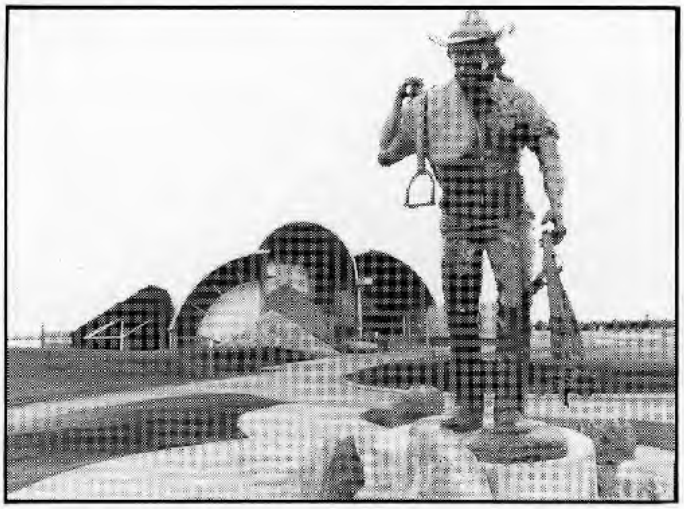
WESTERN ARID REGION
LAND USE STUDY - PART V



E. J. Turner
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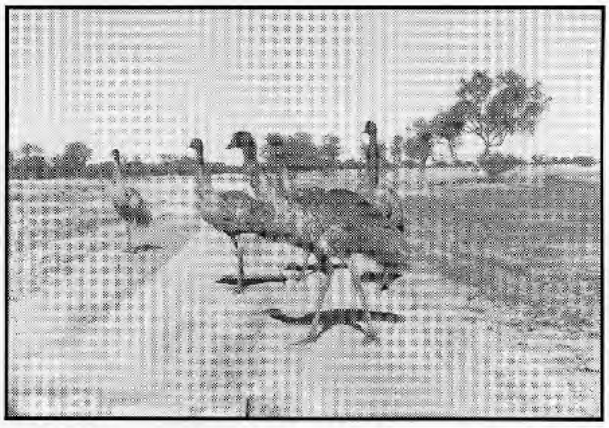

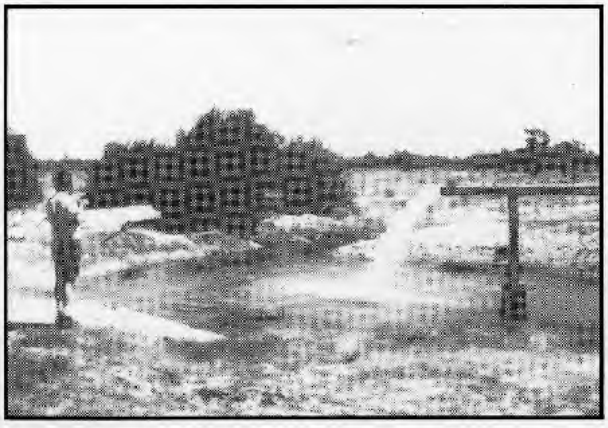

DPI QUEENSLAND DEPARTMENT OF PRIMARY INDUSTRIES

TECHNICAL BULLETIN No. 30
PUBLISHED BY THE DIVISION OF LAND UTILISATION
1993

Queensland Government Technical Report

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This report is intended to provide information only on the subject under review. There are limitations inherent in land resource studies, such as accuracy in relation to map scale and assumptions regarding socio-economic factors for land evaluation. Before acting on the information conveyed in this report, readers should ensure that they have received adequate professional information and advice specific to their enquiry.

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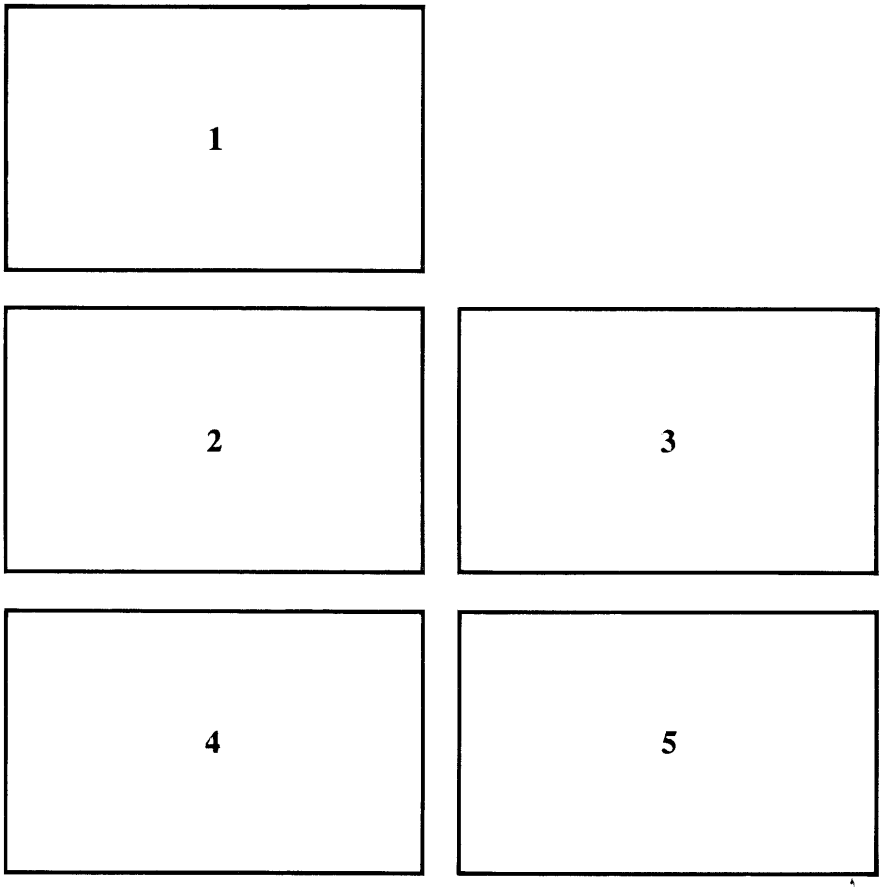

The cover photographs illustrate the following scenes:

1. Australian Stockman's Hall of Fame and Outback Heritage Centre, Longreach.
2. Torrens Creek crossing; River red gum
3. Warnabool Downs (F6); Gidgee in background
4. Artesian bore,Western Queensland.
5. Astrebla grassland, Hughenden - Winton road

Agdex 524

WESTERN ARID REGION LAND USE STUDY

PART V

E.J. Turner
W.J.F. McDonald
C.R. Ahern
M.B. Thomas

TECHNICAL BULLETIN NO. 30

PREPARED BY THE DIVISION OF LAND UTILISATION

FOREWORD

The Land Use and Fisheries Group has been engaged in the conduct of land use studies in the pastoral lands of western Queensland since 1970 . The western grazing lands, which are utilised for sheep husbandry and beef cattle production, cover some 60 million hectares of land in an arid and semi-arid environment. These lands support 60% of sheep numbers and 15% of the cattle numbers in the State and as such represent a valuable resource.

To provide for the continuing sustainability of these industries and the fragile natural resources on which they depend, it is essential that we have a thorough understanding of the natural resources.

This report is the final of a companion series of five which have been progressively published since 1974. The report describes the physical environment and catalogues the land resource data for about 9 million hectares of land centred on Longreach.

The information reported in this study is relevant to the 1990s and outlines the land use problems that pastoralists face as they approach the twenty-first century.

The report will provide a sound basis for property planning and management and for catchment, regional and strategic planning in the Warlus V area. It outlines the pathways for long-term, safe management of these fragile grazing lands, and indicates the safe stocking parameters for the principal Land Systems in the Warlus V area.

The publication will be a valuable reference for graziers, grazier organisations, local authorities and Government departments who have a commitment to maintain the western pastoral lands in a highly productive state for the long term.

Dr G.J. Bacon

GENERAL MANAGER

LAND MANAGEMENT DIVISION

ACKNOWLEDGMENTS

The authors recognise that, with the passage of time since the survey was conducted, some of the text has become out of date. However, with the movement to new Departments of two of the senior authors in the interim, after preparation of the manuscript, publication would have been deferred further to allow thorough updating. A supplementary list of papers published since 1980 has been included for reader convenience (Appendix VI), courtesy of Longreach regional office of the Department of Primary Industries.

The authors are grateful to:

- Mr N.M. Dawson for supervision throughout the survey.
- Mr P. R. Wilson and Mr G.R. Beeston for assistance especially during the field phase of the project.
- The Drafting Section of the Land Management Division, for the preparation of maps and diagrams, and C. Eldershaw for preparation of soil graphs and index to the microfiche.
- Mrs C.R. Smith and Miss K. Adams for dedication and enthusiasm in word processing skills.
- The Agricultural Chemistry Branch staff, for their assistance with the analysis of soil samples.
- Mr K. Rosenthal, for presentation of morphological data in the Microfiche, and computer programming.
- Mr K. Hughes, for his assistance with geology and geomorphology, and the field work.
- A special thanks to Mrs V.J. Eldershaw, for compilation and final editing; a task made difficult by the long period since commencement of the report and the transfer of two of the senior authors to other government departments.

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MICROFICHE

ERRATA

On the Land Systems Map accompanying this report, the area of land associated with the Alluvial Plains, Woodland land system designated as Aberfoyle (W_4) is incorrectly shown as 7770 km^2. It should be 1170 km^2.

LIST OF ILLUSTRATIONS

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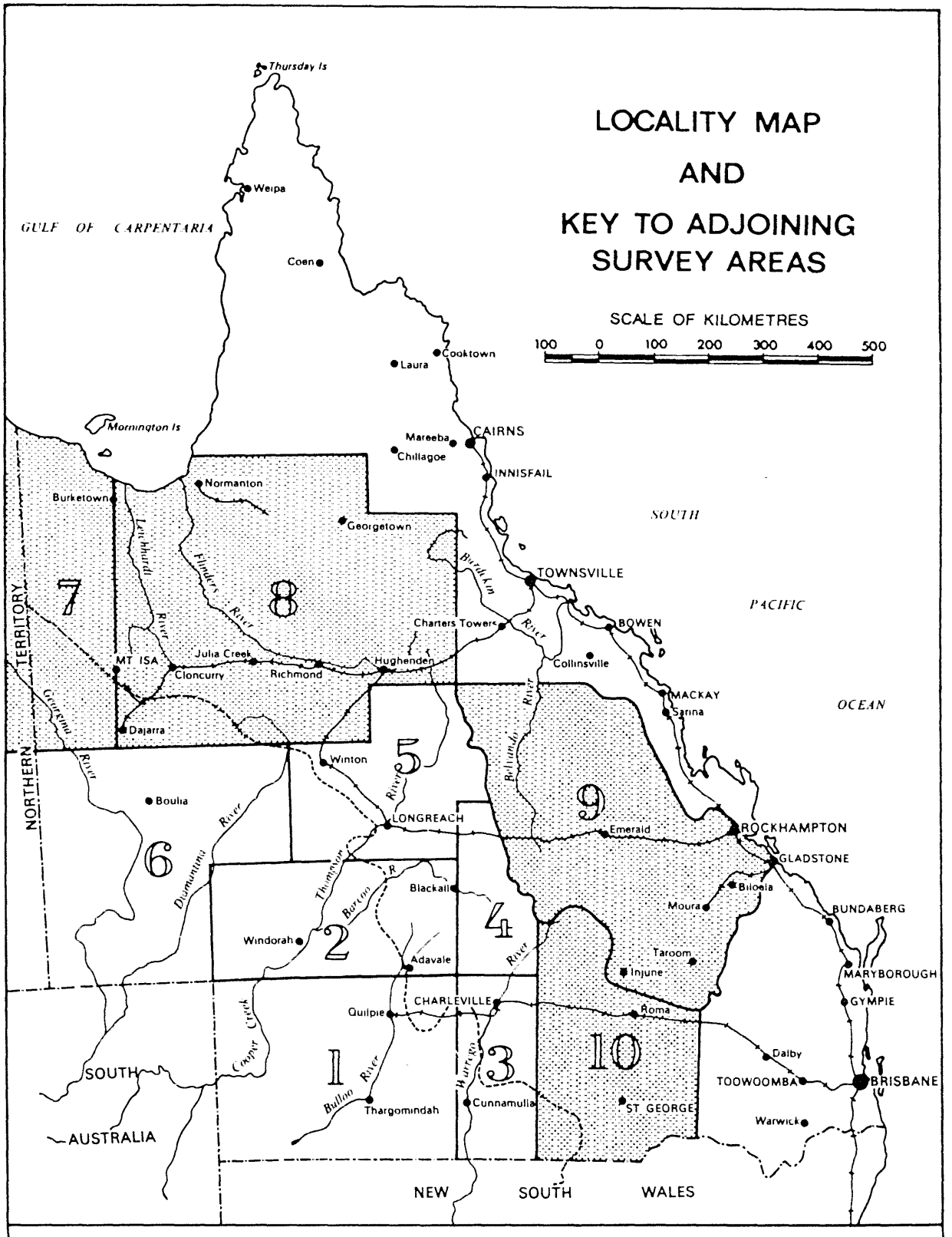

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380mm (15") Isohyet

Division of Land Research (C.S.I.R.O.)

SUMMARY

This study focuses on nine million hectares of pastoral lands in western Queensland, centred on Longreach.

The area receives less than 500 mm average rainfall per annum, with over 70% falling in summer (October to March). Rainfall decreases in the south-western portion, which receives 25% less per annum. Rainfall is very variable with periods of drought frequently extending beyond one year. Evaporation rates exceed precipitation. Temperatures range from 35.5°C (mean summer maximum) to 10.1°C (mean winter minimum) for Longreach.

The area is part of the Great Artesian Basin comprising portions of the Eromanga Basin which have formed over basement rocks which are predominantly low grade metamorphics of the Ordovician to Devonian ages. Uplift followed by shallow marine deposition, has formed a series of geologic layers in these basins. The area is drained by the Thomson River and its tributaries.

A survey was carried out to provide an inventory of the land resources of the area: soils, vegetation, land systems and current land use. Soil and vegetation categories were mapped at a scale of 1:500 000 and 38 land systems were described. Industry in the area is presently based on the grazing of natural pastures by sheep and/or cattle.

The area comprises three distinct regions and major differences are evident in productivity and land stability between these regions.

- The mulga lands in the south-west are unstable and the productivity of substantial areas has been reduced by erosion and the invasion of unpalatable shrubs.

- The upland regions are in a state of natural erosion and result in outwash sandplains. From a productivity viewpoint, these areas are marginally productive and subject to high runoff during times of high storm intensity.

- The alluvial plains, alluvial woodlands, mitchell grass downs and gidgee lands are relatively stable, highly productive areas for the production of wool, mutton and beef.

On the basis of the resource inventory, there is concern for the long term future of the south-west portion of Warlus V. This portion is characterised by instability and decreasing productivity associated with land degradation. Recommendations on this and other, more regional, aspects were defined.

Recommendations

1. There is a need for further research, development and extension of management strategies which will maintain the unstable mulga lands in a state which offers maximum productivity in the long term. One of the specific objectives of such work should be to define practical pasture condition standards which indicate when land is being over utilised.

2. There is a need for a continuing recording program to monitor the condition of mulga lands and provide information on long term trends in condition and productivity.

3. Current management recommendations for mulga lands, are as follows:

. Stocking strategies should concentrate on matching stock numbers to the feed available. Studies to date indicate that stocking to consume 20% of the pasture available at the end of summer will maintain the condition of the land without loss of productivity. In areas of <400 mm rainfall, the felling of mulga scrub for stock feed should be limited to drought periods greater than a one year in ten frequency.

. To facilitate adjustment of stock numbers and the stocking of land in this manner, larger property sizes than many of those presently existing, are necessary in the hard mulga lands. Economically viable block sizes of 8-12000 DSEs are indicated.

. In >400 mm rainfall areas, the use of improved pastures (using buffel grass) has shown promise and has been adopted in some areas. Longevity of improved pastures in the region is uncertain.

. The differential effects that sheep and cattle have on the pastures they are grazing need to be further investigated, with a view to determining both optimum utilisation levels for each animal and complementarity in the diets.

4. Regional financial surveys are needed to provide information on costs and returns on properties typical of various resource regions. This information should be updated regularly, and provide land administrators and those responsible for devising land management systems with information on the needs of land managers and the options available to them.

5. Integrated regional planning is needed. Longreach has become a major regional centre for the area. The provision of new bitumen roads north-west to Mt Isa and west to the Northern Territory has further increased its importance as a regional centre. There is a need to expand the services and attractiveness of this major regional centre in an endeavour to influence people to remain in and to do business in the area. The decentralisation of Government services into such towns should be continued. Public service incomes boost the economy of regional centres such as Longreach and are particularly important in maintaining the local economy during periods of drought and price downturns for rural products.

6. Tourism can provide a certain degree of outside stimulus to the economy of western centres but modern facilities, professional management and promotion of the various tourist attractions are necessary. There are two national parks in the survey area, although with limited public access at present, and attractive destinations in the old opal fields south of Winton, Larks Quarry, the Australian Stockman's Hall of Fame at Longreach, the Workers Heritage Centre at Barcaldine and the Wool Scour at Blackall.

CHAPTER 1

EARLY SETTLEMENT

by E.J. Turner[1] and G. Caltabiano[2]

EXPLORERS

The first officially sponsored explorers to enter the region included Sturt, Mitchell, Kennedy and Leichhardt. Sturt penetrated from Menindee but was forced to return in December 1845 by the harsh climatic conditions. Mitchell in 1846 discovered the Barcoo River and in 1847 Kennedy found that the Thomson and Barcoo Rivers joined and flowed south-west. Gregory came during a period of severe drought in 1858 and understandably, his reports were not enthusiastic.

In 1859-60, Landsborough and Buchanan left Rockhampton and explored the headwaters of the Thomson River in detail. This trip directly resulted in the formation of "Bowen Downs", the first settlement in the region, which was stocked with cattle.

In 1861 Burke and Wills traversed the western edge of the region. Their disappearance led to a stimulus in exploration when search parties were despatched to find them. By the 1880's, broadscale exploration of the region was complete. Pastoral settlements with both sheep and cattle, usually followed immediately. Water-courses played an important role influencing both the pattern of exploration and pastoral settlement (Forrest 1976).

TRANSPORT

The earliest commercially significant routes into the region were the stock routes, opened up by explorers such as Landsborough and Buchanan. The properties in the region were stocked by drovers using the stock route from the Gulf country through the Central West to the Darling River and Victoria. Stock routes also came via the Darling Downs and Warrego Districts to the Barcoo and the west. Once stocking was achieved, the teamsters and coachmen developed routes which later became roads.

In the 1880's and 1890's, the central railway was extended from Rockhampton to service the pastoral industry of the central west. The extension of the railway reached Barcaldine in 1886 and terminated at Longreach in 1892. Winton was connected to the Townsville rail system in 1899 and finally linked to Longreach in 1928.

In 1910, Queensland's first motorised rail service linked Ilfracombe and Isisford. Another tramway connecting Aramac and Barcaldine was opened in 1913. These tramways have since been discontinued. The advent of the railways also caused changes in trading patterns and communications. Mail and telegraph facilities expanded to all settled areas by the 1880's.

TOWNS

The township of Aramac developed in the mid 1860's to serve as the first common post town and commercial centre, and was formally gazetted in 1869. Some early properties in the area include Bowen Downs, Coreena, Aramac, Stainburn and Corinda. Its importance as a commercial centre declined with the arrival of the railways.

Muttaburra developed in the 1870's as a result of the establishment of Mt. Cornish station. Its early growth was stimulated by being the confluence of stock routes. Mail from Bowen for the west went via Muttaburra thence by Cobb and Co. to other centres such as Hughenden, Winton, Richmond, Cloncurry and Torrens Creek.

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[1] Formerly Land Resources Branch, Department of Primary Industries.

[2] Department of Lands, Brisbane.

Barcaldine township was originally known as Lagoon Creek. It is historically important as being the centre of industrial turmoil in 1891. Early properties include Barcaldine Downs (in 1865), Home Creek, Saltern Creek and Delta.

Ilfracombe originally developed as a transport centre servicing Wellshot Station which had been established by Buchanan in 1872. Other early properties include Rodney Downs, Beaconsfield and Portland Downs.

Longreach derived its name from the large waterhole in the Thomson River. It was originally only a coaching change on the mail run from Aramac to Windorah. Its importance as a commercial centre was assured with the arrival of the railway in 1892. Early properties in the area include Maneroo, Darr River Downs, Vergemont and Westlands.

The Winton region was settled about 10 years after the Barcoo and Thomson areas. Early properties include Vindex, Bladensburg, Dagworth, Sesbania, Condooroo and Cork. The earliest settlement was at Pelican Waterholes in 1875. Flooding caused this settlement to move to its present position. Winton is of significance as being the birthplace of QANTAS.

REFERENCE

Forrest, P. (1976), The National Estate in the central west region of Queensland, *National Trust of Queensland.*

CHAPTER 2

RESOURCES OF THE SURVEY AREA

by E.J. Turner[1]

CLIMATE

The summer-dominant rainfall pattern in conjunction with the temperature regime, result in an arid to semi-arid climate classification. The average annual rainfall is about 450 mm with an annual evaporation of about 2500 mm. These values are less favourable than those customarily used to limit rural industry grazing enterprises (500 mm p.a. rainfall and 2000 mm p.a. evaporation; Turner 1978). There is a transition in mean annual rainfall (Figure 2.1), being drier in the south-west (<380 mm p.a.) with more rain received both to the north (eg. Hughenden 488 mm p.a.) and to the east (eg. Barcaldine 499 mm p.a.).

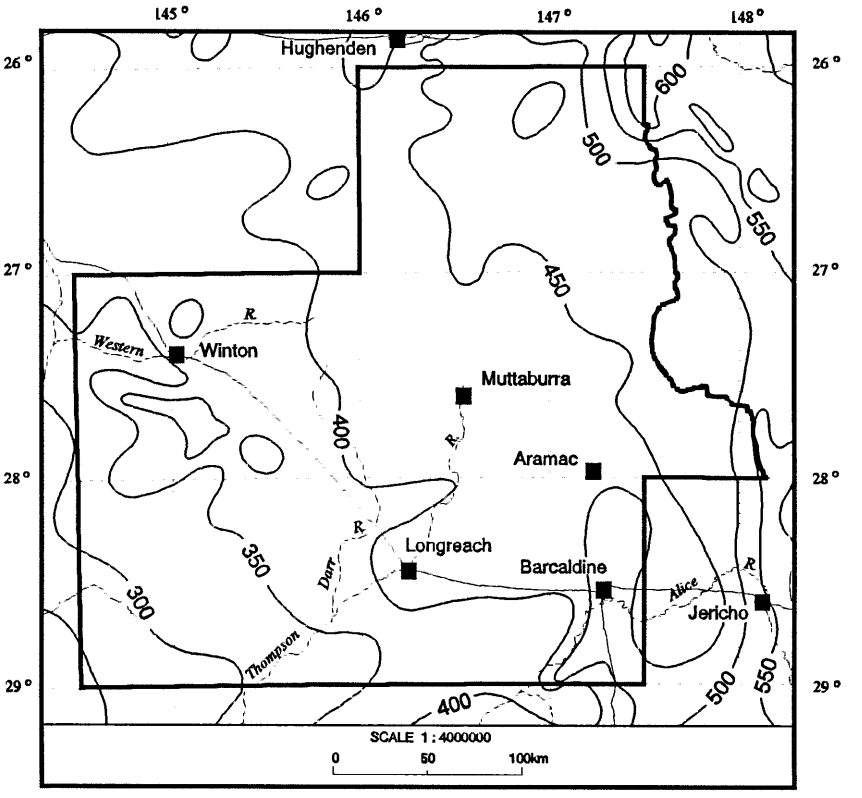

Figure 2.1 Mean annual rainfall over the area

The seasonal rainfall pattern is shown in Table 2.1, where the mean monthly rainfall is presented for 7 stations in the area. January and February are the wettest months, with a dry winter period (July to September). Rainfall in summer tends to be of high intensity while that of winter is more often in the form of light and scattered storms.

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[1] Formerly Land Resources Branch, Queensland Department of Primary Industries.

Table 2.1 Mean rainfall (mm)

Location	J	F	M	A	M	J	J	A	S	O	N	D	Total
Caledonia	98	85	58	27	22	21	19	9	9	26	34	61	466
Aramac	85	73	56	33	26	25	22	13	15	25	34	56	463
Barcaldine	86	77	64	36	34	25	25	16	15	29	34	59	499
Longreach	69	84	59	30	24	20	21	9	12	24	26	53	431
Muttaburra	90	80	63	30	25	21	18	10	13	22	30	51	452
Winton	83	83	54	22	21	18	16	6	9	18	27	49	407
Ayrshire Downs	90	86	51	18	18	17	15	5	8	16	23	52	399

Source: Willcocks and Young (1991)

The summer component (Table 2.2) is over 70%. The northern portion tends to receive an even higher proportion (about 77%) in summer. This has implications for pasture management in years when the summer rains fail. For example, the records for Winton show extended periods of low rainfall: 1925 (325 mm total), 1926 (135 mm), 1927 (187 mm), 1928 (198 mm), 1929 (299 mm); or the period 1964-1969 when the annual average over the seven year period was 231 mm. Using probability percentiles, Longreach can expect <300 mm p.a. 40% of the time (climate data bank, DPI). Different measures of variability are discussed by Wills (1980).

Table 2.2 Average rainfall distribution (mm)

Location	Summer	Winter	Mean p.a.	Median p.a.	Range	% falling in summer
Caledonia	360	106	466	429	51-1375	77
Aramac	330	134	463	434	100-1158	71
Barcaldine	349	151	499	455	146-1192	70
Longreach	315	116	431	399	108-1076	73
Muttaburra	335	117	452	413	129-1357	74
Winton	315	93	407	359	87-1086	77
Ayrshire Downs	318	81	399	341	101-1092	80

Source: Willcocks and Young (1991)

Rainfall variability from year to year can be regarded as high (Figure 2.2). Pasture management needs to be geared to the long-term expectations of rainfall; the average (mean) rainfall is skewed by periods of high rainfall, so for management purposes the median value (Table 2.2) is more accurate (Willcocks and Young 1991). In years of high rainfall, the intensity coupled with soil surface sealing in the outwash areas can result in severe flooding. The low gradients of the area (<2%) result in slow flood dissipitation, however it can result in valuable subsoil water recharge of the alluvial areas. The average number of rain days are shown in Table 2.3 for Winton and Longreach.

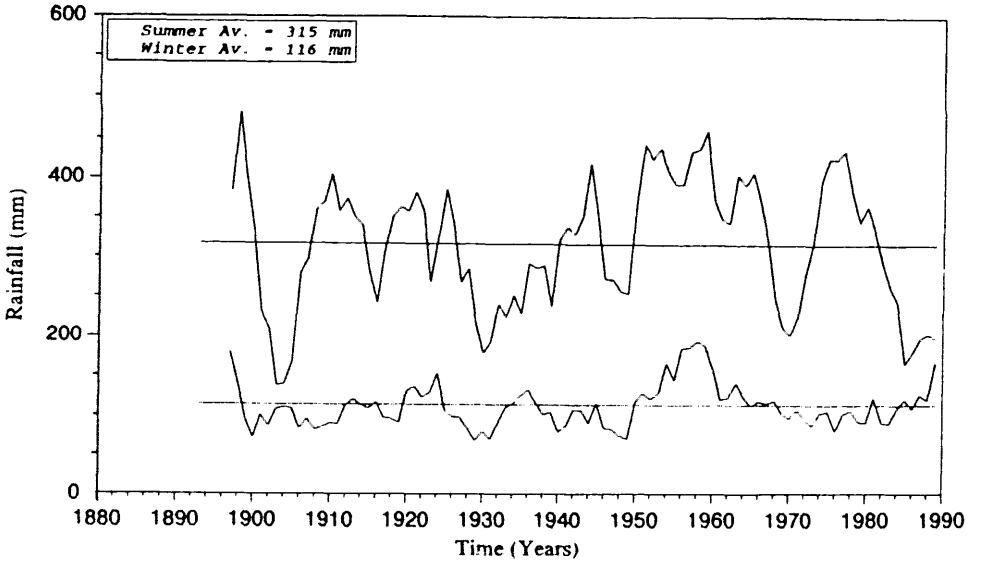

Figure 2.2 **Longreach five year moving averages of summer and winter rainfall** (Source: Willcocks and Young 1991)

Temperature data for Winton and Longreach are presented in Table 2.3. Maximum temperatures exceed 30°C for 6-7 months of the year. This contributes to the high evaporation rates; E pan evaporation rates are 6.8 - 11.6 mm/day over this period (climate data bank, DPI).

Table 2.3 Other climate characteristics

	J	F	M	A	M	J	J	A	S	O	N	D	Yearly
Longreach PO													
Average Max. Temp °C	37	36	34	31	26	23	23	25	29	33	36	37	31
Average Min. Temp °C	22	22	20	16	11	8	6	8	12	17	19	21	15
Rain days	6	6	4	2	2	2	2	1	2	3	4	5	39
Winton PO													
Average Max. Temp °C	37	36	34	32	27	24	24	26	30	34	37	37	31
Average Min. Temp °C	22	22	20	16	12	9	7	9	12	17	20	22	16
Rain days	7	6	4	2	2	2	2	1	2	3	4	5	40

Source: DPI Climate data bank, Toowoomba 1990

GEOLOGY AND LANDFORM

Introduction

The area forms part of the Eromanga Basin which is a sub-basin of the Great Artesian Basin. The geology of the area has been reported in detail by Casey (1966, 1969), Jauncey (1967) and Vine (1964, 1967). Their maps and reports were used in defining the geological controls in the land systems mapping.

The Great Artesian Basin consists of Cretaceous sediments overlain by younger terrestrial deposits. All these sediments were deeply weathered in the Tertiary period. Much of this Tertiary land surface was then eroded, exposing the relatively fresh Cretaceous sediments. Further weathering and erosion produced the present landscape. Quaternary deposits mask the underlying sediments, especially in the east.

A strong correlation exists between parent material and the various soil and vegetation groups. The geological units are recorded in both land unit and land system descriptions. A summary of the geological sequence of events as they have affected present landscape development is recorded in Table 2.4.

Topography

The area slopes both to the south and west. Heights above sea level range from 450 m on the Alice Tableland to 154 m on the Thomson River south-west of Longreach. The area is bounded in the east by the Alice Tableland and the Aramac Range. They are considered part of the Great Dividing Range. The dissected residuals in the west form part of the catchment boundary between the Thomson and Diamantina river systems.

The Thomson River is the main drainage system of the area. Its tributaries include the streams draining the "desert" country such as the Alice River, Torrens Creek and Towerhill Creek. Other streams of note which drain the undulating downs and gidgee areas include Landsborough Creek, Vergemont Creek, Aramac Creek, Cornish Creek and the Darr River.

Part of the Diamantina River system also occurs in the area. The Western River which flows into the Diamantina River west of Winton has its source in the undulating downs south west of Winton, near Chorregon.

Playas occur in the area. Webb's Lake is the only lake of internal drainage. The rest, such as Lakes Dunn, Huffer, Mueller, Barcoorah all eventually drain into the Thomson River system. Claypans are common on the Winton plateau and also in the "desert" bounded by Towerhill Creek and Torrens Creek, north east of Muttaburra. Some of these claypans are extensive in area (800 ha) and could be classed as intermittent lakes.

Geology

Eromanga Basin sedimentation was initiated by uplift of areas outside the basin. Widespread sedimentation occurred during Jurassic times when mainly arenitic sediments were deposited. Regional subsidence early in the Cretaceous resulted in a rapid marine transgression. Marine conditions persisted throughout most of the Lower Cretaceous but the sea was shallow as deposition kept pace with subsidence. Late in the Lower Cretaceous, the rate of sedimentation exceeded the rate of basin subsidence due to the influx of volcanic detritus and marine conditions gave way to a terrestrial environment. The area was peneplaned and deeply weathered during the Tertiary.

Emphasis has been placed on the exposed sediments of the Mesozoic and Cainozoic periods, as they have directly affected present landscape patterns.

Geological Sequence

Pre-Jurassic. Basement rocks are a complex of low grade metamorphics and intrusives.

Jurassic sediments. Jurassic sediments of the Eromanga Basin occur over the whole area. The Jurassic Hooray Sandstones (JKh) rests conformably on the Westbourne Formation. It consists of quartzose to sublabile sandstones with few interbeds of siltstone. The Jurassic Ronlow Beds (JKr) rest conformable on the Hooray Sandstones in the east. It consists of medium to fine quartzose to sub-labile sandstone, commonly kaolinitic. Freshwater aquifers are common within these beds.

Cretaceous sediments. Sediments of the Rolling Downs Group were deposited over the whole area. The Wallumbilla Formation (Klu) consists of two members, the Doncaster Member (Kld) and the Coreena Member (Klc). These sediments were deposited following the marine transgression. The sequence consists of mudstones and siltstones. These beds are exposed in a narrow belt running from Barcaldine north to Aramac. They are then masked by Quaternary deposits.

The *Toolebuc Limestone* (Klo) consists of platey limestone and calcareous shale. It is richly fossiliferous. It outcrops in a narrow strip between Barcaldine and Aramac. It has been associated with selenium poisoning in stock where it is exposed.

Table 2.4 Stratigraphy of the area

Age	Rock Unit (Map Symbol)	Lithology	Thickness (m)	Environment
Quaternary	(Qa)	Clay, silt, sand, gravel near hills	Superficial	Alluvial
	(Qs)	Sand, silt, clay; gravel, rubble	Superficial	Mainly colluvial; minor alluvial and aeolian
		Weathering - Erosion - Unconformity		
Cainozoic	Duricrust	Silcrete, laterite	0 - 8	Chemical alteration of Tertiary and Cretaceous sediments
		Weathering - Erosion - Unconformity		
Tertiary	(T)	Mudstone, commonly with scattered coarse quartz grains	0 - 60	Fluviatile
	Werite Beds (Tw)	Mudstone and siltstone, rarely with quartz grains	0 - 22	Fluviatile
	Glendower Formation (Tg)	Quartz sandstone, minor conglomerate	0 - 60	Fluviatile
		Unconformity		
Rolling Downs Group				
Lower-Upper Cretaceous	Winton Formation (Kw)	Labile sandstone, siltstone, mudstone, in part calcareous, minor coal	0 - 420	Fluviatile, lacustrine paludal
Lower Cretaceous	Mackunda Formation (Klm)	Labile sandstone, siltstone, mudstone, in part calcareous, minor coal	120 - 270	Paralic
	Allaru Mudstone (Kla)	Mudstone, minor fine labile sandstone and siltstone	180 - 360	Shallow marine
	Toolebuc Limestone (Klo)	Platey limestone and calcareous shale	to 12	Shallow marine
	Wallumbilla Formation - Coreena Member (Klc)	Mudstone interbedded with siltstone; in part calcareous and grading to silty limestone	60 - 120	Shallow marine
	Doncaster Member (Kld)	Mudstone, minor siltstone; in parts calcareous; minor limestone; some beds richly glauconitic	60 - 240	Shallow marine
Lower Cretaceous - Upper Jarassic	Ronlow Beds (J-Kr)	Medium to fine quartzose to sublabile sandstone, commonly kaolinitic; minor micaceous siltstone and conglomerate	30 - 90	Fluviatile
	Hooray Sandstones (J-Kh)	Quartzose to sublabile sandstone, with some mudstone and siltstone	to 210	Fluvatile

The *Allaru Mudstones* (Kla) is mainly a blue-grey mudstone with minor beds of siltstone and fine-grained labile sandstone. It occurs as a wide strip sweeping north from Blackall to Aramac and then north west to below Hughenden. Outcrops are common.

The *Mackunda Formation* (Klm) consists of fine to very fine labile sandstone interbedded with mudstone. The sequence is common in the area and outcrops are present.

The *Winton Formation* (Kw) is very similar to the *Mackunda Formation* but is distinguished from it by the absence of marine fossils and the presence of coal beds. This sequence is very widespread in the area.

Tertiary. Deposition of the Cretaceous *Winton Formation* was followed by a period of lateritisation during which a duricrust was developed. This was followed by a period of erosion after which the fluviatile *Glendower Formation* was deposited. These sediments mark the course of a former extensive drainage system. Sediments are mainly medium and coarse grained sandstones with beds of well rounded pebble conglomerate. Large areas of this were silicified. This silicrete is now exposed as hard caps to hills (such as residuals west of Longreach) and on exposed margins of plateaux (such as residuals north of Muttaburra). The Tertiary *Werite Beds* are not extensive and mainly occur south of Winton (Allens Range). They are mainly mudstones with coarse sandstones at the base. These sediments were also silicified to produce another, younger, duricrust.

Quaternary Units. The Quaternary alluvium (Qa) is mainly associated with the Thomson River and its tributaries. Sheet sand (Qs) covers large areas and occurs as outwash plains in the east. It also occurs as a thin depositional plain to the various Tertiary plateaux.

Landscape Development

Present relief in the area is due to the partial preservation of old land surfaces and their associated weathered profiles. Weathering and deposition has led to the formation of four main physiographic units.

Dissected residuals. This unit comprises plateaux, mesas and buttes. They are relics of the Tertiary - Quaternary erosional surface on which a duricrust was developed from Tertiary and Cretaceous sediments. The plateaux surface is often blanketed by a thin covering of Quaternary sediments. Outlying residuals form mesas and buttes e.g. Vindex Range. When the duricrust was absent on the Tertiary sediments, continuing erosion and weathering produced rounded hills. Examples of this occur north of Muttaburra and west of the Thomson River.

Undulating Plains. Stripping of the old weathered profile has exposed the relatively fresh Cretaceous sediments. A thin covering of stone is mainly confined to the timbered areas, while the open undulating downs are often stone free.

Sandplains. The gently undulating plains merge with outwash plains. These sandplains have occurred on upland surfaces and are derived from the erosion and re-working of Tertiary deposits.

Alluvial Plains. Streams in the area are ephemeral, of low gradient, and with the exception of the smallest watercourses, are braided to some extent.

LAND ZONES AND LAND SYSTEMS

Introduction

The land system concept of Christian and Stewart (1953) was used to map and describe land types. Initial photo interpretation was followed by field traverses to identify and describe the soil and vegetation associations within the mapped units. The mapped land systems are often an amalgamation of several land units. For each land unit, a detailed description of landform, geology, soils, vegetation and land use factors is given. The soils were described and classified in terms of principal profile forms (Northcote 1965) and great soil groups. The vegetation description includes lists of species and their structural formations.

Sampling sites were predetermined on a 20 000 m grid. Some 82% of grid sites were sampled with the rest being abandoned due to lack or difficulty of access. Additional or free sites were used to describe those, soil, vegetation associations not covered by the grid pattern.

The area was mapped into 38 land systems which have been grouped into seven broad land zones. A map at a scale of 1:500 000 illustrating the extent and distribution of the land systems is enclosed. Figure 2.3 illustrates the spatial relationship between the land systems across the landscape. Detailed information on the land systems and land units is given in Appendices VI and V respectively. Table 2.5 illustrates the extent of the various land zones.

Table 2.5 Area of Land Zones

Land Zone		Area (km^2)	% Survey Area
Downs	F/T	37 900	45.0
Gidgee	G	6 220	7.4
Alluvia	W/A	15 270	18.1
Eucalypt woodlands	E	14 620	17.4
Dissected residuals	R	4 850	5.8
Mulga	A/M	2 050	2.4
Sandplains	S	2 950	3.5
Miscellaneous	C/L	340	0.4

Downs Land Zone

This land zone developed where the Tertiary land surface has been eroded, exposing the fresh, labile Cretaceous sediments. These sediments weathered to form gently undulating plains with a clay soil cover. This land zone comprises land systems of the open, ashy downs and the shaded or wooded downs. These lands are very productive and are the basis of the wool industry in western Queensland. This land zone is very extensive, bounded generally by the towns of Winton, Longreach, Barcaldine, Aramac, Muttaburra and Hughenden. The lands are very stable but will erode if bare surface soil is exposed to high intensity rains. The component land systems have been recognised by geological, soil and vegetation differences. The soils developed on mudstone formations tend to be deeper than soils formed on sandstone beds. Also, timber is generally restricted to the sandstone formations.

Open downs

Allaru land system has formed on the Cretaceous Allaru Mudstone and few outcrops occur. Slopes range to 3% and average 1%. Boree, myall, boonaree, corkwood occur occasionally but this system is virtually treeless. Streams are braided and seasonally flowing. The channels are often lined by coolibah or red river gum. The soils are moderately deep (75 - 125 cm) cracking clays with strongly self-mulching surfaces. Vegetation is Mitchell grass tussock grassland. Mimosa bush is common along drainage lines. Lack of shade and browse shrubs are its main limitations.

Politic land system has developed on the mudstones and siltstones of the Cretaceous Wallumbilla Formation. It extends in a belt north from Barcaldine to Aramac. Few outcrops occur. Slopes are generally less than 1% and it grades into alluvia. Soils are deep, grey cracking clays. Stone cover is only very light. Nutrient levels are fair with low values of available phosphorus commonly recorded. These clay soils are seasonally scalded. Vegetation is Mitchell grass tussock grassland to herbfield, depending upon seasonal conditions. Lack of shade and browse trees are its main limitations.

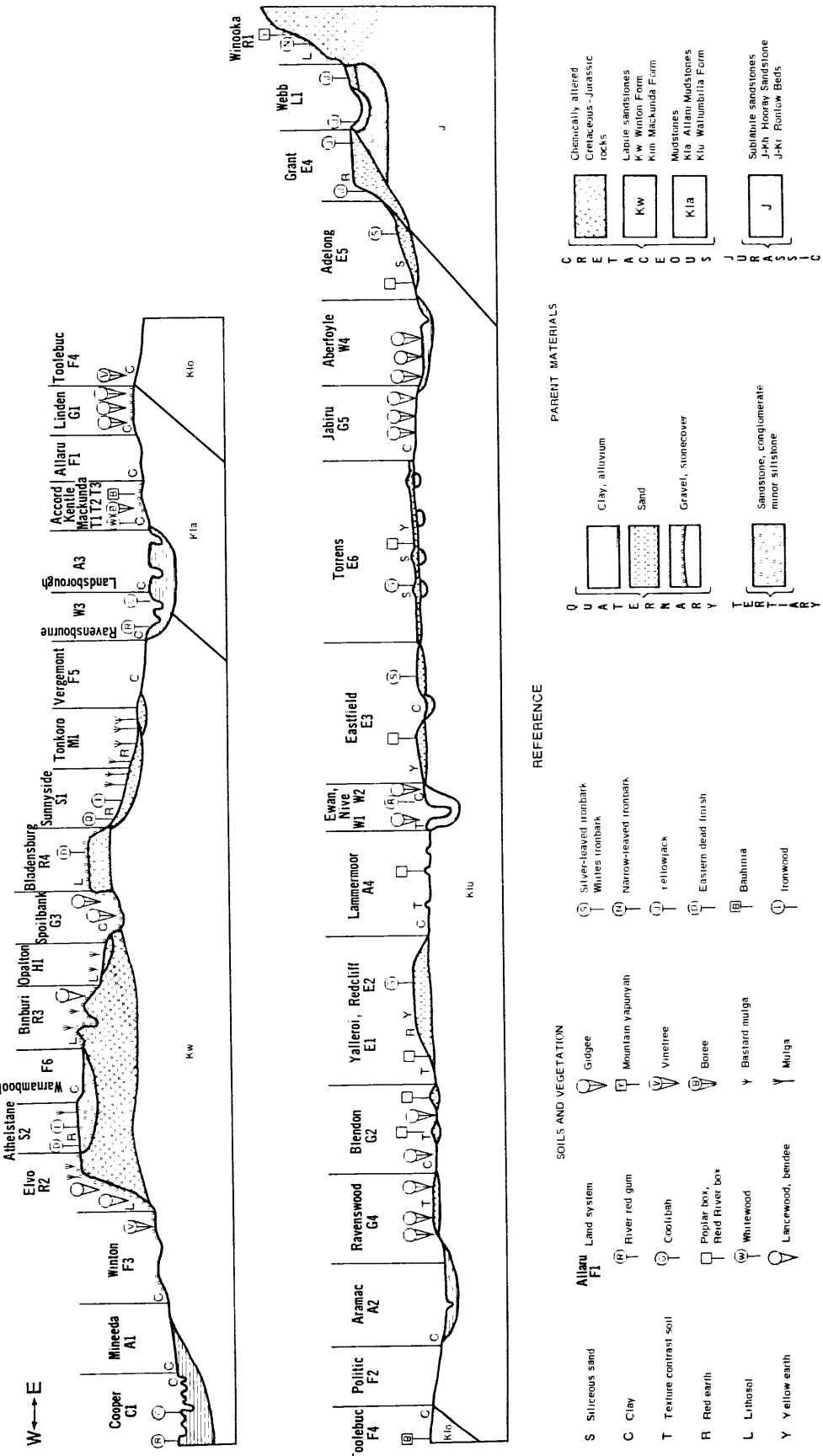

Figure 2.3 Idealized relationship between land systems, soils, vegetation and geology.

Winton land system has developed on the labile sandstones of the Cretaceous Winton and Mackunda Formations. These sediments outcrop frequently and these sandy or rubbly areas support open stands of boonaree, whitewood, bauhinia and vinetree. The soils are shallow to moderately deep, grey and brown cracking clays. Stone cover is usually confined to the outcrops but stone pavements are more common in the western sector. Nutrient levels are fair to very fair. Lack of shade and browse trees are its main limitations.

Toolebuc land system has formed on limestones of the Cretaceous Toolebuc Formation. It is confined to a narrow belt between Barcaldine and Aramac and then as a discontinuous belt from Aramac to Cornish Creek. Platey limestone rubble occurs on rises. The soils are moderately deep to deep, grey cracking clays. Vegetation is Mitchell grass open-tussock grassland with open stands of bauhinia and vinetree common along the sharply-defined ridges. Selenosis in stock has been associated with these limestone beds. Stock eat native selenium-accumulating plants in areas where the ground has been disturbed and the plant roots have access to these sediments.

Vergemont land system comprises the flat to very gently sloping treeless plains of weakly gilgaied red cracking clays. Drainage lines are well defined and fringed by mimosa bush. This land system is relatively small in area and is associated with Vergemont Creek in the south west. Nutrient levels are low. Vegetation is Mitchell grass open-tussock grassland with other short grasses and forbs.

Warnambool land system comprises the flat open plains on the Winton plateau. This plain has developed from weathered Tertiary clay sediments. The soils are shallow to moderately deep, grey cracking clays with broad shallow gilgais throughout. Nutrient levels are generally low. Vegetation is Mitchell grass open-tussock grassland and other short grasses with gidgee, boree and coolibah along the drainage lines. Several water-harvesting schemes operate to divert water from the adjacent mulga sandplain onto these more productive clay plains.

Wooded Downs

The term "wooded downs" is used to describe those lands which have sufficient tree density to distinguish them from the open or ashy downs. Tree densities range from scattered trees to small clumps of low open-woodland. The tree density does not appear to inhibit pasture growth to any extent. These wooded downs are valuable sheep breeding areas as they provide some shade and shelter. The main occurrence is east of the Thomson River and adjacent to alluvia.

Accord land system comprises gently undulating plains of Mitchell grass open-tussock grassland with gidgee throughout. The soils are moderately deep to deep, grey and brown cracking clays with a light stone cover.

Kentle land system comprises gently undulating plains with boree and whitewood throughout. It often fringes the open downs and gidgee lands. Dense stone and gravel cover is common.

Mackunda land system comprises gently undulating plains of Mitchell grass open-tussock grassland and other short grasses wooded with vinetree, bauhinia, eastern dead finish, boonaree and western bloodwood. Soils are shallow to moderately deep, brown and grey clays. It occurs mainly in the east.

Eucalypt Woodland Land Zone ("Desert Country")

The eucalypt woodlands are commonly referred to as "desert country" due to sparse surface water supplies, low quality spinifex-dominated pastures and sandy infertile soils. This land type is very extensive and occurs in the east where the Cretaceous sediments merge with the Quaternary sandplains. Two main physiographic units can be recognised. The elevated Alice Tableland, a remnant of the original Tertiary landscape is confined to the eastern boundary. The surrounding outwash sandplain has been formed by fluvial and aeolian reworking of Tertiary sediments. Subdivision into land systems has been based upon vegetation and soil differences. Properties in this region are semi-intensively managed and concentrate on store cattle production.

Yalleroi land system is an outwash sandplain characterised by gentle slopes and an indistinct drainage pattern. Silver-leaved ironbark open-woodland occurs on the upper slopes with poplar box

woodland in the run-on areas. Spinifex open-hummock grassland predominates while eastern mid-height species are more common in the run-on areas. Desert oak, quinine bush, bloodwood grassy open-woodland occurs on deep sand sheets. Occasionally gidgee or brigalow low woodland is present in clay depressions. Soils are mainly sandy red earths and sandy texture contrast soils. The land systems of the eucalypt woodlands are stable due to the presence of relatively unpalatable pasture grasses. Erosion occurs when the soil surface is unprotected. This is evident along incorrectly sited roads and fire breaks along fence lines. Some areas have been developed by pulling, burning and sowing buffel grass. The buffel grass has been very slow in spreading, due to low soil nutrient levels and competition from native species. The control of eucalypt regrowth can also add to pasture maintenance costs.

Redcliff land system comprises outwash sandplains and low plateau surfaces with exposed duricrust on plateau margins and low hills. The silver-leaved ironbark community from the adjoining Yalleroi land system is replaced by Whites ironbark. Similarly, Reid River box replaces poplar box in the run-on areas. Normanton box, spinifex low open-woodland occurs on duricrust areas. The grass associations are similar to those in Yalleroi land system. The boundary between Yalleroi and Redcliff land systems is often indistinct. The soils are sandy yellow and red earths and minor areas of lithosols. The potential and limitations for pasture improvement are similar to Yalleroi land system.

Eastfield land system comprises flat plains with an extensive system of shallow claypans and ephemeral lakes. It occurs north-east of Muttaburra, and is bounded by Towerhill, Torrens and Blackfellow Creeks. Vegetation is Whites ironbark, desert oak, spinifex low open-woodland with tea-tree tall open-shrubland conspicuous throughout. Gidgee/coolibah/tea-tree often fringe the alluvial depressions. Eastern mid-height species and spinifex are the main grass associations. Soils are sandy yellow earths and texture contrast soils often with large accumulations of laterite. Grey clays occur in the alluvial depressions. Development prospects are similar to Yalleroi land system. Townsville stylo (*Stylosanthes humilis*) was observed to have colonised well in moisture-favoured areas such as the beaches of the larger claypans and lakes.

Grant land system occurs on the Alice Tableland which is an elevated sandplain formed of colluvial material. Vegetation is groved yellowjack and bloodwood open-woodland with tea-tree tall open-shrubland on low rises and Whites ironbark open-woodland associated throughout. Woollybutt and nutwood low open-woodland occur occasionally. Spinifex open-hummock grassland is dominant, with the eastern mid-height grasses a very minor association. The soils are deep to very deep sandy red earths. Heart-leaf poison bush appears confined to this Tertiary landscape and its presence can influence property management. Fires are often used to promote an early green pick and in some areas, dense stands of wattles and heart-leaf poison bush have resulted.

Adelong land system occurs on colluvial slopes and the outwash sand plain adjacent to the Alice Tableland. Vegetation is bloodwood, spinifex open-woodland with red ash and *Acacia* spp. grading into Whites ironbark or Reid River box low open-woodland. The soils are deep, red siliceous sands and sandy red earths. Fires have encouraged the germination and spread of wattles and *Cassias* in some areas.

Torrens land system comprises a stabilised fan plain with sandy-infilled distributaries. It occurs on lands riparian to Torrens Creek. Vegetation is Whites ironbark, desert oak, quinine bush, spiny-oak shrubby low woodland with Reid River box, sandalwood low woodland on run-on areas. Bloodwood, tea-tree and desert gum line the infilled channels. The soils are deep to very deep siliceous sands and sandy yellow and red earths.

Alluvial Plains Land Zone

This land zone comprises the channel country, the wooded alluvial plains and the open alluvial plains.

Channel Country

The characteristics of this land type are better expressed in the lower reaches of the Thomson River south of Tocal. It is generally accepted that the channel country proper begins at the confluence of the Thomson and Barcoo Rivers above Windorah. North of this confluence, the Thomson River still exhibits typical channel country elements but on a much reduced scale. A system of anastomosing channels has developed on the present floodplain.

Kendall land system consists of flat alluvial plains with numerous anastomosing channels. Major channels are fringed by coolibah and river red gum low open-woodland while coolibah, lignum line the smaller channels. Bluebush, herbfields are predominant on interchannel areas. The pastures comprise winter or summer growing annuals depending on time of flooding. The winter growing species such as Cooper clover are regarded as the most valuable forage plants. The soils are very deep, widely cracking clays. Several large interchannel "islands", slightly raised above the present flood plain occur south of Tocal. These islands are less frequently flooded and carry Mitchell grasses, bluebush on deep brown and grey clays. These areas occur more frequently in the lower reaches of the Thomson River.

Wooded Alluvial Plains

Ewan land system comprises flat plains subject to occasional overflow and occurs south of Prairie between Blackfellow and Bullock Creeks. Vegetation is gidgee, bauhinia, scrub wilga low woodland with open areas of blue grass, browntop tussock grassland. Sand sheets overlying the clay plains carry bloodwood, desert gum and wiregrasses. The soils are deep gilgaied grey cracking clays and minor texture contrast soils. Scalding is common. Limited areas have been developed by clearing.

Nive land system comprises single channel streams draining the eucalypt, spinifex woodlands. Permanent waterholes are few although seasonal or flash flooding occurs. River red gum, tea-tree, river oak fringe the streams while poplar box, Reid River box occur on lower slopes. Moreton Bay ash, *Angophora*, bloodwood and quinine bush are common on deep sands. Gidgee, bauhinia, sandalwood occasionally occur in depressions. This land system responds rapidly to small falls of rain but is also drought prone.

Ravensbourne land system consists of numerous braided channels draining Cretaceous sediments. It drains the downs and gidgee land zones. Coolibah and river red gum are associated with the channels with Mitchell grasses on interchannel areas. Soils are deep, grey and brown clays which may be seasonally scalded.

Aberfoyle land system comprises flooded plains with numerous channels. It occurs in the Torrens - Taylor - Mosquito Creeks area. Vegetation is blackwood woodland to low open-woodland with coolibah associated with the channels and occasional swamps. Associated shrubs include sandalwood and currant bush. The soils are deep, gilgaied grey sandy cracking clays and texture contrast soils. Scalding is often associated with the texture contrast soils. Areas of blackwood have been pulled and sown to buffel grass with limited success due to the low phosphate status of these soils. The more open stands of blackwood are not suited to development as they are well grassed with Mitchell grasses and blue grass.

Alluvial Plains (open)

This land zone is relatively small in area and has been subdivided into four land systems on the basis of flooding frequency, soils and vegetation.

Mineeda land system comprises flat plains subject to occasional overflow. Vegetation is Mitchell grass, Flinders grass open-tussock grassland and *Sclerolaena* herbfields. Small areas of coolibah open-woodland may be associated. The soils are deep, brown and grey cracking clays which may be seasonally scalded.

Aramac land system consists of permanently scalded areas and claypans associated with Pelican Creek east of Aramac. Aquifers from the Jurassic Ronlow Beds are the sources of springs and shallow lakes. The majority of this land system is devoid of vegetation and has been classified as sparse herbfields (*Halosarcia* sp.). Porcupine spinifex open-hummock grassland with Ellangowan poison bush and sandalwood occur on the low sand dunes while belalie, black tea-tree, gooramurra and river red gum fringe the drainage lines. The soils are deep, sandy grey clays and gleyed texture contrast soils. Some attempts have been made to revegetate these areas by ripping and ponding but with little success.

Landsborough land system consists of seasonally flooded braided streams draining the Cretaceous sediments. Vegetation is Mitchell grass, Flinders grass (open-) tussock grassland with occasional coolibah, belalie and river red gum fringing the channels. Boree open-woodland often

fringes the stream margins. The soils are deep, grey cracking clays. These areas are highly productive.

Lammermoor land system comprises old alluvial plains with a fine ribbon-like network of low (0.5 - 1.0 m) sand rises throughout. This land type occurs south of Prairie. Vegetation is bluegrass, browntop open-tussock grassland. Reid River box, bloodwood, desert gum, wiregrasses occur on the overlying sand sheets. Soils are sandy grey cracking clays with texture contrast soils on the sand sheets. The clay soils often display broad shallow gilgais. These lands are highly productive in normal seasons but lack drought reserves and appear to be more affected by drought conditions than the Mitchell grass downs.

Gidgee Land Zone

The gidgee land zone occurs where the Tertiary land surface has been stripped away exposing fresh labile Cretaceous sediments. A thin veneer of stone and detritus may remain, especially in the scarp retreat zones. Stone cover is more prominent in the western gidgee areas. The component land systems have been recognised by differences in soil and vegetation associations and landform.

Linden land system occurs in the east and comprises flat to gently undulating plains of gidgee tall shrubland to low woodland. The soils are weakly gilgaied, deep, brown cracking clays. Stone cover is generally light. Extensive areas have been cleared and successfully sown to buffel grass. Gidgee regrowth is usually not a problem but sandalwood can pose a woody weed problem in some areas.

Blendon land system has developed on Cretaceous sediments which are often overlain by Quaternary deposits. This results in a distinct pattern with gidgee low woodlands on the alluvia and lower slopes while eucalypt open-woodland predominates on the elevated sand sheets. The soils are brown cracking clays and texture contrast soils, frequently with light stone cover and weakly gilgaied. The gidgee areas are suitable for development to improved pastures but regrowth of gidgee and sandalwood can become a problem on the texture contrast soils.

