assessment Criteria

Indices commonly used for ranking of sites for conservation assessment include number of native species in a quadrat, number of taxa of conservation significance, proportion of taxa that are native and size of remnant (eg. Stokes, 1996). The Lofty Block composite vegetation quadrat data included variations in season, observer and quadrat size from different surveys and wide geographical range. The number of native species recorded and the proportion of native species in a quadrat reflect this. Native vegetation mapping, which would enable accurate measurement of remnant size for all quadrats, is incomplete for grasslands of the region.

A set of criteria which could be used consistently across the composite data set was nominated. In grassland communities, in the spring to mid-summer season, the presence of 25 or more native species per quadrat were considered to indicate relatively intact native vegetation. Ranking of quadrats by number of significant taxa recorded was used to indicate key locations in the bioregion with a high priority for conservation measures. Those quadrats with taxa which were endangered, vulnerable or rare at the state level were classified as either: I (located in isolated remnants, usually on road, rail or minor reserves and not much more extensive than a quadrat of 0.09-0.25 hectares); or E (the native plant community being more extensive).

Fifty eight native herbaceous species, not of particular conservation significance, only occurred in quadrats with more than 25 native species. Those 30 species that occurred more than once are shown in Table 14, including 7 orchids. Ten sites contained 3 or 4 of these species, and these sites were mainly located in the higher rainfall areas of the ranges. Only one of these 10 sites did not also contain species of regional conservation significance. Those 11 species occurring predominantly (60% or more) in grassy vegetation (but too infrequently to be statistically significant) in the Lofty Block are indicated (+). It was concluded that the species in Table 14 as a group were not reliable indicators of grassy vegetation in good condition, therefore they were not used for ranking sites.

Table 14. Native species only occurring in quadrats with more than 25 native species, and recorded more than once.
(+) indicates species occurring in grassy vegetation in more than 60% of cases

SPECIES	frequency	
Millotia myosotidifolia	12	
Pterostylis pusilla	9	
Hydrocotyle callicarpa	8	
Wurmbea centralis	8	+
Goodenia geniculata	6	
Ptilotus nobilis var. angustifolius	6	+
Swainsona stipularis	6	+
Agrostis avenacea var.	5	
Prasophyllum occidentale	5	+
Lobelia gibbosa	4	
Millotia tenuifolia var.	4	
Minuria cunninghamii	4	
Senecio lautus	4	
Acianthus pusillus	3	
Atriplex suberecta	3	+
Bracteantha bracteata	3	
Euchiton gymnocephalus	3	+
Pterostylis excelsa	3	
Ptilotus seminudus	3	
Swainsona oroboides complex	3	+
Brachycome perpusilla	2	
Caladenia patersonii complex	2	+
Caladenia tensa	2	+
Calandrinia volubilis	2	+
Chrysocephalum semicalvum	2	
Gnaphalium indutum	2	+
Goodenia lunata	2	
Nicotiana maritima	2	
Plantago sp. B	2	
Pterostylis mutica	2	

Site Ranking

Of 513 quadrats, 50 had 5 or more taxa of regional conservation significance (greater than uncommon) and most of these had one or more species significant at the state level. Quadrats with species endangered at the state level were in isolated road reserve remnants and only the Holm Hill grassland was also rich in native species. Among the group of sites containing one species vulnerable at the state level and other species significant at the state level were several that also ranked highly for number of native species and extensive native vegetation. These were on privately owned grasslands in the Burra Hills, near Mount Cone (*Lomandra multiflora*

ssp. dura Tussock Grassland, group 8.4), woodlands of the eastern Mount Lofty Ranges around Kapunda (mainly *Eucalyptus odorata* Low Woodland, group 6), also in private ownership, and woodlands of the southern Flinders Ranges, mainly on public land, notably Mount Remarkable National Park and Wirrabara Forest Reserve, (mainly northern *Allocasuarina verticillata* +/- *E. leucoxylon* +/-*E microcarpa* Low Woodland (11) and *Eucalyptus leucoxylon* +/- *E. odorata* Low Woodland & Woodland (9). The highest ranked quadrat in this group was located on private land in vegetation north of and contiguous with Mount Remarkable National Park. The number of native species recorded was generally more than 30, indicating relatively intact native vegetation, and twice that number were recorded in some woodland quadrats. Generally, alien species were also relatively numerous, even in the locations with the greatest number of native species.

RESERVATION OF GRASSY VEGETATION

Major reserves in the Lofty Block are mainly located in the Southern Lofty and Southern Flinders Ranges - Spring Gully Conservation Park is the only NPWS nature reserve in the Lofty Block between Tanunda and Port Pirie. Assessments of representativeness of the reserve system in the region have used the environmental association system of Laut *et al.* (1977) and the plant association system (Williams and Goodwins, 1988; Thackway & Cresswell, 1995). The current representation of environmental associations in reserves in the Lofty Block is shown in Table 15.

Associations represented in NPWS reserves that include grassy vegetation are:

2.14, 2.13 western slopes of Mount Lofty ranges close to Adelaide; (vegetation grading from grassy woodland to sclerophyllous woodland/forest). Grassy vegetation is modified to varying degrees.
2.17 (undulating upland plain on metasediments) reserve of 63 hectares only
3.19 southern Flinders Ranges; (vegetation grading from grassy woodland to sclerophyllous woodland/forest)

Associations in the mainland Lofty Block that are not represented at all in NPWS reserves are 2.1,2.6,2.8, 2.11, 2.18; 3.2-3.12, 3.14-3.18.

The Adelaide Plains metropolitan area was not included The Adelaide Plains metropolitan area was not included in Environmental Association mapping (Laut *et al.* 1977). The NPWS reserves situated in the Adelaide Plains Metropolitan Area are small and their vegetation highly modified. Kraehenbuehl (1996) mapped the original vegetation dominants of reserves with grassy understorey, as follows:

- Angove Conservation Park (5 hectares): woodland and low woodland dominated by *Allocasuarina verticillata, Callitris preissii, Eucalyptus leucoxylon*
- Ferguson Conservation Park, (8 hectares): woodland and low woodland dominated by *Allocasuarina verticillata, Callitris preissii*, and/or *Eucalyptus leucoxylon.*
- Shepherds Hill Recreation Park, (77 hectares): *Eucalyptus camaldulensis* +/- *E. microcarpa* woodland

Southern Lofty Region

Conservation status of grassy woodlands classified from the Southern Lofty Survey was described in Davies (1997). Updated, this information is presented below:

Eucalyptus camaldulensis- E. leucoxylon open woodland
Degraded examples in Black Hill and Morialta Conservation Parks

Eucalyptus camaldulensis- E. microcarpa woodland
Belair National Park

E. microcarpa savannah woodland +/- *E. fasciculosa*
Belair National Park. The community is also present in Onkaparinga River National Park

E. microcarpa savannah woodland (weedier understorey)
Sturt Gorge Recreation Park. The community also occurs in Shepherds Hill Recreation Park, on council reserves, and reservoir reserve.

E. leucoxylon- E. fasciculosa savannah woodland
Sandy Creek Conservation Park and Para Wirra Recreation Park

Table 15. NPWS Reserves, their area and Environmental Associations in which they occur in the Lofty Block, 1997.
+ reserve includes some grassy native vegetation

NPWS Reserves (excluding some small parks with mainly coastal, non grassy vegetation)	Park area hectares	Env. Assoc.	
Region 2: Peninsula Uplands			
Deep Creek CP	4228	2/3	
Talisker, Waitpinga, Eric Bonython CPs	218	2	
Newland Head CP	1036	4, 2	
Yulte CP	43	5	
Spring Mount CP	199	5	
Myponga CP	166	5	
Cox Scrub CP	545	7	
Scott CP	209	7	
Mount Magnificent CP	90	9	
Finniss CP	103	9	
Kyeema CP	348	10	
Nixon Skinner CP	8	10	
Aldinga Scrub CP	239	12	
Onkaparinga River NP	1380	13/12	+
Scott Creek CP	625	13	
Belair NP	840	13/14	+
Cleland and Eurilla CPs	1002	13/14	+
Sturt Gorge RP	177	13/14	+
Anstey Hill RP	308	14	+
Black Hill CP	707	14	+
Brownhill Creek RP	51	14	+
Greenhill RP	27	14	+
Horsnell Gully CP	245	14	+
Montacute CP	195	14	+
Morialta CP	532	14	+
O'Halloran Hill RP	289	14	+
Cudlee Creek	49	19	
Mark Oliphant CP	178	13	
Mount George CP	79	15	
Cromer CP	50	16	
Totness RP	43	16	
Charleston CP	63	17	+
Hale CP	191	19	
Kaiser Stuhl CP	398	19	
Warren CP	363	19	
Para Wirra RP	1417	19/20	
Region total	16641		
Region 3: Mid-North Wheatlands			
Cobbler Creek RP	263	1	+
Sandy Creek CP	143	1	+
Spring Gully CP	400	13	+
Mount Remarkable NP inc. Napperby Nelshaby section	15036	19	+
Telowie Gorge CP	1967	19	
Mount Brown CP (partly in Flinders & Olary Ranges Bioregion - 6.1.3)	1932	19	+
Region total	19741		
Total for regions 2 and 3	36382		

VEGETATION MAPPING

Vegetation remnants in the Lofty Block exhibit a continuum in vegetation condition, leading to difficulty in aerial photo interpretation and mapping of grassy vegetation using data from regional vegetation surveys, as noted by Stokes (1996) for the box and buloke woodlands in the South-East of South Australia.

Native vegetation remnants associated with Lofty Block Grassland survey sites were mapped as part of this project, to supplement the existing landcover mapping carried out during regional surveys. However, mapping of grassland remnants in the region is still incomplete and complicated by variation in condition.

In the marginal treeless lands of the Burra Hills and the Flinders Ranges section of the Mid-North, large areas are not continuously cropped, and extensive grazing has created a gradient in condition between modified native and wholly alien vegetation. To take account of uncertainties in mapping native grasslands and shrublands from aerial photographs, land in these areas which appears from aerial survey to be uncultivated has been coded as "Vegetation - modified semi-arid/ arid chenopod shrublands/native grasslands" in the South Australian Environmental Database. This includes the largest of the remnants of *Lomandra* spp. grassland mapped previously (Hyde, 1995) from low level aerial photography.

Successive biological surveys by Davies (1983), Hyde (1994,1995), Playfair & Heard (1993) and Milne (pers. comm.) have identified surviving patches of largely treeless native grassland in the Burra Hills within the area outlined by Jessup (1948) and Specht (1972) as being originally native *Lomandra* spp. tussock grassland. During the current survey analysis it has been found that these patches occur mainly in three approximately north-south orientated ranges of the North Mount Lofty Ranges.

1. The northernmost range comprises the hills west of the Barrier Highway, south of Lancelot surveyed township and west of Terowie. This is approximately on the boundary of the 3.3.14 and 5.2.1 Environmental Association according to Laut *et al.* (1977).
2. The central range runs from north of Ulooloo to east of Booborowie (west of the Bald Hill Range) approximately within Environmental Association 3.3.12. There are also patches of grassland to the east of here but they appear to form a mosaic with woodlands, or have scattered trees (sheoaks, pines or eucalypts).
3. The southernmost is the range east of Mount Bryan town (Mount Cone) to south of Burra. This is largely within Environmental Association 3.3.9.

Aerial spraying, fertilising and seeding may have been variously applied to improve pastures, but the scatter of patches of native grassland that have been identified suggest that these disturbances have been intermittent or

patchy. The extent of a remnant appears often to correspond to a particular aspect and slope, in relation to position of fences and watering points.

The adjoining Environmental Association 3.3.11 comprises mainly flatter, lower land where land use is generally more intensive but occasional roadsides and rail reserves support small patches of native grasslands.

The above analysis has only been applied to the area surveyed during the Burra Hills Survey, where information on the *Lomandra* spp. grasslands is available from various sources.

It is concluded that there are some relatively substantial areas of privately owned grassland in Environmental Associations 3.3.14 /5.2.1, 3.3.12 and 3.3.9. **These grazed grassland areas include patches of relatively intact native grassland, the extent of which is generally unknown.** It is therefore concluded that these are the most likely environmental associations to find suitably large areas for reserve or protective management of *Lomandra* spp. grassland.

Heritage Agreements

In the Lofty Block Grassland Survey, 3 Heritage Agreement areas and one proposed Heritage Agreement area known or likely to have grassy vegetation were sampled (5 quadrats). From this survey, and previous quadrats and Native Vegetation Conservation Section file records, it is evident that 12 Heritage Agreement areas in the Lofty Block contain grassy woodland, and all these areas are small. The floristic groups represented are shown in Table 16.

Table 16. Floristic Groups represented in Heritage Agreements (HA), NPWS and Forest Reserves

	Lofty Block Grasslands (Main regions)	HA	Reserves
1.	*Lomandra effusa* Grassland (MU & eastern Lofty Ranges)	1 in prep (MU)	
2.	*Stipa eremophila / Danthonia caespitosa* Grassland with emergent shrubs (NL & FR (plains))		
3.	*Danthonia caespitosa* Very Open Grassland & *Callitris glaucophylla* Low Open Forest/ Woodland (FR)		MOUNT BROWN CONSERVATION PARK (CP210)
4.	*Callitris preissii* or *Eucalyptus porosa* Low Woodland (all regions on low plains & hills)		*MOUNT REMARKABLE NATIONAL PARK (NP008) *MOUNT BROWN CONSERVATION PARK (CP210)
5.	*Danthonia caespitosa /Stipa nitida* Grassland & Low Open Shrubland +/-emergent *Acacia victoriae* (FR)		MOUNT BROWN CONSERVATION PARK (CP210)
6.	*Eucalyptus odorata* Low Woodland FR,NL)	3	*MOUNT REMARKABLE NATIONAL PARK (NP008) *MOUNT BROWN CONSERVATION PARK (CP210)
7.	*Eucalyptus odorata /Eucalyptus socialis* Mallee (NL,FR)		MOUNT REMARKABLE NATIONAL PARK (NP008)
8.1	*Allocasuarina verticillata* Low Woodland	1	
8.2	*Triodia scariosa* Hummock Grassland & *Callitris glaucophylla* Low Woodland (northern)		
8.3	*Stipa blackii* Grassland & Low Eucalypt Woodland (hills,plains)	1 applied for	COBBLER CREEK RECREATION PARK (RP021)
8.4	*Lomandra multiflora ssp. dura* Tussock Grassland (Burra Hills)	1 approved	
9.	*Eucalyptus leucoxylon +/- E.odorata* Low Woodland & Woodland (NL,FR)	part	MOUNT REMARKABLE NATIONAL PARK (NP008), SPRING GULLY CONSERVATION PARK (CP006), WIRRABARA FOREST RESERVE
10	Southern *Eucalyptus microcarpa* Low Woodland (SL)	3 & 1 approved	
11.	Northern *Allocasuarina verticillata+/-Eucalyptus leucoxylon +/- E. microcarpa* Low Woodland & Low Open Woodland (FR,NL)	1 & part	MOUNT BROWN CONSERVATION PARK (CP210), MOUNT REMARKABLE NATIONAL PARK (NP008), WIRRABARA FOREST RESERVE
12.	Northern *Eucalyptus microcarpa +/- Allocasuarina verticillata* Low Woodland (FR)		MOUNT BROWN CONSERVATION PARK (CP210)
SL 39	Southern *Eucalyptus microcarpa +/- E. fasciculosa* Low Woodland		BELAIR NATIONAL PARK, ONKAPARINGA RIVER NATIONAL PARK

*Vegetation type very minor within park; Mount Remarkable and Mount Brown parks listed only if the floristic group was recorded more than once in the region (see Table 11 for data)

HISTORICAL VEGETATION RECORDS

The composition and structure of the original, that is, pre-European vegetation in Australia is of interest for the purposes of comparison with present day vegetation, habitat and ecological processes and is important for planning future vegetation cover and land management. Remnant native vegetation is an important source of evidence, however, in the Lofty Block, most relatively fertile land has been cleared and what vegetation remains has been modified. This leaves a very incomplete picture of the original distribution, composition and structure of the vegetation of the agricultural area from this source alone. Individual mature eucalypts may survive in pastures from before or soon after European settlement of Australia and provide an incomplete but reliable record of pre European vegetation. However, in regions where such large or long lived species have been removed or never occurred, even the most basic data on the original native vegetation type is harder to obtain. This is the situation in the grasslands and much of the woodland of the Lofty Block.

The original land survey records in South Australia have been referred to by early vegetation ecologists and their information was collated by Specht (1972) who derived general maps of the original distribution of vegetation, including tussock grasslands, from all available sources. Lange (1976) noted the importance of land surveyors' records in research. More recently these records have been consulted for the disused rail corridors of the mid and upper north (Hyde, 1994), for the Gladstone mapsheet (Hyde, 1995) and for the Apoinga mapsheet south of Burra (Moore, 1994). Hyde (1995) discussed early exploration and settlement as it relates to exploitation of native grasslands and early description of native vegetation.

The early land surveyors were interested in the native vegetation mainly as an indicator of the capacity of the land to sustain agricultural or pastoral use or as a timber source. The usefulness of the early land surveyors' records vary according to their level of botanical interest and knowledge, consistency in use of common plant names and the impact of settlement on the vegetation prior to the date of survey. A sample of an original survey plan is reproduced in Appendix IX. Vegetation, soil, landform or land capability descriptions were either listed in the legend for each section on the plan or were written directly on the plan. At its best, the scale of recording was sometimes very detailed, at the section level, with observed vegetation or soil boundaries sketched in.

The general methodology employed for recent pre-European vegetation mapping is described in Hyde (1995), accompanying a map at the scale of 1:50 000 for Gladstone. The method involved using the information on the early survey plans, survey of roadside remnants of native vegetation and extrapolation from knowledge of soil, landform and geology, and published literature. Records referring to the Apoinga mapsheet were transferred to map form and show that at least 2/3 of that area (approximately 43,000 of 64,400 hectares) was formerly grassland (Moore, 1994).

While extensive mapping of pre-European vegetation was beyond the scope of the current study due to the size of the bioregion, the relevant Hundreds Plans were inspected to extract whatever data existed for sections sampled during the Lofty Block Grassland Survey. A summary of vegetation data from the current survey, alongside the records copied from the original survey plans is shown in Appendix IX. Variation in vegetation within a section may not be reflected in the comments on the plans, and in such cases may limit the accuracy of comparison with current quadrat vegetation type.

Vegetation descriptions from the survey plans relevant to the Apoinga mapsheet, south of Burra, have been extracted and interpreted by Moore (1994). Terms that were inferred to describe open grassland were "no wood", "destitute of timber", "no timber", "well grassed, bare of timber". Amongst the descriptions were references to "blackgrass", and "cutting grass". Some areas were described as already under cultivation, and ringbarking of trees was occasionally noted. In surveys dated December 1905 and February 1907, "Starthistles" were observed on the stony hills, probably referring to **Carthamus lanatus* (now known as saffron thistle) which was causing concern in the Mid-North in the late 1800's and led to the amendment of the Thistle and Burr Act in 1887 (Kloot, 1987).

Colloquial terms likely to have been used consistently by early surveyors and /or are the same as modern common names, with their current scientific names are:

- grasstrees - *Xanthorrhoea* spp.;
- stringybark - *Eucalyptus baxteri* (or *E.obliqua* at other locations);
- black oak - *Casuarina cristata;*
- spinifex, porcupine - *Triodia* spp.;
- red gum - *Eucalyptus camaldulensis;*
- sheoak - *Allocasuarina verticillata.*

Less specific terms used by early surveyors to describe vegetation on land survey plans, region in which used and probable identity:

- Blackgrass (Murray) - *Lepidosperma viscidum, L. laterale* or *Gahnia lanigera* but could also be mistakenly applied to some *Lomandra* species
- willows (Murray) - *Acacia salicina* or other slender small trees
- bluebush (Flinders Ranges) - *Maireana* spp particularly *M sedifolia*
- saltbush (Flinders Ranges) - *Atriplex* spp, particularly *A vesicaria*
- cottonbush (Flinders Ranges) - *Maireana aphylla,* could also be other *Maireana* spp
- Acacia scrub (Flinders Ranges) - at this location probably *A. victoriae*

- sandalwood (Flinders Ranges) - *Santalum* spp
- pines (Murray) - *Callitris preisii* at this location
- bastard gums (Murray) - *Eucalyptus porosa* probably (bastard box is *E goniocalyx*, unlikely at this location)
- box (Flinders Ranges) - *Eucalyptus odorata, E. porosa, E. microcarpa, or E. albens*
- gum (Northern Lofty) - probably *E. leucoxylon*, could refer to *E. camaldulensis*
- green mallee (Flinders Ranges) - *E viridis* if term used correctly (direct comparison with present day vegetation is difficult in this area because the ranges have many microclimates)
- spear grass (Northern Lofty) - *Stipa* spp
- peppermint (Northern Lofty) - *E odorata*, unless confused with *E porosa*, or *E microcarpa*

General terms such as mallee, big mallee, titree, wattles were also used.

Similar terms for vegetation from historical records were reported in the Temperate Grassland and Rail Corridor reports (Hyde 1994 and Hyde 1995). The vegetation classification used by Hyde (1995) for mapping purposes (based on dominant overstorey) defines narrower communities than the floristic classification derived in the same report from quadrats and indicates the difficulty inherent in attempts to describe the original vegetation from surviving fragments.

To obtain an overview of the historical vegetation records in the area sampled by the Lofty Block survey, (Table 17) surveyors' comments from 65 sites were coded as indicated in Appendix IX.

Thirty eight sites were described as arable (10), arable/pastoral (9) or pastoral (19), of which about half (20) were without any further information on vegetation, but about a third were described as wooded in each of these categories. Five sites on the low country of the Flinders region (Willochra Plain) were described as saltbush and/or bluebush. These sites are now grassland used for grazing and were probably cleared for a crop in the late 1800s. One site in the Murray region, now dominated by *Lomandra effusa*, had reference to open blackgrass country. Spinifex or porcupine was recorded at arable/pastoral, pastoral and other sites, eight in total. Eleven sites included the description "grassed" or "well grassed". In total, 19 sites had reference to surface stones or rock outcropping.

Present day vegetation sampled at locations originally described as arable varied from tussock grassland on the Willochra Plain, and on heavy soil plain at Dawson near Peterborough, low box woodland near Koolunga, Jamestown, Quorn and Laura, low open shrubland on road reserve surrounded by crop near Gladstone, tussock *Lomandra spp.* grassland near Jamestown, hummock grassland near Koolunga, box/blue gum woodland in Wirrabara Forest Reserve, grassy mallee in cemetery reserve on the plains near Tepko, grassland or sheoak woodland on roadsides on Callington Hill surrounded by grazing land.

At the Burra Hills location (north of Mount Cone), the boundary between "arable" and "pastoral" corresponds to the present day boundary between crop and grazing land. The 18 areas which are now grassland had no mention of trees in the original survey; eight of these had been described as pastoral, one arable/pastoral (A/P), and three arable. Apart from five northern areas that were originally described as bluebush/saltbush, the areas that are now grassland had very little vegetation information, apart from scattered references to "grass", "triodia" and "no timber".

Survey plans for the areas said to have been originally grassland (Specht, 1972) were generally lacking in comments on vegetation and were described only as "arable" or "pastoral". From observation of the plans it is surmised that trees, if abundant, would probably have been noted because of their timber value as well as an indication of land potential. Some of the plans that were inspected originate from surveys of districts where settlement and agriculture had already begun and the possibility that trees had already been cleared cannot be excluded entirely. However, Specht, following Jessup (1948) concluded that trees were not widespread in these grasslands. The earliest explorers' comments, as discussed in Davies (1997) support this interpretation.

Table 17. Summary of remarks from original survey plans - Lofty Block Grassland site locations

Vegetation description category		Assessment of agricultural capability			Attribute described	
	no. of sites	ARABLE	A/P	PASTORAL	vegetation	stone
WOODED	29	3	3	8	15	10
NO TIMBER	2	-	-	1	1	-
GRASSED	11	1	2	1	7	9
CHENOPOD	5	-	-	-	5	3
TRIODIA	8	0	3	2	3	4
BLACKGRASS	1	-	-	-	1	-
NO VEG. REMARKS	20	7	5	8	-	6
ROCK/STONE	19	-	3	3	13	
no. of sites	65	10	9	19	25	19

Conclusions and Recommendations

GRASSY ECOSYSTEMS IN THE LOFTY BLOCK OF SOUTH AUSTRALIA

STRUCTURE AND FLORISTIC COMPOSITION

Nineteen grassland and grassy woodland vegetation types can be recognised in the mainland Lofty Block Bioregion (i.e. excluding Kangaroo Island) based on native flora composition. They include the following twelve floristic groups described in this report.

- *Lomandra multiflora* ssp. *dura* Tussock Grasslands,
- *Eucalyptus leucoxylon* (+/- *E.odorata*) Low Woodland & Woodland,
- Northern *Allocasuarina verticillata*+/-*Eucalyptus leucoxylon* +/- *E. microcarpa* Low Woodland & Low Open Woodland
- *Eucalyptus odorata* Low Woodland,
- *Lomandra effusa* Grassland,
- *Stipa eremophila / Danthonia caespitosa* Grassland with emergent shrubs,
- *Callitris preissii* and/or *Eucalyptus porosa* Low Woodland,
- *Danthonia caespitosa /Stipa nitida* Grassland & Low Open Shrubland +/-emergent *Acacia victoriae*
- *Allocasuarina verticillata* low woodland,
- *Stipa blackii* Grassland & Low Eucalypt Woodland,
- Southern *Eucalyptus microcarpa* Low Woodland,
- Northern *Eucalyptus microcarpa* +/- *Allocasuarina verticillata* Low Woodland

Several of these floristic communities are structurally variable (represented by both grassland and woodland sites). This may be due in part to past management, including woodcutting, grazing and suppression of tree regeneration.

The native plant composition of remnants of grassy communities throughout the Lofty Block is remarkably constant and it may be that some of the species previously characterising the various communities are now rare or locally extinct. The most widespread plants in grassy vegetation in the Lofty Block are generally not confined to these communities, they occur also in some sclerophyll or mallee vegetation, but rarely as dominants. However a number of plant and animal species are confined to grassy ecosystems (e.g. Davies 1997). This includes nationally endangered species such as the small scurf pea (*Psoralea parva*) and the Pygmy Bluetongue Lizard (*Tiliqua adelaidensis*). Species largely confined to grassy vegetation in the Lofty Block include relatively common species such as spiny cryptandra (*Cryptandra amara*) and lobed wallaby grass (*Danthonia auriculata*), as well as less common species such as short wallaby grass (*D. carphoides*) and blue devil (*Eryngium rostratum*).

CONSERVATION VALUE OF GRASSY ECOSYSTEMS

Most grassy remnants included in this project were found to be grazed and nearly all have a significant alien flora component. However, most areas provide habitat for plant species of conservation significance at the national, state or regional level. Their future management is therefore of importance for conserving the biodiversity of the region.

Remnants on private land and in parks are mainly located in the ranges, while road verges, unmade road, rail and other minor reserves or public land parcels account for most remnants elsewhere.

The total area of land in NPWS reserves in the mainland part of the Lofty Block bioregion is less than two percent and grassy communities would make up only a small proportion of this. Within most of the larger reserves, such as Mount Remarkable National Park, the major vegetation communities are not grassy. The mainland Lofty Block has only two reserves over 2000 hectares and eight reserves of more than 990 hectares. Heritage Agreement areas in the bioregion covering grassy vegetation are very small and generally modified.

In the study area, the Northern Lofty flora region has a particularly low percentage of conserved land compared to the Southern Lofty, Flinders Ranges and Murray flora regions and its native vegetation is highly fragmented. Thirty two percent of species recorded in grassy vegetation in the Northern Lofty Flora Region were of particular conservation significance, compared with 28% in the Southern Lofty, 23% in the Murray and 18% in the Flinders Ranges regions.

NON-WILDLIFE VALUES OF GRASSY VEGETATION

The grasslands and grassy woodlands that remain on private land have not been cleared because they were considered unsuitable for cropping due to shallow soil, stoniness, slope, low rainfall or a combination of these. However the fact that most have been used in their uncultivated state for stock grazing, indicates that they have been of value to primary producers, as pasture and shelter requiring little management input. Dominant native species are mainly perennial, with some native grasses being green well into summer and, as a

consequence, native grasslands and grassy woodlands have provided relatively drought tolerant native pastures.

Woodland trees on farms and town parklands have also traditionally been retained as sources of timber and for their contribution to the landscape. Native vegetation, as a major component of the local landscape that varies from place to place, contributes to a sense of identity, is part of local heritage and can act as an outdoor classroom.

Few of the many values of naturally occurring native vegetation can readily be replaced by plantings. For example, a stand of intact native vegetation is potentially self perpetuating, under appropriate conditions. Even small patches of degraded vegetation generally consist of at least 10-20 native plant species, of a wide range of life forms. The clearance of native vegetation, including the conversion of deep-rooted, perennial native vegetation to annual vegetation such as cereal crops or annual grasses has been found to be an important contributor to salinity, soil erosion and rising water tables (eg. South Australian Department of Environment and Land Management 1993). Further regional decline of perennial native grassy vegetation and its replacement by annual species or irrigated crops would contribute to these problems.

CONSERVATION STATUS OF MAJOR GRASSY COMMUNITIES IN THE LOFTY BLOCK BIOREGION

From an overview of the conservation status of individual major grassy communities, strategies can be developed for conserving representative grassy vegetation in the Lofty Block. Five main categories of community can be recognised and are outlined in tables 18-22.

Table 18. Category 1 (communities with surviving examples that support significant species and form part or all of a relatively substantial area of native vegetation).
LB =Lofty Block Bioregion, FOR = Flinders and Olary Ranges Bioregion, MDD = Murray Darling Depression Bioregion. NP National Park, CP Conservation Park, RP Recreation Park

Vegetation type	Distribution[1]	Structure	Conservation Assessment
Eucalyptus odorata **low woodland** (floristic group 6)	Northern LB and southern FOR	Sparse understorey	Poorly Conserved. Present in 3 Heritage Agreement Areas, town parklands, edge of Mount Remarkable NP and edge of Mount Brown CP. All reserved examples are very small both in the LB and FOR. *E. odorata* is largely confined to South Australia.
Lomandra multiflora **ssp.** ***dura*** **tussock grassland** (floristic group 8.4)	North eastern LB (Burra Hills)	More or less dominated by Lomandra tussocks	Not conserved and not known outside South Australia. Relatively extensive examples remain on private grazing land in the Burra Hills. Most are heavily modified and depauperate in native species, but a few high quality remnants survive. One small Heritage Agreement has been approved but not finalised. Habitat for Pygmy Bluetongue Lizard.
Eucalyptus leucoxylon **(+/-** ***E.odorata*****) low woodland & woodland** (floristic group 9)	LB, southern FOR	Grassy understorey	Poorly conserved. Reserved in Mount Remarkable NP & Wirrabara Forest Reserve with canopy dominated by *Eucalyptus leucoxylon +/- E. microcarpa.* In Spring Gully CP with canopy dominated by *E. leucoxylon +/- E. macrorhyncha.* One partial Heritage Agreement.
Northern ***Allocasuarina verticillata +/-*** ***Eucalyptus leucoxylon*** **+/-** ***E. microcarpa*** **low woodland & low open woodland** (floristic group 11)	LB, southern FOR	Semi grassy understorey	Moderately conserved. One Heritage Agreement & part of another. Major vegetation type in Mount Brown CP, Mount Remarkable NP, present in Wirrabara Forest Reserve. There are very high value areas outside and adjacent to public land in the southern Flinders Ranges. The highest ranked known area in the Lofty Block is vegetation on private land adjoining the northern boundary of Mount Remarkable NP.

[1] Distribution in study area - consisting of the mainland Lofty Block and adjoining lands (Figure 1)

Table 19. Category 2 (communities with surviving examples that include very small and isolated fragments that support significant species, and other more extensive areas of native vegetation)

Vegetation type	Distribution[1]	Structure	Conservation Assessment
***Stipa eremophila / Danthonia caespitosa* grassland with emergent shrubs** (floristic group 2)	Northern LB and southern FOR (plains)	Includes grasslands of the northern plains which once carried bluebush shrubland.	Not conserved in the Lofty Block. Pastoral zone includes marginal Plains Wanderer habitat. (Webster, 1996) Includes many linear remnants on rail corridors that are likely to have been cleared of trees, shrubs and mallee when railways were first established.
***Allocasuarina verticillata* low woodland** (floristic group 8.1)	Eastern and northern LB	Includes grasslands without trees	Poorly conserved. Present in one Heritage Agreement Area, most examples with understorey are small.
***Stipa blackii* grassland & low Eucalypt woodland** (floristic group 8.3)	Throughout LB other than Fleurieu Peninsula (hills, plains)	Understorey relatively grassy.	One Heritage Agreement applied for. Most remnants are small, isolated. Overstorey dominants vary greatly. Includes grasslands near Peterborough. The highest ranked examples occur on private land near Truro. Present as *Eucalyptus porosa* very open mallee in Cobbler Creek RP, land that was grazed until recently.

Table 20. Category 3 communities (woodlands of the southern Lofty Block - Southern Lofty Flora Region)
Southern Lofty Communities from Goodwins & Stubbs, 1988

Vegetation type	Distribution[1]	Structure	Conservation Assessment
Southern *Eucalyptus microcarpa* low woodland (floristic group 10)	Southern LB		Three Heritage Agreements and another approved but not finalised, including some of the best surviving remnants. Examples modified to varying degrees present in Sturt Gorge RP and Shepherds Hill RP and in council reserves on the Hills Face. Encroachment by urban development continues on private land. Relatively high rainfall, proximity of urban gardens, fragmentation and past disturbance have led to major alien plant invasion, particularly olives.
***Eucalyptus microcarpa* +/- *E fasciculosa* low woodland** (Southern Lofty community 39)	Southern LB	Semi grassy understorey	Reserved in Belair National Park & Onkaparinga River National Park.
***Eucalyptus camaldulensis* - *E. microcarpa* woodland** (Southern Lofty community 27)	Southern LB	Associated with southern grey box woodland	Reserved in Belair National Park, Ferguson Conservation Park. Most surviving examples highly modified.
***Eucalyptus camaldulensis* - *E. leucoxylon* open woodland** (Southern Lofty community 25)			Degraded examples in Black Hill and Morialta Conservation Parks (Davies, 1997) Most examples highly modified

Table 21. Category 4 communities (the only examples conserved in the Lofty Block are within Mount Brown CP)

Vegetation type	Distribution[1]	Structure	Conservation Assessment
Danthonia caespitosa* / *Stipa nitida* grassland & low open shrubland +/- emergent *Acacia victoriae (floristic group 5)	Northern LB and southern FOR		Minor but very important occurrence in eastern grassland section of Mount Brown CP, the main distribution is north of the Lofty Block but many pastoral areas with an *Acacia victoriae* shrub stratum have an understorey dominated by alien grasses or herbs. Inadequately conserved in Lofty Block but should be assessed for adjoining Flinders and Olary Block bioregion where extensive occurrences are known.
Northern *Eucalyptus microcarpa* +/- *Allocasuarina verticillata* low woodland (floristic group 12)	Northern LB	Semi grassy understorey.	Major vegetation type in Mount Brown Conservation Park and adjacent private land. Forms a mosaic with category 1 woodland communities in the ranges.

Table 22. Category 5 communities (not conserved within Lofty Block, occur in adjacent bioregions)

Vegetation type	Distribution[1]	Structure	Conservation Assessment
***Lomandra effusa* tussock grassland** (floristic group 1)	Eastern LB, southern FOR, western MDD bioregions. Widely scattered in LB	Some examples have emergent trees, such as drooping sheoak.	Not conserved and not known outside South Australia. Allied to mallee and to *Lomandra multiflora* ssp. *dura* grassland. Most examples are on private grazing land. In the Burra Hills, may provide pygmy bluetongue habitat. Includes the Tailem Bend grasslands in the MDD, ranked highly by Hyde (1995) for which a Heritage Agreement is in preparation for a small example.
***Triodia scariosa* hummock grassland & *Callitris glaucophylla* low woodland** (floristic group 8.2)	Northern LB		Not conserved in Lofty Block Bioregion. Also occurs in Flinders and Olary Bioregion where related communities are conserved in Dutchman's Stern Conservation Park and Flinders Ranges National Park.

THREATS TO NATURAL VALUES

GRAZING BY DOMESTIC STOCK

Most grassy vegetation in the Lofty Block is grazed by domestic stock. The impacts of stock grazing on native grasslands and grassy woodlands can be summarised as:

- removal of the most palatable and most susceptible species by selective grazing or trampling
- browsing of tree and shrub seedlings, preventing regeneration
- damage to the soil lichen/moss crust promoting invasion by alien species
- spread of alien plants adapted to dispersal by stock (eg. horehound and medics)
- increase in certain alien species that benefit from grazing of dominant grasses, which creates gaps and allows more light in
- soil compaction and erosion
- suppression of native species regeneration and other secondary impacts resulting from the invasion of alien plant species

Davies (1997) found that in plot trials, the period of active growth and reproduction was longer for many native species than for alien plants of grassy communities. The ability of native grasses to respond to summer rain is a contributing factor. This characteristic of the dominant native plants combined with seasonality of stocking may have contributed greatly to preventing the extinction of native grasslands in the Lofty Block, but would not prevent local extinctions of susceptible species.

WEEDS/ALIEN PLANT SPECIES INVASION

Long-grazed grassland and grassy woodland generally supports an alien grass flora which is primarily annual while the native grass species that have survived are predominantly perennial. In the Adelaide Hills, the land use of some such woodland areas has been changed to conservation and open space (eg. Sturt Gorge Recreation Park) and these areas have been invaded by woody alien species such as olives (**Olea europaea*) and boneseed (**Chrysanthemoides monilifera*). Although the

understorey in most of Spring Gully Conservation Park is relatively unmodified, topped lavender (**Lavandula stoechas*) is invading. In grassy vegetation in the moderate rainfall rural areas, the main woody alien species are African Boxthorn (**Lycium ferocissimum*) and Horehound (**Marrubium vulgare*) with the latter species more likely to invade grazed than ungrazed vegetation.

In *Lomandra multiflora* ssp. *dura* tussock grasslands, annual grasses and rosette annual or perennial herbs such as salvation Jane (*Echium plantagineum*), wild sage (*Salvia verbenacea*), catsear (*Hypochoeris* spp.) and ribwort (*Plantago lanceolata*) are particularly important. They occupy inter-tussock spaces important for native herbs. The scarcity of native trees and large shrubs suggests that the environment is less favourable for woody species, so the potential for alien woody plant invasion would appear to be relatively low.

Bridal Creeper (*Myrsiphyllum asparagoides*) is another major weed which can invade grassy woodlands and was commonly recorded in Southern *Eucalyptus microcarpa* low woodland and *Callitris preissii* or *E. porosa* low woodland. It was also recorded in *E. odorata* low woodland. It is not known whether some type of external disturbance is necessary before this species is able to establish, although it is unlikely to thrive in grazed or arid land. It does not generally invade grasslands because its bird-dispersed fruit tends to be deposited initially under trees, large shrubs and fenceposts.

RABBITS AND HARES

Evidence of rabbits or hares was found in grassy vegetation throughout the bioregion. Native vegetation is browsed by rabbits or hares, which leads to changes in vegetation structure and can prevent regeneration of trees, shrubs and herbs. Warrens are among the first sites to be colonised by alien plant species. Mechanical rabbit control measures can also be damaging to native vegetation. The impact of rabbits is therefore important in the conservation and restoration of grasslands and grassy woodlands.

LACK OF AWARENESS

Lack of awareness of the nature and values of native grassy ecosystems leads to a number of problems that are of major importance in this region.

Native grassland is under potential threat of being cleared for agricultural purposes, because many landholders are unaware that this community is defined as native vegetation and that the Native Vegetation Act requires that consent be obtained for clearance. Included is clearance through increased levels of grazing, fertilising or seeding of grassland or grassy woodland.

Changes in grazing regime of grasslands can have major impacts. For example, some areas of grassland have retained a moderately high diversity of native species despite being grazed intermittently, due to the timing and duration of grazing. If the land is grazed in a different season or for longer duration, local extinctions may occur.

Large areas of the Mid-North have very little tree cover and this has caused concern amongst local communities and the Landcare movement. Trees and shrubs are often planted for amenity, for well-intentioned environmental concern or for planting of fodder crops. There are instances where such planting has occurred in substantially native grasslands and grassy woodlands, and this is often combined with herbicide spraying and ripping. Weed invasion may follow this disturbance and can result in local extinctions. Tree planting is not appropriate for small grassland remnants because native species composition can be affected up to 30 metres from each tree planted in grassland (McDougall, 1989). In more extensive, lower quality native grasslands and open woodlands, fenceline or well-spaced clump plantings of drooping sheoaks, golden wattle or occasional local woodland eucalypts may be appropriate. In such cases, ripping, spraying and direct seeding to establish dense woody vegetation is not appropriate.

Grassland or woodland with an open understorey may be targetted for developments such as park or council infrastructure or rabbit bait-laying in preference to native vegetation with a more obvious shrub stratum, even where the intention is to minimise damage to native vegetation.

LACK OF KNOWLEDGE ON MANAGEMENT REQUIREMENTS AND RESTORATION TECHNIQUES

In the grassy white box woodlands of New South Wales (Prober & Thiele, 1995) and the grasslands of Victoria (e.g. Lunt, 1997) small ungrazed remnants (such as cemeteries) of grassy native plant communities have retained a high diversity of native flora by default and larger areas exist that are native-plant-species-poor but are still of importance, particularly to fauna. Generally, the situation is similar in the Lofty Block, however, some relatively extensive, lightly or intermittently grazed areas on private land are still of very high value. To conserve the highly diverse remnants and restore the more modified examples of grassy communities, informed management will be required, taking site specific factors into account. Osborne and others (1995) reviewed the need for greater knowledge of habitat requirements for conserving small reptiles in grasslands. As indicated above, there is little information on the impacts of various management regimes on the grasslands and grassy woodlands of the Lofty Block, particularly fire and herbivory. Even though much more research has been undertaken in the eastern states, conclusions from this research are not necessarily applicable to the South Australian situation.

MANAGEMENT ISSUES

ROADSIDE AND RESERVE MANAGEMENT

Important grassy vegetation remnants in the bioregion occur on roadsides, disused rail corridors, unmade roads, town parklands, and other minor reserves under control of local government. Some of the most significant plant species, threatened at the national level, are only known from such areas. Lack of awareness of native grassy vegetation and its values means that these areas are particularly under threat. The timing of routine maintenance operations and the methods used can have major consequences for grassy vegetation. Management plans are needed to identify where current management should be maintained or changed and to enable weed management, rabbit control, fuel reduction and grassland restoration to be coordinated.

REVEGETATION & BUSHCARE

Natural regeneration is the optimal mechanism for revegetating grassy communities. The potential for modified areas to regenerate after the removal of grazing pressure and control of rabbits and weeds is generally underestimated. Tree planting or direct seeding are often seen as more positive measures for helping the environment than fencing or selective weeding even though in many situations the latter methods may be of greater value. Tree regeneration in some of the region's plant communities appears to be episodic (eg. Venning, 1988) and regeneration sometimes does not immediately follow removal of grazing pressure and or weed control. The unusually high rainfall of 1992 saw much regeneration of SA blue gum in the Upper North. Therefore there is a need to foster a long term approach to revegetating grassy communities so that the potential for natural regeneration can be realised.

Planting of fodder crops, woodlots and shelter belts to improve farm productivity is also regarded as revegetation in the State Revegetation Strategy (State Revegetation Committee, 1996). However, such plantings may pose a threat to native grasslands on private land and adjoining areas. From the producers' point of view, there may be long term productivity gains from rehabilitating degraded native pastures compared to planting fodder crops such as *Atriplex nummularia.* These options need to be compared on a site specific basis.

From the biological diversity conservation perspective, areas of high quality native grassland need to be protected more effectively from planting of fodder crops and inappropriate amenity planting.

FIRE

Grasslands and grassy woodlands of the Lofty Block Bioregion are rarely deliberately burnt for management purposes, probably for reasons of cost and safety. Alternative management options are employed for reducing dry grass levels. These include: grazing - most likely to be employed on extensive areas and sometimes on road, rail and town reserves; spraying - used on functional rail lines and main roads; and mowing or slashing - used on town reserves and some roadsides. Grassy communities were probably mosaic-burnt prior to European settlement, but species requiring regular burning are likely to have disappeared already from long-unburnt remnants.