Spoilbank land system comprises undulating plains and scarp retreat areas in the west. Transported material from higher in the landscape has been deposited on fresh Winton Formation sediments. This results in a dense stone cover overlying the brown and reddish-brown clays. This dense mantle of stone and gravel imparts a measure of stability to these sloping lands. The gidgee is often stunted and more open than the gidgee lands in the east. Development is not recommended.

Ravenswood land system occurs as a flat outwash sandplain west of the Alice Tableland. This sandplain has formed by sandy material being transported and deposited both on recent alluvia and clay plains. Vegetation is gidgee, sandalwood low woodland with open areas of beefwood, needlewood, Ellangowan poison bush, sandalwood grassy tall open-shrubland throughout. Soils are predominantly deep sandy texture contrast soils and minor clays. Claypans (A2 or Aramac Land System) with sparse herbfields are associated with the alluvia. Development of these gidgee lands is not recommended due to a potential woody weed problem and likelihood of increasing areas of claypans through raising of the watertables.

Jabiru land system occurs adjacent to Torrens and Towerhill Creeks, where extensive Quaternary sediments were deposited on gently sloping outwash plains. Vegetation is blackwood low open-forest to grassy low open-woodland. Soils are predominantly sandy brown and grey clays with a light stone cover. Gilgais are common on lower slopes. The dense stands of blackwood are suitable for clearing but in many cases clearing is not recommended as the blackwood is quite open and a dense body of native grasses is already present. These soils generally have low available phosphorus levels and introduced grasses (buffel) may have only limited success in establishing.

Miscellaneous

Webb land system comprises large ephemeral lakes and claypans which occur in the eucalypt woodlands. Lakes Galilee and Buchanan are closed basins of internal drainage, which usually dry out to salt lakes and salt pans. Other lakes (Huffer, Barcoorah) eventually drain into the Thomson River.

River red gum/paper-barked tea-tree / gidgee fringe the lakes with swamp cane grass and samphire common on lake floors. After rains, these lands are popular recreation areas.

Dissected Residual Land Zone

This landscape has been modified by weathering, chemical alteration of sediments and extensive erosion. Component land systems have been recognised by land form and vegetation differences. Stone cover and rock outcrops are extensive and soil development is minimal. These lands are unproductive but are of value for watershedding and recreation. These lands are popular for opal fossicking.

Winooka land system comprises low hills, scarps and gorges of the Great Dividing Range. Vegetation is bendee, lancewood, mountain yapunyah low woodland to tall shrubland on the scarps with Whites ironbark, narrow-leaved ironbark on lower slopes. Yellowjack, tea-tree occur on isolated mesa tops.

Elvo land system comprises undulating plains and dissected low hills in the west. The chemically altered Winton Formation sediments are capped by silicified Glendower Formation sediments. Fresh Winton Formation sediments with stone and rubble cover are exposed on lower slopes. Vegetation is bastard mulga, mulga low open-shrubland with Normanton box, lancewood, spinifex tall open-shrubland on the scarps.

Binburi land system comprises mesas, buttes and dissected tablelands separated by stony undulating plains. A duricrust is often present. Vegetation is bastard mulga, mulga, lancewood, spinifex on the scarps with gidgee tall open-shrubland in the valleys.

Bladensburg land system comprises the flat tops of tablelands, mesas and buttes. Bendee, lancewood open-scrub occur on the steep scarps with Normanton box, mineritchie tall open-shrubland on the lower slopes. The flat tops carry spinifex open-hummock grassland lightly timbered with western bloodwood, desert gum and eastern dead finish.

Mulga Land Zone

This land zone is not extensive and is confined to the south-west.

Opalton land system is representative of the 'hard' mulga lands. The landform is usually gently undulating plains with a thin mantle of erosional detritus overlying altered Winton Formation sediments. Vegetation is bastard mulga, mulga which may be occasionally groved. Gidgee, spinifex low open-woodland occurs on desert loams. This land system is closely associated with the dissected residuals.

Tonkoro land system is representative of the 'soft' mulga lands. The landform is flat to gently sloping plains with mulga low woodland to tall shrubland. The soils are deep, red earths and gilgai microrelief or slump holes occur in grove areas.

Sandplain Land Zone

These sandplains have formed by sands and fine-grained material being deposited on outwash plains. The sandplains are stable and well vegetated. The sandplains are closely associated with the soft mulga lands.

Sunnyside land system comprises flat to very gently sloping plains west of the Thomson River. A veneer of sandy material covers the Tertiary Glendower Formation. Deep, sandy red earths support mulga, beefwood, eastern dead finish and western bloodwood. Mulga tends to become less dominant in the eastern section of the sandplain.

Athelstane land system consists of a flat sandplain with many alluvial clay depressions or swamps throughout. Sand dunes occur infrequently. Vegetation includes mulga, beefwood, western bloodwood, spinifex open-woodland with Normanton box on duricrust areas. The vegetation in this sandplain has been drastically altered over the years by fires.

REFERENCES

Casey, D.J. (1966). Winton, Queensland 1:250 000 Geological Series. *Explanatory Notes Bureau of Mineral Resources, Australia.*

Casey, D.J. (1969). Tangorin, Queensland 1: 250 000 Geological series. *Explanatory Notes Bureau of Mineral Resources, Australia.*

Christian, C.S. and Stewart, G.A. (1953). General report on survey of Katherine-Darwin region, 1946. *CSIRO Australia, Land Resources Series No.1.*

Jauncey, W. (1967). Mancroo, Queensland 1:250 000 Geological Series. *Explanatory Notes Bureau of Mineral Resources, Australia.*

Northcote, K.H. (1965). *A factual key for the recognition of Australian soils.* CSIRO Australia, Division of Soils, Divisional Report 2/65.

Turner, E.J. (1978). Climate, In *Western Arid Region Land Use Study - Part IV.* Queensland Department of Primary Industries, Division of Land Utilisation Technical Bulletin No. 23.

Vine, R.R. (1964). Muttaburra, Queensland 1:250 000 Geological Series. *Explanatory Notes Bureau of Mineral Resources, Australia.*

Willcocks, J. and Young, P. (1991). *Queensland's rainfall history.* Queensland Department of Primary Industries, Information Series, QI 91002.

Wills, A.K. (1980). Climate, In *Western Arid Region Land Use Study - Part II.* Queensland Department of Primary Industries, Division of Land Utilisation Technical Bulletin No. 22.

CHAPTER 3

SOILS

by C.R. Ahern[1] and E.J. Turner[2]

Field data, laboratory analyses, computing, statistics and some of the graphs for this survey were completed over 10 years ago, but for various reasons have remained unpublished. Five other surveys in the Western Arid Region Land Use Study have been published, the first in 1974. Some of the units of measure used for reporting chemical analyses have changed over this time (e.g. dS m^{-1} are now preferred to mS cm^{-1}), but for consistency the units of previous reports are generally used here. Equivalent units currently in use in 1993, or the relevant conversion factors are given in Appendix II.

Properties of some of the soils in the area have been previously described or mapped as part of broader regional studies (Prescott 1931, 1944; Isbell *et al.* 1967; Isbell and Murtha 1970; and Northcote *et al.* 1968).

In this Chapter, the chemical and physical properties of the principal soil groups, and to a lesser extent soil profile classes, are presented together with their relationships with topography, vegetation and geology. Detailed site and morphological descriptions together with analytical data are published in microfiche 1. Brief summaries of the soil groups and their relationships to the land systems and land units are contained in Appendices IV and V respectively.

SOIL DEVELOPMENT AND DISTRIBUTION

The development and distribution of soils in the region are closely related to the lithology of parent material. This is apparent when the patterns of soil distribution and geology are compared. The main geomorphic processes involved in the development of the present landscape include:

- the formation of an old land surface in the upper Cretaceous period
- deep weathering and chemical alteration of Cretaceous beds in the late Cretaceous and Tertiary times
- formation of an old Tertiary land surface with silification and chemical alteration of upper beds
- extensive erosion of the Tertiary land surface, exposing fresh, labile Cretaceous sediments
- subsequent weathering of these Cretaceous sediments to form clay plains.

These geomorphic processes usually resulted in the development of a range of soils in a definite catenary sequence. Sandy, massive red and yellow earths are the dominant soils on the intact Tertiary land surface. Massive earths, siliceous sands and texture contrast soils have developed from redistributed detritus on the adjacent sandplains. Cracking clay soils are associated with weathered Cretaceous sediments and recent alluvium.

SOIL GROUPS AND SOIL PROFILE CLASSES

During the survey, 225 soil profiles were sampled and examined. Two methods of site selection were employed: Grid and Free Survey. A broad grid was overlaid on the survey area for site selection to ensure a good geographic coverage of the study area. This was supplemented at the surveyor's

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discretion by additional or free survey sites in order to sample units occurring between the grid, or to boost sampling intensity on important soils. Figure 3.1 shows the location of the sampled sites.

The soils from these sites were grouped into 11 major soil groups on the basis of geology and specific soil characteristics. These broad soil groups were then subdivided into 24 soil profile classes (SPC's) on the basis of easily recognisable soil morphological characteristics. These included such factors as depth, soil reaction trend, surface characteristics, microrelief and subsoil colour. Table 3.1 lists the soil groups and their component soil profile classes (SPC's), briefly describing their important features. (Soil profile classes are groupings of soils such that the variation in certain profile features within the SPC is much less than the variation between the SPC's).

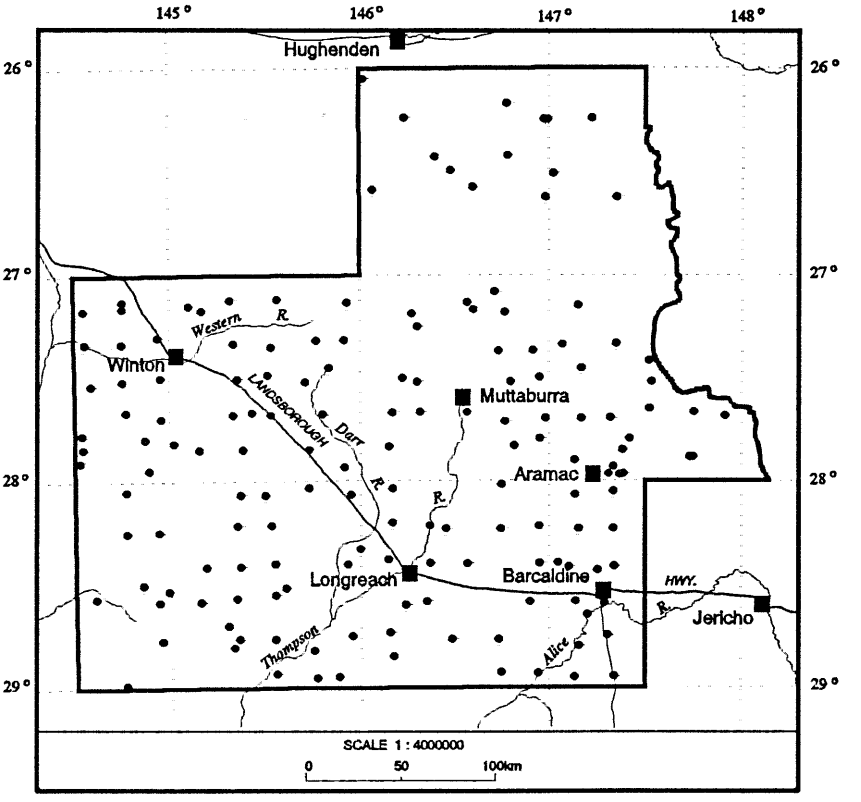

Figure 3.1 Location of sampling sites

Table 3.1 General characteristics of the soil profile classes and soil groups

SPC	PPF Recorded*	Great Soil Group**	Associated Vegetation
A: Grey and brown clay on plains (downs).			
Ascot A1	*Moderately deep to deep cracking clay; strongly self-mulching surface; fragile crust, moderately alkaline throughout; gypsum present in subsoil; light, variable stone cover.*		
	Ug5.22, Ug5.23, Ug5.24, Ug5.32, Ug5.30	Grey and brown clay.	Mitchell grass open tussock grassland.
	[Sites: 9, 10, 11, 13, 14, 15, 16, 17, 18, 22, 23, 24, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 45, 46, 48, 50, 51, 54, 60, 61, 65, 66, 88, 91, 92, 93, 94, 96, 97, 98, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 120, 121, 122, 135, 136, 142, 144, 145, 146, 147, 148, 151, 152, 153, 154, 155, 164, 176, 177, 179, 181, 182, 184, 214, 220, 221, 222, 223, 224, 225.]		
Tiree A2	*Moderately deep to deep, cracking clay; strongly self-mulching surface; broad, shallow gilgais, neutral to medium alkaline profile; sand bands throughout; dense gypsum layer in subsoil.*		
	Ug5.24, Ug5.22, Ug5.36	Grey and brown clay.	Mitchell grass open tussock grassland.
	[Sites: 81, 133, 137, 174, 175, 217.]		
B: Brown clay on plains (gidgee).			
Bibel B1	*Deep, cracking clay often with dense gravel cover; profile strongly alkaline becoming acid in subsoil; gilgais common.*		
	Ug5.31, Ug5.32, Ug5.23	Brown clay.	Gidgee tall shrubland,low woodland.
	[Sites: 5, 12, 20, 21, 26, 41, 52, 55, 56, 62, 68, 74, 113, 114, 126, 139, 143, 185, 187, 188, 189.]		
C: Grey and brown clay on alluvia.			
Thomson C1	*Deep, cracking clay with self-mulching surface; profile neutral to alkaline at the surface and alkaline at depth; ironstone, quartz, lime and gypsum inclusions; colour changes in lower profile; mottling common.*		
	Ug5.14, Ug5.27, Ug5.24	Grey clay.	Mitchell grass open tussock grassland.
	[Sites: 40, 49, 53, 83, 90, 99, 134, 149, 150, 178, 180, 183, 191, 192.]		

Table 3.1 General characteristics of the soil profile classes and soil groups

SPC	PPF Recorded*	Great Soil Group**	Associated Vegetation
Cornish C2	*Deep clays with crusted and hard setting surface; gravel layers and sand seams common; profile neutral.*		
	Uf6.12, Ug5.2	Alluvial soil.	Coolibah, River Red gum open woodland.
[Sites:	4, 42, 70, 77, 95, 138, 199, 212.]		
Lydia C3	*Moderately deep cracking clay with strong surface crust when dry; slightly acid profile, very poorly drained.*		
	Ug5.22	Grey clay.	Coolibah, lignum, low open woodland.
[Sites:	84.]		
Ulva C4	*Deep, cracking clay with thin surface crust; moderately acid surface grades strongly alkaline beyond 30 cm; colour changes in subsoil; gilgais common.*		
	Uf/Ug	Alluvial soil.	Gidgee, blackwood low open woodland.
[Sites:	6, 205.]		
D: Scald.			
Ardno D1	*Deep clay with scalded surface; occasional stone cover; non surface samples are alkaline; ironstone and lime inclusions.*		
	Ug5.32, Ug5.25	Grey and brown clay.	Sparse herbfield to open tussock grassland.
[Sites:	19, 25, 43, 44, 71, 78, 89, 148.]		
E: Texture contrast soil on alluvia.			
Mundoo E1	*Deep soil with hard setting surfaces; shallow A1 horizon; surface is strongly acid and becomes alkaline in subsoil; ironstone shot and manganese inclusions common.*		
	Dy2.42, Dr2.13	Solodized solonetz.	Gidgee, blackwood low open woodland.
[Sites:	7, 203.]		

Table 3.1 General characteristics of the soil profile classes and soil groups

SPC	PPF Recorded*	Great Soil Group**	Associated Vegetation
Shirley E2	*Deep soil with sandy loam surface; mod. deep A horizon; profile is commonly acid to neutral, ironstone nodules occur in subsoil; mottles common.*		
	Dy3.12, Dy3.42 Dy3.43	Soloth/solodized solonetz.	Reid River box low open woodland.
	[Sites: 198, 206, 211, 213.]		
F: Texture contrast soil on plains.			
Sumana F1	*Deep soil with brown, mottled subsoil, acid surface and strongly alkaline subsoil.*		
	Db2.43	Solodized solonetz.	Blackwood low open woodland.
	[Sites: 173.]		
Thorton F2	*Moderately deep to deep soil; gravel common on surface and ironstone throughout; profile neutral at surface to strongly acid at depth; A1 horizon often eroded exposing A2 horizon.*		
	Dr3.11, Dr2.12	Desert loam.	Gidgee low open woodland.
	[Sites: 128.]		
Ludgate F3	*Deep soil with hard setting surface; red subsoil; bleached A2; alkaline subsoil; ironstone, lime inclusions at depth.*		
	Dr3.12, Dr2.13, Dr3.43	Solodic, solodized, solonetz.	Eucalypt, spinifex low open woodland.
	[Sites: 1, 64, 85, 167, 186, 195, 197, 200.]		
Cherhill F4	*Moderately deep soil with mottled yellow subsoil; acid profile; ironstone throughout.*		
	Dy3.41, Dy3.11, Dy3.21	Soloth.	Eucalypt, spinifex low open woodland.
	[Sites: 57, 141, 156, 162.]		

Table 3.1 General characteristics of the soil profile classes and soil groups

SPC	PPF Recorded*	Great Soil Group**	Associated Vegetation
Coorabah F5	*Deep soil with yellow subsoil; prominent bleached A2; acid surface becomes strongly alkaline at depth; ironstone common throughout.*		
	Dy2.43	Solodized solonetz.	Gidgee, Reid River box low open woodland.
[Sites:	2, 158, 159, 168, 194, 218.]		
G: Red clay on plains (mulga).			
Vergemont G1	*Moderately deep, non-cracking clay; silcrete gravel may occur on the surface; acid profile; non-saline and non sodic; slump holes common.*		
	Uf6.31, Uf6.34, Um1.43	Red clay.	Mulga tall open shrubland.
[Sites:	58, 63, 79, 132.]		
H: Loamy red earth.			
Alvo H1	*Deep, loamy soil with ironstone shot on the surface and in profile; strongly to slightly acid profile massive structure; very infertile.*		
	Gn2.12, Um1.43	Red earth.	Predominantly mulga tall shrubland.
[Sites:	69, 80, 86, 110, 124, 125, 130, 131, 169.]		
I: Sandy red earth.			
Webb I1	*Deep sandy soil with massive structure; loamy sand to sandy loam surface; very infertile.*		
	Gn2.11, Gn2.12	Red earth.	Predominantly eucalypt low open woodland.
[Sites:	8, 59, 76, 172, 193, 207.]		

Table 3.1 General characteristics of the soil profile classes and soil groups

SPC	PPF Recorded*	Great Soil Group**	Associated Vegetation
J: Yellow earth.			
Uanda J1	*Moderately deep sandy soil with ironstone nodules both on soil surface and in profiles; medium to slightly acid throughout; massive structure; very infertile.*		
	Gn2.21, Gn2.22	Yellow earth.	Eucalypt, spinifex low open woodland.
[Sites:	163, 171, 196, 204.]		
K: Siliceous sand.			
Tarella K1	*Very deep, loose, yellowish sand; profile is slightly acid to neutral, slight colour change with depth.*		
	Uc5.11	Siliceous sand.	Tea-tree tall shrubland.
[Sites:	201, 202, 219.]		
Tangorin K2	*Deep, red sand, profiles acid; ironstone common throughout.*		
	Uc5.22	Siliceous sand.	Eucalypt, spinifex low open woodland.
[Sites:	140, 160, 165, 170.]		
Wowra K3	*Deep, grey-brown to yellow sand; slightly acid profile.*		
	Uc1.21, Uc5.11	Siliceous sand.	Eucalypt, *Aristida* low open woodland.
[Sites:	3, 161, 166, 208, 209, 210.]		
L: Lithosol.			
Corys L1	*Very shallow, gravelly sandy loams to light clay; extensive rubble; strongly acid.*		
	Uc1.41, Um1	Lithosol	*Acacia* tall open shrublands, spinifex wooded grassland.
[Sites:	47, 67, 72, 73, 75, 82, 111, 112, 127, 129, 190, 216.]		

Table 3.1 General characteristics of the soil profile classes and soil groups

SPC	PPF Recorded*	Great Soil Group**	Associated Vegetation
M: (Miscellaneous).			
Ballygar M1	*Claypan, deep clay with thin scalded surface; becomes very strongly alkaline beyond 30 cm; sand dunes and gleyed duplex soils occur throughout; salt springs evident.*		
	Dg2.13, Uf6.13	Grey clay.	Sparse *Sclerolaena* herbfield, or devoid of vegetation.
	[Sites: 157, 215.]		
Spoilbank M2	*Gravelly light clay occurring on footslopes of scarp; expansive cover of silcrete.*		
	Uf6.34	Grey and brown clay.	Gidgee tall open shrubland.
	[Sites: 87.]		

* PPF: Principal Profile Form (Northcote 1979)

** Great Soil Group - Stace *et al.*(1968)

A: Grey and brown clays on plains (downs)

The grey and brown clays on the plains, characterised by the Mitchell Grass rolling downs, have developed on weathered sedimentary Cretaceous materials such as labile sandstones, mudstones and limestones. They have been extensively sampled in that approximately 40% of grid sites occurred on these clay plains, showing they are extensive in area. Two soil profile classes are involved.

Soils are moderately deep to deep and weathered parent material is usually encountered by 90 cm. Soil colour is quite uniform down the profile or may become slightly paler with increasing depth. The soil surface cracks widely on drying and is strongly self-mulching. Soil structure grades from strong, fine granular at the surface to medium and coarse blocky by 10 cm. The soil surface is virtually stone-free although ironstone pebbles become more prominent in the west and may form stone pavements. Lime occurs throughout the profile and gypsum is more common in the subsoil.

Considerable difference in chemical and some physical properties. exists between the two soil profile classes of this soil group. Because of the extent of the difference, each soil profile class of this group will be discussed separately in relation to soil analyses.

Ascot SPC (A1)

Laboratory pH of the surface ranges from neutral to very strongly alkaline (mean bulk surface, [B10][3] pH = 8.4; CV[4] = 6.4%). A frequency distribution of the sampled 87 B10 pH values is given in Table 62 Microfiche Chem Tables. The mean values for each depth show little change to 60 cm, but

[3] B10 refers to bulk 0-0.1 m sample taken at each described profile. Sometimes only the B10 sample has been analysed, as full profile analyses were limited.

[4] CV refers to coefficient of variation (S.D./mean) x 100.

generally pH decreases at the base (110 - 120cm or shallower where soil depth is limited) of the profile (mean pH = 8.0). Some individual profiles may show slight acid or alkaline trends but no general trend is evident.

Electrical conductivity (EC) and chloride (Cl) values were generally very low to low (mean B10 EC = 0.11 mS cm^{-1}; 0.003% Cl) increasing sharply with depth to give predominantly high to very high values at the base of profiles (mean EC = 2.53 mS cm^{-1}; 0.153% Cl). Medium and low profile values were recorded on some sites.

Large quantities of gypsum (confirmed by total sulphur and 1:50 EC measurements) occur at depth in some sites. Little of this gypsum dissolves in the 1:5 soil: water extract as it is highly crystalline and has very low solubility compared to the other commonly occuring salts (refer methods, Appendix II).

Saline surface soils (as defined by Northcote and Skene 1972) are rare, but some saline subsoils occur. Most surfaces were non sodic (mean B10 ESP = 2.6%), but subsoils were strongly sodic to sodic (mean base of profile ESP = 26%).

Surface clay content ranges from 41-68% (mean B10 = 52%; CV = 13%). Most individual profiles had little variation with depth reflecting in a constant mean value with depth, see Figure 3.2. Silt content of the surface soils ranged from 10-18% (mean B10 = 14%; CV = 19%), with most individual profiles showing little change with depth except at the base of profiles where larger changes were common. Fine sand contents of the surface ranged from 17 to 46% (mean B10 =27%; CV =27%). While there was big variation between profiles, most individual profiles were relatively uniform with depth although a general reduction was common at the base of profiles (mean base = 20% F.S.; CV =35%). Over 80% of sites had less than 10% coarse sand in the surface (mean B10 = 6%). Most sites were relatively uniform with depth.

Surface cation exchange capacity (CEC) ranges from 25 to 51 (mean B10 = 39 m. equiv. 100 g^{-1}; CV = 15%). Most individual profiles were uniform with depth, but a slight reduction in CEC at the base of the profile was common.

Clay activity or CEC/clay ratios of the non surface depths ranged from 0.6 to 1.0 (mean 30 cm = 0.83; CV = 14%). This suggested a high proportion of smectite or 2:1 expanding clay minerals. Most individual profiles were relatively uniform with depth, which was reflected in a uniform mean for each depth to 60 cm. Greater variation occurred at the base of the profiles. Surface CEC/clay values were also high (mean B10 = 0.82) and even when adjusted for organic carbon content, they were still high (mean B10 CEC/clay corrected = 0.77; CV = 15%). Soils are base saturated throughout, good agreement being obtained between the sum of base cations and CEC on all sites except when gypsum occurs (mean B10 CEC = 39.6 m. equiv. 100 g^{-1}; Σ cations = 40.5).

Calcium was the dominant cation in all sites and all depths, with Ca/Mg ratio always greater than 1.0. Most surface ratios were very high (mean B10 = 8.6; CV = 47%) but generally decreased with depth (mean 120 cm = 4.8; CV = 90%). These ratios suggest that good physical structure of the soil can be expected, particularly in the surface. On some sites, the ratio may be inflated by some soluble gypsum increasing the exchangeable calcium result. The predominance of calcium is attributed to the Cretaceous parent material from which soils are formed. Ahern and Wilson (1990), in an adjoining survey to the west of the present area, also found high Ca/Mg ratios (generally > 10) on red and brown clays on Cretaceous sediments. They indicated magnesium may be deficient on the soils with very high Ca/Mg ratios. The soils in the Ascot SPC of this survey have adequate exchangeable magnesium levels, with all surface values being greater than 2.0 m. equiv. 100 g^{-1} (mean B10 = 4.7) and increasing with depth on most profiles. Surface exchangeable calcium levels are high (mean B10 = 33 m. equiv. 100 g^{-1}; CV = 23%). There is little variation with depth in individual profiles, except for a reduction at the base of many profiles (mean base = 28 m. equiv. 100 g^{-1}; CV = 30%).

Exchangeable sodium of the surface was extremely variable, ranging from 0.2 to 3.9 m. equiv. 100 g^{-1} (mean B10 = 1.0; CV = 86%). Values increased sharply with depth. Figure 3.3, showing mean cation changes with depth, highlights the sharp increase in sodium in the upper profile to just exceed magnesium by 60 cm.

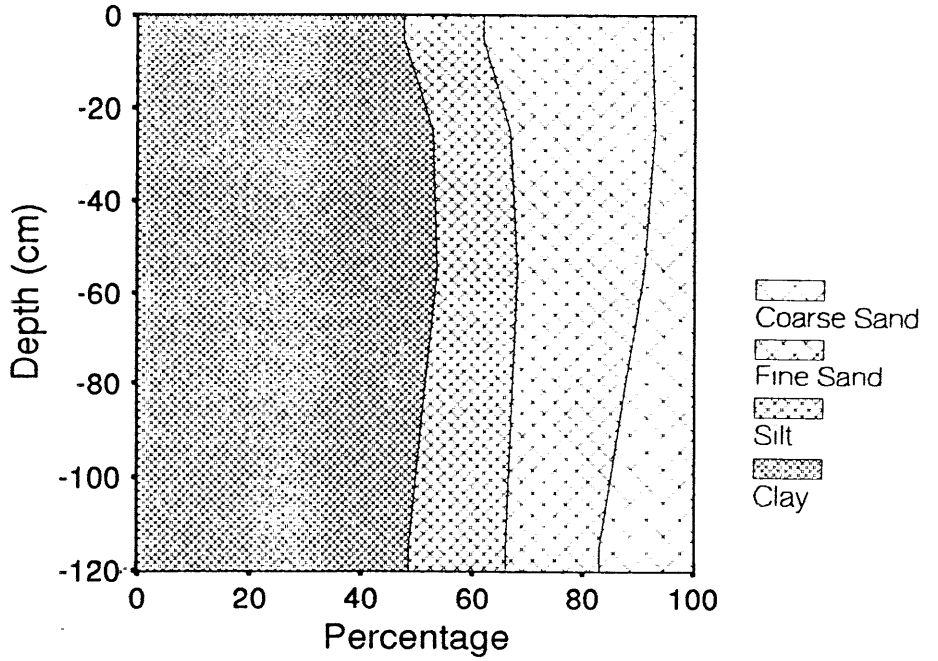

Figure 3.2 Changes in mean particle size with depth for Ascot SPC (A1)

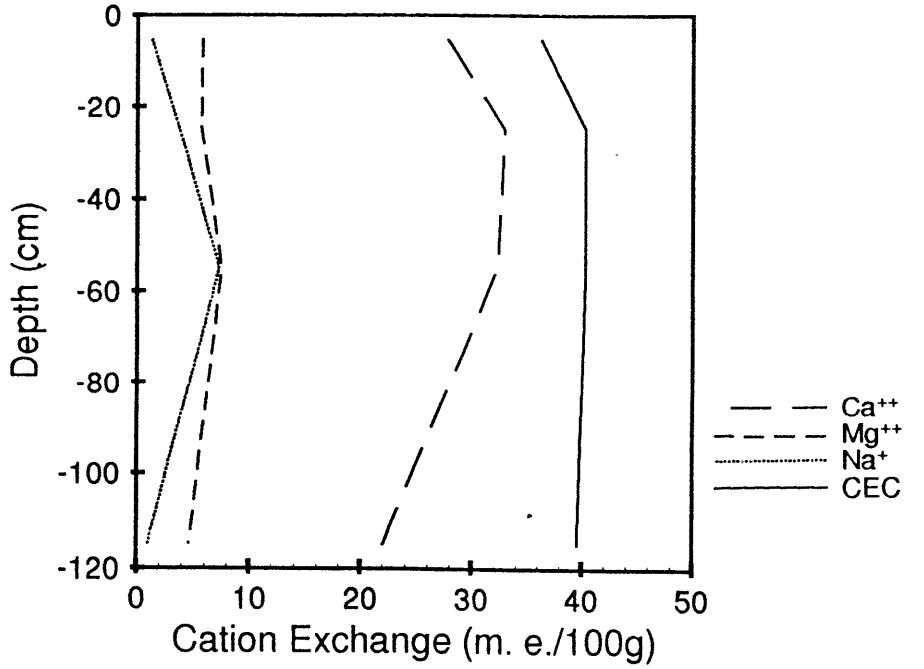

Figure 3.3 Changes in mean cations and CEC with depth for Ascot SPC (A1)

All 29 surface exchangeable potassium values were high (mean B10 = 1.04 m. equiv. 100 g^{-1}) and generally decreased slightly with depth. Replaceable potassium values were also generally high (mean B10 = 0.75 m. equiv. 100 g^{-1}), with mean replaceable /exchangeable potassium ratio equal 0.76. All sites have values exceeding the 0.2 m. equiv. 100 g^{-1} critical value of Crack and Isbell (1970). Total potassium was high to medium (mean B10 = 1.14%; CV = 22%). Potassium is not a limitation to plant growth on the Ascot SPC.

Surface total phosphorus was low to high and variable between sites (mean B10 = 0.036%; CV = 39%). Individual profiles were relatively uniform with depth (mean base profile = 0.034; CV = 26%). Acid extractable phosphorus was extremely variable, mainly between sites rather than with depth. Surface values ranged from a very low 3 ppm to a very high 360 ppm (mean B10 = 102 ppm; CV = 87%). Only 14 of the 76 sites with surface analyses had low or very low acid P values. Surface bicarbonate extractable phosphorus was very low to low with occasional medium sites (mean B10 = 11 ppm; CV = 52%). Values commonly decreased to 20 cm (mean = 7ppm P). While total and acid extractable phosphorus values showed most sites have high P status, bicarbonate extractable values suggest some limitation. The bicarbonate extraction method is considered a better test for phosphorus availability to crops on alkaline soils (Colwell 1963), but it is unlikely that phosphrous is a limitation to growth of native pasture on most sites.

Surface organic carbon and total nitrogen levels were low to very low (mean B10 = 0.52%C, CV = 26%; mean B10 = 0.051%N, CV = 24%). Values decreased slightly to 20 cm. Carbon/nitrogen ratios were low (mean B10 = 10.4; CV =32%) suggesting nett mineralisation of nitrogen should proceed. Mean surface total C:N:S ratios were 135:10:3.1.

DTPA extractable trace element analyses were used to indicate possible trace element deficiencies or toxicities. For interpretative purposes, the criteria of Viets and Lindsay (1973) for extractable iron and the ratings of Bruce and Rayment (1982) for zinc, copper and manganese were employed. However these criteria are broad indications only, as they were developed for sensitive crops from wetter areas and not native vegetation, which may have substantially different trace element requirements, particularly in a semiarid climate.

Of the fifteen surface soils analysed, ten had adequate extractable iron levels, four appeared marginal and one deficient (mean B10 = 7.4 ppm Fe; CV = 60%). Manganese levels were medium (mean B10 = 8.5 ppm Mn; CV = 81%), copper levels were medium (mean B10 = 0.7 ppm; CV = 27%) and zinc levels were low to very low with one medium site (mean B10 = 0.35 ppm; CV = 70%).

Available soil water capacities of this SPC were medium to very high in the surface (mean B10 = 13.8%; CV = 17%) and values increased on most sites with depth (mean 60 cm = 18 %; CV = 22%).

Tiree SPC (S2)

Laboratory pH of the surface was neutral (mean B10 = 7.0; CV = 1.5%). Profiles had an alkaline trend with depth except where appreciable salts were found high in the profile. Values at the base of the profiles were generally mildly alkaline to medium acid (mean 6.1; CV = 9%). There was an obvious large difference in pH values between Ascot (mean B10 pH = 8.4; 110-120 cm = 8.0) and Tiree SPC.

Electrical conductivity and chloride values were very low to low in the surface (mean B10 = 0.048 mS cm^{-1}; 0.004% Cl), increasing sharply with depth down all profiles, to give high to very high values at the base of profiles (mean = 2.2 mS cm^{-1}; 0.236% Cl). Gypsum was commonly low in many profiles. Except where large amounts of gypsum occurred, sodium chloride was the dominant salt in this SPC. Surface soils were non saline but saline subsoils occur. Surface soils may be sodic or non sodic (mean B10 ESP = 4%), but subsoils were usually strongly sodic (mean 120 cm ESP = 23%).

Surface clay content was variable (mean B10 = 41%; CV = 15%), probably affected by the amount of Quaternary Sands cover. Clay content generally increased slightly with depth (mean 120 cm = 50%; CV = 20%). Silt content ranged from 8 to 14% in the surface (mean B10 = 11%). There was a slight increase below the surface, with little variation thereafter in most individual profiles (mean 120 cm = 13.3%). Fine sand content was a maximum in the surface (mean B10 = 28; CV = 17%), decreasing on all profiles with depth (mean 120 cm = 21%; CV = 33%). Coarse sand was variable between sites, ranging from 9 to 27% in the surface (mean B10 = 19%) and generally decreasing below the surface on most profiles (see Figure 3.4).

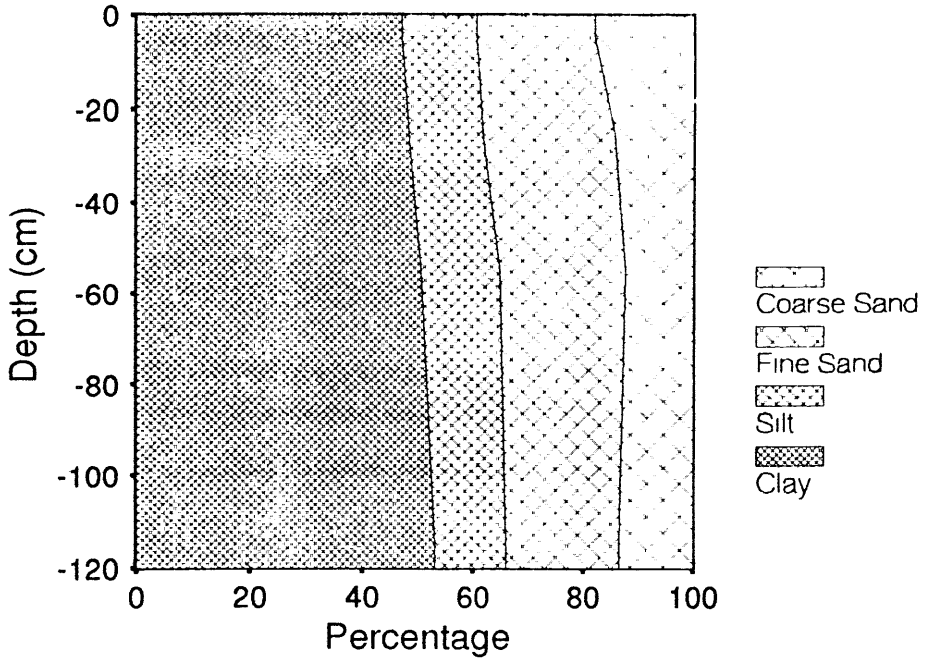

Figure 3.4 Changes in mean particle size with depth for Tiree SPC (A2)

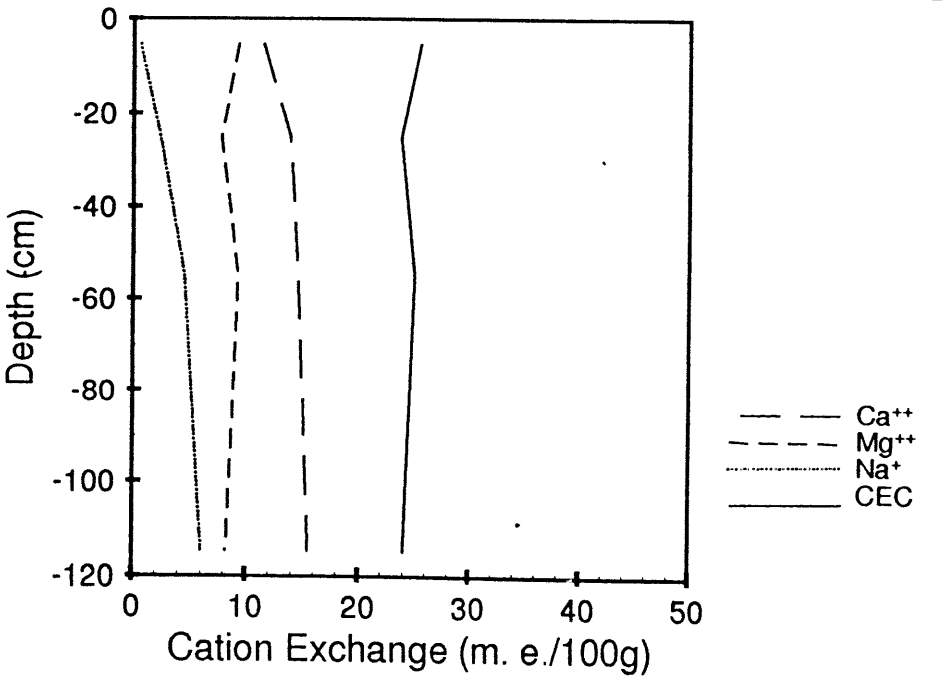

Figure 3.5 Changes in mean cations and CEC with depth for Tiree SPC (A2)

Cation exchange capacity of surface soils was variable (mean B10 = 19 m. equiv. 100 g^{-1}; CV = 27%), increasing below this depth to be relatively uniform down individual profiles for the remainder of the depths (mean 120 cm = 23 m. equiv. 100 g^{-1}; CV = 11%). CEC/clay ratios of the profiles ranged from 0.44 to 0.62 (mean 30 cm = 0.52; CV = 12%). Individual profile values were relatively uniform with depth. These CEC/clay ratios suggest a mixture of clay minerals, certainly with much less smectite than the Ascot SPC.

As Tiree SPC had much lower total potassium values than Ascot, it is likely to have lower illite type clay minerals also. Soils were base saturated (mean B10 = 98%; mean profile = 107%). The sum of cations on some lower depths exceed CEC appreciably when soils contain gypsum, inflating the calcium result.

Generally calcium was the dominant cation but magnesium could be co-dominant or dominant. Deep in some profiles, exchangeable sodium may be close to co-dominant with magnesium and calcium, and when this occurs, soil structure will probably be affected, resulting in poorer drainage. Surface Ca/Mg ratios ranged from 0.93 to 4.6 (mean B10 = 1.93) with values at the base of profiles ranging from 0.67 to 2.3 (mean 120 cm = 1.48). This contrasts strongly with Ascot SPC, which has calcium clearly dominant at all depths.

Exchangeable calcium values of Tiree SPC varied considerably between profiles (B10 range 4.5 - 21 m. equiv. 100 g^{-1}). Generally values increased depth in the upper profile, but some might decrease at 60 cm or beyond on those profiles which had strongly increasing exchangeable magnesium and sodium. Exchangeable magnesium had lower variability between sites (B10 range = 4.6 to 8.8 m. equiv. 100 g^{-1}) than calcium. This may be due to the sandier surface for Tiree SPC, allowing easier leaching of salts out of surface soil or just different parent material and location. Figure 3.5 shows the mean cation and CEC values of Tiree SPC with depth contrasting with the strongly calcium dominated Ascot SPC (Figure 3.3).

Surface exchangeable and replaceable potassium values were medium to high (mean B10 = 0.55; 0.39 m. equiv. 100 g^{-1} respectively). Values decreased sharply below the top 10 cm on most profiles resulting in some low and very low values. Total potassium was low (mean B10 = 0.385%, CV = 14%) and individual profiles remained relatively constant with depth. While extractable potassium is probably sufficient for plant growth, the Tiree SPC had much lower potassium status than the Ascot SPC.

Surface total phosphorus is low to medium (mean B10 = 0.023% P; CV = 65%). Profile values are relatively uniform and slightly lower than the surface value (mean 120 cm = 0.019% P). Surface acid extractable phosphorus is very low to low (mean B10 = 10 ppm; CV = 67%) reducing sharply below the surface where all values were very low. Surface bicarbonate extractable phosphorus was very low to low (mean B10 = 7 ppm; CV = 76%) reducing to all very low values at 20 cm. Extractable phosphorus values suggest that phosphorus may be a limitation to plant growth in this SPC. However, research work is necessary, to establish if phosphorus is a limitation to growth of native pasture in a semiarid environment. Soil phosphorus tests show that Tiree SPC has a much lower phosphorus status than Ascot SPC by all three tests.

Surface organic carbon levels were low to very low (B10 = 0.5%; CV = 25%), reducing to 20 cm. Total nitrogen was very low (mean B10 = 0.032%N; CV = 22%), also reducing to 20 cm. Some carbon/nitrogen ratios were high (mean B10 = 16; CV = 19%), suggesting nett nitrogen mineralisation on a few sites may be a problem, given the low total N values. Mean total C:N:S ratios are 208:10:4.8.

Extractable iron is marginal to adequate (mean B10 = 9.7 ppm; CV = 83%). Manganese and copper levels are medium (mean B10 = 17.7 ppm Mn, CV = 38%; 0.9 ppm Cu, CV = 16%). Zinc levels were low (mean B10 = 0.4 ppm; CV = 13%). Both Tiree and Ascot had similar mean trace element levels or ratings.

Available soil water capacities are medium to high in the surface (B10 = 11%; CV = 14%), increasing with depth on those sites with lowest surface values (mean 60 cm = 13%; CV = 8%).

B: Brown clays on plains (gidgee)

These soils have only one SPC (Bibel) and, like Group A soils, have also developed on sedimentary Cretaceous materials after being overlain by Quaternary gravels.

Soils are deep and gilgai microrelief is often well developed. The soil surface is weakly self-mulching and a thin crust is often present. Surface gravel is common and gravel pavements may develop. The surface colour is predominantly reddish brown and colours tend to become lighter with increasing depth. Ironstone inclusions are common throughout the soil profile.

Laboratory pH of the surface ranged from slightly acid to very strongly alkaline (mean B10 = 7.8; CV = 9.6%). Values generally increased down the profile to reach a maximum at 30 or 60 cm sampling depth, decreasing beyond that depth interval to give moderately alkaline to strongly acid values at 120 cm. The change from an alkaline trend to an acid trend at depth was usually associated with high salt content, especially gypsum.

Electrical conductivity and chloride were very low to low in the surface (mean B10 EC = 0.11 mS cm^{-1}; 0.006% Cl), increasing sharply down profiles to give high and very high values at 120 cm or the profile base (mean 120 cm EC = 2.0 mS cm^{-1}; 0.14% Cl). A gilgai depression site recorded the highest salt values. Soils have non saline surfaces while saline subsoils may occur but are not common. Gypsum was often the dominant salt low in the profile where large quantities commonly occurred. This was verified by high 1:50 soil:water electrical conductivity measurements and total sulphur values.

Most sites were non sodic in the surface (mean B10 = 2.3%; CV = 107%) but strongly sodic to sodic in the subsoil (mean 120 cm = 25.3%; CV = 31%).

Clay content of surface soils are variable ranging from 29-53% (mean B10 = 41%; CV = 20%). Some sites were relatively uniform with depth, while the sites with lighter-textured surfaces had an increase in clay below the surface. Maximum clay values usually occurred at 30 or 60 cm sample depths, but individual profiles were relatively uniform with depth below the surface. Silt content of the surface ranged from 8 to 21% (mean B10 = 11%). Similar to clay, the sites with lower surface values increased below the surface. Fine sand content of the surface ranged from 17 to 45% (mean B10 = 31%). There was little variation down most profiles but wide variation between sites. Coarse sand content of the surface ranged from 4 to 35% (mean B10 = 16%; CV = 58%), values generally decreased with depth on most profiles.

A plot of mean clay, silt, fine sand and coarse sand content with depth is shown in Figure 3.6. The generally lower clay and silt values of the surface soil of some sites was reflected in higher coarse and fine sand contents. With exception of one site, clay and fine sand were the dominant fractions, while silt and coarse sand were generally minor components.

Cation exchange capacity of the surface ranged from 21 to 4.7 m. equiv. 100 g^{-1} (mean B10 = 33; CV = 25%). Individual profiles were relatively uniform with depth, but some of the sites with lighter textured surfaces had lower surface CEC. The overall profile mean CEC was approximately 36 m. equiv. 100 g^{-1} (Figure 3.7). Non surface CEC/clay ratios ranged from 0.68 to 0.97 (mean profile = 0.83). This suggests a high proportion of 2:1 expanding clay minerals such as smectite. All soils were base saturated (mean B10 = 99% BS) with the sum of the cations often exceeding the CEC at depth. Soluble salts, particularly gypsum, were usually responsible.

Except at the base of one profile, Ca/Mg ratios were all greater than unity, (mean B10 Ca/Mg ratio = 4.4; CV = 55%). While the mean values showed little variation with depth, some sites increased while others decreased or remained uniform. There was also considerable variation between sites.

Surface exchangeable calcium ranged from 9 to 39 m. equiv. 100 g^{-1} (mean B10 = 24.8; CV = 39%), with values for calcium generally varying with CEC. Values increased with depth to 30 cm or 60 cm, then most sites decreased to 120 cm. The presence of gypsum may have inflated some exchangeable calcium values. Surface exchangeable magnesium ranged from 3.7 to 11 m. equiv. 100 g^{-1}; CV = 33%). Magnesium usually increased down the profile, particularly in the lower depths (mean 120 cm = 10.2 m. equiv. 100 g^{-1}; CV = 48%). Exchangeable sodium was low in the surface, ranging from 0.1 to 2.6 m. equiv. 100 g^{-1} (mean B10 = 0.7; CV = 100%). Sodium increased sharply down all individual profiles. Exchangeable potassium decreased with depth on all profiles.

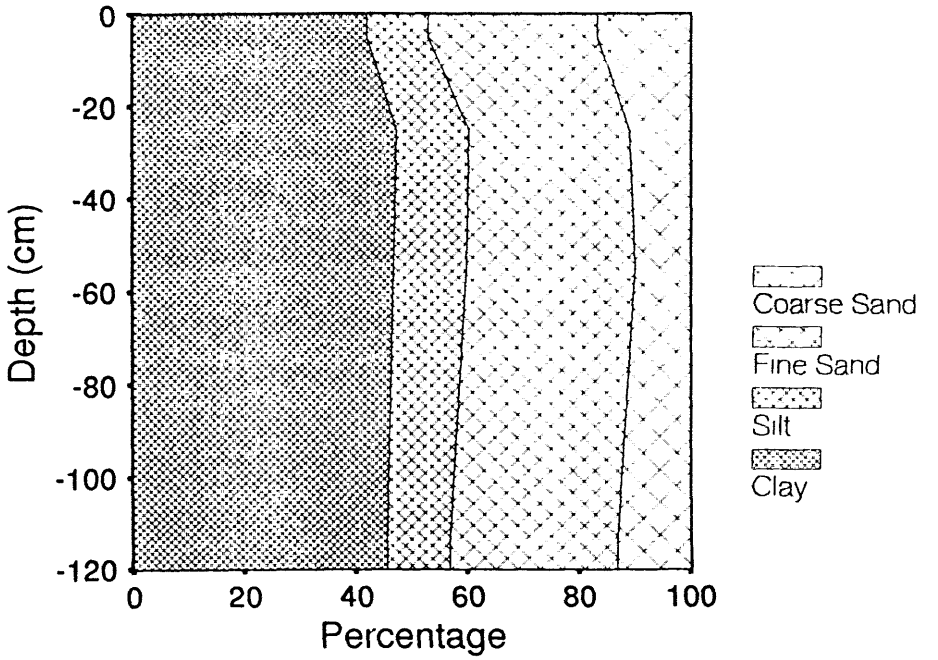

Figure 3.6 Changes in particle size with depth for brown clays on plains (B)

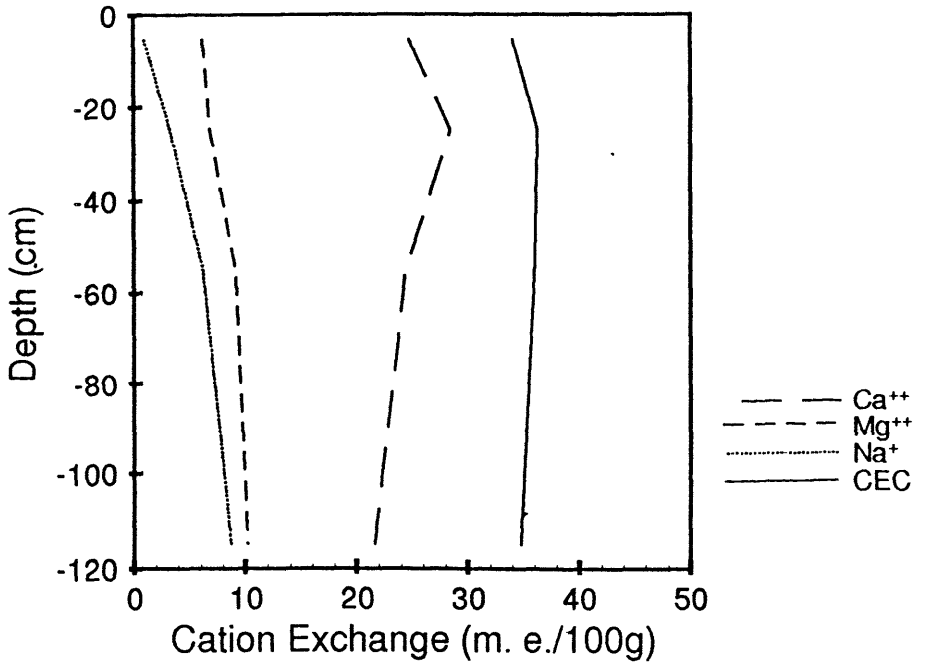

Figure 3.7 Changes in mean cations and CEC with depth for brown clays on plains (B)

Figure 3.7 shows the changes in mean cation and CEC values with depth. There was a general increase in mean magnesium and particularly sodium with depth and a corresponding decrease in calcium. In lower depths the sum of the cations often exceeded CEC due to gypsum content.

Surface exchangeable potassium ranged from medium to high (mean B10 = 0.78 m. equiv. 100 g^{-1}; CV = 36%), decreasing substantially to 30 cm (mean = 0.35). Replaceable potassium (RK) values were all less than the corresponding exchangeable potassium (EK) value (mean B10 RK/EK ratio = 0.84). While two profiles had low exchangeable and replaceable potassium at depth, potassium is unlikely to be a fertility problem on most of these soils. Total potassium ranged from low to high (mean B10 = 0.74%K; CV = 44%). Variation was high between sites but individual sites were fairly uniform with depth.

Total phosphorus of the surface was medium to high (mean B10 = 0.042% P; CV = 31%). Most sites decreased in total P below the surface, some all the way to 120 cm where some low values were recorded. Surface acid extractable phosphorus ranged from very low to very high (mean B10 = 58 ppm; CV = 130%). This mean was inflated by a couple of high values, as only 3 sites out of 17 exceeded the mean. The sites with medium to low values generally had decreasing acid P with depth. Surface bicarbonate extractable phosphorus ranged from very low to medium (mean B10 = 14.5 ppm; CV = 42%). Most individual sites decreased to 20 cm where very low values predominate. Extractable phosphorus is probably limiting on some sites, but more than sufficient on other sites. Due to the concentration of phosphorus in the surface of the poorer P sites, care must be exercised in using only surface analyses. If soils with low overall P status are cleared, for say Buffel grass establishment, problems may eventuate once the small pool of P (in the surface) is used or lost through erosion and clearing practices. Experience in the Blackall area suggests that long term successful areas had higher phosphorus, while other initially successful areas "faded" after a couple of years..

Organic carbon and total nitrogen were predominantly low, with some very low values (mean B10 = 0.53% C, CV = 27%; 0.049% N, CV = 32%) and values decreased slightly to 20 cm on some sites. Carbon/nitrogen ratios were generally low, varying from 8 to 16 (mean B10 = 11.4; CV = 21%), showing nitrogen mineralisation should be adequate on most sites, although N reserves are low. Total sulphur values were low to very high in the surface increasing, usually substantially, with depth to all very high values at 120 cm. This is due to the presence of gypsum. Total sulphur/nitrogen ratios were often very high due to gypsum content, resulting in a mean S/N ratio of 1.2, with the lowest S/N ratio recorded being 0.27.

Surface extractable iron levels for the five analysed surface soils were all adequate (mean B10 = 66 ppm; CV = 87%). Manganese levels were medium to high (mean B10 = 48 ppm; CV = 91%). Copper levels were all medium (mean B10 = 0.5 ppm; CV = 45%).

Available soil water capacity was generally medium to high in the surface (mean B10 = 11.4%; CV = 18%), increasing with depth on most profiles (mean 60 cm = 15.3%; CV = 17%).

C: Grey and brown clays on alluvia

This soil group is associated with the flood plains of the Thomson, Western and Darr Rivers. These rivers and their tributaries drain the clay plains of the rolling downs and gidgee lands. True alluvial soils, in which soil-forming processes are not apparent, are also included in this group. There are four SPC's involved.

The soils are deep to very deep although shallow types are associated with swamps on the Winton Plateau. The soil surface is often strongly self-mulching and cracks widely when dry. A surface crust may also occur. Gilgais are associated with the alluvial soils of the flooded blackwood and gidgee communities. Soil colour is predominantly grey with brown colours confined to the less frequently flooded areas. Mottling is common and sand bands occur in the profile.

Surface laboratory pH ranged from neutral to moderately alkaline (mean B10 = 7.9). Values increased down most individual profiles (mean 60 cm = 8.7) and moderate at the base of the profile, usually associated with medium to high salt levels. The Ulva SPC had medium acid field pH in the surface and increased sharply beyond 30 cm to strongly alkaline values. This SPC is surrounded by the "Desert Country" and the resultant alluvia reflects its source.

Electrical conductivity and chloride values were very low to low in the surface (mean B10 = 0.06 mS cm^{-1}; 0.002% Cl) increasing sharply below 60 cm to medium and high values at depth (mean 120 cm = 1.08 mS cm^{-1}; 0.104% Cl).

Soils had non saline surfaces and subsoils, although data is limited on subsoils (3 profiles). The Cornish SPC (open woodland) had higher mean EC and chloride values than the Thomson SPC (mitchell grass grassland). Soils were generally non sodic in the surface (mean B10 = 2.9%; CV = 63%) but sodic to strongly sodic in the subsoil (mean 120 cm = 16.4%; CV = 28%).

Surface clay content was high ranging from 47 to 56%, with little variation down individual profiles. Values differred between SPC's. The Cornish SPC had significantly higher ($P < 0.05$) coarse sand contents than Thomson SPC which generally had values less than 5% and as low as 1% coarse sand. While analysed profiles were limited, these results support that described in the field. The Thomson SPC, supporting Mitchell grass open tussock land, could be described as broad alluvia with very low gradients and hence likely to have fine particle (clay and silt) settling. In contrast, the wooded Cornish SPC is upper alluvia with greater gradients and could be expected to have greater water velocities, resulting in deposition of the coarse and fine sand and less silt or clay. Figure 3.8 shows that mean particle size for the group is relatively constant with depth..

CEC/clay values in the profile ranged from 0.75 to 0.93 suggesting highly active 2:1 expanding lattice clay minerals. Soils were base saturated throughout the profile (mean B10 = 98%; CV = 1%). Surface calcium/magnesium ratios ranged from 2.4 to 4.5 (mean B10 = 3.2; CV = 20%). On some sites, the ratio decreased low in the profile. Exchangeable calcium was the dominant cation at all depths in the profiles. Surface exchangeable calcium ranged from 14 to 34 m. equiv. 100 g^{-1} (mean B10 = 23 m. equiv. 100 g^{-1}; CV = 32%). Lowest values occurred on the lighter textured soils of the Cornish and Ulva SPC's. Individual profiles were relatively uniform in calcium with depth, generally following the trend in CEC. Exchangeable magnesium of the surface ranged from 4.7 to 7.6 (mean B10 = 7.0; CV = 23%) with only slight increases or decreases with depth on individual profiles. Magnesium is the sub-dominant cation.

Exchangeable sodium was low in the surface ranging from 0.3 to 2.1 m. equiv. 100 g^{-1} (mean B10 = 0.9; CV = 61%). It increased sharply with depth on all profiles, (mean 120 cm = 6.2 m. equiv. 100 g^{-1}; CV = 29%). A plot of mean cation and CEC values with depth is shown in Figure 3.9. The B10 points include some of the lighter textured soils hence the lower calcium and CEC values than the profile values represented by heavier textured sites only.

Replaceable potassium ranged from medium to very high (mean B10 of 16 sites = 0.7 m. equiv. 100 g^{-1}; CV = 29%) with values decreasing to 20 cm . All values exceeded the 0.2 m. equiv. 100 g^{-1} K critical level. Exchangeable potassium exceeded replaceable potassium on the limited number of sites where values were available. Extractable potassium values indicate no limitation to plant growth. Total potassium of surface soils was generally medium to high (mean B10 of 12 sites = 0.99% K; CV = 30%). Individual profiles were relatively uniform with depth. Generally Thomson SPC had higher surface total potassium than Cornish SPC.

Total phosphorus values were generally medium (mean B10 = 0.036% P; CV = 25%) with values down individual profiles being relatively uniform with depth. Acid extractable P was extremely variable, ranging from very low to very high (mean B10 = 89 ppm P; CV = 78%). Only 2 of the 16 surface sites were less than 20 ppm P, while 11 sites had high to very high P values. The lowest values occurred on the Cornish SPC, and highest on the Thomson SPC. There appeared to be no particular trend with depth on the three analysed profiles, which were all high. Since these soils are neutral to alkaline, bicarbonate extractable P may be a better guide to P availability to plants. Surface bicarbonate extractable phosphorus ranged from very low to high (mean B10 = 22 ppm; CV = 63%), generally decreasing to 20 cm. So that, while some sites may be limiting in phosphorus, the majority of the alluvial clays had both adequate extractable P and good reserves of total P. The mean surface bicarb/acid P ratio for Thomson (B10 = 0.25) was significantly ($P < 0.05$) lower than that for Cornish (B10 = 0.44). However the acid/total P ratio for Thomson (B10 = 0.25) was significantly ($P < 0.05$) greater than Cornish SPC (mean B10 = 0.09).

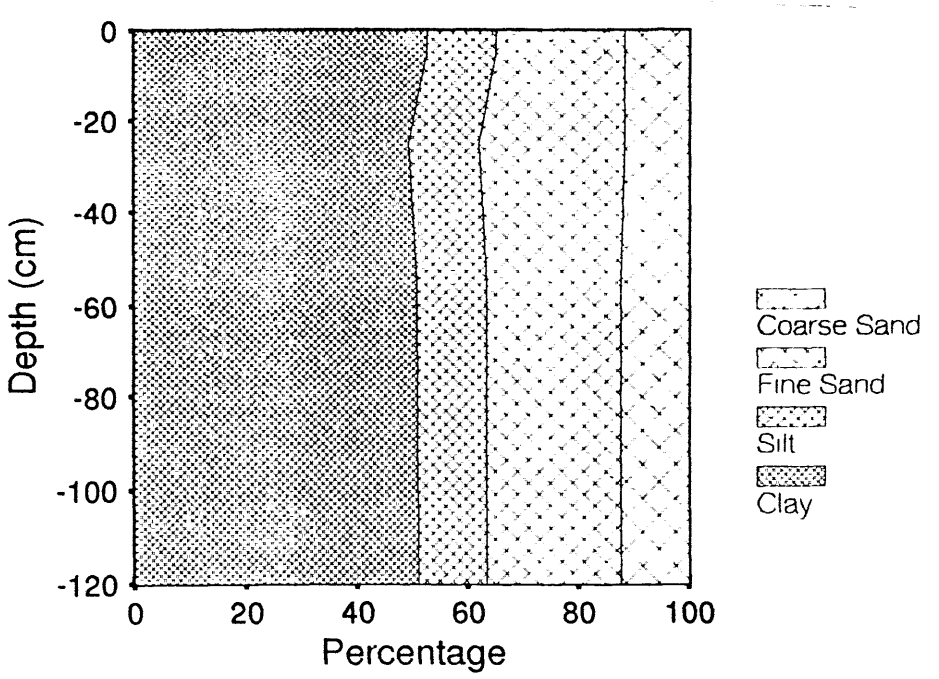

Figure 3.8 Changes in mean particle size with depth for grey and brown clays on alluvia (C)

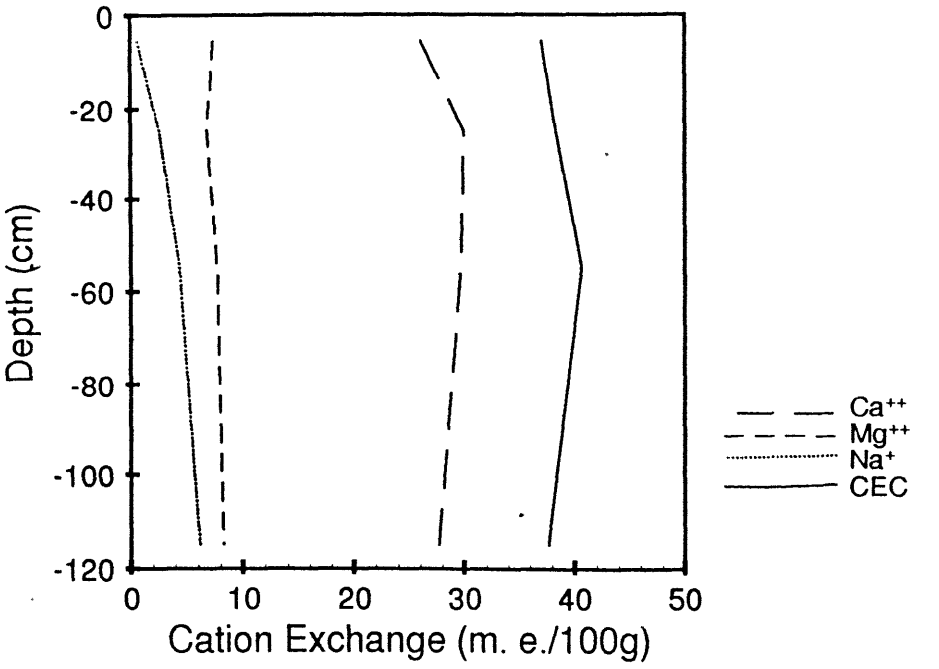

Figure 3.9 Changes in mean cations and CEC with depth for grey and brown clays on alluvia (C)

Surface organic carbon and total nitrogen levels were generally very low to low (mean B10 OC = 0.54, CV = 43%; TN = 0.044%, CV = 36%). Values decrease to 20 cm. Surface C/N ratios range from 9.3 to 16 (mean B10 = 12.2; CV = 17) indicating nett mineralisation of nitrogen should proceed easily on most sites. Total sulphur of surface soils was low to medium (mean B10 = 0.017; CV = 53%) with no values less than the 0.01% S critical value. Values generally increased with depth, particularly in the lower profile when some gypsum occurs. Mean/surface total C:N:S: ratios were 160:10:3.8.

Extractable iron levels of the three analysed surface soils were adequate (mean B10 = 22 ppm, CV = 37%). Manganese was medium (mean B10 = 22 ppm; CV = 23%). Copper was medium (mean B10 = 0.9 ppm; CV = 31%). Zinc was very low to medium (mean B10 = 0.8 ppm; CV = 91%).

Available soil water capacity was medium to high in the surface (mean B10 of 14 sites = 13.8%; CV = 18%). Some profiles remained uniform, while others increased with depth. The Thomson SPC had significantly ($P < 0.01$) higher surface available soil water capacity than Cornish SPC. Calculated plant available water capacity suggests high surface values (mean B10 = 27%), decreasing sharply with depth (mean 60 cm = 7.2%).

D: Scalds

The soils are deep with a characteristic hard, scalded surface. A dense, strong crust occurs on the claypan surface. Infiltration into these soils is very slow and water is either ponded or runs off. Soil colour in the claypans is greyish-yellow brown throughout. Mottling occurs in the subsoil. Scattered stone cover is present on the scalds, especially in the gidgee communities. On scalded alluvia, silt and fine sand may occur at the surface. There is one soil profile class involved. Only six bulk surface samples were analysed in the laboratory and no profile samples for this soil group.

Surface laboratory pH ranged from slightly acid to strongly alkaline (mean B10 = 7.7; CV = 13%). Field pH increased down most individual profiles.

Surface electrical conductivity and chloride values were predominantly very low on the scalds associated with the alluvia, while the scalded site occuring in the gidgee had medium EC and high chloride. Salts were not responsible for creation of these scalds. Surfaces may be non sodic or sodic (mean B10 = 2.0; CV = 103%), while subsoils were expected to be sodic to strongly sodic.

No particle size analyses were available but air dry moisture ranged from 1.6 to 9.5 (mean B10 = 4.3; CV = 63%). This, together with field textures, suggest a wide range of clay contents of surface soils.

Cation exchange capacity of the surface ranged from 11 on the slightly acid site to 40 m. equiv. 100 g^{-1}. Some surface soils were less than fully base saturated (mean B10 = 86%; CV = 22%). Calcium/magnesium ratios ranged from 2 to 8.5 (mean B10 of four sites = 4.8; CV = 57%). Calcium was the dominant cation in the surface with values ranging from 4.3 to 32 m. equiv. 100 g^{-1}. Magnesium was the sub-dominant cation ranging from 2.1 to 6.3 m. equiv. 100 g^{-1}, while sodium was low in the surface ranging from 0.1 to 1.3 m. equiv. 100 g^{-1}.

Surface replaceable potassium of the six sites ranged from medium to very high (mean B10 = 0.65 m. equiv. 100 g^{-1}; CV = 54%). Exchangeable potassium exceeded replaceable potassium on the three sites analysed. Generally extractable potassium levels were adequate for plant growth. Total potassium was low to high in the surface (mean B10 = 0.87% K; CV = 56%).

Surface total phosphorus was medium (mean B10 = 0.041; CV = 25%). Acid extractable phosphorus ranged from low to very high (mean B10 = 51 ppm; CV = 100%). Bicarbonate extractable phosphorus ranged from low to very low (mean B10 = 12 ppm; CV = 45%). Extractable values indicated phosphorus may be a limitation to plant growth on some sites, while other sites have plenty.

Organic and total nitrogen were very low to low in the surface (mean B10 = 0.50% C, CV = 36%; 0.047% N, CV = 45%). Carbon/nitrogen ratios were low ranging from 9.6 to 12.3 (mean B10 = 11; CV = 11%). Total sulphur values were low to medium (mean B10 = 0.018; CV = 28%). Mean surface total C:N:S ratios were 142:10:3.6.

Available soil water capacity of the surface ranged from low to very high (mean B10 of 5 sites = 10.2; CV = 36%). Calculated mean plant available water capacity was much higher (mean B10 = 23.5; CV = 18%).

E: Texture contrast soils on alluvia

The texture contrast soils on alluvia mainly occur in the east where transported material overlies clays. They form an intergrade between the alluvial clay plains and the adjoining sandplains. Two SPC's are involved.

The soils are deep and an A2 horizon is usually present. The surface texture is usually a hard setting sand loam which grades into structured clays. Massive sands may also overlie clays. Pisolitic ironstone may be present throughout the profile or below the A2 horizon. Subsoil colour is predominantly yellow and mottling is common. One representative profile from each SPC was analysed.

Laboratory pH of the surface soil ranged from medium acid to neutral (mean B10 = 6.1). Profiles of the Mundoo SPC had a strong alkaline trend with depth. Shirley SPC had most profile values medium acid to neutral, and only a slight alkaline trend with depth.

Surface electrical conductivity and chloride values were very low and surfaces were non saline and non sodic. Mundoo SPC, which supports gidgee and blackwood open woodland, had medium EC and high chloride. The subsoil is saline and strongly sodic. In contrast, Shirley SPC occurring in the desert, had low EC and chloride values throughout the profile and a non saline, non sodic subsoil. The Mundoo SPC was probably influenced by Cretaceous sediments and its chemical results reflected such an influence.

Clay content was variable in the surface but increased in the B horizon, as expected on texture contrast soils. On the two analysed profiles, coarse sand was the dominant particle size although clay may be dominant in the B horizon. High variability can be expected in this soil group.

Cation exchange capacity was low in the surface as expected (B10 = 5 m. equiv. 100 g^{-1} on the two analysed sites). Values increased sharply within the B horizon of the Mundoo SPC. The CEC/clay ratio increased with depth, suggesting greater Cretaceous influence with depth. In contrast, in the Shirley SPC, CEC increased in line with clay increases and profile CEC/clay ranged from 0.12 to 0.16, thereby suggesting low activity minerals such as kaolinite being predominant.

Generally the Shirley SPC will be non base saturated throughout the profile; calcium, magnesium and sodium will all be low in the profile as CEC remains low throughout. Magnesium will probably increase with depth and may be co-dominant with calcium at depth. The Mundoo SPC had increasing cations with depth in line with increasing CEC and base saturation (also reflected in increasing pH). On the analysed profile, magnesium became strongly dominant and sodium sub-dominant by 30 cm (calcium/magnesium ratio at 30 cm = 0.27).

Surface replaceable and exchangeable potassium were medium (mean B10 = 0.36 m. equiv. 100 g^{-1}; all values exceeded 0.2 m. equiv. 100 g^{-1}). Values decrease with depth and may be less than 0.2 at 20 cm or deeper. There is the potential for potassium to be a limitation to plant growth as it is mainly concentrated in the surface and profile values are usually very low. Total potassium was low to medium.

Total phosphorus was medium to low and decreased with depth. Acid and bicarbonate phosphorus were very low to low in the surface (mean B10 = 12 ppm; 10 ppm respectively) decreasing with depth. Phosphorus is likely to be a limitation to plant growth and any future development on these soils.

Organic carbon was low to very low in the surface (mean B10 = 0.54%; CV = 48%) decreasing substantially with depth. Total nitrogen was very low (mean B10 = 0.033%N; CV = 15%), also decreasing substantially to 20 cm. Carbon/nitrogen ratios are wide, varying from 10 to 23 suggesting nett mineralisation may be difficult on soils with also very low total nitrogen status. Total sulphur values were low, particularly Shirley SPC which had values less than the 0.01% S critical level which has been

suggested as deficient by Andrew *et al.* (1974). Mean total carbon:nitrogen: sulphur ratio of the surface was 203:10:3.3.

Available soil water capacity was low to medium.

F: Texture contrast soils on plains

The texture contrast soils on plains are mainly associated with the eucalypt woodlands on the outwash sandplains and with minor occurrences in the gidgee associations. Five soil profile classes occur in this group.

The soils are moderately deep to deep. The soil surfaces are hard setting sandy loams which grade into strongly structured clay subsoils. Mottling may occur in the subsoil. Gravel content, both on the soil surface and within the profile, varies. Subsoil colour commonly ranges between reds and yellows.

Surface laboratory pH was generally medium acid to neutral (mean B10 = 6.3; CV = 10%). Most profiles increased with depth (mean 120 cm pH = 8.4; CV = 8%), except for the Cherhill SPC, which was medium acid to neutral throughout.

Surface electrical conductivity and chloride were very low in the surface, except for the site belonging to Thorton SPC (Desert Loam). Values at depth were variable ranging from very low to medium. Generally the sites in the desert had low salts, while higher values were often associated with Quaternary sands overlying Jurassic or Cretaceous Beds. Surface soils were non sodic (mean B10 ESP = 2%) but many subsoils were sodic to strongly sodic (mean 120 cm ESP = 22%).

Clay content of the surface ranged from 3 to 18% (mean B10 = 11%; CV = 40%). Clay content increased substantially in the B horizon as expected for texture contrast soils, however the depth of the A horizon varies considerably. The mean clay % at 120 cm = 31% (CV = 25%). Silt levels were less than 11% in the surface (mean B10 = 7%; CV = 41%), with most profiles having fairly uniform silt content with depth (mean 120 cm = 8%; CV = 57%). Fine sand contents of the surface were greater than 25% (mean B10 = 34%; CV = 14%) and values generally decreased in the B horizon (mean 120 cm = 27%; CV = 14%).

Coarse sand was the dominant particle size in the surface, with values greater than 35% (mean B10 = 49%; CV = 14%). Coarse sand decreased in the B horizon when clay % increased, and this decrease was usually greater than the decrease in fine sand. Figure 3.10 showing the relative change in mean particle size with depth, highlights this increase in clay and decrease in coarse sand while little change in mean silt and fine sand occurs. Changes in clay % were more abrupt in individual profiles than indicated by the plot of mean values, since the B horizon occurs at different depths for different sites. For example, one site with a very deep A horizon, had less than 5% clay to 60 cm.

Cation exchange capacities of the surface soils were less than 8 m. equiv. 100 g^{-1} (mean B10 = 5; CV = 34%). Values increased on individual profiles coinciding with increases in clay content of the B horizon.

Profile CEC/clay ratios varied from 0.22 to 0.76. The lower ratios usually occurred in the desert SPC's, Ludgate and Cherhill. Because the higher ratios are associated with low clay and CEC values (which makes the ratio subject to greater error) the result should be treated with caution. The higher ratios were associated with low clay and CEC values and may be in error. The highest CEC/clay ratios for B horizon material was 0.55 and the lowest 0.22. The texture contrast soils in the desert had a high proportion of kaolinitic clay minerals, while the other texture contrast soils probably have a contribution from more active clay minerals.

Soils were generally non base saturated in the surface (mean B10 = 73%; CV = 49%). Calcium/magnesium ratios of most surfaces were greater than one (range 8 to 0.9), but some profiles had ratios less than one at depth. Surface exchangeable calcium was variable between sites ranging from 0.9-6.0 m. equiv. 100 g^{-1} (mean B10 = 2.5; CV = 72%). Values usually increased down the profile (Figure 3.11) as CEC and clay increased in the B horizon. In some of the profiles with acid surfaces, exchangeable calcium increased also as base saturation increased. In a minor number of profiles, magnesium became co-dominant or dominant at depth.

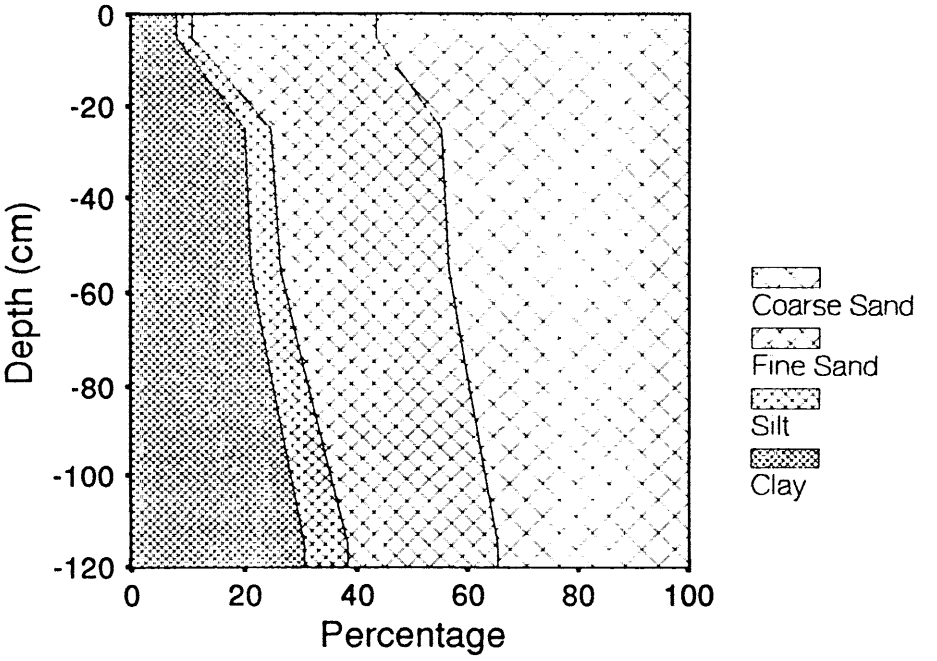

Figure 3.10 Changes in particle size with depth for texture contrast soils on plains (F)

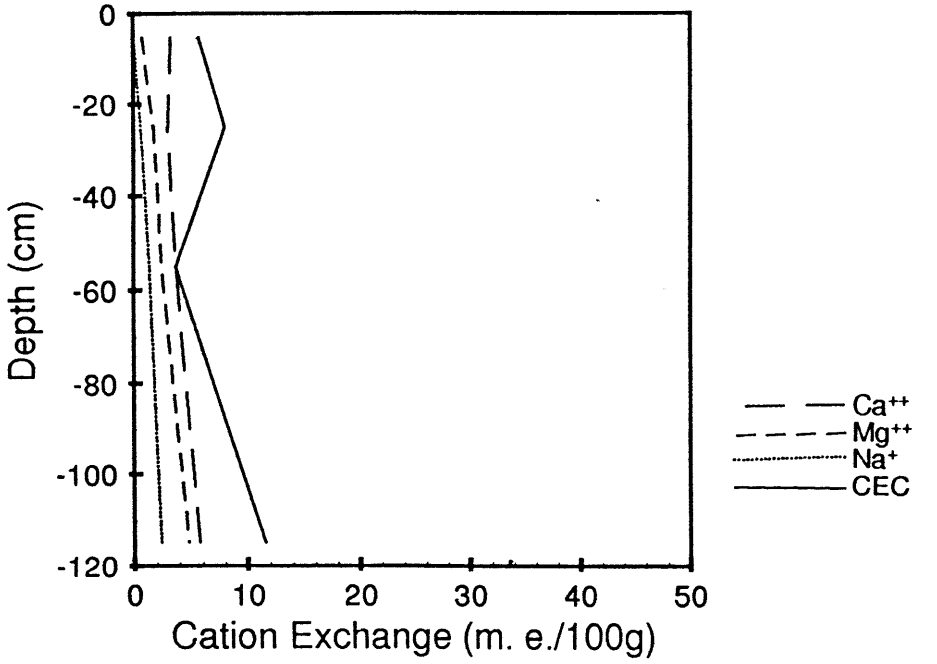

Figure 3.11 Changes in mean cations and CEC with depth for texture contrast soil on plains (F)

Some exchangeable calcium values at depth were inflated by gypsum. Exchangeable magnesium of the surface ranged from a very low 0.1 to 1.7 m. equiv. 100 g^{-1} (mean B10 = 0.97; CV = 58%). All seven analysed profiles increased sharply with depth (mean 120 cm = 4.8; CV = 32%).

Exchangeable sodium was very low in the surface of all sites (mean B10 = 0.1 m. equiv. 100 g^{-1}) and remained low throughout some profiles. Other profiles had very steep increases in exchangeable sodium with depth to where it became equal to magnesium and even calcium. The combination of high sodium, magnesium and lower calcium, leads to poor physical properties such as drainage of the clayey B horizon. Although some low surface values for magnesium occurred, it is unlikely to be a fertility problem as values increase sharply with depth.

Replaceable and exchangeable potassium values ranged from low to high (mean B10 = 0.29 m. equiv. 100 g^{-1}, CV = 53%; 0.31, CV = 46% respectively). Five of the 17 surface samples analysed for replaceable potassium were substantially less than 0.2 m. equiv. 100 g^{-1} K (critical value of Crack and Isbell 1970). Most of these low K sites occurred in the Cherhill SPC of the desert, and potassium could be a limitation to plant growth. Both replaceable and exchangeable potassium decreased below the surface, however exchangeable potassium increased again in the base of some profiles of the Coorabah SPC. This is probably due to Quarternary sand overlying Jurassic or Cretaceous beds. Surface total potassium was low to medium (mean B10 = 0.32 1%; CV = 34%). Individual profiles increased in total K with depth, most changes occurring as clay % increases. Coorabah SPC generally had higher values than the other SPC's, particularly at depth.

Surface total phosphorus was medium to low (mean B10 = 0.024% P; CV = 42%). Values decreased down most individual profiles (mean 120 cm = 0.016% P; CV = 31%). Thirteen of the 17 surface samples analysed for acid and bicarbonate extractable phosphorus were very low (mean B10 = 12 ppm acid P, CV = 132%; 9 ppm bicarb. P, CV = 129%). Values decreased with depth in all profiles. Phosphorus is likely to be limiting to plant growth and/or establishment on the majority of these soils.

Surface organic carbon levels were low to very low (mean B10 = 0.53; CV = 23%), with values decreasing substantially to 20 cm (mean = 0.34; CV = 18%). Surface total nitrogen levels were very low to low (mean B10 = 0.03% N; CV = 33%) decreasing to 20 cm (0.024; CV = 38%). Coorabah SPC supporting gidgee and Reid River box had the highest carbon and nitrogen levels of the SPCs. Carbon/nitrogen ratios were wide varying from 11 to 26 (mean B10 = 19; CV = 21%). Nett mineralisation of nitrogen is likely to be difficult on many sites. Surface total sulphur values were low (mean B10 = 0.011% S; CV = 27%). Five of the ten analysed sites had values less than 0.01% S, the critical value of Andrew *et al.* (1974). This suggests sulphur may be a fertilty limitation on some soils, particularly Ludgate SPC. Total sulphur values generally increased with depth, probably due to gypsum. Sulphur/nitrogen ratios are high, (mean B10 C:N:S ratios = 242:10:3.9).

Extractable iron levels of the surface of four analysed sites for trace elements, was adequate (mean B10 = 17.8 ppm; CV = 29%). Manganese levels were medium (mean B10 = 17.8; CV = 30%). Copper was medium to low (mean B10 = 0.55%; CV = 26%). Zinc levels were low to medium (mean B10 = 0.53 ppm; CV = 54%).

Soil available water capacity was very low to low in the surface (mean 4.3%; CV = 28%) generally increasing slightly with depth (mean 60 cm = 6.0; CV = 28%).

G: Red clays on plains (mulga)

The red clays on the plains occur in the western sector on Cretaceous Winton Formation sediments. The soils are associated with groved mulga and are of minor importance. Only one SPC is involved.

The soils are deep and slump holes are common. A surface crust is usually present. Soil colour ranges from reddish brown to orange with few colour changes down the profile. The soils are only weakly structured. Ironstone inclusions occur in the profile with silcrete and ironstone gravel on the soil surface.

Surface laboratory pH was typically strongly acid to slightly acid, with an alkaline trend low in the profile where mildly alkaline to neutral values may occur. One site was moderate to strongly

alkaline throughout the profile. This range of pH values with depth appears to be characteristic of the red clays supporting mulga. Similar results were found by Dawson and Ahern (1974) in south-western Queensland.

Electrical conductivity and chloride values were very low throughout the profile. These soils were non saline and non sodic throughout.

Clay contents usually increased with depth (mean B10 = 33% clay; mean 120 cm = 44%). Mean cation exchange capacity of the surface was low (mean B10 = 8.5) increasing if clay % increased. Clay activity was low, with CEC/clay ratios of profile depths varying from 0.14 to 0.30. This indicates kaolinitic type clay minerals are dominant. Soils were generally unsaturated (mean B10 = 38%), although base saturation may occur at the base of the profile of some of the deeper alkaline soils which may contain lime.

Surface calcium levels were low (mean B10 = 1.4 m. equiv. 100 g^{-1}) while profiles were either uniform or increase with depth. Surface magnesium was usually lower than calcium but may be co-dominant with calcium. Magnesium increased substantially with depth. Exchangeable sodium was usually low throughout the profile.

Surface replaceable potassium of the four sites was medium to high (mean B10 = 0.56 m. equiv. 100 g^{-1}; CV = 16%). Where analyses were done, exchangeable potassium values exceeded replaceable potassium. Extractable potassium does not appear to be a fertility limitation on these soils. Total potassium was low to medium (mean B10 = 0.49% K; CV = 31%). Individual profiles remained relatively uniform with depth.

Total phosphorus was medium in the surface (mean B10 = 0.037; CV = 27%) with values decreasing substantially with depth. Acid and bicarbonate extractable phosphorus were low to very low in the surface (mean B10 acid P = 11.5 ppm, CV = 51%; bicarb. P = 10 ppm, CV = 50%). Values decreased sharply at 20 cm and were very low for remainder of the profile. This is typical of red clays supporting mulga in other Western Queensland surveys (Ahern and Wilson 1990).

These soils have most of the extractable phosphorus concentrated in the surface due to vegetation cycling and are prone to loss, of an already limiting nutrient, by wind and water erosion, or effects of clearing. Selective clearing only may be used, because maintenance of ground cover and an appreciable shrub cover are important to long term stability.

Surface organic carbon and total nitrogen levels are low to very low (mean B10 = 0.61 % C, CV = 31%; 0.042% N, CV = 43%). Values decreased to the 20 cm depth. Carbon/nitrogen ratios ranged from 19 to 13 (mean B10 = 15.3; CV = 43%). This suggests nett mineralisation of nitrogen should proceed on most sites, but may be a problem on those with the higher ratios. Surface total sulphur values were low to medium (mean B10 = 0.014% S; CV = 43%). Mean total C:N:S ratio of the surface was 198:10:3.6.

Extractable iron of the two analysed sites appeared adequate (mean B10 = 23 ppm). Manganese levels were medium (mean B10 = 39 ppm) with copper and zinc also medium (mean B10 = 0.8 ppm Cu; 1.2 ppm Zn).

Surface available soil water capacity was low to medium (mean B10 = 7.8%; CV = 32%). Values for calculated plant available water capacity of the surface were much higher (mean B10 = 21.7%; CV = 14%); PAWC values decreased while little change occurred in the available soil water capacity values with depth.

H: Loamy red earths

The loamy red earths occur on sandplains and intact tablelands and support predominately mulga shrublands. Only one SPC is involved. These soils are predominantly sandy in texture with clay content increasing gradually with depth. The soil surface is usually a hard-setting, massive sandy loam which grades into a sandy clay loam and sandy light clay. A surface crust may also occur. The soil profile is generally reddish brown to red in colour, with a darker A1 horizon. Ironstone occurs on

the soil surface and throughout the profile. Pisolitic ironstone occasionally occurs as a layer at the base of the soil profile.

Surface laboratory pH for the eight analysed sites was very strongly acid to slightly acid (mean B10 = 5.6; CV = 10%). Individual profiles were generally uniform with depth, but alkaline values may occur in the base of profiles. Similar occurrences have been reported on loamy red earths in surveys of Western Queensland such as Dawson and Ahern (1974) and Ahern and Wilson (1990).

Generally, electrical conductivity and chloride values were very low throughout the profiles. With exception of one site, all values were less than 0.15 mS cm^{-1} and 0.01% Cl. Soils were non saline and non sodic throughout.

Surface clay % on the two analysed profiles was about 29%, increasing to 37% at 60 cm. Silt levels were less than 11%, fine sand approximately 20-30% and coarse sand 30-40%. A plot of mean particle size with depth (Figure 3.12) shows that the increase in clay % to 60 cm depth is at the expense of coarse sand content, there being little change in the mean silt and fine sand values.

Cation exchange capacity of the surface was low (mean B10 = 8.0 m. equiv. 100 g^{-1}; CV = 28%). Organic matter was a major contributor, as CEC usually decreased below the surface, despite the higher clay content. Profile CEC/clay ratios ranged from 0.17 to 0.22, showing a high proportion of low activity, kaolinitic type clay minerals.

Surface soils were not base saturated (mean B10 = 52%; CV = 63%) but base saturation usually increased with depth. Calcium/magnesium ratios were greater than one (mean B10 = 3.4; CV = 68%). Exchangeable calcium levels ranged from 1.4 to 3.0 m. equiv. 100 g^{-1} (mean B10 = 1.9; CV = 33%). Calcium was the domininat basic cation at all depths, although hydrogen may be substantial on the more acid sites. Magnesium values ranged from 0.2 to 1.3 in the surface (mean B10 = 0.85; CV = 47%). As some profile values were even lower than the surface, magnesium could be a limitation to the fertility of these soils. Exchangeable sodium values were very low throughout the profiles.

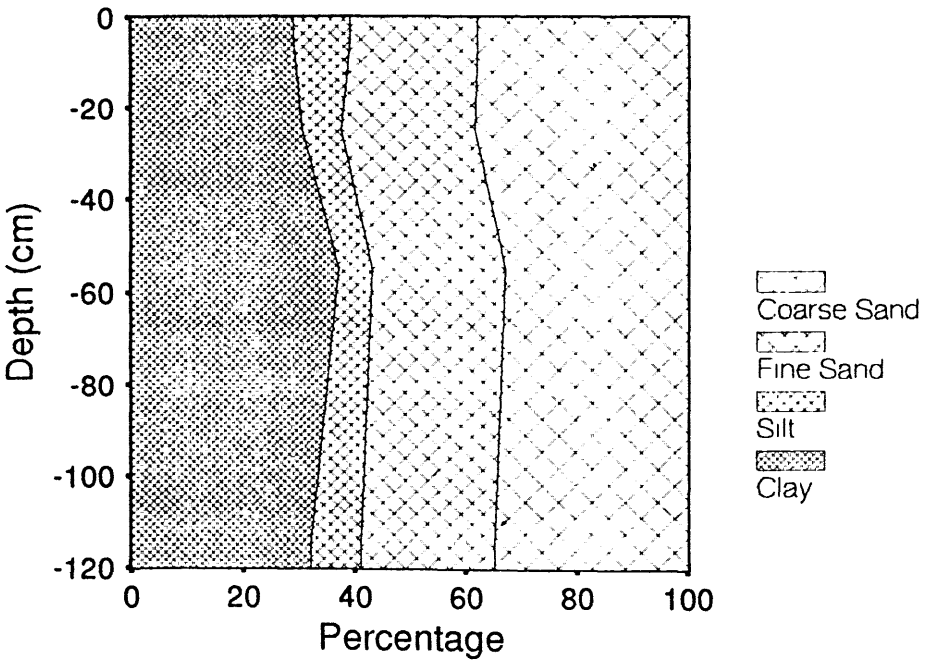

Figure 3.12 Changes in particle size with depth for loamy red earths (H)

Surface replaceable potassium values were very low to high (mean B10 = 0.44; CV = 35%). Values at 20 cm depth were only slightly lower than the surface. On those sites where exchangeable potassium was also determined, it was always higher than the replaceable K value. As only one site in nine had replaceable potassium less than 0.2 m. equiv. 100 g^{-1}, potassium is generally sufficient for plant growth. Total potassium was low (B10 = 0.38% K; CV = 15%) with little variation between or down profiles.

Total phosphorus was medium in the surface (B10 = 0.035% P; CV = 23%), generally decreasing down individual profiles to low values. This reflects the mulga vegetation cycling phosphorus to the surface via leaf and litter drop. Acid extractable phosphorus of the nine surface samples was low to very low (mean B10 = 10 ppm; CV = 48%). Values decreased sharply below the surface to 2 ppm by 60 cm. Bicarbonate phosphorus was very low to low in the surface (mean B10 = 7.4 ppm; CV = 57%), decreasing by 20 cm.

These values indicate that extractable, and to a lesser extent, total phosphorus is concentrated in the surface soil by vegetation cycling. Phosphorus would be a limitation to plant growth on most sites, and particularly to establishment of nutritious grasses. Loss of a few centimetres of surface soil through erosion or clearing practices could result in the loss of a major proportion of an already limiting element. Management practices must be geared to prevent overclearing and overstocking of the mulga lands as the mulga vegetation provides a valuable drought reserve.

Surface organic carbon levels were low, with only one very low site (mean B10 = 0.68; CV = 29%). Values generally decreased to 20 cm. Total nitrogen values were very low to low (mean B10 = 0.04% N; CV = 33%). Carbon/nitrogen ratios were variable ranging from 13 to 30 (mean B10 = 17.7; CV = 27%). Many sites appear to have low potential for nett mineralisation of nitrogen. Surface total sulphur values were low (mean B10 = 0.012% S; CV = 33%). While only one site was less than 0.01% S, others are close, suggesting sulphur may be a fertility limitation in some sites. Mean total carbon:nitrogen:sulphur ratio of the surface soil was 231:10:3.0.

Only one site was analysed for extractable trace elements. Manganese, copper and zinc levels were all medium while iron was marginal.

Available soil water capacity was low to very low (mean B10 = 5.6%; CV = 21%). Most profile values appear to be even lower than the surface.

I: Sandy red earths

Sandy red earth soils occur on undulating to flat sandplains formed from undifferentiated Quaternary deposits. They support eucalypt low open woodland. Only one SPC has been identified. Soils are deep, massive, with loose or hard setting and crusted surfaces. Weak structure may occur at depth. Surface soils may be sandy-loam to loamy-sand texture.

Surface laboratory pH of the six analysed samples was medium acid to neutral (mean B10 = 6.4; CV = 8%) with individual profiles being uniform with depth (mean 120 cm = 6.6; CV =6%).

Electrical conductivity and chloride was very low on the surface and throughout all five profiles (mean B10 = 0.027 mS cm^{-1}, CV = 19%, Cl = 0.001%; mean 120 cm = 0.02 mS cm^{-1}, CV = 30%, Cl 0.001%). Soils are non saline and non sodic. Some exchangeable sodium percentages appear sodic but this is probably due to calculating ESP on sites with very low CEC values (5 and as low as 1 m. equiv. 100 g^{-1}).

Surface clay content of the five analysed profiles range from 4 to 18% (mean B10 = 13%; CV = 37%). Clay % increases down all profiles (mean 120 cm = 25%; CV = 39%). Silt levels were low throughout profiles (mean B10 = 6%, CV = 27%; 120 cm = 5%, CV = 52%). Individual profiles are fairly uniform with depth.

Fine sand contents were less than 36% in the surface (mean B10 = 27%; CV = 26%), decreasing to less than 25% at 120 cm (mean =21%; CV = 5%). Coarse sand is greater than 45% in the surface (mean B10 = 55%; CV = 20%) decreasing on some profiles with depth mean 120 cm = 46%; CV = 22%. By reference to Figure 3.13 a plot of mean PSA with depth, it can be seen that generally the increase in clay % with depth was largely accommodated by decrease in coarse sand and to a minor extent fine sand. Mean silt contents were uniform with depth. Coarse sand was the dominant particle size.

Cation exchange capacities of the six surface samples range from 2 to 6 (mean B10 = 4 m. equiv. 100 g^{-1}; CV = 29%), but most, individual profiles are uniform with depth, except where large increases in clay content occurs. Profile CEC/clay ratios range from 0.08 to 0.42 (mean 120 cm = 0.25; CV = 26%). This shows that low activity, kaolinitic minerals predominate. Surface soils are not generally base saturated (mean B10 = 81%; CV = 46%).

Calcium/magnesium ratios were all greater than one except at 120 cm on some profiles, (mean B10 = 3.0, CV = 49%; mean 120 cm = 1.2, CV = 43%). Surface exchangeable calcium ranges from 0.7 to 3.6 (mean B10 = 2.0 m. equiv. 100 g^{-1}; CV = 43%). Calcium increased down the profile on some sites when CEC increased, while other sites were variable. Calcium was the dominant basic cation for most depths. Surface magnesium values ranged from 0.4 to 2.0 m. equiv. 100 g^{-1} (mean B10 = 0.8; CV = 70%). Some sites increase substantially with depth as clay content and CEC increase, but sites with low CEC often decrease in magnesium with depth. Magnesium may be co-dominant or dominant at the base of some profiles. Some of the lower CEC sites may have insufficient soil magnesium for good plant growth. Surface exchangeable sodium levels are very low (mean B10 = 0.07; CV = 36%). Most sites remain low throughout the profile. Figure 3.14 shows the mean cations and CEC plotted by depth. The exchangeable sodium line is not evident in the figure as it is so low that it plots against the y axis.

Replaceable and exchangeable potassium values are very low to high (mean B10 = 0.3; CV = 47%), remaining fairly uniform with depth. Half of the six sites have replaceable and exchangeable potassium values in the upper 30 cm of the profile less than 0.2 m. equiv. 100 g^{-1}. Thus potassium may be a limitation to the fertility of these soils although other elements may be more crtitical first. Surface total potassium values are low (mean B10 = 0.283% K; CV = 34%). Values increase with depth on those profiles which have a significant increase in clay content (mean 120 cm = 0.55% K; CV = 49%).

Surface total phosphorus is low to medium (mean B10 = 0.019% P; CV = 26%). Most individual profiles have little change with depth although increases may occur at 120 cm. Surface acid extractable phosphorus is very low, with only one site greater than 10 ppm (mean B10 = 6.5 ppm; CV = 51%). Values decrease sharply below the surface reaching 2 ppm by 30 cm. All bicarbonate extractable phosphorus values are very low in the surface (mean B10 = 4.5 ppm; CV = 53%) also reducing sharply with depth. Both extractable methods indicate phosphorus as a limiting element for soil fertility of the sandy red earths.

Surface organic carbon levels are low to very low, with one medium site (mean B10 = 0.71; CV = 50%). Values decrease sharply to 20 cm (mean = 0.32; CV = 18%). Total nitrogen values are very low to low (mean B10 = 0.032% N; CV = 20%) reducing even further to 20 cm (mean = 0.020 % N).

Carbon/nitrogen ratios may be very high, (mean B10 = 22; CV = 49%) with the highest C/N ratios occuring on sites involving spinifex vegetation. Turner and Ahern (1980) in the "Desert" country to the south (supporting spinifex) also noted high C/N ratios. Surface total sulphur levels are low to very low (mean B10 = 0.007% S; CV = 29%). All six B10 samples are less than or equal to 0.01% S. Thus sulphur appears to be another element limiting the fertility of these soils. An increase in total sulphur values occurs with depth on the sites with increasing clay content, while a decrease occurs on the sandier sites. Mean total carbon:nitrogen:sulphur ratio of the surface is 292:10:2.0 and is subject to much variation. The mean ratio at 20 cm is an improvement to 231:10:3.6 particularly for N/S ratio.

All five sites analysed for extractable iron appear adequate (mean B10 = 18 ppm; CV = 70%). Manganese is medium (mean B10 = 25 ppm; Cv = 25%). Copper and zinc levels are medium to low (mean B10 = 0.4 ppm Cu, CV = 49%, 0.7 ppm Zn, CV = 44%).

Available soil water capacity is very low to low in the surface (mean B10 = 3.8%; CV = 46%) generally increasing slightly with depth (mean 60 cm = 5%; CV = 28%).

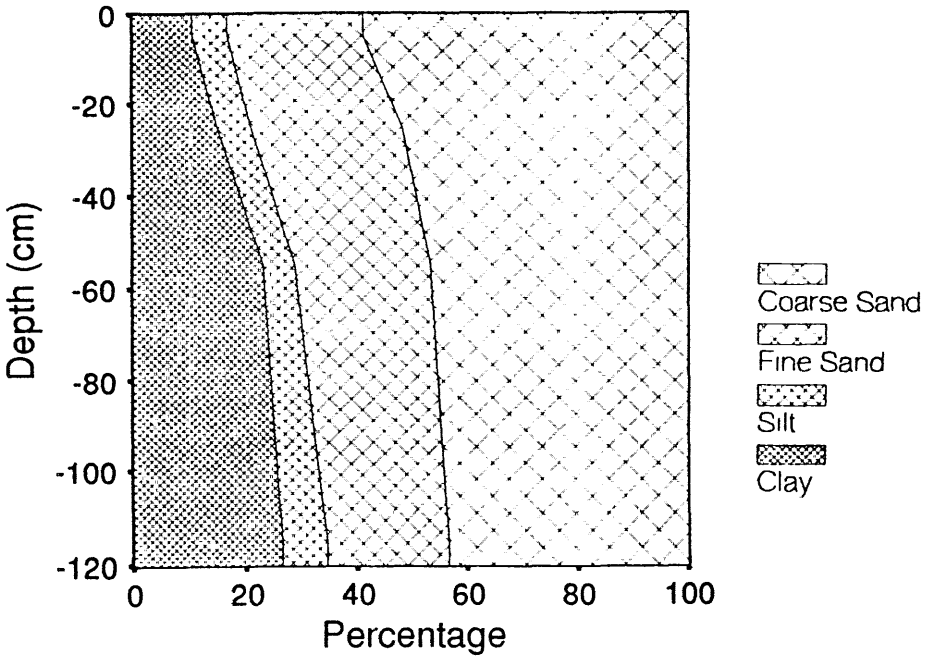

Figure 3.13 Changes in mean particle size with depth for sandy red earths (I)

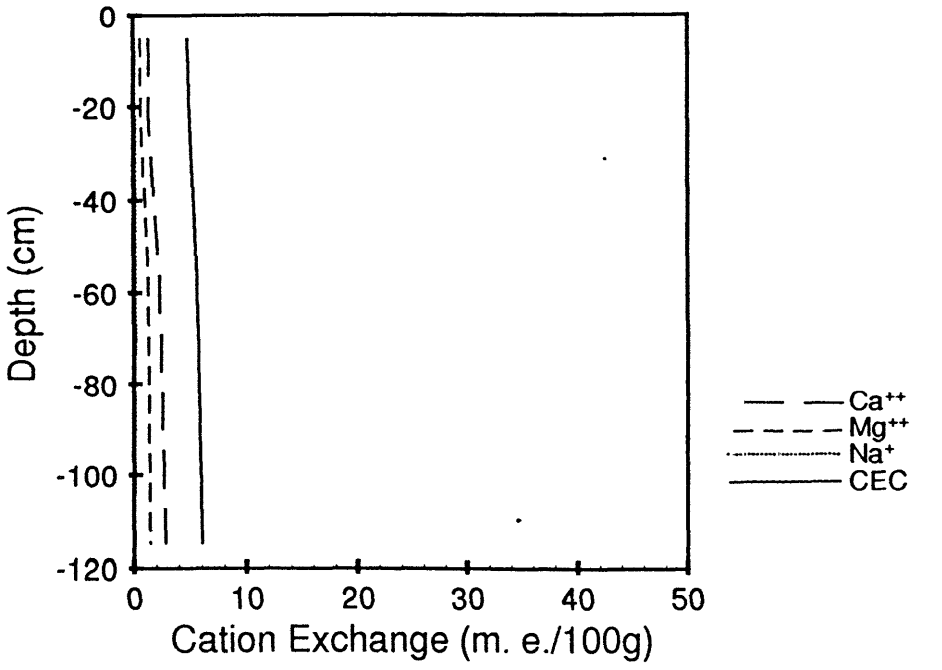

Figure 3.14 Changes in mean cations and CEC with depth for sandy red earths (I)

J: Yellow earths

Yellow earths are closely associated with the red earths of the eucalypt spinifex woodlands of the eastern sandplains. Only one soil profile class is involved. The soils are usually deep although gravelly shallow types occur. Surface textures range from loamy sands to sandy loams and clay content increases gradually with depth. The surfaces are hard-setting and a surface crust is common. Soil colour ranges from greyish - brown at the surface to brown and yellowish - brown in the subsoil. Scattered ironstone concretions occur on the soil surface and often occur in the soil profile.

Laboratory soil pH was relatively uniform for this group, both between sites and down individual profiles. Surface pH ranged from medium acid to slightly acid (mean B10 = 6.1; CV = 5%).

Electrical conductivity and chloride were very low throughout (mean B10 = 0.027 mS cm^{-1}, CV = 44%; Cl = 0.002%, CV = 1%). Soils were non saline and non sodic.

Only one profile was analysed for particle size. Profile values ranged from 6-11% for clay, 6-7% for silt, 19-17% fine sand and 54-62% high coarse sand.

Cation exchange capacity was very low (3-4 m. equiv. 100 g^{-1}) throughout the only analysed profile. Soils were generally unsaturated with respect to base cations. Calcium/magnesium ratio on the one analysed profile reduced sharply from 1.4 in the surface to 0.3 at 120 cm. Exchangeable calcium values were low, being approximately 1 m. equiv. 100 g^{-1} in the surface and reducing to 0.4 at depth. Magnesium increased from a value less than calcium to be much higher at depth. Calcium and possibly magnesium levels may be insufficient for good plant growth. Sodium levels were very low throughout the profile.

Replaceable potassium on the three analysed surface sites was low to medium in the surface (mean B10 = 0.23 m. equiv. 100 g^{-1}; CV = 22%). Although only one of the three sites was less than 0.2 m. equiv. 100 g^{-1} K, values decrease sharply with depth and potassium could be a limitation to good plant growth on some soils. In addition total potassium was low throughout the one analysed profile (0.35% K).

Total phosphorus was low (mean profile = 0.17%). Acid and bicarbonate extractable phosphorus values are very low (all less than 3 ppm). Thus phosphorus is another limiting element to plant growth on these soils.

Organic carbon levels were low to very low (mean B10 = 0.47; CV = 35%), while all total nitrogen values were very low (mean B10 = 0.030% N; CV = 0%). Carbon/nitrogen ratios were variable (mean B10 = 15.5%; CV = 30%) indicating nett mineralisation of nitrogen may be difficult on the higher ratio soils, particularly with the low total nitrogen levels. Total sulphur values were low, decreasing with depth. All values being less than 0.01% S, indicating possible sulphur limitations on these soils. Carbon:nitrogen:sulphur ratio was 202:10:2.6.

The only site analysed for moisture characteristics showed very low available soil water capacity in the surface (4%) decreasing even further with depth (3%). In summary: The yellow earths have very low fertility and poor water holding capacity, and as a result, only drought resistant, low nutritous, adapted native vegetation is prevelant..

K: Siliceous sands

Siliceous sands occur on the sandplains of the eucalypt woodlands and to a limited extent on alluvia. The three SPC's have quite different vegetations, reflecting position in landscape.

Soils are deep to very deep, especially on transported alluvial deposits or dune remnants. The soil surface is characteristically loose and a fragile crust may be present. Soil colour varies widely. Red colours are associated with the outwash sandplains below tablelands, while lighter yellowish - brown colours occur near or on alluvia.

Laboratory pH of the nine surface soils ranged from strongly acid to neutral (mean B10 = 6.1, CV = 6%). Individual profiles generally remained uniform with depth, although a slight increase occurs at the base of some profiles.

Electrical conductivity and chloride values were very low throughout (mean B10 = 0.028 mS cm^{-1}; CV = 107%; Cl = 0.001%). Soils were non saline and non sodic.

Two profiles from Wowra SPC were analysed for particle size. These showed very low clay content (2-8%), very low silt (1-4%), moderate fine sand (11-45%) and very high coarse sand (43-83%). Cation exchange capacities of the three surface samples range from 2 to 4 m. equiv. 100 g^{-1} decreasing sharply below the surface. Organic matter makes a major contribution to the CEC.

Surface soils were generally not base saturated (mean B10 = 62%; CV = 46%). Calcium/magnesium ratios were greater than one in the surface (mean B10 = 5; CV = 58%) reducing sharply with depth (mean 120 cm = 0.7; CV = 45%). Surface exchangeable calcium levels ranged from 0.8 to 2.1 m. equiv. 100 g^{-1}, reducing sharply with depth. Magnesium levels were even lower than Ca in the surface (0.1 to 0.5), but may increase with depth. Both calcium and magnesium are probably limiting to plant growth. Sodium levels were extremely low throughout the profiles. This low level of cations is expected on coarse textured soils with very low colloid content.

Surface replaceable potassium values are very low to low, with only one of the nine sites being greater than 0.2 m. equiv. 100 g^{-1} (mean B10 = 0.12; CV = 39%). Values are even lower at 20 cm depth. On the few sites where both replaceable and exchangeable potassium were determined, exchangeable K values were either equal to, or slightly greater than corresponding replaceable K measurements. Soil potassium levels suggest a fertility limitation on most of these soils. Total potassium values are low (mean B10 = 0.19% K; CV = 15%). There appears to be little change with depth.

Acid and bicarbonate extractable phosphorus are very low throughout the profile (mean B10 acid P = 2.8 ppm; CV = 50%; bicarb. P = 2.2 ppm, CV = 19%). Thus phosphorus would be a major limitation to fertility on these soils. Total phosphorus was low in the surface (mean B10 = 0.013% P; CV = 15%). Values reduce considerably with depth.

Organic carbon levels were low to very low in the surface (mean B10 = 0.45; CV = 29%) reducing even further by 20 cm. Total nitrogen values were all very low in the surface (mean B10 = 0.028 % N; CV = 29%) and even lower at 20 cm. Carbon/nitrogen ratios vary widely from 8 to 24 (mean B10 = 17; CV = 28%) but most were high, indicating difficulty in nett mineralisation of nitrogen, particularly from such low values. Total sulphur values were low to very low (mean B10 = 0.005% S), and there appears to be little change with depth. All values were less than the 0.01% S suggested as limiting by Crack and Isbell (1970), so that sulphur is probably another fertility limitation on these soils. Mean total carbon:nitrogen:sulphur ratio of the surface is 223:10:1.9.

Only one site was analysed for extractable trace elements and its results indicated adequate iron, medium manganese and low copper and zinc.

Available soil water capacity of the soils was very low (mean B10 = 2%; CV = 41%) reducing even further with depth.

In summary, there does not appear to be any apparent difference between the chemical properties of the three soil profile classes. The siliceous sands have very low fertility, extremely low water holding capacity and can only support adapted native vegetation.

L: Lithosols

Lithosols are widespread in the south-west in the dissected residual land zone. They are very shallow, often covered by silcrete and ironstone rubble. Only one SPC exists.

Laboratory pH of the five surface samples range from very strongly acid to medium acid (mean B10 = 5.3; CV = 6%). The shallowest sites were usually the most acid.

Electrical conductivity and chloride values were very low (mean B10 = 0.036 mS cm^{-1}, CV = 58%; Cl = 0.002%, CV = 50%). Soils are non saline and non sodic.

Cation exchange capacities were variable but can be relatively high for the low clay content, mainly due to the contribution of organic matter.

Soils were non base saturated (mean B10 = 40%; CV = 23%). Calcium/magnesium ratios vary from less than 0.5 to 1.0 and can be expected to vary widely. Exchangeable calcium and magnesium levels vary considerably, being dependent on soil parent material and litter drop. Analysed sites ranged from 1.1 to 1.8 m. equiv. 100 g^{-1} calcium while magnesium values were 1.8 to 2.2. Exchangeable sodium is very low as expected.

Replaceable potassium values were medium to very low (mean B10 = 0.2 m. equiv. 100 g^{-1}; CV = 49%). Three of the five analysed sites were less than 0.2 m. equiv. 100 g^{-1}. This, combined with the shallow depth of the soils, suggests that potassium may be a limitation to the fertility of the soil. The limited data for exchangeable potassium shows this method to give higher results than the replaceable potassium method. Total potassium is medium (mean B10 = 0.30% K; CV = 26%).

Total phosphorus was medium (mean B10 = 0.04% P; CV = 25%). Acid and bicarbonate extractable phosphorus were very low to medium (mean B10 acid P = 13 ppm, CV = 50%; bicarb. P = 12 ppm, CV = 63%) and both acid and bicarbonate P levels were almost identical on all five analysed sites. Phosphorus is likely to be a fertility limitation, particularly as soils are very shallow and most nutrients come from recycling of litter in the shallow soil.

Organic carbon levels were low to very low (mean B10 = 0.05%; CV = 37%). Total nitrogen was very low to low (mean B10 = 0.036% N; CV = 22%). Carbon/nitrogen ratios have a limited range (mean B10 = 13.8; CV = 19%) and appear to favour nett nitrogen mineralisation. Total sulphur values were medium to low, with all values greater than 0.01% S (mean B10 = 0.029% S; CV = 31%). This, combined with the high S/N ratio of 0.82, suggests no fertility limitation due to sulphur. Mean carbon:nitrogen:sulphur ratio is 180:10:8.2.

Available soil water capacity was low (mean B10 = 6.7%; CV = 7%).

In summary, the lithosols have shallow depths and low water storage which, together, with low fertility, limit them to adapted vegetation. They are particularly dependent on recycling of nutrients from leaf litter. The *Acacia* shrubs and other wooded species extract moisture by exploiting every crevice in the rocks/weathering material beyond the soil layer in order to survive.

M: Miscellaneous

Predominantly clays, these soils occur scattered over the area. The SPC of the scarp footslopes contains gravelly light clays, usually with silcrete cover. Drainage is adequate. By contrast, the claypan SPC has poor drainage, scalded surfaces and strongly alkaline subsoils. Salt springs occur.

Soil pH was dominated by the effects of salt on the profile and a considerable range (medium acid to strongly alkaline) may be encountered. One site had pH of 9.5 and greater than 10 in the profile. Electrical conductivity and chloride were variable, dependent largely on the location of the sample site. Surface values ranged from low to very high (mean B10 = 1.26 mS cm^{-1}, CV = 65%; Cl = 0.18%, CV = 72%).

Surface soils were mainly saline and sodic, while subsoils varied from sodic or strongly sodic and non saline, to sodic and saline. Highest ESP recorded was close to 100% on the site with pH 10 (salt spring near).

Cation exchange capacities were variable, dependent partly on textured changes. Potassium appears to be sufficient, while phosphorus is more variable with some sites low and others high. Bicarbonate extractable phosphorus values are very low throughout and this test is usually a more reliable indication of plant availability on alkaline soils. Total nitrogen and organic carbon are very low on the bare sites.

REFERENCES

Ahern, C.R. and Wilson, P.W. (1990). Soils, In *Western Arid Regional Land Use Study - Part VI*, Queensland Department of Primary Industries, Division of Land Utilisation Bulletin No. 28.

Andrew, C.S., Crack, B.J. and Rayment, G.E. (1974). Queensland Chapter, in K.D. McLachlan (Ed.) *Handbook on sulphur in Australian Agriculture*, CSIRO, Melbourne.

Bruce, R.C. and Rayment, G.E. (1982). *Analytical methods and interpretations used by Agricultural Chemistry Branch for soil and land use surveys*, Queensland Department of Primary Industries, Bulletin QB82004.

Colwell, J.D. (1963). The estimation of the phosphorus fertilizer requirements of wheat in southern New South Wales by soil analysis, *Australian Journal of Experimental Agriculture and Animal Husbandry* **3**, 190-97.