There are two instances where important grassland sites have been burnt during the life of this project. They are: *Lomandra multiflora* ssp. *dura* tussock grassland near Mount Cone; and a grassy wetland site, habitat of the nationally significant blown grass *Agrostis limitanea.* It appears that neither site has suffered loss of native species as a result of this one-off event. However another important aspect which requires quantitative assessment and an experimental approach is the effect of fire on alien species abundance and the interaction of fire and grazing. Prober and Thiele (1996) have commenced a long term trial on the effects of various fire regimes in grassy white box woodlands in New South Wales, a formerly widespread plant community that is now severely depleted and fragmented. Their initial research and that of Lunt (1990) underline the importance of monitoring native species diversity and weed abundance.

CONSERVATION MANAGEMENT

Important observations and conclusions on grassland management for conservation, from research interstate (see various papers in Sharp & Rehwinkel, 1995; summary in Davies, 1997) include:

- Lightly grazed remnants have been found to be in better condition than intensively grazed remnants
- Fertilising, ploughing and heavy grazing are detrimental to native grassland and grassy woodland
- Intermittently grazed remnants have been found to be in better condition than continuously grazed remnants and the season and duration of grazing is important
- Some alien species (eg. medics and thistles) are favoured by intensive stock grazing
- Extensive *Themeda triandra* grasslands requiring frequent burning or alternative means of reducing the dominant biomass do not occur in the Lofty Block
- Major changes in management such as introduction of grazing to ungrazed sites or **frequent** burning of long unburnt sites will lead to loss of species and/or condition
- Perennial species, including seasonal species, now form the bulk of the native flora of native grasslands and grassy woodlands, while most of the alien flora is annual.

General native grassland management principles for maintaining or improving native plant species richness are as follows:

- The life cycles of both native and alien plant species should be incorporated in weed control strategies;
- The impact of grazing on soil crust, palatable native species and unpalatable alien species should be considered if continued grazing is proposed for weed reduction purposes;
- The period from spring to mid-summer is important for growth and seed set of dominant native grasses and other native grassland species;
- The role of native herbivores and localised 'endogenous disturbance' (e.g. echidna diggings) in maintaining successional species should be considered when managing grasslands. The capacity for many alien species to outcompete native successional species following large scale disturbance events should also be considered;
- Habitat requirements of native fauna (vertebrates and invertebrates) need to be considered;
- Management should be determined on a case by case basis taking into account past management, surrounding land use and native and alien species presence and cover. Dramatic alteration of existing management should in most cases be avoided in high quality remnants;
- Occasional fire may be a useful management tool, but there is no evidence that frequent burning would be beneficial in the Lofty Block grasslands. Any deliberate burning must be designed on an experimental basis with detailed monitoring of the vegetation and prior assessment of the soil seed bank and of likely impacts on individual species. This also applies to slashing.

PRIORITISATION OF SITES

Of the four sites containing species that are endangered in South Australia or of national conservation significance, all are isolated remnants on road reserves or minor reserves (Table 23). Only one (Holm Hill Grassland) is native species-rich.

Most sites containing species that are vulnerable in SA, formed part of more extensive areas of native vegetation (larger than a few hectares) and most were relatively rich in native species. Ranked on species of state significance, the most important sites are in or near Mount Remarkable National Park and in Burra Hills grassland near Mt Cone. The next most important sites are in Wirrabara Forest, and on private land in the Lower Mid-North, including a Heritage Agreement area (Table 23).

Species that are threatened nationally or across South Australia were recorded opportunistically at the following locations:

- Mount Cone grasslands (floristic group 8.4) - *Psoralea parva*, small scurf-pea (nationally endangered)
- Wirrabara Forest Reserve (floristic group 9) - *Glycine tabacina*, variable Glycine (threatened in South Australia)
- Tarcowie Parklands (floristic group 6) - *Senecio macrocarpus*, large fruit groundsel (nationally vulnerable)

Grassy woodland eucalypts with a very restricted distribution in South Australia (vegetation type is floristic group 9 in both cases) are:

- White box (*Eucalyptus albens*) - restricted to the Melrose district and present in Mount Remarkable National Park but more widespread on private grazing land. There are a few surviving stands where modified native understorey is present.
- Red stringybark (*Eucalyptus macrorhyncha*) - restricted to the Clare district and present in Spring Gully Conservation Park.

SITE RANKING BASED ON QUADRATS

Overall rank was assigned to grassland and grassy woodland quadrats in the Lofty Block, (Table 23) based on presence of plant species that are of particular conservation significance (threatened or rare) at the national or state level and the number of native species present. Also listed in Table 23 are the ranking according to the number of species of regional conservation significance recorded and ranking within floristic group based on number of natives in quadrat. Isolated remnants occupy only a few hectares, while "extensive" remnants form part of a larger block of native vegetation that may include other plant communities. Vegetation description for sites listed is in Appendix VII. Location details for sites listed in Table 23 and 24 are included in Appendix X.

Examples of relatively unmodified *Lomandra multiflora* ssp. *dura* , *Lomandra effusa* and *Stipa blackii* native grasslands on privately owned grazing lands in the Burra Hills, Northern Lofty Flora Region are under particular threat of being overlooked because they are grazed and lack a tree stratum. Examples not included in Table 23 are shown in Table 24. The extent of such remnants is generally undefined.

Table 23. Important examples of grassland and grassy woodland in the Study Area

SVY survey number (survey names listed in Table 2); **no.spp** total number of species in quadrat
Region flora region (NL Northern Lofty; MU Murray, FR Flinders Ranges, SL Southern Lofty)
Patch & Site label refer to South Australian Environmental Database, summary vegetation data in Appendix VII
Floristic group, (rank) floristic group into which site classified, (rank on number of natives within group)
no. natives, (rank) number of native species at site, (rank on number of natives)
rank SA EVR, (regional) rank of site on number of species of state significance (endangered, vulnerable or rare) and (rank on number of species of regional significance)

1. "Extensive" native vegetation remnants relatively rich in native species and important due to the presence of species that are **nationally threatened or rare, or threatened in South Australia.**

SVY Patch Site label	Site description	Region	Structure	Floristic group, (rank)	Significant species	No. spp.	No. natives, (rank)	Rank SA EVR, (regional)
049 10936 WIL2101	Private land N of Mt Remarkable NP	FR	Very low woodland	11(1)	1 nationally vulnerable and 1 rare species, 3 species rare in SA	92	62(3)	3(7)
046 11199 TG044	Private land Mt Cone south	NL	(Tussock) grassland	8.4(1)	1 species vulnerable in SA, 5 species rare in SA or possibly threatened.	63	41(59)	4(5)
083 14219 LBGBUR01	Private land Mt Cone north	NL	(Tussock) grassland	8.4(2)	1 species vulnerable in SA, 4 species rare in SA or possibly threatened	62	39(73)	4(11)
083 14184 LBGMEL01	East edge Mt Remarkable NP	FR	Woodland	6(4)	1 nationally vulnerable species, 2 species rare in SA	83	55(7)	5(11)
049 10803 MEL0301	Mt Remarkable NP	FR	Low open woodland	11(4)	1 nationally vulnerable species, 1 species rare in SA	57	48(28)	6(29)
049 10900 RIV0601	Private land, Tothill Range	NL	Very low open forest	9(19)	1 species vulnerable in SA, 1 species rare in SA	40	26(207)	6(29)
083 15577 LBGWLM02	Mt Remarkable NP	FR	Low open woodland	9(7)	1 species vulnerable in SA, 1 species rare in SA	46	38(85)	7(17)
063 11909 WAK0401	Private land, Hummocks Range	NL	Low open forest	11(34)	1 species vulnerable in SA	31	24(237)	7(51)
054 11220 GWL001	Heritage Agreement east of Mount Bryan	MU	Very low open forest	6(23)	1 species vulnerable in SA	54	38(85)	7(86)
083 15575 LBGMEL05	Mt Remarkable NP	FR	Open woodland	9(13)	1 nationally rare species, 3 species rare in SA	43	31(142)	29
083 14231 LBGPEK02	Tarcowie Parklands	FR	Open woodland	6(13)	(1 nationally vulnerable species present in remnant)	57	44(43)	2(51)

2. "Extensive" native vegetation remnants rich in native species and of particular importance due to the presence of species that are **rare in South Australia**

SVY Patch Site label	Site description	Region	Structure	Floristic group, (rank)	Significant species	No. spp	No. natives (rank)	Rank SA EVR (rank)
088 15052 KAP01A04	private land near Kapunda (Lower Mid-North)	NL	Woodland	9(5)	1 species rare in SA	78	39(73)	6(7)
083 15583 LBGPIR06	Wirrabara Forest King Tree Paddock	NL	Open woodland	9(1)	1 species rare in SA	63	49(27)	6(11)
088 15139 HAM00201	private land near Tarlee (Lower Mid-North)	NL	Low woodland	6(26)	1 species rare in SA	60	34(112)	6(29)
088 15064 KAP00101	Heritage Agreement near Nuriootpa (Lower Mid-North)	NL	Woodland	6(5)	1 species rare in SA	79	54(9)	6(51)
083 14234 LBGQUO02	Mt Brown CP	FR	Woodland	6(20)	4 species rare in SA, one possibly threatened	64	40(68)	51

Table 23 (continued). Important examples of grassland and grassy woodland in the Study Area

3. Small isolated remnants of particular importance due to the presence of species that are **threatened at the state or national level**

SVY Patch Site label	Site description	Region	Structure	Floristic group (rank)	Significant species	No. spp	No. natives (rank)	Rank SA EVR (region)
046 11204 TG043	Holm Hill Plantation Reserve	NL	(Tussock) grassland	8.1(1)	1 nationally vulnerable species, 1 species vulnerable in SA, 5 species rare in SA or possibly threatened	75	53(14)	1(3)
046 11118 TG039	road reserve near Burra	NL	Open shrubland	8.1(23)	1 nationally vulnerable species, 1 species rare in SA	31	15(341)	2(141)
054 11245 GWL004	road reserve near Woodchester	SL	Low open forest	2(27)	1 species endangered in SA	22	14(356)	2(86)
049 10713 BUR0201	road reserve near Burra	NL	Open shrubland	2(23)	1 nationally vulnerable species	30	16(333)	2(246)
051 10965 NCS040	rail reserve	NL	(Tussock) grassland	8.3(25)	1 species vulnerable in SA	37	19(292)	7(141)

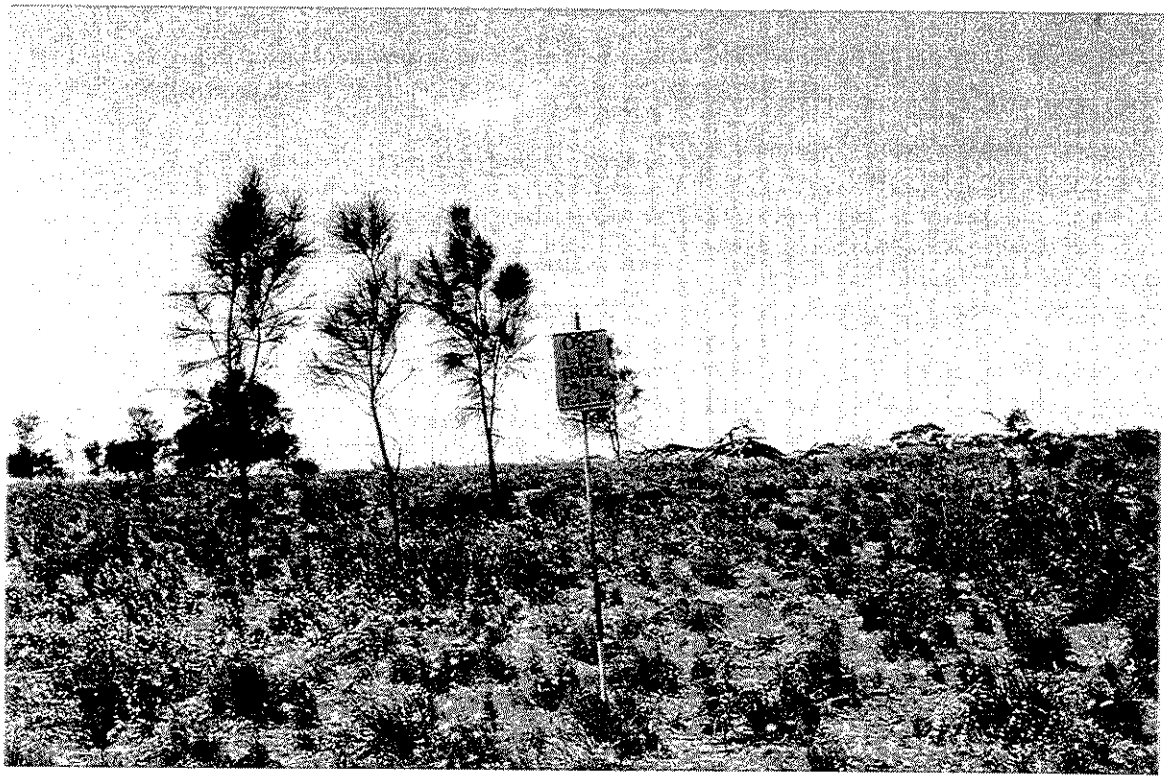


Figure 33. Seasonally grazed vegetation in the eastern foothills of the South Mount Lofty Ranges
Quadrat LBGTRU06. Very low open woodland. *Allocasuarina verticillata* over *Amphipogon caricinus var. caricinus /Aristida behriana /Stipa nodosa /Lomandra effusa /Leptorhynchos tetrachaetus.*

Table 24. Burra Hills Survey Sites (Survey 62): Additional examples of Grasslands

Sites located near known subpopulations of pygmy bluetongue (T. Milne, pers. comm.) are indicated +

Patch	Site label	Structure	Group	Vegetation description	No. spp	Native
+ 12116	TER1301	Very open sedgeland	8.4	*Lomandra multiflora ssp. dura* over *Chrysocephalum apiculatum, Calocephalus citreus*	50	37
+ 12074	HAL1001	Open sedgeland	8.3	*Lomandra multiflora ssp. dura/Stipa blackii* over **Avena barbata /Aristida behriana / *Bromus spp.*	55	34
+ 12080	HAL1801	Low shrubland	1	*Maireana rohrlachii* over *Lomandra effusa, L. multiflora ssp dura and low weedy grass*	45	29
+ 12115	TER1201	Sedgeland	8.3	*Lomandra multiflora ssp. dura/ Chrysocephalum semipapposum/ Maireana aphylla* over *Stipa blackii, S nitida, Danthonia caespitosa*	42	28
+ 12118	TER1701	Low shrubland	8.4	*Cryptandra amara var. amara* over *Lomandra multiflora dura, Stipa nodosa, Leptorhynchos squamatus*	39	26
+ 12114	TER1101	(Tussock) grassland	8.4	*Stipa blackii /Lomandra multiflora ssp. dura/ Cryptandra amara var. amara* over *Stipa scabra, Danthonia eriantha, Aristida behriana*	33	20
12006	BUR0801	Open sedgeland	8.4	*Lomandra multiflora ssp. dura/Lomandra effusa* over **Salvia verbenacea /Danthonia caespitosa /Stipa nitida /Vittadinia gracilis / Elacanthus pusillus /weeds*	44	34
11995	APO1401	Open sedgeland	8.4	*Lomandra multiflora ssp. dura/Cryptandra amara var. amara* over *Danthonia caespitosa, D. carphoides, Stipa setacea, S.blackii., Vittadinia gracilis*	39	30
12069	HAL0501	(Tussock) grassland	8.4	**Avena barbata /Danthonia caespitosa /Stipa nitida* over *Leptorhynchos squamatus, native grasses & herbs*	43	28
12075	HAL1101	(Tussock) grassland	8.3	*Stipa blackii, *Avena barbata* over *Aristida behriana /Danthonia eriantha / introduced grasses *Bromus sp. *Vulpia sp.*	49	27
12070	HAL0601	Sedgeland	8.4	*Lomandra multiflora ssp. dura/*Avena barbata* over *Stipa blackii /*Bromus sp./ Leptorhynchos squamatus*	40	23
12117	TER1401	Sedgeland	8.4	*Lomandra multiflora ssp. dura/Lomandra effusa/ Cryptandra amara var. amara* over *Aristida behrianna, Stipa nitida, *Avena barbata, Danthonia eriantha*	35	22
12111	TER0502	Open sedgeland	8.4	*Lomandra multiflora ssp. dura* over *Stipa setacea, S nitida, Leptorhynchos tetrachaetus Triptilodiscus pygmaeus*	31	21
12011	BUR1401	Very open sedgeland	8.4	*Lomandra multiflora ssp. dura* over *Danthonia carphoides, *Avena barbata, Leptorhynchos squamatus*	26	21
12113	TER1001	Sedgeland	1	*Lomandra effusa/ Maireana turbinata/*Asphodelus fistulosus* over **Avena barbata Stipa nitida *Carthamus lanatus *Neatostema apulum*	32	20

Abbreviations:

SVY survey number (survey names listed in Table 2)
Patch & Site label refer to South Australian Environmental Database
Group floristic group number
No. spp total number of species in quadrat

RECOMMENDATIONS

1. Reservation

Several plant communities were found to be not conserved or poorly conserved, and high quality remnants exist. The most extensive and high quality areas of these major communities should be reserved.

- Grasslands:
  ***Lomandra multiflora ssp. dura* tussock grassland** (floristic group 8.4) *Lomandra* grasslands are not represented in any NPWS reserves. The most extensive, relatively diverse, known *Lomandra multiflora* ssp. *dura* tussock grassland occurs north of Mount Cone in the Burra Hills. Acquisition of this area as a conservation park is the most appropriate action to secure this area (Table 23).
- Woodlands:
  ***Eucalyptus odorata* low woodland** (floristic group 6), ***Eucalyptus leucoxylon* (+/- *E.odorata*) low woodland & woodland** (floristic group 9), **Northern *Allocasuarina verticillata* +/-*Eucalyptus leucoxylon* +/- *E. microcarpa* low woodland & low open woodland** (floristic group 11). These floristic communities are either absent from NPWS reserves or constitute a very minor component at the park margin. Substantial grassy to marginal woodlands remain outside the NPWS reserve system in the bioregion, mainly in the southern Flinders Ranges on private lands adjoining the parks, on Beetaloo Reservoir land and Wirrabara Forest Reserve. The acquisition of further areas for NPWS Reserves or incentives for their protection under Heritage Agreements and commitment to management of SA Water and Forest reserve lands for biodiversity are a high priority.

2. Private land

As indicated above, Heritage Agreements may be an alternative to reservation for some privately owned woodlands adjacent to parks to maximise the effective size of the reserves. Complementary protection could be achieved for grasslands on private land through Heritage Agreements over relatively intact remnants and management covenants (some new form of agreement allowing a specified light grazing regime to continue) on currently grazed grasslands.

Incentives are needed for landowners to manage grassy remnants to encourage natural regeneration where there is longer term potential for Heritage Agreements. Management options include fencing, alteration to grazing regime and spot weed control. Many remnants have survived light and /or seasonal grazing, for a long period, and while protected by the Native Vegetation Act, may need additional protection from changed or intensified farming practices. In order not to devalue the status of Heritage Agreements, an alternative form of perpetual management agreement appears to be required, which would formalise continuation or reduction of existing land use as allowed under the Native Vegetation Act. Involving landowners in developing such a scheme would increase awareness of grassland values.

3. Reserve management

The study of grassy ecosystems in the Lofty Block has underlined the importance of the existing NPWS reserves in the Lofty Block. The particular problems of grassy ecosystems, discussed above, indicate a need for specific strategies and particular attention to management of grassland and grassy woodland which are a minor component of vegetation in existing reserves. Such strategies should include adequate fencing, protection from development infrastructure and grazing and spot control of alien plant invaders before they become established. Biodiversity management plans are needed for native vegetation on forest reserves and extensive SA Water land, with particular emphasis on recognition of the value of native species, control of alien species, grazing management and long term protection of these areas.

4. Roadsides and minor reserves

Small and isolated remnants have an important role as refuges for threatened flora and reference sites. They require recognition, protection from deleterious disturbance and informed, consistent management. Training is needed in recognition of native grasslands and understorey for local government staff and contractors and local groups likely to target roadsides and reserves for tree planting and further detailed advice needs to be available to them. Local government should be encouraged to engage vegetation consultants to map grasslands and grassy woodlands on their roadsides and reserves and prepare management plans for the most valuable areas.

A large number of minor reserves, unmade road reserves or disused cemeteries, owned by the Crown or by local government exist in the Mid-North. Sale of any such area should not be undertaken unless its vegetation has been surveyed in the spring to mid-summer season by a native grassland specialist. Similar prior assessment is needed before the introduction or intensification of grazing on such lands. If the land is found to carry significant native grassland, it should be protected by dedication as a flora and fauna reserve and or Heritage Agreement and appropriately managed.

5. National recognition of *Lomandra multiflora* ssp. *dura* Grasslands

This community is endemic to South Australia and therefore of national significance. A recovery plan or conservation strategy for *Lomandra multiflora* ssp. *dura* Grassland should address conservation of both small isolated and larger remnants. The plan would include examples of the community in adjoining bioregions (Yorke & Eyre Block, Flinders & Olary Ranges) and be complementary to the Pygmy Bluetongue Lizard recovery plan (Milne & Hutchinson, unpublished). A comprehensive inventory of the remaining examples of this community in the Mid-North is required.

6. Restoration

Fragmentation is a feature of grassy native vegetation in the Lofty Block, with most remnants likely to lose species through edge effects and isolation in the long term. Strategic restoration of degraded remnants is needed to ameliorate the effects of fragmentation. This would be more effective than allocating resources to revegetation or corridor building to overcome fragmentation. Such action should be a major goal within a Regional Biodiversity Plan or biodiversity input added to existing regional plans. Priority should be given to restoration in the Mid-North Wheatlands environmental region and part of the Peninsula Uplands environmental region. Priority components should include detailed mapping of native grasslands and development of an agreed set of revegetation priorities and methodology.

7. Education, extension and awareness raising

Guidelines are needed for landowners and field officers on recognition and values of grasslands. A whole of government approach to extension services is urgently required to ensure that consistent advice is disseminated on grassy ecosystems, revegetation programs and legislation covering native vegetation.

A number of groups in Australia are promoting the values of native grasses to primary production, but assistance should be available to interested landowners to assess how much they already have on their properties. Otherwise they may be prompted to purchase native grasses from other regions.

Guidelines and technical advice needs to be available on a case by case basis to community groups and individual landowners involved in tree and shrub planting in the Lofty Block. Botanically-detailed prior site assessment is needed to assess native ground cover, which is often cryptic amongst tall alien species. This level of technical skill is also needed to determine where planting is appropriate and where planting is not appropriate, identify suitable species and densities, and to develop alternative management strategies. Incentives need to be provided to encourage grazing to be withheld or reduced to allow saplings of indigenous trees to establish following particularly wet years. This is likely to be an efficient means of achieving some regional revegetation goals.

The critical period for reproduction of dominant grasses and other native species of grassland and grassy woodland is spring to mid-summer. Withholding grazing during this period appears to be a major requirement for conservation of grassy communities.

Due to the specialised skills and experience needed for assessing native grassland it may be appropriate to appoint a Grassland (including grassy and semi-grassy woodland) Project Officer for the bioregion. The Project Officer should be available to community groups, landowners and local government to identify grasslands, demonstrate their values, and provide advice on their management.

Guidelines are needed for assessment of grasslands in the Mid-North for the purposes of assessing clearance applications and advising on revegetation programs. Some of the main issues to be included in such guidelines are outlined below.

- Assessment in mid-spring to early summer (preferably both) is required. For example, 15 identifiable native species were recorded at a site surveyed in February 1996 during the Lofty Block Grassland Survey. This included some native grasses identifiable at that time. However, approximately 40 native species were recorded at the same site in late November 1997 when conditions were much more favourable for grass and forb identification. There were no apparent changes in management.
- At the optimal time of year (when most non-grass herbs are not completely dried off, and native grasses are in seed) a quadrat native species count can provide an objective indication of the conservation values of a grassland remnant as follows: fewer than 20 -degraded but often with potential for regeneration; 20 or more -moderate; 25 -good; 30 or more -excellent. A quadrat should cover a minimum area of 50 metres by 50 metres.
- Much of the plant diversity in a high quality grassland is generally in native grasses. Heavy grazing in spring reduces production of flowering culms by native grasses and native grass diversity may be under-estimated.
- One third to half of all plant species present may be alien and several of these may be abundant in a medium to high quality grassland.
- Relative abundance of natives and alien species generally varies throughout a remnant and throughout the year, even in a high quality grassland.
- Assessment criteria should acknowledge differing reasons for assessment, whether legal (clearance application) or advisory (suitability of site for community funded tree planting).

8. Research

Research is needed into grassland management which is solely for conservation (appropriate for reserves and Heritage Agreements) and also into management for conservation combined with production (appropriate for private grazing lands). The effects of changes to an existing management regime and of occasional fire on habitat should be examined. Strategies should be developed which favour native species and disadvantage alien plant species through the optimal season, frequency, species and intensity of grazing.

The grassy ecosystems of the Lofty Block Bioregion survive as modified remnants of a formerly widespread and diverse ecosystem. Active conservation management is now critical if we are to retain what little we have left and hope to reverse its long term decline.

Bibliography

Belbin, L. (1987) *PATN, Pattern Analysis Package.* CSIRO Division of Wildlife and Rangelands Research, Canberra.

Belbin, L. (1991) *PATN Pattern Analysis Package - Technical Reference and Users Manual.* Division of Wildlife and Ecology, CSIRO, Canberra.

Boomsma, C.D. & Lewis, N.B. (1980) *The Native Forest and Woodland Vegetation of South Australia.* Bulletin 25, Woods and Forests Department of South Australia.

Braun Blanquet, J. (1932) *Plant Sociology.* McGraw Book Co., New York.

Briggs, J.D. & Leigh, J.H. Leigh (1995) *Rare or threatened Australian plants.* Revised edition. CSIRO, Canberra.

Davies, R.J-P. (1982) *The Conservation of Major Plant Associations in South Australia.* Conservation Council of South Australia Inc., Adelaide.

Davies, R.J-P. (1983) *Surviving Examples of South Australia's Most Threatened Plant Associations.* Conservation Council of South Australia, Inc., Adelaide.

Davies, R.J-P. (1986). *Threatened Plant Species of the Mount Lofty Ranges and Kangaroo Island Regions of South Australia.* Conservation Council of South Australia, Inc.

Davies, R.J-P. (1992). *Threatened Plant Species of the Murray Mallee, Mount Lofty Ranges and Kangaroo Island Regions of South Australia.* Conservation Council of South Australia Inc.

Davies, R.J-P. (1995) *Threatened Plant Species in National Parks and Wildlife Act Reserves in South Australia.* Botanic Gardens of Adelaide and State Herbarium

Davies, R.J-P. (1997) *Weed Management in Temperate Native Grasslands and Box Grassy Woodlands in South Australia.* Botanic Gardens of Adelaide and State Herbarium.

Department of Environment and Planning (1988) A Floristic Vegetation Map of the South Mount Lofty Ranges, prepared by Goodwins, D., & Stubbs, T.

Environment Protection Council of South Australia (1988) *The State of the Environment Report for South Australia.* Department of Environment and Planning.

Forward, L.R. & Robinson, A.C. (1996) *A Biological Survey of the South Olary Plains.* Department of Environment and Natural Resources, South Australia.

Gullan, P.K., Busby, J.R. & Churchill, D.M. (1976) Some aspects of the vegetation of the Dandenong Ranges, Victoria. *Proceedings Royal Soc. Victoria.* **88:** 49-58.

Heard, L. & Channon, B. (eds.) (1997) *Guide to a native vegetation survey (agricultural region) using the Biological Survey of South Australia methodology.* Department of Housing and Urban Development, Adelaide.

Hyde, M.K. (1992) South Australian Temperate Grassland Survey, Mid-North District (1:125,000 scale mapsheet), Information Systems Branch - Department of Housing and Urban Development, Adelaide.

Hyde, M.K. (1994) *A Vegetation Survey of Disused Railway Corridors in the Mid-North Region of South Australia.* Nature Conservation Society of South Australia, Adelaide.

Hyde, M.K. (1995) *The Temperate Grasslands of South Australia: Their Composition and Conservation Status.* World Wide Fund For Nature.

Hyde, M.K. (1996) Unpublished report. *Eucalyptus odorata Woodlands in South Australia.* Native Vegetation Management Branch, Department of Environment and Natural Resources.

Jessop, J.P. (1993) (Ed.) A List of the Vascular Plants of South Australia. Edition IV. *J.Adelaide Bot.Gard.* **12(1):** 1-163.

Jessup, R.W. (1946) The Ecology of the Area Adjacent to Lakes Alexandrina and Albert. *Trans. Roy. Soc. S. Aust.* **70(1):** 3-37.

Jessup, R.W. (1948) A Vegetation and Pasture Survey of Counties Eyre, Burra, and Kimberly, South Australia. *Trans.Roy.Soc. S.Aust* **72(1):** 33-68.

Kazcan, C. (1981) *The Southern Flinders Ranges*. The Nature Conservation Society of South Australia.

Kirkpatrick, J., McDougall, K., & Hyde, M.K. (1996) *Our Most Threatened Ecosystem - The Ecology and Conservation of Lowland Native Grasslands in Southeastern Australia.* World Wide Fund for Nature- Australia, Sydney.

Kloot, P.M. (1987) The Naturalised Flora of South Australia. 1. The documentation of its development. *J. Adelaide Bot. Gardens* **10(1):** 81-90.

Kraehenbuehl, D.N. (1996) *Pre-European Vegetation of Adelaide: A Survey from the Gawler River to Hallett Cove.* Nature Conservation Society of South Australia.

Lang, P.J. & Kraehenbuehl, D.N. (1997). Plants of Particular Conservation Significance in South Australia's Agricultural Regions. (May, 1997 update of unpublished database). Department of Environment & Natural Resources.

Lange, R.T. (1976) Vegetation, Chapter 7, pp. 99-112 in Twidale, C.R., Tyler, M.J. & Webb, B.P; (Eds) *Natural History of the Adelaide Region.* Royal Society of South Australia, Adelaide.

Laut, P., Heyligers, P.C., Keig, G., Löffler, E., Margules, C., Scott, R.M., and Sullivan, M.E. (1977) *Environments of South Australia, Province 3: Mt.Lofty Block, Province 6: Flinders Block, Province 5: Eastern Pastoral and Province 4: Eyre and Yorke Peninsulas.* C.S.I.R.O., Canberra.

Lock, E. & Goodwins, D. (1993) Unpublished report. *A Vegetation Survey of the Western Murray Flats South Australia.* Department of Housing and Urban Development.

Lunt, I.D. (1990) Impact of an Autumn Fire on a long-grazed Themeda triandra (Kangaroo grass) Grassland: Implications for management of invaded, remnant vegetation. *Vict.Nat.* **107:** 45-51.

Lunt, I.D. (1997) Effects of long-term vegetation management on remnant grassy forests and anthropogenic native grasslands in south-eastern Australia. *Biological Conservation* **8:** 287-297.

McDougall, K.L. (1989) *The Re-establishment of Themeda triandra (Kangaroo Grass). Implications for the Restoration of Grassland.* Arthur Rylah Institute for Environmental Research Technical Report Series No. 89. National Parks and Wildlife Division, Department of Conservation Forests and Lands Victoria.

Milne, T.I. & Hutchinson, M.N. (unpublished) *Draft Recovery Plan for the Pygmy Bluetongue lizard Tiliqua adelaidensis.* Submitted to the Australian Nature Conservation Agency.

Moore, B. (1994) Unpublished Report. *Box and Buloke grassy woodlands and allied native grasslands: research and development of recovery plans.* Final report to Biological Survey Section, Department of Environment and Natural Resources.

Muir, B.G. (1977) *Biological Survey of the Western Australian wheatbelt. Part 2. Vegetation and habitat of Bendering Reserve.* Records of the WA Museum Suppl. No. 3.

Neagle, N. (1995) *An Update of the Conservation Status of the Major Plant Associations of South Australia.* Native Vegetation Management Branch, Department of Environment and Land Management, SA.

Oppermann, A. (1995) *Mount Brown Conservation Park Vegetation Survey.* Nature Conservation Society of South Australia, Adelaide.

Osborne, W. Kukolic, K. & Jones, S. (1995) *Management of threatened vertebrates in Native Grasslands: a case of clutching at straws ?* **in** Sharp, S. & Rehwinkel, R. (Eds.) Management of Relict Lowland Grasslands. Proceedings of a workshop and Public seminar. ACT Parks and Conservation Service, Conservation Series no. 8.

Playfair, R.M. & Heard, L. (1995) *A Native Vegetation Survey of the Burra Hills Region of South Australia.* Department of Housing and Urban Development.

Playfair, R.M. and Robinson, A.C. (1997) (Eds.) A *Biological Survey of the North Olary Plains, South Australia, 1995-1997.* Natural Resources Group, Department of Environment and Natural Resources, South Australia.

Prober, S.M. & Thiele, K.R. (1995) Conservation of the grassy white box woodlands: relative contributions of size and disturbance to floristic composition and diversity of remnants. *Aust. J. Bot.* **43:** 349-366.

Prober, S.M. & Thiele, K.R.. (1996) Unpublished Report to the Australian Nature Conservation Agency. Establishment and Management of the "Grassy White Box Woodlands Reserve".

Rowett, A.,Venning, J. & Dendy, T. (1981) *A Botanical Survey of Remnant Vegetation in the Mid-North and Western Murray Flats.* South Australian Department of Environment and Planning.

Sharp, S. & Rehwinkel, R. (1995) (Eds.) *Management of Relict Lowland Grasslands.* Proceedings of a workshop and Public seminar. ACT Parks and Conservation Service, Conservation Series no. 8.

Specht, R.L. & Perry, R.A. (1948) The Plant Ecology of Part of the Mount Lofty Ranges. *Trans. Roy. Soc. S.Aust.* **72(1):** 91-123.

Specht, R.L. (1972). *The Vegetation of South Australia* (2nd Edition). Government Printer, Adelaide.

State Revegetation Committee (1996) *The State Revegetation Strategy for South Australia.* South Australian Government.

Stephens, C.G., Herriot, R.I., Downes, R.G., Langford-Smith, T. and Acock, A.M. (1945) *A Soil, Land-Use, and Erosion Survey of Part of County Victoria, South Australia, including the Hundreds of Belalie, Whyte, Reynolds, and Anne, part of the Hundreds of Caltowie, Yangya and Bundaleer.* Bulletin No.188 Council for Scientific and Industrial Research, Melbourne.

Stokes, A.L. (1996) *A Biological Survey of Box and Buloke Grassy Woodland in the Upper South-East of South Australia.* Department of Environment and Natural Resources, South Australia.

Thackway, R. & Cresswell, I.D. (1995) (Eds.) *An Interim Biogeographic Regionalisation for Australia: A framework for establishing the national system of reserves.* Version 4.0. Australian Nature Conservation Agency, Canberra.

Todd, M.A. (1965) The Distribution of Eucalyptus species in portion of County Stanley, South Australia. *Trans.Roy.Soc.S.Aust.* **89:** 25-33.

Venning, J. (1988) *Growing Trees for Parks, Farms and Roadsides. A Revegetation Manual.* Lothian, Melbourne.

Walsh, N.G. & Entwhistle, T.J. (1996) (Eds.) Flora of Victoria - Volume 3: Dicotyledons. Winteraceae to Myrtaceae. Inkata Press, Melbourne.

Webster, R. (1996) Unpublished report. *Survey and Conservation of the Plains Wanderer Pedionomus torquatus in South east South Australia.* Royal Ornithologists Union.

Williams, M. & Goodwins, D. (1988) Conservation of Biological Diversity on the Fleurieu Peninsula. *Sth. Aust. Nat.* **63(2):** 24-39.

Wood, J.G. (1937) *The Vegetation of South Australia.* Government Printer, Adelaide.

Zar, J.H. (1984) *Biostatistical Analysis.* Prentice Hall, New Jersey.

Personal Communication

R. Davies, pers. comm. - Richard J-P. Davies, Adelaide.

P. Lang, pers. comm. - Peter J.Lang, Heritage and Biodiversity Division, S.A. Department of Environment, Heritage and Aboriginal Affairs.

T. Milne, pers. comm. - T.I. Milne, Biological Sciences, Flinders University of South Australia.

Appendix I

LOFTY BLOCK BIOREGION SURVEY COVERAGE

Biological Survey of South Australia plant quadrat recording/ floristic group classification

Survey name and number		Survey coordinator	No. of map-sheets in Lofty Block	Standard or other quadrat size	Field work date	Previous Floristic Analysis	Lofty Block study area
Southern Mount Lofty Ranges	005	DHUD	12	10x10m	Apr-May 1986	yes	all
Southern Olary Plains	024	DENR	4	50x50m	Aug 1991	yes	part
Western Murray Flats	045	DHUD	6	30x30m	Apr 1992	yes	part
Disused Rail Corridor	051	NCSSA		approx 30x30m	Sep 1992	yes	part
Pygmy Blue Tongue	058	DENR	3+	30x30m	Dec 1994, Oct 1995, Nov 1996	some in TG	all
Yorke Peninsula	063	DHUD		30x30m		no	part
Kyeema	033	NPWS				no	all
Para Wirra	035	NPWS				no	all
Horsnell Gully	037	NPWS				no	all
Morialta	038	NPWS				no	all
Private collectors	042					no	all
Fleurieu Swamps	052					no	all
Rowett and Venning	031	DEP		transect	Feb-Apr 1980	no	all
Mitchell et al	032	DEP		transect	Mar-Apr 1979	no	all
Happy Valley/Mitcham /Stirling(3 LGAs)	056	CC HV	4 (part)	10x10	Sep - Dec 1992	no	all
Stirling District Council	057	DC Stirling	4 (part)	30x30m	1993	no	all
Burra Hills	062	DHUD	10	30x30m	Oct 1994	some in MN	all
Noarlunga Christies Creek	065	CC Noarlunga	1 (part)	30x30m	Sep 1994	no	all
Field River (Noarlunga)	070	CC Noarlunga				no	all
Mid-North*	049	DHUD	18	30x30m	Oct 1992	in prep.	all
Mount Brown CP Vegetation survey	066	NCSSA	2 (part)	30x30m	Oct 1994	in MN	all
Angaston District Council	055	M Chapman	2		Oct-Nov 1993	in GWL & MN	all
Temperate Grassland (TG) Survey	046	M Hyde (WWF)	12	30x30m	Sept-Nov 1991	composite#	part
Grassy Woodland survey (*E odorata*)	054	M Hyde	13	30x30m	1993,1994	composite#	part
Flinders Ranges (southern sector)	006	DENR	6		~ July 1986-April 1987		part
MHyde	047	M Hyde					excluded
Lofty Block Grasslands	083	DENR	74	30x30m, 50x50m	Oct 1995-Dec 1996	no	all
Upper Mid-North	086	DHUD	4	30x30m	Oct 1996	no	part
Northern Adelaide Plains	088	DHUD	8	30x30m	Nov 1996	no	all

* Mid-North PATN analysis is in progress and combines sites from several surveys in the region

"composite" - these analyses included a selection of sites from various surveys from the settled districts and Flinders Ranges (statewide excluding arid far north)

Mapsheets are 1:50 000 scale

ABBREVIATIONS: Survey coordinators

DHUD- Department of Housing and Urban Development; DENR- Department of Environment and Natural Resources; NPWS- National Parks & Wildlife Service; DEP Department of Environment and Planning (now DEHAA & DTUPA).

NCSSA- Nature Conservation Society of South Australia

CC HV- Corporation of the City of Happy Valley; DC Stirling- District Council of Stirling; CC Noarlunga- Corporation of the City of Noarlunga.

WWF- World Wide Fund for Nature, Australia

Appendix II

STANDARD VEGETATION CLASSIFICATIONS USED IN FIELD DATA RECORDING

adapted from Muir (1977)

Life form/height class			Canopy cover			
			Dense d	Mid-dense c	Sparse i	Very sparse r
1	T	trees >30m	>70% Dense Tall Forest	30-70% Tall Forest	10-30% Tall Woodland	<10% Open Tall Woodland
2	M	trees 15-30m	Dense Forest	Forest	Woodland	Open Woodland
3	LA	trees 5-15m	Dense Low Forest A	Low Forest A	Low Woodland A	Open Low Woodland A
4	LB	trees < 5m	Dense Low Forest B	Low Forest B	Low Woodland B	Open Low Woodland B
5	KT	mallee > 3m	Dense Mallee	Mallee	Open Mallee	Very Open Mallee
6	KS	low mallee < 3m	Dense Low Mallee	Low Mallee	Open Low Mallee	Very Open Low Mallee
7	S	shrubs > 2m	Dense Thicket	Thicket	Scrub	Open Scrub
8	SA	shrubs 1.5-2.0m	Dense Heath A	Heath A	Low Scrub A	Open Low Scrub A
9	SB	shrubs 1.0-1.5m	Dense Heath B	Heath B	Low Scrub B	Open Low Scrub B
10	SC	shrubs 0.5-1.0m	Dense Low Heath C	Low Heath C	Dwarf Scrub C	Open Dwarf Scrub C
11	SD	shrubs 0.0-0.5m	Dense Low Heath D	Low Heath D	Dwarf Scrub D	Open Dwarf Scrub D
12	GT	grass > 0.5m	Dense Tall Grass	Tall Grass	Open Tall Grass	Very Open Tall Grass
13	GL	grass <0.5m	Dense Low Grass	Low Grass	Open Low Grass	Very Open Low Grass
16	H	hummock grass	Dense Hummock Grass	Mid-dense Hummock Grass	Hummock Grass	Open Hummock Grass
17	VT	sedges > 0.5m	Dense Tall Sedges	Tall Sedges	Open Tall Sedges	Very Open Tall Sedges
18	VL	sedges < 0.5m	Dense Low Sedges	Low Sedges	Open Low Sedges	Very Open Low Sedges
19	P	mat plants	Dense Mat Plants	Mat Plants	Open Mat Plants	Very Open Mat Plants
21	J	herbaceous spp.	Dense Herbs	Herbs	Open Herbs	Very Open Herbs
22	V	vines	Dense Vines	Vines	Open Vines	Very Open Vines
23	MI	mistletoes	Dense Mistletoes	Mistletoes	Open Mistletoes	Very Open Mistletoes
24	X	ferns	Dense Ferns	Ferns	Open Ferns	Very Open Ferns
25	MO	mosses	Dense Mosses	Mosses	Open Mosses	Very Open Mosses
26	LI	lichens	Dense Lichens	Lichens	Open Lichens	Very Open Lichens

Life Forms

Trees - woody; perennial;erect;canopy raised well above the ground. Depth of Canopy is usually less than or equal to two thirds of the total tree height. Single stemmed, or if multistemmed, fewer than 5 individual trunks resulting from branching of asingle short trunk, that is not a mallee-like lignotuber.Height usually >2m.

Mallees - genus *Eucalyptus*; multi-stemmed, trunks arising from lignotuber. Shrub mallee - five or more trunks. Tree mallee - usually less than five trunks.

Shrubs - woody; perennial;erect, procumbent or weeping; foliage occupies all or part of total plant height; multiple stems and branches arising from a rootstock or very short common trunk; generally <5m tall.

Hummock Grass - Genera *Triodia* or *Plectrachne* only.

Grasses(tussock) - family Poaceae (Gramineae); leaf sheath always split.

Sedges - herbaceaous, usually perennial, erect, generally tufted; arise form stolons, tubers, bulbs, rhizomes or seeds. Leaf sheath never split. Includes Cyperaceae, Juncaceae, Restionaceae, Typhaceae and Xyridaceae and other sedge-like forms.

Herbs - herbaceous or slightly woody; annual or sometimes perennial; erect or creepers; rarely exceeds 0.5m height.

Ferns - vascular cryptogams of the Order Filicales.