Crack, B.J. and Isbell, R.F. (1970). Studies on some solodic soils in north-eastern Australia. I. Morphological and Chemical Characteristics, *Australian Journal of Experimental Agriculture and Animal Husbandry* **10**, 334-41.

Dawson, N.M. and Ahern, C.R. (1974). Soils, in *Western arid region land use study, Part I*, Queensland Department of Primary Industries, Division of Land Utilisation Bulletin No. 12.

Isbell, R.F. and McDonald, R.C. (1984). Soil Taxonomic Units, in R.C. McDonald, R.F. Isbell, J.G. Speight, J. Walker and M.S. Hopkins (Eds), *Australian soil and land survey*, Inkata Press, Melbourne pp 133-4.

Isbell R.F. and Murtha, G.G. (1970). *Soils, Burdekin-Townsville Region, Queensland, Resource Surveys*, Department of National Mapping, Australia.

Isbell, R.F., Thompson, C.H., Hubble, G.D., Beckmann, G.D. and Paton, T.R. (1967). *Atlas of Australian Soils, Sheet 4. Brisbane - Charleville - Rockhampton - Clermont area. With explanatory data*, CSIRO Australia, Melbourne University Press.

Northcote, K.H. (1979). *A factual key for the recognition of Australian Soils, 4th Ed*, Rellim Technical Publications, Glenside, South Australia.

Northcote, K.H., Isbell, R.F., Webb, A.A., Murtha, G.G., Churchward, H.M. and Bettenay, E. (1968). *Atlas of Australian soils, Sheet 10. Central Australia, With explanatory data*, CSIRO Australia, Melbourne University Press.

Northcote, K.H. and Skene, J.K.M. (1972). *Australian soils with saline and sodic properties*, CSIRO Australia, Division of Soils, Soils Publication No. 27.

Prescott, J.A. (1931). *The Soils of Australia in relation to vegetation and climate*, CSIRO Australia, Bulletin No. 52.

Prescott, J.A. (1944). *A soil map of Australia*, CSIRO, Australia, Bulletin No. 177.

Stace, H.C.T., Hubble, G.D.,Brewer, R., Northcote, K.H., Sleeman, J.R., Mulcahey, M.J. and Hallsworth, E.U.G. (1968). *A Handbook of Australian Soils.* Rellim Technical Publications, Glenside South Australia.

Turner, E.J. and Ahern, C.R. (1980). Soils, in *Western arid regional land use study - part IV*, Queensland Department of Primary Industries, Division of Land Utilisation Bulletin No. 23.

Viets, F.G. Jr., and Lindsay, W.L. (1973). *Testing soils for zinc, copper, manganese and iron*, Chapter II, in L.M. Walsh and J.D. Beaton (Eds), *Soil testing and plant analysis*, Soil Science Society of America Incorporated, Madison, Wisconsin, pp 153-172.

CHAPTER 4

VEGETATION

by W.J.F. McDonald[1] and M.B. Thomas[1]

The first descriptions of the plant communities of the area were made during Landsborough's expedition in search of Burke and Wills (Landsborough 1862). His party travelled from the Gulf of Carpentaria up the Flinders River and Walker Creek and then southward along Landsborough Creek and the Thomson River.

Blake (1938) produced the first general account of the plant communities of western Queensland. The study area lies within the region surveyed and mapped by Blake. Other collectors at this time included C.T. White and C.E. Hubbard.

Davidson (1954) studied the Mitchell grass (*Astrebla* spp.) communities of the Longreach district over several seasons. Her collections are particularly valuable, representing the only records of many species in that district. She also provided notes on the associated gidgee and coolibah communities.

Areas adjoining the study area have been surveyed and mapped by Perry and Lazarides (1964) and Pedley (1967) (CSIRO Leichhardt-Gilbert and Nogoa-Belyando surveys), and by Beeston (1978), Boyland (1980) and Purdie (1990) (Western Arid Region Land Use Study - parts 4, 2 and 6 respectively). These surveys, together with the present survey, provided the basis of Neldner's (1992) 1:1 million map and account of the vegetation of central western Queensland.

Various studies have been undertaken on the productivity of native pasture systems, especially the Mitchell grass associations. These have been reviewed by Beeston (1978) and Neldner (1992).

State or national overviews of several of the major associations have been presented by Orr (1975) (Mitchell grass tussock grasslands), Beeston *et al.* (1980) (poplar box woodlands), Neldner (1986) (mulga zone communities) and Mott *et al.* (1985) (savanna ecosystems).

ENVIRONMENTAL FACTORS

There is, as noted by Boyland (1980), an increase in structural complexity and canopy cover with increasing annual average rainfall from less than 400mm in the south-west to more than 500mm in the north-eastern corner of the study area (refer to Climate section). Thus gidgee and lancewood form tall open-shrublands on the Winton plateau, whereas on the edge of the Alice Tableland they occur as low woodlands, woodlands and occasionally open-forests.

There are marked correlations between landform and vegetation patterns in the study area. Physiographic and edaphic features control runoff, surface drainage and redistribution of the available moisture for plant growth. Slope and aspect also influence the effectiveness of any available moisture.

The effect of fires was evident in some associations. In some of the sandplain associations, there were areas of dense *Acacia* regrowth. In areas of the eucalypt woodlands, the species composition of the ground layer has been affected by fires and the grazing history of the pasture. Heavy grazing following fire has resulted in a decrease in *Triodia* spp..

Large areas of *Acacia cambagei* and *A. argyrodendron* associations have been cleared (by pulling and burning) and sown to buffel grass (*Cenchrus ciliaris*). Much downs country (both rolling downs and alluvia) around Longreach and Winton has been invaded by prickly acacia (*Acacia*

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nilotica) (Humphries *et al.* 1991). Rubber vine (*Cryptostegia grandiflora*) has spread down Torrens and Cornish Creeks to the Thomson River.

CLASSIFICATION OF VEGETATION

The vegetation of the area can be classified into seven major floristic groups. Within these groups, some plant associations grade into one another, for example, the *Acacia shirleyi* communities are often found with areas of the *Eucalyptus normantonensis* association. Some associations, for example the *Eucalyptus whitei* association, show considerable variation in floristic composition and structural formation.

The vegetation of the area was classified structurally by using a modification of the scheme proposed by Specht (1970), (Table 4.1). This is based on projective foliage cover, height and life form of the tallest stratum. Modification was necessary to eliminate some difficulties encountered in using Specht's scheme. Associations are assessed on the stratum which contributes most to the total biomass (perennial species only) and not necessarily the tallest stratum. This avoids the problem of how to classify an association with a sparse tree stratum and a dense tall shrub stratum. Nomenclature of structural formations follows that proposed by Specht (1970) with the addition of "sparse herbland" for the category of herblands with projective foliage cover (PFC) less than 10%.

Table 4.1 Structural formations represented in the region

	Projected foliage cover of predominant stratum		
Life form and height of predominant* stratum	Mid dense (30-70%)	Sparse (10-30%)	Very sparse (<10%)
Trees 10-30m	Open forest	Woodland	Open woodland
Trees <10m	Low open forest	Low woodland	Low open woodland
Shrubs 2-8m	Open scrub	Tall shrubland	Tall open shrubland
Shrubs <2m		Low shrubland	Low open shrubland
Hummock grasses	Hummock grassland	Open hummock grassland	
Tussock grasses	Tussock grassland	Open tussock grassland	
Herbs include grasses, forbs and sedges	Herbland	Open herbland	Sparse herbland
	Grassland	Open grassland	
	Sedgeland	Open sedgeland	
	Forbland	Open forbland	Sparse forbland

* Predominant stratum is the layer which contributes most to the biomass. Tree is a woody plant more than 5m tall usually with a single stem. Shrub is a woody plant less than 8m tall either multi-stemmed or branched close to ground level, infrequently with a single stem.

MAJOR STRUCTURAL FORMATIONS

Eighteen structural formations are present. These formations range from sparse herbland to open forest (Table 4.1). Tussock grasslands and open tussock grasslands are the most widely distributed communities, occupying approximately 50% of the total area. Low open-woodland,

open-woodland, woodland and low open-forest make up a further 40% of the area. The remainder consists mostly of shrub communities, particularly tall open-shrubland and tall shrubland.

FLORISTICS

Within the area, 896 plant species have been recorded. These represent 326 genera belonging to 93 families (Appendix III). These totals are significantly higher than those reported by Beeston (1978) and Boyland (1980) and may be due in part to the excellent seasonal conditions prevailing during the period of fieldwork (1976-79), increasing the probability that most ephemeral as well as perennial species would have been recorded.

As was noted by Beeston (1978) and Boyland (1980), the largest families are Poaceae (Gramineae) and Leguminosae (ie. families Fabaceae, Mimosaceae and Caesalpiniaceae), being represented by 59 and 30 genera and 185 and 138 species respectively. Other floristically important families include Asteraceae (Compositae), Chenopodiaceae, Malvaceae, Myrtaceae and Cyperaceae, all with more than 30 species. Families represented by ten (10) or more species are listed in Table 4.2 in order of numbers of recorded species. Table 4.3 records the distribution of families, genera and species in the land zones.

Table 4.2 Families represented by ten or more species

Family	No. of genera	No. of species	Larger genera (no. of species)
Poaceae	59	185	*Eragrostis* (23), *Aristida* (22), *Eriachne* (9), *Enneapogon* (8), *Sporobolus* (8), *Digitaria* (8), *Dichanthium* (7), *Paspalidium* (6), *Panicum* (6), *Iseilema* (6)
Asteraceae	35	64	*Calotis* (6)
Fabaceae	21	62	*Indigofera* (11), *Tephrosia* (9), *Psoralea* (5), *Desmodium* (5)
Mimosaceae	4	55	*Acacia* (50)
Chenopodiaceae	13	54	*Sclerolaena* (24), *Atriplex* (7), *Maireana* (6)
Malvaceae	7	38	*Sida* (18), *Abutilon* (8), *Hibiscus* (7)
Myrtaceae	5	33	*Eucalyptus* (24), *Melaleuca* (6)
Cyperaceae	7	32	*Cyperus* (15), *Fimbristylis* (11)
Amaranthaceae	6	29	*Ptilotus* (14), *Gomphrena* (6)
Convolvulaceae	6	22	*Ipomoea* (10), *Polymeria* (5)
Caesalpiniaceae	5	21	*Cassia*(13)
Euphorbiaceae	7	20	*Euphorbia* (8), *Phyllanthus* (5)
Myoporaceae	2	16	*Eremophila* (14)
Loranthaceae	4	11	*Amyema* (6)
Solanaceae	3	10	*Solanum* (7)
Goodeniaceae	2	10	*Goodenia* (8)
Portulacaceae	2	10	*Portulaca* (5), *Calandrinia* (5)
Rubiaceae	5	10	*Oldenlandia* (4), *Canthium* (3)

Table 4.3 Number of families, genera and species recorded for the various land zones

Land zone	Families	Total number of genera	Species		Area (km^2)
Sand plains	36	82	138	(15%)*	2950
Soft mulga lands	19	37	52	(5%)	1050
Hard mulga lands	21	41	73	(8%)	1000
Dissected residuals	34	75	143	(15%)	4850
Gidgee lands	34	73	121	(13%)	6220
Downs	37	96	160	(17%)	30200
Wooded downs	17	38	62	(6%)	7700
Eucalypt woodlands	46	153	294	(32%)	14620
Wooded alluvia	35	100	172	(19%)	4370
Other alluvia	30	83	146	(16%)	10900
Channel country	24	45	62	(6%)	290
Lakes	20	43	48	(5%)	50

* % of total number of species in the whole area

Twenty-four species of the genus *Eucalyptus* have been recorded from the survey area, and they dominate many of the floristic associations. *Eucalyptus papuana* is probably the most widely distributed, occurring in all land zones except the alluvial plains, undulating downs and gidgee lands. It is often associated with *Eucalyptus terminalis*. *Eucalyptus camaldulensis* and *E. microtheca* occur through much of the survey area but are confined to alluvial plains and river channel areas. The ironbarks *Eucalyptus whitei* and *E. melanophloia* dominate much of the woodland vegetation in the east and north-east. *Eucalyptus populnea* occurs only in the extreme south-east of the study area; to the north it is replaced by the closely related *E. brownii*. *Eucalyptus similis* dominates a belt of "desert" country in the east, often in association with the bloodwood *E. brachycarpa*. In areas of residuals, the mallees *E. persistens* or (on the Winton Tableland) *E. normantonensis* are locally dominant. *Eucalyptus thozetiana* also occurs in lower slopes of residuals throughout the survey area.

Certain species have very restricted distributions. *E. eucentrica* was recorded west of "Vergemont", one of only 3 known populations. *E. miniata* reaches its southern limit near Webb Lake. *E. lamprophylla* is an uncommon bloodwood in the east and north-east.

The low tree and shrub flora is dominated by the genus *Acacia*, with 50 species being recorded from the survey area. *Acacia* species are present (and generally conspicuous) in all land zones, including the undulating downs, where *Acacia farnesiana* and *A. victoriae* may be locally common. *Acacia cambagei* is probably the major species, occurring on cracking clays and texture contrast soils through most of the survey area except the north-east where it tends to be replaced by *Acacia argyrodendron*. *Acacia tephrina* dominates areas of wooded downs. *Acacia aneura* is important in the south-west on sandplains and residual landscapes. *Acacia shirleyi* and *A. catenulata* form dense communities on the dissected residuals. *A. harpophylla* occurs only in the extreme south-east, and *A. cyperophylla* occurs in drainage lines on residuals south-west of Winton.

A. coriacea is present as an understorey through much of the sandplain and eucalypt woodland communities, especially in the east. Many other *Acacia* species also occur in these communities, including *A. acradenia, A. leptostachya, A. melleodora* and *A. tenuissima.*

Some of the more restricted species include *Acacia sutherlandii* and the very rare *A. crombiei.*

Eremophila species are also well represented in the survey area, with 14 species recorded. One of the most widespread is *Eremophila mitchellii* which is most commonly associated with gidgee and wooded alluvia (*Acacia cambagei* and *A. argyrodendron* communities). *E. longifolia* is also widely distributed, but seldom as common as *E. mitchellii*. Other species tend to occur mainly in the residual or sandplain land zones.

Grasses are numerous (185 species) and well represented in most associations. *Aristida* (22) and *Eragrostis* (23) are the largest genera. The most frequent species of *Aristida* include *A. calycina* (vars. *calycina* and *praealta*), *A. contorta*, *A. holathera*, *A. ingrata* and *A. latifolia*. *A. latifolia* is particularly common on the undulating downs and alluvial downs. *Eragrostis lacunaria* and *E. setifolia* are the most widespread species of *Eragrostis*.

Eriachne (9 species), *Enneapogon* (8) and *Sporobolus* (8) are also common components of the ground layer in many communities, generally on the lighter-textured and/or shallower soils.

The genera *Astrebla* and *Triodia*, although each represented by only four species, form major components of the communities in which they occur.

Astrebla lappacea and *A. pectinata* dominate the vegetation of the undulating and wooded downs. They are also prominent on the alluvia together with *A. squarrosa*. *A. elymoides* is also widespread but seldom abundant.

The most frequent species of *Triodia* is *T. pungens*, which is the main ground cover species through much of the eucalypt woodlands and associated communities. *Triodia mitchellii* was recorded in the south-eastern corner of the survey area. *Triodia longiceps* is locally dominant in a few land zones, eg. the dissected residuals.

RARE AND THREATENED PLANT SPECIES

There are seven species (representing six families) occurring in the area which are considered rare or threatened according to the criteria in Thomas and McDonald (1989).

Conservation codes

Distribution code

1 Species known only from the type collection.

2 Species with a very restricted distribution in Australia and with a maximum geographic distribution of less than 100 km This category includes some species which occur outside Australia

3 Species with a range greater than 100 km in Australia but occurring in small populations which are mainly restricted to highly specific habitats.

Conservation status code

X Species presumed extinct. Either not found in recent years despite thorough searching or have not been collected for at least 50 years and were known only from now well-settled areas.

E Endangered species at serious risk of disappearing from the wild state within 10 to 20 years if present land use and other casual factors continue to operate. This includes species with populations possibly too small to survive even if present in proclaimed reserves.

V Vulnerable species not presently endangered but at risk over a longer period through continued depletion, or which largely occur on sites likely to experience changes in land use which would threaten the survival of the species in the wild.

R Species which are rare in Australia, but not currently considered endangered or vulnerable. Such species may be represented by a relatively large population in a relatively restricted area or by smaller populations spread over a wider range or some intermediate combination of distribution patterns.

K Poorly known species that are suspected, but not definitely known, to belong to any of the above categories. At present accurate field distribution information is inadequate.

1. *Acacia crombiei* (pink gidgee) (3V). A small tree found in areas of gidgee (*Acacia cambagei*) or boree (*A. tephrina*) open-woodland or low open-woodland and also in Mitchell grass (*Astrebla*) tussock grassland. The known occurrences are to the north and south of Hughenden with two isolated records north of Longreach. *Acacia crombiei* is regarded as vulnerable, since it only occurs in small isolated populations and is rare at these sites. In

the past the timber has been used for fence posts but the present concern is the lack of regenerating seedlings, the cause of which is unknown.

2. *Ptilotus remotiflorus* (3R). An attractive large herb to small rounded shrub 30cm x 30cm with pink brush-like flowers on the ends of branches. It occurs on the gravelly slopes and ridges of jump-ups. The population in the study area is west of Longreach, growing on the side of a ridge with mountain yapunyah (*Eucalyptus thozetiana*) and *Eremophila latrobei*. The three other localities are south-west of Longreach, east of Adavale and Toompine. It is rare but not considered under threat because the areas where it grows are not heavily grazed by livestock nor affected by fire.

3. *Ptilotus brachyanthus* (3R). A small, annual or short-lived perennial, woody-based herb to 25cm. Flowers in spikes to 3cm long, creamy white on ends of stems. There are two known occurrences in the study area, one near Longreach and the other at Ilfracombe. The only other collections (2) are from near Augathella in the Warrego district. This species is regarded as rare but this may reflect its ephemeral nature which has meant it has therefore been undercollected.

4. *Eremophila alatisepala* (3R). A shrub or small tree growing to 2m. Flowers pale to dark cream, and pale yellow, with some darker spots in the throat. It prefers rocky and stony slopes with shallow soil, usually growing with spinifex and mulga (*Acacia aneura*), other *Acacia* spp. and *Cassia* spp. Two records of this species occur within the study area, one just south of Winton and one in the far south-west corner.

5. *Calotis suffruticosa* (3R). A small woody based herb to a height of 25-30cm. Annual or short lived perennial with a strong tap root. Small daisy flowers, a bright orange yellow, maturing into burrs. It occurs on the heavy soils of the Mitchell grass downs and open grassy plains. It has been recorded from two places in the study area, one north of Longreach and the other between Muttaburra and Aramac. It was first collected from near Jericho to the east of the study area and there is only one other collection, from along the Winton-Jundah road, also outside the study area.

6. *Sclerolaena everistiana* (3R). A small prickly herb growing to a height of 50cm. Little is known about the species and there are only three collections on record. It apparently occurs on stony lateritic soil with gidgee. One collection in the study area is from Aramac while the other two are from north of Hughenden and west of Winton.

7. *Mukia* sp. "Longreach" (*Mukia* sp. Q3) (3K). A native paddy melon vine with small yellow flowers and smooth ellipsoid fruit to 20mm long. It occurs on the cracking clays of Mitchell grass (*Astrebla* spp.) downs. All known collections except one come from within a 60km radius of Longreach to the north-west and east. This species is as yet undescribed and is regarded as poorly known. Indications to date suggest that it is confined to the cracking clays around Longreach.

DESCRIPTION OF VEGETATION

A. Vegetation map

A vegetation map of the area is enclosed with the report, at a scale of 1:1 000 000. The map is based upon one or more land systems in which one major vegetation group is predominant, with other associations making only a minor contribution. Land systems in which two or more vegetation types contribute significantly to the vegetation are mapped as a complex.

B. Vegetation associations

The natural vegetation of the survey area has been described in terms of 43 plant associations. For ease of reference the vegetation has been divided into types dominated by either trees and shrubs or by grasses, herbs or sedges. Each association is described in terms of its range of structural parameters, frequently occurring species, characteristic land form and the principal soil groups on which it occurs.

The associations summarise the more detailed land unit vegetation descriptions given in Appendix V and are cross-referenced to the appropriate units in each case.

Tree and shrub communities

1. *Eucalyptus* spp. associations

2. Mulga (*Acacia aneura*) associations and other *Acacia* communities of the sandplain and residual land zones

3. Gidgee (*Acacia cambagei*) associations and other *Acacia* communities of the undulating downs and alluvial land zones

4. Miscellaneous tree and shrub associations

Grass, forb or sedge communities (herblands)

5. Mitchell grass (*Astrebla* spp.) associations

6. Spinifex (*Triodia* spp.) associations

7. Miscellaneous grass, forb or sedge associations

***Eucalyptus* predominant associations**

Associations dominated by various species of *Eucalyptus* are extensive (approximately 25% of the area) and contribute significantly to the flora.

These associations occur mainly on sandy red earths, texture contrast soils and on clay and alluvial soils associated with the streams. They are best developed in the east and north-east where they constitute the majority of the area referred to as the "desert country" (Blake 1938).

Structurally, the associations range from tall (open-) shrubland to woodland. Various species of *Eucalyptus* predominate depending mainly on the topography and soil. Approximately 32% of the total plant species recorded occur in these associations.

***Acacia aneura* predominant associations and other *Acacia* communities of the sandplain and residual land zones**

These associations occur mainly in the south-west of the area, occupying approximately 12% of the survey area.

The *Acacia aneura* associations occur on red earths and deep texture contrast soils. They vary in structure from open-scrub to open-woodland. The hard and soft mulga types contain 8% and 5% of the total species recorded respectively.

In the residual land zones of the south-west and, to a limited extent, the east, other *Acacia* species become dominant, including *A. stowardii, A. cyperophylla, A. catenulata* and *A. shirleyi.*

***Acacia cambagei* predominant associations and other *Acacia* communities of the undulating downs and alluvial land zones**

These associations occur throughout the area, occupying a total 8% of the survey area. They occupy two different situations, one associated with the alluvia and the other on fresh Cretaceous beds which may have a thin covering of Quaternary material.

Structurally, the associations range from tall shrubland through low open woodland to woodland and low open-forest. These associations contain 13% of the total species recorded.

Miscellaneous tree and shrub associations

This group of communities includes a complex association found on sandplains through much of the area (*Flindersia maculosa* and/or *Acacia excelsa* ± *Grevillea striata*), two associations occupying poorly-drained sites and dominated by species of *Melaleuca* and two shrublands associated with the floodplains of the major river systems and dominated by *Muehlenbeckia cunninghamii* and *Chenopodium auricomum* respectively.

***Astrebla* predominant associations**

These associations occur in the centre and west of the survey area, and occupy slightly less than 50% of the area. They occur on clay soils on undulating downs and alluvial plains.

They range in structure from a low open-woodland or wooded tussock grassland through open-grassland to a sparse to open herbland, depending on seasonal conditions and grazing history.

Approximately 23% of the total species occur in these associations. Floristic composition varies with seasonal conditions, both in terms of the dominant species (eg. *Astrebla* and/or *Dichanthium*) and the associated grasses and forbs (eg. *Iseilema* spp.)

***Triodia* predominant associations**

Species of *Triodia* (spinifex) are prominent in many communities in the residual and sandplain land zones south of Winton and *T. pungens* dominates the ground layer in several of the *Eucalyptus* - dominant associations. Three *Triodia* - dominant associations have been recognised with the most distinctive, dominated by *Triodia longiceps*, also noted by Beeston (1978) east of Barcaldine.

Miscellaneous grass, forb or sedge associations

These associations are found in varying situations ranging from poorly drained or scalded sites in the alluvial land zones to seasonally flooded claypans and lakes and also shallow stony soils on residual landscapes.

1. EUCALYPT (*EUCALYPTUS* SPP.) PREDOMINANT ASSOCIATIONS

1a. *Eucalyptus camaldulensis* — Woodland to (low) open-woodland — Height: 8-12m; PFC: 10-40%; Trees/ha: 25-50

Other frequently occurring species:

Trees: *Eucalyptus microtheca* (in places), *Melaleuca nervosa* var. *pendulosa* (in places), *Acacia stenophylla, Melaleuca trichostachya.*

Graminoids: *Dichanthium fecundum* (in places), *Chloris virgata* (in places), *Eragrostis elongata, Eulalia aurea, Leptochloa digitata, Paspalidium jubiflorum, Pseudoraphis spinescens, Sporobolus caroli.*

Forbs: *Achyranthes aspera, Xanthium pungens* (locally prominent).

Comments:

Occurs along major channels of streams draining the desert country. Soils are alluvia of varying textures. Scattered shrubs may be present. The ground cover is dominated by perennial grasses. Disturbed areas are often invaded by introduced weeds.

Characteristic of land unit 73. Occurs in land system W2.

1b.	***Eucalyptus microtheca*** ± ***E. camaldulensis***	Woodland to open-woodland	Height: 12m PFC: 5-20% Trees/ha: 100-200

Other frequently occurring species:

Trees: *Acacia cambagei* (in places), *Acacia stenophylla.*
Shrubs: *Eremophila bignoniiflora, E. mitchellii* (in places), *Acacia farnesiana, Muehlenbeckia cunninghamii* (in places).

Graminoids: *Bothriochloa ewartiana, Astrebla* spp., *Dichanthium* spp., *Cenchrus ciliaris* (in places), *Chloris* spp., *Eragrostis* spp..

Forbs: *Xanthium pungens* (locally dominant after flooding).

Comments:

Occurs on alluvia along braided streams draining gently undulating plains. Soils are deep, grey and brown clays. A relatively open low shrub layer is usually present. The ground cover varies from 25-30% and is dominated by perennial grasses.

Characteristic of land unit 24. Occurs in land systems C1, A3, W3 and W4.

1c.	***Eucalyptus microtheca***	(Low) woodland to (low) open-woodland	Height: 6-12m PFC: <10% Trees/ha: 125

Other frequently occurring species:

Shrubs: *Acacia farnesiana, Eremophila bignoniiflora.*

Graminoids: *Astrebla* spp., *Cenchrus ciliaris* (in places), *Panicum* spp., *Sporobolus caroli.*

Forbs: *Sclerolaena* spp., *Sida* spp., *Enchylaena tomentosa.*

Comments:

Occurs on cracking clay soils on interchannel areas, and outer margins of flooded alluvial plains. The ground cover is moderately dense (35% cover) and dominated by perennial grasses.

Characteristic of land unit 59. Occurs in land system W3.

1d.	***Eucalyptus melanophloia***	Open-woodland to woodland	Height: 10-12m PFC: 5-15% Trees/ha: 250

Other frequently occurring species:

Trees: *Eucalyptus papuana.*

Shrubs: *Acacia coriacea, Carissa lanceolata.*

Graminoids: *Aristida* spp., *Chrysopogon fallax, Eragrostis lacunaria, Enneapogon polyphyllus, Eriachne mucronata, Triodia pungens.*

Forbs: *Sida* spp., *Solanum ferocissimum, Hibiscus burtonii, Goodenia cycloptera.*

Comments:

Occurs on upper slopes on gently sloping Quaternary sandplains. Soils are moderately deep to deep sandy red earths, yellow earths and associated texture contrast soils. There is a well-defined tall shrub layer (up to 100/ha). The ground stratum is open to mid-dense (PFC 30%) and composed mainly of perennial grasses.

Characteristic of land unit 31. Occurs in land systems E1, E2 and G2.

1e. ***Eucalyptus whitei*** | Low open-woodland to open woodland | Height: 6-12m PFC: 1-10% Trees/ha: 25-50

Other frequently occurring species:

Tall shrubs: *Acacia coriacea, Grevillea parallela, Melaleuca nervosa* (in places).

Low shrubs: *Carissa lanceolata, Acacia melleodora* and *A. tenuissima* (in places).

Graminoids: *Triodia pungens, Aristida calycina,* (in groves), *A. inaequiglumis, Bothriochloa ewartiana,* (in groves), *Themeda triandra* (in groves), *Schizachyrium fragile, Digitaria brownii, Eragrostis lacunaria, Fimbristylis dichotoma.*

Forbs: *Evolvulus alsinoides, Polycarpaea corymbosa* var. *minor, Indigofera parviflora, Sida corrugata, Zornia adenophora, Euphorbia drummondii, Goodenia cycloptera.*

Comments:

Occurs on upper slopes of gently sloping sandplains. Soils are moderately deep to deep sandy texture contrast soils. *Eucalyptus whitei* frequently forms clumped or groved stands, with open areas dominated by *Triodia pungens* while the areas around the trees support a range of other grass species.

Characteristic of land unit 35. Occurs in land systems E2, E3, E5 and R1.

1f. ***Eucalyptus papuana*** ± ***E. terminalis*** ± ***E. whitei*** | Low open-woodland to woodland | Height: 6-15m PFC: 5-15% Trees/ha: 100-150

Other frequently occurring species:

Tall shrubs: *Acacia coriacea, Petalostigma pubescens, Melaleuca nervosa* var. *nervosa.*

Low shrubs: *Carissa lanceolata, Acacia acradenia* (in places), *A. melleodora* (in places).

Graminoids: *Aristida inaequiglumis* (in groves), *A. ingrata, A. holathera, Bothriochloa ewartiana, Eragrostis* spp., *Eriachne mucronata, E. aristidea, Heteropogon contortus, Themeda* spp., *Schizachyrium fragile.*

Forbs: *Sida rohlenae, Waltheria indica.*

Comments:

Occurs on sandy infilled channels in stabilised fan plains. Soils are very deep siliceous sands and sandy red earths.

Characteristic of land unit 4. Occurs in land system E6.

1g. ***Eucalyptus terminalis*** (Low) open-woodland to wooded open hummock grassland — Height: 3-7m; PFC: <10%; Trees/ha: 25

Other frequently occurring species:

Tall shrubs, low trees: *Acacia coriacea, Grevillea striata.*

Low shrubs: *Acacia tenuissima, Gossypium australe.*

Graminoids: *Triodia pungens, Eriachne mucronata, Digitaria brownii, Cymbopogon bombycinus, Themeda triandra, Aristida* spp.

Forbs: *Sida platycalyx, Euphorbia drummondii, Evolvulus alsinoides.*

Comments:

Occurs on gently sloping sandplains. Soils are moderately deep sandy red earths.

Characteristic of land unit 55. Occurs in land system S2.

1h. ***Eucalyptus similis*** Open-woodland to low open-woodland — Height: 8-15m; PFC: 5-10%; Trees/ha: 25-100

Other frequently occurring species:

Trees: *Eucalyptus brachycarpa.*

Tall Shrubs: *Acacia coriacea, Eucalyptus setosa* (in places), *Acacia cowleana, A. stipuligera, Grevillea pteridifolia, Melaleuca tamariscina* (in places), *Alphitonia excelsa, Petalostigma pubescens.*

Graminoids: *Triodia pungens* (dominant), *Aristida* spp., *Enneapogon pallidus, Eragrostis eriopoda, Panicum effusum.*

Forbs: *Sida rohlenae, Phyllanthus fuernrohrii, Olearia subspicata.*

Comments:

Occurs on Quaternary sands on gently sloping tops of Tertiary tablelands. Soils are deep sandy red earths and earthy sands. Areas of tall shrubs (distribution and density dependent on fire history). Ground layer open, (<30% PFC) and dominated by spinifex.

Characteristic of land unit 42. Occurs in land system E4 with minor occurrences in land systems R1 and L1.

1i. ***Eucalyptus brachycarpa*** | Woodland, open-woodland to low open-woodland | Height: 10-15m PFC: 5-15% Trees/ha: 25-75

Other frequently occurring species:

Trees: *Eucalyptus terminalis, E. papuana* (locally common).

Tall Shrubs: *Acacia coriacea, Melaleuca nervosa, Eucalyptus setosa* (in places).

Shrubs: *Acacia melleodora, Carissa lanceolata, Eremophila mitchellii.*

Graminoids: *Aristida ingrata, Triodia pungens.*

Comments:

Occurs on outwash sandplains and stabilised fan plains. Soils are deep sandy red earths, earthy sands or siliceous sands, all very low in nutrients. In places there is a dense shrub layer of regrowth *Acacia* spp.. The ground layer is generally sparse and dominated by perennial grasses with ephemeral forbs being seasonally dependent.

Characteristic of land units 44 and 45. Occurs in land systems E5 and E6.

1j. ***Eucalyptus populnea*** | Low woodland to (open-) woodland | Height: 9-12m PFC: 5-20% Trees/ha: 50-150 Shrubs/ha: 100

Other frequently occurring species:

Shrubs: *Eremophila mitchellii, Cassia* spp., *Carissa ovata.*

Graminoids: *Aristida holathera, Cenchrus ciliaris, Enneapogon polyphyllus, Bothriochloa ewartiana, Heteropogon contortus.*

Forbs: *Evolvulus alsinoides.*

Comments:

Occurs on flat to gently sloping Quaternary sandplains in the southern part of the survey area. Soils are deep, sandy-surfaced texture contrast soils. There is a well-defined tall shrub layer. The ground stratum is variable (5-25% PFC). Intergrades with and is replaced by *Eucalyptus brownii* woodland to low open-woodland (1k) to the north.

Characteristic of land unit 30. Occurs in land system E1, with a minor occurrence in land system G2.

1k. ***Eucalyptus brownii*** | Woodland to low open-woodland | Height: 8-14m PFC: 5-20% Trees/ha: 150-300

Other frequently occurring species:

Shrubs: *Eremophila mitchellii, Myoporum deserti, Carissa lanceolata.*

Graminoids: *Bothriochloa ewartiana, Digitaria brownii, Enneapogon pallidus, Eragrostis*

lacunaria, E. microcarpa, Panicum effusum, Heteropogon contortus, Themeda triandra, Triodia pungens, Tragus australianus, Perotis rara, Paspalidium gracile.

Forbs: *Indigofera linifolia, I. linnaei, Melhania oblongifolia, Rostellularia adscendens, Gomphrena celosioides, Evolvulus alsinoides.*

Comments:

Occurs on flat to gently sloping sandplains. Soils are deep sands and texture contrast soils. A low shrub layer to 2m and with a density of up to 125/hectare is present in some areas. Grasses and forbs are both well represented in the ground layer depending on seasonal occurrence of rainfall.

Characteristic of land unit 34. Occurs in land systems E2, E3, E5, R1, W2, W4 and to a minor extent in E4 and E6.

1l. ***Eucalyptus normantonensis/ E. persistens*** — Tall shrubland to tall open-shrubland — Height: 3-5m, PFC: 5-30%, Trees/ha: 75-175

Other frequently occurring species:

Trees: *Acacia shirleyi* (in places).

Graminoids: *Triodia pungens, Triodia longiceps* (in the south-west).

Comments:

This association occurs on mesas and low rounded sandstone hills. Soils are shallow lithosols often with an extensive cover of ironstone gravel. The ground layer is generally very sparse with bare scalded areas frequent. In places south of Winton there is a prominent grass cover, but otherwise grasses and forbs are ephemeral and sparse.

Characteristic of land unit 38. Occurs in land system S2 and to a minor extent in E2, R2, R3.

2. MULGA (*ACACIA ANEURA*) ASSOCIATIONS and OTHER *ACACIA* COMMUNITIES OF SANDPLAINS AND RESIDUAL TABLELANDS

2a. ***Acacia aneura*** — Open scrub to low woodland — Height: 6-7m, PFC: 10-35%, Trees/ha: 200-500

Other frequently occurring species:

Trees: *Acacia excelsa, Eucalyptus terminalis.*

Shrubs: *Cassia helmsii, Eremophila bowmanii, Acacia adsurgens.*

Graminoids: *Enneapogon polyphyllus, Eriachne mucronata, Aristida jerichoensis, A. obscura, Digitaria ammophila, D. brownii, Eragrostis eriopoda, Themeda triandra.*

Forbs: *Dysphania rhadinostachya, Evolvulus alsinoides, Goodenia lunata, Maireana villosa.*

Comments:

Occurs on flat to gently undulating plains. Soils are moderately deep to deep sandy red earths and sandy light clays. *Acacia aneura* often forms diffuse groves, with grasses dominating the intergrove spaces. Scattered forbs are present.

Characteristic of land unit 15. Occurs in land systems M1 and S1.

2b. ***Acacia aneura*** | Tall shrubland to tall open shrubland | Height: 3-6m PFC: 10-20% Trees/ha: 150-400

Other frequently occurring species:

Trees: *Acacia shirleyi* (in places), *Eucalyptus thozetiana* (in places).

Shrubs: *Eremophila latrobei, Dodonaea petiolaris.*

Graminoids: *Eragrostis lacunaria, Triodia* spp. (in places), *Eriachne pulchella.*

Comments:

Occurs on gently undulating to undulating plains. Soils are very shallow to shallow red earths often with stone cover. There is usually a low shrub layer. The ground layer is sparse and composed of scattered grasses and forbs.

Characteristic of land unit 16. Occurs in land system H1 and to a lesser extent in R2 and R4.

2c. ***Acacia aneura - A. stowardii*** | Low open shrubland to tall open shrubland with areas of tall shrubland and low woodland | Height: 3-8m PFC: 5-15% Shrubs/ha: 25-75

Other frequently occurring species:

Trees: *Acacia shirleyi.*

Graminoids: *Triodia pungens, T. molesta*

Comments:

This association is found on flat to gently undulating plains. Soils are very shallow, strongly acid lithosols. Apart from areas of spinifex the ground cover is sparse, consisting of ephemeral forbs and grasses. Severe scalding and erosion have occurred.

Characteristic of land unit 18. Occurs in land systems H1, R2, R3 and to a minor extent S1.

2d.	***Acacia aneura* ± *A. cyperophylla***	Tall shrubland to tall open shrubland	Height: 3-8m PFC: <10% Trees/ha: 100-500

Other frequently occurring species:

Shrubs: *Dodonaea petiolaris, Eremophila latrobei.*

Graminoids: *Sporobolus caroli, Tripogon loliiformis, Triodia pungens.*

Forbs: *Indigofera leucotricha.*

Comments:

Occurs on undulating plains and adjacent scarp retreat zones. Soils are very shallow loamy lithosols often with extensive cover of rocks and gravel. Trees are sparse and often concentrated along watercourses. The ground cover is open, composed mainly of ephemerals with occasional perennials.

Characteristic of land unit 69. Occurs in land system R4 and to a minor extent R3.

2e.	***Archidendropsis basaltica* and/or *Acacia aneura* ± *Eucalyptus terminalis***	Low open woodland	Height: 5-13m PFC: 5-10% Trees/ha: 100-400

Other frequently occurring species:

Trees: *Acacia coriacea, Grevillea striata.*

Shrubs: *Eremophila bowmanii.*

Graminoids: *Aristida armata, A. contorta, Bothriochloa ewartiana, Enneapogon polyphyllus, Eragrostis eriopoda, Eriachne mucronata.*

Forbs: *Goodenia lunata, Gossypium australe, Maireana villosa, Sida platycalyx.*

Comments:

Occurs on gently sloping sandplains. Soils are moderately deep sandy red earths and minor sandy light clays. Scattered shrubs are present and can sometimes form a defined layer 1-2m high and up to 500 shrubs/ha. The ground layer is open and dominated by tussock grasses and forbs.

Characteristic of land unit 52. Occurs in land systems S1 and S2.

2f.	***Acacia shirleyi* ± *Eucalyptus thozetiana***	Tall (open) shrubland to low shrubland	Height: 2-3m PFC: 5-20% Shrubs/ha: 50-250

Other frequently occurring species:

Shrubs: *Cassia oligophylla.*

Graminoids: *Triodia pungens, Cymbopogon bombycinus.*

Comments:

Occurs in the scarp retreat zones and crests of dissected tablelands. Soils range from very shallow loamy lithosols to exposed rock outcrops. *Eucalyptus thozetiana* present as emergent trees. Ground cover is generally sparse.

Characteristic of land unit 65. Occurs in land systems R2, R3, R4 and to a minor extent S2.

2g.	***Acacia catenulata* + *A.shirleyi***	Low woodland, low open woodland to tall shrubland	Height: 3-5m PFC: 5-20% Trees/ha: 5-500

Other frequently occurring species:

Trees: *Eucalyptus thozetiana.*

Shrubs: *Eremophila latrobei, Cassia artemisioides, Acacia spania, A. multisiliqua, A. longispicata.*

Graminoids: *Eragrostis lacunaria, Triodia pungens, Paspalidium gracile, Digitaria breviglumis.*

Forbs: *Maireana georgei, Pilotis obovatus, Sida filiformis.*

Comments:

Occurs in the scarp retreat zones of dissected tablelands. Soils are very shallow loamy lithosols with areas of exposed rock common.

Characteristic of land unit 63. Occurs in land systems R1, R4 and to a lesser extent in E2 and E4.

3. GIDGEE (*ACACIA CAMBAGEI*) ASSOCIATIONS and OTHER *ACACIA* COMMUNITIES OF UNDULATING DOWNS AND ALLUVIAL LAND ZONES

3a.	***Acacia cambagei* - *Eremophila mitchellii***	Low woodland to low open woodland	Height: 6-10m PFC: 5-20% Trees/ha: 50-200

Other frequently occurring species:

Low trees and shrubs: *Flindersia maculosa, Myoporum deserti* (in places). *Atalaya hemiglauca, Canthium oleifolium.*

Graminoids: *Chloris virgata, Enneapogon polyphyllus, Enteropogon acicularis, Eragrostis lacunaria, Sporobolus caroli, Tripogon loliiformis, Oxychloris scariosa.*

Forbs: *Sclerolaena birchii, Enchylaena tomentosa.*

Comments:

Occurs on flat to very gently undulating plains on Cretaceous sediments overlain in part by Quaternary material. Soils range from deep brown cracking clays to deep sandy texture contrast soils.

Characteristic of land units 8, 9 and 11. Occurs in land systems G1, G2 and G4 and to a minor extent in land systems E1, E2, G5 and S1.

3b. ***Acacia cambagei*** | Low open woodland to tall open shrubland and open scrub | Height: 4-7m, PFC: 10-30%, Trees/ha: 50-200

Other frequently occurring species:

Trees: *Atalaya hemiglauca, Santalum lanceolatum.*

Shrubs: *Apophyllum anomalum, Cassia artemisioides, C. oligophylla.*

Graminoids: *Enneapogon avenaceus, E. polyphyllus, E. oblongus, Sporobolus actinocladus.*

Forbs: *Sida fibulifera, Sclerolaena glabra, Solanum esuriale.*

Comments:

Occurs on undulating plains and dissected low hills. Soils are shallow to deep brown cracking clays and desert loams, usually with a dense stone and gravel cover. Shrubs are frequent but do not normally form a distinct layer. The ground layer is sparse, mostly ephemeral grasses and forbs.

Characteristic of land units 10 and 66. Occurs in land systems G3 and R3 and to a minor extent in S1 and R2.

3c. ***Acacia cambagei*** | Low woodland to low open woodland | Height: 6-8m, PFC: 5-15%, Trees/ha: 50-100

Other frequently occurring species:

Shrubs: *Eremophila mitchellii.*

Graminoids: *Enteropogon acicularis, Paspalidium caespitosum, Sporobolus caroli, Astrebla squarrosa* (in gilgais), *Diplachne fusca* (in gilgais).

Forbs: *Einadia linifolia, Sclerolaena* spp., *Portulaca oleracea.*

Comments:

Occurs on flat alluvial plains with numerous shallow channels and sandy rises throughout. Soils are deep, sandy grey clays and texture contrast soils which are moderately gilgaid.

Characteristic of land unit 57. Occurs in land system W1 and to a minor extent in land system A4.

3d. ***Acacia cambagei* ± *A. tephrina* ± *A. argyrodendron***

Low open woodland to wooded open tussock grassland

Height: 5-10m
PFC: <5-10%
Trees/ha: 75-100

Other frequently occurring species:

Trees and shrubs: *Atalaya hemiglauca.*

Graminoids: *Astrebla pectinata, A. elymoides, A. lappacea, Aristida latifolia, Sporobolus actinocladus, Dactyloctenium radulans.*

Comments:

Occurs on flat to undulating plains. Soils are moderately deep to deep, grey and brown cracking clays. Gravel cover is common.

Characteristic of land unit 49. Occurs in land system T1.

3e. ***Acacia argyrodendron***

Low woodland to low open woodland

Height: 6-10m
PFC: 5-20%
Trees/ha: 100-200

Other frequently occurring species:

Shrubs: *Eremophila mitchellii.*

Graminoids: *Astrebla pectinata* (in places), *Paspalidium caespitosum, Enteropogon acicularis.*

Comments:

Occurs on flat alluvial plains subject to occasional flooding. Soils are deep grey clays with ironstone and quartz inclusions. The community is frequently groved and gilgais are common. The ground layer is variable, depending on amount of tree cover and micro relief.

Characteristic of land unit 62. Occurs in land systems G5 and W4 and to a minor extent in A4.

3f. ***Acacia tephrina***

Grassy open woodland to wooded open tussock grassland

Height: 6-10m
PFC: <10%
Trees/ha: 25-200

Other frequently occurring species:

Trees: *Acacia cambagei* (in places).

Shrubs: *Apophyllum anomalum, Eremophila mitchellii, Acacia farnesiana.*

Graminoids: *Aristida latifolia, Astrebla lappacea, A. pectinata, Bothriochloa ewartiana, Iseilema vaginiflorum.*

Comments:

Occurs on flat to gently undulating plains. Soils are deep grey and brown clays, often with a dense stone cover. Ground cover is dense (up to 60%) and dominated by perennial grasses.

Forbs are infrequent and seasonally dependent.

Characteristic of land unit 50. Occurs in land system T2 with minor occurrences in G1.

4. MISCELLANEOUS TREE AND SHRUB ASSOCIATIONS

4a.	***Flindersia maculosa*** **and/or** ***Acacia excelsa*** ***± Grevillea striata***	Tall (open) shrubland to low (open) woodland	Height: 4-7m PFC: <15% Trees/ha: up to 250

Other frequently occurring species:

Trees: *Lysiphyllum carronii, Atalaya hemiglauca, Archidendropsis basaltica* (in places), *Eucalyptus terminalis* (in places), *Ventilago viminalis.*

Low shrubs: *Eremophila mitchellii, Carissa lanceolata, Melaleuca nervosa* (in places).

Graminoids: *Aristida holathera, Bothriochloa ewartiana, Eriachne mucronata, Themeda triandra.*

Forbs: *Boerhavia diffusa, Evolvulus alsinoides, Indigofera linifolia.*

Comments:

Occurs on gently sloping sandplains. Soils are moderately deep sandy red earths and sandy texture contrast soils. In the east, this community grades into *Eucalyptus papuana*, etc. low open woodland (lf) while in the west it grades into *Archidendropsis basaltica - Acacia aneura*, etc. low open woodland (2e).

Characteristic of land unit 53. Occurs in land systems G5, S1 and S2.

4b.	***Melaleuca nervosa*** **var.** ***nervosa***	Low woodland to woodland	Height: 6-15m PFC: 15-30% Trees/ha: 25-500

Other frequently occurring species:

Shrubs: *Petalostigma pubescens.*

Graminoids: *Fimbristylis caespitosa, Cyperus conicus, Bothriochloa bladhii* var. *cloncurrensis.*

Forbs: *Euphorbia mitchellii.*

Comments:

Occurs on sandy infilled swamps in Quaternary sandplains. Soils are very deep siliceous sands. The sparse ground stratum consists mainly of perennial sedges.

Characteristic of land unit 48. Minor occurrences in land systems E6 and L1.

4c. ***Melaleuca bracteata*** | Low open woodland to tall shrubland | Height: 3-4m PFC: <10% Trees/ha: <25

Other frequently occurring species:

Trees: *Eucalyptus microtheca, E. camaldulensis.*

Graminoids: *Eragrostis australasica, Leptochloa digitata.*

Comments:

Occurs on flat plains with associated salt springs and minor drainage lines. Soils are deep grey clays which are often saline. Trees and tall shrubs are found along the more well-defined drainage lines, with ground cover absent or very sparse.

Characteristic of land unit 23. Occurs as a minor part of land system A2.

4d. ***Muehlenbeckia cunninghamii*** | Low open shrubland to open scrub | Height: 1-2m PFC: <10-50%

Other frequently occurring species:

Tall shrubs: *Acacia stenophylla, Eremophila bignoniiflora.*

Graminoids: *Eleocharis pallens, Sporobolus mitchellii, Elytrophorus spicatus, Eragrostis setifolia, Cyperus victoriensis.*

Forbs: *Sclerolaena muricata, Polymeria longifolia, Marsilea drummondii, Alternanthera nodiflora.*

Comments:

Minor occurrences in internal drainage depressions and swamps on the sandplains of the Winton Plateau, but widespread in low-lying, frequently flooded swamps and channels on the alluvial plains of the major river systems. Soils are very deep, grey cracking clays.

Associated with land units 28 and 54. Occurs in land systems C1 and S2.

4e. ***Chenopodium auricomum*** | Low open shrubland | Height: 1m PFC: 5-15% Shrubs/ha: 500 -3000

Other frequently occurring species:

Graminoids: *Astrebla lappacea, Panicum decompositum, Sporobolus australasicus, S. mitchellii.*

Forbs: *Sclerolaena anisacanthoides, S. intricata, S. muricata, Psoralea cinerea, Neobassia proceriflora.*

Comments:

Occurs on the interchannel areas of braided channel country. Soils are very deep grey cracking clays. Scattered low trees and shrubs may be present. The ground layer, a mixture of grasses and forbs, is usually sparse, and dependent on seasonal conditions.

Characteristic of land unit 29. Occurs in land system C1.

5. MITCHELL GRASS (*ASTREBLA*) ASSOCIATIONS

5a. ***Astrebla lappacea* ± *Aristida latifolia* ± *Panicum decompositum*** Tussock grassland to open tussock grassland — Height: 0.5m, PFC: 20-50%

Other frequently occurring species:

Shrubs: *Acacia farnesiana* (in places).

Graminoids: *Iseilema vaginiflorum, Astrebla elymoides, A. squarrosa* (in places).

Forbs: *Psoralea cinerea, Phyllanthus maderaspatensis, Rhynchosia minima, Sida fibulifera.*

Comments:

Occurs on gently undulating clay plains with long slopes of not more that 2%. Soils are deep grey and brown cracking clays with a strongly self mulching surface. In some places slight gilgais occur and in western areas a light stone cover of billy gravel is sometimes present. Tussock grassland predominates but occasionally scattered low shrubs may occur. Ephemeral forbs are an important component of these grasslands particularly in seasons of high winter rains.

Characteristic of land unit 1. Occurs in land systems F1, F2, F3, F4, T1, T2 and T3.

5b. ***Astrebla pectinata* ± *A. lappacea*-*Enneapogon polyphyllus*** Wooded open tussock grassland to tussock grassland — Height: <1m, PFC: 15-35%

Other frequently occurring species:

Trees: *Atalaya hemiglauca, Acacia tephrina, Ventilago viminalis, Lysiphyllum carronii. Flindersia maculosa.*

Low shrubs: *Acacia farnesiana* (in places).

Graminoids: *Iseilema vaginiflorum, Panicum decompositum, P. laevinode, Aristida latifolia, Dichanthium sericeum* (seasonally), *Astrebla elymoides.*

Forbs: *Psoralea cinerea.*

Comments:

Occurs on gently undulating clay plains with sandstone outcrops. Soils are shallow to moderately deep, brown and grey cracking clays.

Characteristic of land units and 4 and 51. Occurs in land systems F3 and T3.

5c.	***Astrebla squarrosa* ± *A. pectinata* ± *Iseilema* spp.**	(Open) tussock grassland	Height: 0.8m PFC: 10-30%

Other frequently occurring species:

Graminoids: *Aristida latifolia, Astrebla lappacea, A. elymoides, Dichanthium fecundum, Eragrostis tenellula, E. xerophila, Eulalia aurea.*

Forbs: *Goodenia fascicularis, Neptunia monosperma, Sida fibulifera, Streptoglossa adscendens.*

Comments:

Occurs on flat clay plains of the Winton plateau. Soils are moderately deep grey cracking clays with a strongly self mulching surface. Broad shallow gilgais are common. Scattered emergent shrubs to 2m sometimes occur. Forbs are an important component of the ground layer depending on the seasons.

Characteristic of land unit 6. Occurs in land system F6.

5d.	***Dichanthium fecundum*, ± *Astrebla* spp. ±, *Eulalia aurea***	Open tussock grassland to tussock grassland	Height: <.6m PFC: 20-35%

Other frequently occurring species:

Low shrubs: *Eremophila polyclada.*

Graminoids: *Aristida latifolia, Iseilema vaginiflorum, I. membranaceum, Eragrostis xerophila.*

Comments:

Occurs on flat alluvial plains. Soils are deep, sandy grey cracking clays with quartz and ironstone throughout the profile. Broad shallow gilgais are widespread. Trees and shrubs are scattered and mainly confined to water courses. The community is diverse, with a wide range of forbs and ephemeral grasses.

Characteristic of land unit 27. Occurs in land systems A4, W1 and W4.

5e.	***Astrebla pectinata* and/or *A. lappacea* - *Dichanthium* spp. - *Iseilema* spp.**	Tussock grassland to wooded open tussock grassland	Height: 0.5-1m PFC: 15-35%

Other frequently occurring species:

Graminoids: *Aristida latifolia, Panicum decompositum, P. laevinode, Astrebla elymoides, A. squarrosa* (in places).

Forbs: *Psoralea cinerea, Boerhavia diffusa, Sida fibulifera, S. trichopoda.*

Comments:

Occurs on flat plains adjacent to alluvia and on interchannel areas of braided streams. Soils are deep, grey and brown cracking clays. This association intergrades with *Dichanthium fecundum*, etc. open tussock grassland (5d) towards the north and north-east of the study area.

Characteristic of land units 20 and 25. Occurs in land systems A1, A3, C1 and W3.

6. SPINIFEX (*TRIODIA*) ASSOCIATIONS

6a.	***Triodia* spp. - *Acacia* spp.**	Shrubby open hummock grassland to hummock grassland	Height: 1m PFC: 20-50% Shrubs/ha: up to 4000

Other frequently occurring species:

Low shrubs: *Acacia tenuissima, A. stowardii* (in places), *A. aneura* (in places), *Cassia pruinosa, Eremophila latrobei, Gossypium australe.*

Graminoids: *Paraneurachne muelleri, Schizachyrium fragile, Triodia longiceps* (in places), *Triodia* sp. aff. *T. molesta* (in places).

Forbs: *Hibiscus burtonii, Sida filiformis.*

Comments:

Occurs on upper slopes and gently undulating tops of low hills in the extreme south-west of the study area. Soils are very shallow, very gravelly red loamy lithosols with lateritic gravel and rock. Shrub density is very variable and probably related to fire history. The ground between the *Triodia* hummocks is usually bare. Forbs may be common after burning.

Associated with land units 18 and 19. Occurs on land systems H1, R2 and R3.

6b.	***Triodia longiceps***	Open hummock grassland	Height: <1m PFC: 15-20%

Other frequently occurring species:

Graminoids: *Oxychloris scariosa, Enneapogon polyphyllus, Eragrostis cilianensis, Sporobolus partimpatens, Tripogon loliiformis.*

Comments:

Occurs on sand dunes fringing claypans. Soils are strongly alkaline, with a thin layer (8cm) of fine sand overlying deep sandy clays. There are no trees or shrubs and relatively few ephemeral grasses and forbs occur between the hummocks.

Characteristic of land unit 22. Occurs in land system A2.

6c.	***Triodia pungens* -** ***Eucalyptus terminalis***	Wooded open hummock grassland to low open woodland open woodland	(Hummock grassland) Height: 1m PFC: 10-30% (Open woodland) Height: 5-7m PFC: <10% Trees/ha: <25-100 Shrubs/ha: variable

Other frequently occurring species:

Trees, shrubs: *Acacia acradenia, A. adsurgens, A. cowleana, Cassia notabilis, C. oligophylla, Eucalyptus papuana, Gossypium australe.*

Graminoids: *Amphipogon caricinus, Aristida holathera, Digitaria brownii, Eriachne mucronata, Paraneurachne muelleri.*

Forbs: *Abutilon otocarpum, Bonamia media, Hibiscus sturtii, Sida filiformis, Tephrosia brachycarpa.*

Comments:

Occurs in the extreme south-west on flat to gently undulating tops of dissected tablelands, usually where sand deposits occur on the surface. Soils are very shallow to shallow loamy red earths and lithosols to moderately deep sandy red earths. The shrub density and *Triodia* cover depend on the fire history.

Associated with land units 55 and 56. Minor occurrences in land system S2.

7. MISCELLANEOUS GRASS, FORB OR SEDGE ASSOCIATIONS

7a.	***Eragrostis australasica***	Sparse to open hummock grassland	Height: 1-1.5m PFC: <5-25%

Other frequently occurring species:

Shrubs: *Acacia stenophylla.*

Graminoids: *Diplachne fusca, Leptochloa digitata.*

Comments:

Occurs on clay pans and ephemeral lakes. Soils are deep grey clays, often saline. *Eragrostis australasica* generally forms pure stands with scattered low shrubs present on the margins of the claypans or lakes.

Associated with land units 23 and 68. Occurs to minor extent in land systems A2 and L1, mainly in the east of the study area.

7b.	***Sporobolus mitchellii*** ± ***Cyperus victoriensis*** ± ***Astrebla squarrosa***	Tussock grassland to to wooded tussock grassland	Height: 0.5m PFC: 20-35%

Other frequently occurring species:

Trees, shrubs: *Eucalyptus microtheca* (in places), *Acacia stenophylla, Muehlenbeckia cunninghamii* (in places).

Graminoids: *Dichanthium* spp., *Panicum* spp., *Iseilema* spp.