Cover/Abundance Scale

[adapted from Braun-Blanquet (1932, in Gullan et al. 1976)]

N - 1-10 individual plants; cover small (less than 5%)
T - sparsely present; cover small (less than 5%)
1 - plentiful; but of small cover (less than 5%)
2 - any number of individuals covering 5-25% of the area
3 - any number of individuals covering 25-50% of the area
4 - any number of individuals covering 50-75% of the area
5 - any number of individuals covering more than 75% of the area

SOUTH AUSTRALIAN VEGETATION STRUCTURAL FORMATIONS

Adapted from Specht (1970) and Muir (1977)

Life form/ height class	Canopy cover of Tallest Stratum			
	Dense (>70%)	Mid-dense (30-70%)	Sparse (10-30%)	Very sparse (<10%)
Trees < 30m	Tall closed forest	Tall Forest	Tall Woodland	Tall open woodland
Trees 10-30m	Closed forest	Forest	Woodland	Open woodland
Trees 5-10m	Low closed forest	Low forest	Low woodland	Open low woodland
Mallee tree > 3m	Closed tree mallee	Mallee	Open mallee	Very open mallee
Mallee shrub < 3m	Closed shrub mallee	Low mallee	Open low mallee	Very open low mallee
Shrubs > 2m	Tall closed shrubland	Tall shrubland	Tall open shrubland	Tall very open shrubland
Shrubs 1-2m	Closed shrubland	shrubland	Open shrubland	Very open shrubland
Shrubs < 1m	Closed low shrubland	Low shrubland	Open low shrubland	Very open low shrubland
Tussock grasses	Closed (tussock) Grassland	(Tussock) Grassland	Open (tussock) Grassland	Very open (tussock) Grassland
Hummock grasses	Closed Hummock Grassland	Hummock Grassland	Open Hummock Grassland	Very Open Hummock Grassland
Sedges	Closed Sedgeland	Sedgeland	Open Sedgeland	Very Open Sedgeland
Herbs	Closed Herbland	Herbland	Open Herbland	Very Open Herbland
Ferns	Closed Fernland	Fernland	Open Fernland	Very Open Fernland

Appendix III

PLANT SPECIES FROM GRASSLAND AND GRASSY WOODLAND IN THE LOFTY BLOCK SURVEY AREA BY FLORISTIC GROUP

Taxonomic Decisions for PATN Analysis

LABEL	Lumped taxon	Comments
Acacligu	*Acacia ligulata*	may include some *A.cupularis*
Acacreti	*Acacia retinodes var. retinodes (hill form)*	includes all records of *A. retinodes*
Airasp.	*Aira sp.*	Includes all *Aira* spp
Ajugaust	*Ajuga australis form A*	Includes 3 specimens not allocated to form
Allomuel	*Allocasuarina muelleriana ssp. muelleriana*	ssp.updated
Arthfimb	*Arthropodium fimbriatum*	includes 1 *A. milleflorum* probably misidentified
Avenbafa	*Avena sp.*	*A. barbata & A .fatua* (not reliably distinguished in the field - most records are likely to be *A. barbata*)
Bromdiri	*Bromus diandrus/rigidus*	includes *B. diandrus & B.rigidus*
Calopurp	*Calostemma purpureum*	includes C.sp
Cardtenu	*Carduus tenuiflorus*	includes 12 identified as C.sp
Cartlana	*Carthamus lanatus*	includes 6 identified as C.sp
Centmeli	*Centaurea melitensis*	includes 3 identified as C.sp
Cerasemi	*Cerastium semidecandrum*	sensu lat
Chorglom	*Choretrum glomeratum var. chrysanthum*	includes 2 identified only as var. - habitat suggests var *chrysanthum*
Corrglab	*Correa glabra*	includes 1 record identified as C.sp
Correfl	*Correa reflexa*	single record in region
Dantcaes	*Danthonia caespitosa group*	includes *D.erianiha & D. tenuior*
Dantpilo	*Danthonia pilosa var.*	includes both varieties.
Dodovisc	*Dodonaea viscosa* ssp. *angustissima /spatulata*	includes *D.viscosa* spp., spp. *angustissima* & ssp. *spatulata*
Erodcrin	*Erodium crinitum*	inc. 4 records identified as *cygnorum* prob in error
Eucadumo	*Eucalyptus dumosa*	includes 1 record identified as *E.percostata*
Eutamicr	*Eutaxia microphylla var. microphylla*	includes 29 records not id'd to variety
Galepube	*Galenia pubescens var. pubescens*	includes 1 record of *Galenia* .sp
Glycclan	*Glycine clandestina var. sericea*	includes 1 record id'd as var. *clandestina* prob in error
Grevilic	*Grevillea ilicifolia var. ilicifolia*	var updated
Leptscab	*Leptorhynchos scabrus*	may be error - *L. elongatus*
Lolipere	*Lolium perenne*	includes 18 records that are hybrids between *L.perenne & L. rigidus*
Marsdrum	*Marsilea drummondii*	includes 3 records identified as M.sp
Micrunif	*Microtis unifolia complex*	includes all species: *M. arenaria, M. frutetorum, M. parviflora, M. uniflora*
Oleapann	*Olearia pannosa ssp. pannosa*	includes 9 records not id'd to ssp.
Pimecurv	*Pimelea curviflora var.*	2 ssp. lumped due to difficulty in separating taxa
Planvari	*Plantago varia complex*	includes. *P.drummondii, P.gaudichaudii, P.aff. debilis, P.hispida, P.varia*
Sclediac	*Sclerolaena diacantha*	includes *S.uniflora*
Soncoler	*Sonchus oleraceus*	includes 13 records id'd as *S. tenerrimus*
Sparsp.	*Sparaxis sp.*	includes *S. bulbifera & S. tricolor*
Stacsp.	*Stackhousia sp.*	includes *S.monogyna & S.aspericocca*
Stipmoll	*Stipa mollis group*	includes *S.hemipogon & S.mollis*
Swaioroc	*Swainsona oroboides complex*	records are probably all *S.behriana*
Trioscar	*Triodia scariosa ssp.*	inc. 39 recs not id'd to sp.& 52 records id'd as *T.irritans* probably in error
Vulpsp.	*Vulpia sp.*	includes all Vulpia records: *V. bromoides, V. ciliata, V. muralis, V. myuros*

Species Frequency in Floristic Groups

Some taxa were grouped for purpose of analysis as above. Plant taxonomy follows Jessop (1993) except where taxa are grouped, or updated since 1993 in the SA FLORA database. Species are arranged in alphabetical order.
Floristic group names and descriptions in text of report. Life form: P perennial, A annual, S seasonal, PG perennial grass, O orchid, M mistletoe. In the case of taxa with a frequency of 9 or fewer, (not included in PATN analysis) A denotes either annual or seasonal. Origin:* denotes not native in the Lofty Block. No. gps: number of groups in which taxon occurs.

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Abutilon fraseri	P	6	2			1		5											
Abutilon halophilum	P	1	1					1											
Acacia acinacea	P	21	7		1		4		8		2		1			1	4		
Acacia ancistrophylla /sclerophylla	P	1	1	1															
Acacia argyrophylla	P	3	3			1	1	1											
Acacia brachybotrya	P	4	4	1								1	1					1	
Acacia burkittii	P	1	1			1													
Acacia calamifolia	P	44	13	3	3	9	2	10	3	5	2	2	1		2			1	1
Acacia continua	P	44	10			1		1		3	5	1	1		1	1		28	2
Acacia cupularis	P	1	1							1									
Acacia cyclops	P	1	1										1						
Acacia glandulicarpa	P	2	2		1						1								
Acacia gracilifolia	P	4	1															4	
Acacia hakeoides	P	19	7	1	9	1	3	1	3			1							
Acacia iteaphylla	P	5	3			1		2									2		
Acacia ligulata	P	20	7		8		3	2		2		1	1					3	
Acacia longifolia var. longifolia	P*	1	1														1		
Acacia montana	P	1	1															1	
Acacia notabilis	P	17	7		3	1	5		3	3	1							1	
Acacia nyssophylla	P	10	4	1	3			5					1						
Acacia oswaldii	P	12	4		4		4	2	2										
Acacia papyrocarpa	P	1	1		1														
Acacia paradoxa	P	42	9	1	1		1		5		4		1			10	17	2	
Acacia pravifolia	P	5	5			1			1	1		1							1
Acacia pycnantha	P	169	14	7	9	3	1		28	4	14	4	13	2		28	18	22	16
Acacia retinodes var. retinodes	P	3	3	1						1						1			
Acacia rupicola	P	4	4						1	1								1	1
Acacia salicina	P	1	1		1														
Acacia spinescens	P	1	1						1										
Acacia tetragonophylla	P	1	1			1													
Acacia victoriae ssp. victoriae	P	51	10	1	13	1	1	24	3			1	4		2			1	
Acacia wattsiana	P	17	5						5		1	1				2		8	
Acaena echinata var.	S	90	10	2	1				8		6		3	2		36	16	9	7
Acetosella vulgaris	P*	1	1								1								
Acianthus caudatus var.	O	1	1													1			
Acianthus pusillus	O	3	1															3	
Acrotriche affinis	P	2	1													2			
Acrotriche patula	P	6	5							1	1	1				1		2	
Acrotriche serrulata	P	4	2													2	2		
Actinobole uliginosum	A	32	10	1	2	4	2	3	12	1	.		3			3			1
Adriana klotzschii	P	2	2	1				1											
Agrostis avenacea var.	A	5	3													2	2	1	
Agrostis capillaris var. capillaris	P*	1	1													1			
Aira sp.	A*	128	12	5	1				18	2	16	2	10	9		29	5	26	5
Ajuga australis form A	S	11	5						1						1	4		1	4
Ajuga iva	P*	1	1		1														
Alectryon oleifolius ssp. canescens	P	18	7				5	4	4	1		2						1	1
Allocasuarina muelleriana ssp.	P	2	1															2	
Allocasuarina verticillata	P	158	14	7			2	1	14	3	20	5	11	1	1	24	9	49	11
Alyogyne huegelii	P	5	3							1								1	3
Alyssum linifolium	A*	9	4		1		2	5	1										
Alyxia buxifolia	P	3	2				2											1	
Amaranthus albus	A*	2	2		1								1						
Amphipogon caricinus var. caricinus	PG	14	6						1		6		2			2	1	2	
Amphipogon strictus var. setifer	PG	1	1									1							
Amsinckia lycopsoides	A*	2	2									1		1					
Amyema miquelii	M	56	12			1	2		18	2	1	2	5	1		11	2	8	3
Amyema miraculosum ssp. boormanii	P	3	1		3														
Amyema preissii	P	3	2		2		1												

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Anacampseros australiana	P	3	3					1				1							1
Anagallis arvensis	A*	138	14	2	2	5	6	1	19	11	9	3	2			20	12	35	11
Angianthus tomentosus	A	1	1				1												
Anogramma leptophylla	A	1	1															1	
Aphanes australiana	A	2	1																2
Arabidella filifolia	P	1	1					1											
Arabidella trisecta	P	4	1					4											
Arctotheca calendula	A*	127	16	8	11	5	7	4	24	4	10	3	6	3	3	17	5	15	2
Arenaria leptoclados	A*	1	1							1									
Aristida anthoxanthoides	A	1	1													1			
Aristida behriana	PG	128	13	16	6		2	7	6		18	2	30	22	7	9		1	2
Aristida holathera var. holathera	PG	1	1								1								
Arthropodium fimbriatum	S	45	9	3	7	1	6		6		10		9			1	2		
Arthropodium minus	S	17	9	2		1	2	2	1		1	3						2	3
Arthropodium strictum	S	263	16	8	16	10	14	2	35	6	18	9	22	6	1	45	12	48	11
Asclepias rotundifolia	P*	11	4	2					1		1						7		
Asperula conferta	S	83	14	2	12	1		2	21	1	3	2	10	5	1	7		8	8
Asperula syrticola	P	1	1						1										
Asphodelus fistulosus	P*	48	8	4	19		4	16	1			1	2		1				
Asplenium flabellifolium	P	2	2													1			1
Aster subulatus	P*	3	3						1				1						1
Asteridea athrixioides forma athrixioides	A	5	3	1	3										1				
Astroloma conostephioides	P	4	2						3								1		
Astroloma humifusum	P	89	8						6	4	5	1				12	17	39	5
Atriplex acutibractea ssp. acutibractea	P	3	3		1				1					1					
Atriplex angulata	P	4	1					4											
Atriplex eardleyae	P	5	1					5											
Atriplex holocarpa	A	3	2		1			2											
Atriplex leptocarpa	A	2	1					2											
Atriplex lindleyi ssp. inflata	A	2	2				1	1											
Atriplex semibaccata	P	42	8	4	15		2	1	11				7	1					1
Atriplex spongiosa	A	1	1					1											
Atriplex stipitata	P	25	5		9		4	9	2				1						
Atriplex suberecta	A	3	2	1								2							
Atriplex vesicaria	P	6	4			1	1	3				1							
Avellinia michelii	A*	22	10	7			1	1	3		1	2		1		1		4	1
Avena barbata/fatua	A*	344	16	24	35	13	21	32	38	10	19	11	23	25	6	38	5	32	12
Avena sativa	A*	2	2	1									1						
Banksia marginata	P	2	2													1	1		
Beyeria lechenaultii	P	13	5		3		4	1		3								2	
Billardiera cymosa	P	6	3						1							1	4		
Billardiera versicolor	P	8	2							2								6	
Blennospora drummondii	A	2	2						1							1			
Boerhavia dominii	S	24	6	6				12		1			1	2	2				
Bolboschoenus caldwellii	P	1	1													1			
Bossiaea prostrata	P	4	3													1	2	1	
Bothriochloa macra	P	1	1		1														
Brachychiton populneus	P*	1	1														1		
Brachycome ciliaris var. ciliaris	S	15	8	3	1	3	2	1	2	1								2	
Brachycome ciliaris var. lanuginosa	S	9	5		2	1		3	1				2						
Brachycome ciliaris var. lyrifolia	P	1	1																1
Brachycome ciliaris var. subintegrifolia	S	12	4				2		6			3	1						
Brachycome dichromosomatica var. dichromosomatica	A	2	2		1			1											
Brachycome exilis	A	1	1											1					
Brachycome goniocarpa	A	1	1		1														
Brachycome leptocarpa	A	1	1		1														
Brachycome linearifloba	A	62	10	4	10	7	5	18	10	1	1	4	2						
Brachycome perpusilla	A	2	1						2										
Brachycome trachycarpa	P	1	1						1										
Brachypodium distachyon	A*	146	16	8	13	4	8	5	22	4	15	4	11	2	1	11	14	13	11
Bracteantha bracteata	A	3	3			1						1							1
Brassica juncea	A*	2	1						2										
Brassica tournefortii	A*	12	5	5	1		3	1			2								
Briza maxima	A*	102	11	1					18	1	6	1	6	1		32	22	13	1
Briza minor	A*	53	10	1			1		11	1	1		2	2		16	6	12	
Bromus arenarius	A	2	2		1								1						
Bromus diandrus/rigidus	A*	170	16	11	22	1	11	14	27	5	14	1	17	7	3	24	2	8	3

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Bromus hordeaceus ssp. hordeaceus	A*	44	9	2				1	6		5		9	12		5		2	2
Bromus lanceolatus	A*	3	2						1							2			
Bromus madritensis	A*	45	13		1	5	2	3	8	1	2		4	1		6	2	6	4
Bromus rubens	A*	212	15	24	35	13	14	41	17	4	8	6	15	13	6	7		5	4
Brunonia australis	P	2	2													1	1		
Buglossoides arvensis	A*	21	10	5	4	3	1	2	1		1	2	1					1	
Bulbine bulbosa	S	97	12	3	11			2	14		5	2	11	4		23	14	7	1
Bulbine semibarbata	A	7	4				1	1	4					1					
Bupleurum semicompositum	A*	19	7	3	3		6		3	1		2				1			
Burchardia umbellata	A	5	3						1							2	2		
Bursaria spinosa	P	194	16	10	14	1	7	3	28	8	19	8	14	7	1	20	7	35	12
Caesia calliantha	S	35	6	1					5		3					5	10	11	
Caladenia carnea var. carnea	O	2	2													1		1	
Caladenia clavula	O	7	3						2	1								4	
Caladenia patersonii complex	O	2	2							1								1	
Caladenia tensa	O	2	1									2							
Caladenia tentaculata	O	2	2													1	1		
Calandrinia calyptrata	A	12	7	1			3		2	1		1				3		1	
Calandrinia eremaea	A	21	11	1	1	1	3	3	4	1	1	2						1	3
Calandrinia granulifera	A	1	1				1												
Calandrinia polyandra var. polyandra	A	1	1						1										
Calandrinia volubilis	A	2	2					1											1
Calendula arvensis	A*	11	3		2	2		7											
Callistemon teretifolius	P	6	3						1	1								4	
Callitris glaucophylla	P	48	9		2	11	1	4	6			5	1					11	7
Callitris preissii	P	42	8	4	6		16		6		2		1			3		4	
Callitris verrucosa	P	1	1																1
Calocephalus citreus	P	46	9	2					11		2	1	10	9		9	1	1	
Calostemma purpureum	S	49	11		4		4		5		2	2	2	1		10	7	8	4
Calotis hispidula	A	45	10	4	9	5	6	9	7		1	2	1					1	
Calytrix tetragona	P	26	7						1	1	1	1					1	18	3
Capsella bursapastoris	A*	4	3			2		1	1										
Carduus tenuiflorus	A*	49	13	2	1	8	2	2	10	2			1	1	2	7		4	7
Carex appressa	P	2	2						1				1						
Carex breviculmis	P	19	4										1			8	8	2	
Carex gaudichaudiana	P	1	1													1			
Carex inversa var.	P	2	2						1								1		
Carex tereticaulis	P	1	1														1		
Carpobrotus aequilaterus	P	1	1		1														
Carpobrotus modestus	P	1	1	1															
Carpobrotus sp.	P	5	2		1				4										
Carrichtera annua	A*	104	11	1	30	7	8	42	5	3	1	4	2		1				
Carthamus lanatus	A*	148	14	17	13	10		30	10	2	7	5	17	17	3	2		11	4
Cassinia arcuata	P	8	4		1		3		3	1									
Cassinia laevis	P	64	10			5		1		3	1	4	2		1	2		28	17
Cassinia uncata	P	22	6						1	1			1			2		13	4
Cassytha glabella forma dispar	P	1	1				1												
Cassytha melantha	P	4	4					1	1	1								1	
Cassytha peninsularis var. flindersii	P	6	1															6	
Cassytha pubescens	P	1	1														1		
Casuarina pauper	P	1	1					1											
Centaurea calcitrapa	A*	1	1	1															
Centaurea melitensis	A*	41	12	2	2	5	2	8	7	1	1	2	5		1				5
Centaurium erythraea	A*	12	5	1					3		5		2					1	
Centaurium maritimum	A*	1	1														1		
Centaurium spicatum	A*	6	6							1	1		1	1		1		1	
Centaurium tenuiflorum	A*	2	2													1	1		
Centrolepis aristata	A	2	2								1						1		
Centrolepis cephaloformis ssp. cephaloformis	A	1	1						1										
Centrolepis strigosa	A	3	3						1		1						1		
Cerastium glomeratum	A*	23	5						5		1					6		7	4
Cerastium semidecandrum	A*	4	3	2			1									1			
Chamaescilla corymbosa var. corymbosa	A	3	3								1					1	1		
Chasmanthe floribunda var. floribunda	S*	1	1													1			
Cheilanthes austrotenuifolia	S	121	11	1			1		16	3	8	4	3			21	8	41	15
Cheilanthes distans	P	8	5				1	1				2	1					3	
Cheilanthes lasiophylla	P	18	8			1	2	2		2	2	2	1					6	

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Cheilanthes sieberi ssp. sieberi	P	17	8		1	1					4	2	1			3		4	1
Cheiranthera alternifolia	P	5	2							1								4	
Chenopodium cristatum	A	1	1		1														
Chenopodium curvispicatum	P	1	1					1											
Chenopodium desertorum ssp. desertorum	P	6	3				1		4				1						
Chenopodium desertorum ssp. microphyllum	P	28	9		1	1	8	1	7	3			1	5		1			
Chenopodium nitrariaceum	P	2	2				1	1											
Chenopodium pumilio	P	1	1											1					
Chloris truncata	A	4	3				1	2	1										
Choretrum glomeratum var.	P	5	3						2	1						2			
Chrysanthemoides monilifera	P*	15	2						1								14		
Chrysocephalum apiculatum	P	91	15	7	4	2	3	2	8	2	8	8	11	7		12	2	14	1
Chrysocephalum semicalvum ssp. semicalvum	P	2	2										1					1	
Chrysocephalum semipapposum	P	58	12	1	4		2	2	13		8	7	11	4		2	2	2	
Cirsium vulgare	A*	4	3										1	1		2			
Citrullus lanatus	A*	1	1				1												
Clematis microphylla	P	45	11		1	1	4	1	10	2		1	1			3		11	10
Comesperma volubile	P	2	2							1								1	
Convolvulus arvensis	P*	2	2					1					1						
Convolvulus erubescens	S	111	13	23	17	7	4	8	3		2	4	14	22	3	2	2		
Convolvulus microsepalus	P	3	1					3											
Convolvulus remotus	S	106	15	2	12	4		23	4	2	12	3	13	5	3	11	3	1	8
Correa glabra	P	1	1													1			
Correa reflexa	P	1	1							1									
Cortaderia selloana	P*	1	1														1		
Cotoneaster glaucophyllus	P*	1	1														1		
Cotula australis	A	6	4			1			3							1			1
Craspedia glauca	A	17	6		2			2				2				1		6	4
Craspedia globosa	P	1	1						1										
Craspedia pleiocephala	A	17	3		3		1	13											
Crassula closiana	A	1	1													1			
Crassula colorata var.	A	117	15	6	8	7	8	12	32	2	7	8	12	1	1	9		3	1
Crassula decumbens var. decumbens	A	35	5						18			1	1			12		3	
Crassula sieberiana ssp.	A	83	14	5	5	3	9	3	27	3	3	5	1			7	1	6	5
Crepis foetida ssp. foetida	A*	3	3							1	1		1						
Critesion marinum	A*	1	1					1											
Critesion murinum	A*	118	15	5	20	9	16	36	12	1	1	3	4	2	2	3		3	1
Cryptandra amara var. amara	P	11	4		1		1						3	6					
Cryptandra amara var. longiflora	P	32	9	2							10	2	5	7	1	1		3	1
Cryptandra tomentosa	P	1	1														1		
Cucumis myriocarpus	A*	1	1											1					
Cyanicula deformis	O	1	1															1	
Cymbonotus preissianus	P	21	7			1			9		1		1	2		4			3
Cymbopogon ambiguus	PG	16	10	1	2	1		5		1	1	1	2					1	1
Cymbopogon obtectus	PG	1	1								1								
Cynara cardunculus	A*	17	8		5		2		2		1		1	3		2			1
Cynodon dactylon	P*	8	5	1	3						2		1						1
Cynoglossum suaveolens	S	13	5						5		1		1			5		1	
Cynosurus echinatus	A*	22	6						2		3		1			8	7	1	
Cyperus alterniflorus	P	1	1						1										
Cyperus tenellus	A	3	3								1					1	1		
Cyperus vaginatus	P	5	2														1		4
Cyrtostylis reniformis	O	1	1															1	
Cytisus proliferus	P*	1	1													1			
Dactylis glomerata	P*	4	1														4		
Dampiera dysantha	P	6	1															6	
Danthonia auriculata	PG	69	13	3	1		1	4	13		7	2	8	6		13	3	5	3
Danthonia caespitosa group	PG	319	16	23	43	18	23	35	36	4	18	10	26	19	4	24	9	18	9
Danthonia carphoides var. carphoides	PG	19	6	1							2		1	10		4		1	
Danthonia geniculata	PG	6	4			1					2					2			1
Danthonia laevis	PG	4	2		2											2			
Danthonia linkii var. fulva	PG	2	2		1				1										
Danthonia pilosa var.	PG	27	10	2	1		1		4		2		2	2		4	4	5	
Danthonia racemosa var. racemosa	PG	21	9	1				1			1		1	2		8	3	3	1
Danthonia setacea var. setacea	PG	106	16	1	6	2	2	1	27	6	11	3	10	8	1	13	7	3	5
Daucus glochidiatus	A	164	16	9	6	9	6	9	28	7	6	10	9	4	1	10	3	34	13
Daviesia genistifolia	P	6	5		1				1	1			1					2	

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Daviesia leptophylla	P	2	2														1	1	
Daviesia ulicifolia	P	1	1														1		
Derwentia decorosa	P	7	2															2	5
Desmazeria rigida	A*	27	11	2	3		3	1	7	2		1	1			2		1	4
Deyeuxia densa	PG	2	1															2	
Dianella longifolia var. grandis	S	3	2													2	1		
Dianella revoluta var.	P	211	15	7	20	4	12		19	12	16	6	20	6	1	19	21	33	15
Dianella revoluta var. divaricata	P	16	4						4		1							9	2
Dichelachne crinita	PG	12	5						1							5	1	4	1
Dichondra repens	S	15	8	1					1				1	1		1	7	1	2
Dillwynia hispida	P	4	2													1	3		
Dissocarpus biflorus var. biflorus	P	1	1				1												
Dissocarpus paradoxus	P	5	2		1			4											
Dittrichia graveolens	A*	13	5		7	1							3		1				1
Diuris palustris	O	1	1															1	
Dodonaea baueri	P	15	7		2	2	3		2	1	4	1							
Dodonaea bursariifolia	P	2	1							2									
Dodonaea lobulata	P	8	2			1		7											
Dodonaea procumbens	P	1	1								1								
Dodonaea viscosa ssp.	P	68	13	1	5	5	2	7	5		3	3	2			1	6	19	9
Dodonaea viscosa ssp. cuneata	P	1	1						1										
Drosera auriculata	A	13	3													4	3	6	
Drosera glanduligera	A	6	5	1					1		1					2		1	
Drosera macrantha ssp. planchonii	A	15	5						2	1	2	1						9	
Drosera peltata	A	13	4						2		2					4		5	
Drosera whittakeri	A	7	4						1			1				4	1		
Echinopogon ovatus var. ovatus	A	2	2													1		1	
Echium plantagineum	A*	277	16	17	26	9	13	32	37	7	25	6	22	18	6	19	7	22	11
Ehrharta calycina	P*	7	4						2		2					2		1	
Ehrharta longiflora	A*	49	10		3		5	2	8		2		3			7	14	4	1
Einadia nutans ssp. nutans	P	139	16	7	7	4	20	11	32	4	6	2	14	3	1	5	1	6	16
Elachanthus pusillus	A	17	6	1	6	1		7				1		1					
Elymus scabrus var. scabrus	PG	94	12	1	2	1			23		5	1	17	3		20	7	9	5
Enchylaena tomentosa var. tomentosa	P	139	13	6	28	10	26	27	19	2	6	6	4	2	2				1
Enneapogon nigricans	PG	68	13	16	9		4	10	1	1	8	1	11	3	2	1			1
Enteropogon acicularis/ramosus	PG	27	8		9		2	7	1		2	1	4		1				
Eremophila alternifolia	P	7	3		1	2		4											
Eremophila deserti	P	2	2					1	1										
Eremophila glabra	P	10	4		3				2	3		2							
Eremophila longifolia	P	26	9	1	8	1	2	7	1		2	3	1						
Eremophila oppositifolia var.	P	3	3			1			1			1							
Eremophila santalina	P	4	2							3		1							
Eremophila subfloccosa ssp.	P	1	1				1												
Eriochilus cucullatus	O	1	1									1							
Eriochiton sclerolaenoides	P	23	7	1	4	1	1	14					1			1			
Eriochlamys behrii	A	7	5		1			3	1				1		1				
Erodium botrys	A*	86	13	18	8		2	2	6		6	1	9	17		11	1	4	1
Erodium brachycarpum	A*	6	2		4								2						
Erodium cicutarium	A*	54	10	9	14	9		8	2	1		4			1			3	3
Erodium cygnorum ssp./cicutarium	A	52	12		16	6	1	14	1	1	3	3	1	3	2			1	
Erodium moschatum	A*	5	1				5												
Eryngium rostratum	P	6	4								1		1	2		2			
Eucalyptus 'anceps'	P	1	1				1												
Eucalyptus aff. viridis	P	2	1																2
Eucalyptus albens	P	3	2										1			2			
Eucalyptus brachycalyx	P	1	1							1									
Eucalyptus calycogona var. calycogona	P	2	1				2												
Eucalyptus camaldulensis var. camaldulensis	P	18	8			1		5	1				1			3	2	2	3
Eucalyptus cladocalyx	P	10	4		1								1			2		6	
Eucalyptus dumosa	P	4	3	1			2											1	
Eucalyptus fasciculosa	P	1	1															1	
Eucalyptus goniocalyx	P	5	3													1		3	1
Eucalyptus gracilis	P	11	5		2	2	4	1		2									
Eucalyptus leptophylla	P	1	1															1	
Eucalyptus leucoxylon	P	89	13	1	2		2		14	1	3		6	1	1	32	4	21	1
Eucalyptus macrorhyncha ssp. macrorhyncha	P	2	1													2			
Eucalyptus microcarpa	P	68	7						1		1		4			4	23	17	18

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Eucalyptus odorata	P	102	12		1	3	6		52	9	5	1	2		1	16		4	2
Eucalyptus oleosa	P	1	1				1												
Eucalyptus porosa	P	30	7	1	3		15		2	1		2	6						
Eucalyptus socialis	P	25	6		2	3	8		2	9								1	
Eucalyptus viminalis ssp.	P	1	1													1			
Euchiton gymnocephalus	P	3	3				1		1	1									
Euchiton sphaericus	A	4	3			1		1										2	
Euphorbia drummondii	S	98	14	14	11	1	2	13	4		5	1	22	17	2	3		1	2
Euphorbia peplus	A*	1	1														1		
Euphorbia tannensis ssp. eremophila	P	1	1					1											
Euphorbia terracina	P*	3	3		1		1	1											
Eutaxia microphylla var. diffusa	P	7	5		1				1	1	2						2		
Eutaxia microphylla var. microphylla	P	74	12	2	1				16	10	5	4	5	2		6	1	16	6
Exocarpos aphyllus	P	25	8		6	1	2	4	5	2		4						1	
Exocarpos cupressiformis	P	21	4							1						6	8	6	
Exocarpos sparteus	P	8	5	1			1		1	1								4	
Festuca benthamiana	PG	1	1													1			
Foeniculum vulgare	P*	1	1																1
Fraxinus rotundifolia ssp. rotundifolia	P*	1	1													1			
Freesia hybrid	A*	1	1				1												
Fumaria capreolata ssp. capreolata	A*	2	2													1	1		
Fumaria densiflora	A*	2	2					1			1								
Fumaria muralis ssp.	A*	1	1															1	
Fumaria officinalis ssp. officinalis	A*	1	1													1			
Fumaria parviflora	A*	1	1		1														
Gahnia deusta	P	1	1	1															
Gahnia lanigera	P	8	5	4	1				1	1	1								
Galenia pubescens var. pubescens	P*	1	1										1						
Galenia secunda		1	1								1								
Galium binifolium	S	1	1																1
Galium divaricatum	A*	14	8	4					2		2		1	1		2	1	1	
Galium gaudichaudii	S	31	7						6	2				1		4	7	8	3
Galium migrans	S	17	8			1			2	2		1	2			1		5	3
Galium murale	A*	72	15	5	2	1	1	1	19	1	1	5	2	4	1	8		14	7
Galium spurium ssp. ibicinum	A*	6	6				1			1	1	1						1	1
Gastridium phleoides	A*	1	1															1	
Geijera linearifolia	P	2	2		1				1										
Genista monspessulana	P*	1	1													1			
Geranium dissectum	A*	2	2						1		1								
Geranium potentilloides var. potentilloides	P	4	3								1							2	1
Geranium retrorsum	S	52	9		2		1		6		1	1	7			17		11	6
Geranium solanderi var. solanderi	S	11	7	1		1						3	1			1	3	1	
Glaucium corniculatum var. corniculatum	A*	1	1		1														
Glossodia major	O	2	2						1							1			
Glycine clandestina var. sericea	S	93	14	11	5	2		3	3	2	9	6	6	7		3	1	20	15
Glycyrrhiza glabra	P*	1	1							1									
Gnaphalium indutum	A	2	2						1									1	
Gonocarpus elatus	S	131	12	1			5	1	14	2	23		9	6		24	10	34	2
Gonocarpus mezianus	P	7	2						1								6		
Gonocarpus tetragynus	S	20	4									1				8	4	7	
Goodenia albiflora	S	25	9		1	7	1		1	4	4	3						1	3
Goodenia amplexans	P	3	2							2							1		
Goodenia blackiana	P	16	4				1		6				1			8			
Goodenia fascicularis	P	32	7		5			21	1	1		2						1	1
Goodenia geniculata	P	6	2		1												5		
Goodenia lunata	P	2	2		1						1								
Goodenia pinnatifida	S	169	16	14	26	12	7	5	29	1	5	8	16	14	2	14	1	4	11
Goodenia pusilliflora	A	93	14	18	17	2	3	18	10	1	2	5	9	3	2			1	2
Goodenia robusta	S	29	4						1	1						2		25	
Goodenia willisiana	P	6	5	1			1		1	2	1								
Grevillea huegelii	P	1	1		1														
Grevillea ilicifolia var. ilicifolia	P	2	2								1	1							
Grevillea lavandulacea var.	P	9	2								1							8	
Gynandriris setifolia	S*	154	15	20	32		10	10	17	4	7	1	15	7	5	11	5	9	1
Gypsophila tubulosa	A*	6	4					2	2		1							1	

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Haeckeria punctulata	P	1	1			1													
Hainardia cylindrica	A*	1	1					1											
Hakea carinata	P	1	1						1										
Hakea leucoptera	P	4	3		2							1	1						
Hakea rugosa	P	1	1								1								
Halgania cyanea	P	7	7	1	1				1	1	1	1	1						
Haloragis acutangula forma	P	2	2						1					1					
Haloragis aspera	A	3	3		1							1	1						
Halosarcia pergranulata ssp./indica	P	2	1				2												
Hardenbergia violacea	P	10	3						2							1	7		
Harmsiodoxa brevipes var. brevipes	A	1	1		1														
Hedypnois rhagadioloides	A*	99	16	9	8	5	3	9	20	5	5	3	11	6	1	5	2	4	3
Helichrysum leucopsideum	S	13	7	2	2		4		1	2	1					1			
Heliotropium asperrimum	P	4	4					1		1		1			1				
Heliotropium europaeum	A*	3	3	1				1						1					
Herniaria cinerea	A*	8	6		1	1		2	2	1		1							
Hibbertia exutiacies	P	45	6						5				2			8	11	16	3
Hibbertia riparia (canescens)	P	5	1															5	
Hibbertia riparia (glabriuscula)	P	1	1														1		
Hibbertia sericea var.	P	10	2													2	8		
Hibbertia stricta var. stricta	P	4	1														4		
Holcus lanatus	A*	2	2										1				1		
Homeria flaccida	S*	19	4								2					11	5	1	
Homeria miniata	S*	2	2		1											1			
Homopholis proluta	PG	13	7		4			1			2		1	2	1	2			
Hyalosperma demissum	A	18	7	1					8			1	1			3		3	1
Hyalosperma glutinosum ssp. glutinosum	A	15	8	1	1			2	4			2	3			1			1
Hyalosperma semisterile	A	45	11	5	4	4	1	7	9		4	3	5	1					2
Hybanthus floribundus ssp. floribundus	P	3	2															2	1
Hybanthus monopetalus	P	1	1									1							
Hydrocotyle callicarpa	A	8	2						6									2	
Hydrocotyle foveolata	A	7	2						5									2	
Hydrocotyle hirta	A	1	1															1	
Hydrocotyle laxiflora	P	33	6						6		1		2			15		3	6
Hydrocotyle trachycarpa	A	1	1															1	
Hymenanthera dentata	P	6	4										2	1		1			2
Hypericum gramineum	A	1	1													1			
Hypericum perforatum	P*	7	2													6	1		
Hypochaeris glabra	A*	232	16	22	10	10	7	23	29	7	14	9	18	16	3	22	1	32	9
Hypochaeris radicata	P*	101	15	5	7	1		3	8	1	11	1	11	13	2	20	7	9	2
Hypoxis glabella var. glabella	A	24	9	5	8	1			1				2	1		2		1	3
Indigofera australis var. australis	P	10	3							1								6	3
Indigofera leucotricha	P	1	1															1	
Iris germanica	S*	1	1																1
Isoetopsis graminifolia	A	36	10	8	6	1		6	2			2	2	3				4	2
Isolepis hookeriana	A	1	1													1			
Isolepis marginata	A	7	5						1	1	1					3		1	
Isotoma petraea	P	2	1															2	
Ixiolaena leptolepis	P	7	2		5			2											
Ixiolaena tomentosa	P	6	2			2		4											
Juncus acutus	P	1	1																1
Juncus aridicola	P	1	1																1
Juncus bufonius	A*	3	3											1			1	1	
Juncus capitatus	A*	8	6	1					2		1					2	1	1	
Juncus effusus	P	1	1								1								
Juncus flavidus	P	2	1													2			
Juncus kraussii	P	1	1											1					
Juncus subsecundus	P	21	6						3		1		2			8	6		1
Kennedia prostrata	P	22	7	1	1				1		2					8	2	7	
Kickxia elatine ssp. crinita	P*	1	1								1								
Lactuca serriola	A*	16	8		1		3	1	5		2		1			2		1	
Lagenifera huegelii	S	79	9				2		23	1	1		2			15	10	16	9
Lagurus ovatus	A*	3	2								2					1			
Lamarckia aurea	A*	32	10		1	3	2	6	12	2	1	2	1						2
Lamium amplexicaule var. amplexicaule	A*	6	4						1	3						1		1	
Lavandula stoechas	P*	5	2													4	1		
Lawrencia squamata	P	3	1			3													

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Leontodon taraxacoides ssp. taraxacoides	A*	1	1						1										
Lepidium africanum	A*	47	10	1	7		4	2	17		1		6	1		6	2		
Lepidium oxytrichum	A	1	1						1										
Lepidium papillosum	A	7	3					3	3			1							
Lepidium phlebopetalum	A	3	1					3											
Lepidosperma carphoides	P	2	2	1												1			
Lepidosperma congestum	A	3	3	1	1						1								
Lepidosperma curtisiae	P	8	3						1		1						6		
Lepidosperma laterale	P	6	4	2				1				1					2		
Lepidosperma viscidum	P	63	10	2	1				6	8	7	3	3			2		26	5
Leptomeria aphylla	P	2	2						1									1	
Leptorhynchos scabrus	A	1	1		1														
Leptorhynchos squamatus	P	56	10	1					12		4	1	1	14		5	2	9	7
Leptorhynchos tetrachaetus	A	34	12	4	2	2	1	1	7		3	1	5	6		1			1
Leptorhynchos waitzia	A	1	1									1							
Leptospermum myrsinoides	P	1	1													1			
Leucopogon virgatus	P	2	1													2			
Levenhookia dubia	A	23	5						13			1	1			5		3	
Limonium lobatum	A*	28	8		3	2	2	17		1		1	1		1				
Linum marginale	S	21	9	2		1	1		3	1	3	2	3					5	
Linum trigynum	A*	8	3								2		1				5		
Lissanthe strigosa	P	1	1													1			
Lobelia gibbosa	A	4	1															4	
Logania sp. B	P	2	1															2	
Logfia gallica	A*	5	3								2					2		1	
Lolium loliaceum	A*	6	6					1	1		1		1			1			1
Lolium perenne	P*	34	11	1	7				7	1	4		3	5	1	3		1	1
Lolium rigidum	A*	76	15	3	6	1	8	3	15	4	5	2	5	4	1	13		3	3
Lolium x#hybridum	A*	1	1											1					
Lomandra collina	P	12	7	4	1				2	2		1	1						1
Lomandra densiflora	P	139	12	2	1				17		12	3	9	2	1	21	20	33	18
Lomandra effusa	P	125	13	32	23	2	8	4	10	4	8	6	15	9	3			1	
Lomandra fibrata	P	1	1														1		
Lomandra leucocephala ssp. robusta	P	1	1				1												
Lomandra micrantha ssp. micrantha	P	26	9		1				10		2	1	2	1		3	5		1
Lomandra multiflora ssp. dura	P	240	15	11	14		8	4	30	1	23	12	29	24	4	7	9	41	23
Lomandra nana	P	13	5						1		2					4	5	1	
Lomandra sororia	P	19	6						2		2					4	9	1	1
Lotus australis	P	1	1												1				
Luzula meridionalis	P	12	4													7	1	2	2
Lycium australe	P	3	2			1		2											
Lycium ferocissimum	P*	99	16	6	12	9	17	15	14	4	2	1	4	2	2	1	1	4	5
Lysiana exocarpi ssp. exocarpi	M	31	11	2	3		1	9	1	1	4	3	1				1	5	
Lythrum hyssopifolia	A	3	2								2					1			
Maireana aphylla	P	32	8	3	4		3	12	2				6	1	1				
Maireana brevifolia	P	56	10	4	20	3	11	6	5		1	1	4	1					
Maireana ciliata	P	2	2		1								1						
Maireana enchylaenoides	P	191	15	10	13	11	14	5	33	8	11	8	24	16	5	6		8	19
Maireana excavata	P	23	8	2	4	3		4	3		1		1	5					
Maireana georgei	P	2	2		1				1										
Maireana lobiflora	P	11	5	1	5	1		3							1				
Maireana planifolia	P	1	1			1													
Maireana pyramidata	P	16	3			2	2	12											
Maireana rohrlachii	P	7	3	3				2			2								
Maireana sedifolia	P	9	3		1		1	7											
Maireana trichoptera	P	20	6	3	10			2	1		1		3						
Maireana turbinata	P	19	6	1	3		1	11	1					2					
Malacocera tricornis	P	1	1					1											
Malva parviflora	A*	9	2		6		3												
Marrubium vulgare	P*	75	13	11	14	8	6	12	4	3	2	1	5	4	1				4
Medicago littoralis	A*	3	3	1										1	1				
Medicago minima var. minima	A*	179	15	22	24	15	10	43	14	4	2	8	9	9	4	1		3	11
Medicago polymorpha var. polymorpha	A*	61	13	2	17	2	4	11	5	2	1	1	9	4				2	1
Medicago sativa ssp.	P*	4	2										3			1			
Medicago truncatula	A*	54	11	7	3	5	4	21	5	1		2	1	3					2
Melaleuca acuminata	P	1	1				1												
Melaleuca lanceolata	P	19	7		2	4	5			5	1	1					1		
Melaleuca uncinata	P	1	1						1										
Mesembryanthemum nodiflorum	A*	23	5		8		3	9	2				1						

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Microlaena stipoides var. stipoides	PG	6	2						1								5		
Microseris lanceolata	S	38	7	1		1			6			4				4		19	3
Microtis unifolia complex	O	26	7						5	2	1					3	2	12	1
Millotia myosotidifolia	A	12	8	1		1	1		3		1	3					1	1	
Millotia tenuifolia var.	A	4	4	1					1				1					1	
Minuartia mediterranea	A	1	1	1															
Minuria annua	A	3	2	1		2													
Minuria cunninghamii	P	4	2			2		2											
Minuria leptophylla	P	71	10	5	20	2	3	9	7	1		4	6	14					
Misopates orontium	A*	2	1					2											
Mitrasacme paradoxa	A	12	3						3	2								7	
Moenchia erecta	A*	4	3						2							1			1
Molineriella minuta	A*	1	1																1
Monadenia bracteata	O*	5	1														5		
Myoporum montanum	P	15	9				1	4	2	3	1	1				1		1	1
Myoporum platycarpum	P	15	6		1		3	6	3	1	1								
Myoporum viscosum	P	1	1															1	
Myrsiphyllum asparagoides	S*	39	9		2		10	1	5	2		1				2	15	1	
Neatostema apulum	A*	23	8	7	1			1			2	1	4	6	1				
Neurachne alopecuroidea	PG	17	6						3		3			1		3	6	1	
Nicotiana maritima	A	2	2			1						1							
Nicotiana velutina	A	2	2			1				1									
Nitraria billardierei	P	7	3		1		3	3											
Oenothera stricta ssp. stricta	A*	1	1		1														
Olea europaea ssp. europaea	P*	53	10		6		1		4		3	1	4			6	23	4	1
Olearia decurrens	P	27	8			3			1	3	1	5			1			8	5
Olearia minor	P	1	1				1												
Olearia muelleri	P	1	1				1												
Olearia pannosa ssp.	P	5	3						1									2	2
Olearia picridifolia	P	1	1							1									
Olearia pimeleoides ssp. pimeleoides	P	24	9	2	6	3	1	3	5			2	1						1
Olearia ramulosa	P	24	3													1	20	3	
Olearia tubuliflora	P	1	1															1	
Omphalolappula concava	A	9	4	1	2	5		1											
Oncosiphon suffruticosum	A*	3	2		1		2												
Onopordum acaulon	A*	17	7	3	7			2		1			2		1			1	
Opercularia turpis	P	7	2														1	6	
Ophioglossum lusitanicum	A	8	6	1					2			1				2		1	1
Opuntia sp.	P*	4	4				1		1								1	1	
Oxalis corniculata ssp. corniculata	A*	2	2	1					1										
Oxalis perennans	P	313	16	21	24	17	15	20	39	6	15	10	16	17	4	35	17	39	18
Oxalis pes-caprae	S*	50	11		14	1	7		2		2		2		2	8	9	1	2
Oxalis purpurea	A*	1	1													1			
Oxalis radicosa	A*	5	4			1				1		1						2	
Ozothamnus retusus	P	8	3						5	2	1								
Ozothamnus scaber	P	3	1						3										
Pallenis spinosa	A*	4	2	1	3														
Panicum decompositum var. decompositum	PG	1	1										1						
Panicum effusum var. effusum	PG	7	4	1	1						4					1			
Papaver hybridum	A*	14	3		4	4		6											
Parapholis incurva	A*	15	8	1	4	1	1		4	1		1				2			
Parentucellia latifolia	A*	10	5	3					1				1			2		3	
Parietaria cardiostegia	A	1	1									1							
Parietaria debilis	A	16	7				1		3	1	2					1		3	5
Paspalidium constrictum	PG	12	8	1		1		2		1	2	1	3						1
Pennisetum setaceum	P*	1	1				1												
Pennisetum villosum	P*	1	1										1						
Pentaschistis airoides	A*	85	14	3	2	4	4	5	26	5	7	2	9		2	7	1	8	
Pentaschistis pallida	P*	9	4							1	2					2	4		
Persicaria decipiens	P	1	1										1						
Petrorhagia nanteuilii	A*	4	4	1							1		1			1			
Petrorhagia velutina	A*	34	10			1			4	2	4		6	3		4	1	7	2
Phalaris aquatica	P*	2	2														1		1
Phalaris minor	A*	2	2						1							1			
Phyllanthus saxosus	P	9	6					1		4	1	1						1	1
Picnomon acarna	A*	2	2				1			1									
Pimelea curviflora var.	P	13	10	2	1		1	2			1	2	1				1	1	1
Pimelea flava ssp. dichotoma	P	1	1	1															
Pimelea glauca	P	15	7	3	1				2				1			3		4	1

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Pimelea humilis	P	14	5						1		2					5	5	1	
Pimelea micrantha	P	44	8	8	15				4	3	4	4	4					2	
Pimelea microcephala ssp. microcephala	P	18	6		3		2	7	1	2		3							
Pimelea octophylla	P	1	1															1	
Pimelea petrophila	P	3	1															3	
Pimelea serpyllifolia ssp. serpyllifolia	P	4	2	1			3												
Pimelea stricta	P	6	4	1					1	1								3	
Pinus halepensis	P*	8	5		4				1				1			1	1		
Pinus ponderosa	P*	1	1										1						
Piptatherum miliaceum	P*	8	4		4								2				1		1
Pittosporum phylliraeoides var. microcarpa	P	49	13	1	11	3	16	1	8	2	1	1	1		1		1	2	
Plagiobothrys plurisepaleus	A	1	1					1											
Plantago bellardii	A*	15	6	6				1	2		4	1	1						
Plantago coronopus ssp.	A*	1	1										1						
Plantago lanceolata var. lanceolata	P*	34	5		6				2							6	19		1
Plantago sp. B	P	2	2						1									1	
Plantago turrifera	A	1	1						1										
Plantago varia complex	P	107	13	2	1			7	23	1	4	3	9	9		18	8	7	15
Pleurosorus rutifolius	P	19	7				1		1		1		1				1	6	8
Poa annua	A*	1	1																1
Poa bulbosa	P*	30	10	5	3		1		9		1	1	1	4		4			1
Poa clelandii	PG	7	2													5	2		
Poa crassicaudex	PG	58	10	2					12		2	2	8	2		9	4	12	5
Poa drummondiana	PG	2	1													2			
Poa labillardieri var. labillardieri	PG	10	4								1					5	1		3
Podolepis capillaris	A	1	1			1													
Podolepis muelleri	A	5	3			1		3				1							
Podolepis tepperi	A	8	3	6	1						1								
Pogonolepis muelleriana	A	34	10	4	6	1	2	2	11			1	3	3		1			
Polycarpon tetraphyllum	A*	7	5					2	1	1								1	2
Polygonum aviculare	A*	3	3		1				1		1								
Pomaderris paniculosa ssp. paniculosa	P	20	9	1	2		1			4	5	2	2				1	2	
Poranthera microphylla	A	8	4					1								3	2	2	
Prasophyllum fitzgeraldii	A	1	1					1											
Prasophyllum occidentale	A	5	4	2	1			1	1										
Prasophyllum odoratum	A	5	4		2					1		1						1	
Prasophyllum pallidum	A	2	1															2	
Prostanthera behriana	P	1	1															1	
Prostanthera striatiflora	P	1	1															1	
Prunus cerasifera	P*	2	1														2		
Prunus dulcis	P*	1	1														1		
Pseudognaphalium luteoalbum	A	5	3		1	1												3	
Psilurus incurvus	A*	3	2						2				1						
Psoralea australasica	P	6	4			1							1		2				2
Pterostylis aff. excelsa	O	1	1																1
Pterostylis biseta	O	28	10		1		1	2	8	2	1	3				1		7	2
Pterostylis cycnocephala	O	3	2				1											2	
Pterostylis excelsa	O	3	3							1		1						1	
Pterostylis mutica	O	2	2	1								1							
Pterostylis nutans	O	1	1																1
Pterostylis pusilla	O	9	5						3	1	1							3	1
Pterostylis robusta	O	6	4						2							2		1	1
Pterostylis sanguinea	O	1	1															1	
Ptilotus erubescens	P	12	7	1	1				1		2		2	4		1			
Ptilotus nobilis var. angustifolius	P	6	4		1								3	1		1			
Ptilotus obovatus	P	14	5			3		7		1		2			1				
Ptilotus seminudus	P	3	3	1			1	1											
Ptilotus spathulatus forma spathulatus	P	152	15	25	5	13	12	15	18	3	8	10	16	15	3		1	3	5
Pultenaea graveolens	P	2	1															2	
Pultenaea largiflorens	P	45	9					1	9	1	1					14	5	13	1
Pultenaea laxiflora	P	1	1													1			
Pultenaea pedunculata	P	2	1														2		
Pultenaea tenuifolia	P	1	1						1										
Ranunculus hamatosetosus	A	14	5						2	1		1						7	3
Ranunculus pachycarpus	P	4	2															3	1
Ranunculus sessiliflorus var.	A	3	2						2							1			
Raphanus raphanistrum	A*	1	1							1									

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Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Rapistrum rugosum ssp. rugosum	A*	38	13	1	14	2	1	4	4	1	3	2	3		1			1	1
Reichardia tingitana	A*	11	4	5	4			1								1			
Reseda lutea	P*	2	2					1				1							
Reseda luteola	P*	3	2	1				2											
Retama raetam	P*	1	1													1			
Rhagodia parabolica	P	90	11	1	14	8	21	7	8	6	2	4						6	13
Rhagodia preissii ssp. preissii	P	2	1				2												
Rhagodia spinescens	P	21	6		2	1	4	12		1		1							
Rhamnus alaternus	P*	5	2													1	4		
Rhodanthe corymbiflora	A	29	6		4		5	10	8			1							1
Rhodanthe floribunda	A	6	2					4	2										
Rhodanthe microglossa	A	5	1					5											
Rhodanthe polygalifolia	A	4	3				1	1	2										
Rhodanthe pygmaea	A	88	12	10	18	11	2	28	5		1	5	2	3	2				1
Rhodanthe stuartiana	A	2	2				1	1											
Rhodanthe troedelii	A	6	4		3			1	1				1						
Rhyncharrhena linearis	P	1	1	1															
Romulea minutiflora	S*	95	12	11	6		1	1	22		9	1	10	9		19	4	2	
Romulea rosea	S*	17	6	1							1			2		2	10		1
Rosa canina	P*	13	5	1	1								1			5	5		
Rosa rubiginosa	P*	2	2													1		1	
Rostraria cristata	A*	91	14	15	12	8	10	11	10	6	1	4	6	4		1		2	1
Rostraria pumila	A*	12	5		2			1	5		1		3						
Rubus ulmifolius var. ulmifolius	P*	1	1													1			
Rumex brownii	S	39	9					1	1		3		8	1		8	2	5	10
Rumex conglomeratus	P*	6	3						3		1							2	
Rumex crispus	P*	6	3		3								2			1			
Rumex dumosus var.	S	18	5								1		3	12	1			1	
Rutidosis helichrysoides	A	1	1		1														
Rutidosis multiflora	A	4	2						2							2			
Sagina apetala	A*	3	3	1												1			1
Salsola kali	A	49	8	2	14	1	6	12	9		1		4						
Salvia verbenaca form A	A*	126	13	17	30	2	4	11	10		6	2	17	15	3	7			2
Sanguisorba minor ssp. muricata	A*	3	2		2								1						
Santalum acuminatum	P	13	8		2	1	1	2	2	3	1					1			
Santalum murrayanum	P	1	1							1									
Sarcozona praecox	P	1	1				1												
Sauropus rigens	P	1	1													1			
Scabiosa atropurpurea	P*	19	6		7				3		1		2			5			1
Scaevola albida	P	43	9		3				8	1	4	1	3		1	10	12		
Scaevola humilis	P	12	10	1	1		1	1		2	1	2			1	1		1	
Scaevola spinescens	P	10	5		5		1	2	1	1									
Schinus areira	P*	9	5		5		1	1	1						1				
Schismus barbatus	A*	14	6		2	3	3	4	1	1									
Schoenus apogon	S	28	6						4		4			1		9	4	6	
Schoenus breviculmis	P	1	1								1								
Scleranthus pungens	P	15	5					1				2	6	4					2
Sclerolaena brachyptera	P	18	5		6			7	3		1		1						
Sclerolaena constricta	P	1	1					1											
Sclerolaena diacantha	P	42	8		7	2	5	7	12	1		1	7						
Sclerolaena lanicuspis	P	2	2		1			1											
Sclerolaena obliquicuspis	P	17	4	1	3			12	1										
Sclerolaena patenticuspis	P	13	3		3		1	9											
Scorzonera laciniata	A*	1	1										1						
Scutellaria humilis	A	1	1													1			
Sebaea ovata	A	10	5	2					1	1						1		5	
Sedum sediforme	P*	1	1														1		
Senecio cunninghamii var.	P	1	1													1			
Senecio glossanthus	A	11	6		1	1	4		2		1	2							
Senecio lautus	P	4	2		2				2										
Senecio odoratus var. odoratus	P	3	3								1							1	1
Senecio picridioides	A	3	2													1	2		
Senecio pterophorus var. pterophorus	P*	17	5				1		2		1					1	12		
Senecio quadridentatus	S	66	14	2	3	5	4	1	9	1	4		4		1	12	3	9	8
Senecio tenuiflorus	S	24	6				1		5	2						3		10	3
Senna artemisioides nothossp. artemisioides	P	6	4			1		3			1	1							
Senna artemisioides nothossp. coriacea	P	63	12	1	23	1	8	5	10	2	4	3	4		1	1			
Senna artemisioides ssp. filifolia	P	4	3		2	1						1							
Senna artemisioides ssp. petiolaris	P	27	7	1	4	1	9	7	4				1						

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Senna artemisioides ssp. quadrifolia	P	1	1		1														
Sherardia arvensis	A*	9	5		1				3		1					2	2		
Sida corrugata var.	P	119	12	7	17	5	1	30	17		7	1	20	10	3				1
Sida fibulifera	P	4	4		1			1	1				1						
Sida intricata	P	13	2		3			10											
Sida petrophila	P	18	4	1		10		4											3
Sida trichopoda	P	1	1					1											
Sigesbeckia australiensis	A	2	2			1						1							
Silene apetala	A*	1	1					1											
Silene gallica var.	A*	20	10				2	2	1	2	2		2			1	1	6	1
Silene nocturna	A*	75	13	3	4	8	7	11	10	3	5	7	8	1				5	3
Silene tridentata	A*	6	3				1	4					1						
Silybum marianum	A*	6	4			1										2		1	2
Sisymbrium erysimoides	A*	65	9		6	6	15	20	10	3		3	1					1	
Sisymbrium irio	A*	7	4		1		1	4		1									
Sisymbrium officinale	A*	2	2										1					1	
Sisymbrium orientale	A*	18	5		4	2		8	3		1								
Solanum cinereum	P*	1	1										1						
Solanum coactiliferum	P	1	1		1														
Solanum ellipticum	P	8	5		1	1	1	3				2							
Solanum esuriale	P	9	3		2			6							1				
Solanum nigrum	A*	17	10	1	2	1	2	1	3		1			1		3	2		
Solanum petrophilum	P	7	5					1		1		2			2			1	
Solanum simile	P	3	2							1								2	
Solanum tuberosum	A*	1	1								1								
Solenogyne dominii	P	6	5						2		1			1		1	1		
Sonchus asper ssp.	A*	13	6		1		1	1	3	3								4	
Sonchus oleraceus	A*	226	16	11	25	10	14	36	29	5	12	8	11	2	5	19	4	26	9
Sparaxis bulbifera /tricolor	S*	12	3		1											4	7		
Spergularia diandra	A*	28	10	1	5	2	4	5	2			1	2	5					1
Spergularia rubra	A*	25	10	1	2	2	1	2	10	1	1	1	4						
Sporobolus virginicus	P	1	1													1			
Spyridium parvifolium	P	5	2													1		4	
Spyridium phlebophyllum	P	10	2															8	2
Stackhousia monogyna /aspericocca	S	133	15	3	3	2	5	1	17	4	10	6	9	10		19	5	26	13
Stellaria media	A*	13	6				3		3			1				2		2	2
Stellaria palustris var.	P	6	3			1									1				4
Stenopetalum lineare	A	8	4			1	3		3				1						
Stipa acrociliata	PG	16	7	3	3		3	1	1	4				1					
Stipa blackii	PG	156	15	7	7	4	4	4	28		20	7	31	19	3	14	1	5	2
Stipa breviglumis	PG	7	4						2	1						2			2
Stipa curticoma	PG	18	6	1			1		6		1					4		5	
Stipa drummondii	PG	43	10	2	17	7	4	6	3	1		1	1			1			
Stipa elegantissima	PG	152	15	8	12	8	18	15	34	2	13	8	8	1		6	7	5	7
Stipa eremophila	PG	132	14	22	39	3	11	22	11	1	7	1	9	2	2		1		1
Stipa exilis	PG	4	3		1		2		1										
Stipa flavescens	PG	24	11	1	1	1	3		3	4	2			1		3	3	2	
Stipa gibbosa	PG	19	6	3					4		1					5	1	5	
Stipa mollis group	PG	21	8				1		2		3	1	1			4	7	2	
Stipa multispiculis	PG	3	2										1				2		
Stipa nitida	PG	158	15	18	22	3	16	28	20	4	7	3	8	15	1	5		6	2
Stipa nodosa	PG	114	16	6	9	8	8	18	13	1	6	10	11	2	8	5	2	6	1
Stipa petraea	PG	3	2		2			1											
Stipa pilata	PG	5	3	1	2	2													
Stipa platychaeta	PG	22	7		5	3	8	2	2		1		1						
Stipa puberula	PG	7	4		1			4					1	1					
Stipa scabra ssp.	PG	131	15	2	6		6	3	29	4	10	3	16	7	1	28	5	10	1
Stipa semibarbata	PG	15	8						2	1	1		1			7	1	1	1
Stipa setacea	PG	27	6						2		5		3	7		4	6		
Stipa tenuifolia	PG	4	3						2		1		1						
Stipa trichophylla	PG	2	1	2															
Stuartina muelleri	A	12	4						7				1			3			1
Swainsona fissimontana	P	1	1		1														
Swainsona oroboides complex	P	3	2											1		2			
Swainsona stipularis	A	6	3		4	1		1											
Swainsona tephrotricha	P	2	2	1	1														
Synnotia villosa	S*	1	1														1		
Templetonia aculeata	P	16	6		1							1	3			1		9	1
Templetonia egena	P	6	2		1			5											
Tetragonia eremaea	A	15	5			1	2	9	2			1							
Tetragonia implexicoma	P	1	1		1														

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Teucrium corymbosum	P	1	1							1									
Teucrium racemosum	S	21	7		7			6	3		1			1	2			1	
Teucrium sessiliflorum	S	25	7	4	9		5		2	2	2					1			
Thelymitra antennifera	O	1	1													1			
Thelymitra grandiflora	O	1	1													1			
Thelymitra nuda	O	26	6						1		1					7	3	13	1
Thelymitra pauciflora	O	2	2						1									1	
Thelymitra rubra	O	1	1													1			
Themeda triandra	PG	105	15	4	2		2	1	6	1	23	1	13	6	3	15	10	16	2
Threlkeldia diffusa	P	1	1				1												
Thysanotus baueri	S	39	12	8	9	1	4	1	5	1	2	2	4		1				1
Thysanotus patersonii	S	58	11	3					10	3	3	3	1	1		6	5	22	1
Thysanotus tenellus	S	12	6	1				4	2					2				2	1
Tolpis barbata	A*	1	1								1								
Trachymene anisocarpa	A	1	1							1									
Tricoryne elatior	S	22	7	2					4		2	2				5	6	1	
Trifolium angustifolium	A*	160	16	5	3	1	5	3	25	5	18	2	21	11	1	28	7	16	9
Trifolium arvense var. arvense	A*	153	16	9	4	4	1	4	32	4	18	4	22	9	3	19	1	17	2
Trifolium campestre	A*	139	16	9	1	1	2	2	16	7	15	1	18	11	2	23	5	20	6
Trifolium dubium	A*	6	4	1								1		2				2	
Trifolium fragiferum var.	A*	1	1													1			
Trifolium glomeratum	A*	75	13	4	2		4	1	18		7		14	2	1	10	1	7	4
Trifolium hirtum	A*	4	4						1		1	1				1			
Trifolium michelianum 'var. balansae'	A*	1	1													1			
Trifolium pilulare	A*	1	1															1	
Trifolium scabrum	A*	30	8	7	1				11		1		3	1		5		1	
Trifolium subterraneum	A*	20	9	1					3		1		2	1		7	1	2	2
Trifolium tomentosum	A*	25	8			2	1		11				2		1	2		3	3
Triglochin centrocarpum	A	1	1						1										
Triodia scariosa complex	PG	88	12		1		2		6	6	10	9	5	1	3	1		34	10
Triptilodiscus pygmaeus	A	87	14	8	3	4	2	4	12		4	8	12	12	2	3		10	3
Triticum aestivum	A*	4	3		2			1					1						
Trymalium wayae	P	5	3							3	1	1							
Ulex europaeus	P*	1	1													1			
Urospermum picroides	A*	30	10			2	1	2	3	1	1	1				1		13	5
Urtica urens	A*	2	2			1												1	
Valerianella discoidea	A*	2	2	1	1														
Velleia arguta	S	21	5	7	8				1		2					3			
Velleia paradoxa	S	26	7						5		2	2	2	8		6	1		
Verbascum virgatum	A*	1	1													1			
Veronica hederifolia	A*	1	1													1			
Veronica plebeia	P	9	5						1	1						1		2	4
Vicia cracca	P*	1	1									1							
Vicia hirsuta	A*	2	2							1			1						
Vicia monantha	A*	22	9		8	1		1	3				2		1	2		3	1
Vicia sativa ssp. sativa	A*	11	5						1				1			3	5		1
Vittadinia arida	A	1	1					1											
Vittadinia australasica var. australasica	A	6	3	2					3		1								
Vittadinia blackii	P	41	12	4	12			3	3	1	5	1	4	1		3		2	2
Vittadinia cervicularis var. cervicularis	A	39	10	1	6	2	6	1	14	2			4	1				2	
Vittadinia condyloides	P	3	3			1			1										1
Vittadinia cuneata var.	P	139	15	12	12	2	4	16	19	4	9	9	17	15		1	3	6	10
Vittadinia gracilis	P	152	14	15	26	7	6	18	13		5	2	18	17	3	13		4	5
Vittadinia megacephala	P	19	7	9					2	1	1		2	3		1			
Vittadinia pterochaeta	A	3	3		1			1							1				
Vittadinia sulcata	A	4	3						2		1								1
Vulpia sp.	A*	299	16	21	24	11	20	26	43	9	23	11	26	15	6	24	8	27	5
Wahlenbergia communis	S	10	6					3				2		1	1	1		2	
Wahlenbergia gracilenta	A	51	11	3	1	2		2	12	5		5	4			3		13	1
Wahlenbergia luteola	S	203	15	15	14	11	7	15	30	3	9	10	20	19	6	13		17	14
Wahlenbergia multicaulis	P	1	1								1								
Wahlenbergia stricta ssp. stricta	S	75	12	3			2	1	7	3	4	1	3			13	8	21	9
Westringia rigida	P	4	4		1	1	1			1									
Wurmbea biglandulosa ssp. flindersica	A	1	1															1	
Wurmbea centralis	A	8	3									1						5	2
Wurmbea dioica ssp. dioica	S	79	14	8	11	5		13	13		2	2	3	3	1	10	2	4	2
Wurmbea latifolia ssp. latifolia	A	1	1						1										
Xanthorrhoea quadrangulata	P	55	10		1				1	1	2	4	1		1	3		36	5
Xanthorrhoea semiplana ssp.	P	3	2													1	2		

SPECIES	Life form / origin	total freq	no. gps	Floristic Group 1	2	3	4	5	6	7	8.1	8.2	8.3	8.4	8.5	9	10	11	12
Number of sites in group		513		33	46	20	31	52	53	13	28	12	34	25	2	51	23	54	27
Zaluzianskya divaricata	A*	24	9	2		1	3		6		3	1	3			4	1		
Zygophyllum ammophilum	A	1	1					1											
Zygophyllum angustifolium	P	1	1					1											
Zygophyllum apiculatum	P	2	2				1		1										
Zygophyllum aurantiacum	P	9	2		6			3											
Zygophyllum confluens	P	12	7	1	1	4		2	2			1							1
Zygophyllum crenatum	A	27	4	1	10	5		11											
Zygophyllum glaucum	P	10	6	1	4		1	2				1	1						
Zygophyllum iodocarpum	A	1	1					1											
Zygophyllum ovatum	A	2	2		1		1												

Appendix IV

LOFTY BLOCK GRASSLANDS (SURVEY 83) - Vouchered plant taxa

Total number of quadrats: 74

Abbreviations:
svy freq: survey frequency
E, V, R, etc.: Conservation status codes- see Appendix V
sig. record: number of records of regional conservation significance
no. vch: number of vouchers
FR Flinders Ranges, **MU** Murray, **NL** Northern Lofty, **SL** Southern Lofty Regions.
@: species recorded only in sites LBGANG03 and /or LBGONK01 (non-grassy sites not included in analysis)

Native species and their conservation status

Native speciesand national, state and regional conservation status	sig. record	Common name	no. vch	svy freq	Regional frequency FR	MU	NL	SL
Abutilon halophilum		plains lantern-bush	1	1	1			
Acacia acinacea - N MU U	1	wreath wattle	1	2		1		1
Acacia calamifolia		wallowa	1	1			1	
Acacia continua		thorn wattle	5	7			7	
Acacia hakeoides		hakea wattle	2	3	3			
Acacia iteaphylla		Flinders Ranges wattle	1	2				2
Acacia ligulata		umbrella bush		1		1		
Acacia oswaldii		umbrella wattle	3	3	2	1		
Acacia paradoxa		kangaroo thorn	3	8		4		4
Acacia pravifolia - U FR U	1	coil-pod wattle	1	1	1			
Acacia pycnantha		golden wattle	6	27	9	3	7	8
Acacia retinodes var. retinodes (hill form)		wirilda	1	1		1		
Acacia victoriae ssp.		elegant wattle	2	5	5			
Acacia wattsiana		dog wattle	6	5			5	
Acaena echinata var.		a sheep's burr	4	15	4	1	4	6
Acrotriche serrulata		cushion ground-berry	1	2				2
Actinobole uliginosum		flannel cudweed	5	9	5	2	2	
Agrostis avenacea var. avenacea		common blown-grass	3	4	1		1	2
Ajuga australis form A		Australian bugle	2	2	1		1	
Alectryon oleifolius ssp. canescens		bullock bush	1	2	2			
Allocasuarina verticillata		drooping sheoak	5	32	7	6	14	5
Amphipogon caricinus var. caricinus - N NL R SL U	5	long grey-beard grass	7	9		4	4	1
Amyema miquelii		box mistletoe	7	11	6	1	4	
Arabidella trisecta		shrubby cress	1	1	1			
Aristida anthoxanthoides		yellow threeawn	1	1			1	
Aristida behriana - N MU R SL U	11	brush wire-grass	8	40	11	10	18	1
Arthropodium fimbriatum - N FR U	3	nodding vanilla-lily	8	22	3	9	6	4
Arthropodium strictum		common vanilla-lily	13	43	12	8	14	9
Asperula conferta		common woodruff	8	9	6		3	
Astroloma humifusum		cranberry heath	6	17	3	2	6	6
Atriplex semibaccata		berry saltbush	5	10	6	1	3	
Atriplex stipitata		bitter saltbush	3	3	2	1		
Banksia marginata		silver banksia	1	1				1
Beyeria lechenaultii		pale turpentine bush	1	1		1		
Billardiera cymosa		sweet apple-berry	1	2				2
Boerhavia dominii		tar-vine	1	1		1		
Bossiaea prostrata		creeping bossiaea	1	1				1
Brachycome ciliaris var. ciliaris		variable daisy	2	3	1	1		1
Brachycome ciliaris var. lanuginosa		woolly variable daisy	3	3	2	1		
Brachycome ciliaris var. subintegrifolia - K NL K	1	narrow-leaf variable daisy	3	4	3		1	
Brachycome goniocarpa		dwarf daisy	1	1		1		
Brachycome lineariloba		hard-head daisy	5	15	13	2		
Brunonia australis - N MU V	1	blue pincushion	1	3		1		2
Bulbine bulbosa - N MU R	5	bulbine-lily	11	19	3	5	5	6
Bulbine semibarbata		small leek-lily	2	4	3		1	
Burchardia umbellata - N MU R	1	milkmaids	1	2		1		1
Bursaria spinosa		sweet bursaria	6	32	9	7	13	3
Caesia calliantha		blue grass-lily	1	1				1
Caladenia leptochila @		narrow-lip spider-orchid	1	1				1
Calandrinia eremaea		dryland purslane	1	1	1			

Native speciesand national, state and regional conservation status	sig. record	Common name	no. vch	svy freq	Regional frequency FR	MU	NL	SL
Calandrinia sp.		purslane/parakeelya	1	2	2			
Callitris glaucophylla		white cypress-pine	1	2	2			
Callitris preissii		southern cypress pine	7	9	2	1	6	
Calocephalus citreus - U FR U MU V NL U SL R	18	lemon beauty-heads	7	18	8	1	8	1
Calostemma purpureum		pink garland-lily	3	5	2	1		2
Calotis hispidula		hairy burr-daisy	3	10	9	1		
Calytrix tetragona		common fringe-myrtle	2	2			1	1
Carex breviculmis - N FR R MU K NL R	7	short-stem sedge	4	11	3	1	3	4
Carex gaudichaudiana		fen sedge	1	1			1	
Carex inversa var. inversa - R FR K	1	knob sedge	1	1	1			
Carex tereticaulis - N MU R	1	rush sedge	1	1		1		
Carpobrotus sp.		pigface	1	3	3			
Cassinia laevis		curry bush	2	3	3			
Cassinia uncata		sticky cassinia	5	5	3		2	
Cassytha peninsularis var. flindersii - N NL R	1	Flinders Ranges dodder-laurel	1	1			1	
Centrolepis aristata - N MU K	2	pointed centrolepis	1	3		2		1
Centrolepis strigosa		hairy centrolepis	1	3		2		1
Chamaescilla corymbosa var. corymbosa		blue squill	1	2				2
Cheilanthes austrotenuifolia		annual rock-fern	6	12	2	2	1	7
Cheilanthes lasiophylla - N MU U	1	woolly cloak-fern	1	1		1		
Cheilanthes sieberi ssp.		narrow rock-fern	4	5			5	
Cheilanthes sieberi ssp. sieberi - N MU K	2	narrow rock-fern	4	4	2	2		
Chenopodium cristatum		crested goosefoot	1	1	1			
Chenopodium curvispicatum - N FR K	1	cottony goosefoot	1	1	1			
Chenopodium desertorum ssp. desertorum		frosted goosefoot	2	2	2			
Chenopodium desertorum ssp. microphyllum		small-leaf goosefoot	2	2		1	1	
Chloris truncata		windmill grass	1	1	1			
Choretrum glomeratum var.			2	2			2	
Chrysocephalum apiculatum		common everlasting	8	16	6		8	2
Chrysocephalum semipapposum - N SL K	2	clustered everlasting	5	12	5	1	4	2
Clematis microphylla		old man's beard	3	6	3	1	2	
Convolvulus erubescens		Australian bindweed	6	14	2	5	3	4
Convolvulus remotus		grassy bindweed	16	23	11	3	7	2
Craspedia glauca		billy-buttons	1	4	4			
Craspedia pleiocephala		soft billy-buttons	1	4	4			
Crassula colorata var. acuminata		dense crassula	12	28	15	6	7	
Crassula sieberiana ssp. tetramera		Australian stonecrop	3	3		2		1
Cryptandra amara var.			1	5	1		4	
Cryptandra amara var. amara		spiny cryptandra	1	1		1		
Cryptandra amara var. longiflora - R FR R MU K NL R	8	long-flower cryptandra	7	8	1	2	5	
Cymbopogon ambiguus - N MU R	1	lemon-grass	2	2		1	1	
Cymbopogon obtectus - N MU V	1	silky-head lemon-grass	1	1		1		
Cynoglossum suaveolens - N FR R MU R NL R SL U	5	sweet hound's-tongue	4	5	1	1	1	2
Cyperus tenellus - N MU R	2	tiny flat-sedge	1	3		2		1
Danthonia auriculata - N FR K MU R NL R SL U	28	lobed wallaby-grass	20	29	13	5	7	3
Danthonia caespitosa		common wallaby-grass	46	47	15	10	11	8
Danthonia carphoides var.		short wallaby-grass	1	1			1	
Danthonia carphoides var. carphoides - K NL K	1	short wallaby-grass	3	3		2	1	
Danthonia eriantha - R FR R MU K NL R	17	hill wallaby-grass	15	17	8	4	5	
Danthonia geniculata		kneed wallaby-grass	3	2		1		1
Danthonia linkii var. fulva - R FR R	1	leafy wallaby-grass	1	1	1			
Danthonia pilosa var. paleacea - N NL K	1	velvet wallaby-grass	5	6	2	1	1	2
Danthonia pilosa var. pilosa		velvet wallaby-grass	2	2			1	1
Danthonia racemosa var. racemosa - N FR U NL U	5	slender wallaby-grass	9	8	4		1	3
Danthonia setacea var. setacea		small-flower wallaby-grass	39	38	12	8	12	6
Daucus glochidiatus		native carrot	6	27	14	5	5	3
Daviesia genistifolia - U FR U	1	broom bitter-pea	1	1	1			
Daviesia ulicifolia		gorse bitter-pea	1	1		1		
Dianella longifolia var. grandis - R FR R	1	pale flax-lily	1	1	1			
Dianella revoluta var.			7	26	7	5	12	2
Dianella revoluta var. revoluta		black-anther flax-lily	2	10	1	1	2	6
Dichelachne crinita - N FR U NL R	4	long-hair plume-grass	4	5	3		1	1
Dichondra repens		kidney weed	3	4	1	2		1
Dillwynia hispida		red parrot-pea	1	1				1
Dissocarpus paradoxus		ball bindyi	1	1	1			
Dodonaea baueri		crinkled hop-bush	2	2	1		1	
Dodonaea viscosa ssp. angustissima		narrow-leaf hop-bush	2	2			2	
Dodonaea viscosa ssp. spatulata		sticky hop-bush	4	6	2	1		3
Drosera auriculata		tall sundew	1	2				2
Drosera glanduligera - N MU U	1	scarlet sundew	1	1		1		
Drosera macrantha ssp. planchonii		climbing sundew	1	1		1		
Drosera peltata - N MU K NL U	6	pale sundew	4	7		2	4	1
Drosera whittakeri		scented sundew		2		1		1
Einadia nutans ssp. nutans		climbing saltbush	4	22	11	7	4	
Elachanthus pusillus - U FR R	2	elachanth	2	2	2			

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Elymus scabrus var. scabrus - N MU R NL U	18	native wheat-grass	10	34	10	6	12	6
Enchylaena tomentosa var. tomentosa		ruby saltbush	6	17	8	3	5	
Enneapogon nigricans - N NL U	5	black-head grass	8	11	1	5	5	
Enteropogon acicularis		umbrella grass	2	3	1	2		
Enteropogon ramosus		umbrella grass	3	4	3		1	
Eragrostis benthamii - N MU R @	1	Bentham's love-grass	1	1		1		
Eremophila deserti		turkey-bush	1	1	1			
Eremophila glabra ssp.			1	2	2			
Eremophila longifolia		weeping emubush	2	2	1	1		
Eremophila oppositifolia var.			1	1	1			
Eriochiton sclerolaenoides		woolly-fruit bluebush	2	3	3			
Eriochlamys behrii - N FR T NL X	3	woolly mantle	2	3	2		1	
Erodium crinitum		blue heron's-bill	6	8	6		2	
Eryngium rostratum - V FR V NL V	2	blue devil	2	2	1		1	
Eucalyptus albens - R FR R	2	white box	2	2	2			
Eucalyptus camaldulensis var. camaldulensis		river red gum	2	4	2	1	1	
Eucalyptus cladocalyx		sugar gum	1	2	2			
Eucalyptus fasciculosa @		pink gum	1	1				1
Eucalyptus leucoxylon hybrid		South Australian blue gum hybrid	1	1		1		
Eucalyptus leucoxylon ssp. leucoxylon		South Australian blue gum	2	3			1	2
Eucalyptus leucoxylon ssp. pruinosa		inland South Australian blue gum	12	16	5	2	8	
Eucalyptus microcarpa - N NL R SL U	12	grey box	10	16	4		5	7
Eucalyptus odorata		peppermint box	9	11	7		4	
Eucalyptus porosa - N SL U	1	mallee box	3	3		1	1	1
Eucalyptus socialis		beaked red mallee	1	1		1		
Euchiton gymnocephalus		creeping cudweed	2	2	1	1		
Euphorbia drummondii		caustic weed	8	22	5	5	11	1
Eutaxia microphylla var.			1	5	2		3	
Eutaxia microphylla var. diffusa - U FR R	1	large-leaf eutaxia		1	1			
Eutaxia microphylla var. microphylla		common eutaxia	8	9	2	3	4	
Exocarpos aphyllus		leafless cherry	3	4	3			
Exocarpos cupressiformis		native cherry	2	5	1			4
Festuca benthamiana 3RCa R FR R	1	Bentham's fescue	1	1	1			
Galium gaudichaudii		rough bedstraw	3	4	1			3
Galium migrans		loose bedstraw	1	1		1		
Geranium retrorsum		grassland geranium	4	4	3	1		
Glycine clandestina var. sericea		twining glycine	6	16	4	7	4	1
Gonocarpus elatus		hill raspwort	11	29	4	7	12	6
Gonocarpus tetragynus		small-leaf raspwort	3	5	2			3
Goodenia albiflora - U NL U	1	white goodenia	1	1			1	
Goodenia fasciculatis		silky goodenia	1	1	1			
Goodenia geniculata		bent goodenia	2	5				5
Goodenia pinnatifida - Q MU U NL U SL U	10	cut-leaf goodenia	8	21	11	5	4	1
Goodenia pusilliflora		small-flower goodenia	4	18	10	7	1	
Goodenia robusta		woolly goodenia	3	3			3	
Goodenia sp.		goodenia	5	6	5			
Grevillea ilicifolia var.			1	1			1	
Grevillea lavandulacea var. lavandulacea		spider-flower	1	1				1
Hakea leucoptera		silver needlewood	1	1		1		
Halgania cyanea		rough blue-flower	3	3	2		1	
Haloragis aspera		rough raspwort	1	1		1		
Haloragis heterophylla @		variable raspwort	1	1		1		
Hardenbergia violacea		native lilac		2				2
Harmsiodoxa brevipes var. brevipes		short cress	1	1	1			
Helichrysum leucopsideum		satin everlasting	1	1		1		
Hibbertia exutiacies - N FR U NL U	6	prickly guinea-flower	5	10	3		3	4
Hibbertia sericea var. sericea		silky guinea-flower	2	3				3
Hibbertia stricta var. stricta		stalked guinea-flower	1	4				4
Homopholis proluta		rigid panic	2	2	1		1	
Hyalosperma demissum		dwarf sunray	2	2			2	
Hyalosperma glutinosum ssp. glutinosum		golden sunray	2	3	2	1		
Hyalosperma semisterile		orange sunray	9	11	5	3	3	
Hydrocotyle laxiflora - N MU K NL U	5	stinking pennywort	5	8	2	2	3	1
Hymenanthera dentata - U FR U MU R	2	tree violet	2	2	1	1		
Hypericum gramineum - N FR R MU K	2	small St John's wort	1	3	1	1		1
Isoetes drummondii ssp. drummondii - R SL R @	1	plain quillwort	1	2		1		1
Isoetopsis graminifolia		grass cushion	2	6	3		3	
Isolepis marginata		little club-rush	1	1		1		
Juncus bufonius		toad rush	1	2		1		1
Juncus pallidus @		pale rush	1	1		1		
Juncus planifolius - N MU K @	1	broad-leaf rush	1	1		1		
Juncus subsecundus		finger rush	7	12	3	2	2	5
Kennedia prostrata - N MU U	2	scarlet runner	3	10	1	2	5	2
Lagenifera huegelii - N FR R MU R	5	coarse bottle-daisy	4	10	4	1	2	3
Lepidium papillosum		warty peppercress		1	1			

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Lepidium phlebopetalum		veined peppercress	1	2	2			
Lepidosperma carphoides		black rapier-sedge	1	1				1
Lepidosperma curtisiae - N MU R	1	little sword-sedge	2	4		1		3
Lepidosperma viscidum		sticky sword-sedge	4	6		2	3	1
Leptorhynchos squamatus - N MU R	1	scaly buttons	5	7	3	1	1	2
Leptorhynchos tetrachaetus - U FR U MU K NL U	9	little buttons	8	10	2	5	2	
Leptospermum continentale @		prickly tea-tree	1	1		1		
Levenhookia dubia - N MU R NL R	2	hairy stylewort	2	2		1	1	
Linum marginale - N FR U MU U NL U	6	native flax	4	6	4	1	1	
Lobelia gibbosa		tall lobelia	1	1			1	
Lomandra collina		sand mat-rush	2	2		2		
Lomandra densiflora - N MU R	1	soft tussock mat-rush	6	23	7	1	7	8
Lomandra effusa - N FR R	7	scented mat-rush	5	26	7	10	9	
Lomandra micrantha ssp.			1	3		2		1
Lomandra micrantha ssp. micrantha		small-flower mat-rush	1	1				1
Lomandra multiflora ssp. dura		hard mat-rush	5	43	13	8	17	4
Lomandra nana - U MU T SL U	6	small mat-rush	2	6		2		4
Lomandra sororia - U SL U	4	sword mat-rush	2	4				4
Luzula meridionalis - N FR U	2	common wood-rush	3	6	2		3	1
Luzula ovata - R MU T @	1	clustered wood-rush	1	1		1		
Lysiana exocarpi ssp. exocarpi		harlequin mistletoe	4	5	1	1	2	1
Lythrum hyssopifolia		lesser loosestrife	1	1		1		
Maireana aphylla - N MU R	1	cotton-bush	2	6	5	1		
Maireana brevifolia		short-leaf bluebush	3	7	2	4	1	
Maireana ciliata		hairy fissure-plant	2	2	2			
Maireana enchylaenoides		wingless fissure-plant	16	30	16	4	10	
Maireana georgei		satiny bluebush	1	2	2			
Maireana pyramidata		black bluebush	1	1	1			
Maireana rohrlachii 3RC- R NL V	2	Rohrlach's bluebush	2	2			2	
Maireana trichoptera		hairy-fruit bluebush	2	7	2	5		
Maireana turbinata		top-fruit bluebush	1	2	2			
Microlaena stipoides var. stipoides - N FR U MU R	2	weeping rice-grass	3	5	1	1		3
Microtis arenaria		notched onion-orchid	4	4		2	2	
Microtis parviflora - U NL R	1	slender onion-orchid	1	1			1	
Microtis sp.		onion-orchid		1				1
Microtis unifolia		common onion-orchid		1				1
Millotia myosotidifolia - N SL U	1	broad-leaf millotia	1	1				1
Millotia tenuifolia var. tenuifolia		soft millotia	1	1		1		
Minuria leptophylla		minnie daisy	6	11	8	1	2	
Mitrasacme paradoxa		wiry mitrewort	1	1				1
Myoporum montanum		native myrtle	2	2	1		1	
Myoporum platycarpum ssp.			2	2		1	1	
Myosotis australis - N MU R @	1	austral forget-me-not	1	1		1		
Myriocephalus rhizocephalus var. rhizocephalus - U MU R @	1	woolly-heads	1	1		1		
Neurachne alopecuroidea		fox-tail mulga-grass	1	3				3
Nitraria billardierei		nitre-bush	1	1	1			
Olearia decurrens		winged daisy-bush	2	2	2			
Olearia pimeleoides ssp. pimeleoides		pimelea daisy-bush	2	7	4	3		
Olearia ramulosa		twiggy daisy-bush	1	6				6
Omphalolappula concava		burr stickseed	1	1	1			
Opercularia turpis		twiggy stinkweed	1	1				1
Oxalis perennans		native sorrel	7	32	13	10	1	7
Ozothamnus scaber - K FR K	2	rough bush-everlasting	3	3	2		1	
Panicum decompositum var. decompositum		native millet	1	1			1	
Panicum effusum var. effusum		hairy panic	2	4		3	1	
Paspalidium constrictum		knotty-butt paspalidium	2	2	2			
Pentapogon quadrifidus var. quadrifidus - V SL E @	1	five-awn spear-grass	1	1				1
Pimelea curviflora var. gracilis		curved riceflower	4	5	1	3		1
Pimelea humilis		low riceflower	4	7		2		5
Pimelea micrantha		silky riceflower	3	3	1		2	
Pimelea microcephala ssp.			1	1	1			
Pittosporum phylliraeoides var. microcarpa - N SL R	2	native apricot	2	6	3	1		2
Plantago drummondii		dark plantain	2	2	2			
Plantago gaudichaudii - N FR R MU T NL U SL R	13	narrow-leaf plantain	9	13	4	1	2	6
Plantago hispida		hairy plantain	9	14	9		3	2
Plantago sp. B		little plantain	1	1	1			
Plantago turrifera - N FR U	1	crowned plantain	1	1	1			
Pleurosorus rutifolius - N SL U	1	blanket fern	1	1				1
Poa clelandii		matted tussock-grass	3	5	4			1
Poa crassicaudex		thick-stem tussock-grass	12	12	1		5	5
Poa labillardieri var. labillardieri		common tussock-grass	4	4	2		1	1
Podolepis muelleri - K FR K	1	button podolepis	1	1	1			
Podolepis tepperi		delicate copper-wire daisy	2	4		4		
Pogonolepis muelleriana		stiff cup-flower	5	13	8	3	2	