Forbs: *Haloragis glauca, Polymeria* spp., *Goodenia subintegra, Rostellularia adscendens.*

Comments:

Occurs on interchannel areas of braided streams on gently undulating plains on Cretaceous sediments. Soils are deep, grey and brown cracking clays.

Characteristic of more low-lying, poorly drained situations in land unit 25. Occurs in land systems A1, A3, C1 and W3.

7c.	**Ephemeral forbs and grasses**	Seasonally variable sparse forbland or sparse herbland	Height: <0.3m PFC: <10%

Frequently occurring species:

Low Shrubs: *Halosarcia pergranulata* (in places).

Graminoids: *Chloris pectinata, Dactyloctenium radulans, Iseilema vaginiflorum, Sporobolus actinocladus* .

Forbs: *Atriplex angulata, A. spongiosa, Sclerolaena glabra, S. calcarata, S. lanicuspis, Portulaca oleracea, Salsola kali, Trianthema triquetra.*

Comments:

Widespread over flat, frequently scalded, alluvial plains of the major rivers. Soils are very deep, grey cracking clays or alluvial texture-contrast soils. The ground layer is composed of ephemeral herbs, mostly from the family Chenopodiaceae. Perennial grasses are absent.

Associated with land units 21 and 25. Occurs in land systems A2, A3, W3 and C1.

7d.	**Short grasses and ephemeral forbs**	Seasonally variable sparse grassland or sparse herbland	Height: <0.3m PFC: <10%

Frequently occurring species:

Trees: *Eucalyptus papuana* (tops), *E. terminalis* (tops).

Shrubs: *Acacia cambagei* (valleys), *A. stowardii* (tops), *Hakea collina* (tops), *Hemichroa mesembryanthema* (valleys).

Graminoids: *Aristida contorta, A. latifolia, Eriachne pulchella.*

Forbs: *Gunniopsis zygophylloides, Atriplex* (sp. aff. *A. cornigera*), *Sclerolaena eriacantha, S. minuta, Polycarpaea breviflora, Ptilotus schwartzii, Streptoglossa* spp., *Tribulus astrocarpus.*

Comments:

Occurs in the south-west of study area on gently undulating tops of residuals and in small valleys of dissected low hills and tablelands. Soils are very shallow to shallow gravelly loamy red earths or shallow desert loams with surface ironstone gravel. Trees and shrubs are sparsely scattered. The ground stratum is always very sparse and the floristic composition varies seasonally. Often associated with *Triodia* spp. - *Acacia* spp. open hummock grassland (6a) and *Acacia aneura - A. stowardii* low open-shrubland (2c).

Characteristic of land unit 72 and also associated with land units 18 and 19. Occurs to minor extent in land systems H1, R2 and R3.

7e.	**Ephemeral grasses and forbs (lakes and claypans)**	Seasonally variable sparse to open-forbland or grassland	Height: <0.5m PFC: <5-30%

Frequently occurring species:

Shrubs: *Eremophila bignoniiflora.*

Graminoids: *Uranthoecium truncatum, Iseilema vaginiflorum, I. membranaceum, Echinochloa colona, Diplachne fusca, Brachyachne convergens, Panicum larcomianum.*

Forbs: *Eryngium plantagineum, Alternanthera angustifolia, Marsilea* spp., *Polymeria pusilla, Goodenia subintegra.*

Comments:

Occurs on seasonally flooded lake floors and clay depressions in flat sandplains. Soils grey cracking clays, sometimes saline and salt-encrusted during dry seasons.

Characteristic of land units 41 and 68. Occurs in land systems E3 and L1.

CONSERVATION STATUS OF PLANT COMMUNITIES

There are two national parks within the area surveyed. Bladensburg National Park (NP88 Adams), of about 33 700 ha, lies c. 30 km south of Winton, while Forest Den National Park (NP9 Thistlebank), of 5 890 ha, is about 100 km north of Aramac on Torrens and Paradise Creeks.

Two other reserves lie just outside the study area. Goneaway Environmental Park (EP2 Binburie), of 24 800 ha, lies south of the Mayne River and west of the Winton - Jundah Road, while White Mountains National Park (NP9 Boston), 108 000 ha in area, extends from the upper Flinders River south-east to the Burra Range between Torrens Creek and Pentland.

Residual landscapes are represented in Bladensburg National Park and Goneaway Environmental Park. The major communities are Normanton box (*E. normantonensis*) tall open-shrubland (floristic association 1l) and bastard mulga (*Acacia stowardii*) low open shrubland (floristic association 2c).

Forest Den National Park (Thistlebank) provides a relatively small sample of blackwood (*Acacia argyrodendron*) low woodland and low open woodland (3e) and the bluegrass/browntop/Mitchell grass association (5d).

The Mitchell grass - dominant communities are not represented in national parks within the study area.

Some of the eucalypt-dominant communities of the desert country are represented in White Mountains National Park, particularly the yellow jacket (*Eucalyptus similis*) open-woodland (1h). *Eucalyptus persistens* (1l) and lancewood (*Acacia shirleyi*) and bendee (*A. catenulata*) communities (2f and 2g) also occur within this reserve. It does not however sample the *Eucalyptus whitei* open-woodland and low open-woodland association (1e).

No examples of gidgee (*Acacia cambagei*) low woodland are reserved within the study area. This is probably the most threatened plant community in the region, because of the extensive clearing that has taken place. It is represented in only two conservation reserves, Mazeppa National Park and Willandspey Environmental Park.

Boree (*Acacia tephrina*) open-woodland (3f) is another community which is inadequately represented in conservation reserves.

REFERENCES

Beeston, G.R. (1978). Vegetation, In *Western Arid Region Land Use Study - Part 4.* Queensland Department of Primary Industries, Division of Land Utilisation Technical Bulletin No. 23.

Beeston, G.R., Walker P.J., Purdie, R.W. and Pickard, J. (1980). Plant communities of the poplar box (*Eucalyptus populnea*) lands of eastern Australia. *Australian Rangelands Journal* **2**, 1-16.

Blake, S.T. (1938). The plant communities of Western Queensland and their relationships, with special reference to the grazing industry. *Proceedings of the Royal Society of Queensland* **49**, 165-204.

Boyland, D.E. (1980). Vegetation, In *Western Arid Region Land Use Study - Part 2.* Queensland Department of Primary Industries, Division of Land Utilisation Technical Bulletin No. 22.

Davidson, D. (1954). *The Mitchell grass association of the Longreach district.* University of Queensland paper, Department of Botany III, 45-59.

Humphries S.E., Groves, R.H. and Mitchell, D.S. (1991). Plant invasions. The incidence of environmental weeds in Australia. *Kowari* **2**, 1-134.

Landsborough W. (1862). Journal of Landsborough's expedition from Carpentaria, in search of Burke and Wills. Balliere, Melbourne.

Mott, J.J., Williams, J., Andrew, M.H. and Gillison A.N. (1985). Australian savanna ecosystems, in J.C. Tothill and J.J. Mott (Eds), *Ecology and Management of the World's Savannas.* Australian Academy of Science, Canberra, pp. 56-82.

Neldner V.J., (1986). Vegetation communities of the Australian mulga zone. In P.S. Sattler (Ed.), *The Mulga Lands.* Royal Society of Queensland, Brisbane, pp. 20-26.

Neldner V.J., (1992). *Central Western Queensland, Vegetation Survey of Queensland.* Queensland Department of Primary Industries, Botany Bulletin No. 9.

Orr, D.M. (1975). A review of *Astrebla* (Mitchell grass) pastures in Australia. *Tropical Grasslands* **9**, 21-36.

Pedley, L. (1967). Vegetation of the Nogoa-Belyando area. In *Lands of the Nogoa-Belyando area, Queensland.* CSIRO Australia, Land Research Series No. 18, 138-169.

Perry, R.A. and Lazarides, M. (1964). Vegetation of the Leichhardt-Gilbert area. In *General Report on Lands of the Leichhardt-Gilbert area, Queensland, 1953-54.* CSIRO Australia, Land Research Series No. 11, 152-191.

Purdie, R.W. (1990). Vegetation, In *Western Arid Region Land Use Study - Part 6.* Queensland Department of Primary Industries, Division of Land Utilisation Technical Bulletin No. 28.

Specht, R.L. (1970). Vegetation, In G.N. Leeper (Ed.), *The Australian environment*, 4th edition (revised), CSIRO, Melbourne University Press.

Thomas, M.B. and McDonald, W.J.F. (1989). Rare and threatened plants of Queensland. Queensland Department of Primary Industries, Information Series QI88011.

CHAPTER 5

CURRENT LAND USE†

by E.J. Turner[1], G. Caltabiano[2] and G. Coonan[2]

POPULATION

Population figures for the shires involved are listed in Table 5.1. Most centres reflect the trend of declining population numbers caused by various economic and social pressures. This has important implications on the cost structure of the pastoral industries.

Table 5.1 Population trends in local authority areas

	1971+	1976+	1978++
Aramac	1 168	1 059	1 070
Barcaldine	1 868	1 780	1 790
Ilfracombe	389	428	440
Longreach	4 300	4 052	4 050
Winton	2 095	1 938	1 930
Flinders	3 019	2 875	2 930

\+ Corrected census figures
++ Estimated at the time of compilation of this Chapter

TYPES OF TENURE

Table 5.2 illustrates the type of tenure, the number and nature of the enterprise, the respective areas of land involved, as well as the estimated carrying capacity, in the study area as at December 1977.

The dominant tenure is Grazing Selection - Grazing Homestead and Grazing Farm. Some of these Grazing Selections are being freeholded or converted to perpetual leases, hence the terms Grazing Homestead Freeholding Leases and Grazing Homestead Perpetual Leases.

Tenure types are separated into sheep or cattle enterprises according to the dominant activity. In all, ten tenure types could be classified as carrying on a mixed sheep and cattle enterprise. The dominant land use is wool growing. Tables 5.3 and 5.4 set out the property size range as well as the corresponding range in their estimated carrying capacities for both sheep and cattle respectively. The ten tenure types which had mixed enterprises formed aggregations with other tenures, the end result being that seven sheep properties also carried cattle and two cattle properties also carried sheep.

In calculating the carrying capacities, properties were treated as either a cattle or sheep enterprise, according to the dominant use, and one adult beast was defined as being equivalent to seven sheep.

From a comparison of the numbers of various tenures (Table 5.2) and the number of properties (Tables 5.3 and 5.4), it can be seen that many properties consist of aggregations of several leases which are worked as one unit. Many properties (aggregations or otherwise) are held by several families and family groups.

Of the sheep properties, 74% range in size from 500 to 20 000 hectares, which accounts for 53% of the total carrying capacity.

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† The statistics presented in this Chapter reflect the position as at 1978 and should now be treated as historical data

Table 5.2 Types of tenure, enterprise and carrying capacity

	Number of properties			Area in hectares			Estimated carrying capacity	
	Sheep	Cattle	Total	Sheep	Cattle	Total	Sheep	Cattle
Special leases	4	-	4	1 837	-	1 837	1 311	-
Occupation licences	1	-	1	3 727	-	3 727	2 662	-
Perpetual lease selections	1	-	1	480	-	480	300	-
Pastoral development holdings	1	1	2	39 627	284 498	324 525	16 319	9 490
Stud holdings	5	-	5	95 800	-	95 800	65 297	-
Freehold	9	-	9	19 874	-	19 874	14 454	-
Preferential pastoral holdings	7	1	8	161 647	15 491	177 138	63 761	704
Agricultural farms	12	-	12	17 337	-	17 337	9 543	-
Grazing homestead perpetual leases	16	-	16	131 843	-	131 843	75 518	-
Pastoral holdings	38	26	64	1 292 088	1 400 438	2 692 526	383 615	46 032
Grazing farms	139	5	144	684 812	37 540	722 352	360 549	2 517
Grazing homestead freeholding leases	290	-	290	2 064 535	-	2 064 535	1 243 481	-
Grazing homesteads	452	1	453	3 710 159	11 531	3 721 690	2 234 139	1 571
TOTALS	975	34	1009	8 223 766	1 749 498	9 973 465	4 470 949	60 314

Table 5.3 Property size range and estimated carrying capacity (sheep)

Property size range (hectares)	Number	Estimated carrying capacity range (sheep)	Total estimated carrying capacity
1 - 5 000	31	333 - 3 719	70 060
5 000 - 7 500	45	977 - 6 243	205 077
7 500 - 10 000	82	2 378 - 7 633	463 433
10 000 - 12 500	76	3 484 - 9 745	520 125
12 500 - 15 000	49	*3 502 - 12 385	378 949
15 000 - 17 500	43	4 268 - 14 267	409 259
17 500 - 20 000	36	6 071 - 15 998	358 576
20 000 - 22 500	26	*6 960 - 18 056	319 187
22 500 - 25 000	21	7 856 - 20 168	281 164
25 000 - 27 500	15	7 769 - 18 496	203 163
27 500 - 30 000	9	10 421 - 18 406	135 495
30 000 - 35 000	20	**7 343 - 26 066	338 946
35 000 - 40 000	13	*10 508 - 28 814	262 135
40 000 - 50 000	6	11 036 - 29 602	140 992
50 000 - 60 000	6	9 400 - 39 026	156 746
60 000 - 70 000	3	*12 608 - 30 190	64 762
70 000 - 190 000	4	*22 768 - 53 441	162 880
TOTALS	485		4 470 949

* Includes one property with cattle
** Includes two properties with cattle

Table 5.4 Property size range and estimated carrying capacity (cattle)

Property size range (hectares)	Number	Estimated carrying capacity range (cattle)	Total estimated carrying capacity
5 000 - 10 000	1	507	507
10 000 - 15 000	**3	85 - 1571	1 785
15 000 - 20 000	4	231 - 858	2 633
20 000 - 50 000	*6	360 - 2239	6 479
50 000 - 100 000	6	1294 - 4566	18 139
100 000 - 200 000	2	2481 - 5444	7 925
200 000 - 300 000	**3	6142 - 9490	22 846
TOTALS	25		60 314

* One property had no carrying capacity
** One property also carried sheep

Of the cattle properties, 80% range in area from 500 to 100 000 hectares, which accounts for 48% of the total carrying capacity.

In Table 5.5, properties are classified according to flock or herd size. On the basis of estimated carrying capacity of the 485 sheep properties, 93 (19%) have less than 5000 sheep, 240 (49%) have flock sizes between 5000 and 10 000 sheep, while the remaining 152 (32%) have more than 10 000 sheep.

A more detailed discussion of the administration of land tenure is found in Western Arid Region Land Use Study - Part 1, and will not be repeated here.

LIVING AREA STANDARDS

In 1970, the Land Administration Commission proposed guidelines to "living areas" in terms of sheep numbers. The sheep numbers are the approximate maximum for which freeholding will be allowed as well as the maximum for new leases. The figures stated are broad general classifications and meant as a guide only.

In determining living area standards, regard is given to such matters as the district in which the land is situated, nature of the country, its potential and distance from transport facilities and markets and occurrence of variable seasons. In the longer term, property sizes are influenced by such factors as changes in technology, productive capacity of properties, market prospects for the produce and the cost of improvements. The standards applicable to the study area are as follows:

Longreach District. Heavy soil country - essentially open downs. Breeding country except where too open. Rainfall 15" to 17" (381 mm to 432 mm) per annum. 8 000 to 10 000 sheep. For (generally) mulga country - inferior breeding or dry sheep country. Rainfall 12" to 15" (305 mm to 381 mm) per annum. 11 000 to 12 500 sheep.

Winton District. Generally mulga country. Inferior breeding or dry sheep country. Rainfall 12" to 15" (305 mm to 381 mm) per annum - 11 000 to 12 500 sheep. For open downs country - limited breeding. Rainfall 15" to 20" (381 mm to 508 mm) per annum. 10 000 to 12 500 sheep.

Barcaldine District. Heavy soil country containing a large extent of open black soil with areas of gidyea and brigalow suited for improvement to introduced pastures. Usually good breeding country except where country is too open. Rainfall 17" to 20" (432 mm to 508 mm) per annum. 7500 to 9500 sheep. For desert country - has been regarded as relief country. Rainfall 15" to 20" (381 mm to 508 mm) per annum. 12 500+ sheep.

Hughenden District. Open downs country - limited breeding. Rainfall 15" to 20" (381 mm to 508 mm) per annum. 10 000 to 12 500 sheep.

SUMMARY

From the foregoing, if a figure of 8000 sheep is taken as the basic minimum living area, then 280 properties (57%) can be considered as below this standard. It must be borne in mind that these standards are for administrative purposes and although reflecting socially desirable levels, it does not necessarily follow that a major problem exists.

Individual economic and social circumstances vary as well as management abilities, and hence what may officially appear to be an undersized property may, in fact, be fulfilling particular individual needs; and what may be an uneconomic size to one manager may be an economic size to another.

Further complex inter- and intra-family arrangements exist enabling individuals to have interests in several properties, and therefore, caution must be exercised in drawing definite conclusions.

Table 5.5 Distribution of estimated carrying capacity and number of properties

SHEEP		CATTLE	
Stock numbers	Number of properties	Stock numbers	Number of properties
1 - 2 000	13	0 - 1 000	10
2 000 - 3 000	18	1 000 - 2 000	**3
3 000 - 4000	21	2 000 - 3 000	5
4 000 - 5000	*41	3 000 - 4 000	2
5 000 - 6 000	62	4 000 - 5 000	1
6 000 - 7 000	66	5 000 and above	4
7 000 - 8 000	*59		
8 000 - 9 000	27		
9 000 - 10 000	26		
10 000 - 11 000	*22		
11 000 - 12 000	21		
12 000 - 13 000	*19		
13 000 - 14 000	*19		
14 000 - 15 000	8		
15 000 - 16 000	8		
16 000 - 17 000	9		
17 000 - 18 000	8		
18 000 - 19 000	4		
19 000 - 20 000	4		
20 000 - 21 000	4		
21 000 - 22 000	6		
22 000 - 23 000	*2		
23 000 - 24 000	4		
24 000 - 25 000	*2		
25 000 - 30 000	6		
Above 30 000	6		
TOTAL	485		

Less than 5000 sheep - 93
5000 to 10 000 sheep - 240
Above 10 000 sheep - 152

* Includes properties with sheep
** Includes properties with sheep

1. Mitchell grasses (*Astrebla* spp.) (+ short grasses + forbs) pasture group

This pasture group is widespread on cracking clay soils on undulating downs and alluvial plains. Extensive areas are treeless, but the pastures may be associated with gidgee, boree, blackwood, whitewood or boonaree in many localities.

The community is dominated by Mitchell grass, which are long-living drought-resisting tussock grass species. Curly Mitchell grass is the most common species, but barley Mitchell grass is also widespread, especially on soils of relatively low fertility or where surface stone is present. Hoop and bull Mitchell grass are less common, but may be dominant in moist habitats or on old alluvial plains.

The tussocks are widely spaced and after early summer rains, the interspaces are occupied by ephemeral grasses such as the Flinders grasses and button grass. Other grass species commonly associated with Mitchell grass include Queensland bluegrass, feathertop grass, white spear grass and yabila grass.

Following winter rain, the forb component of the pasture increases, with species from the Chenopodiaceae, Malvaceae, Fabaceae, Amaranthaceae, Brassicaceae and other families. If winter rain is followed by frosts, the nutritional value of the Mitchell grass declines rapidly.

On the shallow sandstone outcrops, which typically carry wooded downs, short grasses are a major component of the pasture together with barley Mitchell grass. The most important species are *Enneapogon* spp. and *Sporobolus* spp.. In many areas buffel grass is also a common constituent.

Productivity and management of these pasture lands are discussed by Wilson and Purdie (1990).

There are several minor pasture communities within the Mitchell grasslands which provide useful grazing. These have been described by Wilson and Purdie (1990) and include the clay frontage grass pasture, Queensland bluebush pasture and lignum pasture.

2. Bluegrass - browntop pasture group

The bluegrass - browntop plains (Perry 1964) are distributed mainly in the north-eastern corner of the survey area, and are considered the higher-rainfall or better-watered equivalent of the Mitchell grass downs, with which they intergrade.

This pasture group occurs on heavy cracking clay soils and is generally treeless, although it may be associated with areas of gidgee or coolibah. The pasture consists mainly of perennial drought-evading tussock grasses and is generally taller and denser than Mitchell grassland. It is more variable floristically. Prominent species include curly bluegrass, browntop, barley Mitchell grass, feathertop, tassel bluegrass, desert bluegrass and bull Mitchell grass. Shorter grasses, especially Flinders grasses and native couch (*Brachyachne convergens*) occur in the spaces between the taller grasses. Forbs include *Polymeria marginata*, native sensitive plants (*Neptunia* spp.) and sidas.

With adequate rain, these pastures grow rapidly. Yield is high, but during the dry season, forage quality is poor and stock lose weight. This pasture group has a moderately high stocking rate, somewhat below that of the Mitchell grass downs. As far as possible, fire is excluded from these pastures (Perry 1964).

3. Scrub grasses pasture group

This pasture group is associated with gidgee and blackwood woodlands and open-woodlands. The main species are short, perennial, drought-evading tussock grasses, including *Enneapogon* spp., *Enteropogon acicularis*, *Sporobolus* spp. (especially *S. caroli*) and *Paspalidium caespitosum*. In more open communities, bluegrasses, feathertop and Mitchell grasses are important components of

the pasture. Forbs (*Enchylaena tomentosa*, *Einadia* spp., *Sclerolaena* spp., *Portulaca* spp., *Trianthema triquetra* and *Dipteracanthus australasicus*) are a small but important part of this pasture group. In many areas, buffel grass has become a naturalised species.

Melonholes (or gilgais) in dark cracking clay soils are seasonally flooded and support a distinct flora. Frequent species include *Leptochloa filiforme*, beetle grass (*Diplachne fusca*), bull Mitchell grass, *Cyperus* spp., *Marsilea* spp. and *Ammannia multiflora*.

In their natural state, the communities containing these pastures have a very low carrying capacity. Clearing by pulling followed by burning and sowing of introduced pasture species greatly increases the carrying capacity, although some years after pulling these areas show a fertility decline with a resultant loss of vigour of the pasture.

In bendee and lancewood woodlands, the ground layer is even sparser and is dominated by *Eriachne mucronata*, *Eragrostis lacunaria*, *Aristida* spp. (*A. contorta*), *Paspalidium* spp. and *Sida* spp.. The grazing value of these areas is negligible.

4. Mulga pasture group

This pasture group is associated with the soft mulga and sandplain land zones. The soils are deep sandy red earths and light clays and sandy texture contrast soils.

Communities range from pure groved stands of mulga to relatively open mixed stands of mulga, eastern dead finish, western bloodwood and whitewood. The associated ground layer vegetation ranges from mid-height perennial tussock grassland to spinifex open hummock grassland. The composition and density of the pasture depend upon the density of the mulga and the woody shrub layer (*Eremophila duttonii*, *E. latrobei*, silver turkey bush (*Cassia artemisioides*) and other *Cassia* species).

Mills and Boyland (1980) described four pasture associations which also occur in the mulga lands in this survey area. They are (i) wiregrass pastures, (ii) mulga Mitchell and/or mulga oats pasture, (iii) kerosene grass pasture and (iv) woollybutt grass pasture.

Common grass species include *Aristida contorta* (kerosene grass), *A. obscura*, *A. pruinosa*, *Amphipogon caricinus*, *Eriachne mucronata*, *Enneapogon* spp. (especially *E. polyphyllus*), *Eragrostis eriopoda* (woollybutt), *Digitaria brownii* and *Thyridolepis xerophila* (mulga Mitchell grass).

In favourable seasons, ephemeral grasses and forbs are present, including *Austrochloris dichanthoides*, *Eriachne armittii*, *E. pulchella*, *Mnesithea formosa*, *Perotis rara*, *Dysphania rhadinostachya*, *Evolvulus alsinoides* and *Sida* spp..

Many of these species are moderately palatable and also provide standover feed into drought, but the pastures are susceptible to overgrazing, which leads to an increase in the less palatable and less nutritious wiregrasses (*Aristida* spp.). Wiregrasses also increase after thinning or clearing of the mulga, itself a valuable topfeed species and useful reserve of drought fodder.

5. *Triodia* pasture group

This pasture group is the western extension of the eastern spinifex country described by Pedley (1967). It is associated with the eucalypt woodlands of the "desert" country. It consists of perennial drought-resisting hummock grasses, mainly *Triodia pungens* and, in the south, *T. mitchellii*. The spaces between hummocks are often bare or have *Aristida* spp. or ephemerals such as *Schizachyrium fragile*.

In many places this group forms a mosaic with the eastern mid-height pasture group. This is most marked in the groved yellowjack woodlands where the eastern mid-height grasses (*Bothriochloa ewartiana*, *Themeda triandra*, *Aristida* spp.) occur under the trees and the spinifex in the intergroves.

The forage value of the pasture is low and is restricted to periods following a burn. Forbs constitute a small but important component of this pasture group. The stocking rates are low and are really dependent on the amount of eastern mid-height grasses present.

6. Eastern mid-height pastures group

This group is similar to the pasture lands of the same name described by Pedley (1967). It typically occurs in the eastern eucalypt woodlands (the "desert" country), often in association with the *Triodia* pasture group (see above). It also occurs on frontage country along the major rivers and creeks (the sandy frontage grass pasture of Wilson and Purdie (1990)).

The pasture is characterised by perennial drought-evading tussock grasses (1-1.5m tall), the major species being *Bothriochloa ewartiana*, *Heteropogon contortus*, *Themeda triandra*, *Chrysopogon fallax* and *Aristida* spp.. Ephemeral species are common and include *Schizachyrium fragile* and the forbs *Polycarpaea* spp., *Zornia* spp., *Indigofera* spp. and *Bonamia* spp..

The pasture quality varies with the species composition and pastures dominated by *Bothriochloa ewartiana* are regarded more highly than those dominated by *Aristida* spp..

TOPFEED

Topfeed species (edible trees and shrubs) are an important component of grazing systems in western Queensland. Some species such as mulga, vinetree and whitewood are browsed by cattle even when other forage is available (Chippendale 1968). During drought, when herbage and grasses are absent, many other species such as belalie and lancewood, which otherwise are seldom eaten, become major components of the diet.

The food value of topfeed plants depends on factors such as their abundance, accessibility, palatability, digestibility and, as noted above, the availability of other forage (Chippendale 1963, Leigh *et al.* 1978, Maconochie and Lange 1970, McDonald and Ternouth 1979). Some species, although highly palatable, may be poorly digested and hence nutritionally inadequate, eg. whitewood.

Some topfeed species may be toxic under certain conditions (eg. boonaree, whitewood) or when fed as the only component of the diet (eg. vinetree).

Mulga, the most important topfeed species in inland Queensland, has a relatively limited distribution within the area, occurring mainly to the south and west of Winton and Longreach. Most other topfeed species, although widely distributed, occur in very low numbers and are of limited value as a drought reserve (eg. emu apple and berrigan). Some widespread species may be locally abundant and therefore valuable; these include beefwood, silver cassia, mimosa bush and whitewood (Purdie 1990).

Topfeed species occurring in the area are listed in Table 6.1, with notes on their habit, palatability, toxicity, edible parts and general distribution. Many of the species are described in more detail in Everist (1969) and Askew and Mitchell (1978), who also suggest management techniques to ensure their continued regeneration.

Table 6.1 Topfeed species

Common name	Scientific name	P[1]	H[2]	Land zone[3]												EP[4]	Comments
				D	T	G	E	W	C	A	H	M	S	R	L		
Bat's wing coral tree	*Erythrina vespertilio*	M	S				e									f	Rare.
Bauhinia	*Lysiphyllum carronii, L. gilvum*	H	T			g		w	c	a						fp	Trees are usually leafless in major droughts.
Beefwood	*Grevillea striata*	H	T/S			g	e	w			h	m	s			f	
Belalie	*Acacia stenophylla*	M	S				e	w	c	a					l	f	Of some value only during droughts.
Bendee	*Acacia catenulata*	M	S											r		d	Of some value only during droughts.
Berrigan	*Eremophila longifolia*	M	S				e			a		m	s			f	Eaten readily; not toxic in the field.
Berry saltbush	*Rhagodia spinescens*	M	L			g										f	
Boobialla	*Myoporum acuminatum*	H	S			g	e	w		a						f	Toxic if eaten in large amounts.
Boonaree	*Alectryon oleifolius*	H	S	d	t					a			s			f	Eaten readily but should not be cut for stock in the absence of other feed, especially if young foliage is present under moist conditions.
Broad-leaf myrtle tree	*Canthium latifolium*	M	S											r			
Myrtle tree	*Canthium oleifolium*	H	S			g	e							r		f	
Bumble	*Capparis mitchellii*	H	S	d									s			if	Rare.
Butterfly bush	*Petalostylis cassioides*	M	L											r		f	
Cassias	*Senna artemisioides* subsp. *petiolaris*	M	L	d		g	e			a			s	r		f	
	Senna artemisioides subsp. *sturtii*	M					e							r		f	
Conker berry	*Carissa lanceolata*	M	L	d		g	e	w		a	h		s			f	
Coonta	*Ehretia saligna*	H	L		t											f	Rare.
Desert oak	*Acacia coriacea*	M	S				e	w			h		s	r		f	Eaten only when herbage is absent
Doolan	*Acacia salicina*	L	S				e	w	c							fp	Foliage grazed only during droughts.
Eastern dead-finish	*Archidendropsis basaltica*	H	S			g	e			a			s	r		f	Rare; leaves are shed during drought.
Emu apple	*Owenia acidula*	H	S			g	e						s	r		f	Roots sucker freely.

Common name	Scientific name	P[1]	H[2]	Land zone[3]												EP[4]	Comments
				D	T	G	E	W	C	A	H	M	S	R	L		
Eremophilas	*Eremophila latrobei* var. *latrobei*	M	T				e			a	h		s	r		f	Grazed in dry periods; not toxic in the field.
	Eremophila latrobei var. *glabra*	M	T				e			a	h		s	r		f	Grazed in dry periods; not toxic in the field.
Flinders rose	*Capparis spinosa* var. *nummularia*	H	T	d												f	
Fuchsia bush	*Eremophila maculata*	H	L	d	t					a						f	Eaten readily; may cause death of hungry travelling stock.
Gidgee	*Acacia cambagei*	L	T/S		t	g		w		a	h		s	r		d	Generally of little value.
Gooramurra	*Eremophila bignoniiflora*	H	S				e	w	c	a			s		l	f	Eaten readily
Gunda-bluey	*Acacia victoriae*	H	S	d												fp	Shrubs may die out quickly in severe drought.
Ironwood	*Acacia excelsa*	M	S			g	e			a	h	m	s	r		f	Eaten readily.
Kurrajong	*Brachychiton populneus*	H	T				e						s			f	Eaten readily but may cause stock losses if only component of diet.
Lancewood	*Acacia shirleyi*	M	S				e				h			r		f	
Leopardwood	*Flindersia maculosa*	H	S		t	g	e						s	r		f	Rare.
Lime Bush	*Eremocitrus glauca*	M	S	d				w		a						f	
Lignum	*Muehlenbeckia cunninghamii*	M	L			g			c	a			s		l	bf	
Lignum fuchsia	*Eremophila polyclada*	H	L	d	t					a						bf	
Lolly bush	*Clerodendrum floribundum*	M	S				e									f	
Meemeei	*Pittosporum phylliraeoides*	H	S			g					h	m		r		f	
Mimosa bush	*Acacia farnesiana*	H	L	d	t	g	e	w		a			s			fp	
Mineritchie	*Acacia cyperophylla*	M	T/S											r		f	
Mountain bluebush	*Maireana georgei*	M	L											r			
Mulga	*Acacia aneura*	H	T/S								h	m	s	r		fpd	
Mustard bush, Broom bush	*Apophyllum anomalum*	H	L	d	t	g		w					s	r		b	
Myall	*Acacia pendula*	M	T		t											f	
Narrow-leaf bumble	*Capparis loranthifolia*	H	L						c							f	
Needlewood	*Hakea leucoptera*	M	S	d						a						f	Of limited value; leaves are needle-like.

Common name	Scientific name	P[1]	H[2]	Land zone[3]												EP[4]	Comments
				D	T	G	E	W	C	A	H	M	S	R	L		
Nelia	*Acacia oswaldii*	M	S			g					h		s			f	Rare; eaten when little else is available.
Nipan	*Capparis lasiantha*	H	L	d	t	g	e			a			s			f	
Plumwood	*Satalum lanceolatum*	H	S		t	g	e	w			h	m	s	r		f	
Prickly wattle (acacia)	*Acacia nilotica*	M	S	d	t			w		a						f	
Queensland bluebush	*Chenopodium auricomum*	H	L							a						f	Eaten readily; not toxic in the field.
Turpentine mulga	*Acacia brachystachya*	M	S									m	s			f	Rare; of limited value.
Vinetree	*Ventilago viminalis*	H	S	d	t	g	e						s			f	Eaten readily; not toxic in the field so long as the diet is mixed.
Western dead-finish	*Acacia tetragonophylla*	H	L								h		s	r		f	Leaves shed during drought.
Whitewood	*Atalaya hemiglauca*	H	T/S	d	t	g	e	w			h	m	s	r		f	Eaten readily; rarely causes stock losses.
Wilga	*Geijera parviflora*	H	T			g	e	w			h					f	Eaten readily.
Witchetty bush	*Acacia kempeana*	H	S									m				f	Most common on shallow calcareous soils.

1. **Palatability:** see Appendix III for codes.

2. **Habit:** see Appendix III for codes.

3 **Land zone:** see Appendix III for codes.

4. **Edible part of plant:**
   b = branchlets, young stems
   d = dead, fallen leaves
   f = foliage
   i = inflorescence, flowers
   p = seed pods
   s = suckers

WOODY WEEDS

Woody weeds are tree and shrub species which have the potential to occur at such high densities that they suppress herbage growth and/or make stock management difficult. They generally become a problem in overgrazed native pastures or in areas that have been cleared for sown pasture establishment.

Species which may cause a problem in the area are listed in Table 6.2. One of the most widespread and common species is budda or false sandalwood (*Eremophila mitchellii*). It is a serious weed in gidgee lands following clearing, and is also common in eucalypt communities on heavier soils.

Other *Eremophila* species are a problem in mulga and sandplain communities together with turkey bush and other *Cassia* species.

Gidgee communities often have dense regeneration which limits herbage growth. Landholders consider that gidgee is their worst woody weed (Reynolds and Carter 1990). Where gidgee communities have a mix of plant sizes, mechanical treatment usually results in a regrowth problem. Smaller gidgee plants exist as multi-stemmed suppressed seedlings which grow rapidly when released from competition.

Gidgee is scattered throughout most of the wooded downs land systems and it is invading following significant recruitment in the 1950s and mid-1970s. Changes in the fire regime and increase in grazing pressure have favoured this development.

Belalie may become a nuisance along watercourses and mimosa bush can form dense stands on parts of the undulating and alluvial downs. Several other species of *Acacia* may reach very high densities in certain residual, sandplain and eucalypt communities, probably as a result of the burning of the predominantly spinifex (*Triodia* spp.) ground stratum. They probably have little effect on the normally sparse palatable herbage, but may restrict stock movement (Purdie 1990).

The most serious woody weed within the area is prickly wattle (*Acacia nilotica*). Originally introduced for shade and fodder in the 1890s, it has now invaded large areas of undulating downs and alluvia, forming dense thorny thickets and eliminating the Mitchell grass pasture (Carter *et al.* 1989).

Parkinsonia and prosopis are two other potentially serious weed species (Humphries *et al.* 1991).

POISONOUS PLANTS

Plant species known to be toxic under field conditions, summaries of their distribution in the land zones and their toxic components are listed in Table 6.3. Other species which are known to contain poisonous compounds or which have caused poisoning only in experimental situations, are listed in Appendix III. Descriptions of each species, its toxic components, symptoms of poisoning and treatment are included in Everist (1974) and Dowling and McKenzie (1992).

Factors contributing to stock losses have been discussed by Mitchell (1979) and are summarised by Purdie (1990). Many potentially poisonous plants are readily eaten by stock and cause no problems unless they are the only available food. Local knowledge of poisonous species and the conditions under which they can cause death is essential for efficient management of an area. Stock losses can be minimised by avoiding conditions that lead to a buildup of poisonous plants (particularly overgrazing) and by not placing stock in potentially dangerous situations. For example, areas of the eucalypt land zone in the east need to be fenced to exclude stock from heart-leaf poison bush (*Gastrolobium grandiflorum*).

Table 6.2 Woody weed species

Common name	Scientific name	Occurrence in land zone*
Acacias	*Acacia cowleana* *A adsurgens* *A. leptostachya* *A. melleodora* *A. torulosa* *A. tenuissima*	E,S E,M E E E,W,L E,S
Ant bush	*Senna planiticola*	
Belalie	*Acacia stenophylla*	E,W,C,A,L
Butter Bush	*Senna artemisiodes* subsp. *coriacea*	
Butterfly bush	*Petalostylis cassioides*	S
Cassia	*Senna artemisiodes* subsp. *helmsii*	F,H,M,S
Castor oil plant	*Ricinus communis*	W
Charleville turkey bush	*Eremophila gilesii*	S
Cockroach bush	*Senna notabilis*	
Conker berry, Boorum bush	*Carissa lanceolata*	F,G,E,W,A,H,S
Coolibah	*Eucalyptus coolibah*	E,W,C,A,S,L
Creek wilga, Gooramurra	*Eremophila bignoniiflora*	E,H,M,S,R
Currant Bush	*Carissa ovata*	G,W,S
Ellangowan poison bush	*Myoporum deserti*	G,E,W,A
Eremophila	*Eremophila duttonii*	G
Georgina poison bush	*Eremophila latrobei*	E,A,H,S,R
Gidgee	*Acacia cambagei*	T,G,W,C,A,H,S,R
Gunda-bluey	*Acacia victoriae*	F
Large-fruited hop bush	*Dodonaea petiolaris*	H,R
Lignum	*Muehlenbeckia cunninghamii*	G,C,A,S,L
Mimosa bush	*Acacia farnesiana*	F,T,G,E,W,A,S
Mulga	*Acacia aneura*	H,M,S,R
Parkinsonia	*Parkinsonia aculeata*	W
Poplar box	*Eucalyptus populnea*	E
Prickly wattle, prickly acacia	*Acacia nilotica*	F,T,W
Prosopis, Algoraba	*Prosopis limensis*	
Sandalwood, Budda	*Eremophila mitchellii*	F,T,G,E,W,A,H,S,R
Sandhill hopbush	*Dodonaea viscosa* subsp. *angustissima*	E
Silver cassia	*Senna artemisioides* subsp. *artemisioides* *Senna artemisioides* subsp. *petiolaris*	G,E,A,R F,G,E,A,S,R
Turkey bush	*Senna artemisoides* subsp. *oligophylla*	F,G,E,A,H,S,R
Turpentine bush	*Acacia chisholmii*	E

* See Appendix III for codes

Table 6.3 Poisonous plant species

Common name	Scientific name	Land zone[1]												Poisonous component[2]	Comments
		D	T	G	E	W	C	A	H	M	S	R	L		
TREES															
Bitter bark	*Alstonia constricta*				e									AL	
Boonaree	*Alectryon oleifolius*	d	t		e			a			s			CG	Moist young leaves highly toxic.
Kurrajong	*Brachychiton populneus*				e						s			UT	Seeds particularly toxic.
Whitewood	*Atalaya hemiglauca*	d	t	g	e	w			h	m	s	r		UT	Not usually toxic in the field.
Vine tree/supple jack	*Ventilago viminalis*	d	t	g	e					s				OT	Not toxic so long as diet is mixed.
SHRUBS															
Boobialla	*Myoporum acuminatum*			g	e	w		a						Ni	
Berrigan	*Eremophila longifolia*				e			a		m	s			UT	
Castor oil plant	*Ricinus communis*					w								OT	
Caustic vine	*Sarcostemma australe*								h					UT	
Ellangowan poison bush	*Myoporum deserti*			g	e	w		a						EO	
Fuchsia bush	*Eremophila maculata*	d	t					a						OG	
Heart leaf poison bush	*Gastrolobium grandiflorum*				e						s	r		OT	
Georgina poison bush	*Eremophila latrobei*				e			a	h		s	r		OT	
GRASSES															
Buffel grass	*Cenchrus ciliaris*	d		g	e			a						Ox	A valuable introduced pasture grass, only occasionally a problem.
Button grass	*Dactyloctenium radulans*	d	t	g	e	w	c	a	h	m	s	r	l	UT	Common in overgrazed areas.
Hairy panic	*Panicum effusum*			g	e				h		s			UT	
Native couch/spider grass	*Brachyachne convergens*	d		g	e	w	c							CG	
Purple plume grass	*Triraphis mollis*							a						EO	

Common name	Scientific name	Land zone[1]												Poisonous component[2]	Comments
		D	T	G	E	W	C	A	H	M	S	R	L		
FORBS															
Annual saltbush	*Atriplex muelleri*						c							Ox, Ni	
Bathurst burr	*Xanthium spinosum*					w		a						OG, UT	
Birdsville indigo	*Indigofera linnaei*				e	w							l	UT	
Boggabri	*Amaranthus mitchellii*	d		g		w								Ox, Ni	
Caltrop	*Tribulus terristris*	d												Ni, OT	
Caustic weed	*Euphorbia drummondii*	d			e			a						UT	
Crested goosefoot	*Chenopodium cristatum*				e									CG	
Golden billy-buttons	*Craspedia chrysantha*												l	UT	
Gomphrena weed	*Gomphrena celosioides*				e	w		a						UT	
Flinders poppy	*Pimelea decora*	d													
Mexican poppy	*Argemone ochroleuca*					w	c	a						AL	Common in disturbed areas.
Morgan flower/Blue rod	*Stemodia florulenta (Morgania floribunda)*					w								UT	
Mulga fern/Rock fern	*Cheilanthes sieberi*				e							r		Ox, UT	
Munyeroo, Pigweed	*Portulaca oleracea*	d		g		w		a						Ox, Ni	
Native thorn-apple	*Datura leichhardtii*					w	c	a						Ni, AL	Occurs in overgrazed areas.
Nettle-leaf goosefoot	*Dysphania glomulifera*								h					CG	
Noogoora burr	*Xanthium pungens*	d			e	w	c	a						OG,OT,UT	Common in disturbed areas and along water courses.
Parakeelya	*Calandrinia balonensis*				e									Ox	
Pimelea poppy	*Pimelea haematostachya*	d												UT	
Potato bush	*Solanum ellipticum*			g	e						s			OT	
Poverty bush	*Pimelea simplex* subsp. *continua*		t	g										UT	
Prickly paddy melon	*Cucumis myriocarpus*			g		w		a	h	m				UT	
Red spinach	*Trianthema triquetra*	d	t	g		w		a						Ox, Ni	
Sand spurge	*Phyllanthus fuernrohrii*				e	w								UT	Rarely causes stock losses in the field.
Soda bush	*Neobassia proceriflora*		t				c							Ox	

Common name	Scientific name	Land zone[1]												Poisonous component[2]	Comments
		D	T	G	E	W	C	A	H	M	S	R	L		
Soft roly poly	*Salsola kali*	d	t	g		w	c					r		Ox, Ni	Widespread in overgrazed areas.
Twin leaf	*Zygophyllum ammophilum*	d												UT	
Weir vine	*Ipomoea calobra*										s			UT	

1. Land zone: see Appendix III for codes.

2. Poisonous component:

Ox = oxalates	OG = other glycosides
Ni = nitrates	AL = alkaloids
EO = essential oils	OT = other known toxins
CG = cyanogenetic glycosides	UT = uncertain or unknown toxins

TIMBER TREATMENT

Timber clearing and sowing improved pastures have mainly been confined to the gidgee lands. The gidgee woodlands are not extensive in this survey area and many of the larger areas have been partly developed. Small isolated areas of virgin gidgee are often uneconomic to develop at the property level. The gidgee lands fringing the dissected residuals have not been cleared. These areas are quite open, often very stony and the slopes are conducive to soil erosion if ground cover is lost. Attempts to clear areas of low gidgee or gidgee of mixed height/size classes have been largely unsuccessful and vigorous regrowth has occurred within 10 years of treatment. Hot grass fires are a preferred method to control regrowth.

Most cleared areas are sown to buffel grass (*Cenchrus ciliaris*) which has proven suitable in this semi-arid environment where rainfall is <500 mm p.a.. However, compared to the gidgee lands around Blackall, buffel has often established poorly after clearing.

Blackwood (*Acacia argyrodendron*) or black gidgee occurs in the Torrens Creek portion in the north east. The open woodlands are well grassed in normal seasons with native species such as Mitchell grass and curly bluegrass. There is little incentive for clearing these areas as they are already productive. Some blackwood woodlands/forests have been cleared but buffel grass has not been successful in establishing. This may be attributed to the low available phosphorus status (surface soils have a mean of 15 ppm) of these clay soils. Christie (1975), in pot trials, demonstrated that buffel grass required 25 ppm of available phosphorus for successful establishment.

The eucalypt woodlands have very limited potential for development due to drought-prone, infertile soils and regrowth problems. Regrowth from suppressed seedlings and suckers requires costly treatment if pasture productivity is to be maintained. It is unlikely that the costs of pasture maintenance will be recouped. Additionally, no suitable replacement pasture species has yet been found for this demanding environment.

The mulga associations in the south west are of minor importance. Some areas have been pushed for drought feeding and have regenerated well. Most damage to these associations has been caused by fires resulting in loss of mulga topfeed and an increase in woody weeds.

EROSION

The region is basically stable with natural geological erosion mainly evident in the dissected uplands of the south-west and sections of the Alice Tableland. Data collected during the survey indicates erosion is not a problem in the more productive areas. The soil types mainly affected by erosion include the massive earths and texture contrast soils of the sandplains.

Mitchell Grass Downs

This land zone, comprising nine land systems, occupies 74.9% of the region. It is the most productive land zone, being the basis of the sheep industry. The soils are medium to heavy clays, strongly structured and widely cracking when dry. Long, low slopes are common (2%) and the soils are usually well-protected by perennial grasses. Soil stability is further enhanced in the timbered areas by stone cover. These clay soils will erode if the grass cover is inadequate and high intensity storms are experienced. Erosion is generally not a problem although minor siltation of culverts and gully dams may occur.

Gidgee Lands

The gidgee woodlands of the gently undulating plains are stable except in heavily grazed areas. The soils are medium to heavy clays, often gilgaied and usually with stone cover. The soils are well-structured and crack when dry. Long, low slopes are common except in the scarp retreat areas of the dissected uplands. These clay soils absorb substantial amounts of rain before the cracks close, gilgais fill and runoff is initiated. Most of the gidgee woodlands have been cleared and sown to buffel grass. This grass is well-adapted to this environment and dense swards are common. These pastures extend runoff times.

The gidgee open woodlands in the scarp retreat zones are prone to erosion. These open woodlands fringe the dissected uplands and active erosion gradients exist. Generally these areas are not well grassed. This is due in some cases to overgrazing by stock, while seeking shade and a change in diet. Gullying is common and ground cover must be maintained to contain erosion within acceptable limits. Timber clearing or thinning on these footslopes is not recommended.

Eucalypt Woodlands

This land zone occurs along the eastern section and consists of two landform elements. They include the intact Tertiary tableland (or high plain) and the surrounding outwash plain. The interface of these landforms is naturally eroding. The soils of the sandplain are massive-structured red and yellow earths, and sandy texture contrast soils. Hard setting surfaces are characteristic and surface seals occur. Initial water infiltration into the earths is good but the soils have low water holding capacities. Consequently, the soil profile soon becomes saturated and runoff occurs. Runoff time may be hastened by surface seals and impermeable subsoils in the texture contrast soils. Sheet and gully erosion result, usually along poorly sited property roads and fences. Relocation of these structures has been necessary in some cases. Generally, erosion is not a problem but loss of even shallow depths of topsoil can greatly reduce productivity. These sandplains owe their stability to the protective cover of unpalatable grasses such as spinifex. Careful property planning and maintenance of grass cover will minimise the likelihood of erosion.

Mulga Lands

The soft mulga lands are presently in good condition with few signs of serious erosion. Scalding and minor sheet erosion are the main observable forms. In average seasons, the massive earths are well protected by both tree and grass cover. Little mulga clearing for topfeed has occurred. Conversely, the hard mulga lands are severely degraded. Severe sheet and gully erosion are widespread and productivity is very low. The total area involved is very small. Management practices such as total or partial retirement from grazing may assist in alleviating the problem.

Dissected Residuals

These lands are inherently unstable and are actively eroding. They are of little value for grazing but useful for watershedding and recreation purposes. Reclamation is impractical and unwarranted.

Alluvia

The alluvial clay plains are stable but are subject to flooding. Limited seasonal scalding occurs on interchannel areas and stream margins. These scalds revegetate in normal rainfall seasons. Extensive scalding is associated with the gidgee and blackwood alluvial plains of Torrens and Towerhill Creeks. Revegetation of these scalds is difficult as these frontage areas provide valuable grazing to the eucalypt and spinifex woodlands.

Permanent scalds and claypans occur on the alluvia of Splitters and Pelican Creeks east of Aramac. The soils are highly saline and saline springs occur. Vegetation is sparse forbland. Reclamation is unlikely although the methods developed by the New South Wales Soil Conservation Service (now the NSW Department of Conservation and Land Management) would apply.

PESTS

Animals which are considered pests in the area are feral pigs, kangaroos, dingoes, locusts and wedge-tailed eagles.

Feral pigs compete with stock for feed during dry periods and are also thought to be responsible for lamb deaths. However pigs also pose a major threat to the pastoral industry through the potential to spread and establish exotic diseases.

Both kangaroos and wallaroos occur within the area and compete for limited feed during dry periods. Kangaroo densities fluctuate, but have been estimated at 9/sq km (reds) and 4.5/sq km (greys) around Longreach. The grey kangaroos are more numerous in the eastern portion, where

densities may reach 20/sq km. Wallaroos are generally associated with broken, residual country and appear to be at relatively low densities (4/sq km).

Dingoes and wedge-tailed eagles may be responsible for some lamb losses. The wedge-tailed eagles are protected birds. Other pests such as rabbits, crows, foxes, rats and mice may cause problems locally.

AGRICULTURAL DEVELOPMENT

Pastures

Extensive areas of the gidgee woodlands in the south east of the area were cleared and sown to buffel grass in the 1960's. Generally only the more isolated areas of standing gidgee remain. Buffel grass has been successful in establishing and spreading in most cleared gidgee lands. Large areas of undeveloped blackwood (or black gidgee) occur in the Torrens Creek portion. The open woodlands are productive and not really suited to clearing. However, the productivity of the woodlands could be increased by clearing and allowing native grasses to thicken. Buffel grass has not been as successful in establishing in the blackwood areas, due probably to low available soil phosphorus.

Screening trials for assessing selected lines of legumes and grasses were initiated by CSIRO in 1976. These trials are sited on the massive red earths of the eucalypt and soft mulga sandplains. Several lines of both legumes and grasses show promise and evaluation is continuing (R. Strickland pers. comm.).

Crops

These lands are very marginal for dryland cropping. Available soil moisture is a major limitation and cropping is confined to the deep, cracking clays. During the period 1958 to 1977, the area cultivated ranged from 5 to 174 ha. Yields ranged from 0.68 to 2.2 t/ha but crop failures were more common.

Irrigation

Large scale public irrigation schemes are not possible due to the lack of suitable dam sites. Private schemes are feasible and would rely on the storage of surface runoff or off-stream storages. Irrigation research with shallow water storages has been carried out at Richmond. Stored water is used for irrigation of short-season summer crops. The ponded area is also used for cropping as the water recedes (Weston 1972). Very few private schemes operate. The capital investment, variability in results and unreliability of rainfall will be constraints to acceptance.

Some water harvesting schemes operate for irrigating native pastures. This entails gathering runoff water, diverting it via channels or diversion banks and then flooding Mitchell grass pastures. These schemes are claimed to be economic and have been successfully integrated into present stock management on a few properties.

TOURISM

Tourism is actively promoted in the larger centres of Barcaldine, Blackall, Longreach and Winton. These towns are linked by the bituminised Landsborough Highway and central western railway to Rockhampton. Scenic attractions are few. The monotony of the rolling downs is relieved only away from the main roads. Apart from the ephemeral lakes, the eucalypt 'desert' country has little to offer in the way of scenery. The rough range country west of Longreach and south of Winton is popular with opal fossickers. No regular organised tours are centred on these towns. However, these towns are regularly used as overnight stopovers by tourist coaches *en route* to Mt. Isa and the Northern Territory.

NATIONAL PARKS

Forest Den National Park is located 100 km north of Aramac on the Torrens Creek road. Approximately 5890 hectares in area, the park preserves a fine stand of blackwood (black gidgee). Its primary purpose is for conservation, as well as providing seasonally important wildlife habitat along Torrens and Paradise Creeks. The park has limited tourism potential and presently offers no facilities.

Bladensburg National Park, located 35 km south of Winton, is 33700 hectares in area and conserves the upper catchment of Mistake Creek in the Forsyth Range. The present park consists of eucalypt and spinifex woodland and has no public access. Purchase of additional areas in 1993 will extend the park to include scenic range country (dissected residuals) and waterholes easily accessible from the Matilda Highway. These areas will be progressively opened for tourism over the next four years.

REFERENCES

Askew, K and Mitchell, A.S. (1978). *The fodder trees and shrubs of the Northern Territory.* Division of Primary Industries, Extension Bulletin, No. 16.

Carter, J.O., Bolton, M.P. and Cowan, D.C. (1989). Prickly acacia: save dollars by early control measures. *Queensland Agricultural Journal* **115**, 121-126

Chippendale, G.M. (1963). Effects of grazing on topfeed in central Australia. *Australian Journal of Experimental Agriculture and Animal Husbandry* **3**, 30-34.

Chippendale, G.M. (1968). *A study of the diet of cattle in central Australia as determined by rumen samples.* Northern Territory Administration, Primary Industries Branch Technical Bulletin, No. 1.

Christie, E.K. (1975). A study of phosphorus nutrition and water supply on the early growth and survival of buffel grass grown on a sandy red earth from south-west Queensland. *Australian Journal of Experimental Agriculture and Animal Husbandry* **15**, 239-49.

Dowling, R.M. and McKenzie, R.A. (1992). *Poisonous plants: A field guide.* Queensland Department of Primary Industries Information Series, QI 92035.

Everist, S.L. (1969). *Use of fodder trees and shrubs.* Queensland Department of Primary Industries, Advisory Leaflet No. 1024.

Everist, S.L. (1974). *Poisonous plants of Australia.* Angus and Robertson Pty Ltd, Sydney.

Humphries, S.E., Groves, R.H. and Mitchell, D.S. (1991). Plant invasions of Australian ecosystems. A status review and management directions. *Kowari* **2**, 1-127.

Leigh, J.H., Wilson, A.D. and Mulham, W.E. (1978). Season variation in the leaf fall and quality of the leaves of four Australian fodder trees. *Australian Rangelands Journal* **1**, 137-141.

Maconochie, J.R. and Lange, R.J. (1970). Canopy dynamics of trees and shrubs with particular reference to arid-zone topfeed species. *Transactions of the Royal Society of South Australia* **94**, 243-248.

McDonald, W.J.F. and Ternouth, J.H. (1979). Laboratory analyses of the nutritional value of western Queensland browse feeds. Australian *Journal of Experimental Agriculture and Animal Husbandry* **19**, 344-349.

Mitchell, A.S. (1979). Poisonous plants in Northern Territory rangelands. *Australian Rangelands Journal* **1**, 239-243.

Mills, J.R. and Boyland, D.E. (1980). Resource Use, In *Western Arid Region Land Use Study, Part II.* Queensland Department of Primary Industries, Division of Land Utilisation Technical Bulletin No. 22, 103-142.

Pedley, L. (1967). Pasture lands of the Nogoa-Belyando area. In *Lands of the Nogoa-Belyando area, Queensland*, CSIRO Australia, Land Research Series No. 18, 170-175.

Perry, R.A. (1964). Land use in the Leichhardt-Gilbert area. In *General report on Lands of the Leichhardt-Gilbert area, Queensland, 1953-54.* CSIRO Australia, Land Research Series No. 11, 192-213.

Perry, R.A. and Lazarides, M. (1964). Vegetation of the Leichhardt-Gilbert area. In *General report on Lands of the Leichhardt-Gilbert area, Queensland, 1953-54.* CSIRO Australia, Land Research Series No. 11, 152-191.

Purdie, R.W. (1990). Vegetation, In *Western Arid Region Land Use Study, Part VI*, Queensland Department of Primary Industries, Division of Land Utilisation, Technical Bulletin No. 28, 49-92.

Reynolds, J.A. and Carter, J.O. (1990). Woody weeds in central western Queensland. *Proceedings 6th Australian Rangelands Society Conference, Carnarvon*, pp 304-306.

Turner, E.J. and Beeston, G.R. (1978). Resource Use. In *Western Arid Region Land Use Study, Part IV*, Queensland Department of Primary Industries, Division of Land Utilisation Bulletin No. 23, 69-92.

Weston, E.J. (1972). Cropping in the north-west. Part II. *Queensland Agricultural Journal* **98(3)**, 114-120.

Wilson, P.R. and Purdie, R.W. (1990). Resource Use. In *Western Arid Region Land Use Study, Part VI*, Queensland Department of Primary Industries, Division of Land Utilisation Technical Bulletin No. 28, 106-141.