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Pomaderris paniculosa ssp.			2	2			2	
Pomaderris paniculosa ssp. paniculosa		mallee pomaderris	1	1	1			
Poranthera microphylla		small poranthera	1	1		1		
Prasophyllum occidentale		plains leek-orchid	2	2	2			
Pterostylis biseta		two-bristle greenhood	2	3	3			
Ptilotus erubescens Q R MU R NL T SL R	6	hairy-tails	3	6		3	2	1
Ptilotus nobilis var.			1	1	1			
Ptilotus nobilis var. nobilis - N MU K	1	yellow-tails	1	1		1		
Ptilotus spathulatus forma			4	11	8	1	2	
Ptilotus spathulatus forma spathulatus - N SL R	1	pussy-tails	1	13	2	10		1
Pultenaea largiflorens		twiggy bush-pea	3	8	2		2	4
Pultenaea pedunculata		matted bush-pea	1	1				1
Rhagodia parabolica		mealy saltbush	2	5	4	1		
Rhagodia spinescens		spiny saltbush	2	2	1	1		
Rhodanthe corymbiflora		white cluster everlasting	2	3	3			
Rhodanthe floribunda		white paper-daisy	2	4	4			
Rhodanthe pygmaea		pigmy sunray	2	12	11		1	
Rhodanthe troedelii			2	6	6			
Rumex brownii		hooked dock	5	10	5	2		3
Rumex dumosus var.			1	1			1	
Rutidosis multiflora		small wrinklewort	1	1			1	
Salsola kali		prickly saltwort	3	9	6		3	
Santalum acuminatum - N NL U	1	quandong	1	1			1	
Scaevola albida		white fan-flower	5	8	1	1	3	3
Scaevola spinescens		spiny fanflower	1	1	1			
Schoenus apogon		common bog-rush	4	5		1	2	2
Scleranthus pungens		prickly knawel	1	1	1			
Sclerolaena brachyptera		short-wing bindyi	6	8	7		1	
Sclerolaena diacantha		grey bindyi	7	12	8	2	2	
Sclerolaena obliquicuspis		oblique-spined bindyi	3	3	3			
Sclerolaena patenticuspis		spear-fruit bindyi	2	3	2			
Scutellaria humilis - R FR K	1	dwarf skullcap	1	1	1			
Senecio cunninghamii var.			1	1	1			
Senecio glomeratus - N MU R @	1	swamp groundsel	1	1		1		
Senecio glossanthus		annual groundsel	3	4	3	1		
Senecio lautus		variable groundsel	1	1		1		
Senecio quadridentatus		cotton groundsel	11	17	9	1	4	1
Senecio tenuiflorus - N NL Q	1	woodland groundsel		1			1	
Senna artemisioides nothossp. coriacea		desert senna	9	13	6	4	3	
Senna artemisioides ssp. petiolaris		flat-stalk senna	3	5	3	2		
Sida corrugata var.			16	21	9	3	9	
Sida corrugata var. angustifolia		corrugated sida	4	4	2	1	1	
Sida corrugata var. corrugata		corrugated sida	1	1	1			
Sida fibulifera		pin sida	1	4	4			
Sida intricata		twiggy sida	5	4	4			
Sida trichopoda		high sida	1	1	1			
Solanum esuriale		quena	2	2	2			
Solenogyne dominii - U MU R SL U	3	smooth solenogyne	3	3		2		1
Sporobolus virginicus		salt couch	1	1			1	
Stackhousia monogyna		creamy candles	6	9	3	1	3	2
Stackhousia sp.		candles	5	5	3		1	1
Stenopetalum lineare		narrow thread-petal	2	3	2	1		
Stipa blackii - N MU T	5	crested spear-grass	31	45	19	5	19	2
Stipa curticoma - V NL T SL V	2	short crest spear-grass	3	3		1	1	1
Stipa elegantissima - N SL U	3	elegant spear-grass	5	28	12	6	7	3
Stipa eremophila - N SL U	2	desert spear-grass	16	27	15	7	3	2
Stipa exilis			1	1		1		
Stipa flavescens - N MU U NL R	4		7	7		2	2	3
Stipa gibbosa - R SL R	1		1	1				1
Stipa hemipogon - N SL U	3	half-beard spear-grass	3	3				3
Stipa mollis		soft spear-grass	1	2				2
Stipa multispiculis 3RC- R SL R	3	small-seed spear-grass	2	3				3
Stipa nitida		Balcarra grass	9	15	11	1	3	
Stipa nodosa		smooth spear-grass	14	19	8	6	2	3
Stipa platychaeta - N FR R NL R	3	flat-awn spear-grass	4	5	2	2	1	
Stipa puberula - R MU K	1		1	1		1		
Stipa scabra ssp.				5	1	2	2	
Stipa scabra ssp. falcata		slender spear-grass	30	34	12	2	15	4
Stipa scabra ssp. scabra		rough spear-grass	2	2	2			
Stipa semibarbata		barbed spear-grass	1	1				1
Stipa setacea - R FR R MU K NL R SL R	11	corkscrew grass	7	11	1	3	4	3
Stipa tenuifolia - R MU T	1		2	2	1	1		
Stuartina muelleri		spoon cudweed	2	2		1	1	
Swainsona oroboides		variable swainson-pea	1	1			1	
Swainsona stipularis		orange swainson-pea	1	1	1			

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Templetonia aculeata - U FR U NL R	3	spiny mallee-pea	2	3	1		2	
Tetragonia eremaea		desert spinach	1	1	1			
Teucrium racemosum		grey germander	3	3	3			
Teucrium sessiliflorum - N MU R	1	mallee germander	2	2		1	1	
Thelymitra antennifera		lemon sun-orchid	1	1		1		
Thelymitra grandiflora - U FR R	1	scented sun-orchid		1	1			
Thelymitra nuda		scented sun-orchid	4	7	3	1	1	2
Thelymitra pauciflora - N MU U	1	slender sun-orchid	1	1		1		
Thelymitra sp.		sun-orchid	3	4			1	3
Themeda triandra		kangaroo grass	6	34	3	8	17	6
Thysanotus baueri - N NL R	1	mallee fringe-lily	8	14	6	7	1	
Thysanotus patersonii		twining fringe-lily	4	11	2	4	3	2
Thysanotus tenellus - R FR R	3	grassy fringe-lily	2	3	3			
Tricoryne elatior - N NL R	1	yellow rush-lily	3	3		1	1	1
Triodia scariosa ssp.		spinifex	4	16	5		11	
Triodia scariosa ssp. bunicola		spinifex	1	2	2			
Triptilodiscus pygmaeus		small yellow-heads	6	20	10	4	6	
Trymalium wayae - U NL U	1	grey trymalium	1	1			1	
Velleia arguta		spur velleia	2	2		1	1	
Velleia paradoxa - Q MU Q NL Q SL U	5	spur velleia	4	5		1	3	1
Vittadinia australasica var.			1	2	2			
Vittadinia blackii - N MU U	2	narrow-leaf New Holland daisy	5	8	2	2	4	
Vittadinia cervicularis var. cervicularis		waisted New Holland daisy	4	8	6		2	
Vittadinia condyloides			1	1	1			
Vittadinia cuneata var.			12	14	6		7	1
Vittadinia cuneata var. cuneata forma cuneata		New Holland daisy	8	12	2	8		2
Vittadinia gracilis		woolly New Holland daisy	12	27	11	7	9	
Vittadinia megacephala		giant New Holland daisy	1	1		1		
Vittadinia pterochaeta		rough New Holland daisy	1	1	1			
Vittadinia sulcata			1	1	1			
Wahlenbergia gracilenta		annual bluebell	3	5	2	2	1	
Wahlenbergia luteola		yellow-wash bluebell	20	34	17	8	8	
Wahlenbergia multicaulis - N MU K	1	Tadgell's bluebell	1	1		1		
Wahlenbergia stricta ssp. stricta		tall bluebell	6	18	2	5	5	6
Wurmbea biglandulosa ssp. flindersica			1	1			1	
Wurmbea dioica ssp. dioica		early star-lily	8	13	2	3	5	3
Wurmbea latifolia ssp. latifolia V V FR E	1	broad-leaf star-lily	1	1	1			
Wurmbea sp.		star-lily	2	8	6		2	
Xanthorrhoea quadrangulata		rock grass-tree	2	3			3	
Xanthorrhoea semiplana ssp. semiplana		yacca	1	2		1		1
Zygophyllum apiculatum		common twinleaf	1	1	1			
Zygophyllum confluens			2	3	2	1		
Zygophyllum crenatum		notched twinleaf	3	6	6			
Zygophyllum ovatum		dwarf twinleaf	1	1	1			

Alien Species

Alien Species including native species that are not indigenous in Lofty Block	Common Name	no, Vch	svy freq	Regional frequency			
				FR	MU	NL	SL
**Acacia longifolia var. longifolia*	sallow wattle	1	1				1
**Acetosella vulgaris*	sorrel	1	1		1		
**Aira cupaniana*	small hair-grass	13	29	5	6	13	5
**Aira elegantissima ssp. elegantissima*	delicate hair-grass	2	2			2	
**Alyssum linifolium*	flax-leaf alyssum	1	1	1			
**Anagallis arvensis*	pimpernel	4	19	3	3	6	7
**Arctotheca calendula*	Cape weed	2	7	4	2		1
**Asclepias rotundifolia*	broad-leaf cotton-bush	2	4		2		2
**Asphodelus fistulosus*	onion weed	1	4	4			
**Avena barbata*	bearded oat	8	62	21	10	22	9
**Brachychiton populneus*	kurrajong	1	1				1
**Brachypodium distachyon*	false brome	14	29	8	2	12	7
**Brassica tournefortii*	wild turnip	1	3		3		
**Briza maxima*	large quaking-grass	4	26	5	7	5	9
**Briza minor*	lesser quaking-grass	5	12	1	2	5	4
**Bromus diandrus*	great brome	10	25	10	5	7	3
**Bromus hordeaceus ssp. hordeaceus*	soft brome	7	10	4	2	4	
**Bromus madritensis*	compact brome	6	5	2		3	
**Bromus rubens*	red brome	7	25	15	6	3	1
**Bupleurum semicompositum*	hare's ear	2	3		1	2	
**Capsella bursapastoris*	shepherd's purse	1	1	1			
**Carduus tenuiflorus*	slender thistle	3	3	1		1	1
**Carrichtera annua*	Ward's weed	2	11	11			
**Carthamus lanatus*	saffron thistle	6	37	15	7	14	1
**Centaurea melitensis*	Malta thistle	3	6	5		1	
**Centaurium erythraea*	common centaury	1	6		6		
**Centaurium spicatum*	spike centaury	2	3	1		2	
**Centaurium tenuiflorum*	branched centaury		1				1
**Chrysanthemoides monilifera*	boneseed	2	6	1			5
**Cirsium vulgare*	spear thistle	2	3	2		1	
**Cotoneaster glaucophyllus*	cotoneaster	1	1				1
**Critesion murinum ssp. glaucum*	blue barley-grass	2	3	3			
**Cynara cardunculus*	artichoke thistle		1				1
**Cynosurus echinatus*	rough dog's-tail grass	2	10	1	2	2	5
**Dactylis glomerata*	cocksfoot	1	2				2
**Desmazeria rigida*	rigid fescue	1	3	3			
**Echium plantagineum*	Salvation Jane	4	34	10	8	15	1
**Ehrharta calycina*	perennial veldt grass	1	1		1		
**Ehrharta longiflora*	annual veldt grass	4	9	1	2	1	5
**Erodium botrys*	long heron's-bill	3	7		5	2	
**Fraxinus rotundifolia ssp. rotundifolia*	desert ash	1	1			1	
**Galenia secunda*	galenia	1	1		1		
**Galium divaricatum*	slender bedstraw	5	7		4	3	
**Galium murale*	small bedstraw	1	1		1		
**Gynandriris setifolia*	thread iris	5	20	10	6	4	
**Hainardia cylindrica*	common barb-grass	1	1	1			
**Hedypnois rhagadioloides*	Cretan weed	7	29	10	7	10	2
**Heliotropium europaeum*	common heliotrope	1	1	1			
**Herniaria cinerea*	rupturewort	1	3	3			
**Holcus lanatus*	Yorkshire fog	2	2	1	1		
**Homeria flaccida*	one-leaf Cape tulip	3	6			3	3
**Hypericum perforatum*	St John's wort	2	2			1	1
**Hypochaeris glabra*	smooth cat's ear	5	29	15	9	5	
**Hypochaeris radicata*	rough cat's ear	8	34	10	3	16	5
**Juncus capitatus*	dwarf rush	1	3		2		1
**Lactuca serriola*	prickly lettuce	1	3	3			
**Lamarckia aurea*	toothbrush grass	2	6	4	2		
**Lavandula stoechas*	topped lavender	1	1				1
**Lepidium africanum*	common peppercress	7	11	5	1	4	1
**Limonium lobatum*	winged sea-lavender	3	4	4			
**Linum trigynum*	French flax	3	7			2	5
**Logfia gallica*	narrow cudweed	4	6		1	5	
**Lolium loliaceum*	stiff ryegrass	1	1	1			
**Lolium rigidum*	Wimmera ryegrass	6	10	6	1	2	1
**Lycium ferocissimum*	African boxthorn	2	10	7	2	1	
**Malva parviflora*	small-flower marshmallow	2	2	2			
**Marrubium vulgare*	horehound	2	5	3		2	
**Medicago minima var. minima*	little medic	6	17	14	2	1	
**Medicago polymorpha var. polymorpha*	burr-medic	2	3	2	1		
**Medicago truncatula*	barrel medic	3	3	2	1		
**Mesembryanthemum nodiflorum*	slender iceplant	1	4	4			

Alien Species including native species that are not indigenous in Lofty Block	Common Name	no, Vch	svy freq	Regional frequency			
				FR	MU	NL	SL
**Minuartia mediterranea*	slender sandwort	1	1		1		
**Monadenia bracteata*	weed orchid	1	3				3
**Myrsiphyllum asparagoides*	bridal creeper	1	4		2		2
**Neatostema apulum*	hairy sheepweed	3	5		3	2	
**Olea europaea ssp. europaea*	olive	3	10	1		1	8
**Onopordum acaulon*	horse thistle	1	1	1			
**Papaver hybridum*	rough poppy	1	3	3			
**Parentucellia latifolia*	red bartsia	3	3	1	1	1	
**Pentaschistis airoides*	false hair-grass	7	27	13	8	5	1
**Pentaschistis pallida*	pussy tail		4				4
**Petrorhagia nanteuilii*		2	3	1		2	
**Petrorhagia velutina*	velvet pink	4	12	3	4	4	1
**Phalaris aquatica*	phalaris		1				1
**Pinus halepensis*	Aleppo pine		1				1
**Pinus radiata*	radiata pine		1				1
**Piptatherum miliaceum*	rice millet	1	1				1
**Plantago bellardii*	hairy plantain	2	4		4		
**Plantago coronopus ssp. coronopus*	bucks-horn plantain	1	1		1		
**Plantago lanceolata var.*	ribwort	1	2				2
**Plantago lanceolata var. lanceolata*	ribwort	1	6		1		5
**Poa bulbosa*	bulbous meadow-grass	2	2	1	1		
**Prunus cerasifera*	cherry-plum	1	1				1
**Rapistrum rugosum ssp. rugosum*	turnip weed	2	4	2		1	1
**Reichardia tingitana*	false sowthistle	1	1		1		
**Reseda lutea*	cut-leaf mignonette	1	1	1			
**Rhamnus alaternus*	blow-fly bush	1	2				2
**Romulea minutiflora*	lesser Guildford grass	5	19	1	10	4	4
**Rosa canina*	dog rose	3	5		1	2	2
**Rosa rubiginosa*	sweet briar	1	1	1			
**Rostraria cristata*	annual cat's-tail	4	6		4	2	
**Rostraria pumila*	tiny bristle-grass	3	11	8		3	
**Salvia verbenaca form A*	wild sage	5	13	4	3	6	
**Sanguisorba minor ssp. muricata*	sheep's burnet	1	1	1			
**Scabiosa atropurpurea*	purple pincushion	1	1			1	
**Senecio pterophorus var. pterophorus*	African daisy	2	4				4
**Sherardia arvensis*	field madder	2	3		3		
**Silene apetala*	mallee catchfly	1	1	1			
**Silene gallica var.*	French catchfly	2	3	2		1	
**Silene gallica var. gallica*	French catchfly	1	3		2		1
**Silene nocturna*	Mediterranean catchfly	3	16	8	5	3	
**Sisymbrium erysimoides*	smooth mustard	3	6	5	1		
**Sisymbrium orientale*	wild mustard	2	3	3			
**Solanum cinereum*	Narrawa burr	1	1	1			
**Sonchus oleraceus*	common sow-thistle	12	30	15	5	5	5
**Sparaxis bulbifera*	harlequin flower	1	2				2
**Sparaxis sp.*	Sparaxis		3				3
**Spergularia diandra*	lesser sand-spurrey	2	2	2			
**Spergularia rubra*	red-spurrey	3	12	8	3	1	
**Tolpis barbata*		1	1		1		
**Trifolium angustifolium*	narrow-leaf clover	6	46	13	9	19	5
**Trifolium arvense var. arvense*	hare's-foot clover	7	40	18	8	13	1
**Trifolium campestre*	hop clover	5	40	9	9	18	4
**Trifolium glomeratum*	cluster clover	5	26	8	7	9	2
**Trifolium scabrum*	rough clover	1	4		4		
**Trifolium subterraneum*	subterranean clover	1	1	1			
**Trifolium tomentosum*	woolly clover	1	3	3			
**Vellereophyton dealbatum*		1	1		1		
**Vulpia bromoides*	squirrel-tail fescue		1	1			
**Vulpia muralis*		7	11	3	5	3	
**Vulpia myuros forma*	fox-tail fescue	1	2	2			
**Vulpia myuros forma megalura*	fox-tail fescue	1	1	1			
**Vulpia myuros forma myuros*	rat's-tail fescue	16	24	11	3	7	3
**Vulpia sp.*			24	6	6	8	4
**Zaluzianskya divaricata*	spreading night-phlox	1	6		5		1

Appendix V

PLANT SPECIES WITH REGIONAL CONSERVATION SIGNIFICANCE RECORDED IN GRASSLAND AND GRASSY WOODLAND IN THE LOFTY BLOCK (COMPOSITE VEGETATION DATA)

Plant taxonomy follows Jessop (1993) but includes recent taxonomic changes in the SA FLORA database. Species records are from all 513 sites included in the final PATN analysis, including selected sites from surveys 46, 49, 51, 54, 55, 56, 58, 62, 63, 66, 70, 83, 86, 88. In some instances, such as on rail reserves, individual specimen trees may have been planted.

Conservation status codes are listed for Australia (AUS), South Australia (SA) and regions where applicable: Flinders Ranges (FR), Murray (MU), Northern Lofty (NL), Southern Lofty (SL) and Yorke Peninsula (YP).

Conservation Status Codes described below are from **Lang, P.J. & Kraehenbuehl, D.N. (1997). Plants of Particular Conservation Significance in South Australia's Agricultural Regions. (*May*, 1997 update of unpublished database). Department of Environment & Natural Resources.**

CONSERVATION STATUS CODES

The categories below may apply to the whole of a species distribution (usually equivalent to the Australian (AUS) level) or to a specified part of a species distribution at State (SA) or regional level (AD region code).

They are listed in order of decreasing conservation significance.

X - Extinct/Presumed extinct: not located despite thorough searching of all known and likely habitats; known to have been eliminated by the loss of localised population(s); or not recorded for more than 50 years from an area where substantial habitat modification has occurred.

E - Endangered: rare and in danger of becoming extinct in the wild.

T - Threatened: likely to be either Endangered or Vulnerable but insufficient data for a more precise assessment.

V - Vulnerable: rare and at risk from potential threats or long term threats which could cause the species to become endangered in the future.

K - Uncertain: likely to be either Threatened or Rare but insufficient data for a more precise assessment.

R - Rare: has a low overall frequency of occurrence (may be locally common with a very restricted distribution or may be scattered sparsely over a wider area). Not currently exposed to significant threats, but warrants monitoring and protective measures to prevent reduction of population sizes.

U - Uncommon: less common species of interest but not rare enough to warrant special protective measures.

Q - Not yet assessed but flagged as being **of possible significance**.

N **Not of particular significance / Common.** - (Also indicated by a blank entry.)

AUSTRALIAN STATUS CODES

Where the Australian status is indicated by a single letter code it follows the definitions on the preceding page.

Where the Australian status is indicated by a three or four letter code (eg 2RCi) it is derived from Briggs, J.D., & Leigh, J.H. (1996). "Rare or Threatened Australian Plants, 1995 Revised Edition." (CSIRO, Australia). These codes comprise the following elements.

Distribution categories:

1 - species known from type collection only
- or from a single location only

2 - species with a very restricted distribution in Australia and with a maximum geographic range of less than 100 km

3 - species with a range of at least 100 km but occurring only in small populations (often restricted to highly specific and localised habitats

Conservation categories

X - **Presumed extinct**: species that have either not been found in recent years despite thorough searching, or have not been collected for at least 50 years and were known only from now intensively settled areas.

E - **Endangered**: in serious risk of disappearing from the wild state within one or two decades if present land use and other causal factors continue to operate.

V - **Vulnerable**: not presently Endangered but at risk of disappearing from the wild over a longer period (20-50 years), or which largely occur on sites likely to experience changes in land use that would threaten the survival of the species in the wild.

R - **Rare**: species which are rare in Australia but which overall are not considered Endangered or Vulnerable. Such species may be represented by a relatively large population in very restricted area, or by smaller populations spread over a wider range or some intermediate combination of distribution pattern.

K - Poorly known: species that are suspected, but not definitely known, to belong to any of the above categories

Reservation categories

C - known to be present within a national park or other conservation reserve

a - adequately reserved with a total of at least 1000 plants known to occur in reserves.

i - inadequately reserved, with a total of less than 1000 plants in reserves

t - total known populations are in reserves

PLANT SPECIES WITH REGIONAL CONSERVATION SIGNIFICANCE RECORDED IN GRASSLAND AND GRASSY WOODLAND IN THE LOFTY BLOCK

COMPOSITE VEGETATION DATA: 513 QUADRATS

TAXON	Total number of records	Number of sig. records	National, state and regional conservation status						
			AUS	SA	FR	MU	NL	SL	YP
Acacia acinacea	21	10		N		U	U		
Acacia glandulicarpa	2	2	3VC	E			E		
Acacia gracilifolia	4	4	3RC	R	R		R		
Acacia iteaphylla	5	3	3RC	R	R		R		
Acacia montana	1	1	a	R			R		
Acacia notabilis	17	2		N				K	V
Acacia oswaldii	12	1		N				E	
Acacia pravifolia	5	5		U	U		R		
Acacia rupicola	4	4		N	K		R		
Acacia spinescens	1	1		N			V		
Acacia victoriae ssp. victoriae	27	2		N		R			
Acacia wattsiana	17	1		N	K				
Acrotriche affinis	2	2		N			K		
Acrotriche patula	6	6		N			R		
Alectryon oleifolius ssp. canescens	17	2		N			U		
Alyxia buxifolia	3	1		N				R	
Amphipogon caricinus var. caricinus	14	10		N			R	U	
Anogramma leptophylla	1	1		R	R				
Aristida behriana	127	30		N		R		U	
Aristida holathera var. holathera	1	1		N				E	
Arthropodium fimbriatum	44	6		N	U				
Arthropodium minus	17	5		N		R	V		
Asplenium flabellifolium	2	2		N			R		
Astroloma conostephioides	5	3		N			R		
Banksia marginata	2	1		N			R		
Billardiera versicolor	8	7		U	U				
Bolboschoenus caldwellii	1	1		N	U				
Bossiaea prostrata	4	2		N			E		
Bothriochloa macra	1	1		E				T	
Brachycome ciliaris var. subintegrifolia	12	3		K			K		
Brachycome leptocarpa	1	1		U			T		
Bromus arenarius	2	2		N			X		U
Bulbine bulbosa	96	9		N		R			
Burchardia umbellata	5	1		N			K		
Caesia calliantha	36	11		N	R	R			
Callistemon teretifolius	6	4		N			U		
Callitris preissii	42	5		N				U	
Calocephalus citreus	46	46		U	U	V	U	R	
Carex breviculmis	19	10		N	R		R		
Carex inversa var. inversa	1	1		R	K				
Cassinia arcuata	8	7		U			U		
Cassytha glabella forma dispar	1	1		N			R		
Cassytha peninsularis var. flindersii	1	1		N			R		
Centrolepis aristata	2	1		N		K			
Centrolepis cephaloformis ssp. cephaloformis	1	1		R			R		
Chamaescilla corymbosa var. corymbosa	3	1		N			R		
Cheilanthes distans	8	1		N			R		
Cheilanthes lasiophylla	17	1		N		U			
Cheilanthes sieberi ssp. sieberi	11	1		N		K			
Cheiranthera alternifolia	5	5		N	R		T		
Chenopodium curvispicatum	1	1		N	K				
Chenopodium nitrariaceum	2	2		N	K				
Choretrum glomeratum var. chrysanthum	2	2		R	R		T		
Chrysocephalum semipapposum	58	4		N				K	
Correa glabra	1	1		N			R		

TAXON	Total number of records	Number of sig. records	National, state and regional conservation status						
			AUS	SA	FR	MU	NL	SL	YP
Craspedia glauca	17	3		N			R		
Craspedia globosa	1	1		V		E			
Crassula closiana	1	1		N			R		
Cryptandra amara var. longiflora	32	32		R	R	K	R		
Cymbonotus preissianus	21	21		U	V	K	R		
Cymbopogon ambiguus	16	1		N		R			
Cymbopogon obtectus	1	1		N		V			
Cynoglossum suaveolens	13	13		N	R	R	R	U	
Cyperus tenellus	3	1		N		R			
Danthonia auriculata	70	70		N	K	R	R	U	
Danthonia carphoides var. carphoides	5	3		K			K		
Danthonia eriantha	39	39		R	R	K	R		
Danthonia linkii var. fulva	2	2		R	R		K		
Danthonia pilosa var. paleacea	11	3		N			K		
Danthonia racemosa var. racemosa	23	17		N	U	K	U		
Danthonia tenuior	3	1		Q			Q		
Daviesia genistifolia	6	6		U	U		U		
Daviesia leptophylla	2	1		N	U				
Derwentia decorosa	7	7	3RC	R	R				
Dianella longifolia var. grandis	3	3	-	R	R		T	V	
Dichelachne crinita	12	11		N	U		R		
Diuris palustris	1	1		U	R				
Dodonaea lobulata	8	1		N		U			
Dodonaea procumbens	1	1	3V	E			E		
Dodonaea viscosa ssp. cuneata	1	1		U				V	
Drosera auriculata	13	9		N	U		U		
Drosera glanduligera	6	6		N	R	U	R		
Drosera peltata	13	11		N	U	K	U		
Echinopogon ovatus var. ovatus	2	2		R	R		R		
Elachanthus pusillus	17	17		U	R		R		
Elymus scabrus var. scabrus	94	51		N		R	U		
Enneapogon nigricans	68	25		N			U		
Eremophila longifolia	25	1		N				V	
Eremophila santalina	4	4		U	U				
Eriochilus cucullatus	1	1		N		R			
Eriochlamys behrii	7	7		N	T		X		
Eryngium rostratum	6	6		V	V		V		
Eucalyptus aff. viridis	2	2		R	R				
Eucalyptus albens	3	3		R	R				
Eucalyptus calycogona var. calycogona	2	2		N			R		
Eucalyptus dumosa	4	1		N				V	
Eucalyptus goniocalyx	5	1		N			U		
Eucalyptus macrorhyncha ssp. macrorhyncha	2	2		R			R		
Eucalyptus microcarpa	68	33		N			R	U	
Eucalyptus porosa	30	7		N				U	
Eucalyptus socialis	25	1		N				U	
Eutaxia microphylla var. diffusa	7	7		U	R		E	V	
Exocarpos cupressiformis	21	8		N			U		
Exocarpos sparteus	8	1		N				R	
Festuca benthamiana	1	1	3RC	R	R				
Gahnia lanigera	8	5	a	N			Q	R	
Goodenia albiflora	25	25		U	U		U		
Goodenia amplexans	3	3		U	R			U	
Goodenia blackiana	16	16		N			R		
Goodenia pinnatifida	168	91		Q		U	U	U	
Goodenia willisiana	6	1		N				R	
Grevillea huegelii	1	1		N			Q		
Grevillea ilicifolia var. ilicifolia	1	1		N	T				
Grevillea lavandulacea var. sericea	5	5		U	U				
Haeckeria punctulata	1	1		R	R				
Hakea carinata	1	1		N			U		

TAXON	Total number of records	Number of sig. records	National, state and regional conservation status						
			AUS	SA	FR	MU	NL	SL	YP
Hakea rugosa	1	1		N			V		
Hardenbergia violacea	10	3		N			U		
Helichrysum leucopsideum	13	4		N	R				
Hibbertia exutiacies	45	34		N	U		U		
Homopholis proluta	13	1		N				R	
Hydrocotyle laxiflora	33	21		N		K	U		
Hymenanthera dentata	6	6		U	U		R		
Hypericum gramineum	1	1		N	R				
Isolepis marginàta	7	6		N			K		
Juncus flavidus	2	2		R	R		V		
Kennedia prostrata	22	2		N		U			
Lagenifera huegelii	79	24		N	R	R			
Lepidosperma curtisiae	8	1		N			R		
Lepidosperma laterale	6	6		N		R		Q	
Leptomeria aphylla	2	2		U			E		
Leptorhynchos scabrus	1	1		R	T				
Leptorhynchos squamatus	56	1		N		R			
Leptorhynchos tetrachaetus	35	35		U	U	K	U		
Leptorhynchos waitzia	1	1		N	R				
Levenhookia dubia	23	23		N	R	R	R		
Linum marginale	21	21		N	U	U	U		
Logania sp. B	2	2		R	R		R		
Lomandra collina	12	2		N	R			R	
Lomandra densiflora	139	4		N		R			
Lomandra effusa	124	43		N	R			R	
Lomandra leucocephala ssp. robusta	1	1		N			T		
Lomandra micrantha ssp. micrantha	15	7		N			K		
Lomandra nana	13	13		U		T	K	U	
Lomandra sororia	20	20		U		K	V	U	
Luzula meridionalis	13	5		N	U				
Maireana aphylla	32	16		N		R	V	V	
Maireana enchylaenoides	191	7		N				U	
Maireana excavata	23	22		K	K		E		
Maireana rohrlachii	7	7	3RC	R	R		V		
Melaleuca lanceolata	19	2	-	N				U	
Microlaena stipoides var. stipoides	6	1		N	U				
Microtis parviflora	1	1		U			R		
Millotia myosotidifolia	12	1		N				U	
Millotia tenuifolia var. tenuifolia	2	1		N			R		
Myoporum viscosum	1	1		U	Q				
Olearia pannosa ssp. pannosa	1	1	3VC	V			V		
Olearia picridifolia	1	1	[a]	R	V				
Ophioglossum lusitanicum	8	6		N		U	U		
Ozothamnus retusus	8	4		Q			U		
Ozothamnus scaber	3	2		K	K				
Panicum effusum var. effusum	7	1		Q				K	
Persicaria decipiens	1	1		N			T		
Phyllanthus saxosus	9	9		U	U		R		
Pimelea curviflora var.	4	1		R			K		
Pimelea micrantha	44	2		N				R	
Pittosporum phylliraeoides var. microcarpa	48	6		N				R	
Plantago aff. debilis	2	2		R	R				
Plantago gaudichaudii	29	29		N	R	T	U	R	
Plantago turrifera	1	1		N	U				
Pleurosorus rutifolius	19	6		N			U	U	
Poa crassicaudex	59	2		N		U			
Poa drummondiana	2	2	Q	R			X		
Podolepis muelleri	4	4		K	K		K		
Pomaderris paniculosa ssp. paniculosa	14	9		N			Q	U	
Prasophyllum fitzgeraldii	1	1		U			R		
Prasophyllum odoratum	5	1		N			R		

TAXON	Total number of records	Number of sig. records	National, state and regional conservation status						
			AUS	SA	FR	MU	NL	SL	YP
Prasophyllum pallidum	2	2	3VC	V	V				
Prostanthera behriana	1	1		U	R				
Pterostylis biseta	28	1		N				K	
Ptilotus erubescens	12	12	Q	R		R	T	R	
Ptilotus nobilis var. nobilis	1	1		N		K			
Ptilotus spathulatus forma spathulatus	76	4		N				R	
Pultenaea graveolens	2	2		U	U				
Pultenaea tenuifolia	1	1		N				K	
Ranunculus pachycarpus	4	4		U	U		R		
Rhagodia parabolica	89	4		N				V	
Rumex dumosus var.	13	1		K	T				
Santalum acuminatum	13	8		N			U		
Sclerolaena uniflora	5	1		N				K	
Scutellaria humilis	1	1		R	K				
Senecio odoratus var. odoratus	2	2		N	U		U		
Senecio picridioides	3	1		N			K		
Senecio tenuiflorus	24	24		N	R	R	Q		
Sida corrugata var. angustifolia	21	2		Q				R	
Solenogyne dominii	6	6		U		R	R	U	
Stenopetalum lineare	8	1		N			R		
Stipa acrociliata	16	10		N	R		K	R	
Stipa blackii	155	8		N		T			
Stipa breviglumis	7	7	3RC	R	R		R		
Stipa curticoma	18	14	-	V			T	V	
Stipa elegantissima	151	13		N				U	
Stipa eremophila	131	7		N				U	
Stipa exilis	4	2		N			T		
Stipa flavescens	24	12		N		U	R		
Stipa gibbosa	19	16		R	K		T	R	
Stipa hemipogon	5	4		N		R		U	
Stipa mollis	15	8		N			R		
Stipa multispiculis	3	3	3RC	R				R	
Stipa petraea	3	3	-	R	R				
Stipa pilata	5	5		K	K				
Stipa platychaeta	22	20		N	R		R	T	U
Stipa puberula	7	1		R		K			
Stipa semibarbata	15	9		N			K		
Stipa setacea	27	27		R	R	K	R	R	
Stipa tenuifolia	4	3		R		T	E	V	
Stipa trichophylla	2	2		N		K			
Swainsona tephrotricha	2	2	3RC	R		E	T		
Templetonia aculeata	16	16	a	U	U		R		
Teucrium racemosum	21	2		N		U			
Teucrium sessiliflorum	25	4		N		R		V	
Thelymitra grandiflora	1	1		U	R				
Thelymitra rubra	1	1		N			R		
Thysanotus baueri	39	7		N			R	E	
Thysanotus tenellus	12	11		R	R		R		
Trachymene anisocarpa	1	1		R			T		
Tricoryne elatior	22	7		N			R		
Trymalium wayae	5	4		U			U		
Velleia arguta	21	1		N				R	
Velleia paradoxa	26	26		Q		Q	Q	U	
Veronica plebeia	9	9		U	U		U		
Vittadinia australasica var. australasica		1		N				R	
Vittadinia blackii	41	8		N		U		R	
Vittadinia megacephala	19	1		N				R	
Wahlenbergia multicaulis	1	1		N			E		
Wurmbea biglandulosa ssp. flindersica	1	1		U			R		
Wurmbea latifolia ssp. latifolia	1	1	V	V	E				

Appendix VI

TWO WAY TABLES: PLANT TAXA OCCURRING AT 30% OR MORE OF QUADRATS WITHIN ONE OR MORE FLORISTIC GROUPS - % OCCURRENCE IN GROUP

1. NATIVE SPECIES (INCLUDING SPECIES EXCLUDED FROM PATN ANALYSIS)
Species sorted by hand to maximise clustering in table.
Life form (LF): P= Perennial, A= true annual, PG= perennial grass, S= geophyte, M= mistletoe.

Floristic group:		1	2	3	4	5	6	7	8	9	10	11	12
sites in group:		33	46	20	31	52	53	13	110	51	23	54	27
Species	LF												
Enneapogon nigricans	PG	48											
Salsola kali	A		30										
Atriplex semibaccata	P		33										
Pimelea micrantha	P		33										
Minuria leptophylla	P		43										
Senna artemisioides nothossp. coriacea	P		50										
Stipa drummondii	PG		37	35									
Erodium cygnorum ssp./cicutarium	A		35	30									
Sida petrophila	P			50									
Callitris glaucophylla	P			55									
Eucalyptus porosa	P				48								
Callitris preissii	P				52								
Pittosporum phylliraeoides var. microcarpa	P				52								
Goodenia fascicularis	P					40							
Acacia victoriae ssp. victoriae	P					46							
Rhodanthe pygmaea	A	30	39	55		54							
Stipa eremophila	PG	67	85		35	42							
Goodenia pusilliflora	A	55	37			35							
Maireana brevifolia	P		43		35								
Brachycome lineariloba	A			35		35							
Enchylaena tomentosa var. tomentosa	P		61	50	84	52	36						
Amyema miquelii	M						34						
Crassula decumbens var. decumbens	A						34						
Asperula conferta	S						40						
Crassula sieberiana ssp.	A						51						
Eutaxia microphylla var. microphylla	P						30	77					
Phyllanthus saxosus	P							31					
Pomaderris paniculosa ssp. paniculosa	P							31					
Stipa acrociliata	PG							31					
Stipa flavescens	PG							31					
Melaleuca lanceolata	P							38					
Wahlenbergia gracilenta	A							38					
Eucalyptus socialis	P							69					
Chrysocephalum apiculatum	P								31				
Triptilodiscus pygmaeus	A								35				
Stipa blackii	PG						53		73				
Lomandra effusa	P	97	50					31	37				
Ptilotus spathulatus forma spathulatus	P	76		65	39		34		47				
Vittadinia gracilis	P	45	57	35		35			41				
Convolvulus erubescens	S	70	37	35					41				
Stipa nitida	PG	55	48		52	54	38	31	31				
Goodenia albiflora	S			35				31					
Acacia calamifolia	P			45				38					
Aristida behriana	PG	48							72				
Euphorbia drummondii	S	42							43				
Convolvulus remotus	S					44			33				

Floristic group:		1	2	3	4	5	6	7	8	9	10	11	12
sites in group:		33	46	20	31	52	53	13	110	51	23	54	27
Species	LF												
Stipa nodosa	PG			40		35			34				
Crassula colorata var.	A			35			60						
Sida corrugata var.	P		0.37			58	32		37				
Rhagodia parabolica	P		30	40	68			46					48
Goodenia pinnatifida	S	42	57	60			55		41				41
Glycine clandestina var. sericea	S	33										37	56
Stipa elegantissima	PG			40	58		64				30		
Wahlenbergia luteola	S	45	30	55			57		58			31	52
Maireana enchylaenoides	P	30		55	45		62	62	58				70
Vittadinia cuneata var.	P	36				31	36	31	45				37
Lomandra multiflora ssp. dura	P	33	30				57		84		39	76	85
Bursaria spinosa	P	30	30				53	62	45	39	30	65	44
Dianella revoluta var.	P		43		39		36	92	45	37	91	61	56
Arthropodium strictum	S		35	50	45		66	46	51	88	52	89	41
Danthonia caespitosa group	PG	70	93	90	74	67	68	31	70	47	39	33	33
Oxalis perennans	P	64	52	85	48	38	74	46	56	69	74	72	67
Acacia pycnantha	P						53	31	30	55	78	41	59
Einadia nutans ssp. nutans	P				65		60	31					59
Daucus glochidiatus	A			45			53	54				63	48
Eucalyptus odorata	P						98	69		31			
Danthonia setacea var. setacea	PG						51	46	30		30		
Stipa scabra ssp.	PG						55	31	34	55			
Stackhousia sp.	S						32	31	32	37		48	48
Gonocarpus elatus	S								35	47	43	63	
Plantago varia complex	P						43			35	35		56
Allocasuarina verticillata	P								35	47	39	91	41
Cheilanthes austrotenuifolia	S						30			41	35	76	56
Lomandra densiflora	P						32			41	87	61	67
Lepidosperma viscidum	P							62				48	
Themeda triandra	PG								42		43		
Astroloma humifusum	P							31			74	72	
Elymus scabrus var. scabrus	PG						43			39	30		
Lagenifera huegelii	S						43				43		33
Triodia scariosa complex	PG							46				63	37
Eucalyptus leucoxylon	P									63		39	
Geranium retrorsum	S									33			
Bulbine bulbosa	S									45	61		
Acaena echinata var.	S									71	70		
Calostemma purpureum	S										30		
Dichondra repens	P										30		
Galium gaudichaudii	S										30		
Hardenbergia violacea	P										30		
Stipa mollis group	PG										30		
Carex breviculmis	P										35		
Exocarpos cupressiformis	P										35		
Hibbertia sericea var.	P										35		
Lomandra sororia	P										39		
Caesia calliantha	S										43		
Hibbertia exutiacies	P										48		
Scaevola albida	P										52		
Acacia paradoxa	P										74		
Olearia ramulosa	P										87		
Eucalyptus microcarpa	P										100	31	67
Wahlenbergia stricta ssp. stricta	S										35	39	33
Calytrix tetragona	P											33	
Microseris lanceolata	S											35	
Thysanotus patersonii	S											41	
Goodenia robusta	S											46	
Acacia continua	P											52	

Species	LF	Floristic group:	1	2	3	4	5	6	7	8	9	10	11	12
		sites in group:	33	46	20	31	52	53	13	110	51	23	54	27
Xanthorrhoea quadrangulata	P												67	
Cassinia laevis	P												52	63
Dodonaea viscosa ssp.	P												35	33
Clematis microphylla	P													37
Rumex brownii	S													37

2. ALIEN SPECIES

Species sorted by hand to maximise clustering in table.

Life form (LF) P Perennial, A true annual or biennial, S geophyte.

Species	LF	1	2	3	4	5	6	7	8	9	10	11	12
Floristic group:		1	2	3	4	5	6	7	8	9	10	11	12
sites in group:		33	46	20	31	52	53	13	110	51	23	54	27
* *Medicago polymorpha var. polymorpha*	A		37										
* *Rapistrum rugosum ssp. rugosum*	A		30										
* *Carduus tenuiflorus*	A			40									
* *Silene nocturna*	A			40									
* *Erodium cicutarium*	A		30	45									
* *Marrubium vulgare*	P	33	30	40									
* *Carrichtera annua*	A		65	35		81							
* *Critesion murinum*	A		43	45	52	69							
* *Asphodelus fistulosus*	S		41			31							
* *Medicago truncatula*	A					40							
* *Limonium lobatum*	A					33							
* *Sisymbrium erysimoides*	A			30	48	38							
* *Rostraria cristata*	A	45		40	32			46					
* *Lycium ferocissimum*	P			45	55			31					
* *Erodium botrys*	A	55							30				
* *Salvia verbenaca form A*	S	52	65						39				
* *Carthamus lanatus*	A	52		50		58			45				
* *Gynandriris setifolia*	S	61	70		32		32	31	32				
* *Bromus rubens*	A	73	76	65	45	79	32	31	44				
* *Romulea minutiflora*	S	33					42			37			
* *Oxalis pes-caprae*	S		30								39		
* *Myrsiphyllum asparagoides*	S				32						65		
* *Bromus diandrus/rigidus*	A	33	48		35		51	38	38	47			
* *Medicago minima var. minima*	A	67	52	75	32	83		31					41
* *Hypochaeris glabra*	A	67		50		44	55	54	55	43		59	33
* *Avena barbata*	A	73	76	65	68	62	72	77	76	75		59	44
* *Sonchus oleraceus*	A	33	54	50	45	69	55	38	35	37		48	33
* *Vulpia sp.*	A	64	52	55	65	50	81	69	74	47	35	50	
* *Echium plantagineum*	A	52	57	45	42	62	70	54	70	37	30	41	41
* *Hedypnois rhagadioloides*	A						38	38					
* *Galium murale*	A						36						
* *Trifolium glomeratum*	A						34						
* *Lepidium africanum*	A						32						
* *Lolium rigidum*	A							31					
* *Pentaschistis airoides*	A						49	38					
* *Arctotheca calendula*	A						45	31		33			
* *Briza maxima*	A						34			63	96		
* *Hypochaeris radicata*	S								35	39	30		
* *Aira sp.*	A						34		34	57		48	
* *Trifolium angustifolium*	A						47	38	48	55	30		33
* *Brachypodium distachyon*	A						42	31	30		61		41
* *Trifolium arvense var. arvense*	A						60	31	51	37		31	
* *Trifolium campestre*	A						30	54	43	45		37	
* *Anagallis arvensis*	A						36	85		39	52	65	41
* *Briza minor*	A									31			
* *Asclepias rotundifolia*	P										30		
* *Chrysanthemoides monilifera*	P										61		
* *Cynosurus echinatus*	A										30		
* *Ehrharta longiflora*	A										61		
* *Olea europaea ssp. europaea*	P										100		
* *Plantago lanceolata var. lanceolata*	S										83		
* *Romulea rosea*	S										43		
* *Senecio pterophorus var. pterophorus*	P										52		
* *Sparaxis sp.*	S										30		

Appendix VII

QUADRATS INCLUDED IN PATN ANALYSIS: VEGETATION SUMMARY

Vegetation Structure (modified Muir Code, Appendix II), Dominant overstorey and understorey and number of species
Site identifier for TG, GWL surveys prefixed by group number from previous analysis and Burra Hills survey sites prefixed by B
Species listed in field description may require updating from vouchered plant species list. (NC) denotes a non-current species name. *: Dominant species that have been planted.