APPENDIX I

LIST OF ABBREVIATIONS, SYMBOLS, RATINGS AND TERMS*

Abundance:	A qualitative indication of the density or aerial biomass of a species throughout a particular vegetation type, land unit or land zone
A.D. Moist:	Air dried moisture (see Appendix II)
Av. H_20 :	Available water (see Appendix II)
A.P. :	Acid extractable P (see Appendix II)
Association:	Stable plant communities which have the same dominant species and the same structural formation
A.W.C. :	Available soil water capacity - the difference between equilibrium moisture contents at suctions of -33 kPa and -1500 kPa
Available water rating:	Available water %

>16	Very high
13-16	High
9-12	Medium
5-8	Low
<5	Very low

Biomass:	Total weight of aerial and underground organs of a plant
Biotic factors:	The influence of animals on plant communities
Bulk rating of herbage:	A rough indication of aerial biomass based on PFC values:

PFC <1%	Limited, very low
1 - 10%	Low
10 - 20%	Medium
20 - 50%	High
>50%	Very high

B P. :	Bicarbonate extractable P (see Appendix II)
C :	Organic carbon (see Appendix II)
Ca .	Calcium
$CaCO_3$:	Calcium carbonate, lime (see Appendix II)
C.E.C.	Cation exchange capacity (see Appendix II)
Cl :	Chloride (see Appendix II)
Claypan:	Areas (sometimes scalded) with hard, massive surface soil which are predominantly clayey
C/N :	Ratio of % organic carbon to % total nitrogen
Condition:	The character of the vegetal cover and the soil under man's use, in relation to its potential

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* This is not a complete list of terms, but rather a list of terms which are used, but not adequately defined in the Concise Oxford Dictionary.

Condition classes:

Condition	Description
Excellent	No erosion. Few or no bare spaces General ground cover greater than 50 percent. Very high proportion of valuable pasture species.
Very good	No erosion. Some bare spaces. General ground cover greater than 30 percent. High proportion of valuable pasture species.
Good	Occasional minor sheeting by wind or water erosion with some bare spaces - (10 to 30 percent). General ground cover 20 - 30 percent. Moderate to high proportion of valuable pasture species.
Fair	Some minor sheeting by wind or water erosion with some rilling and gullying - frequent bare spaces (30 - 50 percent). General ground cover 10 - 20 percent. Moderate proportion of valuable pasture species.
Mediocre	Frequent moderate sheeting by wind or water erosion (50 - 60 percent bare space) with moderate rilling and gullying. General ground cover 5 - 10 percent. Moderate to low proportion of valuable pasture species.
Poor	Frequent moderate and severe sheeting by wind or water erosion (60 - 70 percent bare spaces) with severe rilling and gullying throughout. General ground cover less than 5 percent. Low proportion of valuable pasture species.
Very poor	Extensive moderate and severe sheeting by wind or water, or scalding (70 - 90 percent bare space) with extensive moderate and severe rilling and gullying, especially on drainage lines and flats.

Dominant species: Species which contribute most to the biomass of a plant community in any given area

Edaphic factors: The influence of the physical, chemical and biological characteristics of the soil on plant communities

E.C. : Electrical conductivity mS/cm (see Appendix II)

Endemic: Species whose natural distribution is confined to a particular region or to an unusual type of habitat

Erosion classes:

Class	1	Little or no erosion
	2	Wind erosion - scalding with little or no drift
	3	or scalding with moderate or plentiful drift
	4	Wind erosion - wind sheeting with little drift
	5	Wind erosion - wind sheeting with moderate to plentiful drift
	6	Wind erosion - drift and dune activation
	7	Water erosion - sheet erosion with or without associated rilling and gullying
	8	Water erosion - gully erosion with or without associated sheet erosion
	9	Water erosion - gullying and sheet erosion and lower slopes of steep rocky hills and ranges
	10	Special class - sandhill - claypan complex
	11	Special class - sloping scalds
	12	Special class - scalding and hummocking

E.S.P. . Exchangeable sodium percentage. Ratio of exchangeable sodium to cation exchangeable capacity expressed as %

Ex : Exchangeable

Ferricrete: A ferruginous natural material formed in a zone of iron oxide or hydroxide accumulation in the earth's crust

Floristic diversity: See species diversity

Fluctuating climax: A term used to denote a condition which appears relatively stable but which in reality is in a state of unstable equilibrium

Forb: Herbs other than grasses, grass-like plants and ferns (mostly dicotyledons)

Frequency: The percentage of times a species is present when sampling a vegetation type, land unit or land zone

Frequency per abundance rating:

	Frequency	Abundance
Abundant (=dominant species)	High (>50%)	Usually high
Frequent	High (>50%)	High
Common (=locally abundant)	Low (<50%)	High
Infrequent	Low (<50%)	Always low

F.S. : Fine sand

G.C. : Grazing capacity

Gilgai: Small scale surface undulations, the alternate hummocks and hollows of which show some degree of regularity

Graminoid: Grass and grass-like herbs (usually from the families Poaceae and Cyperaceae)

Grove: Clumps of trees or shrubs roughly aligned with the contour and forming a banded pattern

Herb: Non-woody plants forming the ground stratum

Hummock grass: Large, perennial, evergreen sclerophyllous grasses which are usually >40 cm tall in the vegetative state, and whose aerial parts are drought resistant. Usually refers to *Triodia* spp. and *Zygochloa paradoxa* but is also taken to include *Eragrostis australasica*

Ht : Height

K : Potassium

K (Total) Potassium (Total) X-ray fluorescence See Appendix II

K rating: Exchangeable K, m. equiv./100 g soil

m. equiv. per 100 g	Rating
<.15	Very low
.15 - .24	Low
.25 - .34	Fair
.35 - .54	Very fair
>.55	High

Crack and Isbell (1970) use value of 0.2 m. equiv./100 g ex.K as critical deficiency level.

Land system: An area or group of areas throughout which there is a recurring pattern of topography soils and vegetation

Land unit: A group of related sites associated with a particular landform within a land system and wherever the land unit recurs it has the same sites and similar, within defined limits, soils, vegetation and topography

Land zone: A broad grouping of land systems based on similarity of physiography, soils, vegetation and geomorphology

Limiting factor: Environmental factor limiting the growth and reproduction of a species

Mallee: Small *Eucalyptus* plants with a shrub-like habit in which many stems arise from a large swollen root or lignotuber

Mantled pediment: Gently undulating to undulating bedrock plains, sloping away from adjacent hills which carry a veneer of transported detritus the thickness of which varies from place to place

m. equiv./100 g Milli equivalents per 100 grams

Mesic: Moist

Mg : Magnesium

N : Nitrogen (see Appendix II)

Nitrogen ratings:

Rating	% Total N
Very low	<0.05
Low	0.05 - 0.09
Fair	0.10 - 0.14
Very fair	0.15 - 0.24

Na or Na+ : Sodium

Org C : Organic carbon

P : Phosphorus
Phosphorus (acid extraction N/100 H_2SO_4) - see Appendix II
Phosphorus (bicarbonate extraction) - see Appendix II
Phosphorus (Total) X-ray fluorescence

Phosphorus ratings:

Acid extraction		Bicarbonate extraction	
<11	Very low	<11	Very low
11 - 20	Low	11 - 20	Low
21 - 35	Fair	21 - 30	Fair
36 - 45	Very fair	31 - 40	Very fair
46 - 100	High	>40	High

PFC : Projective foliage cover, that is, the percentage of area covered by the foliage of plants, as estimated by the vertical projection of the foliage onto the ground

PFC ratings:

Dense	PFC 30-70%
Open	PFC 10 - 30%
Sparse	PFC <10%

pH ratings:

Rating	pH
Extremely acid	<4.5
Very strongly acid	4.5 - 5.0
Strongly acid	5.1 - 5.5
Medium acid	5.6 - 6.0
Slightly acid	6.1 - 6.5
Neutral	6.6 - 7.3
Mildly alkaline	7.4 - 7.8
Moderately alkaline	7.9 - 8.4
Strongly alkaline	8.5 - 9.0
Very strongly alkaline	>9.0

Phytogeography: The study of the geographical and evolutionary relationships of plant species

PPF : Principal profile form (Northcote 1974)

Rainfall rating: Rainfall received in a single precipitation event:

Light	12-25 mm
Medium	25-50 mm
Heavy	>50 mm

Relic: Populations or taxonomic groups now occupying a restricted part of a region where once abundant

RP : Representative profile

Run-on areas: An area which benefits from runoff water either by the water lying for a period or by water moving over the area

Saline: Northcote and Skene (1972)

Salinity ratings: Saline subsoil - >0.3% NaC1 or >0.18% C1

Rating	E.C.	% C1
Very low	<0.015	<0.01
Low	0.16 - 0.45	0.01 - 0.03
Medium	0.46 - 0.90	0.04 - 0.06
High	0.91 - 2.0	0.07 - 0.20
Very high	>2.0	>0.20

Saltpan: The term has been applied to soils with loose, puffy surface soil containing visible salt crystals. They commonly have a surface crust which is easily broken

Sandplain: Gently undulating to flat plains with well sorted fine to medium quality sand with reddish coating of iron oxides with increasing clay admixtures in sub-surface horizons. Little if any dune development

Scald: Those areas which are bare because of wind and water erosion

Seasonally abundant: Refers to ephemeral, annual or short-lived perennial herbs whose biomass is high only for a short period after seasonal high rainfall or flooding

Si Silt

Silcrete: A siliceous natural material formed in a zone of silica accumulation in the earth's crust

SMU : Soil mapping unit

SPC: Soil profile class. A three-dimensional soil body so that any profile within the body has a similar number and arrangement of major horizons whose attributes, primarily morphological, are within a defined range. All profiles within the soil type have similar parent materials (R.C. McDonald, personal communication).

Sodic: Northcote and Skene (1972)

sodic	E.S P. 6 - 14
strongly sodic	E.S P >14

Species diversity: (Floristic-, herb-, tree-, shrub-diversity): an indication of the richness and evenness of the flora of a particular region or vegetation type

Structural formation: The structure of a plant community as determined by the life form, height and PFC of the dominant species (see Table 5.5)

Topfeed: Edible trees and shrubs

Topfeed ratings:

limited	<25/ha
scattered	25-100/ha
abundant	>100/ha

Woody weeds: Unwanted trees and shrubs that frequently reach high densities after vegetation is disturbed

REFERENCES

Crack, B J. and Isbell, R.F. (1970), Studies in some solodic soils in north eastern Queensland. I. Morphological and Chemical Characteristics, *Australian Journal of Experimental Agriculture and Animal Husbandry* **10**, 334 - 341.

Northcote, K.H. (1974), *A Factual Key for the Recognition of Australian Soils*, 3rd Edition, Rellim Technical Publications, Glenside, South Australia.

Northcote, K.H. and Skene J.K.M. (1972), *Australian Soils with Saline and Sodic Properties*, CSIRO Australia, Division of Soils, Soils Publication No 27.

Rock Symbols


Chemically altered
Cretaceous-Jurassic rocks

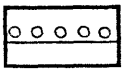
Labile sandstones (K)
Kw Winton forms
Klm Mackunda forms

Toolebuc limestones

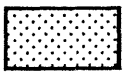
Mudstones
Kla Allaru mudstones
Klu Wallumbilla form
(Kld Doncaster member)
(Klc Coreena member)

Sandstones, conglomerate
minor siltstones [Tertiary]

Sublabile sandstones
J-Kh Hooray sandstone
J-Kr Ronlow beds


Gravel, stonecover


Clay, alluvium


Sand

Surface Symbols (Soils)

C Clay

T Texture contrast soil

Y Yellow earth

S Siliceous sand

R Red earth

L Lithosol

Vegetation Symbols


Silver leaved ironbark,
Whites ironbark


Coolibah


River red gum


Long fruited bloodwood


Ironwood


Eastern dead finish


Western bloodwood
Gum - topped bloodwood,
Bloodwood (unspecified)


Whitewood


Yellowjack


Emu apple


Melaleuca bracteata /
M. tamarascina


Desert gum


Mountain yapunyah


Poplar box,
Reid River box


Bauhinia


Eucalyptus eucentrica


Normanton box


Gidgee


Vinetree


Boree


Blackwood


Mineritchie


Boonaree


Lancewood, bendee


Mulga


Bastard mulga


Beefwood


Low shrubs

APPENDIX II

SOIL ANALYTICAL METHODS

by C.R. Ahern

SAMPLE PREPARATION - 1B1*

All samples were dried at 40°C in a forced air draught. Gravel was sieved out using a 2 mm sieve, while samples not containing gravel were ground to less than 2 mm. All determinations were carried out using the less than 2 mm soil fraction. All results are reported on an air dry basis except where indicated.

PARTICLE SIZE DISTRIBUTION

Particle size distributions were determined by a modification of the hydrometer method of Piper (1942). The modifications were that the soils were dispersed with sodium hexametaphosphate and sodium hydroxide and samples high in gypsum were sieved with 0.2 mm sieve after an initial boiling treatment prior to an acid treatment. Results are reported on an oven dry basis (%).

With soils containing appreciable carbonate, the sum of particle sizes may be less than 100% where acid treatment was used.

ELECTRICAL CONDUCTIVITY - 3A1

A 1:5 soil:deionised water suspension was shaken for an hour and the electrical conductivity (EC) was measured at 25°C (mS cm^{-1}).

A 1 50 soil:water suspension was generally used on soils with EC greater than 1 mS cm^{-1}, particularly if gypsum was suspected of being present. EC 1:50 values were converted to approximate EC 1:5 values by multiplying by a factor of 10.

$$1 \text{ mS cm}^{-1} = 1 \text{ dS m}^{-1}$$

Soluble salts can be estimated approximately from electrical conductivity readings by using the factor of Piper (1942).

$$\% \text{ TSS} = \text{EC mS cm}^{-1} \times 0.336 \text{ at } 25°\text{C}.$$

This factor can be in error, particularly on arid soils with unusually high concentrations of sulphates, bicarbonates, or calcium salts.

pH - 4A1

After determination of electrical conductivity, the pH of the same 1:5 suspension was measured with a glass electrode and saturated calomel reference electrode.

CHLORIDES

After conductivity and pH readings were complete, potassium alum was added to the 1:5 soil water suspension. Chlorides were determined on the stirred suspension with a specific ion electrode (Haydon *et al.* 1974). Results were reported as % Cl.

$$0.01\% \text{ Cl}^- = 100 \text{ mg Cl}^{-1} \text{ kg}^{-1}$$

ORGANIC CARBON - 6A1

The wet oxidation method of Walkley and Black (1934) was used on a finely ground sample. The reduced chromic ion (Cr^{+++}) was read colorimetrically (Sims and Haby 1971). Results reported are uncorrected Walkley and Black values (% C).

TOTAL NITROGEN - 7A2

The sample was finely ground. Selenium catalyst was used in a semi-micro Kjeldahl digestion. An auto analyser system was used for estimation of ammonium in the digests using a procedure similar to that of Crooke and Simpson (1971). Results are reported as total N(%).

EXTRACTABLE PHOSPHORUS - 9G2, 9B2

Acid Extractable P (0.005 M H_2SO_4) was determined by the Kerr and von Stieglitz (1938) method. Readings were carried out

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* Code refers to the corresponding though not always identical method given in Rayment and Higginson (1992).

using an auto analyser technique. Results are reported as parts per million (ppm) of phosphorus

$$1 \text{ ppm P} = \text{mg P kg}^{-1}$$

Bicarbonate Extractable P (0.5 M Na HCO_3 adjusted to pH 8.5), was determined by the Colwell (1963) method as above.

REPLACEABLE POTASSIUM - 18B1

Potassium was extracted by shaking air dry soil and 0.05 M HCl (von Stieglitz 1953) at a soil:solution ratio of 1:40 for 4 hours. Potassium in the centrifuged extract was determined by flame photometry. Results are reported as m. equiv. $100g^{-1}$ soil.

TOTAL PHOSPHORUS, TOTAL POTASSIUM, TOTAL SULPHUR - 9A1, 17A1, 10A1

About 3g of soil sample was very finely ground and pelleted with boric acid. The pellet was then exposed to a beam of X-rays in a Phillips 1410 vacuum X-ray spectrograph. Simple linear calibration was used to obtain percentage phosphorus, potassium and sulphur from fluorescent intensities.

EXCHANGEABLE CATIONS (Ca Mg Na K) AND CATION EXCHANGE CAPACITY (CEC) - 15C1

A method similar to that of Loveday (1974) was used.

After pre-washing with 60% ethanol, exchangeable cations were removed with 1M NH_4 Cl at pH 8 5 in 60% ethanol. Absorbed ammonium was removed with 0.5M sodium sulphate.

Ammonium and chloride in the sodium sulphate leachate were determined on an auto analyser using colorimetric methods. The difference in milliequivalents per 100g of soil was reported as the cation exchange capacity (CEC).

Measurements for soil with low CEC are not as precise as those for soils of high CEC. Calculated ratios such as CEC/clay may have considerable error when CEC is low, particularly if clay percentage is also low.

Exchangeable calcium may be slightly inflated on soils containing gypsum.

DTPA EXTRACTABLE COPPER, ZINC, MANGANESE AND IRON - 12A1

The method of Lindsay and Norwell (1978) is used for these micronutrients (0.005 M DTPA, 0.01 M $CaCl_2$ and 0 1 M triethanolamine, adjusted to pH 7.3, at a soil solution ratio of 1:2, with shaking for 2 hr). All four elements are determined by atomic absorption spectrophotometry and reported as ppm.

$$1 \text{ ppm} = 1 \text{ mg kg}^{-1}$$

MOISTURE CHARACTERISTICS

Moisture percentage at metric potentials of -33 kPa and -1500 kPa was determined on samples ground to less than 2 mm. A pressure plate apparatus of Soil Moisture Equipment Co of California was used Results are reported on an oven dry basis (%).

'Available soil water capacity' was approximated by the difference between these two laboratory measurements.

REFERENCES

Colwell, J.E. (1963), The estimation of the phosphorus fertiliser requirements of wheat in southern New South Wales by soil analysis, *Australian Journal of Experimental Agriculture and Animal Husbandry* **3,** 190-97.

Crooke, W.M. and Simpson, W.E. (1971), Determination of ammonium in Kjeldahl digests of crops by an automated procedure, *Journal of the Science of Food and Agriculture* **22,** 9-10.

Haydon, G.F., Williams, H. and Ahern, C.R. (1974), An investigation into the measurement of soil chloride by specific ion electrode, *Queensland Journal of Agriculture and Animal Science* **31,** 43-9

Kerr, H W. and von Stieglitz, C.R. (1938), The laboratory determination of soil fertility, *Bureau of Sugar Experimental Stations Queensland*, Technical Communication No. 9.

Lindsay, W.L. and Norvell, W.A. (1978), Development of a DTPA soil test for zinc, iron, manganese and copper, *Soil Science Society of America Journal* **42,** 421-28.

Loveday, J. (1974), *Methods for Analysis of Irrigated Soils*, Commonwealth Agricultural Bureau Technical Communications Number 54.

Piper, C.S. (1942), *Soil and Plant Analysis*, University of Adelaide.

Rayment, G.E. and Higginson, F.R. (1992). *Australian Laboratory Handbook of Soil and Water Chemical Methods*, (Inkata Press, Melbourne).

Sims, J.R. and Haby, V.A. (1971), Simplified colorimetric determination of soil organic matter, *Soil Science* **112,** 137-41.

United States Salinity Laboratory Staff (1954), Diagnosis and improvement of saline and alkali soils, *United States Department of Agriculture Handbook No. 60.*

von Stieglitz, C.R. (1953), Methods used in Queensland for assessing soil fertility, *Proceedings of the 1st Australian Conference in Soil Science* **1,** 2-21.

Walkley, A. and Black, I.A. (1934), An examination of the Degtjareff method for determining soil organic matter and a proposed modification of the chromic acid titration method, *Soil Science* **37,** 29-38.

APPENDIX III

VEGETATION

by W.J.F. McDonald and M.B. Thomas

A. LIST OF SPECIES OCCURRING IN EACH LAND ZONE

Families are arranged alphabetically, genera are listed alphabetically within the families, and species are listed alphabetically within genera. The presence of species in the land zones is indicated by symbols. The following information is given in the columns of the table:

Habit or Lifeform (where recorded):

E = ephemeral herb
H = annual or short-lived perennial herb
P = woody perennial forb, subshrub, and long-lived perennial graminoid
S = shrub
T = tree
V = vine or twiner
* = herb, with underground perennating organ, that acts like E or H

Land zones:

F	=	undulating downs	A	=	other alluvia
T	=	wooded downs	H	=	hard mulga
G	=	gidgee lands	M	=	soft mulga
E	=	eucalypt woodlands	S	=	sandplains
W	=	alluvial plains, woodlands	R	=	dissected residuals
C	=	channel country	L	=	miscellaneous (Lake)

Palatability rating:

L = Low or unknown M = Medium H = High

Toxicity values:

T = Toxic with feeding trials
C = Known to contain poisons
S = Suspected on field evidence
U = Not known or not suspected
* = Toxic if the only component of the diet

Note: plants known to be toxic are not always dangerous and may be useful components of the diet; see Resource Use chapter, Poisonous Plants.

Family and species	Lf	Land F	T	G	E	W	Zone C	A	H	M	S	R	L	Pal	Tox	Common name
ACANTHACEAE																
Dipteracanthus australasicus subsp. *corynothecus*	P	f				w										
Rostellularia adscendens	P	f			e							r		L	S	
AIZOACEAE																
Glinus lotoides	E					w	c							L	U	Hairy Carpet Weed
Gunniopsis zygophylloides	E													L	U	
Trianthema portulacastrum	H	f												L	S	Giant Pigweed , Black Pigweed
Trianthema triquetra	E/H	f	t	g		w	c	a						M	T*	Red Spinich
Zaleya galericulata	H	f												L	S	Hog Weed
ALISMATACEAE																
Caldesia oligococca var. *oligicocca*						w										
AMARANTHACEAE																
Achyranthes aspera	P	f			e	w								L	U	Chaff Flower
Alternanthera angustifolia	H	f		g	e	w		a						L	U	
Alternanthera denticulata	E/H	f			e	w		a						L	S	Lesser Joyweed
Alternanthera nodiflora	E			g		w	c	a						L	S	Common Joyweed
Alternanthera pungens	H													L	S	Khaki Weed
Amaranthus interruptus	H											r				
Amaranthus mitchellii	E	f		g		w								H	T*	Boggabri
Gomphrena brachyanthus	H															
Gomphrena celosioides	H				e	w		a						L	T	Gomphrena Weed
Gomphrena conica	H															
Gomphrena lanatus	E	f			e	w								L	U	
Gomphrena leontopodioides	H	f										r				
Hemichroa mesembryanthema	S											r		L	T	
Ptilotus exaltatus	H/P	f		g		w						r		M	U	Prince-of-Wales Feathers
Ptilotus exaltatus var *semilanatus*	H			g		w										
Ptilotus fusiformis					e											
Ptilotus macrocephalus	H/P										s			M	U	Large Green Pussy Tails
Ptilotus murrayi	E													L	U	
Ptilotus obovatus var. *obovatus*	P	f							h			r		M	U	
Ptilotus obovatus var. *parviflorus*	P															Smoke Bush
Ptilotus pedleyanus var. *pedleyanus*	P			g					h			r		L	U	
Ptilotus polystachyus	H/P													M	U	Green Foxbush, Pussy Tails
Ptilotus remotiflorus																
Ptilotus schwartzii	H								h			r		L	U	
Ptilotus spicatus var. *leianthus*	E	f												L	U	
Ptilotus brachyanthus	E															
AMARYLLIDACEAE																
Calostemma luteum	E*													M/L	S	Wilcannia Lily
Crinum flaccidum	E*	f												M/L	S	Murray Lily
APIACEAE																
Ammi majus	H/P															Bishop's Weed, Meadow sweet

Family and species	Lf	Land Zone												Pal	Tox	Common name
		F	T	G	E	W	C	A	H	M	S	R	L			
Berula erecta																
Ciclospermum leptophyllum	E															
Daucus glochidiatus	E													H	U	Australian Carrot
Eryngium plantagineum	H	f			e								l			Blue Devil
APOCYNACEAE																
Alstonia constricta	S				e									M	T	Bitterbark/ Quinine Tree
Carissa lanceolata	S	f		g	e	w		a	h		s			M	C	Conker Berry, Boorum Bush
Carissa ovata	S			g		w					s			M	C	Currant Bush
Parsonsia eucalyptophylla	V															
Parsonsia lanceolata	V				e					m						
ASCLEPIADACEAE																
Cynanchum floribundum	S													L	U	
Pentatropis atropurpurea																
Rhyncharrhena linearis	V									m				L	U	
Sarcostemma australe	S								h					M	T	Caustic Vine
ASTERACEAE																
Acanthospermum hispidum	H			g	e	w								M	C	Star Burr
Acomis macra					e							r				
Bidens pilosa	E										s	r		L	U	Beggar's Ticks, Cobbler's Pegs
Blumea diffusa	H				e						s					
Blumea saxatilis	H				e											
Brachyscome ciliaris var. *lanuginosa*	P/H													H	U	Native Daisy
Brachyscome tetrapterocarpa	E													H	U	
Brachyscome trachycarpa	H							a						H	U	
Brachyscome whitei	H				e								l	H	U	
Calotis cunefolia	E				e											
Calotis hispidula	E				e				h			r		H	U	Bogan Flea, Bindy Eye
Calotis lappulaceae	E													M	U	Yellow Daisy Burr
Calotis squamigera	E													M	U	
Calotis suffruticosa	E															
Carthamnus lanatus	H	f														Saffon Thistle
Centipeda cunninghamii	E/H													L	U	Common Sneezeweed
Centipeda minima	E				e						s			L	U	Spreading Sneezeweed
Centipeda racemosa	E/H															Snuff Weed
Cirsium vulgare	H															Spear Thistle
Conyza bonariensis	E/H															Flax-leaf Thistle
Craspedia chrysantha	E/H												l	H	S	Golden Billy Buttons
Emilia sonchifolia	E				e								l			Emilia
Epaltes australis	E/H							a					l	M	U	Spreading Nutheads
Erigeron ambiguus	E													L	U	
Eriochlamys behrii	E												l			Woolly Mantle
Flaveria australasica	E	f												L	U	Speedy Weed
Glossocardia bidens	E				e									M	U	Native Cobbler's Pegs
Gnaphalium diamantinensis	H													M	U	A Cudweed
Gnaphalium luteoalbum	H													M	U	Jersey Cudweed
Gnaphalium polycaulon	H													M	U	Indian Cudweed
Chrysocephalum apiculatum	H				e									M	U	Yellow Buttons
Helichrysum gracilescens	H				e											
Helichrysum podolepideum	P													L	U	
Helipterum corymbiflorum	E													M	U	Small White Paper Daisy
Helipterum floribundum	E									m		r		M	U	White Paper Daisy
Helipterum microglossum	E													M	U	
Helipterum polyphyllum	E											r				
Ixiolaena brevicompta	E	f			e									H	U	
Ixiolaena tomentosa	H	f												H	U	Wooly Ixiolaena
Minuria cunninghamii	P													L	U	Bush Minuria Scrambling
Minuria integerrima	H/E							a						M	U	Smooth Minuria

Family and species	Lf	Land Zone F	T	G	E	W	C	A	H	M	S	R	L	Pal	Tox	Common name
Olearia stuartii	S											r		L	U	
Olearia subspicata	S			g	e								l	L	U	Turkey Bush
Olearia xerophila	S											r				
Parthenium hysterophorus	H															Annual Ragweed, Parthenium
Pluchea dentex	P											r		L	U	
Pterocaulon redolens	H				e								l			
Pterocaulon serrulatum	H				e									L	U	
Pterocaulon sphacelatum	H	f		g								r		L	U	Ragweed - Apple Bush
Rutidosis helichrysoides	E				e			a		m	s			M	U	Billy Buttons
Senecio lautus	E				e	w		a						L	U	Variable Groundsel
Sphaeranthus indicus	H	f												L	U	
Streptoglossa adscendens	E	f	t		e	w	c	a			s			H	U	
Streptoglossa bubakii	P											r		L	U	
Streptoglossa odora	P			g				a						L	U	
Verbesina encelioides	H													L	T	Crownbeard
Vernonia cinerea	P				e									L	U	Vernonia
Vittadinia arida	H													L	U	
Vittadinia pterochaeta	H													L	U	
Wedelia spilanthoides	P													L	U	
Xanthium pungens	E	f			e	w	c	a						L	T	Noogoora Burr
Xanthium spinosum	E													L	T	Bathurst Burr
BORAGINACEAE																
Heliotropium fasciculatum	P													L	U	
Heliotropium indicum	H															
Heliotropium ovalifolium	H												l	L	U	
Heliotropium paniculatum	H													L	U	
Heliotropium strigosum	H															
Heliotropium tenuifolium	H	f												L	U	
Heliotropium ventricosum	H	f														
Trichodesma zeylanicum	E	f												M	S	Camel Bush, Cattle Bush
BRASSICACEAE																
Lepidium bonariense	E/H													L/M		Argentine Peppercress
Lepidium sagittulatum	E													L/M	U	
Rorippa eustylis	E													L/M	U	
Stenopetalum decipiens	P/H											r		M/H	U	
CACTACEAE																
Opuntia imbricata	P													L	U	
CAESALPINIACEAE																
Cassia pruinosa	S								h					L	U	White Cassia
Lysiphyllum carronii	T			g	e	w	c	a						H	U	Bauhnia
Lysiphyllum gilvum	T													H	U	Bauhnia, Bean Tree
Parkinsonia aculeata	S					w		a						L	U	Parkinsonia, Jerusalem Thorn
Petalostylis cassioides	S											r				
Senna artemisioides subsp. *coriacea*	S			g	e							r		L	U	Desert Cassia
Senna artemisioides subsp. *circinnata*	S							a						L	U	
Senna artemisioides subsp. *artemisioides*	S			g	e			a				r		L	U	Silver Cassia
Senna artemisioides subsp *helmsii*	S	f							h	m	s			L	U	Crinkled Cassia
Senna artemisioides subsp. *zygophylla*	S											r		L	U	
Senna artemisioides subsp. *oligophylla*	S	f		g	e			a	h		s	r		L	U	Turkey Bush
Senna artemisioides subsp. *petiolaris*	S	f		g	e			a			s	r		M	U	Grey Cassia

Family and species	Lf	Land F	T	G	E	W	Zone C	A	H	M	S	R	L	Pal	Tox	Common name
Senna artemisioides subsp. *sturtii*	S											r		M	U	Grey Cassia
Senna costata	S				e									L	U	Bean Cassia
Senna glutinosa subsp. *luerssenii*	S											r		L	U	
Senna notabilis	S													L	U	Cockroach Bush, Beetle Bush
Senna planitiicola	S													L	U	Yellow Pea, Arsenic Bush, Ant Bush
CAMPANULACEAE																
Isotoma petraea	H											r		L	S	Rock Isotome
Wahlenbergia communis	E				e			a			s			L	U	Australian Native Bluebell
Wahlenbergia graniticola	E				e									L	U	Native Bluebell
Wahlenbergia queenslandica	E													L	U	Native Bluebell
Wahlenbergia tumidifructa	E													L	U	Native Bluebell
CAPPARACEAE																
Apophyllum anomalum	S	f	t	g		w					s	r		H	U	Broom Bush, Mustard Bush
Capparis lasiantha	S	f	t	g	e			a			s			H	U	Nipan, Split Jack
Capparis loranthifolia	S						c							M	U	Narrowleaf Bumble
Capparis mitchellii	S	f									s			H	U	Bumble, Wild Orange
Capparis spinosa var. *nummularia*	S	f												H	U	Flinders Rose
CARYOPHYLLACEAE																
Polycarpaea breviflora	H/E								h			r		L	U	
Polycarpaea corymbosa var. *corymbosa*	H/E											r				
Polycarpaea corymbosa var *minor*	H/E			g							s					
Polycarpaea microphylla	H								h			r		L	U	
Polycarpaea sp. nov	H/E											r				
Sagina apetala	E													L	U	Pearlwort
CASUARINACEAE																
Casuarina cunninghamiana	T													L	U	River Oak
CELASTRACEAE																
Denhamia oleaster	T				e									L	U	
Maytenus cunninghamii	S				e									L	U	
CHENOPODIACEAE																
Atriplex cornigera	E/H													M	U	
Atriplex crassipes	E													M	U	
Atriplex eardleyae	E													M	U	A Saltbush
Atriplex lindleyi	E		t											L	U	A Saltbush
Atriplex muelleri	E						c							M	T*	Annual Saltbush
Atriplex sp. (R.W. Purdie 1441)	H													L	U	
Atriplex spongiosa	E/H							a						M	U	Pop Saltbush
Chenopodium auricomum	S						c							H	C*	Queensland Bluebush
Chenopodium cristatum	E													M	T	Crested Goosefoot
Chenopodium murale	H															
Chenopodium pumilio	E													M	S	Small Crumbweed
Dissocarpus biflorus var. *cephalocarpus*	H													L	U	
Einadia nutans	P				e								l	M	U	Climbing Saltbush
Einadia nutans subsp. *linifolia*	P					w								M	U	
Enchylaena tomentosa var. *tomentosa*	P	f	t	g	e				h			r		M	C	Ruby Saltbush
Halosarcia pergranulata	S							a					l	M/L	U	Samphire

Family and species	Lf	Land Zone F	T	G	E	W	C	A	H	M	S	R	L	Pal	Tox	Common name
Maireana coronata	E							a						M	U	
Maireana dichoptera	E	f												M	U	
Maireana georgei	S											r		M	U	Mountain Bluebush
Maireana tomentosa	P															
Maireana triptera	P								h					M	U	Three Wing Bluebush
Maireana villosa	H								h	m	s			L	U	A Cotton Bush
Neobassia proceriflora	E		t				c							M	T	Soda Bush
Rhagodia parabolica	S			g										M	U	
Rhagodia spinescens	S			g										L	U	Berry Saltbush
Salsola kali	E/H	f	t	g		w	c					r		H/M	T*	Soft Roly Poly
Sclerochlamys brachyptera	E	f												M	U	Short-winged Saltbush
Sclerolaena anisacanthoides	E/H	f				w	c							H	C	Yellow Burr
Sclerolaena bicornis var. *bicornis*	H	f												L	U	Goathead Burr
Sclerolaena bicornis var. *horrida*	H	f												L	U	Goathead Burr
Sclerolaena birchii	H			g		w								L	U	Galvanized Burr
Sclerolaena calcarata	E		t				c							H	C	Red Burr
Sclerolaena convexula	H				e	w								M	U	Copper Burr, Buck Burr
Sclerolaena cornishiana	H													L	U	Cart Wheel Burr
Sclerolaena diacantha	E/H					w						r		L	U	Grey Copper Burr
Sclerolaena divaricata	H													L	U	Gidgee Burr, Copper Burr
Sclerolaena eriacantha	P					w								M	U	
Sclerolaena everistiana	H			g		w		a						L	U	
Sclerolaena glabra	E		t			w			h			r		L	U	
Sclerolaena intricata	H/P		t				c	a					l	L	U	
Sclerolaena lanicuspis	E/H	f	t	g		w						r		L	U	Woolly-spined Burr
Sclerolaena longicuspis	H		t											L	U	
Sclerolaena minuta	H				e				h			r		L	U	
Sclerolaena muricata	H	f				w	c					r		L	S	Prickly Roly Poly, Black Roly Poly
Sclerolaena parviflora	H													L	U	
Sclerolaena tricuspis	H			g			c	a						L	U	
Sclerolaena ventricosa	H	f												L	U	
Sclerostegia tenuis	S													M/L	U	A Samphire
CLEOMACEAE																
Cleome oxalidea	E								h			r		L	U	
Cleome viscosa	H/E			g								r		L	U	Tickweed
COMBRETACEAE																
Terminalia aridicola	T															
COMMELILACEAE																
Murdannia graminea	E*													L	U	Grass Lilly
Commelina undulata	E*	f												H	U	Three Seeded Scurvey Weed
CONVOLVULACEAE																
Bonamia media	H				e	w								M	U	
Convolvulus erubescens	H	f												H	U	Australian Bindweed
Evolvulus alsinoides	H	f		g	e	w			h	m	s	r	l	H	U	Tropical Speedwell
Ipomoea argillicola	V															
Ipomoea calobra	V										s			M	T	Weir Vine
Ipomoea diamantinensis	E					w	c							H	U	Cow Vine, Potato Vine
Ipomoea gracilis	V												l	H	U	Cow Vine, Potato Vine
Ipomoea lonchophylla	E	f												H	C	Cow Vine
Ipomoea muelleri	H									m	s			H	C	A Morning Glory
Ipomoea nil	V															
Ipomoea plebia	V															
Ipomoea polymorpha	E													M	U	
Operculina sp. aff. *O. turpethum*	E*															

Family and species	Lf	Land F	T	G	E	Zone W	C	A	H	M	S	R	L	Pal	Tox	Common name
Polymeria ambigua	V				e	w										Creeping Polymeria
Polymeria calycina					e											
Polymeria longifolia	E*	f					c							M	U	Peak Downs Curse
Polymeria marginata		f				w								L	U	
Polymeria pusilla		f			e			a								
CUCURBITACEAE																
Citrullus lanatus					e									L/M	S	Wild Water Melon, Pie Melon
Cucumis melo subsp. *agrestis*		f		g	e									L/M	S	Paddy Melon, Wild Cucumber
Cucumis myriocarpus	E													L	T	Prickly Paddy Melon
Momordica balsamina	H										s			L	S	Balsam Apple
Mukia Sp. Q3	H													L	S	Gooseberry Cucumber
CYPERACEAE																
Bulbostylis barbata	E/H				e					m	s			L	U	A Sedge
Bulbostylis turbinata vel. aff	E/H									m				L	U	
Cyperus bifax	P	f	t	g			c	a						H	U	Downs Nut Grass
Cyperus bulbosus	E*													L	U	Nalgoo
Cyperus conicus	H				e	w							I	L	U	
Cyperus dactylotes	H					w		a						L	U	
Cyperus difformis	E					w	c	a					I	L	U	Umbrella Sedge, Variable Flat Sedge
Cyperus exaltatus	H/P													L	U	Tall Flat Sedge
Cyperus fulvus	H				e									M	U	
Cyperus gilesii	E	f	t	g				a						L	U	
Cyperus gymnocaulos	P													L	U	Spiny Flat Sedge
Cyperus iria	E			g	e	w								L	U	
Cyperus laevigatus	P													L	U	
Cyperus pygmaeus	E													M	U	Flat Sedge
Cyperus rigidellus	H			g	e	w		a						L	U	
Cyperus squarrosus	H							a						L	U	
Cyperus victoriensis	P					w	c	a						H	U	Channel Nut Grass
Eleocharis pallens	H						c				s			L	U	Pale Spike Rush
Fimbristylis aestivalis	H															
Fimbristylis caespitosa	H				e											
Fimbristylis corynocarya	H				e											
Fimbristylis dichotoma	H			g										M	U	
Fimbristylis littoralis	H					w							I	M	U	
Fimbristylis microcarya	H															
Fimbristylis microcarya	H															
Fimbristylis neilsonii	H				e											
Fimbristylis oxystachya	H				e											
Fimbristylis rara	H					w							I			
Fimbristylis squarrulosa	H				e											
Frimbristylis microcarya	H															
Liphocarpha microcephala	H					w										
Schoenoplectus litoralis	H															
DICRASTYLIDACEAE																
Spartothamnella teucriiflora	S										s			H	U	
DROSERACEAE																
Drosera burmanii	E													L	U	A Sundew
Drosera indica	E													L	U	A Sundew
DYSPHANIACEAE																
Dysphania glomulifera	E								h					M	T	Nettle-leaf Goosefoot Red Crumbweed
Dysphania rhadinostachya subsp. *rhadinostachya*	E									m		r	I	M	C	Green Crumbweed
Dysphania rhadinostachya subsp. *inflata*	E										s					

Family and species	Lf	Land Zone F	T	G	E	W	C	A	H	M	S	R	L	Pal	Tox	Common name
Ehretia saligna	S													H	C	Coonta
ELATINACEAE																
Bergia ammanioides	E				e									L	U	
Bergia pedicellaris	E					w								L	U	
Bergia trimera	E													M	U	
ERYTHROXYLACEAE																
Erythroxylum australe	S/T											r				
EUPHORBIACEAE																
Adriana glabrata						w										
Euphorbia coghlanii	E													M	S	Sandhill Caustic
Euphorbia dallachyana	E															
Euphorbia drummondii	E	f			e			a						M	T	Caustic Weed
Euphorbia hirta	E															Asthma Plant
Euphorbia inappendiculata	E	f									s			M	U	
Euphorbia mitchelliana	E/H	f			e									M	U	
Euphorbia parvicaruncula	E			g										M	U	Rough Seeded Spurge
Euphorbia tannensis																
subsp. eremophila	E							a			s			M	S	Desert Spurge
Leptopus decaisnei																
Petalostigma banksii	T			g	e											
Petalostigma pubescens	T				e	w							l	M	U	Quinine Bush
Phyllanthus fuernrohrii	H				e	w								L	S	Sand Spurge
Phyllanthus maderaspatensis																
var. angustifolius	E	f				w	c	a						M	U	
Phyllanthus sp. aff																
P. carpentariae	E				e											
Phyllanthus sp. nov.		f														
Phyllanthus virgatus	E				e			a								
Ricinus communis	S					w								L	T	Castor Oil Plant
Sauropus rigens	S										s	r		L	U	
Sauropus trachyspermus	E				e									M	U	
FABACEAE																
Aeschynomene brevifolia	E/H															
Aeschynomene indica	E/H				e	w	c		h					L/M	S	Budda Pea
Alysicarpus rugosus	H															Rough Chain Pea
Crotalaria cunninghamii	S													L	C	Parrot Pea
Crotalaria dissitiflora	E*	f												M	S	Grey Rattlepod
Crotalaria linifolia	E	f						a								
Crotalaria medicaginea	P				e	w								H	U	Trefoil Rattlepod
Desmodium campylocaulon	E*	f						a						H	U	
Desmodium filiforme	E	f			e											
Desmodium muelleri	E															
Desmodium sp. nov.																
Desmodium varians	H															Slender Tick Trefoil
Dicerma biarticulatum					e	w							l			
Erythrina vespertilio	S/T				e									M	S	Batswing Coral Tree
Gastrolobium grandiflorum	S				e						s	r		H	T	Heart Leaf Poison Bush
Glycine canescens	V													H	U	Silky Glycine
Glycine falcata	E*	f						a						H	U	
Glycine tomentella	H				e									H	U	Woolly Glycine
Hovea longifolia	S											r				Long Leaved Hovea
Indigofera brevidens	P				e									L	U	
Indigofera colutea	E													L	U	Sticky Indigo
Indigofera hirsuta	H					w								L	U	Hairy Indigo
Indigofera leucotricha	P											r		L	U	
Indigofera linifolia	E	f			e						s			M	S	Native Indigo
Indigofera linnaei	E				e	w							l	H	T	Birdsville Indigo
Indigofera parviflora	P	f												M	U	Small Flowered Indigo
Indigofera sp. *Q6.*	P				e									L	U	

Family and species	Lf	Land F	T	G	E	W	Zone C	A	H	M	S	R	L	Pal	Tox	Common name
Indigofera trita var *maffei*	E													M	U	
Indigofera trita var. *subulata*	E															
Indigofera trita var. *trita*	E	f												M	U	
Jacksonia ramosissima	P				e									L	U	
Jacksonia vernicosa	P				e									L	U	
Melolotus indicus	E													M	S	Hexham Scent
Muelleranthus trifoliolatus	H				e						s			M	U	
Psoralea australasica	E/H													M/L	U	
Psoralea cinerea	E/H	f	t				c	a			s			M/L	U	Annual Verbine
Psoralea graveolens	H/P							a								Emu Foot
Psoralea patens	P/H															Bullamon Lucerne
Psoralea tenax	P/H															Emu Foot
Rhynchosia minima	E*	f	t	g	e	w								M	U	
Sesbania campylocarpa	H													L/M	U	Sesbania Pea
Sesbania cannabina	H													L/M	U	Sesbania Pea
Sesbania javanica	E													L/M	U	
Swainsona burkei	E/H													M	U	
Swainsona campylantha	E/H													M	U	
Swainsona oligophylla	E/H													M	S	
Swainsona oroboides	E/H													M	S	Variable Swainsona
Tephrosia astragaloides	H															
Tephrosia benthamii	H															
Tephrosia brachycarpa	P										s			L	U	
Tephrosia brachyodon	H				e	w							l			
Tephrosia filipes	H				e	w										
Tephrosia flagellaris	H															
Tephrosia leptoclada	H				e											
Tephrosia stipuligera	P				e									M	U	
Tephrosia supina	P										s			L	S	
Trigonella suavissima	E					w	c							H	U	Copper Clover
Vigna lanceolata	H				e	w								H	U	Maloga Bean
Zornia adenophora	H				e											
Zornia muelleriana	H				e								l			
Zornia muriculata	H				e	w					s	r		L	U	
Zornia nervata	H				e						s			L	U	
FLINDERSIACEAE																
Flindersia maculosa	T		t	g	e						s	r		H	U	Leopard Wood
FRANKENIACEAE																
Frankenia serpyllifolia	P					w		a					l	L	U	
GENTIANACEAE																
Centaurium spicatum	E													L	U	Native Centaury
GOODENIACEAE																
Goodenia cycloptera	H/P				e									L	U	
Goodenia fascicularis	E/H	f			e		c	a			s			M	U	
Goodenia heterochila	E									m	s			L	U	Silky Goodenia
Goodenia lunata	H						c			m	s			M	U	
Goodenia paniculata	E				e											
Goodenia strangfordii	H	f												M	U	
Goodenia viridula	E				e											
Scaevola parvifolia	E				e									L	U	
Scaevola spinescens	S													L	U	Spiny Fan Flower
GYROSTEMONACEAE																
Codonocarpus cotinifolius	S/T									m				L	S	Desert Poplar

Family and species	Lf	Land F	T	G	E	W	Zone C	A	H	M	S	R	L	Pal	Tox	Common name
HALORAGACEAE																
Haloragis glauca forma *glauca*	E*													L	U	Grey Raspweed
Haloragis glauca f. *sclopetifera*	E*						c	a						L	U	A Raspweed
Haloragis heterophylla	E						c									
Myriophyllum verrucosum	H													L	U	Red Water Milfoil
HYDROCHARITACEAE																
Vallisneria americana var. *americana*	H															
LAMIACEAE																
Basilicum polystachyon	H/P													L	U	
Mentha australis	H/P													L	U	Native Mint
Ocimum tenuiflorum	E	f		g		w										
Teucrium integrifolium	H/P	f					c							L	U	Green Germander
LILIACEAE																
Bulbine bulbosa	E*	f												L	S	Native Leek
Dianella longifolia	P				e											Blue Flax Lily
Thysanotus tuberosus	E*															
Tricoryne elatior	E*															
LORANTHACEAE																
Amyema bifurcatum																A Mistletoe
Amyema maidenii				g		w								H	U	A Mistletoe
Amyema miraculosum subsp. *boormanii*														H	U	A Mistletoe
Amyema preissii														H	U	A Mistletoe
Amyema quandang var. *quandang*				g		w								H	U	Grey Mistletoe
Amyema quandang var. *bancroftii*												r				A Mistletoe
Dendrophthoe glabrescens					e											A Mistletoe
Diplatia grandibractea					e									H	U	A Mistletoe
Lysiana exocarpi														H	U	Green Mistletoe
Lysiana linearifolia														H	U	A Mistletoe
Lysiana subfalcata						w								H	U	A Mistletoe
LYTHRACEAE																
Ammania multiflora	E			g		w		a					l	H	U	
Lythrum hyssopifolia	E															Hyssop Loosestrife
MALVACEAE																
Abelmoschus ficulneus	P	f														Native Rosella
Abutilon arenarium	P															
Abutilon calliphyllum	P/S			g										L	U	
Abutilon fraseri	P			g	e							r		L	U	Dwarf Lantern Flower
Abutilon leucopetalum	P/S				e							r		L	U	Desert Chinese Lantern
Abutilon malvifolium	E	f	t		e			a						M	U	Bastard Mallow
Abutilon nobile																
Abutilon otocarpum	P			g	e	w					s			M	U	Flannel Weed
Abutilon oxycarpum var *subsagittatum*	P					w								L	U	
Gossypium australe	S				e						s			L	U	Native Cotton
Gossypium sturtianum	S															
Hibiscus brachysiphonius	H	f		g		w								M	U	
Hibiscus burtonii	P				e				h		s	r		M	U	
Hibiscus leptocladus																
Hibiscus meraukensis	P													M	U	
Hibiscus sturtii	P			g	e				h	m		r		M	U	

Family and species	Lf	Land F	T	G	Zone E	W	C	A	H	M	S	R	L	Pal	Tox	Common name
Hibiscus trionum	E	f												L	U	Bladder Ketmia
Malva parviflora	H															Small Flowered Mallow
Malvastrum americanum	E/H	f				w								M	C	Spiked Malvastrum
Sida ammophila	H													L	U	
Sida atherophora	H													L	U	
Sida cleisocalyx	E										s			L	U	
Sida cordifolia	H															
Sida corrugata	H				e											Corrugated Sida
Sida fibulifera	H	f	t	g	e	w		a						M	U	Silver Sida
Sida filiformis	H/P				e				h		s	r		L	U	
Sida goniocarpa	H	f												L	U	
Sida platycalyx	E	f								m	s			L	U	Lifesaver Burr
Sida rohlenae	H				e	w							l	L	U	Shrub Sida
Sida sp. aff. *S. corrugata*	H				e											
Sida sp. aff. *S. pleiantha*	H			g								r				
Sida spencerıana	E/H		t		e									M	U	
Sida spinosa	H	f			e											Spiny Sida
Sida subspicata	H				e							r				Spiked Sida
Sida trichopoda	H	f	t	g		w		a						H	U	High Sida
MARSILEACEAE																
Marsilea angustifolia	E															A Nardoo
Marsilea drummondii	E													M	S	Common Nardoo
Marsilea exarata	E													M	S	A Nardoo
Marsilea hirsuita	E													M	S	Short Fruited Nardoo
Ibicella lutea	H															Yellow Flowered Devil's Claw
MARTYNACEAE																
Martynia annua																
MELIACEAE																
Owenia acidula	T			g	e						s	r		H	U	
MENYANTHACEAE																
Nymphoides crenata	E															Water Lily
MIMOSACEAE																
Acacia acradenia	S				e							r		L	U	
Acacia adsurgens	S				e					m				L	U	
Acacia aneura	S/T								h	m	s	r		H	U	Mulga
Acacia aprepta	S															
Acacia argyrodendron	S/T		t	g		w						r				Blackwood, Black gidgee
Acacia bidwillii	T															
Acacia bivenosa subsp. *wayi*	S				e									L	U	Marpoo, Dune Wattle
Acacia brachystachya	S									m	s			M	U	Turpentine Mulga
Acacia cambagei	T/S		t	g		w	c	a	h		s	r		L	U	Gidgee
Acacia catenulata	T											r		M	U	Bendee
Acacia chisholmii	S				e							r		L	U	Turpentine Bush
Acacia coriacea	T				e	w			h		s	r		M	U	Desert Oak
Acacia cowleana	S				e						s			L	U	
Acacia crombiei	T		t													Pink Gidgee
Acacia cyperophylla	T/S											r		M	U	Mineritchie
Acacia decora	S				e											Pretty Wattle
Acacia ensifolia	S															
Acacia excelsa	T			g	e			a	h	m	s	r		M	U	Ironwood
Acacia farnesiana	S	f	t	g	e	w		a			s			H	U	Mimosa Bush
Acacia galioides	S				e											
Acacia gonoclada	S				e							r		L	U	
Acacia hemsleyı	S										s			L	U	
Acacia holosericea	T/S				e	w								L	U	
Acacia ixiophylla	S				e									L	U	Flat Top Wattle
Acacia kempeana	S													H	U	Witchetty Bush

Family and species	Lf	Land Zone F	T	G	E	W	C	A	H	M	S	R	L	Pal	Tox	Common name
Acacia laccata					e											
Acacia leptostachya					e											
Acacia longispicata												r				
Acacia maitlandii	S															
Acacia melleodora	S				e							r		L	U	
Acacia microcephala												r				
Acacia multisiliqua												r				
Acacia nilotica	S	f	t			w		a						L	U	Prickly Acacia
Acacia oligophleba	S															
Acacia oswaldii	S			g					h		s			M	C	Nelia
Acacia pendula	T		t											H	U	Myall
Acacia platycarpa	S				e											
Acacia salicina	S/T				e	w	c							L	S	Doolan, Sally Wattle
Acacia shirleyi	T/S				e				h			r		M	U	Lancewood
Acacia spania	S/T				e							r				
Acacia stenophylla	S				e	w	c	a					l	M	U	Belalie
Acacia stipuligera					e											
Acacia stowardii	S								h		s	r		L	U	Bastard Mulga
Acacia sutherlandii	T	f						a			s					
Acacia tenuissima	S				e						s			L	U	
Acacia tephrina	T	f	t					a						H	U	Boree
Acacia tetragonophylla	S								h		s	r		H	U	Western Dead Finish
Acacia torulosa	S				e	w							l			
Acacia victoriae	S	f												H	U	Gundabluie
Archidendropsis basaltica	S/T			g	e			a			s	r		H	U	Eastern Dead Finish
Neptunia dimorphantha	H/P	f			e	w								M	U	Native Sensitive Plant
Neptunia gracilis f. *gracilis*	H							a						H	U	Native Sensitive Plant
Neptunia monosperma	H/P	f												M	U	Native Sensitive Plant
Prosopis limensis	S															Algoroba
MYOPORACEAE																
Eremophila alatisepala	S															
Eremophila bignoniiflora	S				e	w	c	a			s		l	H	S	Creek Wilga, Gooramurra
Eremophila bowmanii	S				e				h	m	s	r		L	U	
Eremophila cordatisepala	S								h					L	U	
Eremophila duttonii	S			g							s			L	U	
Eremophila gilesii	S										s			L	U	Charleville Turkey Bush
Eremophila latrobei	S				e			a	h		s	r		M	T	Georgina Poison Bush
Eremophila longifolia	S				e			a		m	s			M	T	Berrigan, Dogwood
Eremophila maculata	S	f	t					a						H	T	Fuchsia Bush
Eremophila mitchellii	S	f	t	g	e	w		a	h		s	r		L	U	Sandalwood, Budda
Eremophila oppositifolia var. *rubra*	S											r		L	U	Mountain Sandalwood
Eremophila polyclada	S	f	t					a						H	U	Lignum Fuchsia
Eremophila sp. aff. elderi	S										s			L	U	
Eremophila tetraptera	S													H	U	
Myoporum acuminatum	S			g	e	w		a						H	T	Boobialla, Water Bush
Myoporum deserti	S			g	e	w		a						H	T	Ellangowan Poison Bush
MYRTACEAE																
Angophora floribunda	T				e			a								Rough Barked Apple
Calytrix microcoma	S															
Eucalyptus aspera	T											r				
Eucalyptus brachycarpa	T				e									L	U	Gum Topped Bloodwood
Eucalyptus brownii	T				e	w										Reid River Box
Eucalyptus camaldulensis	T				e	w		a				r	l	L	U	River Red Gum
Eucalyptus coolibah	T				e	w	c	a			s		l	L/M	U	Coolibah
Eucalyptus dolichocarpa	T				e	w										Long Fruited Bloodwood
Eucalyptus eucentrica	M											r		L	U	
Eucalyptus exserta	M											r		L	U	Bendo
Eucalyptus lamprophylla	T															
Eucalyptus melanophloia	T				e									L	U	Silver Leaved Ironbark

Family and species	Lf	Land Zone F	T	G	E	W	C	A	H	M	S	R	L	Pal	Tox	Common name
Eucalyptus miniata	T				e											Darwin Woollybutt
Eucalyptus papuana	T				e	w			h		s	r		L/M	U	Ghost Gum, Desert Gum
Eucalyptus persistens	M				e							r		L	U	Normanton Box
Eucalyptus populnea	T				e									L	U	Poplar Box
Eucalyptus setosa	T				e									L	U	Rough Leaved Bloodwood
Eucalyptus similis	T				e									L	U	Desert Yellow Jacket
Eucalyptus terminalis	T				e	w				m	s			L	U	Western Bloodwood
Eucalyptus tessellaris	T					w										Moreton Bay Ash, Carbeen
Eucalyptus thozetiana	T								h			r		L	U	Mountain Yapunyah
Eucalyptus whitei	T				e							r		L	U	Whites' Ironbark
Melaleuca bracteata	S/T							a								River Teatree, Black Teatree
Melaleuca nervosa var. *pendulosa*	T				e	w								L	U	Weeping Teatree
Melaleuca nervosa var. *nervosa*	T				e	w					s					
Melaleuca tamariscina	T				e											
Melaleuca trichostachya	S					w	c							L	U	River Teatree
Melaleuca uncinata	S/T				e											Broom Honey Myrtle
Myrtella microphylla	S				e											
NYCTAGINACEAE																
Boerhavia diffusa sens lat	E	f	t	g	e	w		a			s			H	S	Tar Vine
OLACACEAE																
Ximenia americana												r				
OLEACEAE																
Jasminum didymum subsp. *lineare*	V										s	r		L	U	Desert Jasmine
Jasminum didymum subsp. *racemosum*	V											r		L	U	Desert Jasmine
ONAGRACEAE																
Ludwigia octovalvis	H															Willow Primrose
Ludwigia peploides	H															Water Primrose
PAPAVERACEAE																
Argemone ochroleuca	H													L	T	Mexican Poppy
PEDALIACEAE																
Josephina eugeniae	E	f														Josephinia Burr
PERIPLOCACEAE																
Cryptostegia grandiflora	V					w										Rubber Vine
PITTOSPORACEAE																
Bursaria incana	S				e									M	U	Prickly Pine, Blackthorn
Pittosporum phylliraeoides	S													H/M	U	Meemeei, Cattle Bush
PLANTAGINACEAE																
Plantago cunninghamii	E															
Plantago drummondii	E	f												M	U	Sago Weed
PLUMBAGINACEAE																
Plumbago zeylanica	P											r		L	U	
POACEAE																
Amphipogon caricinus var. *caricinus*	P				e					m	s			M	U	Grey Beard Grass
Ancistrachne uncinulata					e									H	U	Hooky Grass
Aristida anthoxanthoides	E/H							a						M	U	Yellow Threeawn
Aristida benthamii					e				h		s			L	U	Wire Grass
Aristida biglandulosa	H													L	U	Two Gland Threeawn