PATCH	sitelabel	gp	STRUCTURE	OVERSTOREY DOMINANTS: FIELD DESCRIPTION	UNDERSTOREY FIELD DESCRIPTION	no. spp	natives
10209	5TG001	1	Open sedgeland	*Lomandra effusa*	*HERBS*	44	24
11395	5TG010	1	Open sedgeland	*Lomandra effusa*	*Stipa drummondii/Chrysocephalum apiculatum*	22	10
11397	5TG018	1	Open sedgeland	*Lomandra effusa*	*Herbland*	56	30
11398	5TG019	1	Open sedgeland	*Lomandra effusa*	*Herbs*	43	23
11108	5TG011	1	Open sedgeland	*Lomandra effusa*	*HERBS*	38	24
10213	5TG002	1	Open sedgeland	*Lomandra effusa*	*HERBS*	23	15
11109	5TG009	1	Sedgeland	*Lomandra effusa*	*herbs*	33	14
11381	8TG051	1	Very open shrubland	*Bursaria spinosa*	*Lomandra effusa/Stipa nitida/Stipa eremophila*	19	12
12004	BBUR0601	1	Very open sedgeland	*Lomandra effusa*	*Av barbata S eremophila/blackii Vit gracilis*	21	11
12045	BEUD2301	1	Open sedgeland	*Lomandra effusa*	*Enneapogon nigrans Stipa* spp *Danthonia* spp	36	10
12046	BEUD2401	1	Sedgeland	*Lomandra effusa*	*Stipa* spp *Danthonia caespitosa herbs*	27	10
12098	BMON1501	1	Open sedgeland	*Lomandra effusa*	*Stipa nitida Avena barbata Danthonia auriculata*	19	11
12291	MBS0113	1	Tall open shrubland	*Acacia victoriae ssp.*	*Stipa/Danthonia//*	40	20
12042	BEUD1B33	1	Open sedgeland	*Lomandra effusa/Avena barbata/L.multiflora dura/Stipa* spp.	*Danthonia* spp/*Aristida behriana/Maireana enchylaenoides*	37	18
12080	BHAL1801	1	Low shrubland	*Maireana rohrlachii*	*Lomandra effusa L multiflora ssp dura and low grass*	45	29
15474	PET00901	1	(Tussock) grassland	*Lomandra effusa/Lomandra multiflora ssp. dura/*		42	26
12113	TER1001	1	Sedgeland	*Lomandra effusa/Maireana turbinata/Asphodelus fistulosus*	*Avena barbata Stipa nitida Carthamus lanatus Neatostema apulum*	32	20
12078	BHAL1601	1	Low open woodland	*Eucalyptus leucoxylon ssp. pruinosa*	*Lomandra and Stipa* spp *and Avena*	53	42
15464	PEK00701	1	(Tussock) grassland	*Lomandra effusa/Lomandra multiflora ssp. dura/Stipa eremophila*	*Danthonia eriantha/Stipa nitida/*	50	29
15409	PET02A09	1	(Tussock) grassland	*Lomandra effusa/Stipa eremophila/*	*Goodenia pusilliflora/Aristida behriana/*	63	45
15594	**LBGTRU03**	**1**	**Tall shrubland**	***Acacia retinodes var. retinodes (hill form)/***	***Lomandra effusa/***	47	**34**
15469	ORR01701	1	Open shrubland	*Acacia calamifolia/*	*Danthonia caespitosa/Lomandra effusa/Stipa eremophila/Stipa pilata/Danthonia eriantha/*	40	25
15595	**LBGTRU04**	**1**	**(Tussock) grassland**	***Avena barbata/Lomandra effusa/***	***Stipa eremophila/***	37	18
11110	7TG012	1	Very open shrubland	*Bursaria spinosa*	*Lomandra effusa and herbland*	24	13
11462	1A0101	1	Open sedgeland	*Lomandra effusa/Lomandra multiflora ssp. dura*	*Vittadinia* spp/*Stipa* spp/*Danthonia* spp/*Avena barbata*	33	17
11396	5TG017	1	Sedgeland	*Lomandra effusa*	*Herbs and grasses/Stipa acrociliata*	41	27
11813	LOC1802	1	Open sedgeland	*Lomandra effusa*	*As arthrixiodes Da caespitosa Stipa sp herbs*	23	15
12044	BEUD2101	1	Very open sedgeland	*Lomandra effusa*	*Chrysocephalum apiculatum Vittadinia* spp *Danthonia pilosa*	35	21
12038	BEUD1201	1	Open sedgeland	*Lomandra effusa*	*Stipa blackii Danthonia*	52	27
12041	BEUD1901	1	Open sedgeland	*Lomandra effusa*	*Danthonia Wahlenbergia*	48	26
12047	BEUD2501	1	Very low open woodland	*Allocasuarina verticillata/Acacia pycnantha*	*Dianella revoluta Lomandra effusa Lomandra densiflora*	70	41
11814	LOC2F21	1	Very low open forest	*Allocasuarina verticillata*	*Gahnia lanigera Dianella revoluta Goodenia willisiana*	42	34
15059	KAP01201	1	Low woodland	*Allocasuarina verticillata/*		45	22
10713	BUR0201	2	Open shrubland	*Acacia pycnantha*	*Grass*	30	16
10756	GLA1301	2	Tall open shrubland	*Acacia pycnantha*	*Stipa eremophila/Lomandra effusa/Brachypodium distachyon*	20	12

PATCH	sitelabel	gp	STRUCTURE	OVERSTOREY DOMINANTS: FIELD DESCRIPTION	UNDERSTOREY FIELD DESCRIPTION	no. spp	natives
11009	3NCS057	2	Low open forest	*Eucalyptus odorata*	*Acacia pycnantha/Paradoxa/Stipa blackii*	41	19
11017	3NCS056	2	Low open woodland	*Eucalyptus leucoxylon ssp.*	*A pycnantha/Stipa*	39	18
10966	3NCS042	2	(Tussock) grassland	*Maireana brevifolia*	*Stipa / Gynandriris*	30	12
15433	PEK00401	2	Open (tussock) grassland	*Stipa eremophila/Stipa drummondii/Bromus rubens*		41	24
10992	3NCS018	2	Low open shrubland	*Acacia victoriae ssp.*	*Stipa/Hordeum/Goodenia*	43	24
10981	3NCS013	2	Shrubland	*Senna artemisioides nothossp. coriacea*	*Stipa/Chenopods/Medicago*	52	30
15456	WIL00601	2	Low open shrubland	*Maireana sedifolia/*	*Stipa eremophila/*	20	13
14223	**LBGYED01**	**2**	**Open (tussock) grassland**	***Stipa eremophila/***	***Rhodanthe troedelii/***	**28**	**17**
11245	0GWL004	2	Low open forest	*Allocasuarina verticillata/Eucalyptus odorata*	*Acacia/Lomandra/Stipa/Danthonia*	22	14
14221	**LBGWIL01**	**2**	**(Tussock) grassland**	***Stipa eremophila/Danthonia caespitosa/***	***Rhodanthe troedelii/Brachycome lineariloba/Elachanthus pusillus/***	27	16
14237	**LBGQUO04**	**2**	**(Tussock) grassland**	***Stipa eremophila/***	***Danthonia caespitosa/***	26	16
14238	**LBGQUO05**	**2**	**(Tussock) grassland**	***Maireana georgei***	***Stipa eremophila/Danthonia caespitosa***	20	11
10950	3NCS024	2	Open shrubland	*Acacia pycnantha*	*Senna/Stipa/Danthonia*	40	23
10952	4NCS025	2	Very low woodland	*Acacia pycnantha*	*Bursaria/Stipa/Xanthorrhoea*	68	48
10985	3NCS035	2	Tall shrubland	*Acacia ligulata*	*Senna art coriacea/Stipa/Danthonia*	42	20
10963	3NCS037	2	Low shrubland	*Acacia pycnantha*	*Pimelea/Stipa/Danthonia*	45	23
10999	3NCS061	2	Low open forest	*Pinus halepensis*	*Senna art coriacea/A victoriae/Stipa*	46	20
10998	3NCS060	2	Tall shrubland	*Acacia victoriae ssp./Acacia salicina*	*Avena/Stipa/Danthonia*	40	20
11004	3NCS065	2	Tall open shrubland	*Eucalyptus gracilis/Acacia ligulata*	*Senna art coriacea*	51	24
10970	3NCS052	2	Low open woodland	*Eucalyptus odorata*	*Acacia acinacea/Danthonia/Stipa*	40	21
10972	3NCS062	2	(Tussock) grassland	*Bursaria sp./Eremophila longifolia*	*Stipa/Danthonia/Avena*	50	28
10973	3NCS064	2	Open (tussock) grassland	*Avena barbata*	*Stipa/Herbs*	55	22
10987	3NCS019	2	Tall shrubland	*Eremophila longifolia*	*Senna/Lomandra/Goodenia*	52	27
14228	**LBGPET03**	**2**	**Low woodland**	***Callitris preissii/***	***Danthonia auriculata/Stipa nodosa/Stipa eremophila/Hyalosperma semisterile/***	**65**	**36**
11010	3NCS022	2	Open shrubland	*Eucalyptus porosa/Callitris preissii*	*Acacia/Senna/Grasses*	51	32
15477	PET01001	2	Low woodland	*Callitris glaucophylla/*	*Rhagodia parabolica/Enteropogon acicularis/Dodonaea viscosa ssp. angustissima/Hyalosperma glutinosum/semisterile/*	62	48
11012	3NCS026	2	Low woodland	*Eucalyptus porosa/Callitris glaucophylla*	*Acacia/Exocarpus/Olearia/Atriplex/Stipa*	75	51
15598	**LBGANG01**	**2**	**Low open woodland**	***Callitris preissii/***	***Stipa eremophila/Senna artemisioides ssp. petiolaris/***	**50**	**36**
15600	**LBGTEP01**	**2**	**Open mallee**	***Eucalyptus socialis/***	***Danthonia setacea var. setacea/Senna artemisioides nothossp. coriacea/***	74	52
11194	8TG041	2	(Tussock) grassland	*Acacia victoriae ssp. victoriae/Acacia hakeoides/Dodonaea viscosa ssp. angustissima*	*Stipa eremophila*	61	35
15475	PET01501	2	(Tussock) grassland	*Stipa eremophila/Stipa scabra ssp./*		42	27
15466	ORR00201	2	Open shrubland	*Senna artemisioides ssp. filifolia/Hakea leucoptera/*	*Stipa drummondii/Stipa blackii/Stipa eremophila/Stipa platychaeta/*	60	43
15467	ORR00602	2	(Tussock) grassland	*Stipa pilata/Stipa eremophila/*		46	33
15463	WIL01101	2	(Tussock) grassland	*Stipa blackii/Avena barbata/*	*Eriochiton sclerolaenoides/Vulpia muralis*	54	36
15465	WIL00401	2	(Tussock) grassland	*Atriplex stipitata/Stipa blackii/*		52	39
15472	WIL01001	2	(Tussock) grassland	*Avena barbata/*	*Danthonia caespitosa/Goodenia pinnatifida/*	44	34
15468	ORR02D10	2	(Tussock) grassland	*Stipa pilata/Lomandra effusa/*	*Danthonia caespitosa/Asteridea athrixioides forma/*	41	29
10978	2NCS005	2	Tall shrubland	*Acacia hakeoides*	*Nitraria/Oxalis/Avena*	27	15
10979	3NCS007	2	Tall shrubland	*Senna artemisioides nothossp. coriacea*	*Acacia/Senna/Avena*	39	18
10980	3NCS008	2	Tall open shrubland	*Acacia ligulata*	*Acacia notabilis/Pittosporum/Stipa/Danthonia*	37	23
11001	3NCS053	2	Mallee	*Eucalyptus socialis*	*Acacias/Stipa eremophila/Danthonia*	68	37
11006	3NCS069	2	Open shrubland	*Eucalyptus gracilis*	*Senna/Acacia/Stipa*	64	40
10964	3NCS039	2	Low open woodland	*Eucalyptus cladocalyx**	*Stipa / Danthonia*	42	26
10969	3NCS051	2	Very open mallee	*Bursaria spinosa/Eucalyptus porosa*	*Stipa/Danthonia*	34	15
10695	BOO0701	3	Open mallee	*Eucalyptus odorata*	*GRASSES AND HERBS*	47	23

PATCH	sitelabel	gp	STRUCTURE	OVERSTOREY DOMINANTS: FIELD DESCRIPTION	UNDERSTOREY FIELD DESCRIPTION	no. spp	natives
10789	LAU0101	3	Low open forest	*Eucalyptus odorata/Callitris glaucophylla*	*Avena barbata/Bromus rubens*	29	17
15427	ORR00801	3	Low woodland	*Callitris glaucophylla/*	*Hyalosperma semisterile/Maireana excavata/*	50	24
15499	CAR01601	3	Low woodland	*Callitris glaucophylla/*	*Danthonia eriantha/Stipa blackii/Stipa nodosa/*	35	19
15449	ORR00401	3	Low open forest	*Callitris glaucophylla/*		38	19
10791	LAU0301	3	Low open forest	*Eucalyptus odorata/Callitris glaucophylla*	*introduced grasses and annual herbs*	34	15
15398	KAN00701	3	Low open forest	*Callitris glaucophylla/*	*Enchylaena tomentosa var./*	36	18
15402	ORR02A02	3	Very low woodland	*Eucalyptus socialis/Callitris glaucophylla/*	*Rhagodia parabolica/*	31	15
15389	KAN00301	3	Low woodland	*Callitris glaucophylla/*	*Senna artemisioides nothossp. artemisioides/Dodonaea viscosa ssp. angustissima/*	43	29
15450	WIL00502	3	Low open forest	*Callitris glaucophylla/*	*Acacia calamifolia/Melaleuca lanceolata/Senna artemisioides nothossp. coriacea/*	46	38
15452	WIL00402	3	Low open forest	*Callitris glaucophylla/*	*Acacia argyrophylla/*	42	26
11949	MBS0201	3	Open shrubland	*Acacia calamifolia/Melaleuca lanceolata*	*SIDA/STIPA/DANTHONIA*	27	18
15406	PET00501	3	Tall open shrubland	*Acacia calamifolia/Acacia pycnantha/*		42	21
12317	MBS0209	3	Low open shrubland	*Acacia calamifolia/Eremophila alternifolia*	*grasses/herbs*	35	23
15401	ORR02A01	3	Mallee	*Eucalyptus socialis/*	*Sclerolaena diacantha/Rhagodia parabolica/Westringia rigida/*	60	39
11957	MBS0202	3	Mallee	*Eucalyptus gracilis*	*STIPA/DANTHONIA*	19	14
11961	MBS0206	3	Mallee	*Eucalyptus gracilis/Eucalyptus socialis*	*STIPA/DANTHONIA*	29	23
11958	MBS0203	3	Low shrubland	*Lawrencia squamata/Eremophila alternifolia*	*STIPA/DANTHONIA/SIDA*	23	18
12315	MBS0208	3	Open shrubland	*Zygophyllum confluens*	*grasses/herbs*	51	28
12254	MBS0104	3	Shrubland	*Lycium australe/Sida petrophila/Zygophyllum confluens*	*MAIREANA/SWAINSONIA*	62	33
10758	HAL0101	4	Low open forest	*Callitris preissii*	*Alectryon oleifolius/grasses*	26	15
10763	HAL0601	4	Low open forest	*Eucalyptus leucoxylon (NC)/Eucalyptus odorata*	*Grasses*	33	18
10766	HAL0901	4	Low open forest	*Callitris preissii*	*Grasses*	37	20
10770	HAL1201	4	Low open forest	*Callitris preissii*	*Grasses*	36	21
11974	MBS0404	4	Open (tussock) grassland	*Stipa sp./Themeda triandra*	*DANTHONIA/HYPOCHOERIS/ANAGALLIS/MEDICAGO*	49	27
12021	CAR0701	4	Very low open woodland	*Callitris preissii*	*Rhag parabolica Lom effusa Sti scabra Lep tetrachaetus*	31	20
12101	PET0101	4	Very low open forest	*Callitris preissii*	*Lomandra effusa Stipa nodosa Chrysocephalum apiculatum*	33	28
15123	BAL01101	4	Low open forest	*Callitris preissii/*	*Bursaria spinosa/*	38	23
12103	PET0202	4	Very low woodland	*Callitris preissii*	*Senna art petiolaris Dodonaea baueri Stipa nitida Lomand eff*	37	27
15098	GAW00401	4	Low woodland	*Callitris preissii/Eucalyptus porosa/*	*Senna artemisioides nothossp. coriacea/Rhagodia parabolica/Bursaria spinosa/*	26	14
15122	BAL00801	4	Low open forest	*Callitris preissii/Eucalyptus odorata/*		32	15
10761	HAL0401	4	Low woodland	*Callitris preissii*	*Alyxia buxifolia*	51	34
15132	HAM00901	4	Mallee	*Eucalyptus calycogona var./*	*Arthropodium strictum/Stipa elegantissima/Stipa scabra ssp. falcata/*	50	29
15133	HAM00801	4	Mallee	*Eucalyptus socialis/*	*Stipa exilis/Teucrium sessiliflorum/*	64	31
15136	HAM00301	4	Open mallee	*Eucalyptus porosa/*	*Stipa eremophila/Acacia hakeoides/Rhagodia parabolica/*	46	27
11804	LOC0301	4	Low open forest	*Eucalyptus gracilis*	*E socialis S acuminatum Stipa* spp	31	22
11811	LOC1701	4	Low woodland	*Eucalyptus oleosa*	*Callitris preissii Enchylaena tomentosa Stipa* spp	20	17
10818	MEL1501	4	Low open woodland	*Eucalyptus odorata*	*Stipa grassland with scattered mixed shrubs*	41	26
15408	PET00601	4	Mallee	*Eucalyptus porosa/*	*Danthonia caespitosa/Stipa nitida/Maireana brevifolia/*	37	22
15428	ORR01601	4	Mallee	*Eucalyptus porosa/*	*Stipa curticoma/Stipa exilis/Senecio quadridentatus/Enchylaena tomentosa var. tomentosa/*	54	30
11382	0GWL018	4	Low woodland	*Eucalyptus odorata*	*Senna/Danthonia caespitosa/Stipa sp*	28	22
11383	0GWL017	4	Low woodland	*Eucalyptus odorata*	*Myoporum platycarpum/Senna/Pittosporum*	28	22
15099	GAW00501	4	Open mallee	*Eucalyptus porosa/*	*Rhagodia parabolica/Senna artemisioides nothossp. coriacea/*	32	23
11384	0GWL016	4	Very low woodland	*Eucalyptus porosa*	*Melaleuca lanceolata/Nitraria billardiera*	29	18
11803	LOC0201	4	Low woodland	*Eucalyptus porosa*	*Cassinia arcuata Stipa blackii Lomandra effusa*	35	27
15438	PEK02B12	4	Low woodland	*Eucalyptus porosa/*	*Stipa elegantissima/Stipa blackii/Enteropogon acicularis/Rhagodia parabolica/*	47	31

PATCH	sitelabel	gp	STRUCTURE	OVERSTOREY DOMINANTS: FIELD DESCRIPTION	UNDERSTOREY FIELD DESCRIPTION	no. spp	natives
15487	YAL00401	4	Open forest	*Eucalyptus porosa/*	*Enchylaena tomentosa var. tomentosa/Maireana brevifolia/*	30	20
10783	KOO0601	4	Low woodland	*Eucalyptus socialis*	*Stipa species*	27	12
15124	BAL00601	4	Open mallee	*Eucalyptus socialis/Eucalyptus gracilis/*	*Rhodanthe corymbiflora/Stipa eremophila/*	49	30
15407	PET00502	4	Mallee	*Eucalyptus socialis/*	*Stipa eremophila/*	40	26
12026	CAR1201	4	Mallee	*Eucalyptus socialis/Eucalyptus gracilis*	*very sparse Maireana species (aphylla)*	18	16
10851	PIR1101	5	Low woodland	*Callitris glaucophylla*	*GRASSES*	41	22
10860	PIR2001	5	Low woodland	*Eucalyptus camaldulensis var.*	*+/- Pimelea microcephala/grasses*	36	15
15341	WIC00202	5	Low open shrubland	*Ptilotus obovatus var. obovatus/*		43	19
15514	CAR00301	5	Low woodland	*Callitris glaucophylla/*	*Cymbopogon ambiguus/*	34	16
15397	KAN00401	5	Very open herbland	*Asphodelus fistulosus/*		20	11
15337	WIC00501	5	Low very open shrubland	*Sida petrophila/Ptilotus obovatus var. obovatus/*	*Stipa eremophila/*	39	24
15425	WIL00902	5	Shrubland	*Dodonaea lobulata/Pimelea microcephala ssp. microcephala/*		45	25
15494	YAL01601	5	Shrubland	*Dodonaea lobulata/*	*Stipa nitida/Enchylaena tomentosa var./*	56	39
15495	YAL01502	5	Shrubland	*Dodonaea lobulata/*	*Enchylaena tomentosa var./*	42	28
15426	PET00101	5	Low very open shrubland	*Ptilotus obovatus var. obovatus/Sida petrophila/*	*Scleranthus pungens/*	51	30
15357	MOO00202	5	Woodland	*Eucalyptus camaldulensis var. camaldulensis/*	*Cymbopogon ambiguus/*	31	12
15382	KAN02001	5	Open woodland	*Eucalyptus camaldulensis var. camaldulensis/*	*Cymbopogon ambiguus/*	40	25
15454	WIL00101	5	Open forest	*Eucalyptus camaldulensis var. camaldulensis/*	*Cymbopogon ambiguus/*	48	20
11402	9TG023	5	Open sedgeland	*Lomandra effusa*	*Stipa sp /Enneapogon nigricans*	28	11
15511	CAR00201	5	Low very open shrubland	*Maireana aphylla/Maireana sedifolia/*	*Ptilotus obovatus var. obovatus/*	29	19
12109	TER0201	5	Low open shrubland	*Maireana aphylla*	*Bromus diandrus Stipa blackii Avena barbata*	29	13
12119	TER1702	5	(Tussock) grassland	*Stipa nitida/Stipa blackii*	*Danthonia eriantha Bromus rubens Vulpia myuros myu Avena ba*	27	13
14229	**LBGPET04**	**5**	**(Tussock) grassland**	***Maireana aphylla/Stipa nitida/***	***Danthonia setacea var. setacea/***	**63**	**33**
15380	MOO00201	5	Open shrubland	*Maireana aphylla/*	*Stipa nitida/*	18	10
15393	KAN01401	5	Low open shrubland	*Maireana aphylla/*	*Podolepis muelleri/*	19	13
12024	CAR1001	5	Low open shrubland	*Dodonaea viscosa ssp. angustissima*	*Avena barbata Echium plantagineum Stipa nitida*	16	10
12102	PET0201	5	Shrubland	*Senna artemisioides nothossp. coriacea/Dodonaea viscosa ssp. angustissima*	*E tomentosa C annua S nitida A barbata M minima*	37	24
15498	CAR01001	5	Open shrubland	*Senna artemisioides ssp. petiolaris/Acacia calamifolia/Senna artemisioides nothossp. coriacea*	*Stipa nitida/*	35	22
12032	CAR1901	5	Shrubland	*Dodonaea lobulata*	*no real understorey*	26	18
12052	FRA0301	5	Tall open shrubland	*Dodonaea viscosa ssp./Acacia nyssophylla*	*Asphodelus fistulosus*	42	28
12055	FRA0602	5	(Tussock) grassland	*Stipa nodosa/Asphodelus fistulosus*	*Medicago minima*	46	31
15489	YAL00102	5	Very low woodland	*Eremophila longifolia/*	*Atriplex vesicaria ssp./Dodonaea viscosa ssp. angustissima/*	43	37
12064	FRA1801	5	Tall very open shrubland	*Acacia victoriae ssp.*	*Stipa sp As fistulosus Cri mur ssp glaucum Med minima*	29	14
12112	TER0801	5	Low shrubland	*Maireana aphylla*	*Vittadinia cuneata Avena barbata Medicago truncatula*	23	13
12330	MBS0610	5	(Tussock) grassland	*Aristida behriana/Stipa sp./Danthonia sp.*	*herbs*	56	30
14218	**LBGQUO01**	**5**	**Open (tussock) grassland**	***Stipa scabra ssp. falcata/Danthonia caespitosa/***	***Ptilotus nobilis var./Hyalosperma semisterile/Maireana trichoptera/***	71	**43**
15414	PET00401	5	(Tussock) grassland	*Stipa eremophila/*	*Stipa puberula/*	53	35
15415	PET00301	5	(Tussock) grassland	*Stipa puberula/*	*Hyalosperma semisterile/*	54	37
15539	PET02A14	5	Closed (tussock) grassland	*Bromus rubens/Vulpia myuros forma myuros/*	*Crassula colorata var. acuminata/Danthonia auriculata/Maireana excavata/Triptilodiscus pygmaeus/Hyalosperma glutinosum ssp. glutinosum/*	51	32
15434	ORR02B08	5	Tall open shrubland	*Eremophila longifolia/*	*Maireana turbinata/Enchylaena tomentosa var. tomentosa/Stipa sp./*	31	16
10879	QUO0701	5	Very open (tussock) grassland	*Stipa sp./Carrichtera annua*	*Low mixed herbs and sparse low chenopods*	37	22
15394	KAN00801	5	Tall open shrubland	*Acacia victoriae ssp./*		25	15
15342	WIC00201	5	Low very open shrubland	*Zygophyllum aurantiacum/*		40	27

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15391	KAN01001	5	Low open shrubland	*Atriplex stipitata/*		39	24
15461	WIL02D02	5	Low very open shrubland	*Enchylaena tomentosa var. tomentosa/*	*Stipa nodosa/Brachycome lineariloba/Stipa eremophila/Plantago drummondii/Rhodanthe corymbiflora/*	47	31
15457	WIL00701	5	Very open shrubland	*Templetonia egena/*	*Maireana turbinata/*	28	18
14222	**LBGWIL02**	**5**	**(Tussock) grassland**	***Stipa eremophila/Stipa scabra ssp. falcata/***	***Rhodanthe troedelii/***	**28**	**17**
14236	**LBGQUO03**	**5**	**Open (tussock) grassland**	***Emergent Maireana pyramidata/***	***Danthonia caespitosa/Stipa nodosa/Podolepis muelleri/***	**35**	**25**
15453	WIL01801	5	Very open (tussock) grassland	*Stipa nitida/Stipa eremophila/*	*Sclerolaena obliquicuspis/*	28	18
15396	KAN00501	5	Low open shrubland	*Maireana pyramidata/'unverified species - nv'/*	*Stipa nitida/*	29	15
15405	ORR01101	5	Low woodland	*Casuarina pauper/*	*Stipa nitida/*	28	19
15480	YAL01202	5	Open shrubland	*Acacia nyssophylla/*	*Stipa nitida/Vittadinia gracilis/*	43	26
15445	WIL01301	5	Shrubland	*Templetonia egena/Senna artemisioides nothossp. coriacea/Acacia hakeoides*	*Eriochiton sclerolaenoides/Maireana brevifolia/Enchylaena tomentosa var. tomentosa/Zygophyllum confluens/Rhagodia spinescens/*	30	19
15490	YAL01701	5	Open shrubland	*Senna artemisioides nothossp. coriacea/Senna artemisioides ssp. petiolaris/*	*Stipa eremophila/*	48	32
15448	WIL00802	5	Tall shrubland	*Templetonia egena/Senna artemisioides nothossp. coriacea/*		30	17
15455	WIL00301	5	Shrubland	*Bursaria spinosa/Dodonaea lobulata/Alectryon oleifolius ssp. canescens*		28	11
15473	ORR02D15	5	Low open shrubland	*Scaevola spinescens/*	*Elachanthus pusillus/*	37	22
10680	APO0501	6	Low woodland	*Eucalyptus odorata*	*Avena barbata/Vulpia low grass*	51	33
10937	WIL2201	6	Low open forest	*Eucalyptus odorata*	*Danthonia/ Stipa low grass*	70	34
10895	RIV0301	6	Low woodland	*Eucalyptus odorata*	*Avena barbata open low grass*	62	37
10904	RIV1001	6	Low woodland	*Eucalyptus odorata*	*Low mixed grasses and herbs*	50	33
10685	APO0801	6	Low woodland	*Eucalyptus leucoxylon (NC)/Eucalyptus odorata*	*Bromus diandrus/Vulpia low grass*	63	34
10714	BUR0301	6	Woodland	*E. odorata/E leucoxylon* spp *pruinosa*	*herbs mostly weeds*	57	26
14184	**LBGMIEL01**	**6**	**Woodland**	***Eucalyptus odorata/***	***Hyalosperma semisterile/Danthonia auriculata/***	**83**	**55**
10681	APO0502	6	Low woodland	*Eucalyptus odorata*	*Low Xanth quadrangulata scrub with grasses*	63	58
10896	RIV0401	6	Low woodland	*Eucalyptus odorata*	*Low Stipa grasses and Arthropodium strictum herbs*	60	50
10901	RIV0701	6	Low open forest	*Eucalyptus odorata*	*Briza maxima/low grass*	71	50
10902	RIV0801	6	Low open forest	*Eucalyptus odorata*	*Briza maxima/low grass*	61	41
10903	RIV0802	6	Low woodland	*Eucalyptus microcarpa*	*Open low scrub/Acacia pycnantha and low grass*	72	53
15056	KAP00802	6	Low woodland	*Eucalyptus odorata/Eucalyptus leucoxylon ssp. pruinosa/*	*Stipa scabra ssp. falcata/Arthropodium strictum/*	76	51
15064	KAP01001	6	Woodland	*Eucalyptus odorata/*	*Acacia pycnantha/Arthropodium strictum/Stipa elegantissima/*	79	54
11230	4GWL009	6	Low open forest	*Eucalyptus odorata/Callitris preissii*	*Dodonea/Astroloma/Acacia*	58	40
15065	KAP01501	6	Low open forest	*Callitris preissii/*	*Pultenaea largiflorens/Leptomeria aphylla/Stipa elegantissima/Bursaria spinosa/Acacia acinacea/*	94	61
11235	4GWL005	6	Low open forest	*Eucalyptus odorata/Callitris preissii*	*Choetrum glomeratum/Acacias/Pittosporum*	81	52
11379	5GWL015	6	Low open forest	*Eucalyptus odorata*	*Allocasuarina/Acacia paradoxa/Stipa/Danthonia*	40	29
15075	BAR00302	6	Woodland	*Eucalyptus odorata/*	*Stipa scabra ssp. falcata/Danthonia caespitosa/Calocephalus citreus/Minuria leptophylla/*	55	32
11984	4GWL022	6	Low open forest	*Eucalyptus odorata*	*Acacia pycnantha/Lomandra* spp */Stipa* spp */Danth* spp	52	42
15055	KAP00801	6	Low open forest	*Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus odorata/*	*Stipa eremophila/Danthonia setacea var. setacea/*	55	29
15071	BAR00101	6	Woodland	*Eucalyptus odorata/*	*Stipa curticoma/Danthonia caespitosa/Acacia paradoxa/Elymus scabrus var. scabrus/*	64	38
15139	HAM00201	6	Low woodland	*U/S exotic*		60	34
10793	LAU0501	6	Low open forest	*Eucalyptus odorata*	*A rupicola/B spinosa/grasses - Danthonia/Stipa/intro*	43	26
10797	LAU0901	6	Low open forest	*Eucalyptus odorata/Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus camaldulensis var.*	*B spinosa/A wattsiana/H exutiacies/grasses*	59	42

PATCH	sitelabel	gp	STRUCTURE	OVERSTOREY DOMINANTS: FIELD DESCRIPTION	UNDERSTOREY FIELD DESCRIPTION	no. spp	natives
10796	LAU0801	6	Low woodland	*Eucalyptus odorata*	*Acacia wattsiana/Bursaria spinosa*	32	23
10686	APO0802	6	Low woodland	*Eucalyptus odorata*	*Low Vulpia/Bromus grass*	28	13
15053	KAP00201	6	Open mallee	*Eucalyptus odorata/*		43	18
15057	KAP00101	6	Open mallee	*Eucalyptus odorata/*		39	17
12105	BRIV1401	6	Low open forest	*Eucalyptus odorata*	*Lolium Bromus Danthonia* spp	30	17
10752	GLA0901	6	Low woodland	*Eucalyptus odorata*	*Pasture grasses/Bursaria spinosa/Lepidosperma*	33	17
14262	**LBGKOO04**	**6**	**Low woodland**	***Eucalyptus porosa/Eucalyptus odorata/***	***Stipa blackii/***	**33**	**23**
14247	**LBGPEK06**	**6**	**Woodland**	***Eucalyptus leucoxylon ssp. pruinosa/***	***Stipa nodosa/Bursaria spinosa/Danthonia setacea var. setacea/***	**50**	**27**
15054	KAP00701	6	Open mallee	*Eucalyptus odorata/*	*Stipa nodosa/Stipa curticoma/Danthonia setacea var. setacea/Stipa blackii/Stipa eremophila*	41	18
14263	**LBGKOO05**	**6**	**Low woodland**	***Eucalyptus odorata/***	***Danthonia setacea var. setacea/Stipa scabra ssp. falcata/***	**30**	**13**
10700	BOO1201	6	Low open forest	*Eucalyptus odorata*	*Sparse shrubs/introduced & native grasses/Triodia sp*	32	15
10754	GLA1101	6	Very open mallee	*Eucalyptus odorata/Melaleuca uncinata*	*Grasses*	38	20
10771	JAM0101	6	Mallee	*Eucalyptus odorata*	*Bursaria spinosa/Olearia panosa ssp*	36	24
10694	BOO0601	6	Low woodland	*Eucalyptus odorata*	*Exocarpus aphyllus/introduced grasses*	44	30
10822	MEL2101	6	Open mallee	*Eucalyptus odorata*	*GRASSES AND HERBS*	46	22
11220	4GWL001	6	Very low open forest	*Eucalyptus odorata*	*Rhagodia/Senna/Danthonia*	54	38
10891	QUO1901	6	Low woodland	*Eucalyptus odorata*	*poor herbaceous layer*	48	24
10920	WIL0301	6	Low woodland	*Eucalyptus odorata*	*tall Avena grass*	74	44
10931	WIL1501	6	Low woodland	*Eucalyptus odorata*	*mixed grasses and herbs*	64	39
14234	**LBGQUO02**	**6**	**Woodland**	***Eucalyptus odorata/***	***Danthonia linkii var. fulva/Stipa scabra ssp. falcata/***	**64**	**40**
10792	LAU0401	6	Low woodland	*Eucalyptus odorata*	*S art /S acum /C glauco /C glom /O ret /A pyc /intro grasses*	53	41
11224	4GWL003	6	Low open forest	*Eucalyptus odorata*	*Acacia leiophylla/Callitris preissii/Senna/Stipa/Dantho*	98	68
14242	**LBGQUO07**	**6**	**Open mallee**	***Eucalyptus odorata/***	***Senna artemisioides ssp. petiolaris/Stipa eremophila/Olearia pimeleoides ssp./Danthonia caespitosa/***	**56**	**41**
14243	**LBGQUO06**	**6**	**Low open forest**	***Eucalyptus odorata/***	***Stipa nitida/Rhodanthe floribunda/***	**79**	**52**
12072	BHAL0801	6	Low woodland	*Eucalyptus odorata*	*Stipa blackii and low grasses and herbs*	50	34
14271	**LBGLAU04**	**6**	**Low open forest**	***Eucalyptus odorata/***	***Danthonia setacea var. setacea/***	**48**	**31**
14230	**LBGPEK01**	**6**	**Low woodland**	***Eucalyptus odorata/Callitris preissii/***	***Danthonia setacea var. setacea/Stipa scabra ssp. falcata/Acacia hakeoides/***	**68**	**54**
14231	**LBGPEK02**	**6**	**(Tussock) grassland**	***Eucalyptus leucoxylon ssp. pruinosa/***	***Stipa eremophila/Calocephalus citreus/Danthonia setacea var. setacea/***	**57**	**44**
10717	CLA0401	7	Tall open shrubland	*Melaleuca lanceolata*	*Acrotriche patula/Gahnia lanigera*	23	18
11203	0TG047	7	Tall open shrubland	*Myoporum montanum/Acacia calamifolia/Melaleuca lanceolata*	*Trymalium wayii/Triodia scariosa scariosa/Acacia continua/*	41	25
10738	CRY0301	7	Open mallee	*Eucalyptus odorata/Eucalyptus socialis*	*Acacia calamifolia/Bursaria spinosa*	37	20
10911	SPA0601	7	Low woodland	*Eucalyptus odorata/Eucalyptus socialis*	*Bursaria spinosa/Dianella revoluta var*	43	29
10916	SPA1101	7	Very low woodland	*Eucalyptus odorata*	*Bursaria spinosa/Triodia sp*	40	27
10748	GLA0101	7	Mallee	*Eucalyptus odorata*	*Lepidosperma viscidum/"Acacia ligulata"(dog wattle)*	59	36
10757	GLA1D20	7	Mallee	*Eucalyptus odorata/Eucalyptus socialis*	*"Acacia ligulata"Lepidosperma viscidum*	50	29
10750	GLA0601	7	Tall open shrubland	*Eucalyptus porosa/Eucalyptus odorata/Acacia calamifolia*	*Lepidosperma viscidum/grasses*	35	18
10808	MEL0601	7	Open mallee	*Eucalyptus odorata*	*Acacia notabilis/Danthonia ssp*	51	35
10806	MEL0401	7	Open mallee	*Eucalyptus gracilis/Eucalyptus socialis*	*Stipa grassland*	47	33
10933	WIL1801	7	Mallee	*Eucalyptus socialis*	*Stipa grasses*	40	23
10880	QUO0801	7	Mallee	*Eucalyptus odorata/Eucalyptus socialis*	*mixed shrubs and herbs*	55	40
10881	QUO0901	7	Open mallee	*Eucalyptus odorata/Eucalyptus socialis*	*mixed shrub layer*	63	42
10698	BOO1001	8.1	Low woodland	*Allocasuarina verticillata/Eucalyptus odorata*	*A pycnantha/Triodia sp /D revoluta var divaricata*	37	26
14246	**LBGPEK05**	**8.1**	**Very low woodland**	***Allocasuarina verticillata/***	***Chrysocephalum semipapposum/Bursaria spinosa/Stipa blackii/Danthonia setacea var. setacea/Cryptandra amara var. longiflora/***	**51**	**33**

PATCH	sitelabel	gp	STRUCTURE	OVERSTOREY DOMINANTS: FIELD DESCRIPTION	UNDERSTOREY FIELD DESCRIPTION	no. spp	natives
14279	LBGKOO01	8.1	Hummock grassland	*Avena barbata/Triodia scariosa/Themeda triandra*		50	27
15157	BAL00401	8.1	Low open woodland	*Allocasuarina verticillata/*	*Bursaria spinosa/*	48	31
14267	LBGLAU02	8.1	Low woodland	*Allocasuarina verticillata/*	*Triodia scariosa/Bursaria spinosa/*	29	17
14268	LBGLAU03	8.1	Low open woodland		*Triodia scariosa/Bursaria spinosa/Cryptandra amara var. longiflora/*	44	34
15435	PEK00101	8.1	Low woodland	*Allocasuarina verticillata/*	*Cryptandra amara var. longiflora/Triodia scariosa ssp. bunicola/Bursaria spinosa/*	33	20
10780	KOO0301	8.1	Very low woodland	*Allocasuarina verticillata*	*Bursaria spinosa/Lepidosperma viscidum*	28	20
11223	4GWL002	8.1	Very low open forest	*Allocasuarina verticillata/Eucalyptus odorata*	*Acacia/Lepidosperma/herbs*	61	46
12079	BHAL1701	8.1	Low open woodland	*Allocasuarina verticillata*	*Gonocarpus elatus Lomandra densiflora herbs and low sedges*	73	50
14259	LBGGLA01	8.1	Low open shrubland	*Stipa blackii/Lepidosperma viscidum/Stipa eremophila*	*Danthonia caespitosa/Halgania cyanea/*	42	30
14261	LBGKOO03	8.1	Low woodland	*Allocasuarina verticillata/*	*Triodia scariosa ssp./Themeda triandra/Bursaria spinosa/Lepidosperma viscidum/*	38	25
15593	LBGTRU02	8.1	Very low woodland	*Allocasuarina verticillata/*	*Acacia paradoxa/Stipa blackii/Bursaria spinosa/Gonocarpus elatus/Stipa setacea/*	46	31
15084	GAW00901	8.1	Very low woodland	*Allocasuarina verticillata/*	*Themeda triandra/*	39	21
15085	GAW00902	8.1	Low woodland	*Callitris preissii/*	*Stipa blackii/Themeda triandra/Stipa elegantissima/Stipa nodosa/*	33	17
11118	7TG039	8.1	Open shrubland	*Acacia glandulicarpa*	*Stipa grassland*	31	15
12012	BBUR1501	8.1	Low open woodland	*Allocasuarina verticillata*	*BURSARIA SPINOSA MIXED GRASSES NATIVE AND EXOTIC*	27	19
11200	7TG048	8.1	Low shrubland	*Bursaria spinosa/Acacia pycnantha/Astroloma humifusum*	*Themeda triandra/Stipa nitida/s blackii/Gonocarpus elatus*	60	38
11204	7TG043	8.1	(Tussock) grassland	*Themeda triandra/Lepidosperma viscidum/Acacia acinacea*	*Cryptandra ssp Stipa* spp *Danthonia* spp	75	53
12746	TEL1	8.1	(Tussock) grassland	*Themeda triandra*	*Stipa blackii S gibbosa Danthonia setacea Sida corrugata*	29	19
11214	7TG045	8.1	Low woodland	*Allocasuarina verticillata*	*Stipa* spp */Themeda triandra/Danthonia* spp*/Enneapogon sp*	44	19
15599	LBGANG02	8.1	Very low open woodland	*Allocasuarina verticillata/*	*Themeda triandra/*	54	31
15074	BAR00201	8.1	Woodland	*Eucalyptus leucoxylon ssp. leucoxylon/*	*Stipa mollis/Themeda triandra/Stipa scabra ssp. falcata/*	67	42
15596	LBGTRU05	8.1	Low open woodland	*Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus leucoxylon hybrid/*	*Aristida behriana/Gonocarpus elatus/Themeda triandra/*	59	41
12284	MBS0604	8.1	Shrubland	*Bursaria spinosa*	*TRIODIA/THEMEDA/AND OTHER GRASSES AND HERBS*	28	19
14260	LBGKOO02	8.1	Hummock grassland	*Triodia scariosa ssp./Cryptandra amara var. longiflora/Themeda triandra/ Bursaria spinosa*	*Aristida behriana/Gonocarpus elatus/*	44	26
15584	LBGMON01	8.1	Very low open woodland	*Acacia pycnantha/*	*Aristida behriana/Themeda triandra/*	53	27
15585	LBGMON02	8.1	Very low open forest	*Allocasuarina verticillata/*	*Stipa eremophila/Stipa setacea/Danthonia caespitosa/*	44	31
11107	7TG014	8.2	Open hummock grassland	*Sedge*	*Triodia 2*	58	42
15436	PEK00601	8.2	Open shrubland	*Bursaria spinosa/*	*Stipa drummondii/Calocephalus citreus/Danthonia caespitosa/Lomandra multiflora ssp. dura/Triodia scariosa ssp. bunicola/Dianella revoluta var. revoluta/Cryptandra amara var. longiflora/*	72	55
15437	PEK01401	8.2	Open shrubland	*Grevillea ilicifolia var. ilicifolia/Rhagodia parabolica/*	*Triodia scariosa ssp. bunicola/Bulbine bulbosa/Stackhousia monogyna/Stipa blackii/*	60	41
11198	7TG042	8.2	Low shrubland	*Pomaderris paniculosa ssp. paniculosa/Acrotriche patula*	*Lomandra/grasses/herbs*	53	39
11117	7TG036	8.2	Open hummock grassland	*Triodia scariosa ssp. scariosa*		41	17
15321	WIC01701	8.2	Low woodland	*Eucalyptus odorata/Callitris glaucophylla/*	*Olearia decurrens/Acacia calamifolia/Pimelea microcephala ssp. microcephala/Exocarpos aphyllus/*	93	63
15356	MOO01801	8.2	Low woodland	*Callitris glaucophylla/*	*Senna artemisioides nothossp. coriacea/Stipa blackii/Hyalosperma semisterile/Arthropodium strictum/Aristida behriana/*	60	45
15410	PET02A10	8.2	Low open forest	*Callitris glaucophylla/*	*Leptorhynchos tetrachaetus/Stipa blackii/Chrysocephalum semipapposum/Chrysocephalum apiculatum/Olearia decurrens/*	61	48
15348	MOO01101	8.2	Low woodland	*Callitris glaucophylla/Eucalyptus porosa/*	*Atriplex vesicaria ssp./Rhagodia parabolica/Eremophila oppositifolia var./Dodonaea viscosa ssp. angustissima/*	65	51
15359	MOO01203	8.2	Low shrubland	*Olearia decurrens/Dodonaea viscosa ssp.*	*Daucus glochidiatus/Chrysocephalum semipapposum/Oxalis*	51	39

PATCH	sitelabel	gp	STRUCTURE	OVERSTOREY DOMINANTS: FIELD DESCRIPTION	UNDERSTOREY FIELD DESCRIPTION	no. spp	natives
				angustissima/Pomaderris paniculosa ssp. paniculosa	*perennans/Goodenia pinnatifida/*		
10802	MEL0202	8.2	Open shrubland	*Acacia calamifolia/Cassinia laevis*	*Triodia sp /Xanthorrhoea quadrangulata*	36	28
10817	MEL1301	8.2	Very low open woodland	*Allocasuarina verticillata*	*"Acacia ligulata"/A continua & Stipa nitida*	57	38
10960	4NCS033	8.3	Very low woodland	*Acacia pycnantha*	*Themedia triandra/Stipa*	54	29
15579	**LBGBOO01**	**8.3**	**Low open woodland**	***Acacia pycnantha/***	***Chrysocephalum apiculatum/Bursaria spinosa/Stipa blackii/Stipa eremophila/***	**46**	**35**
10961	4NCS036	8.3	(Tussock) grassland	*Stipa sp./Dianella revoluta (NC)/Senna artemisioides ssp. petiolaris*	*Danthonia/Aristida/Goodenia/Medicago*	56	34
10984	3NCS032	8.3	Low shrubland	*Acacia brachybotrya*	*Stipa/Danthonia*	45	21
15083	GAW01301	8.3	Low woodland	*Eucalyptus porosa/*	*Lomandra densiflora/Lomandra multiflora ssp. dura/Aristida behriana/Stipa eremophila/*	46	27
10965	4NCS040	8.3	(Tussock) grassland	**Eucalyptus cladocalyx*	*Stipa / Avena*	37	19
11019	4NCS027	8.3	Low open forest	*Eucalyptus camaldulensis var.*	*A pycnantha/Callitris/Themeda*	45	27
11228	4GWL008	8.3	Very low woodland	*Eucalyptus porosa/Eucalyptus odorata*	*Danthonia/Lomandra/Herbs*	53	37
15587	**LBGADE03**	**8.3**	**Very open mallee**	***Eucalyptus porosa/***	***Stipa blackii/Stipa multispiculis/***	**49**	**27**
12001	BAPO2101	8.3	Woodland	*Eucalyptus porosa*	*All vert Ac pycnantha numerous grasses and herbs*	26	17
11385	7TG050	8.3	Very low woodland	*Eucalyptus porosa*	*Lomandra dura Stipa* spp *Themeda*	26	15
14253	**LBGMEL02**	**8.3**	**Woodland**	***Allocasuarina verticillata/Eucalyptus microcarpa/***	***Stipa blackii/Aristida behriana/Lomandra densiflora/Danthonia pilosa var. paleacea/***	**28**	**13**
12120	TER1C12	8.3	Very low open forest	*Acacia pycnantha*	*Dianella rev var rev Stipa scabra ssp falcata S blackii*	30	22
15462	PEK00901	8.3	(Tussock) grassland	*Stipa blackii/Triodia scariosa ssp. bunicola/Stipa scabra ssp. falcata*		37	11
14257	**LBGJAM02**	**8.3**	**Open (tussock) grassland**	***Stipa nitida/***	***Danthonia sp./Aristida behriana/Danthonia eriantha/***	**39**	**17**
14276	**LBGJAM05**	**8.3**	**(Tussock) grassland**	***Stipa blackii/Themeda triandra/***	***Aristida behriana/Stipa scabra ssp. falcata/***	**34**	**15**
14277	**LBGJAM06**	**8.3**	**(Tussock) grassland**	***Bursaria spinosa/***	***Themeda triandra/Stipa blackii/***	**48**	**31**
14258	**LBGJAM03**	**8.3**	**(Tussock) grassland**	***Allocasuarina verticillata/***	***Stipa blackii/Danthonia setacea var. setacea/Cryptandra amara var. longiflora/Aristida behriana/Stipa scabra ssp. falcata/***	**49**	**29**
12067	BHAL0201	8.3	Closed (tussock) grassland	*Avena barbata/Enneapogon nigricans*	*scattered herbs and Aristida scattered - open herb*	36	19
12075	BHAL1101	8.3	(Tussock) grassland	*Stipa blackii*	*introduced grasses Bromus Vulpia Avena*	49	27
12068	BHAL0301	8.3	Low woodland	*Eucalyptus leucoxylon ssp. pruinosa*	*grasses and herbs low*	69	44
14240	**LBGPEK04**	**8.3**	**Woodland**	***Eucalyptus leucoxylon ssp. pruinosa/***	***Stipa nodosa/Stipa blackii/Chrysocephalum semipapposum/***	**64**	**37**
15586	**LBGTRU01**	**8.3**	**Open woodland**	***Eucalyptus leucoxylon ssp. pruinosa/***	***Stipa blackii/Lomandra multiflora ssp. dura/Stipa nodosa/***	**61**	**36**
12074	BHAL1001	8.3	Open sedgeland	*Lomandra multiflora ssp. dura/Stipa blackii*	*low grass Avena barbata*	55	34
12115	TER1201	8.3	Sedgeland	*Lomandra multiflora ssp. dura/Chrysocephalum semipapposum/Maireana aphylla*	*Stipa blackii S nitida Danthonia caespitosa*	42	28
15413	PET01003	8.3	Low shrubland	*Bursaria spinosa/Maireana aphylla/*	*Calocephalus citreus/Chrysocephalum semipapposum/Triptilodiscus pygmaeus/*	66	47
15476	PET01002	8.3	(Tussock) grassland	*Lomandra multiflora ssp. dura/Cryptandra amara var. longiflora/*	*Leptorhynchos tetrachaetus/*	48	40
14225	**LBGPET01**	**8.3**	**(Tussock) grassland**	***Lomandra effusa/Stipa nodosa/Stipa blackii***	***Eriochlamys behrii/***	**47**	**31**
14227	**LBGPET02**	**8.3**	**(Tussock) grassland**	***Stipa blackii/Stipa eremophila/Cryptandra amara var.***	***Danthonia setacea var. setacea/Calocephalus citreus/***	**54**	**37**
15601	**LBGTRU06**	**8.3**	**Very low open woodland**	***Allocasuarina verticillata/***	***Amphipogon caricinus var. caricinus/Aristida behriana/Stipa nodosa/Lomandra effusa/Leptorhynchos tetrachaetus/***	**74**	**52**
15602	**LBGTRU07**	**8.3**	**Open mallee**	***Eucalyptus porosa/***	***Stipa blackii/Stipa platychaeta/***	**73**	**51**
14254	**LBGMEL03**	**8.3**	**Woodland**	***Eucalyptus microcarpa/Eucalyptus odorata/***	***Stipa blackii/Hibbertia exutiacies/***	**54**	**33**
14256	**LBGJAM01**	**8.3**	**Woodland**	***Eucalyptus microcarpa/Eucalyptus leucoxylon ssp. pruinosa/***	***Danthonia setacea var. setacea/Stipa blackii/***	**45**	**27**
15581	**LBGWLM03**	**8.3**	**Woodland**	***Eucalyptus microcarpa/***	***Danthonia setacea var. setacea/Aristida behriana/Stipa***	**50**	**35**

PATCH	sitelabel	gp	STRUCTURE	OVERSTOREY DOMINANTS: FIELD DESCRIPTION	UNDERSTOREY FIELD DESCRIPTION	no. spp	natives
12116	TER1301	8.4	Very open sedgeland	*Lomandra multiflora ssp. dura*	*nodosa/Enteropogon acicularis/*		
11199	7TG044	8.4	(Tussock) grassland	*Avena barbata*	*Chrysocephalum apiculatum Calocephalus citrens*	50	37
14219	**LBGBUR01**	**8.4**	**(Tussock) grassland**	***Stipa setacea/Stipa scabra ssp. falcata/Danthonia auriculata***	*Danthonia* spp */Stipa* spp */Trifolium* spp */Aristida behriana*	63	41
12006	BBUR0801	8.4	Open sedgeland	*Lomandra multiflora ssp. dura/Lomandra effusa*	*Leptorhynchos tetrachaetus/Danthonia carphoides var. carphoides/Lomandra multiflora ssp. dura/*	62	39
11995	BAPO1401	8.4	Open sedgeland	*Lomandra multiflora ssp. dura/Cryptandra amara var. amara*	*mixed grass and herbs*	44	34
12013	BBUR1701	8.4	Very open sedgeland	*Lomandra multiflora ssp. dura/Cryptandra amara var. longiflora*	*Danthonia* spp *Stipa* spp *Vittadinia* spp	39	30
12003	BBUR0401	8.4	Open sedgeland	*Lomandra multiflora ssp. dura*	*Stipa blackii/eremophila/scabra Vel paradoxa Vit cuneata*	26	19
12008	BBUR1001	8.4	Open (tussock) grassland	*Stipa nitida/Stipa blackii*	*AVENA STIPA SCABRA DANT CAESPITOSA VITTADINIA GRACILIS*	26	17
12070	BHAL0601	8.4	Sedgeland	*Lomandra multiflora ssp. dura/Avena barbata*	*Vit cuneata Vit gracilis Hypo glabra Pti spathu*	30	15
12011	BBUR1401	8.4	Very open sedgeland	*Lomandra multiflora ssp. dura*	*grasses and herbs*	40	23
12043	BEUD2001	8.4	Open sedgeland	*Lomandra effusa*	*Dant carphoides Av barbata Cot australis*	26	21
12069	BHAL0501	8.4	(Tussock) grassland	*Avena barbata*	*Danthonia* spp *Stipa* spp *Romulea minutiflora*	30	14
12073	BHAL0901	8.4	Low woodland	*Eucalyptus leucoxylon ssp. pruinosa*	*small herbs*	43	28
11112	7TG013	8.4	(Tussock) grassland	*Avena barbata*	*grasses Avena and Bromus*	43	21
11996	BAPO1701	8.4	Open (tussock) grassland	*Stipa setacea*	*Stipa blackii/Lomandra effusa*	24	13
12014	BBUR1D04	8.4	Open sedgeland	*Lomandra multiflora ssp. dura*	*Lom mul ssp dura Dan caespit/carphoides Vitt gracilis*	26	16
11471	2B0101	8.4	Open sedgeland	*Lomandra multiflora ssp. dura/Lomandra effusa*	*Avena barbata Echium plantagineum Erodium botrys*	24	12
15424	PEK00801	8.4	Sedgeland	*Lomandra multiflora ssp. dura/*	*Medicago sp Trifolium sp Salvia verbenaca/Vittadinia gracil*	34	14
11472	4A0101	8.4	Open sedgeland	*Lomandra multiflora ssp. dura*	*Goodenia pusilliflora/Crassula colorata var. acuminata/*	41	25
12110	TER0501	8.4	Open sedgeland	*Lomandra multiflora ssp. dura*	*Aristida behriana/Stipa* spp *and Danthonia racemosa*	35	15
12111	TER0502	8.4	Open sedgeland	*Lomandra multiflora ssp. dura*	*Sclerolaena pungens Ptilotus spathalatus Avena barbata*	31	19
12114	TER1101	8.4	(Tussock) grassland	*Stipa blackii/Lomandra multiflora ssp. dura/Cryptandra amara var. amara*	*Stipa setacea S nitida Leptorhynchos tetrachaetus Trip pygma*	31	21
12117	TER1401	8.4	Sedgeland	*Lomandra multiflora ssp. dura/Lomandra effusa/Cryptandra amara var. amara*	*Stipa scabra Danthonia eriantha Aristida behriana*	33	20
12118	TER1701	8.4	Low shrubland	*Cryptandra amara var. amara*	*Aristida behrianna Stipa nitida Avena barbata Danthonia eria*	35	22
12005	BBUR0701	8.4	Open sedgeland	*Dianella revoluta var.*	*Lomandra multiflora dura Stipa nodosa Leptorhynchos squamatu*	39	26
11115	7TG032	8.4	Low open shrubland	*Bursaria spinosa*	*mixed grasses Lomandra Salvia*	25	15
11116	7TG033	8.4	Low very open shrubland	*Bursaria spinosa*	*Stipa sp /Lomandra dura*	31	17
10974	3NCS068	8.5	Open (tussock) grassland	*Senna artemisioides nothossp. coriacea*	*Lomandra multiflora sp dura/Stipa sp*	40	24
15470	ORR01702	8.5	Open shrubland	*Xanthorrhoea quadrangulata/*	*Avena/Stipa/Themedia/Brachypodium*	33	17
11463	1C0101	8.5	Open sedgeland	*Lomandra multiflora ssp. dura*	*Triodia scariosa ssp. bunicola/Stipa blackii/Lomandra multiflora ssp. dura/Danthonia sp./*	41	25
12282	MBS0602	8.5	(Tussock) grassland	*Avena barbata/Bromus rubens/Stipa sp.*	*Avena barbata/Medicago* spp *Trifolium* spp *Danthonia* spp	26	12
12296	MBS0116	8.5	Low woodland	*Eucalyptus odorata*	*Medicago and scattered native herbs*	21	10
14239	**LBGPEK03**	**8.5**	**Open (tussock) grassland**	***Stipa nodosa/Stipa blackii/***	*BURSARIA/STIPA*	25	15
15515	CAR01401	8.5	Tall open shrubland	*Acacia calamifolia/*	*Danthonia eriantha/Danthonia caespitosa/*	26	13
10994	3NCS028	8.5	Tall shrubland	*Acacia victoriae ssp.*	*Stipa nodosa/Danthonia caespitosa/*	21	12
12285	MBS0605	8.5	Open shrubland	*Acacia calamifolia*	*Stipa/Avena/Echium*	27	14
10684	APO0701	9	Low woodland	*Eucalyptus odorata*	*Triodia/Themeda/Danthonia*	28	18
10900	RIV0601	9	Very low open forest	*Eucalyptus odorata*	*Low mixed grasses and herbs*	59	38
10894	RIV0201	9	Low open woodland	*Allocasuarina verticillata*	*Dense low grass/Briza*	40	26
10839	MUN0801	9	Low woodland	*Allocasuarina verticillata*	*Avena barbata grassland with Hypochoeris herb*	55	28
11994	BAPO1101	9	Low woodland	*Eucalyptus odorata/Allocasuarina verticillata*	*Bursaria spinosa/introduced grasses*	22	11
					Bursaria spinosa Stipa spp *Avena barbata*	23	15

PATCH	sitelabel	gp	STRUCTURE	OVERSTOREY DOMINANTS: FIELD DESCRIPTION	UNDERSTOREY FIELD DESCRIPTION	no. spp	natives
10768	HAL1101	9	Low woodland	*Allocasuarina verticillata/Eucalyptus odorata*	*Acacia paradoxa/herbs*	28	16
10769	HAL1102	9	Low woodland	*Eucalyptus odorata*	*Acacia paradoxa/Acacia pycnantha*	29	20
10905	RIV1101	9	Low woodland	*Eucalyptus leucoxylon ssp. pruinosa*	*Low grass various*	48	28
15072	BAR01B02	9	Woodland	*Eucalyptus odorata/*	*Acacia paradoxa/Gonocarpus elatus/Calostemma purpureum/Arthropodium strictum/*	58	32
10764	HAL0702	9	Low woodland	*Eucalyptus odorata*	*Cassinia laevis/grasses*	26	18
11229	4GWL010	9	Very low woodland	*Eucalyptus odorata*	*Acacia pycnantha/Danthonia*	27	18
11413	ADC0701	9	Open mallee	*Eucalyptus sp.*	*Stipa elegantissima/Acacia pycnantha*	35	15
10716	CLA0201	9	Open woodland	*Eucalyptus leucoxylon (NC)*	*Acacia pycnantha/Acacia paradoxa*	22	12
10720	CLA0701	9	Low woodland	*Eucalyptus leucoxylon (NC)*	*Bursaria spinosa/Lavendula stoechas*	42	20
10722	CLA0901	9	Low woodland	*Eucalyptus leucoxylon (NC)*	*Acacia pycnantha*	24	13
10723	CLA0902	9	Low woodland	*Eucalyptus leucoxylon (NC)*	*Bursaria spinosa/Acacia pycnantha*	22	17
10718	CLA0501	9	Low woodland	*Eucalyptus leucoxylon (NC)*	*Acacia pycnantha/grasslands*	23	14
11414	ADC0801	9	Low woodland	*Eucalyptus leucoxylon ssp. pruinosa*	*Acacia pycnantha/Avena barbata/Acaena echinata*	36	17
10719	CLA0601	9	Very open mallee	*Eucalyptus odorata*	*Acacia paradoxa/Acacia pycnantha saplings*	33	24
10735	CLA1C15	9	Low open forest	*Allocasuarina verticillata*	*Lavendula stoechas*	30	26
10724	CLA1002	9	Open mallee	*Eucalyptus macrorhyncha ssp. macrorhyncha*	*Grassland/herbland*	34	23
10725	CLA1003	9	Low woodland	*Eucalyptus macrorhyncha ssp. macrorhyncha*	*Pultenea largiflorens/Xanthorrhoea quadrangulata*	23	20
12407	HVY0301	9	Low woodland	*Eucalyptus leucoxylon ssp./Eucalyptus microcarpa*	*Olearia ramulosa Lepidosperma carphoides Hibbertia sericea*	44	23
12408	HV0302	9	Woodland	*Eucalyptus viminalis ssp.*	*Xanthorrhoea semiplana Poa clelandii*	46	25
10701	BUN0101	9	Open forest	*Eucalyptus leucoxylon (NC)*	*Avena barbata*	34	18
10863	PIR2201	9	Open forest	*Eucalyptus leucoxylon ssp. pruinosa*	*Acacia wattsiana/native herbs and grasses*	39	25
15441	PEK01101	9	Woodland	*Eucalyptus leucoxylon ssp. pruinosa/*	*Bolboschoenus caldwellii/Poa crassicaudex/Juncus flavidus/*	26	15
10729	CLA1401	9	Woodland	*Eucalyptus leucoxylon ssp. pruinosa*	*Grassland*	28	11
11410	ADC0401	9	Low woodland	*Eucalyptus odorata/Eucalyptus leucoxylon ssp. pruinosa*	*Lomandra sp and Stipa flavescens*	22	13
11406	ADC0201	9	Low woodland	*Eucalyptus leucoxylon ssp. pruinosa*	*Themeda triandra/Stipa elegantissima*	24	14
12104	BRIV1301	9	Low woodland	*Eucalyptus leucoxylon ssp./Allocasuarina verticillata/Eucalyptus odorata*	*Acacia paradoxa Stipa* spp *Danthonia* spp	31	18
12107	BRIV1B36	9	Low open forest	*Eucalyptus leucoxylon ssp.*	*Acacia pycnantha Stipa blackii Danthonia setacea*	30	18
11013	4NCS050	9	Low woodland	*Eucalyptus leucoxylon ssp. leucoxylon*	*A pycnantha/Stipa semibarbata/Liliaiceae*	78	46
11016	4NCS048	9	Very low open forest	*Eucalyptus leucoxylon ssp.*	*Acacia pycnantha/Themedia triandra*	77	44
11015	4NCS049	9	Low open forest	*Eucalyptus leucoxylon ssp. pruinosa*	*Acacia pycnantha/Stipa/Sparaxis*	59	31
11018	4NCS058	9	Low open forest	*Eucalyptus leucoxylon ssp.*	*Acacia paradoxa/A pycnantha/Themeda*	53	24
14255	**LBGPIR02**	9	**Woodland**	***Eucalyptus leucoxylon ssp. pruinosa/***	***Themeda triandra/Cassinia uncata/Hibbertia exutiacies/Stipa blackii/Danthonia setacea var. setacea/***	54	43
14265	**LBGPIR01**	9	**Woodland**	***Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus leucoxylon ssp. leucoxylon/Eucalyptus microcarpa***	***Bursaria spinosa/Danthonia setacea var. setacea/Danthonia pilosa var. paleacea/***	50	33
15583	**LBGPIR06**	9	**Open woodland**	***Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus microcarpa/Eucalyptus camaldulensis var. camaldulensis***	***Stipa blackii/Danthonia auriculata/***	63	49
15582	**LBGPIR05**	9	**Woodland**	***Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus microcarpa/***	***Danthonia setacea var. setacea/Danthonia caespitosa/Stipa nodosa/***	53	37
15051	KAP00301	9	Open forest	*Eucalyptus odorata/Eucalyptus leucoxylon ssp. pruinosa/*	*Stipa scabra ssp. falcata/Acacia pycnantha/Danthonia setacea var. setacea/*	53	25
15052	KAP00401	9	Woodland	*Eucalyptus leucoxylon ssp. pruinosa/*	*Crassula sieberiana ssp. tetramera/Danthonia setacea var. setacea/Stipa scabra ssp. falcata/*	78	39
15073	BAR00501	9	Woodland	*Eucalyptus leucoxylon ssp. pruinosa/*	*Arthropodium strictum/Acacia pycnantha/Stipa curticoma/Wahlenbergia stricta ssp. stricta/Luzula meridionalis/*	50	24
11121	7TG034	9	Open (tussock) grassland	*Stipa nitida/Stipa setacea/Stipa scabra ssp.*	*Herbs*	43	29
15574	**LBGMEL04**	9	**Woodland**	***Eucalyptus albens/***	***Chrysocephalum apiculatum/Hibbertia exutiacies/***	46	34
15577	**LBGWLM02**	9	**Low open woodland**	***Eucalyptus cladocalyx/***	***Juncus subsecundus/Gonocarpus elatus/Hibbertia exutiacies/***	46	38

PATCH	sitelabel	gp	STRUCTURE	OVERSTOREY DOMINANTS: FIELD DESCRIPTION	UNDERSTOREY FIELD DESCRIPTION	no. spp	natives
11998	BAPO1802	9	Sedgeland	*Lepidosperma viscidum*	*Stipa elegantissima/scabra/blackii and herbs*	27	19
12002	BAPO2201	9	Very low woodland	*Allocasuarina verticillata*	*Correa glabra Xanth quadrangulata herbs and grasses*	31	27
15575	LBGMEL05	9	Open woodland	*Eucalyptus camaldulensis var. camaldulensis/*		43	31
15576	LBGWLM01	9	Open woodland	*Eucalyptus camaldulensis var. camaldulensis/*	*Poa labillardieri var. labillardieri/Danthonia racemosa var. racemosa/Acaena echinata var./*	53	39
14278	LBGBUN01	9	(Tussock) grassland	*Themeda triandra/Gramineae sp*	*Danthonia auriculata*	43	21
12312	NCC0101	10	Open mallee	*Eucalyptus microcarpa*	*OLEA EUROPAEA SPP EUROPAEA*	34	19
12406	MIT0102	10	Low woodland	*Eucalyptus microcarpa/Acacia pycnantha*	*Olearia ramulosa*	49	19
14248	LBGADE01	10	Open forest	*Eucalyptus microcarpa/*	*Stipa flavescens/Danthonia pilosa var. paleacea/Gonocarpus elatus/*	68	41
14250	LBGADE02	10	Woodland	*Eucalyptus microcarpa/*	*Hibbertia exutiacies/Danthonia pilosa var. paleacea/*	55	33
15588	LBGNOA01	10	Low open forest	*Eucalyptus microcarpa/*	*Bursaria spinosa/Stipa hemipogon/Danthonia caespitosa/Lomandra densiflora/*	66	51
15589	LBGNOA02	10	Low woodland	*Eucalyptus microcarpa/*	*Acacia pycnantha/Hibbertia exutiacies/Stipa flavescens/*	66	45
15590	LBGNOA03	10	Woodland	*Eucalyptus microcarpa/*	*Bursaria spinosa/Acacia pycnantha/Stipa multispiculis/*	36	24
15591	LBGNOA04	10	Low woodland	*Eucalyptus microcarpa/*	*Dodonaea viscosa ssp. spatulata/Lepidosperma curtisiae/Themeda triandra/Acacia pycnantha/*	75	54
15592	LBGADE04	10	Woodland	*Eucalyptus microcarpa/*	*Gonocarpus elatus/Dodonaea viscosa ssp. spatulata/*	65	41
12327	NCC0401	10	Open mallee	*Eucalyptus microcarpa*	*OLEARIA RAMULOSA*	38	21
12342	NCCO901	10	Mallee	*Eucalyptus microcarpa*	*OLEARIA RAMULOSA DODONAEA VISCOSA PASTURE HERBS GRASSES*	37	21
12736	NFC0301	10	Mallee	*Eucalyptus microcarpa*	*sclerophyllous shrubs*	49	38
12405	MIT0101	10	Low open forest	*Eucalyptus microcarpa*	*Hibbertia sericea Gonocarpus elatus*	47	22
12735	NFC0201	10	Open mallee	*Eucalyptus microcarpa*	*acacia paradoxa & olea europaea over grass & herbs*	47	27
12739	NFC0601	10	Open mallee	*Eucalyptus microcarpa*	*acacia paradoxa +/- olea europaea*	47	26
12738	NFC0501	10	Open mallee	*Eucalyptus microcarpa*	*acacia paradoxa +/- Olea europaea*	50	28
12331	NCC0501	10	Mallee	*Eucalyptus microcarpa*	*ALLOCASUARINA VERTICILLATA ACACIA PARADOXA*	34	16
12332	NCC0601	10	Mallee	*Eucalyptus microcarpa*	*ACACIA PARADOXA GRASSES & HERBS*	34	18
12733	NFC0101	10	Mallee	*Eucalyptus microcarpa*	*Acacia paradoxa & Myrsiphyllum asparagoides*	39	22
12734	NFC0102	10	Open mallee	*Eucalyptus microcarpa*	*olea europaea & acacia paradoxa*	30	16
12737	NFC0401	10	Mallee	*Eucalyptus microcarpa*	*olea europaea +/- acacia paradoxa &mostly intro grass &herbs*	40	18
12335	NCC0801	10	Low woodland	*Eucalyptus microcarpa/Eucalyptus leucoxylon ssp. leucoxylon*	*ACACIA PYCNANTHA ALLOCASURINA VERTICILLATA*	40	27
12338	NCC0802	10	Woodland	*Eucalyptus microcarpa/Eucalyptus camaldulensis var. camaldulensis*	*ACACIA PARADOXA ACACIA PYCNANTHA DODONAEA VISCOSA*	42	25
10703	BUN0301	11	Open forest	*Eucalyptus leucoxylon (NC)*	*Acacia pycnantha/Bursaria spinosa*	36	25
11909	WAK0401	11	Low open forest	*Allocasuarina verticillata*	*Acacia pycnantha Beyeria lechenaultii Pomaderris pan*	31	24
10704	BUN0401	11	Open forest	*Allocasuarina verticillata/Eucalyptus leucoxylon (NC)*	*Bursaria spinosa/Xanthorrhoea quadrangulata*	30	18
10706	BUN0502	11	Woodland	*Eucalyptus leucoxylon (NC)*	*X quadrang /Avena barbata/Trifolium/Carduus tenuflorus*	41	19
10773	JAM0203	11	Low woodland	*Eucalyptus leucoxylon (NC)*	*Bursaria spinosa/Triodia sp*	33	26
10794	LAU0601	11	Low open forest	*Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus cladocalyx*	*B spinosa/A wattsiana/H exutiacies/Triodia sp*	45	29
10795	LAU0701	11	Low woodland	*Eucalyptus leucoxylon ssp. pruinosa*	*A wattsiana/B spinosa/O ramulosa over Triodia sp*	37	24
14272	LBGPIR03	11	Low woodland	*Allocasuarina verticillata/Eucalyptus leucoxylon ssp. pruinosa/*	*Triodia scariosa/Stipa flavescens/Xanthorrhoea quadrangulata/Acacia wattsiana/*	48	32
14273	LBGPIR04	11	Low woodland	*Allocasuarina verticillata/*	*Xanthorrhoea quadrangulata/Acacia wattsiana/Triodia scariosa/Themeda triandra/*	44	26
10798	LAU1001	11	Low open woodland	*Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus socialis/Eucalyptus leptophylla*	*A wattsiana/C teretifolius/B spinosa/L viscidum*	37	28
10847	PIR0701	11	Low woodland	*Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus cladocalyx*	*Acacia wattsiana/Exocarpus cupressiformis/A gracilifolia*	49	37
10749	GLA0301	11	Low open woodland	*Allocasuarina verticillata/Eucalyptus leucoxylon (NC)*	*Grasses/Bursaria spinosa*	38	16

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10753	GLA1001	11	Low woodland	*Allocasuarina verticillata*	*Acacia continua/Bursaria spinosa and Avena barbata*	37	23
10914	SPA0901	11	Very low open forest	*Allocasuarina verticillata*	*Lepidosperma viscidum*	21	11
10755	GLA1201	11	Sedgeland	*Lepidosperma viscidum*	*With emergent Allocasuarina verticillata + Bursaria spinosa*	27	12
11412	ADC0601	11	Low woodland	*Callitris preissii*	*Leptomeria aphylla/Pimelea stricta/Lepid viscidum/Lomandra*	25	14
10803	MEL0301	11	Low open woodland	*Eucalyptus leucoxylon ssp. pruinosa*	*Xanthorrhoea quadrangulata mixed heath*	57	48
10809	MEL0701	11	Low open woodland	*Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus cladocalyx*	*X quadrangulata/mixed shrub heath*	67	54
10811	MEL0801	11	Low open woodland	*Allocasuarina verticillata/Eucalyptus leucoxylon hybrid/Eucalyptus leucoxylon ssp. pruinosa*	*Xanthorrhoea quadrangulata/Allocas muelleriana heath*	56	47
10804	MEL0302	11	Very low open woodland	*Allocasuarina verticillata/Eucalyptus goniocalyx*	*Triodia and mixed Stipa/Danthonia/& Avena*	74	56
10810	MEL0702	11	Low open woodland	*Eucalyptus cladocalyx*	*Eucalyptus cladocalyx saplings and Acacia pycnantha*	58	46
10807	MEL0501	11	Very open low mallee	*Eucalyptus odorata*	*Eutaxia microphylla/Lepidosperma viscidum*	62	47
10814	MEL1101	11	Low woodland	*Eucalyptus goniocalyx*	*Triodia sp / Lomandra densiflora/mixed grass/herb land*	70	47
10936	WIL2101	11	Very low woodland	*Allocasuarina verticillata*	*Bursaria spinosa/Pimelea stricta Low heath C*	92	62
10816	MEL1202	11	Low open woodland	*Callitris glaucophylla/Eucalyptus camaldulensis var./Eucalyptus cladocalyx*	*Calytrix tetragona/Dodonaea visc ssp spat /grasses/herbs*	59	37
10827	MEL2801	11	Low woodland	*Allocasuarina verticillata*	*Cassinia laevis & Xanthorrhoea quadrangulata/Triodia sp*	47	37
10846	PIR0501	11	Low woodland	*Allocasuarina verticillata*	*Cassinia laevis over Triodia sp*	48	43
11963	MBS0302	11	Low woodland	*Eucalyptus microcarpa*	*ALLOCASUARINA/XANTHORRHOEA/BURSARIA/TRIODIA*	36	33
11965	MBS0304	11	Low woodland	*Eucalyptus microcarpa*	*ALLOCASUARINA/BURSARIA/TRIODIA*	24	21
11976	MBS0406	11	Low open woodland	*Eucalyptus microcarpa/Eucalyptus goniocalyx*	*ALLOCASUARINA/CASSINIA/XANTHORRHOEA/TRIODIA*	38	33
12277	MBS0505	11	Low open woodland	*Eucalyptus microcarpa*	*Triodia scariosa*	42	31
12280	MBS0508	11	Low woodland	*Eucalyptus microcarpa/Allocasuarina verticillata*	*Triodia scariosa*	47	39
12274	MBS0502	11	Low woodland	*Eucalyptus microcarpa*	*XANTHORRHOEA/LEPIDOSPERMA*	33	29
12286	MBS0606	11	Low open woodland	*Eucalyptus microcarpa*	*Allocasuarina/Xanthorrhoeae/Cassinia*	33	29
12287	MBS0607	11	Low woodland	*Eucalyptus microcarpa*	*Allocasuarina/Xanthorrhoea/Lepidosperma*	24	22
12328	MBS0510	11	Low woodland	*Eucalyptus microcarpa*	*Cassinia/Lepidosperma*	23	22
12275	MBS0503	11	Low woodland	*Eucalyptus microcarpa/Allocasuarina verticillata*	*CASSINIA/POMADERIS/LOMANDRA*	34	28
10919	WIL0202	11	Low woodland	*Allocasuarina verticillata/Eucalyptus microcarpa*	*Xanthorrhoea heath B*	52	33
12289	MBS0609	11	Low open woodland	*Eucalyptus leucoxylon ssp. leucoxylon/Eucalyptus microcarpa*	*Allocasuarina/Xanthorrhoea/Cassinina/Callitris*	33	25
10867	PIR2601	11	Low woodland	*Allocasuarina verticillata*	*Mixed shrubs and herbs*	56	35
12204	MBS0101	11	Low open forest	*Allocasuarina verticillata*	*XANTHORRHOEA/CASSINA*	64	47
12242	MBS0103	11	Very low woodland	*Allocasuarina verticillata*	*XANTHORRHOEA/CASSINIA/TRIODA*	42	30
12265	MBS0106	11	Low woodland	*Allocasuarina verticillata/Eucalyptus dumosa*	*XANTHORRHOEA/TRIODIA/LEPIDOSPERMA*	53	39
12267	MBS0108	11	Low open forest	*Allocasuarina verticillata*	*SPYRIDIUM/XANTHORRHOREA*	36	29
10890	QUO1801	11	Low woodland	*Allocasuarina verticillata*	*mixed shrubs/herbaceous layer*	72	39
12216	MBS0102	11	Low open woodland	*Allocasuarina verticillata*	*XANTHORROEA/CASSINA/BURSARIA*	66	43
12272	MBS0501	11	Low open woodland	*Eucalyptus microcarpa/Allocasuarina verticillata/Callitris glaucophylla*	*CASSINIA CALYTRIX LOMANDRA*	32	25
12279	MBS0507	11	Low woodland	*Eucalyptus microcarpa/Allocasuarina verticillata*	*Exocarpus/Xanthorrhoea/Lomandra*	24	22
10869	PIR2E16	11	Very low open forest	*Allocasuarina verticillata*	*Xanthorrhoea quadrangulata/Lomandra densiflora*	34	32
12000	BAPO1901	11	Low woodland	*Allocasuarina verticillata*	*Xanth quadrangulata Lom multiflora ssp dura*	25	13
15101	BAR00301	11	Low open woodland	*Allocasuarina verticillata/Eucalyptus fasciculosa/*	*Lomandra multiflora ssp. dura/*	34	18
10926	WIL1001	11	Low open woodland	*Allocasuarina verticillata*	*Triodia sp mid-dense hummock grass & tall grass Avena*	47	25
10939	WIL2401	11	Open woodland	*Eucalyptus leucoxylon ssp. pruinosa*	*Acacia pycnantha dense heath A*	47	33
10940	WIL2402	11	Low open woodland	*Eucalyptus leucoxylon ssp. pruinosa*	*Dodonaea/ Acacia pycnantha low heath C*	55	39
10790	LAU0201	12	Low woodland	*Eucalyptus microcarpa*	*B spinosa/M montanum/Triodia sp & introduced grasses*	34	24
15580	**LBGBOO02**	**12**	**Open woodland**	***Eucalyptus microcarpa/***	***Bursaria spinosa/Triodia scariosa ssp. bunicola/***	**41**	**22**
11966	MBS0305	12	Low woodland	*Eucalyptus microcarpa*	*CASSINIA/TRIODIA*	21	16
11968	MBS0306	12	Low woodland	*Eucalyptus microcarpa*	*STIPA*	21	15

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11964	MBS0303	12	Low open forest	*Eucalyptus microcarpa*	*BURSARIA/ALLOCASUARINA/CASSINIA*	25	20
11969	MBS0307	12	Low woodland	*Eucalyptus microcarpa*	*CASSINIA/BURSARIA*	26	19
12308	MBS0308	12	Low open forest	*Eucalyptus microcarpa*	*Xanthorrhoea*	22	19
12325	MBS0509	12	Low woodland	*Eucalyptus microcarpa*	*Acacia/Stipa*	22	17
12329	MBS0511	12	Low woodland	*Eucalyptus microcarpa*	*Acacia/Stipa*	18	17
12306	MBS0121	12	Low open forest	*Eucalyptus camaldulensis var.*	*Cassinia/Acacia/Dodonea/Themeda/Stipa*	53	31
12310	MBS0310	12	Tall open shrubland	*Bursaria spinosa*	*Cassinia/Dodonea*	42	27
12309	MBS0309	12	Low woodland	*Eucalyptus camaldulensis var.*	*Cassinia/Dodonea*	41	28
12343	NCC1001	12	Low woodland	*Eucalyptus camaldulensis var. camaldulensis/Eucalyptus microcarpa*	*OLEA EUROPAEA BURSARIA SPINOSA HERBS GRASSES*	46	15
10917	WIL0101	12	Low woodland	*Eucalyptus goniocalyx*	*mixed low grass*	38	25
10918	WIL0201	12	Low woodland	*Eucalyptus microcarpa*	*Xanthorrhoea low scrub B*	56	34
12071	BHAL0701	12	Low open shrubland	*Hymenanthera dentata*	*grass and herbs*	62	35
11970	MBS0401	12	Low open woodland	*Eucalyptus microcarpa*	*CHEILANTHES/MOSS/HYPOCHOERIS*	44	26
12278	MBS0506	12	Woodland	*Eucalyptus microcarpa/Eucalyptus aff. viridis*	*Stipa/lomandra*	39	31
12311	MBS0311	12	Low woodland	*Eucalyptus microcarpa*	*Acacia/Dianella/Cassinia/Lomandra*	28	24
12288	MBS0608	12	Open woodland	*Eucalyptus microcarpa*	*Allocasuaring/Cassinia/Acacia pycnantha*	30	23
11973	MBS0403	12	Low woodland	*Allocasuarina verticillata*	*VERONICA/CHEILANTHES/AVENA/DANTHONIA*	42	30
12292	MBS0114	12	Low woodland	*Bursaria spinosa*	*grasses*	67	44
12266	MBS0107	12	Low open forest	*Eucalyptus. aff viridis/E leucoxylon/E odorata*	*Cassinia/Rhagodia*	51	37
12276	MBS0504	12	Low open woodland	*Eucalyptus microcarpa*	*acacia pycnantha/ olearia pannosa and grasses*	39	30
12269	MBS0110	12	Low woodland	*Callitris glaucophylla*	*CRYPTANDRA*	88	54
12270	MBS0111	12	Low open woodland	*Callitris glaucophylla*	*HERBS AND FERN*	67	40
12305	MBS0120	12	Low woodland	*Callitris glaucophylla*	*Cassinia/Stipa/Danthonia*	27	17

Appendix VIII

SURVEY 83 (LOFTY BLOCK GRASSLANDS)

1. QUADRAT LOCATION DETAILS
* Quadrats not included in PATN analysis

PATCH	Survey 083 site identifier	1:50 000 MAP	Hundred	Sections	AMG ZONE	EASTING	NORTHING
14248	LBGADE01	ADELAIDE	ADELAIDE	1077	54	285200	6127250
14250	LBGADE02	ADELAIDE	ADELAIDE	1077	54	285670	6126950
15587	LBGADE03	ADELAIDE	YATALA	486	54	288600	6149500
15592	LBGADE04	ADELAIDE	ADELAIDE	1143	54	282700	6125200
15598	LBGANG01	ANGASTON	JELLICOE	396	54	338887	6177983
15599	LBGANG02	ANGASTON	JELLICOE	810	54	335855	6168011
15603	LBGANG03*	ANGASTON	MOOROOROO	531	54	318558	6171539
15579	LBGBOO01	BOOLEROO	BOOLEROO	road/ rail res adj 8,9E 9W	54	251348	6352079
15580	LBGBOO02	BOOLEROO	APPILA	230	54	245395	6348071
14278	LBGBUN01	BUNDALEER	BELALIE	25	54	277373	6316295
14219	LBGBUR01	BURRA	KINGSTON	168	54	308900	6285950
14259	LBGGLA01	GLADSTONE	NARRIDY	road res adj 196	54	255015	6295086
14256	LBGJAM01	JAMESTOWN	MANNANARIE	road res 75/78 126/127	54	275953	6344019
14257	LBGJAM02	JAMESTOWN	MANNANARIE	PT 42	54	278834	6335695
14258	LBGJAM03	JAMESTOWN	BELALIE	298	54	274421	6333914
14276	LBGJAM05	JAMESTOWN	MANNANARIE	road res adj 40	54	279275	6336968
14277	LBGJAM06	JAMESTOWN	MANNANARIE	51	54	279059	6337362
14279	LBGKOO01	KOOLUNGA	YACKAMOORUNDIE	28 or adj	54	262009	6282713
14260	LBGKOO02	KOOLUNGA	YACKAMOORUNDIE	218	54	267226	6290217
14261	LBGKOO03	KOOLUNGA	YACKAMOORUNDIE	320	54	267593	6276387
14262	LBGKOO04	KOOLUNGA	KOOLUNGA	243	54	255351	6289666
14263	LBGKOO05	KOOLUNGA	YACKAMOORUNDIE	road res adj 320/125	54	265465	6276931
14267	LBGLAU02	LAURA	APPILA	320	54	248430	6335330
14268	LBGLAU03	LAURA	APPILA	323	54	249734	6335615
14271	LBGLAU04	LAURA	BOOYOOLIE	PT 3522	54	246761	6333768
14184	LBGMEL01	MELROSE	GREGORY	56	54	235750	6370150
14253	LBGMEL02	MELROSE	WONGYARRA	175	54	238145	6351971
14254	LBGMEL03	MELROSE	WONGYARRA	397	54	236335	6364643
15574	LBGMEL04	MELROSE	WONGYARRA	373	54	235512	6358971
15575	LBGMEL05	MELROSE	WONGYARRA	489	54	233752	6362547
15584	LBGMON01	MONARTO	MONARTO	road res adj 38/128	54	323990	6112513
15585	LBGMON02	MONARTO	MONARTO	road res adj 74/485	54	324093	6114306
15588	LBGNOA01	NOARLUNGA	ADELAIDE	PT 2205	54	281700	6122380
15589	LBGNOA02	NOARLUNGA	ADELAIDE	18/1041	54	280570	6120630
15590	LBGNOA03	NOARLUNGA	ADELAIDE	1041	54	280600	6120500
15591	LBGNOA04	NOARLUNGA	ADELAIDE	1148	54	281250	6123300
15604	LBGONK01*	ONKAPARINGA	TALUNGA	9	54	314900	6149650
14230	LBGPEK01	PEKINA	TARCOWIE	328	54	267500	6350500
14231	LBGPEK02	PEKINA	TARCOWIE	328	54	267900	6350700
14239	LBGPEK03	PEKINA	PEKINA	263	54	267070	6363540
14246	LBGPEK04	PEKINA	PEKINA	44,45	54	267870	6361040
14240	LBGPEK05	PEKINA	PEKINA	44,45	54	267200	6361250
14247	LBGPEK06	PEKINA	TARCOWIE	130	54	269240	6346930
14225	LBGPET01	TEROWIE	GUMBOWIE	49	54	305350	6345770
14227	LBGPET02	PETERBOROUGH	GUMBOWIE	61	54	303610	6348020
14228	LBGPET03	PETERBOROUGH	MORGAN	24	54	290710	6354700
14229	LBGPET04	PETERBOROUGH	COGLIN	423,424,425	54	310520	6368920
14265	LBGPIR01	PIRIE	DARLING	302	54	241781	6335981
14255	LBGPIR02	PIRIE	HOWE	12	54	237850	6326300

PATCH	Survey 083 site identifier	1:50 000 MAP	Hundred	Sections	AMG ZONE	EASTING	NORTHING
14272	LBGPIR03	PIRIE	HOWE	178	54	242792	6321544
14273	LBGPIR04	PIRIE	HOWE	179	54	243535	6321138
15582	LBGPIR05	PIRIE	DARLING	42	54	241210	6337481
15583	LBGPIR06	PIRIE	DARLING	302	54	241730	6335976
14218	LBGQUO01	QUORN	WOOLUNDUNGA	150	54	225000	6404000
14234	LBGQUO02	QUORN	WOOLUNDUNGA	230	54	220960	6402820
14236	LBGQUO03	QUORN	PALMER	450	54	237000	6412470
14237	LBGQUO04	QUORN	PALMER	483	54	237130	6411400
14238	LBGQUO05	QUORN	WILLOCHRA	197	54	237010	6406420
14243	LBGQUO06	QUORN	PICHI RICHI	547	54	218680	6421610
14242	LBGQUO07	QUORN	PICHI RICHI	63	54	221330	6421360
15600	LBGTEP01	TEPKO	ANGAS	525	54	336779	6152604
15586	LBGTRU01	TRURO	DUTTON	74	54	330521	6194004
15593	LBGTRU02	TRURO	DUTTON	436	54	331812	6204958
15594	LBGTRU03	TRURO	NEALES	2	54	327474	6207254
15595	LBGTRU04	TRURO	JULIA CREEK	206	54	320992	6205650
15596	LBGTRU05	TRURO	JELLICOE	700	54	332813	6181318
15601	LBGTRU06	TRURO	DUTTON	300	54	335734	6198955
15602	LBGTRU07	TRURO	DUTTON	299	54	334980	6198240
14221	LBGWIL01	WILLOWIE	PINDA	112	54	248480	6393970
14222	LBGWIL02	WILLOWIE	PINDA	58	54	246240	6389900
15576	LBGWLM01	WILMINGTON	GREGORY	399	54	227514	6374117
15577	LBGWLM02	WILMINGTON	GREGORY	402	54	227648	6374715
15581	LBGWLM03	WILMINGTON	WILLOCHRA	road res adj 576/389	54	228285	6384268
14223	LBGYED01	YEDNALUE	EURILPA	55	54	287560	6431540