Family and species	Lf	Land F	T	G	E	W	Zone C	A	H	M	S	R	L	Pal	Tox	Common name
Aristida calycina var. *calycina*	H				e	w			h		s			L	U	Dark Wiregrass
Aristida calycina var. *praealta*	H			g					h		s			M	U	Number 8 Wiregrass
Aristida caput-medusae	H				e											Many Headed Wiregrass
Aristida contorta	E/H	f		g	e			a	h	m	s	r		M	U	Kerosene Grass, Silver Grass
Aristida helicophylla	H															
Aristida holathera	H			g	e	w					s	r		M	U	Erect Kerosene Grass
Aristida inaequiglumis	H				e	w					s			L	U	Feather Top Threeawn
Aristida ingrata	H				e	w			h		s			M	U	
Aristida jerichoensis var. *jerichoensis*	E/H				e	w								M	U	Jericho Threeawn
Aristida jerichoensis var. *subspinulifera*	H				e											
Aristida latifolia	H	f	t	g	e	w	c	a			s	r		M	U	Feather Top Wiregrass
Aristida leptopoda														M/H	U	White Speargrass
Aristida obscura									h	m						
Aristida pruinosa	H									m	s			L	U	A Wiregrass
Aristida ramosa var. *ramosa*	H				e									L	U	Purple Wiregrass
Aristida sciuroides					e	w							l			
Arundinella nepalensis	P													L	U	Reed Grass
Astrebla elymoides	P	f	t					a						H	U	Hoop Mitchell Grass
Astrebla lappacea	P	f	t	g			c	a						H	U	Curly Mitchell Grass
Astrebla pectinata	P	f	t	g		w	c	a						H	U	Barley Mitchell Grass
Astrebla squarrosa	P	f	t	g		w	c	a						H	U	Bull Mitchell Grass
Austrochloris dichanthioides	E/H	f			e					m	s			M	U	
Bothriochloa bladhii	H/P					w								M/H	U	Forest Bluegrass
Bothriochloa decipiens var. *cloncurrensis*	H/P				e	w								M	U	Cloncurry Bluegrass
Bothriochloa ewartiana	H/P	f	t	g	e	w		a	h		s			H	U	Desert Bluegrass
Brachiaria foliosa																Leafy Panic
Brachiaria gilesii	E											r		H	U	Hairy-edged Armgrass
Brachiaria holosericea																Silky Top Armgrass
Brachiaria piligera	E/H													L	U	Hairy Armgrass
Brachiaria subquadripara	E							a						H	U	Green Summer Grass
Brachiaria windersii														H	U	
Brachyachne ciliaris	E								h					M	U	Hairy Native Couch
Brachyachne convergens	E	f		g	e	w	c							H	T	Native Couch, Spider Grass
Briza maxima	E															
Cenchrus ciliaris	P	f		g	e			a						H	U	Buffel Grass
Cenchrus echinatus	E	f												L/M	U	Mossman River Grass
Cenchrus pennisetiformis	P							a						H	U	Cloncurry Buffel, Slender Buffel Grass
Cenchrus setiger	E															Birdswood Grass
Chionachne hubbardiana	E	f						a						M	U	River Grass
Chloris divaricata																
Chloris inflata																Purpletop Chloris
Chloris pectinata	E	f	t	g	e	w		a		m	s			H	U	Comb Chloris
Chloris virgata	E	f		g	e	w		a						L	U	Feathertop Rhodes Grass
Chrysopogon fallax	P	f		g	e	w					s			H	U	Golden Beard Grass
Cymbopogon bombycinus	H/P				e						s	r		M	U	Silky Oilgrass, Silky Heads
Cymbopogon obtectus	H/P				e						s			M	U	Kapok Grass, Silky Heads
Cynodon dactylon	P				e	w		a					l	H	S	Couch Grass
Dactyloctenium radulans	E	f	t	g	e	w	c	a	h	m	s	r	l	H	T	Button Grass
Dichanthium annulatum	H/E															Angelton Grass
Dichanthium aristatum	H/E															
Dichanthium fecundum	H	f				w		a						H	U	Curly Bluegrass
Dichanthium sericeum subsp. *sericeum*	H/E	f	t	g	r			a		m				H	U	Queensland Bluegrass
Dichanthium sericeum subsp. *humilius*	E/H	f						a						H	U	Dwarf Bluegrass

Family and species	Lf	Land F	T	G	Zone E	W	C	A	H	M	S	R	L	Pal	Tox	Common name
Dichanthium sericeum subsp. *polystachyum*		f						a						H	U	Tassel Bluegrass
Digitaria ammophila	H				e			a		m	s			H	U	Silky Umbrella Grass
Digitaria bicornis						w							l			
Digitaria breviglumis												r				
Digitaria brownii	H				e				h	m	s	r		H	U	Cotton Panic Grass, Silver Spike Grass
Digitaria coenicola	H													H	U	Finger Panic Grass
Digitaria ctenantha	E	f												H	U	Comb Finger Grass
Digitaria divaricatissima														H	U	Blow-away Grass
Digitaria hystrichoides																
Diplachne fusca	E/H				e	w		a						M	U	Brown Beetle Grass
Echinochloa colona	E				e	w							l	H	C	Awnless Barnyard Grass
Echinochloa turneriana	E					w	c							H	U	Channel Millet
Ectrosia danesii																Hares Foot Grass
Ectrosia leporina																
Elytrophorus spicatus	E			g							s			L	U	Spike Grass
Enneapogon avenaceus	E	f	t	g				a			s	r		H	U	Ridge Grass
Enneapogon cylindricus	H/P													H	U	Jointed Nineawn
Enneapogon intermedius		f										r				
Enneapogon lindleyanus	H			g										L	U	Wiry Bottlewasher Grass
Enneapogon oblongus	H		t	g								r		L	U	Purple Bottlewasher Grass
Enneapogon pallidus	H			g	e	w	c							L	U	Conetop Nineawn
Enneapogon polyphyllus	E/H	f	t	g	e	w		a	h	m	s	r		M	U	Leafy Nineawn
Enneapogon robustissimus																
Enteropogon acicularis	H	f	t	g	e	w		a	h		s	r		H	U	Curly Windwill Grass
Eragrostis australasica	P						c	a						M	U	Swamp Cane Grass
Eragrostis basedowii	E			g	e									M	U	
Eragrostis cilianensis		f						a						L	U	Stink Grass
Eragrostis confertiflora	E					w								M/L	U	Spike Lovegrass
Eragrostis cumingii				g										M	U	Cumings Lovegrass
Eragrostis dielsii	E/H							a						H	U	Mallee Lovegrass
Eragrostis elongata	E/H				e	w		a						M	U	Clustered Lovegrass
Eragrostis eriopoda	P				e				h	m	s			M	U	Woolly butt Grass
Eragrostis falcata								a			s			H	U	Sickle Lovegrass
Eragrostis lacunaria	H			g	e				h		s	r		M	U	Purple Lovegrass
Eragrostis laniflora	P													M	U	Hairy Flowered Woolly butt
Eragrostis leptocarpa	E/H				e	w								M	U	Drooping Lovegrass
Eragrostis leptostachya																
Eragrostis microcarpa	E/H			g	e	w			h	m				M	U	
Eragrostis parviflora	E/H					w		a						M	U	Weeping Lovegrass
Eragrostis pergracilis	E				e									M	U	
Eragrostis setifolia	P	f		g	e		c	a			s			M	U	Neverfail Grass
Eragrostis sororia					e									M	U	
Eragrostis sp. *(Brass 1846)*											s		l			
Eragrostis speciosa	H			g	e			a			s		l	L	U	Handsome Lovegrass
Eragrostis sterilis																
Eragrostis tenellula	E	f		g	e	w		a						M	U	Delicate Lovegrass
Eragrostis xerophila	P	f				w								H	U	Knottybutt Wanderrie
Eremochloa bimaculata								a								Poverty Grass
Eriachne aristidea	E				e	w					s		l	M	U	Threeawn Wanderrie
Eriachne armittii	E	f			e					m				M	U	Longawn Wanderrie
Eriachne ciliata					e											
Eriachne helmsii	P									m				L	U	Woollybutt Wanderrie
Eriachne mucronata (typical form)	P			g	e				h	m	s	r		M/H	U	Rock Grass
Eriachne mucronata (desert form)												r				
Eriachne obtusa					e									M	U	Northern Wanderrie
Eriachne ovata	P							a						M	U	Swamp Wanderrie
Eriachne pulchella	E								h	m				L	U	Pretty Wanderrie
Eriochloa australiensis	E/H													H	U	Australian Cupgrass
Eriochloa crebra	E/H	f	t					a						H	U	Tall Cupgrass

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Eriochloa pseudoacrotricha	E/H	f			e	w				m				H	U	Early Spring Grass, Perennial Cupgrass
Eulalia aurea	H	f	t			w		a						H	U	Silky Browntop
Heteropogon contortus	H	f		g	e	w		a						M	U	Black Spear Grass
Iseilema convexum	E													H	U	
Iseilema fragile		f						a								
Iseilema macratherum		f														Bull Flinders Grass
Iseilema membranaceum	E	f		g		w	c	a						H	U	Small Flinders Grass
Iseilema vaginiflorum	E	f	t			w	c	a						H	U	Red Flinders Grass
Iseilema windersii						w										
Leptochloa digitata	P				e	w		a						M	U	Umbrella Cane Grass
Leptochloa filiformis																Red Sprangletop
Melinis repens														L	U	Red Natal Grass
Mnesithea formosa	E				e					m				M	U	
Monochather paradoxa	H/P									m	s			H	U	Mulga Oats, Bandicoot Grass
Neurachne munroi	P										s	r		M	U	Dwarf Mulga Grass
Oxychloris scariosa	E/H			h		w		a				r		L	U	Large Flowered Chloris, Winged Chloris
Panicum antidotale																Blue Panic, Giant Panic
Panicum buncei	H													H	U	
Panicum decompositum	E/H	f	t				c	a						M/H	S	Native or Wild Millet
Panicum effusum var. *effusum*	E/H			g	e				h		s			H	T	Hairy Panic
Panicum laevinode	E	f	t	g		w	c	a						M	U	Pepper Grass
Panicum larcomianum	E												l			
Paraneurachne muelleri	H/P				e						s			H	U	Northern Mulga Grass
Paspalidium basicladum	H											r		M	U	
Paspalidium caespitosum	H/P			g		w						r		M	U	Brigalow Grass
Paspalidium constrictum	H/P													M	U	Belah Grass
Paspalidium gracile	H				e	w						r		M	U	
Paspalidium jubiflorum	P					w	c	a						H	U	Warrego Summer Grass
Paspalidium rarum					e	w			h			r		H	U	Rare Paspalum
Pennisetum basedowii																Asbestos Grass
Perotis rara	E			g	e					m	s			L	U	Comet Grass
Plectrachne helmsii											s					
Plectrachne pungens																
Pseudoraphis spinescens	P					w		a					l	L	U	Spiny Mud Grass
Schizachyrium fragile				g	e				h							Fire Grass, Red Spathe Grass
Sehima nervosum					e			a								
Setaria apiculata																
Setaria oplismenoides		f														
Setaria surgens	E				e									L	U	Pigeon Grass
Sorghum bicolor																
Sorghum sudanense																Sudan Grass
Sporobolus actinocladus	E/H	f	t	g		w		a	h		s	r		H	U	Katoora
Sporobolus australasicus	E	f	t	g	e		c	a	h					H	U	Australian Dropseed
Sporobolus caroli	E/H		t	g		w						r		H	U	Fairy Grass
Sporobolus coromandelianus																
Sporobolus indicus						w		a								
Sporobolus mitchellii	P	f					c	a						M	U	Rats Tail Grass
Sporobolus partimpatens								a								
Sporobolus scabridus												r		H	U	
Thaumastochloa pubescens																
Themeda avenacea	P				e	w		a			s			M	U	Native Oats Grass
Themeda triandra	P	f			e			a		m	s	r		H	U	Kangaroo Grass
Thyridolepis mitchelliana										m		r				Mulga Mitchell Grass
Thyridolepis xerophila	H/P									m	s	r		H	U	
Tragus australianus	E	f		g	e	w						r		M	U	Small Burr Grass
Triodia longiceps	P			g	e			a	h					L	U	Giant Grey Spinifex, Porcupine Spinifex
Triodia mitchellii					e									L	U	
Triodia molesta									h			r		L	U	Hard Spinifex
Triodia pungens	P				e			a	h		s	r		L	U	Soft Spinifex

Family and species	Lf	Land F	T	G	E	W	Zone C	A	H	M	S	R	L	Pal	Tox	Common name
Tripogon loliiformis	E			g		w		a	h		s	r		H	U	Five Minute Grass
Triraphis mollis	H							a						H	T	Purple Plume Grass
Uranthoecium truncatum	E				e	w							I	M	U	Flat Stem Grass
Yakirra australiensis	E				e	w							I	L	U	Bunch Panic
POLYGALACEAE																
Comesperma pallidum	P				e											
Polygala argillacea	H	f														
Polygala arida	H				e											
Polygala linarifolia	H															Native Milkwort
POLYGONACEAE																
Muehlenbeckia cunninghamii	S			g			c	a			s		I	M	U	Lignum
Persicaria attenuatum	H													L	U	
Persicaria lapathifolium	H				e	w								L	U	Pale Knotweed
Polygonum glabrum	H													L	U	
Polygonum plebeium	E													L	U	Small Knotweed
Rumex crystallinus	E						c							M	U	Shiny Dock
Rumex vesicarius	E													L	U	Bladder Dock, Ruby Dock
PONTEDERIACEAE																
Monochoria cyanea	E												I			Native Water Hyacinth
PORTULACACEAE																
Calandrinia balonensis	E													H	T	Broad Leaved Parakeelya
Calandrinia pleiopetala	E				e	w							I			
Calandrinia ptychosperma	E													M	C	
Calandrinia pumila	E													M	C	
Calandrinia remota	E								h			r		M	C	
Portulaca bicolor	E					w						r				
Portulaca digyna	E											r				
Portulaca filifolia	E		t	g		w		a						M	C	Pigweed
Portulaca sp. aff. oleracea	E	f		g		w		a						H	T	Munyeroo, Inland Pigweed
Portulaca australis	E															
POTAMOGETONACEAE																
Potamogeton crispus	P													L	U	Curly Pondweed
Potamogeton tricarinatus	P															Floating Pondweed
PROTEACEAE																
Grevillea glauca	S/T				e											
Grevillea parallela	T				e				h		s					
Grevillea pteridifolia	S/T				e											
Grevillea striata	T			g	e	w			h	m	s			L	U	Beefwood
Grevillea wickhamii	S										s	r		L	U	Holly Leaved Grevillea
Hakea chordophylla	S				e				h		s			L	U	Bootlace Tree
Hakea collina	S								h			r		L/M	U	Dwarf Needlewood
Hakea leucoptera	S	f						a						M	U	Needlewood
Persoonia falcata	S				e											A Geebung
RANUNCULACEAE																
Ranunculus pumilio	E													L	U	Small Flowered Buttercup
RHAMNACEAE																
Alphitonia excelsa	T				e									H	U	Red Ash, Soap Tree, Pink Almond
Ventilago viminalis	S	f	t	g	e						s			H	T*	Vinetree, Supplejack
RUBIACEAE																
Canthium latifolium	S											r		M	U	Broadleaf Myrtle
Canthium oleifolium	T			g	e							r		H	U	Myrtle Tree
Canthium vacciniifolium	T											r				
Oldenlandia coerulescens	H						c	a			s					

Family and species	Lf	Land F	T	G	Zone E	W	C	A	H	M	S	R	L	Pal	Tox	Common name
Oldenlandia galioides	H					w										
Oldenlandia polyclada	H															
Oldenlandia mitrasacmoides subsp. *trachymenoides*	H				e											
Richardia brasiliensis																
Spermacoce multicaulis					e						s					
Synaptantha tillaeacea	E				e									L	U	
RUPPIACEAE																
Ruppia maritima	E															
RUTACEAE																
Eremocitrus glauca	S/T													H	U	Limebush
Geijera parviflora	T			g	e	w			h					H	U	Wilga
Geijera salicifolia var. *salicifolia*	T													L	U	Scrub Wilga
Phebalium glandulosum	S											r				
SANTALACEAE																
Exocarpos sparteus	S															
Santalum accuminatum	S															
Santalum lanceolatum	S		t	g	e	w	c	a			s	r		H	U	Plumwood, True Sandalwood
SAPINDACEAE																
Alectryon oleifolius subsp. *elongatus*	S	f	t		e			a			s			H	T	Boonaree, Rosewood
Atalaya hemiglauca	T/S	f	t	g	e	w			h	m	s	r		H	T	Whitewood
Distichostemon hispidulus	S				e											
Dodonaea lanceolata	S				e									L	U	
Dodonaea petiolaris	S								h			r		L	U	Large Fruited Hopbush
Dodonaea vestita	S															
Dodonaea viscosa subsp. *angustissima*	S				e									L	U	Sandhill Hopbush
Dodonea viscosa subsp. *arborescens*	S											r				Sticky Hopbush
SCROPHULARIACEAE																
Buchnera ramosissima					e											
Mimulus gracilis	E													L	U	
Mimulus prostratus	E/H												l	L	U	
Peplidium maritimum	E															
Stemodia florulenta	P					w							l	L	T	Morgan Flower, Blue Rod
Stemodia glabella	E/H	f			e		c							L	U	Morgan Flower, Blue Rod
SINOPTERIDACEAE																
Cheilanthes sieberi	H				e							r			T	Rock Fern
SOLANACEAE																
Datura leichhardtii	E													M	T	Native Thorneapple
Nicotiana megalosiphon	E/H	f	t				c							L	U	Long Flowered Native Tabacco
Nicotiana suaveolens	E															
Solanum chippendalei	P													L	U	
Solanum cleistogamum	E															
Solanum ellipticum	E			g	e						s			L	T	Potato Bush
Solanum esuriale	E	f	t	g		w	c	a		m	s	r		H	S	Quena
Solanum ferocissimum	E				e									L	S	Narrow Leaved Gins Whisker
Solanum quadriloculatum	H/P										s	r		M	S	Tomato Bush
STACKHOUSIACEAE																
Macgregoria racemigera	E									m	s			L	U	Carpet of Snow

Family and species	Lf	Land F	T	G	E	W	Zone C	A	H	M	S	R	L	Pal	Tox	Common name
STERCULIACEAE																
Brachychiton populneus	T				e						s			H	T	Kurrajong
Keraudrenia integrifolia	P/S				e									L	U	
Melhania oblongifolia	P				e									L	U	
Melhania ovata	H			g												
Waltheria indica	P				e									L	U	
STYLIDIACEAE																
Stylidium eglandulosum	E/H				e											A Trigger Plant
Stylidium eriorrhizum	E/H				e											A Trigger Plant
THYMELAEACEAE																
Pimelea decora	E/H	f												L	T	Flinders Poppy, Pimilea Poppy
Pimelea haematostachya	E/H	f													T	
Pimelea simplex subsp. *continua*	E													L	T	
TILIACEAE																
Corchorus olitorius	E	f					c	a						L	S	Jute
Corchorus pascuorum	E													L	U	
Corchorus tridens	E	f					c	a						L	U	
Corchorus trilocularis	H															
Corchorus sidoides	H				e						s			L	U	
Grewia retusifolia	S				e											Dogs Balls
Triumfetta glaucescens											s					
VERBENACEAE																
Clerodendron heterophyllum																
Clerodendrum floribundum	S				e									M	S	Lolly Bush
Verbena littoralis	H															
Verbena macrostachya	E/H													L	U	
Verbena officinalis	H															
VIOLACEAE																
Hybanthus aurantiacus	P	f									s			L	S	Spade Flower
XANTHORRHOEACEAE																
Lomandra leucocephala	P				e											A Matrush
ZYGOPHYLLACEAE																
Tribulus astrocarpus	E								h					L	U	Star Caltrop
Tribulus cistoides	E															
Tribulus micrococcus	E															
Tribulus occidentalis	E					w								L	U	Perenial Caltrop
Tribulus terrestris	E													H	T	Caltrop
Zygophyllum ammophilum	E													L	T	Sand Twinleaf
Zygophyllum simile	E															

B. LIST OF COMMON NAMES - BOTANICAL NAMES FOR THE MORE COMMON SPECIES

Common name	Botanical name
A Cotton Bush	*Maireana villosa*
A Cudweed	*Gnaphalium diamantinensis*
A Geebung	*Persoonia falcata*
A hard spinifex	*Triodia molesta*
A Matrush	*Lomandra leucocephala*
A Mistletoe	*Amyema miraculosum* subsp. *boormanii*
A Mistletoe	*Amyema preissii*
A Mistletoe	*Amyema maidenii*
A Mistletoe	*Dendrophthoe glabrescens*
A Mistletoe	*Lysiana subfalcata*
A Mistletoe	*Lysiana linearifolia*
A Mistletoe	*Lysiana exocarpi*
A Morning Glory	*Ipomoea muelleri*
A Nardoo	*Marsilea angustifolia*
A Nardoo	*Marsilea exarata*
A Raspweed	*Haloragis glauca* f. *sclopetifera*
A Salt Bush	*Atriplex eardleyae*
A Salt Bush	*Atriplex lindleyi*
A Samphire	*Sclerostegia tenuis*
A Sedge	*Bulbostylis barbata*
A Sundew	*Drosera burmanii*
A Sundew	*Drosera indica*
A Trigger Plant	*Stylidium eglandulosum*
A Trigger Plant	*Stylidium eriorrhizum*
A Wiregrass	*Aristida pruinosa*
Angelton Grass	*Dichanthium annulatum*
Annual Ragweed	*Parthenium hysterophorus*
Annual Saltbush	*Atriplex muelleri*
Annual Verbine	*Psoralea cinerea*
Asbestos Grass	*Pennisetum basedowii*
Asthma Plant	*Euphorbia hirta*
Australian Bindweed	*Convolvulus erubescens*
Australian / native bluebell	*Wahlenbergia communis*
Australian Carrot	*Daucus glochidiatus*
Australian Cupgrass	*Eriochloa australiensis*
Australian Dropseed	*Sporobolus australasicus*
Awnless Barnyard Grass	*Echinochloa colona*
Balsam Apple	*Momordica balsamina*
Barley Mitchell Grass	*Astrebla pectinata*
Bastard Mulga	*Acacia stowardii*
Bastard Marshmallow	*Abutilon malvifolium*
Bathurst Burr	*Xanthium spinosum*
Batswing Coral Tree	*Erythrina vespertilio*
Bauhinia	*Lysiphyllum carronii*
Bauhinia, Bean Tree	*Lysiphyllum gilvum*
Bean Bush/Bean Cassia	*Senna costata*
Beefwood	*Grevillea striata*
Beggar's Ticks, Cobbler's Peg	*Bidens pilosa*
Belah Grass	*Paspalidium constrictum*
Belalie	*Acacia stenophylla*
Bendee	*Acacia catenulata*
Bendo	*Eucalyptus exserta*
Berrigan, Dogwood	*Eremophila longifolia*
Berry Saltbush	*Rhagodia spinescens*
Billy Buttons	*Rutidosis helichrysoides*

Common name	Botanical name
Birdsville Indigo	*Indigofera linnaei*
Birdwood Grass	*Cenchrus setiger*
Bitter Bark / Quinine tree	*Alstonia constricta*
Black Spear Grass	*Heteropogon contortus*
Bladder Dock, Ruby Dock	*Rumex vesicarius*
Bladder Ketmia	*Hibiscus trionum*
Blow-away Grass	*Digitaria divaricatissima*
Blue Panic / Giant Panic	*Panicum antidotale*
Blue Flax Lily	*Dianella longifolia*
Bogan Flea, Bindy Eye	*Calotis hispidula*
Boggabri	*Amaranthus mitchellii*
Boobialla, Waterbush	*Myoporum acuminatum*
Boonaree, Rosewood	*Alectryon oleifolius* subsp. *elongatus*
Bootlace Tree	*Hakea chordophylla*
Boree	*Acacia tephrina*
Brigalow Grass	*Paspalidium caespitosum*
Broad-leaved Parakeelya	*Calandrinia balonensis*
Broadleaf Myrtle	*Canthium latifolium*
Broom Bush, Mustard Bush	*Apophyllum anomalum*
Broom Honey Myrtle	*Melaleuca uncinata*
Brown Beetle Grass, Water Grass	*Diplachne fusca*
Budda Pea	*Aeschynomene indica*
Buffel Grass	*Cenchrus ciliaris*
Bull Flinders Grass	*Iseilema macratherum*
Bull Mitchell Grass	*Astrebla squarrosa*
Bullamon Lucerne	*Psoralea patens*
Bumble, Wild Orange	*Capparis mitchellii*
Bunch Panic	*Yakirra australiensis*
Bush Minuria, Scrambling Minuria	*Minuria cunninghamii*
Button Grass	*Dactyloctenium radulans*
Caltrop	*Tribulus terrestris*
Camel Bush, Cattle Bush	*Trichodesma zeylanicum*
Carpet-of-Snow	*Macgregoria racemigera*
Cartwheel Burr	*Sclerolaena cornishiana*
Castor Oil Plant	*Ricinus communis*
Caustic Weed	*Euphorbia drummondii*
Caustic Vine	*Sarcostemma australe*
Chaff flower	*Achyranthes aspera*
Channel Nut Grass	*Cyperus victoriensis*
Channel Millet	*Echinochloa turneriana*
Charleville Turkey Bush	*Eremophila gilesii*
Climbing Saltbush	*Einadia nutans* subsp. *nutans*
Cloncurry Bluegrass	*Bothriochloa decipiens* var. *cloncurrensis*
Clustered Love Grass	*Eragrostis elongata*
Cockroach Bush, Beetle Bush	*Senna notabilis*
Comb Chloris	*Chloris pectinata*
Comb Finger Grass	*Digitaria ctenantha*
Comet Grass	*Perotis rara*
Common Nardoo	*Marsilea drummondii*
Common Sneezeweed	*Centipeda cunninghamii*
Common Joyweed	*Alternanthera nodiflora*
Conetop Nineawn	*Enneapogon pallidus*
Conker Berry, Boorum Bush	*Carissa lanceolata*
Coolibah	*Eucalyptus coolibah*
Coonta	*Ehretia saligna*
Cooper Clover	*Trigonella suavissima*
Copper Burr, Buck Bush	*Sclerolaena convexula*
Corrugated Sida	*Sida corrugata*
Cotton Panic Grass, Silver Spike Grass	*Digitaria brownii*

Common name	Botanical name
Couch Grass	*Cynodon dactylon*
Cow Vine	*Ipomoea lonchophylla*
Cow Vine, Potato Vine	*Ipomoea gracilis*
Cow Vine, Potato Vine	*Ipomoea diamantinensis*
Creek Wilga, Gooramurra	*Eremophila bignoniiflora*
Creeping Polymeria	*Polymeria ambigua*
Crested Goosefoot	*Chenopodium cristatum*
Crinkled Cassia	*Senna artemisioides* subsp. *helmsii*
Crownbeard	*Verbesina encelioides*
Cuming's Lovegrass	*Eragrostis cumingii*
Curly Pondweed	*Potamogeton crispus*
Curly Mitchell Grass	*Astrebla lappacea*
Curly Windmill Grass	*Enteropogon acicularis*
Curly Bluegrass	*Dichanthium fecundum*
Currant Bush	*Carissa ovata*
Dark Wire Grass	*Aristida calycina* var. *calycina*
Darwin Woollybutt	*Eucalyptus miniata*
Delicate Love Grass	*Eragrostis tenellula*
Desert Cassia	*Senna artemisioides* subsp. *coriacea*
Desert Oak	*Acacia coriacea*
Desert Bluegrass	*Bothriochloa ewartiana*
Desert Jasmine	*Jasminum didymum* subsp. *racemosum*
Desert Spurge	*Euphorbia tannensis* var. *eremophila*
Desert Poplar	*Codonocarpus cotinifolius*
Desert Jasmine	*Jasminum didymum* subsp. *lineare*
Desert Chinese Lantern	*Abutilon leucopetalum*
Desert Yellow Jacket	*Eucalyptus similis*
Dog's Balls	*Grewia retusifolia*
Doolan, Sally Wattle	*Acacia salicina*
Downs Nut Grass	*Cyperus bifax*
Drooping Love Grass	*Eragrostis leptocarpa*
Dwarf Lantern Flower	*Abutilon fraseri*
Dwarf Needlewood	*Hakea collina*
Dwarf Bluegrass	*Dichanthium sericeum* subsp. *humilius*
Dwarf Mulga Grass	*Neurachne munroi*
Early Spring Grass, Perennial Cupgrass	*Eriochloa pseudoacrotricha*
Eastern Dead Finish	*Archidendropsis basaltica*
Ellangowan Poison Bush	*Myoporum deserti*
Emu Foot	*Psoralea graveolens*
Emu Apple	*Owenia acidula*
Emu Foot	*Psoralea tenax*
Erect Kerosene Grass	*Aristida holathera*
Fairy Grass	*Sporobolus caroli*
Feathertop Rhodes Grass	*Chloris virgata*
Feathertop Wiregrass	*Aristida latifolia*
Feathertop Threeawn / Unequal threeawn	*Aristida inaequiglumis*
Finger Panic Grass	*Digitaria coenicola*
Fire Grass / Red Spathe Grass	*Schizachyrium fragile*
Five Minute Grass	*Tripogon loliiformis*
Flannel Weed	*Abutilon otocarpum*
Flat Sedge	*Cyperus pygmaeus*
Flat-stem Grass	*Uranthoecium truncatum*
Flat Top Wattle	*Acacia ixiophylla*
Flax-leaf Fleabane	*Conyza bonariensis*
Flinders Poppy	*Pimelea decora*
Flinders Rose	*Capparis spinosa* var. *nummularia*
Floating Pondweed	*Potamogeton tricarinatus*
Forest Bluegrass	*Bothriochloa bladhii*

Common name	Botanical name
Fuchsia Bush	*Eremophila maculata*
Galvanized Burr	*Sclerolaena birchii*
Georgina Poison Bush	*Eremophila latrobei*
Ghost Gum, Desert Gum	*Eucalyptus papuana*
Giant Pigweed / Black Pigweed	*Trianthema portulacastrum*
Giant Grey Spinifex	*Triodia longiceps*
Gidgee	*Acacia cambagei*
Gidgee Burr, Copper Burr	*Sclerolaena divaricata*
Goathead Burr	*Sclerolaena bicornis* var. *bicornis*
Goathead Burr	*Sclerolaena bicornis* var. *horrida*
Golden Billybuttons	*Craspedia chrysantha*
Golden Beard Grass	*Chrysopogon fallax*
Gomphrena Weed	*Gomphrena celosioides*
Gooseberry Cucumber	*Mukia* sp. Q3
Green Mistletoe	*Diplatia grandibractea*
Green Fox Brush, Pussy Tails	*Ptilotus polystachyus*
Green Germander	*Teucrium integrifolium*
Green Crumbweed	*Dysphania rhadinostachya*
Green Summer Grass / Armgrass	*Brachiaria subquadripara*
Grey Beard Grass	*Amphipogon caricinus* var. *caricinus*
Grey Cassia	*Senna artemisioides* subsp. *petiolaris*
Grey Cassia	*Senna artemisioides* subsp. *sturtii*
Grey Copper Burr	*Sclerolaena diacantha*
Grey Mistletoe	*Amyema quandang*
Grey Raspweed	*Haloragis glauca* f. *glauca*
Grey Rattlepod	*Crotalaria dissitiflora*
Gum Topped Bloodwood	*Eucalyptus brachycarpa*
Gundabluie, Gunda-bluey	*Acacia victoriae*
Hairy Armgrass	*Brachiaria piligera*
Hairy Carpet Weed	*Glinus lotoides*
Hairy Indigo	*Indigofera hirsuta*
Hairy-edged Armgrass	*Brachiaria gilesii*
Hairy-flowered Woollybutt	*Eragrostis laniflora*
Hairy Native Couch	*Brachyachne ciliaris*
Hairy Panic	*Panicum effusum* var. *effusum*
Handsome Love Grass	*Eragrostis speciosa*
Hare's-foot Grass	*Ectrosia danesii*
Heart-Leaf Poison Bush	*Gastrolobium grandiflorum*
High Sida	*Sida trichopoda*
Hogweed	*Zaleya galericulata*
Holly-leaved Grevillea	*Grevillea wickhamii*
Hooky Grass	*Ancistrachne uncinulata*
Hooky Grass	*Ancistrachne uncinulata*
Hoop Mitchell Grass	*Astrebla elymoides*
Hyssop Loosestrife	*Lythrum hyssopifolia*
Indian Cudweed	*Gnaphalium polycaulon*
Indigo	*Indigofera trita* var. *subulata*
Ironwood	*Acacia excelsa*
Jericho Threeawn	*Aristida jerichoensis* var. *jerichoensis*
Jersey Cudweed	*Pseudognaphalium luteoalbum*
Jointed Nineawn	*Enneapogon cylindricus*
Josephinia burr	*Josephina eugeniae*
Jute	*Corchorus olitorius*
Kangaroo Grass	*Themeda triandra*
Kapok Grass, Silkyheads	*Cymbopogon obtectus*
Katoora	*Sporobolus actinocladus*
Kerosene Grass / Silver Grass	*Aristida contorta*

Common name	Botanical name
Khaki Weed	*Alternanthera pungens*
Knotty-butt Neverfail Grass	*Eragrostis xerophila*
Kurrajong	*Brachychiton populneus*
Lancewood	*Acacia shirleyi*
Large Green Pussy Tails	*Ptilotus macrocephalus*
Large-flowered Chloris, Winged Chloris	*Oxychloris scariosa*
Large-fruited Hopbush	*Dodonaea petiolaris*
Leafy Panic	*Brachiaria foliosa*
Leafy Nineawn	*Enneapogon polyphyllus*
Leopardwood	*Flindersia maculosa*
Lesser Joyweed	*Alternanthera denticulata*
Lifesaver Burr	*Sida platycalyx*
Lignum	*Muehlenbeckia cunninghamii*
Lignum Fuchsia	*Eremophila polyclada*
Limebush	*Eremocitrus glauca*
Lollybush	*Clerodendrum floribundum*
Long Fruited Bloodwood	*Eucalyptus dolichocarpa*
Long-flowered Native Tobacco	*Nicotiana megalosiphon*
Longawn Wanderrie Grass	*Eriachne armittii*
Longleaved Hovea	*Hovea longifolia*
Mallee Love Grass	*Eragrostis dielsii*
Maloga Bean	*Vigna lanceolata*
Many Headed Wiregrass	*Aristida caput-medusae*
Marpoo, Dune Wattle	*Acacia bivenosa* subsp. *wayi*
Meemeei, Cattle Bush	*Pittosporum phylliraeoides*
Mexican Poppy	*Argemone ochroleuca*
Mimosa Bush	*Acacia farnesiana*
Mineritchie	*Acacia cyperophylla*
Mistletoe	*Amyema quandang* var. *bancroftii*
Moreton Bay Ash, Carbeen	*Eucalyptus tessellaris*
Morgan Flower, Blue Rod	*Stemodia florulenta*
Morgan Flower, Blue Rod	*Stemodia glabella*
Mossman River Grass	*Cenchrus echinatus*
Mountain Yapunyah	*Eucalyptus thozetiana*
Mountain Bluebush	*Maireana georgei*
Mountain Sandalwood	*Eremophila oppositifolia* var. *rubra*
Mulga Mitchell Grass	*Thyridolepis mitchelliana*
Mulga	*Acacia aneura*
Mulga Oats, Bandicoot Grass	*Monochather paradoxa*
Munyeroo, Inland Pigweed	*Portulaca* sp. aff. *oleracea*
Murray Lily	*Crinum flaccidum*
Myall	*Acacia pendula*
Myrtle Tree	*Canthium oleifolium*
Nalgoo	*Cyperus bulbosus*
Narrow-leaf Bumble	*Capparis loranthifolia*
Narrow Leaved Gin's Whisker	*Solanum ferocissimum*
Native Cobbler's Pegs	*Glossocardia bidens*
Native Rosella	*Abelmoschus ficulneus*
Native Cotton	*Gossypium australe*
Native Indigo	*Indigofera linifolia*
Native or Wild Millet	*Panicum decompositum*
Native Thornapple	*Datura leichhardtii*
Native Centaury	*Centaurium spicatum*
Native Couch, Spider Grass	*Brachyachne convergens*
Native Leek	*Bulbine bulbosa*
Native Mint	*Mentha australis*
Native Oats Grass	*Themeda avenacea*
Native Daisy	*Brachyscome ciliaris* var. *lanuginosa*

Common name	Botanical name
Native Sensitive Plant	*Neptunia gracilis forma gracilis*
Native Sensitive Plant	*Neptunia dimorphantha*
Native Water Hyacinth	*Monochoria cyanea*
Native Sensitive Plant	*Neptunia monosperma*
Native Bluebell	*Wahlenbergia tumidifructa*
Needlewood	*Hakea leucoptera*
Nelia	*Acacia oswaldii*
Nettle-leaf Goosefoot, Red Crumbweed	*Dysphania glomulifera*
Neverfail Grass	*Eragrostis setifolia*
Nipan, Split Jack	*Capparis lasiantha*
Noogoora Burr	*Xanthium pungens*
Normanton Box	*Eucalyptus persistens*
Northern Mulga Grass	*Paraneurachne muelleri*
Northern Wanderrie	*Eriachne obtusa*
Number 8 Wiregrass	*Aristida calycina* var. *praealta*
Number Eight Wiregrass	*Aristida calycina* var. *praealta*
Paddy Melon, Wild Cucumber	*Cucumis melo* subsp. *agrestis*
Pale Knotweed	*Persicaria lapathifolium*
Pale Spike Rush	*Eleocharis pallens*
Parkinsonia, Jerusalem Thorn	*Parkinsonia aculeata*
Parrot Pea	*Crotalaria cunninghamii*
Peak Downs Curse	*Polymeria longifolia*
Pepper Grass	*Panicum laevinode*
Perennial Caltrop	*Tribulus occidentalis*
Pigeon Grass	*Setaria surgens*
Pigweed	*Portulaca filifolia*
Pimilea Poppy	*Pimelea haematostachya*
Plumwood, True Sandalwood	*Santalum lanceolatum*
Pop Saltbush	*Atriplex spongiosa*
Poplar box	*Eucalyptus populnea*
Porcupine Grass, Porcupine Spinifex	*Triodia longiceps*
Potato Bush	*Solanum ellipticum*
Poverty Grass	*Eremochloa bimaculata*
Pretty Wattle	*Acacia decora*
Pretty Wanderrie	*Eriachne pulchella*
Prickly Acacia, Prickly Wattle	*Acacia nilotica*
Prickly Paddy Melon	*Cucumis myriocarpus*
Prickly Pine, Blackthorn	*Bursaria incana*
Prickly Roly Poly, Black Roly Poly	*Sclerolaena muricata*
Prince-of-Wales Feathers / Red Fox Brush	*Ptilotus exaltatus*
Purple Wiregrass	*Aristida ramosa* var. *ramosa*
Purple Plume Grass	*Triraphis mollis*
Purple Bottlewasher Grass	*Enneapogon oblongus*
Purple Lovegrass	*Eragrostis lacunaria*
Purpletop Chloris	*Chloris inflata*
Queensland Bluegrass	*Dichanthium sericeum* subsp. *sericeum*
Queensland Bluebush	*Chenopodium auricomum*
Quena	*Solanum esuriale*
Quinine Berry	*Petalostigma pubescens*
Ragweed, Apple Bush	*Pterocaulon sphacelatum*
Rare Paspalum	*Paspalidium rarum*
Rat's Tail Grass	*Sporobolus mitchellii*
Red Sprangletop	*Leptochloa filiformis*
Red Natal grass	*Melinis repens*
Red Flinders Grass	*Iseilema vaginiflorum*
Red Water Milfoil	*Myriophyllum verrucosum*
Red Burr	*Sclerolaena calcarata*
Red Ash, Soap Tree, Pink Almond	*Alphitonia excelsa*
Red Spinach	*Trianthema triquetra*

Common name	Botanical name
Reed Grass	*Arundinella nepalensis*
Reid River Box	*Eucalyptus brownii*
Ridge Grass	*Enneapogon avenaceus*
River Oak	*Casuarina cunninghamiana*
River Grass	*Chionachne hubbardiana*
River Red Gum	*Eucalyptus camaldulensis*
River Teatree, Black Teatree	*Melaleuca bracteata*
River Tea Tree	*Melaleuca trichostachya*
Rock Fern	*Cheilanthes sieberi*
Rock Grass	*Eriachne mucronata* (typical form)
Rock Isotome	*Isotoma petraea*
Rough Chainpea	*Alysicarpus rugosus*
Rough Leaved Bloodwood	*Eucalyptus setosa*
Rough-seeded Spurge	*Euphorbia parvicaruncula*
Rough Barked Apple	*Angophora floribunda*
Rubber Vine	*Cryptostegia grandiflora*
Ruby Saltbush	*Enchylaena tomentosa* var. *tomentosa*
Saffron Thistle	*Carthamnus lanatus*
Sago Weed	*Plantago drummondii*
Samphire	*Halosarcia pergranulata*
Sand Spurge	*Phyllanthus fuernrohrii*
Sand Twinleaf	*Zygophyllum ammophilum*
Sandalwood, Budda, False sandalwood	*Eremophila mitchellii*
Sandhill Caustic	*Euphorbia coghlanii*
Sandhill Hopbush	*Dodonaea viscosa* subsp. *angustissima*
Scrub Wilga	*Geijera salicifolia* var. *salicifolia*
Sesbania Pea	*Sesbania campylocarpa*
Sesbania Pea	*Sesbania cannabina*
Shiny Dock	*Rumex crystallinus*
Short-fruited Nardoo	*Marsilea hirsuita*
Short-winged Saltbush	*Sclerochlamys brachyptera*
Shrub Sida	*Sida rohlenae*
Sickle Lovegrass	*Eragrostis falcata*
Silky-top Armgrass	*Brachiaria holosericea*
Silky Glycine	*Glycine canescens*
Silky Browntop	*Eulalia aurea*
Silky Oilgrass / Silky Heads	*Cymbopogon bombycinus*
Silky Goodenia	*Goodenia fascicularis*
Silky Umbrella Grass	*Digitaria ammophila*
Silver Cassia	*Senna artemisioides* subsp. *artemisioides*
Silver Cassia	*Senna artemisioides* subsp. *petiolaris*
Silver Sida	*Sida fibulifera*
Silverleaved Ironbark	*Eucalyptus melanophloia*
Silvery Weeping Tea Tree	*Melaleuca nervosa* var. *pendulosa*
Slender Tick Trefoil	*Desmodium varians*
Slender Buffel Grass / Cloncurry buffel	*Cenchrus pennisetiformis*
Small Knotweed	*Polygonum plebeium*
Small-flowered Buttercup	*Ranunculus pumilio*
Small-flower Indigo	*Indigofera parviflora*
Small White Paper Daisy	*Helipterum corymbiflorum*
Small Flinders Grass	*Iseilema membranaceum*
Small Crumbweed	*Chenopodium pumilio*
Small Burr Grass	*Tragus australianus*
Small Flowered Mallow	*Malva parviflora*
Smoke Bush	*Ptilotus obovatus* var. *parviflorus*
Smooth Minuria	*Minuria integerrima*
Snuffweed	*Centipeda racemosa*

Common name	Botanical name
Soda Bush	*Neobassia proceriflora*
Soft Roly Poly	*Salsola kali*
Soft Spinifex	*Triodia pungens*
Spade Flower Bush	*Hybanthus aurantiacus*
Spear Thistle	*Cirsium vulgare*
Speedy Weed	*Flaveria australasica*
Spike Love Grass	*Eragrostis confertiflora*
Spike Grass	*Elytrophorus spicatus*
Spiked Malvastrum	*Malvastrum americanum*
Spiked sida	*Sida subspicata*
Spiny Flat Sedge	*Cyperus gymnocaulos*
Spiny Fan Flower	*Scaevola spinescens*
Spiny Sida	*Sida spinosa*
Spiny Mud Grass	*Pseudoraphis spinescens*
Spreading Sneeze Weed	*Centipeda minima*
Spreading Nut Heads	*Epaltes australis*
Star Caltrop	*Tribulus astrocarpus*
Star Burr	*Acanthospermum hispidum*
Sticky Indigo	*Indigofera colutea*
Sticky Hopbush	*Dodonea viscosa* subsp. *arborescens*
Stink Grass	*Eragrostis cilianensis*
Sudan Grass	*Sorghum sudanense*
Swamp Cane Grass	*Eragrostis australasica*
Swamp Wanderrie Grass	*Eriachne ovata*
Tall Cup Grass	*Eriochloa crebra*
Tall Flat Sedge	*Cyperus exaltatus*
Tar Vine	*Boerhavia diffusa* sens lat.
Tassel Bluegrass	*Dichanthium sericium* subsp. *polystachyum*
Three Wing Bluebush	*Maireana triptera*
Three Seeded Scurvey Weed	*Commelina undulata*
Threeawn Wanderrie	*Eriachne aristidea*
Tickweed	*Cleome viscosa*
Tomato Bush	*Solanum quadriloculatum*
Trefoil Rattlepod	*Crotalaria medicaginea*
Tropical Speedwell	*Evolvulus alsinoides*
Turkey Bush	*Olearia subspicata*
Turkey Bush	*Senna artemisioides* subsp. *oligophylla*
Turpentine Mulga	*Acacia brachystachya*
Turpentine Bush	*Acacia chisholmii*
Two Gland Threeawn	*Aristida biglandulosa*
Umbrella Sedge, Variable Flat Sedge	*Cyperus difformis*
Umbrella Cane Grass	*Leptochloa digitata*
Variable Swainsona	*Swainsona oroboides*
Variable Groundsel	*Senecio lautus*
Vernonia	*Vernonia cinerea*
Vinetree, Supplejack	*Ventilago viminalis*
Warrego Summer Grass	*Paspalidium jubiflorum*
Water Primrose	*Ludwigia peploides*
Water Lily	*Nymphoides crenata*
Weeping Love Grass	*Eragrostis parviflora*
Weir Vine	*Ipomoea calobra*
Western Bloodwood	*Eucalyptus terminalis*
Western Dead Finish	*Acacia tetragonophylla*
White Speargrass	*Aristida leptopoda*
White Paper Daisy	*Helipterum floribundum*
White Cassia	*Cassia pruinosa*

Common name	Botanical name
White's ironbark	*Eucalyptus whitei*
Whitewood	*Atalaya hemiglauca*
Wilcannia Lily	*Calostemma luteum*
Wild Water Melon, Pie Melon	*Citrullus lanatus*
Wilga	*Geijera parviflora*
Willow Primrose	*Ludwigia octovalvis*
Wire Grass	*Aristida benthamii*
Wiry Bottlewasher	*Enneapogon lindleyanus*
Witchetty Bush	*Acacia kempeana*
Woolly Mantle	*Eriochlamys behrii*
Woolly Ixiolaena	*Ixiolaena tomentosa*
Woolly-spined Burr	*Sclerolaena lanicuspis*
Woolly Glycine	*Glycine tomentella*
Woollybutt Grass	*Eragrostis eriopoda*
Woollybutt Wanderrie	*Eriachne helmsii*
Yellow Buttons	*Chrysocephalum ramosissimum*
Yellow Burr	*Sclerolaena anisacanthoides*
Yellow Daisy-burr	*Calotis lappulaceae*
Yellow Flowered Devil's Claw	*Ibicella lutea*
Yellowjack	*Eucalyptus similis*
Yellow Pea, Arsenic Bush, Ant Bush	*Senna planitiicola*
Yellow Threeawn	*Aristida anthoxanthoides*

C. LIST OF SPECIES WITH RECENT NAME CHANGES (Old name = new name)

Acanthaceae
Dipteracanthus corynothecus = *D. australasicus*
Justicia procumbens = *Rostellularia adscendens*

Aizoaceae
Azoon spp. = *Gunniopsis* spp.
Trianthema galericulata = *Zaleya galericulata*

Amaranthaceae
Gomphrena brownii = *G. lanatus*

Asclepiadaceae
Pentatropis atropurpurea = *Rhyncharrhena linearis*
Sarcostemma australe = *S. viminale* subsp. *australe*

Asteraceae
Glossogyne tenuifolia = *Glossocardia bidens*
Helichrysum apiculatum = *Chrysocephalum apiculatum*
Helichrysum ramosissimum = *Chrysocephalum apiculatum*
Gnaphalium luteo-album = *Pseudognaphalium luteoalbum*
Pterigeron adscendens = *Streptoglossa adscendens*

Caesalpiniaceae
Bauhinia carronii = *Lysiphyllum carronii*
Cassia desolata var. *desolata* = *Senna artemisioides* subsp. *sturtii*
Cassia desolata var. *planipes* = *Senna artemisioides* subsp. *petiolaris*
Cassia eremophila = *Senna artemisioides* subsp. *coriacea*
Cassia circinnata = *Senna artemisioides* subsp. *circinnata*
Cassia artemisioides = *Senna artemisioides* subsp. *artemisioides*
Cassia helmsii = *Senna artemisioides* subsp. *artemisioides*
Cassia nemophila = *Senna artemisioides* subsp. *coriacea*
Cassia nemophila var. *zygophylla* = *Senna artemisioides* subsp. *zygophylla*
Cassia oligophylla = *Senna artemisioides* subsp. *oligophylla*
Cassia phyllodinea = *Senna artemisioides* subsp. *petiolaris*
Cassia costata = *Senna costata*
Cassia sturtii = *Senna artemisioides* subsp. *sturtii*
Cassia glutinosa = *Senna glutinosa*
Cassia luerssenii = *Senna glutinosa* subsp. *luerssenii*
Cassia notabilis = *Senna notabilis*
Cassia planitiicola = *Senna planitiicola*

Celastraceae
Denhamia obscura = *Denhamia oleaster*

Chenopodiaceae
Arthrocnemum spp. = *Halosarcia* spp.
Bassia andersonii = *Sclerolaena glabra*
Bassia biflora = *Dissocarpus biflorus*
Bassia brachyptera = *Sclerochlamys brachyptera*
Bassia paradoxa = *Dissocarpus paradoxus*
Bassia quinquicuspis = *Sclerolaena muricata*
Chenopodium inflatum = *Dysphania rhadinostachya* subsp. *rhadinostachya*
Chenopodium rhadinostachyum = *Dysphania rhadinostachya* subsp. *rhadinostachya*
Pachycornia tenuis = *Sclerostegia tenuis*
Rhagodia linifolia = *Einadia nutans* subsp. *nutans*
Rhagodia linifolia = *Einadia nutans* subsp. *linifolia*

Sclerolaena andersonii = *Sclerolaena glabra*
Sclerolaena cucullata = *Sclerolaena longicuspis*
Threlkeldia proceriflora = *Neobassia proceriflora*
Bassia spp. = *Sclerolaena* spp., *Dissocarpus* spp.
Kochia spp. = *Maireana* spp.

Convolvulaceae
Ipomoea heterophylla = *Ipomoea polymorpha*

Cucurbitaceae
Citrullus vulgaris = *Citrullus lanatus*
Cucumis trigonus = *Cucumus melo*

Cyperaceae
Cyperus aristatus = *Cyperus squarrosus*
Scirpus littoralis = *Schoenoplectus littoralis*

Dysphaniaceae
Dysphania myriocephala = *Dysphania glomulifera*

Euphorbiaceae
Andrachne decaisnei = *Leptopus decaisnei*
Euphorbia eremophila = *Euphorbia tannensis* subsp. *eremophila*
Phyllanthus rigens = *Sauropus rigens*

Fabaceae
Indigofera dominii = *Indigofera linnaei*
Crotalaria trifoliastrum = *Crotalaria medicaginea*
Psoralea eriantha = *Psoralea australasica*

Goodeniaceae
Goodenia subintegra = *Goodenia fascicularis*

Liliaceae
Bulbinopsis bulbosa = *Bulbine bulbosa*

Malvaceae
Sida brachypoda = *Sida* sp. aff. *S. corrugata*
Sida pedunculata = *Sida cunninghamii*

Mimosaceae
Acacia cana = *Acacia tephrina*
Acacia clivicola = *Acacia stowardii*
Acacia ligulata = *Acacia bivenosa* subsp. *wayi*
Albizia basaltica = *Archidendropsis basaltica*

Myrtaceae
Eucalyptus microtheca (in the study area) = *Eucalyptus coolibah*
Eucalyptus normantonensis (in part) = *Eucalyptus persistens*
Eucalyptus dichromophloia (in the study area) = *Eucalyptus brachycarpa*
Eucalyptus polycarpa (in study area) = *Eucalyptus dolichocarpa*
Eucalyptus socialis = *Eucalyptus eucentrica*

Nyctaginaceae
Boerhavia diffusa = A number of *Boerhavia* spp.

Oleaceae
Jasminum lineare = *Jasminum didymum* subsp. *lineare*
Jasminum racemosum = *Jasminum didymum* subsp. *racemosum*

Plantaginaceae
Plantago pritzellii = *Plantago drummondii*

Poaceae
Aristida armata = *Aristida calycina* var. *praealta*
Aristida arenaria = *Aristida contorta*
Aristida browniana = *Aristida holathera*
Aristida glumaris = *Aristida calycina* var. *calycina*
Bothriochloa intermedia = *Bothriochloa bladhii*
Brachiaria miliiformis = *Brachiaria subquadripara*
Chloris acicularis = *Enteropogon acicularis*
Chloris dichanthioides = *Austrochloris dichanthioides*
Chloris scariosa = *Oxychloris scariosa*
Dichanthium affine = *Dichanthium sericeum* subsp. *humilis*
Dichanthium tenuiculum = *Dichanthium sericeum* subsp. *polystachyum*
Diplachne muelleri = *Diplachne fusca*
Diplachne reptatrix = *Diplachne fusca*
Echinochloa turnerana = *Echinochloa turneriana*
Eragrostis diandra = *Eragrostis elongata*
Eragrostis japonica = *Eragrostis tenellula*
Eulalia fulva = *Eulalia aurea*
Neurachne mitchelliana = *Thyridolepis xerophila*
Neurachne xerophila = *Thyridolepis xerophila*
Panicum australiense = *Yakirra australiense*
Panicum whitei = *Panicum laevinode*
Rhychelytrum repens = *Melinis repens*
Rottboellia formosa = *Mnesithea formosa*
Setaria brownii = *Setaria surgens*
Themeda australis = *Themeda triandra*

Rubiaceae
Hedyotis coerulescens = *Oldenlandia coerulescens*
Hedyotis galioides = *Oldenlandia galioides*
Hedyotis polyclada = *Oldenlandia polyclada*
Hedyotis trachymenoides = *Oldenlandia mitrasacmoides* subsp. *trachymenoides*

Sapindaceae
Dodonaea angustissima = *Dodonaea viscosa* subsp. *angustissima*
Heterodendrum oleifolium = *Alectryon oleifolius*
Dodonaea attenuata = *Dodonaea viscosa* subsp. *angustissima*

Thymelaeaceae
Pimelea continua = *Pimelea simplex* subsp. *continua*
Corchorus vermicularis = *Corchorus sidoides*

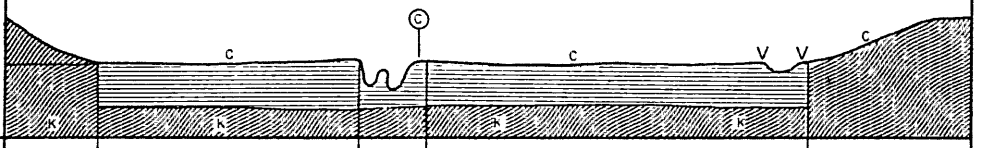
APPENDIX IV

LAND SYSTEMS

by E.J. Turner and W.J.F. McDonald

A1	Mineeda
A2	Aramac
A3	Landsborough
A4	Lammermoor
C1	Kendall
E1	Yalleroi
E2	Redcliff
E3	Eastfield
E4	Grant
E5	Adelong
E6	Torrens
F1	Allaru
F2	Politic
F3	Winton
F4	Toolebuc
F5	Vergemont
F6	Warnambool
G1	Linden
G2	Blendon
G3	Spoilbank
G4	Ravenswood
G5	Jabiru
H1	Opalton
L1	Webb
M1	Tonkoro
R1	Winooka
R2	Elvo
R3	Binburi
R4	Bladensbury
S1	Sunnyside
S2	Athelstane
T1	Accord
T2	Kentle
T3	Mackunda
W1	Ewan
W2	Nive
W3	Ravenbourne
W4	Aberfoyle

A1 MINEEDA (960 km^2)



Land Unit and / or Associated Land System	F, T Land Zone	20	A3 W3	20	G Land Zone
Site and / or special comment		15, 134, F400 - 1, F404			
Est. % of Land System		90	10		

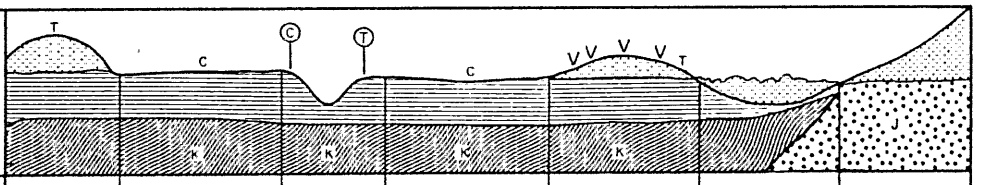
LANDFORM: Flat alluvial plains adjacent to rivers and streams.

GEOLOGY: Quaternary clay alluvium.

SOILS: Deep to very deep, brown and grey cracking clays with self-mulching surfaces Ug5.32, Ug5 22 (Ascot). Seasonally scalded.

VEGETATION: Mitchell grass / Flinders grass open-tussock grassland to tussock grassland. Sparse forblands occur on the scalded areas.