2. ENVIRONMENTAL DATA

Patch	Survey 083 site identifier	Alt.	Landform	Landform pattern	Slope	Aspect	Strew cover	Outcrop cover	Soil texture class
14248	LBGADE01	330	hill crest	Escarpment	0	999	<10%	<10%	clay loam
14250	LBGADE02	330	ridge	Escarpment	14	300	<10%	(Nil)	loam
15587	LBGADE03	150	hill slope	Escarpment	30	200	<10%	<10%	clay loam
15592	LBGADE04	250	hill slope	Escarpment	40	52	10-30%	10-50%	sand
15598	LBGANG01	160	plain (incl undulating plain)	Plain	2	190	(nil)	(Nil)	clay loam
15599	LBGANG02	320	hill footslope	Hills	50	360	30-70%	>50%	sandy clay loam
15603	LBGANG03	500	flat	Flood plain	3	45	(nil)	(Nil)	loamy sand
15579	LBGBOO01	385	plain (incl undulating plain)	Rises	0	999	<10%	(Nil)	clayey sand
15580	LBGBOO02	450	hill slope	Rises	20	50	10-30%	(Nil)	loam
14278	LBGBUN01	490	hill slope	Low hills	10	313	30-70%	10-50%	sandy loam
14219	LBGBUR01	585	hill slope	Low hills	16	230	<10%	(Nil)	medium clay
14259	LBGGLA01	220	hill slope	Low hills	6	320	<10%	(Nil)	sandy clay loam
14256	LBGJAM01	540	hill slope	Hills	3	356	<10%	(Nil)	sandy clay loam
14257	LBGJAM02	540	hill slope	Rises	4	300	<10%	<10%	sandy loam
14258	LBGJAM03	610	hill slope	Low hills	9	260	<10%	<10%	sandy clay loam
14276	LBGJAM05	570	hill slope	Low hills	2	326	<10%	(Nil)	sandy clay loam
14277	LBGJAM06	560	hill slope	Low hills	6	339	10-30%	<10%	sandy loam
14279	LBGKOO01	180	hill slope	Low hills	9	42	30-70%	(Nil)	sandy loam
14260	LBGKOO02	340	hill slope	Hills	6	230	gt 70%	10-50%	clay loam
14261	LBGKOO03	290	hill slope	Low hills	4	338	<10%	(Nil)	sandy clay loam
14262	LBGKOO04	230	hill slope	Low hills	5	230	<10%	(Nil)	sandy clay loam
14263	LBGKOO05	270	hill slope	Hills	7	274	<10%	(Nil)	sandy clay loam
14267	LBGLAU02	340	hill slope	Low hills	3	177	10-30%	10-50%	loam
14268	LBGLAU03	380	hill slope	Low hills	10	275	30-70%	(Nil)	loam
14271	LBGLAU04	280	hill crest	Rises	0	999	<10%	(Nil)	sandy loam
14184	LBGMEL01	310	plain (incl undulating plain)	Plain	0	999	<10%	(Nil)	clayey sand
14253	LBGMEL02	420	hill slope	Low hills	7	180	<10%	10-50%	sandy clay loam
14254	LBGMEL03	400	hill slope	Hills	26	108	<10%	<10%	sandy loam
15574	LBGMEL04	300	hill slope	Low hills	20	250	30-70%	(Nil)	sandy loam
15575	LBGMEL05	450	hill slope	Hills	35	230	<10%	<10%	loam
15584	LBGMON01	180	hill crest	Escarpment	5	265	<10%	<10%	silt loam
15585	LBGMON02	190	hill slope	Escarpment	25	250	10-30%	<10%	clayey sand
15588	LBGNOA01	220	hill slope	Hills	25	170	(nil)	(Nil)	sandy loam
15589	LBGNOA02	200	hill slope	Hills	15	240	(nil)	(Nil)	sandy loam
15590	LBGNOA03	180	hill slope	Hills	40	160	(nil)	<10%	loam

Patch	Survey 083 site identifier	Alt.	Landform	Landform pattern	Slope	Aspect	Strew cover	Outcrop cover	Soil texture class
15591	LBGNOA04	230	hill crest	Hills	5	270	<10%	<10%	loam
15604	LBGONK01	450	flat	Plain	0	999	(nil)	(Nil)	sandy loam
14230	LBGPEK01	490	hill slope	Rises	4	270	<10%	(Nil)	loam
14231	LBGPEK02	500	hill slope	Rises	5	230	<10%	(Nil)	sandy loam
14239	LBGPEK03	540	hill slope	Hills	10	60		(Nil)	loam
14240	LBGPEK04	540	hill footslope	Low hills	4	130	<10%	(Nil)	loam
14246	LBGPEK05	570	hill footslope	Low hills	8	80	10-30%	<10%	sandy loam
14247	LBGPEK06	540	hill slope	Low hills	10	190	<10%	(Nil)	sandy loam
14225	LBGPET01	630	hill footslope	Low hills	7	180	<10%	(Nil)	light clay
14227	LBGPET02	600	hill crest	Low hills	5	254	<10%	10-50%	clay loam
14228	LBGPET03	480	hill slope	Hills	10	242	<10%	(Nil)	clayey sand
14229	LBGPET04	420	plain (incl undulating plain)	Plain	1	90	<10%	(Nil)	heavy clay
14265	LBGPIR01	350	hill slope	Low hills	1	85	<10%	(Nil)	sandy loam
14255	LBGPIR02	490	hill slope	Low hills	11	318	<10%	(Nil)	clay loam
14272	LBGPIR03	330	hill slope	Low hills	18	179	10-30%	10-50%	sandy loam
14273	LBGPIR04	330	hill slope	Low hills	12	271	10-30%	<10%	sandy loam
15582	LBGPIR05	340	plain (incl undulating plain)	Low hills	0	999	<10%	(Nil)	loamy sand
15583	LBGPIR06	350	plain (incl undulating plain)	Low hills	1	100	(nil)	(Nil)	loamy sand
14218	LBGQUO01	375	hill slope	Low hills	9	90	<10%	(Nil)	medium heavy clay
14234	LBGQUO02	490	ridge	Hills	6	290	10-30%	(Nil)	sandy clay loam
14236	LBGQUO03	240	plain (incl undulating plain)	Plain	0	999	<10%	(Nil)	sandy clay loam
14237	LBGQUO04	235	plain (incl undulating plain)	Plain	0	999	10-30%	(Nil)	clay loam
14238	LBGQUO05	240	plain (incl undulating plain)	Plain	0	999	<10%		clay loam
14243	LBGQUO06	360	hill footslope	Hills	5	50	<10%	(Nil)	
14242	LBGQUO07	390	hill footslope	Alluvial plain	4	140	<10%	(Nil)	loam
15600	LBGTEP01	160	plain (incl undulating plain)	Plain	0	999	(nil)	(Nil)	clayey sand
15586	LBGTRU01	320	plain (incl undulating plain)	Plain	2	220	<10%	(Nil)	sandy clay loam
15593	LBGTRU02	320	hill slope	Low hills	10	85	30-70%	10-50%	sandy clay loam
15594	LBGTRU03	400	hill slope	Hills	15	56	<10%	<10%	sandy clay loam
15595	LBGTRU04	350	hill slope	Low hills	10	220	<10%	<10%	sandy clay loam
15596	LBGTRU05	390	gully	Hills	10	130	<10%	(Nil)	sandy loam
15601	LBGTRU06	230	hill slope	Low hills	10	314	<10%	<10%	sandy clay loam
15602	LBGTRU07	260	hill slope	Low hills	20	270	<10%	(Nil)	sandy loam
14221	LBGWIL01	300	plain (incl undulating plain)	Plain	0	999	<10%	(Nil)	light clay
14222	LBGWIL02	360	plain (incl undulating plain)	Plain	0	999	<10%	(Nil)	clay loam
15576	LBGWLM01	550	hill slope	Low hills	35	146	<10%	<10%	loam
15577	LBGWLM02	550	hill slope	Low hills	30	126	<10%	<10%	loam
15581	LBGWLM03	315	plain (incl undulating plain)	Plain	0	999	10-30%	<10%	sandy loam
14223	LBGYED01	420	plain (incl undulating plain)	Plain	0	999	<10%	(Nil)	light clay

3. OWNERSHIP AND TENURE OTHER THAN UNRESERVED PRIVATE FREEHOLD

* Abbreviations: HA Heritage Agreement, CR Council Land, RP, CP, NP Recreation, Conservation, National Park

Site identifier	Herbarium region	Owner/ Status /Reserve code*	Name	Land Use
LBGADE01	SL	HA NOT FINAL	WAITE HILLS	HERITAGE AGREEMENT
LBGADE02	SL	HA NOT FINAL	WAITE HILLS	HERITAGE AGREEMENT
LBGADE03	SL	RP021	COBBLER CREEK	RECREATION PARK
LBGADE04	SL	CR	RANDELL PARK	COUNCIL
LBGANG01	MU	CROWN	TOWITTA CEMETERY	CEMETERY
LBGANG03	MU	CP167	KAISERSTUHL	CONSERVATION PARK
LBGBOO01	FR	ROAD/RAIL RESERVE		ROAD/RAIL RESERVE
LBGGLA01	NL	ROAD RESERVE		ROAD RESERVE
LBGJAM01	NL	ROAD RESERVE(UNMADE)		ROAD RESERVE(UNMADE)
LBGJAM05	NL	ROAD RESERVE (UNMADE)	FORMER STOCK ROUTE, LEASED	GRAZED INTERMITTENTLY
LBGKOO05	NL	ROAD RESERVE		ROAD RESERVE
LBGMEL01	FR	NP008	MOUNT REMARKABLE	NATIONAL PARK
LBGMEL02	FR	PROPOSED HA		CONSERVATION
LBGMEL03	FR	CR	MONUMENT RES	COUNCIL
LBGMEL05	FR	NP008	MOUNT REMARKABLE	NATIONAL PARK
LBGMON01	MU	ROAD RESERVE	CALLINGTON HILL	ROAD RESERVE
LBGMON02	MU	ROAD RESERVE	N OF CALLINGTON HILL	ROAD RESERVE
LBGNOA01	SL	HA	GULFVIEW RD BLACKWOOD	HERITAGE AGREEMENT
LBGNOA02	SL	CR	MOUNTBATTEN AVE/BLACKWOOD HILL	COUNCIL
LBGNOA03	SL	CR	BLACKWOOD HILL	COUNCIL
LBGNOA04	SL	CR	SLEEP HILL	COUNCIL
LBGONK01	SL	CP145	CROMER	CONSERVATION PARK
LBGPEK01	FR	CR	TARCOWIE PARKLANDS	FLORA RESERVE
LBGPEK02	FR	CR	TARCOWIE PARKLANDS	RESERVE
LBGPET04	FR	CR	DAWSON PARKLANDS	COUNCIL
LBGPIR01	NL	60010	WIRRABARA	FOREST RESERVE
LBGPIR02	NL	SA WATER	BEETALOO	RESERVOIR
LBGPIR03	NL	HA	BURR	HERITAGE AGREEMENT
LBGPIR05	NL	60010	WIRRABARA	FOREST RESERVE
LBGPIR06	NL	60010	WIRRABARA	FOREST RESERVE
LBGQUO01	FR	CP210	MOUNT BROWN	CONSERVATION PARK
LBGQUO02	FR	CP210	MOUNT BROWN	CONSERVATION PARK
LBGQUO03	FR	CROWN	STEPHENSTON HISTORIC CEMETERY	PASTORAL
LBGQUO04	FR	CROWN LEASEHOLD(PRIV)		PASTORAL
LBGQUO05	FR	CROWN LEASEHOLD(PRIV)		PASTORAL
LBGTEP01	MU	CR	SANDERSTON CEMETERY	PLANTATION
LBGWIL01	FR	CROWN LEASEHOLD(PRIV)		PASTORAL
LBGWIL02	FR	CROWN LEASEHOLD(PRIV)		PASTORAL
LBGWLM01	FR	NP008	MOUNT REMARKABLE	NATIONAL PARK
LBGWLM02	FR	NP008	MOUNT REMARKABLE	NATIONAL PARK
LBGWLM03	FR	ROAD RESERVE		ROAD RESERVE
LBGYED01	FR	CROWN LEASEHOLD(PRIV)		PASTORAL

Appendix IX

HISTORICAL VEGETATION RECORDS

Original and current survey data, Survey 83 quadrat locations. Text is exactly as read on the plans with this author's notes in square brackets and any queries as to interpretation of handwriting indicated by "?". Quadrat localities are given in Appendix VIII.

Fl Gp: Floristic Group to which quadrat assigned in PATN analysis of 513 quadrats, 216 perennial native species

Group 1: *Lomandra effusa* GRASSLAND
Group 2: *Stipa eremophila* GRASSLAND WITH EMERGENT SHRUBS
Group 5: *Danthonia caespitosa* +/- *Acacia victoriae* GRASSLAND & OPEN SHRUBLAND
Group 6: *Eucalyptus odorata* LOW WOODLAND
Group 8: *Lomandra multiflora ssp dura* GRASSLAND & LOW WOODLAND
Group 9: *Eucalyptus leucoxylon* LOW WOODLAND & WOODLAND
Group 10: *Eucalyptus microcarpa* LOW WOODLAND (includes regrowth with "mallee" form)
Group 11: *Allocasuarina verticillata+/-Eucalyptus leucoxylon; E microcarpa* LOW WOODLAND & LOW OPEN - WOODLAND
Group 12: *Eucalyptus microcarpa +/- Allocasuarina verticillata* LOW WOODLAND

Remarks codes applied to surveyors' remarks for analysis purposes (Table 17): L blackgrass, W wooded or lightly wooded, timbered, C chenopod shrubland, saltbush or bluebush, N no timber, G grassed or well grassed, T spinifex or porcupine, V vegetation soils and/or landform described, P pastoral/pasture (includes descriptions "rough stony land" and "middling land"), A arable, S "stony" or rock outcrops.

CURRENT VEGETATION SURVEY						PRE-EUROPEAN SURVEY VEGETATION, SOIL & LAND FORM RECORDS		Location	
Fl Gp	Patch	Survey 083 site number	Vegetation Structure	OVERSTOREY	UNDERSTOREY	SURVEY YEAR	SURVEYOR'S REMARKS FROM ORIGINAL PLAN	Remarks code	Region	Current landuse
1	15594	LBGTRU03	Tall shrubland	*Acacia retinodes var. retinodes (hill form)/*	*Lomandra effusa/*	1867	Good hilly pasture lightly wooded	PW	MU	grazing
1	15595	LBGTRU04	(Tussock) grassland	*Avena barbata/Lomandra effusa/*	*Stipa eremophila/*	1864/5	Good pasture, no timber	PN	MU	grazing
2	15598	LBGANG01	Low open woodland	*Callitris preissii/*	*Stipa eremophila/Senna artemisioides ssp. petiolaris/*	1886	Open blackgrass country, firm, loam clay subsoil [adjacent creekline:] alluvial flat timbered with ?willows	LV	MU	cemetery reserve

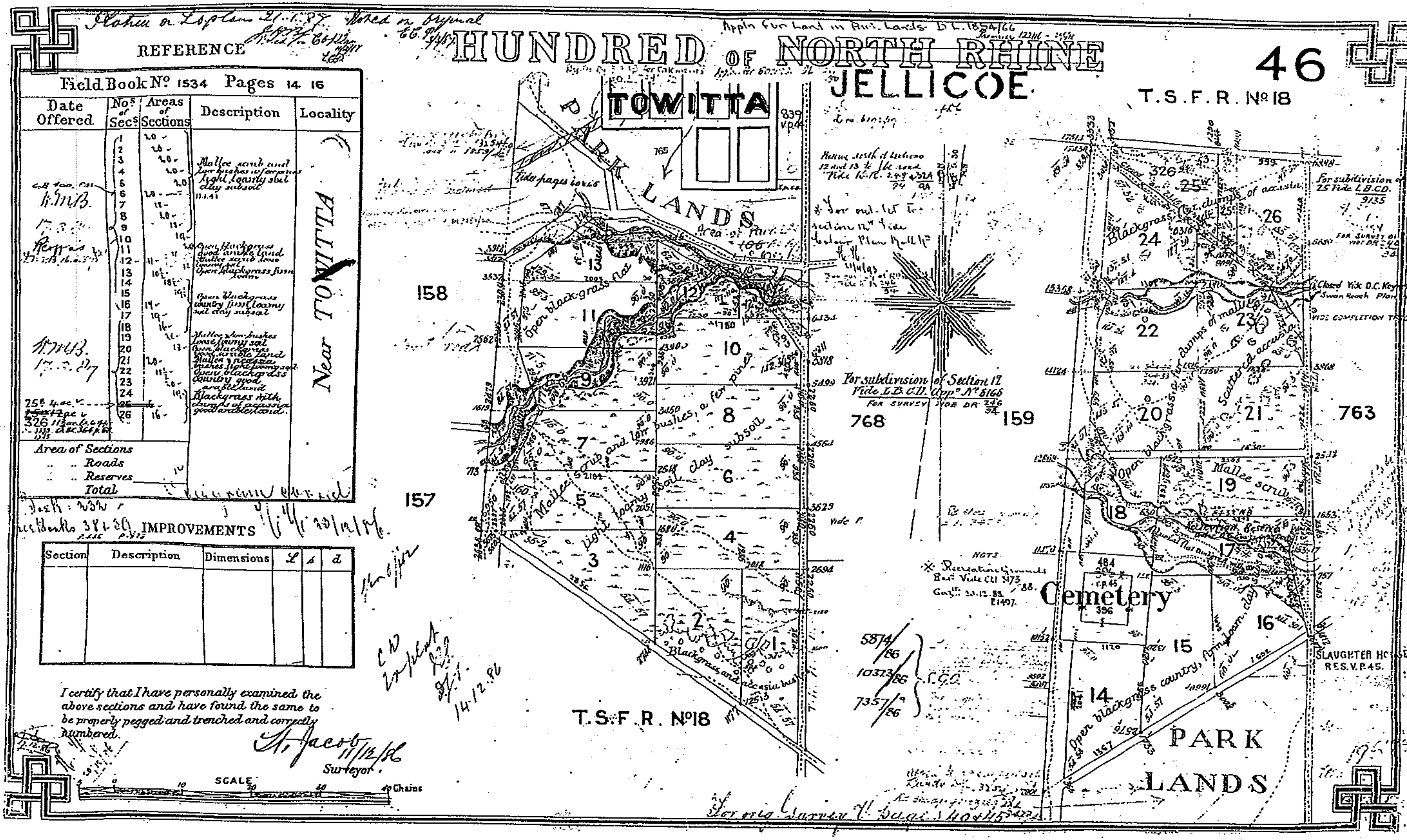
Fl Gp	Patch	Survey 083 site number	Vegetation Structure	OVERSTOREY	UNDERSTOREY	SURVEY YEAR	SURVEYOR'S REMARKS FROM ORIGINAL PLAN	Remarks code	Region	Current landuse
2	14228	LBGPET03	Low woodland	*Callitris preissii/*	*Danthonia auriculata/Stipa nodosa/Stipa eremophila/Hyalosperma semisterile/*	1879	[legend] Good open plain Reddish clay soil loose stones scrubby bushes [Plan] low rises mixed scrub low rocky range [site is on rise]	WVS	FR	grazing?
2	14237	LBGQUO04	(Tussock) grassland	*Stipa eremophila/*	*Danthonia caespitosa/*	1876	Blue bush, limestone, rubble on surface [towards the west becomes saltbush, area subject to inundation, part Acacia scrub, good clayey loam and loam, railway reserve. See plan]	CVS	FR	grazing
2	14238	LBGQUO05	(Tussock) grassland	*Maireana georgei*	*Stipa eremophila/Danthonia caespitosa*	1875?	Arable land [band from nw to se of black oak & sandalwood scrub]	A	FR	grazing
2	15600	LBGTEP01	Open mallee	*Eucalyptus socialis/*	*Danthonia setacea var. setacea/Senna artemisioides nothossp. coriacea/*	1888 Goyder	(gen) chiefly rich red alluvial soil on flats and good red soil on rises with red clay subsoil. Covered with mallee and bushes and well grassed on rises. Pines and a few bushes and well grassed on flats. First class arable or grazing land and suitable for orchards. Fringe of Bastard gums along Sanders Creek	AGWV	MU	cemetery plantation reserve
2	14221	LBGWIL01	(Tussock) grassland	*Stipa eremophila/Danthonia caespitosa/*	*Rhodanthe troedelii/Brachycome lineariloba/Elachanthus pusillus/*	1876	Open plain covered with salt and bluebush	CV	FR	grazing
2	14223	LBGYED01	Open (tussock) grassland	*Stipa eremophila/*	*Rhodanthe troedelii/*	1880	Open plain covered blue and cotton bush. Soil good firm clay sandstone rubble on surface. Patches of Bay of Biscay ground	CVS	FR	grazing
5	14229	LBGPET04	(Tussock) grassland	*Maireana aphylla/Stipa nitida/*	*Danthonia setacea var. setacea/*	1881	Arable, slatey ridge	A	FR	grazing,recreation
5	14218	LBGQUO01	Open (tussock) grassland	*Stipa scabra ssp. falcata/Danthonia caespitosa/*	*Ptilotus nobilis var./Hyalosperma semisterile/Maireana trichoptera/*	1890	section 150:[from plan] Open rises, covered with spinifex very stony, patches good land Well grassed. [from remarks indicates that good land is on eastern side]	GVS	FR	Cons Park grazed
5	14236	LBGQUO03	Open (tussock) grassland	*Emergent Maireana pyramidata/*	*Danthonia caespitosa/Stipa nodosa/Podolepis muelleri/*	1876	Blue bush	CV	FR	grazing
5	14222	LBGWIL02	(Tussock) grassland	*Stipa eremophila/Stipa scabra ssp. falcata/*	*Rhodanthe troedelii/*	1876	Dark red soil Hilly bluebush A little sandalwood surface stone	CVS	FR	grazing
6	14262	LBGKOO04	Low woodland	*Eucalyptus porosa/Eucalyptus odorata/*	*Stipa blackii/*	1874	Arable land good clayey soil [241,242 also]	A	NL	grazing
6	14263	LBGKOO05	Low woodland	*Eucalyptus odorata/*	*Danthonia setacea var. setacea/Stipa scabra ssp. falcata/*	1873	125:arable and good pasture land	A/P	NL	? possibly grazed, adjacent crop
6	14271	LBGLAU04	Low open forest	*Eucalyptus odorata/*	*Danthonia setacea var. setacea/*	1855	Pasture & agricultural land -part thickly wooded with gums and pines good water	A/PW	NL	grazing
6	14184	LBGMEL01	Woodland	*Eucalyptus odorata/*	*Hyalosperma semisterile/Danthonia auriculata/*	1885	Easterly slope rich sandy loam timbered with mallee and box	WV	FR	National Park
6	14230	LBGPEK01	Low woodland	*Eucalyptus odorata/Callitris preissii/*	*Danthonia setacea var. setacea/Stipa scabra ssp. falcata/Acacia hakeoides/*	1874	Soil red loam spinifex mallee gum and low bushes [description from general township allotments]	WV	FR	Council Reserve
6	14231	LBGPEK02	(Tussock) grassland (very open woodland)	*Eucalyptus leucoxylon ssp. pruinosa/*	*Stipa eremophila/Calocephalus citreus/Danthonia setacea var. setacea/*	1874	ditto	WV	"	Council Reserve

Fl Gp	Patch	Survey 083 site number	Vegetation Structure	OVERSTOREY	UNDERSTOREY	SURVEY YEAR	SURVEYOR'S REMARKS FROM ORIGINAL PLAN	Remarks code	Region	Current landuse
6	14247	LBGPEK06	Woodland	*Eucalyptus leucoxylon ssp. pruinosa/*	*Stipa nodosa/Bursaria spinosa/Danthonia setacea var. setacea/*	not found	[plan page to west was surveyed 1872]		FR	grazing
6	14234	LBGQUO02	Woodland	*Eucalyptus odorata/*	*Danthonia linkii var. fulva/Stipa scabra ssp. falcata/*	1890	ADJACENT TO SECTION 150 [no information on Sn230]		FR	Cons Park
6	14243	LBGQUO06	Low open forest	*Eucalyptus odorata/*	*Stipa nitida/Rhodanthe floribunda/*	1884	Undulating porcupine country about 3/4 good arable land	A/PT	FR	grazing
6	14242	LBGQUO07	Open mallee	*Eucalyptus odorata/*	*Senna artemisioides ssp. petiolaris/Stipa eremophila/Olearia pimeleoides ssp./Danthonia caespitosa/*	1876?	Green mallee, sheoak, and red gum red clay soil, stony surfaces one third open or red loam soil, green mallee scrub & bushes	WVS	FR	grazing
8	15587	LBGADE03	Very open mallee	*Eucalyptus porosa/*	*Stipa blackii/Stipa multispiculis/*	1852	Stoney [lands nearby on crests described as good arable land Sn 2118]	A/PS	SL	Recreation Park
8	15599	LBGANG02	Very low open woodland	*Allocasuarina verticillata/*	*Themeda triandra/*	1866	Good pasture wood	PW	MU	grazing
8	15579	LBGBOO01	Low open woodland	*Acacia pycnantha/*	*Chrysocephalum apiculatum/Bursaria spinosa/Stipa blackii/Stipa eremophila/*	1875	Hilly, no timber, good red soil, porcupine	NTV	FR	road reserve
8	14219	LBGBUR01	(Tussock) grassland	*Stipa setacea/Stipa scabra ssp. falcata/Danthonia auriculata*	*Leptorhynchos tetrachaetus/Danthonia carphoides var. carphoides/Lomandra multiflora ssp. dura/*	1860	good pastoral land	P	NL	grazing
8	14259	LBGGLA01	Low open shrubland	*Stipa blackii/Lepidosperma viscidum/Stipa eremophila*	*Danthonia caespitosa/Halgania cyanea/*	1874	Good arable land soil red loam clay subsoil [on plan vegetation on adjacent hills described see M Hyde pre European map of Gladstone]	A	NL	road reserve
8	14256	LBGJAM01	Woodland	*Eucalyptus microcarpa/Eucalyptus leucoxylon ssp. pruinosa/*	*Danthonia setacea var. setacea/Stipa blackii/*	1872 1898	Arable pasture 126: Good grassland timbered with Box Gums Sheoaks and a few Wattles in places spinifex - spear-grass and other grasses good red dark loamy soil on spurs flats gullies rises - stone on surface Hills Rocky & Stoney 127:Good grassland timbered with Gums Box, Sheoak, peppermint-spinifex - flats. Spurs gullies good arable land-soil red and brown loamy soil loose stone on surface- hills and rises stony- From 20 to 60 acres on the (each) above sections are arable	A/PWGTS	NL	road reserve
8	14257	LBGJAM02	Open (tussock) grassland	*Stipa nitida/*	*Danthonia sp./Aristida behriana/Danthonia eriantha/*	1872	Agricultural	A	NL	grazing
8	14258	LBGJAM03	(Tussock) grassland	*Allocasuarina verticillata/*	*Stipa blackii/Danthonia setacea var. setacea/Cryptandra amara var. longiflora/Aristida behriana/Stipa scabra ssp. falcata/*	1868	Parts arable [description on this plan is limited to arable or pasture]	A/P	NL	grazing
8	14276	LBGJAM05	(Tussock) grassland	*Stipa blackii/Themeda triandra/*	*Aristida behriana/Stipa scabra ssp. falcata/*	1872	Pastoral	P	NL	light grazing
8	14277	LBGJAM06	(Tussock) grassland	*Bursaria spinosa/*	*Themeda triandra/Stipa blackii/*	1872	Pastoral	P	NL	grazing

Fl Gp	Patch	Survey 083 site number	Vegetation Structure	OVERSTOREY	UNDERSTOREY	SURVEY YEAR	SURVEYOR'S REMARKS FROM ORIGINAL PLAN	Remarks code	Region	Current landuse
8	14279	LBGKOO01	Hummock grassland	*Avena barbata/Triodia scariosa/Themeda triandra*		1870	second class arable	A	NL	not known
8	14260	LBGKOO02	Hummock grassland	*Triodia scariosa ssp./Cryptandra amara var. longiflora/Themeda triandra/ Bursaria spinosa*	*Aristida behriana/Gonocarpus elatus/*	1873	Arable and good pasture land	A/P	NL	grazing
8	14261	LBGKOO03	Low woodland	*Allocasuarina verticillata/*	*Triodia scariosa ssp./Themeda triandra/Bursaria spinosa/Lepidosperma viscidum/*	1918	about 4/10 is covered with open big mallee & sheoak. 6/10 Class No 1: High undulations of clayey loam over clay; occasional small patches of quartzite stones on surface: all has been cultivated except where shewn timbered: all well grassed. 4/10 Class No 2: Steep rough hills: shallow dark soil over quartzite which outcrops frequently: poorly grassed: patches of spinifex: rough grazing land not suitable for cultivation	A/PWGTVS	NL	grazing
8	14267	LBGLAU02	Low woodland	*Allocasuarina verticillata/*	*Triodia scariosa/Bursaria spinosa/*	1873	Rough stony land	?PS	NL	grazing
8	14268	LBGLAU03	Low open woodland		*Triodia scariosa/Bursaria spinosa/Cryptandra amara var. longiflora/*	1873	Middling land ('porcupine')	?PT	NL	grazing
8	14253	LBGMEL02	Woodland	*Allocasuarina verticillata/Eucalyptus microcarpa/*	*Stipa blackii/Aristida behriana/Lomandra densiflora/Danthonia pilosa var. paleacea/*	illegible	Pastoral heavily timbered	PW	FR	applied for HA not grazed
8	14254	LBGMEL03	Woodland	*Eucalyptus microcarpa/Eucalyptus odorata/*	*Stipa blackii/Hibbertia exutiacies/*	1890, 1923	Steep stony hills of red loam and soft ferruginous sandstone outcropping in places. Large box and gum trees, saplings and titree, good mixed grass	WGVS	FR	reserve
8	15584	LBGMON01	Very low open woodland	*Acacia pycnantha/*	*Aristida behriana/Themeda triandra/*	1887 1866	38 western portion sandy flat - well grassed. Remaining Bald Hills well grassed - soil rich red loam - red clay - subsoil in places steep & stony. [Bald Hills are adjacent to site on plan] 128 Pasture land, stones [illegible] [shows mallee on top of range]	PGS	MU	grazing
8	15585	LBGMON02	Very low open forest	*Allocasuarina verticillata/*	*Stipa eremophila/Stipa setacea/Danthonia caespitosa/*	1856 1868	74 Pasture[71,72 arable, 73 part arable] 485 Arable, lightly timbered with mallee	A/PW	MU	road reserve
8	14239	LBGPEK03	Open (tussock) grassland	*Stipa nodosa/Stipa blackii/*	*Danthonia eriantha/Danthonia caespitosa/*	1875	[same as 262: very high. rock slab, rocky range porcupine, a few sheoaks unfit for agriculture	PTS	FR	grazing
8	14240	LBGPEK05	Woodland	*Eucalyptus leucoxylon ssp. pruinosa/*	*Stipa nodosa/Stipa blackii/Chrysocephalum semipapposum/*	1872	44 pastoral 45 part arable[on plan 'gums'across higher land-western third]	A/P	FR	little grazing
8	14246	LBGPEK04	Very low woodland	*Allocasuarina verticillata/*	*Chrysocephalum semipapposum/Bursaria spinosa/Stipa blackii/Danthonia setacea var. setacea/Cryptandra amara var. longiflora/*					little grazing
8	14225	LBGPET01	(Tussock) grassland	*Lomandra effusa/Stipa nodosa/Stipa blackii*	*Eriochlamys behrii/*	1877	rough pasture land, soil light loam	P	NL	grazing

Fl Gp	Patch	Survey 083 site number	Vegetation Structure	OVERSTOREY	UNDERSTOREY	SURVEY YEAR	SURVEYOR'S REMARKS FROM ORIGINAL PLAN	Remarks code	Region	Current landuse
8	14227	LBGPET02	(Tussock) grassland	*Stipa blackii/Stipa eremophila/Cryptandra amara var.*	*Danthonia setacea var. setacea/Calocephalus citreus/*	1877	good pasture land, soil chocolate brown rough in parts	P	FR	grazing
8	15586	LBGTRU01	Open woodland	*Eucalyptus leucoxylon ssp. pruinosa/*	*Stipa blackii/Lomandra multiflora ssp. dura/Stipa nodosa/*	1861	Pasture land	P	MU	grazing
8	15593	LBGTRU02	Very low woodland	*Allocasuarina verticillata/*	*Acacia paradoxa/Stipa blackii/Bursaria spinosa/Gonocarpus elatus/Stipa setacea/*	1896	Open stony tussocks grass red and brown loam clay. Rough stony hill	GVS	MU	grazing
8	15596	LBGTRU05	Low open woodland	*Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus leucoxylon hybrid/*	*Aristida behriana/Gonocarpus elatus/Themeda triandra/*	1862	Good pasture lightly timbered ['hilly'?]	PW	MU	grazing
8	15601	LBGTRU06	Very low open woodland	*Allocasuarina verticillata/*	*Amphipogon caricinus var. caricinus/Aristida behriana/Stipa nodosa/Lomandra effusa/Leptorhynchos tetrachaetus/*	~ 1866?	[on plan] lightly timbered sheoak	WV	MU	seasonal grazing
8	15602	LBGTRU07	Open mallee	*Eucalyptus porosa/*	*Stipa blackii/Stipa platychaeta/*	~ 1866?	on plan lightly timbered sheoak	WV	MU	seasonal grazing
8	15581	LBGWLM03	Woodland	*Eucalyptus microcarpa/*	*Danthonia setacea var. setacea/Aristida behriana/Stipa nodosa/Enteropogon acicularis/*	1876	Chocolate loam with light surface stone	VS	FR	road reserve
9	14278	LBGBUN01	(Tussock) grassland	*Themeda triandra/Gramineae sp*	*Danthonia auriculata*	1868	Pasture [adjacent marked arable]	P	NL	grazing
9	15574	LBGMEL04	Woodland	*Eucalyptus albens/*	*Chrysocephalum apiculatum/Hibbertia exutiacies/*	1916?	About 1/14 class No 2 undulating country. Chocolate soil over clay mixed with loose stones. Scattered box & a few sheoaks. About 3/14 class No 3 Rough stony hills, good grazing, well grassed, numerous rock outcrops open box and a little sheoak	GWVS	FR	grazing
9	15575	LBGMEL05	Open woodland	*Eucalyptus camaldulensis var. camaldulensis/*		no date	rough pasture thickly wooded with gums	PW	FR	National Park
9	14265	LBGPIR01	Woodland	*Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus leucoxylon ssp. leucoxylon/Eucalyptus microcarpa*	*Bursaria spinosa/Danthonia setacea var. setacea/Danthonia pilosa var. paleacea/*	1890	Gums, good garden land, soil light and dark loam, clay	AW	NL	Forest Reserve
9	14255	LBGPIR02	Woodland	*Eucalyptus leucoxylon ssp. pruinosa/*	*Themeda triandra/Cassinia uncata/Hibbertia exutiacies/Stipa blackii/Danthonia setacea var. setacea/*	1891	----------		NL	Water Reserve
9	15582	LBGPIR05	Woodland	*Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus microcarpa/*	*Danthonia setacea var. setacea/Danthonia caespitosa/Stipa nodosa/*	1890	Red and brown loamy soil from 6 to 9 in depth with gravel subsoil peppermint and box. High stony rises with peppermint & box.	WVS	NL	Forest Reserve

Fl Gp	Patch	Survey 083 site number	Vegetation Structure	OVERSTOREY	UNDERSTOREY	SURVEY YEAR	SURVEYOR'S REMARKS FROM ORIGINAL PLAN	Remarks code	Region	Current landuse
9	15583	LBGPIR06	Open woodland	*Eucalyptus leucoxylon ssp. pruinosa/Eucalyptus microcarpa/Eucalyptus camaldulensis var. camaldulensis*	*Stipa blackii/Danthonia auriculata/*	1890	Gums good garden land, soil light and dark loam, clay	AW	NL	Forest Reserve
9	15576	LBGWLM01	Open woodland	*Eucalyptus camaldulensis var. camaldulensis/*	*Poa labillardieri var. labillardieri/Danthonia racemosa var. racemosa/Acaena echinata var./*	1882	eastern part well grassed hills, sandy loam western part bare rocky hills, gum and peppermint [?]rest[?] sheoak and wattle	GWVS	FR	National Park
9	15577	LBGWLM02	Low open woodland	*Eucalyptus cladocalyx/*	*Juncus subsecundus/Gonocarpus elatus/Hibbertia exutiacies/*	1882	eastern part well grassed hills, sandy loam western part bare rocky hills, gum and peppermint [?]rest[?] sheoak and wattle	GWV	FR	National Park
10	14248	LBGADE01	Open forest	*Eucalyptus microcarpa/*	*Stipa flavescens/Danthonia pilosa var. paleacea/Gonocarpus elatus/*	1907	no comments		SL	Heritage Agreement
10	14250	LBGADE02	Woodland	*Eucalyptus microcarpa/*	*Hibbertia exutiacies/Danthonia pilosa var. paleacea/*	1907	no comments			Heritage Agreement
10	15592	LBGADE04	Woodland	*Eucalyptus microcarpa/*	*Gonocarpus elatus/Dodonaea viscosa ssp. spatulata/*		no comments		SL	Council Reserve
10	15588	LBGNOA01	Low open forest	*Eucalyptus microcarpa/*	*Bursaria spinosa/Stipa hemipogon/Danthonia caespitosa/Lomandra densiflora/*	1851	Middling land wooded [ditto for 2206]	?PW	SL	Heritage Agreement
10	15589	LBGNOA02	Low woodland	*Eucalyptus microcarpa/*	*Acacia pycnantha/Hibbertia exutiacies/Stipa flavescens/*	1843	plan is of government farm see plan for Sn 1041		SL	Council Reserve
10	15590	LBGNOA03	Woodland	*Eucalyptus microcarpa/*	*Bursaria spinosa/Acacia pycnantha/Stipa multispiculis/*	1850	[on plan] steep hilly land (slate) stony	VS	SL	Council Reserve
10	15591	LBGNOA04	Low woodland	*Eucalyptus microcarpa/*	*Dodonaea viscosa ssp. spatulata/Lepidosperma curtisiae/Themeda triandra/Acacia pycnantha/*		no comments		SL	Council Reserve
11	14272	LBGPIR03	Low woodland	*Allocasuarina verticillata/Eucalyptus leucoxylon ssp. pruinosa/*	*Triodia scariosa/Stipa flavescens/Xanthorrhoea quadrangulata/Acacia wattsiana/*	1891	Rough rocky hills & spurs covered with spinifex and gums very little grass- very inferior country	TWVS	NL	
11	14273	LBGPIR04	Low woodland	*Allocasuarina verticillata/*	*Xanthorrhoea quadrangulata/Acacia wattsiana/Triodia scariosa/Themeda triandra/*	1891	Rough stony hilly country covered partly with spinifex and gums - fairly well grassed	GTWVS	NL	
12	15580	LBGBOO02	Open woodland	*Eucalyptus microcarpa/*	*Bursaria spinosa/Triodia scariosa ssp. bunicola/*	1874	Good arable land	A	FR	grazing
-	15603	LBGANG03	Open Woodland	*Eucalyptus camaldulensis*	*Lepidosperma curtisiae/ Juncus subsecundus/ Danthonia geniculata*	1854	Rough pasture, thickly covered with grasstrees and stringybarks	PW	MU	Cons. Park
-	15604	LBGONK01	Woodland	*Eucalyptus fasciculosa*	*Hibbertia sericea/ Acacia pycnantha/ Leptorhynchos squamatus/ Lepidosperma viscidum/ Stipa semibarbata*	1881	Hilly and timbered quartz & ironstone arable flats and gullies, good pasture	PW	SL	Cons. Park


HUNDRED OF NORTH RHINE
JELLICOE
46
T.S.F.R. Nº18
TOWITTA
PARK LANDS
Cemetery
SLAUGHTER HOUSE RES. V.P.45.
158
157
768
159
763
REFERENCE
Field Book Nº 1534 Pages 14 16
Date Offered
Nos of Secs
Areas of Sections
Description
Locality
Near TOWITTA
Area of Sections
.. Roads
.. Reserves
Total
IMPROVEMENTS
Section
Description
Dimensions
£
s
d
I certify that I have personally examined the above sections and have found the same to be properly pegged and trenched and correctly numbered.
Surveyor.
SCALE
40 Chains
For subdivision of Section 12 Vide L.B.C.D. Appn Nº 8166
Open black-grass flat
Mallee scrub and low bushes, a few pines
light loamy soil clay subsoil
Blackgrass and acacia bushes
Open blackgrass country, firm loam, clay
Scattered acacia
Mallee scrub

Appendix X

Site location details for important examples of grassland and grassy woodland

Svy	Site	Patch	Hundred	Section	Mapcode	Alt.	AMG	Easting	Northing
49	WIL2101	10936	GREGORY	44	6532-04	560	54	226967	6378503
46	TG044	11199	KOORINGA	119	6630-01	530	54	306925	6276075
83	LBGBUR01	14219	KINGSTON	168	6630-01	585	54	308900	6285950
83	LBGMEL01	14184	GREGORY	56	6532-03	310	54	235750	6370150
83	LBGMEL05	15575	WONGYARRA	489	6532-03	450	54	233752	6362547
83	LBGWLM02	15577	GREGORY	402	6532-04	550	54	227648	6374715
49	MEL0301	10803	WINNINOWIE	230	6532-03	650	54	222655	6371511
49	RIV0601	10900	JULIA CREEK	424	6629-01	580	54	311781	6229059
54	GWL001	11220	HALLETT	91	6731-03	500	54	318500	6308500
63	WAK0401	11909	KULPARA	488	6529-04	330	54	230682	6231770
83	LBGPEK02	14231	TARCOWIE	328	6632-03	500	54	267900	6350700
83	LBGPIR06	15583	DARLING	302	6531-04	350	54	241730	6335976
83	LBGQUO02	14234	WOOLUNDUNGA	230	6533-03	490	54	220960	6402820
88	KAP00101	15057	KAPUNDA	269	6629-02	390	54	313266	6205710
88	KAP01A04	15052	KAPUNDA	A1 F15358	6629-02	390	54	301990	6203720
88	HAM00201	15139	ALMA	431	6629-03	320	54	286052	6206867
46	TG043	11204	STANLEY	620	6630-02	455	54	301425	6243075
46	TG039	11118	HANSON	ROAD R	6630-01	440	54	297750	6267850
49	BUR0201	10713	HANSON	ROAD_R	6630-01	460	54	296607	6265857
51	NCS040	10965		RAIL_R	6631-02	570	54	303293	6295205
54	GWL004	11245	STRATHALBYN	ROAD R	6627-01	80	54	314250	6101250

Site location details for Burra Hills Survey Sites (Survey 62): Additional examples of Grasslands

Svy	Site	Patch	Hundred	Section	Mapcode	Alt.	AMG	Easting	Northing
62	APO1401	11995	HANSON	343	6630-02	555	54	303131	6260954
62	BUR0801	12006	KOORINGA	144	6630-01	510	54	313034	6274303
62	BUR1401	12011	AYERS	528	6630-01	550	54	298640	6284232
62	HAL0501	12069	ANNE	396	6631-02	550	54	297533	6293705
62	HAL0601	12070	ANNE	474	6631-02	570	54	297542	6296132
62	HAL1001	12074	HALLETT	224	6631-02	630	54	307666	6304052
62	HAL1101	12075	ANNE	325	6631-02	600	54	300117	6303836
62	HAL1801	12080	WHYTE	389	6631-02	580	54	303110	6310743
62	TER0502	12111	WHYTE	BK487	6631-01	625	54	299187	6330012
62	TER1001	12113	GUMBOWIE	13	6631-01	580	54	306824	6338252
62	TER1101	12114	YONGALA	161	6631-01	630	54	302210	6339750
62	TER1201	12115	YONGALA	127E	6631-01	620	54	300720	6337374
62	TER1301	12116	YONGALA	125S	6631-01	650	54	300460	6339014
62	TER1401	12117	WHYTE	BK484	6631-01	615	54	298686	6333959
62	TER1701	12118	YONGALA	163	6631-01	580	54	302378	6342532