A2 ARAMAC (450 km^2)



Land Unit and / or Associated Land System	22	21 (a)	23	21 (b)	12	Salt Springs	G4, S1
Site and / or special comment	215, F398	157, F368	F311 F515	F438	159, F367	No observations	
Est. % of Land System	<5	80	<5		10	<5	

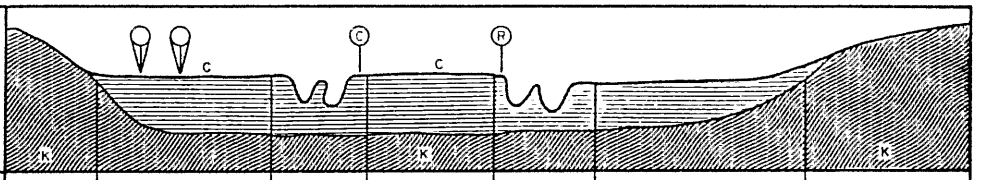
LANDFORM: Claypans with low sand dunes and occasional salt springs.

GEOLOGY: Recent clay alluvium and aeolian sand deposits.

SOILS: Deep to very deep, sandy clays with very hard, crusting surfaces Uf6.13 (Ballygar) and sandy, gleyed texture contrast soils on dunes Dg2.13 (Mueller).

VEGETATION: Sparse forbland and occasionally samphire low open-shrubland on the claypans. Porcupine spinifex open-hummock grassland and Ellangowan poison bush, sandalwood low open-shrubland on the dunes. Areas of belalie, coolibah, black tea-tree, river red gum low open-woodland to tall shrubland fringing drainage lines.

A3 LANDSBOROUGH (8 030 km²)



Land Unit and / or Associated Land System	F Land Zone	26	24	25	24	25	G Land Zone
Site and / or special comment		6, 71, 77, F356	4, 19, 42, 70, 90, 95, 199, F376	25, 40, 43, 83, 99, 118, 148-150 178, 180, 183, F403, F446-8, F492		178, 180, 183, F403, 446-8	
Est. % of Land System		10	30	60			

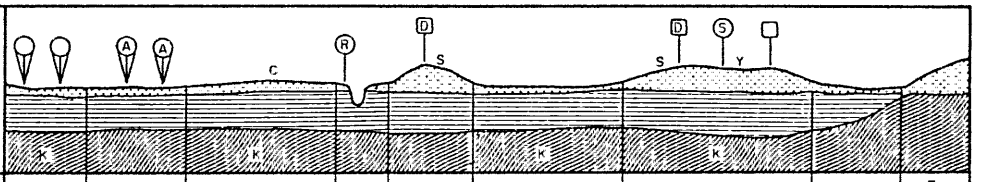
LANDFORM: Seasonally flooded alluvial plains of braided rivers and streams.

GEOLOGY: Recent clay alluvium.

SOILS: Deep to very deep, grey and brown cracking clays Ug5.24, Ug5.34, Ug5.32 (Thomson). Gravel beds occur. Interchannel and outer margins subject to seasonal scalding.

VEGETATION: Mitchell grass, Flinders grass, desert blue grass open-tussock grassland to tussock grassland on interchannel areas with coolibah, belalie, gooramurra, river red gum open-woodland fringing the channels. Sparse herbfields occur on scalded areas. Minor areas of gidgee low woodland to low open-woodland

A4 LAMMERMOOR (1 460 km²)



Land Unit and / or Associated Land System	57	62	27	W2	46	27	46	27	E Land Zone
Site and / or special comment	194, F379, F419, F424	203 205, F432, 411	174-5, 191-2, F413-5, F420, F422, F428		193, 208, F387	F440	F390-3, F421, F423		
Est. % of Land System	<5	<5	60	<5	30				

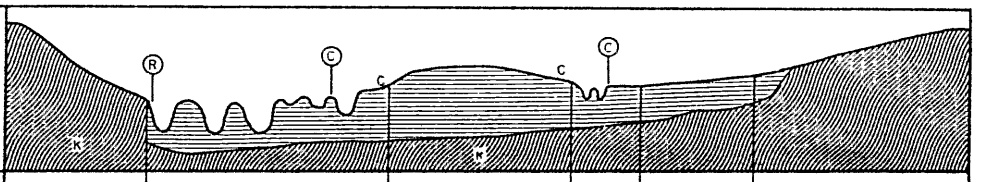
LANDFORM: Flat alluvial plain overlain by ribbon-like network of sand rises.

GEOLOGY: Recent clay alluvium, overlain by Quaternary sands.

SOILS: Very deep, grey sandy cracking clays Ug5.24, Ug5.14, Ug5.27 (Tiree). Broad, shallow gilgais common. Associated soils include siliceous sands (Uc5.11) and sandy red earths (Gn2.12) sand sheets.

VEGETATION: Curly blue grass, Mitchell grass tussock grassland to open-tussock grassland, with bloodwood / desert gum / Whites ironbark / Reid River box woodland to low open-woodland on the sandy rises. Minor areas of blackwood and / or gidgee low woodland to low open-woodland.

C1 KENDALL (290 km2)



Land Unit and / or Associated Land System	F3	28	29	24	25	W3, A3
Site and / or special comment		138, F442, 443, 466, 467	49, 53, 150, F468	4, 19, 42, 70, 90, 95, 199, F376	25, 40, 43, 83, 99, 118, 148-49, 178, 180, 183, F403, F446-8, F492	
Est. % of Land System		30	40	20	10	

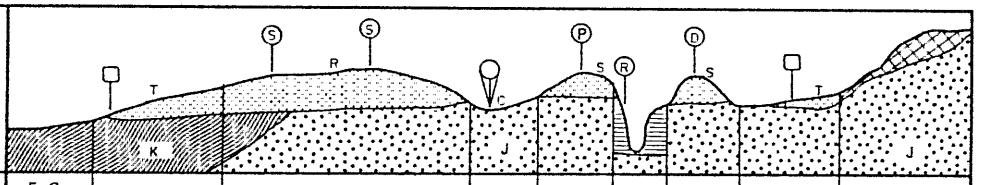
LANDFORM: Flooded alluvial plains with anastomising channels.

GEOLOGY: Recent clay alluvium.

SOILS: Very deep, grey cracking clays with sand and silt intermixed Ug5.24, Ug5 25 (Thomson).

VEGETATION: Predominantly open-herbland (short grasses and forbs) with bluebush, lignum low open-shrubland in depressions. Coolibah / river red gum, belalie, gooramurra, lignum shrubby open-woodland fringing the channels and deep waterholes.

E1 YALLEROI (810 km2)



Land Unit and / or Associated Land System	F, G Land Zones	30	31	8	32	W2	33	30	R1
Site and / or special comment		1, 218, (C11, 34, 299, 303)	(C4, 9, 10, 12, 35, 72, 74, 255, 304, 312) F375 380, 382	12 20 139	3, 219, F435, 437		8		
Est. % of Land System		30	50	< 5	10	< 5			

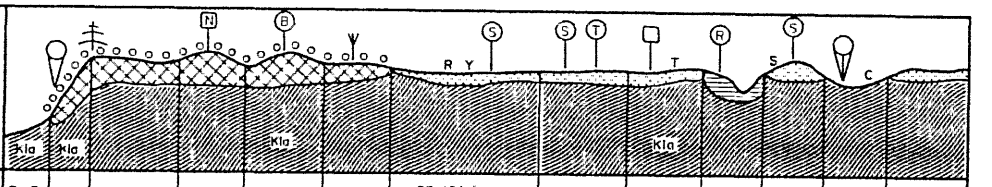
LANDFORM: Flat to very gently sloping sandplain with an indistinct drainage system. Slopes < 2%

GEOLOGY: Quaternary sands, overlying Jurassic sediments.

SOILS: Moderately deep texture contrast soils on lower slopes Dr3 12, Dy5.23 (Ludgate, Cherhill) grading to deep sandy red earths on upper slopes Gn2.12 (Webb). Associated are siliceous sands on dune remnants and sand sheets Uc5.11, Uc1.22 (Wawra) with minor grey clays in depressions Ug5.21 (Bibel).

VEGETATION: Silver-leaved ironbark, spinifex open-woodland to woodland on upper slopes with poplar box open-woodland to low open-woodland on lower slopes. Minor areas of bloodwood, quinine bush grassy open-woodland on sandy rises. Occasionally gidgee or brigalow low woodland in clay depressions

E2 REDCLIFF (5 390 km^2)



Land Unit and / or Associated Land System	F, G Land Zone	63	40	38	37	H1	35 (31 in the south and east)	39	34	W2	36	8	E3, E6 W1, W4
Site and / or special comment	112 F322 F343 F367 F360 F361 F394 F396 F450		195 F325 F358 F388 F431	57 75 85, 111 F345 F347 F350 F395 F462	127 169 F358		141, 156, 161, 163, 171, 186, 190, 197 200, 204, 216, 220, F371, F430	140, 196 F383 F407 F409	162, 166, 167, 168 206, 211 F381		198 201 F416 F427	12, 20 139	
Est. % of Land System		<5	<5	<5	<5	<5	50	20	10	<5	<5	<5	

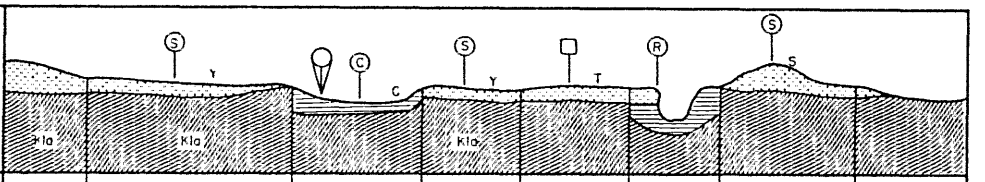
LANDFORM: Gently sloping sandplain and plateau surfaces with duricrust exposed on scarps and low rises. Slopes < 2%.

GEOLOGY: Quaternary sediments overlying Cretaceous material.

SOILS Sandy yellow and red texture contrast soils on lower slopes, Dy3.12, Dy2.43, Dy3.43, Dr2.13, Dr3.12 (Ludgate, Cherhill) grading into sandy yellow and red earths upslope Gn2.22, Gn2.12 (Uanda, Webb); with minor siliceous sands (Uc5.11) on sand sheets and loamy lithosols on plateau margins Uc4.11 (Corys).

VEGETATION: Whites ironbark / silver-leaved ironbark, spinifex low open-woodland with Reid River box, sandalwood low woodland to low open-woodland on lower slopes. Minor areas of Normanton box, beefwood, tea-tree, spinifex tall open-shrubland on exposed duricrust with lancewood, mountain yapunyah tall shrubland to low woodland on scarps.

E3 EASTFIELD (2 730 km^2)



Land Unit and / or Associated Land System	E2 H1	35	41	35	34	W2	36	A4 W4
Site and / or special comment		141, 156, 161, 163, 171, 186, 190, 197, 200, 204, 216, 220, F371, F430	F329-330 F410 F417-8		162, 166, 167, 168, 206, 211, F381		198, 201, F416, F427	
Est. % of Land System		60	15		20	< 5	< 5	

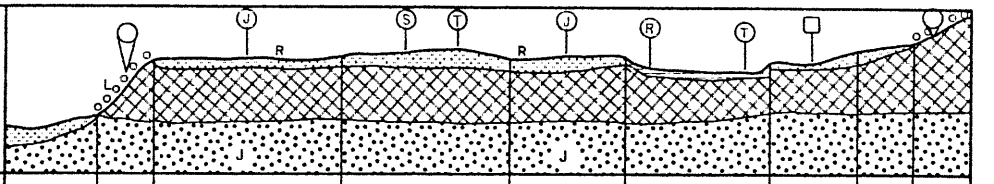
LANDFORM: Gently sloping sandplain with extensive system of shallow alluvial drainage depressions and minor ephemeral lakes. Slopes < 1%.

GEOLOGY: Quaternary sediments.

SOILS: Moderately deep sandy yellow earths with ironstone inclusions Gn2.22, Gn2.42 (Uanda), associated soils include sandy texture contrast soils Dy2.43, Dy3.43, Dy3.41 (Coorabah), Dr2.13 (Ludgate) and siliceous sands Uc5.22, Uc1.21 (Tangorin)

VEGETATION: Whites ironbark, spinifex low woodland to low open-woodland with tea-tree, desert oak tall open-shrubland to wooded open-hummock grassland conspicuous in places Reid River box, sandalwood low woodland to low open-woodland on lower slopes. Areas of gidgee / coolibah low open-woodland to open-woodland fringing drainage depressions.

E4 GRANT (3 190 km^2)



Land Unit and / or Associated Land System	E5	63	42	43	42	L1	34	E2	63
Site and / or special comment		112 F322 F323 F343	165, 170, 172, F359, F386	C274 F342			162, 166-8 206 211 F381		F357 F360-1 F394 F391 F450
Est. % of Land System		5	70	20		<5	5		

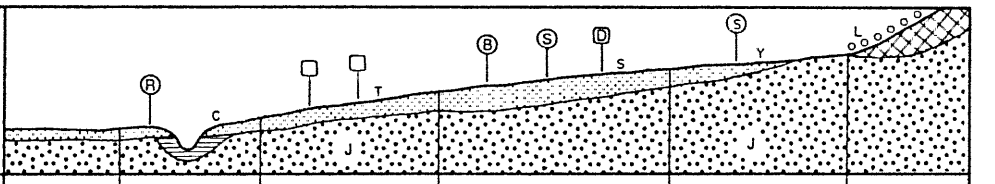
LANDFORM: Flat to very gently sloping tops of tablelands and mesas. Slopes < 1%.

GEOLOGY: Jurassic Ronlow Beds overlain by Quaternary deposits.

SOILS: Predominantly deep sandy red earths Gn2.11, Gn2.12 (Webb), associated with deep siliceous sands Uc5.11 (Tarella). Ironstone shot occurs on the soil surface. Pisolitic ironstone may occur on the surface and at the base of the soil profile.

VEGETATION: Groved yellowjack, bloodwood, spinifex open-woodland with Whites ironbark open-woodland occurring throughout. Occasionally tea-tree tall open-shrubland on low rises. Nutwood and Darwin woollybutt may be locally dominant as low open-woodland in the north-east.

E5 ADELONG (1 010 km^2)



Land Unit and / or Associated Land System	E2, E6, A2	W2	34	44	35	E4
Site and / or special comment			162, 166, 167, 168, 206, 211, F381	160, F358, F362, F364, F397	141, 156, 161, 163, 171, 186, 190, 197, 200, 204, 216, 220, F371, F430	
Est. % of Land System		<5	10	75	10	<5

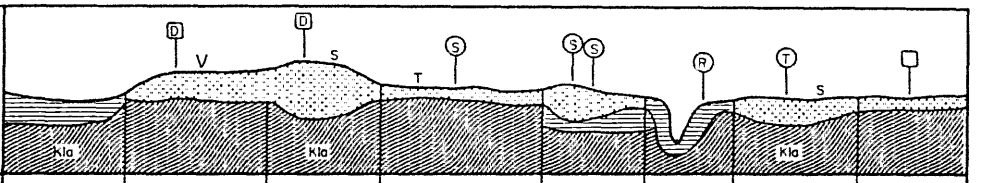
LANDFORM: Gently sloping outwash sandplain. Slopes < 3%.

GEOLOGY: Quaternary sediments.

SOILS: Very deep, red siliceous sands Uc1.23 (Tangorin) associated with deep sandy texture contrast soils Dr2.13 (Ludgate), Dy2.43, Dy3.43, Dy3.12 (Coorabah). Sandy yellow earths occur upslope Gn2.22 (Uanda).

VEGETATION: Gum-topped bloodwood, Acacia spp, quinine bush shrubby open-woodland with Whites ironbark open-woodland to low open-woodland on upper slopes. Reid River box, sandalwood low woodland to low open-woodland on lower slopes.

E6 TORRENS (1 490 km^2)



Land Unit and / or Associated Land System	A4 W1, W4	45	46	47	36	W2	48	34
Site and / or special comment		209, 210 F385	193, 208, F387, F390-3, F421, F423	207, 213	198 201 F416 F427		202	162 166-8 206, 211 F381
Est. % of Land System		30	10	30	10	10	5	5

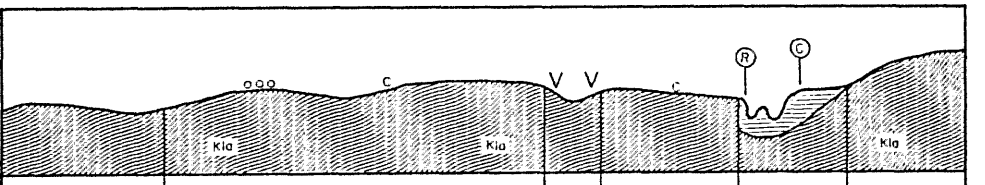
LANDFORM: Gently sloping stabilised fan plain with network of sandy infilled distributaries Slopes < 1%.

GEOLOGY: Quaternary sediments.

SOILS: Very deep siliceous sands Uc5 11 (Wowra) associated with deep sandy texture contrast soils Dy3.12, Dy3.42 (Shirley, Cherhill).

VEGETATION: Whites ironbark, desert oak, quinine bush shrubby low woodland to woodland with Reid River box, sandalwood low woodland on lower slopes. Bloodwood, desert gum, tea-tree open-woodland occurs on infilled channels.

F1 ALLARU (5 470 km^2)



Land Unit and / or Associated Land System	F3, T1-3 G1	1	2	3	A3	G, F Land Zones
Site and / or special comment		10, 13, 14, 17, 18, 23, 24, 27, 34, 39, 46, 50, 54, 60, 61, 65, 88, 93, 94, 96, 98, 100, 102-9, 115-7, 119, 121 135, 136, 142, 144-7, 151, 154, 155, 177, 179, 181, 182, F369, F374, F402, F405, F406, F445, F479	91 92 152 214	16 28 44		
Est. % of Land System		80	5	10	5	

LANDFORM: Gently undulating plains with long slopes ranging from 0.5% to 2%, averaging 1½%.

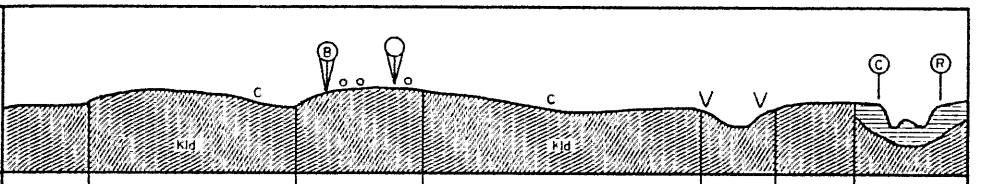
GEOLOGY: Fresh, labile sediments of the Cretaceous Allaru Mudstones.

SOILS: Moderately deep to deep, alkaline grey and brown cracking clays with strongly self-mulching surfaces Ug5.22, Ug5 24, Ug5.32, Ug5.34 (Ascot)*. Soils are weakly gilgaied with occasional scattered stones. Seasonal scalds may occur at base of slopes and adjacent to alluvia.

VEGETATION: Mitchell grass open-tussock grassland to tussock grassland with mimosa bush conspicuous along drainage lines. Coolibah / river red gum open-woodland fringing local creeks. Sparse forblands occur on scalded areas.

Footnote: *(Ascot) refers to major soil groups.

F2 POLITIC (800 km^2)



Land Unit and / or Associated Land System	F1	1	T1 T2	3	2	3	A1-3, W3
Site and / or special comment		(as per Allaru L.S.)		16, 28, 44	91 92 152 214		
Est. % of Land System		70	20	10	<5		

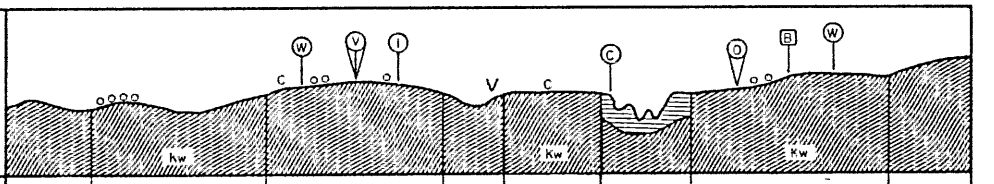
LANDFORM: Flat to gently sloping plains with long slopes to 1%.

GEOLOGY: Fresh, labile sediments of Cretaceous Wallumbilla Formation.

SOILS: Moderately deep to deep, alkaline, grey and brown cracking clays Ug5.22, Ug5.24, Ug5.32, Ug5.34 (Ascot) with extensive seasonal scalding on alluvia and run-on areas (Ardno).

VEGETATION: Mitchell grass open-tussock grassland to tussock grassland with other short grasses. Sparse forblands occur on the extensive scalds. Minor areas of Mitchell grass, gidgee / boree wooded open-tussock grassland.

F3 WINTON (22 920 km^2)



Land Unit and / or Associated Land System	T1-3, S1, R4	1	4	2	3	A3	4	G Land Zone
Site and / or special comment		(as per Allaru L.S.)	29-33, 36, 37, 45, 97, 120, 122, 153, 176, 184	91 92 152 214	16 28 44			
Est. % of Land System		40	50	<5	10			

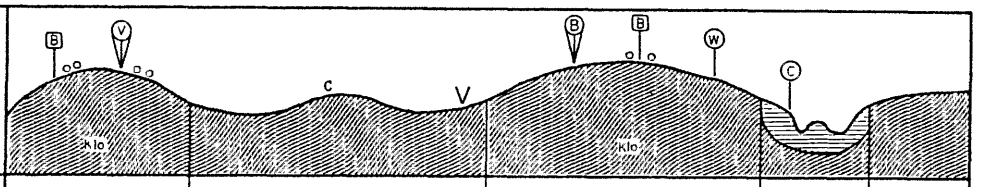
LANDFORM: Gently undulating plains with sandstone outcrops. Slopes to 3%.

GEOLOGY: Fresh, labile sediments of Cretaceous Winton and Mackunda Formations.

SOILS: Moderately deep to deep, brown and grey alkaline cracking clays with strongly self-mulching surfaces Ug5.32, Ug5.23 (Ascot) which grade into shallow brown stony clays on timbered crests Ug5.32, Ug5.22, Uf6.31. Minor stone pavements in western areas. Seasonal scalding occurs.

VEGETATION: Mitchell grass open-tussock grassland to tussock grassland and other short grasses with wooded open-tussock grassland on cre[illegible] (trees include bauhinia, boonaree, vinetree and whitewood). Minor areas of sparse forbland on scalds.

F4 TOOLEBUC (360 km^2)



Land Unit and / or Associated Land System	5	1	5	A3	F2 T1 - 2
Site and / or special comment	11 F370	(as per Allaru L.S.)			
Est. % of Land System	60	30		10	

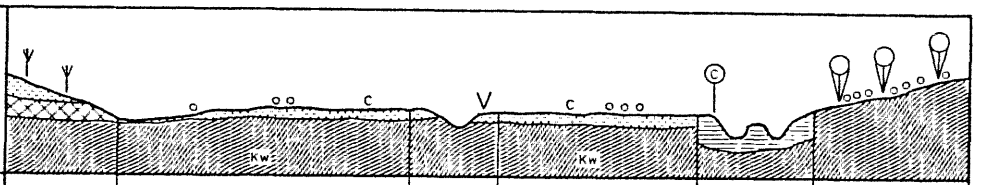
LANDFORM: Gently undulating plains with sharply defined limestone ridges; slopes < 2%

GEOLOGY: Fresh, labile sediments of Cretaceous Toolebuc Formation.

SOILS: Moderately deep to deep, brown and grey alkaline cracking clays with strongly self-mulching surfaces Ug5.32, Ug5.22 (Ascot). Soils become shallower on limestone ridges.

VEGETATION Mitchell grass open-tussock grassland with wooded open-tussock grassland on limestone ridges (trees include bauhinia, boonaree, boree, emu-apple and vinetree).

F5 VERGEMONT (70 km^2)



Land Unit and / or Associated Land System	M Land Zone	7	2	7	A3 W3	G Land Zone
Site and / or special comment		133, F464 - 5	91 92 152			
Est. % of Land System		90	5		5	

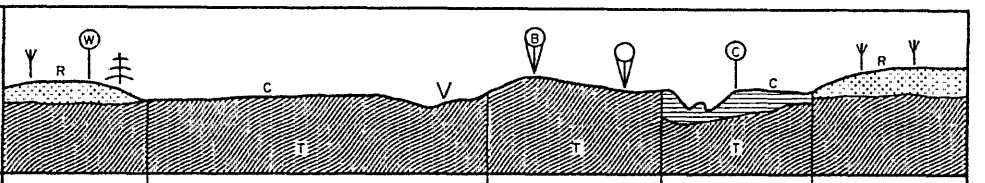
LANDFORM: Flat plains with occasional drainage lines. Slopes < 1%.

GEOLOGY: Fresh, labile sediments of Cretaceous Winton Formation, overlain in part by duricrust.

SOILS: Moderately deep to deep, red alkaline cracking clays with sinkholes and depressions. Silcrete present Ug5.36 (Tiree).

VEGETATION: Mitchell grass / short grass open-tussock grassland with areas of open-forbland and mimosa bush fringing drainage lines.

F6 WARNAMBOOL (580 km^2)



Land Unit and / or Associated Land System	S2	6	T1, T2	W3	M1
Site and / or special comment		48, 81 F353, F453-5 F459			
Est. % of Land System		90	5	5	

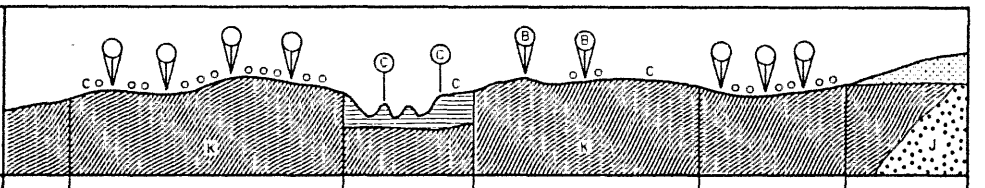
LANDFORM: Flat clay plains of relic Winton plateau. Slopes <1%.

GEOLOGY: Exposed Tertiary clay sediments.

SOILS: Moderately deep, grey cracking clays with strongly self-mulching surfaces Ug5 22 (Ascot). Broad shallow gilgais common. Surface soils are neutral, tending alkaline beyong 30cm.

VEGETATION: Mitchell grass open-tussock grassland to tussock grassland, with other short grasses. Minor areas of gidgee / boree wooded open-tussock grassland. Mimosa bush fringes drainage lines.

G1 LINDEN (730 km^2)



Land Unit and / or Associated Land System	F Land Zone	8	W3	50	8	E Land Zone
Site and / or special comment		12, 20, 139 F373		21, 22, 35, 38, 51, 66, 101, 114, 164, 185, 188, 189		
Est. % of Land System		90	5	5		

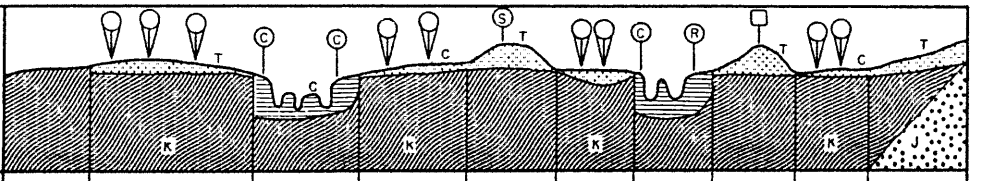
LANDFORM: Flat to gently undulating plains; slopes <3%.

GEOLOGY: Fresh, labile Cretaceous sediments overlain in part by Quaternary deposits.

SOILS. Deep alkaline brown and grey cracking clays with soft self-mulching surfaces Ug5.32, Ug5.21 (Bibel). Gilgais are weakly to moderately developed. Surface stone cover light and variable.

VEGETATION: Gidgee, sandalwood tall shrubland to low woodland. Minor areas of boree low woodland to low open-woodland.

G2 BLENDON (1 100 km^2)



Land Unit and / or Associated Land System	F Land Zone	9	W3	9	31	9	W3	30	9	E Land Zone
Site and / or special comment		2, 5, 7			F375 F380 F382			1, 218		
Est. % of Land System		80	5		10			5		

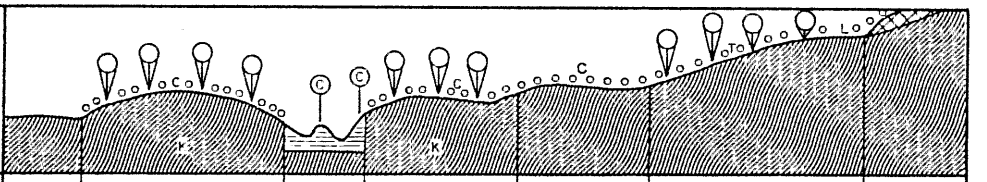
LANDFORM: Flat to very gently sloping plains, slopes <2%

GEOLOGY: Fresh labile Cretaceous sediments overlain by Quaternary deposits Some local alluvial influence.

SOILS Deep alluvial brown cracking clays Ug5.32 (Bibel) with texture contrast soils Dr2.13 (Thornton), Dy2.43 (Coorabah). Stone cover common and rock outcrops in places. Layering of soils near alluvia.

VEGETATION: Gidgee, sandalwood, currant bush low woodland with silver-leaved ironbark and poplar box open-woodland on low sand rises.

G3 SPOILBANK (3 210 km^2)



Land Unit and / or Associated Land System	S1 T1-2	10	W3	10	F3	66	R Land Zone
Site and / or special comment		26, 52, 56, 62, 68, 143, 187, F478				74, 113, 128, F463	
Est. % of Land System		80	<10		<10	<10	

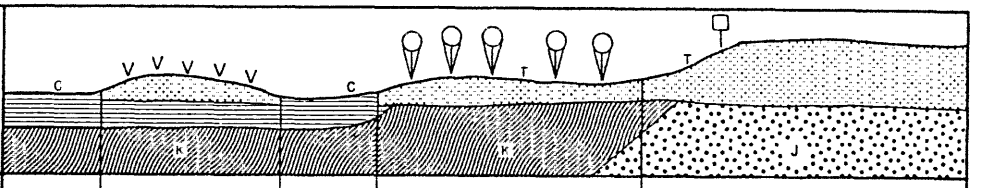
LANDFORM Mantled pediments and scarp retreat zones, slopes to 10%.

GEOLOGY: Fresh labile Cretaceous sediments with gravel cover.

SOILS: Moderately deep to deep, brown cracking clays Ug5.31, Ug5.32 (Bibel) and minor desert loams Dr3.11 (Thorton); dense stone and gravel cover.

VEGETATION: Gidgee / sandalwood tall shrubland to tall open-shrubland to low open-woodland. Minor areas of Mitchell grass wooded open-tussock grassland.

G4 RAVENSWOOD (130 km^2)



Land Unit and / or Associated Land System	21 (a)	12	21 (a)	11	E5
Site and / or special comment	157, F368	159, F367		158, F365 -6, F389, F473	
Est. % of Land System	20	30		50	

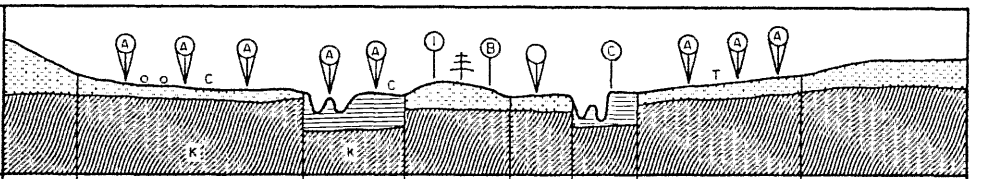
LANDFORM: Gently sloping outwash plains; slopes <2%. Claypans occur throughout.

GEOLOGY: Quaternary sands overlying recent clay alluvium and Cretaceous sediments.

SOILS Deep sandy texture contrast soils Dy2.43 (Coorabah) with minor areas of grey clays (Uf6.13, Ug5.22) on claypans.

VEGETATION: Gidgee, sandalwood low woodland with areas of Ellangowan poison bush, beefwood, needlewood, sandalwood grassy tall open-shrubland on low sandy rises. Minor areas of sparse forbland on claypans.

G5 JABIRU (1 050 km^2)



Land Unit and / or Associated Land System	E Land Zone	13	W4	53	8	W3	13	F2, A2, A4
Site and / or special comment		137, 173, 217		63, 64, 346, F439, 469, 495	12, 20, 139, F373			
Est. % of Land System		80	<5	10	5	5		

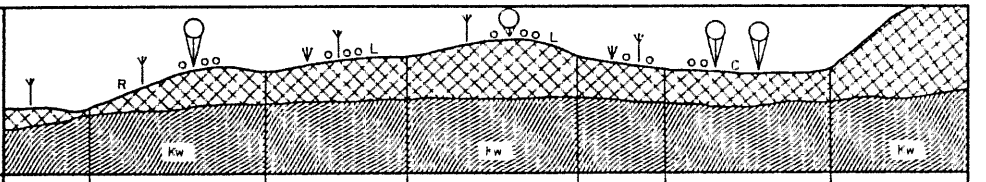
LANDFORM Flat to gently sloping plains grading into alluvium. Slopes <2%.

GEOLOGY. Quaternary deposits overlying Cretaceous sediments.

SOILS: Deep, weakly gilgaied grey clays, with scattered ironstone cover Ug5.28, Uf6.31 (Tiree) and texture contrast soils Db2.43 (Sumana).

VEGETATION: Blackwood low woodland to grassy low open-woodland with areas of ironwood, beefwood, western bloodwood low open-woodland on minor sandsheets.

H1 OPALTON (1000 km^2)



Land Unit and / or Associated Land System	M1 W3	16	18	17	18	19	R Land Zone
Site and / or special comment		131, F328, 408, 449, F486-9	67, 129 F476-7, 485	82, 349		78, 126 F348, 354	
Est. % of Land System		20	60	10		10	

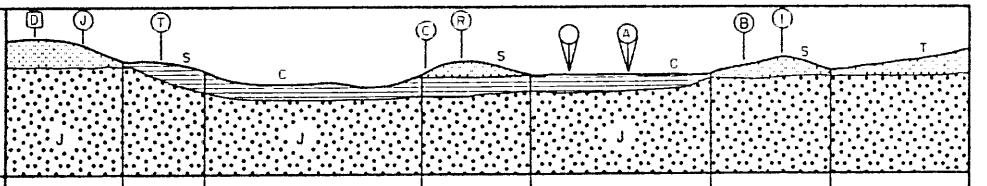
LANDFORM: Flat to gently undulating plains, grading into dissected hills. Slopes to 10%

GEOLOGY: Chemically altered Cretaceous sediments.

SOILS: Very shallow red earths Gn2.11 (Webb), lithosols and desert loams with shallow stony clays in depressions Uf6.31. Soils are scalded and often severely sheet eroded

VEGETATION: Mulga / bastard mulga tall open-shrubland, sparse in places, to mulga tall shrubland, groved in places. Occasionally gidgee, spinifex low open-woodland. Areas devoid of vegetation.

L1 WEBB (50 km^2



Land Unit and / or Associated Land System	42	48	68	60	W1, W4	32	E Land Zone
Site and / or special comment	165, F386, 170, F359, 172	202		212, F384		3, 219 F435, F437	
Est. % of Land System	<5	<5	80	10	5	<5	

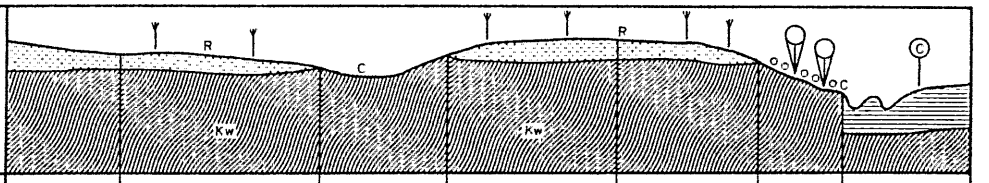
LANDFORM: Large ephemeral lakes and seasonally flooded claypans.

GEOLOGY: Recent alluvium.

SOILS: Siliceous sands and sandy texture contrast soils on lake margins, grading to massive, grey clays on lake floor.

VEGETATION: Open-herbland (short grasses, sedges and forbs) to swamp canegrass open-tussock grassland on claypans and lake floors. Areas of river red gum / paper-barked tea-tree / gidgee / coolibah low open-woodland fringing the lakes.

M1 TONKORO (1 050 km^2)



Land Unit and / or Associated Land System	S1 - 2 H	14	7	15	14	G3	W3
Site and / or special comment		79, 80, 130, 132 F461, 470, 514	133 F464 - 5	69, 86, 110 F355			
Est. % of Land System		60	5	35			

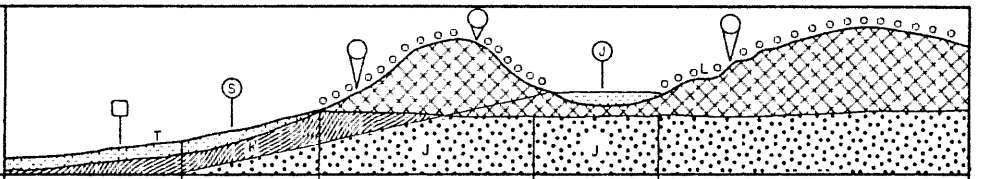
LANDFORM: Flat to gently sloping plains; slopes <3%.

GEOLOGY: Quaternary sands overlying Cretaceous sediments.

SOILS: Deep sandy red earths Gn2.12, Um1.43 (Webb) and light clays Uf6.34 associated with slump holes. Minor red clays in depressions, Ug5.36.

VEGETATION: Mulga low woodland to tall shrubland, often distinctly groved.

R1 WINOOKA (390 km^2)



Land Unit and / or Associated Land System	34	35 (31 in south)	63	42	63
Site and / or special comment	162, 166 167, 168 206, 211, F381	141, 156, 161, 163, 171, 186, 190, 197, 200, 204, F371, F430	112, F322, F323, F343, F357, F360-1, F394, F396, F450	165 170 172 F359 F386	
Est. % of Land System	<10	20	70	<5	

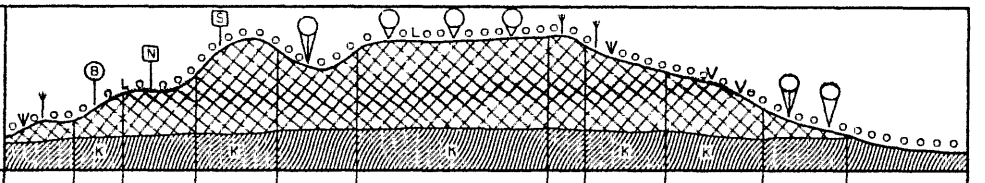
LANDFORM Dissected low hills, scarps and gorges.

GEOLOGY Chemically altered Cretaceous, Jurassic sediments.

SOILS: Predominantly lithosols Uc4.11, Um1.44 (Corys) with sandy red earths Gn2.12 and texture contrast soils (Dr2.13) on colluvial slopes. Extensive rock outcropping.

VEGETATION Lancewood / bendee / mountain yapunyah tall shrubland to low woodland on scarps with Whites ironbark / silver-leaved ironbark low woodland to low open-woodland on lower slopes. Minor occurrence of yellowjack, tea-tree low open-woodland on mesa tops.

R2 ELVO (2210 km^2)



Land Unit and / or Associated Land System	18	37	38	71	66	65	16	67	64	72	F3 G3
Site and / or special comment	67 129 F476-7 485	127 169 F358	57, 75 85, 111 F345,347 350, 395 462		74, 113 128 F463	72, 73, F352	131 F408 F328 F486-9 F449	B263	47 F483-4	87 F337	
Est. % of Land System	15	5	5	<10	<5	25	<5	20	20	<5	

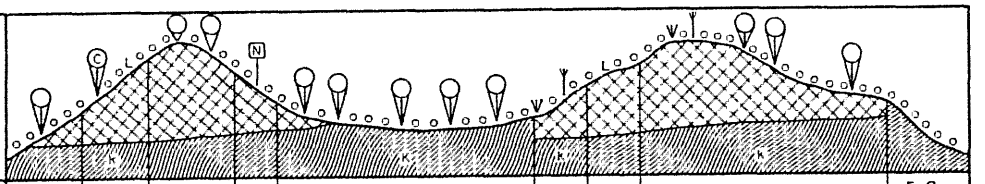
LANDFORM: Undulating plains, dissected low hills and scarps.

GEOLOGY: Chemically altered Cretaceous sediments.

SOILS Lithosols, minor desert loams and shallow red earths. Extensive rock outcropping.

VEGETATION: Bastard mulga, mulga low open-shrubland or mulga tall open-shrubland and sparse forbland, with Normanton box, lancewood, spinifex tall open-shrubland on scarps and gidgee on lower slopes.

R3 BINBURI (1380 km^2)



Land Unit and / or Associated Land System	72	69	65	38	10	18	67	65	F, G Land Zone
Site and / or special comment	87 F337	F351 F480	72, 73, F352	57 75 85 111 F345 F347 F350 F395 F462	26, 52, 56, 62, 68, 143, 187, F478	67, 129, F476 F477 F485	B263		
Est. % of Land System	<5	<5	40	<5	30	20	<5		

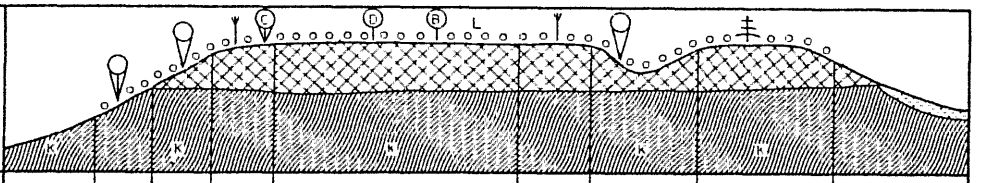
LANDFORM: Mesas, buttes and dissected tablelands separated by gently undulating plains.

GEOLOGY: Chemically altered and fresh labile Cretaceous sediments.

SOILS Lithosols, desert loams with stony brown clays on colluvial slopes.

VEGETATION: Mulga / bastard mulga / lancewood / spinifex low open-shrubland to tall open-shrubland. Sparse forbland and gidgee tall open-shrubland occur on lower slopes.

R4 BLADENSBURG (870 km^2)



Land Unit and / or Associated Land System	F3, G3	72	65	69 (a) (b)	70	16	63	70	S2
Site and / or special comment		87 F337	72 - 3 F352	F351 F480	F444	131 F328 408, 449 486 - 9	112, F322, F343, F357, F360-1 F394, F396, F450		
Est. % of Land System		< 10	10	10	70	< 5	< 10		

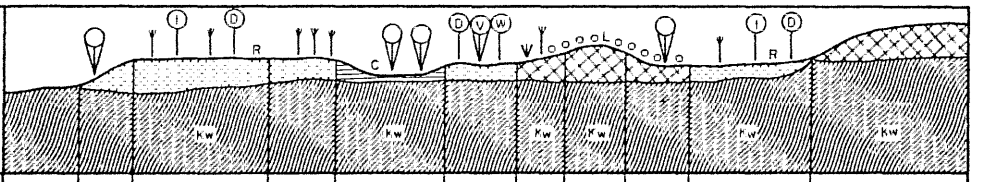
LANDFORM: Flat tops of tablelands, mesas and buttes

GEOLOGY: Tertiary Werite Beds, overlain by duricrust.

SOILS: Lithosols and shallow red earths.

VEGETATION: Mulga / bendee / lancewood open - scrub to tall open - scrubland on the scarps with Normanton box, mineritchie tall open - shrubland on lower slopes. Western bloodwood, beefwood, eastern dead finish, spinifex wooded open - hummock grassland on flat tops.

S1 SUNNYSIDE (1 720 km^2)



Land Unit and / or Associated Land System	W3 F3	11	52	14	8	53	18	64	66	52	R Land Zone
Site and / or special comment		158 F365-6 F389 F473	58-9, 125, F471-2, F474-5 F481-2	79, 80, 130, 132 F514 F461, F470,	12, 20 139 F373	63 - 4 F346 F439 F469, 495	67 129 F476-7 F485	47 F483-4	74, 113 138 F463		
Est. % of Land System		< 5	40	10	< 5	30	< 5	< 5	< 5		

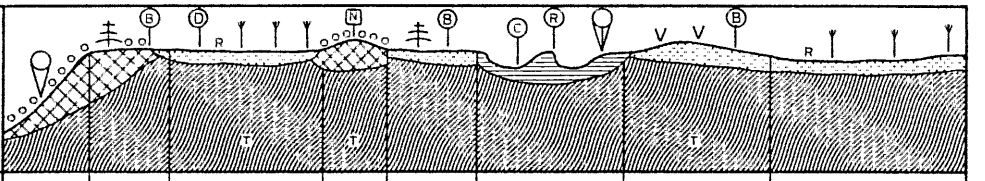
LANDFORM: Flat to very gently sloping sandplain. Slopes < 2%.

GEOLOGY: Quaternary sands overlying Cretaceous and Tertiary sediments

SOILS: Deep sandy red earths Gn2.12, Um1 43 (Webb) and light sandy clays Uf6 31 (Vergemont) and sandy texture contrast soils Dr2 13 (Ludgate). Minor lithosols on lateritised outcrops and grey clays in depressions.

VEGETATION: Mulga tall shrubland to tall open - shrubland and eastern dead finish / mulga, beefwood, western bloodwood tall open - shrubland to low open - woodland, grading into ironwood , beefwood, western bloodwood low open - woodland in the east.

S2 ATHELSTANE (1230 km²)



Land Unit and / or Associated Land System	65	55	52	38	53	54	56	M1
Site and / or special comment	72, 73, F352	76, 124, F451 - 2, F456, 460	58 - 9, 125 F471 - 2, F474 - 5 F481 - 2	57, 75 85, 111 F345, 350, 347 462	63 - 4 F346, 439 F469, F495	84 F458	F457	
Est. % of Land System	<5	<5	30	10	40	10	<5	

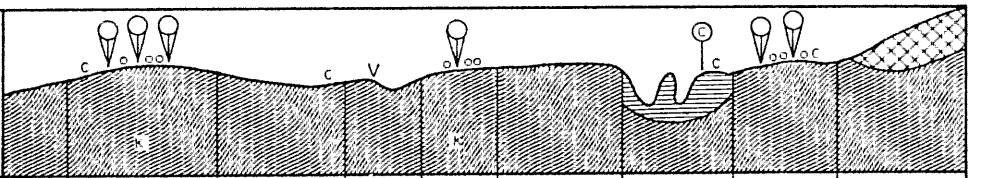
LANDFORM: Flat sandplain of the Winton plateau, with alluvial clay depressions and swamps throughout .Duricrust exposed on margins and occasional low rises.

GEOLOGY: Quaternary sands overlying Tertiary sediments.

SOILS: Deep sandy red earths Gn2 12, Gn2 13, Um1 43 (Webb), with minor desert loams Dy2.12 associated with duricrust and shallow grey clays in swamps Ug5 22 (Lydia).

VEGETATION: Western bloodwood, beefwood, spinifex shrubby open - woodland to wooded hummock grassland and mulga tall open - shrubland. Occasionally Normanton box tall open - shrubland on duricrust. Coolibah, river red gum / gidgee open - woodland to low open - woodland associated with shallow depressions and swamps

T1 ACCORD (2320 km²)



Land Unit and / or Associated Land System	F, G	49	1	2	49	1	A3, W3	49	E2, R4
Site and / or special comment		55, 89, F372 F399, F490 - 1, F494	(as per Allaru L.S.)	91, 92, 152 214					
Est. % of Land System		70	20	5			5		

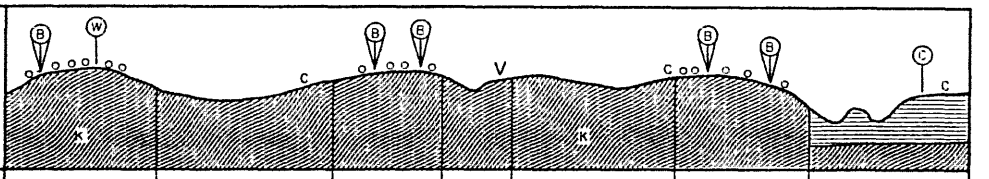
LANDFORM: Flat to gently undulating plains, slopes < 2%.

GEOLOGY: Fresh, labile Cretaceous sediments.

SOILS: Moderately deep to deep, brown and grey cracking clays with soft self - mulching surfaces Ug5.32, Ug5.33 (Ascot). Surface gravel is common in timbered areas.

VEGETATION: Mitchell grass, gidgee wooded open - tussock grassland to tussock grassland with gidgee low open - woodland or tall open - shrubland throughout.

T2 KENTLE (4 260 km^2)



Land Unit and / or Associated Land System	50	1	50	2	1	50	A3, W3
Site and / or special comment	21, 22, 35, 38, 51, 66, 101, 114 164, 185, 188, 189	(as per Allaru L.S.)		91 92 152 214			
Est. % of Land System	70	20		<5			<5

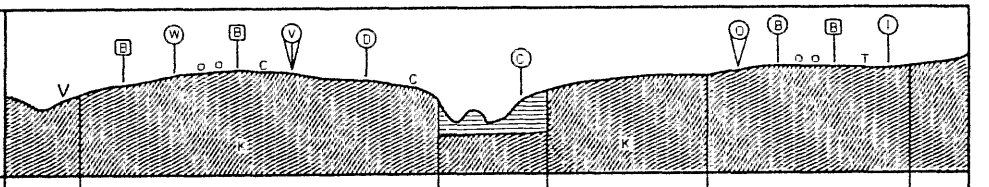
LANDFORM Flat to gently undulating plains; slopes < 2%.

GEOLOGY Fresh, labile Cretaceous sediments.

SOILS: Deep, grey and brown cracking clays with dense gravel cover Ug5.23, Ug5.22, Ug5.32 (Bibel).

VEGETATION: Mitchell grass, boree wooded open-tussock grassland. Occasionally boree, whitewood, boonaree grassy open-woodland

T3 MACKUNDA (1 120 km^2)



Land Unit and / or Associated Land System	2	51	A3 W3	1	51	G, F, E
Site and / or special comment	91, 92, 152 214	9, 41, (C22, 26, 27, 89, 142, 144, 234, 235)		(as per Allaru L.S.)		
Est. % of Land System	5	80	5	10		

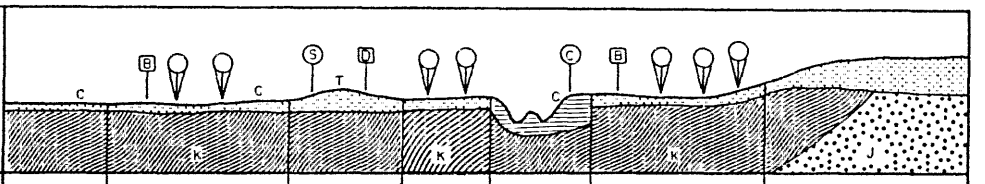
LANDFORM: Gently undulating plains, with slopes to 3%.

GEOLOGY: Fresh, labile Cretaceous Mackunda Formation sandstones.

SOILS: Shallow to moderately deep, brown and grey clays Uf6.31, Ug5.22 (Ascot) and minor texture contrast soils, Db2.13.

VEGETATION: Mitchell grass wooded open-tussock grassland and other short grasses to bauhinia, boonaree, eastern dead finish, whitewood grassy low open woodland.

W1 EWAN (720 km^2)



Land Unit and / or Associated Land System	27	57	46	57	W3 - 4	57	E Land Zone
Site and / or special comment	174, 175, 191, 192, F413 - 5, F420, F422, F428, F440	194, F379, F419, F424	193, 208, F387, F390-3, F421, F423				
Est. % of Land System	20	70	~10		< 10		

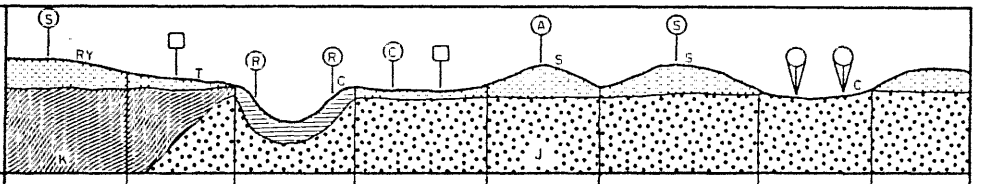
LANDFORM: Flat plains subject to occasional overflow.

GEOLOGY: Quaternary deposits overlying Cretaceous sediments.

SOILS: Deep, grey sandy clays Uf6.31 (Tiree) and gilgaied grey cracking clays Ug5 24 (Mundoo) associated with minor sandy red earths Gn2.12 (Webb) and siliceous sands Uc5.11 on sand sheets.

VEGETATION Gidgee, bauhinia, sandalwood low woodland to low open - woodland with areas of curly blue grass, Mitchell grass tussock grassland to open - tussock grassland. Areas of bloodwood / desert gum / Whites ironbark / Reid River box low woodland to low open - woodland on sandy rises.

W2 NIVE (900 km^2)



Land Unit and / or Associated Land System	E Land Zone	34	73	61	32	36	58	E Land Zone
Site and / or special comment		162, 166 - 8, 206, 211, F381	F345, 411, 412, 433	F336	3, 219, F435, F437	198, 201, F416, 427	F324, F377-8, F425	
Est. % of Land System		40	10	10	< 10	10	20	

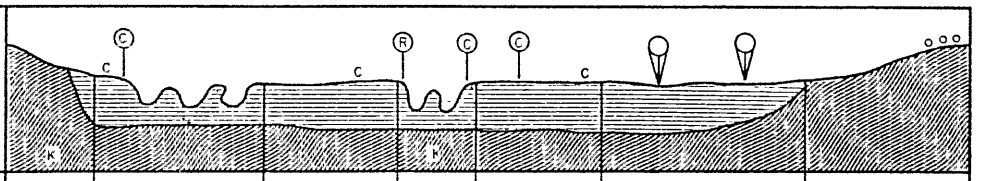
LANDFORM: Flat alluvial plains associated with single channel streams draining the desert country, intermittent seasonal flows.

GEOLOGY: Quaternary alluvium.

SOILS: Very deep siliceous sands on dunes and levee remnants Uc5.11 (Tarella) with deep sandy texture contrast soils throughout Dy3.41, Dy3.43, Dr2.13 (Shirley, Ludgate). Minor grey clays in depressions. Bed load of sand.

VEGETATION River red gum, tea - tree open - woodland on the channels with poplar box and / or Reid River box low open - woodland to open - woodland on lower slopes. Moreton Bay ash, bloodwood open - woodland on sand sheets Areas of gidgee, bauhinia, sandalwood low open - woodland in clay depressions

W3 RAVENSBOURNE (1 580 km^2)



Land Unit and / or Associated Land System	F Land Zone	24	25	24	59	26	G Land Zone
Site and / or special comment		4, 19, 42, 90, 95, 199, F376	25, 40, 43, 83, 99, 118, 148, 149, 150, 178, 180, 183, F403, F446-8, F492		C13	6, 71, 77, F356	
Est. % of Land System		50	20		10	20	

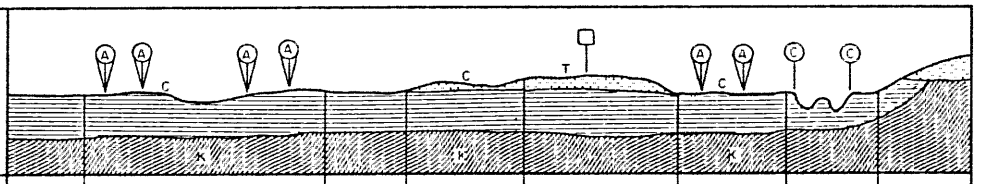
LANDFORM: Flooded alluvial plains with numerous braided channels.

GEOLOGY: Recent clay alluvium.

SOILS: Deep to very deep, grey cracking clays Ug5.24, Ug5.27, Ug5.29 and brown clays Ug5.32, Ug5.34 (Cornish), (Thomson). Soils may be seasonally scalded.

VEGETATION: Coolibah / river red gum grassy low open-woodland to open-woodland on the channels. Gidgee low woodland, Mitchell grass open-tussock grassland to tussock grassland and open-forbland on interchannel areas.

W4 ABERFOYLE (1 170 km^2)



Land Unit and / or Associated Land System	W1-3	62	58	27	34	62	24	G, E Land Zone
Site and / or special comment		203, 205, F432, 441	F324, F377-8, F425	174-5, 191-2, F413-5, 420, 432, 428, 440	162, 166-8, 206, 211, F381		4, 19, 42, 70, 90, 95, F376	
Est. % of Land System		65	15	< 10	< 10		< 10	

LANDFORM: Flat alluvial plains subject to occasional flooding.

GEOLOGY: Quaternary clay alluvium.

SOILS: Deep to very deep, gilgaied grey sandy clays Uf6.32, with deep texture contrast soils on overlying sand sheets Dy2.43, Dr2.13 (Ulva).

VEGETATION: Blackwood low open-woodland to woodland with areas of Reid River box open-woodland. Coolibah fringes the channels.

APPENDIX V

LAND UNITS

by E.J. Turner, W.J.F. McDonald, M.B. Thomas and C.R. Ahern

EXPLANATORY NOTES

Landform: General landform pattern or element types (see McDonald *et al.*1984) are given.

Geology: See Chapter 2.

Soils: The description covers the following aspects:

- A general description of the soil with any distinguishing attributes.
- Principal Profile Form (Northcote 1974).
- General soil fertility ratings: see Appendix 1.

See Chapter 3 for detailed soils information.

Vegetation: A general description is given, in which dominant species are listed in their order of importance, and other species alphabetically. The description covers the following aspects:

- *Tree and shrub strata:* The average height and density ranges are given for the dominant species, woody weeds and topfeed species. PFC ratings (see Appendix I) are sometimes given for the shrub stratum.
- Ground stratum: PFC ratings or the average range of PFC values are given for the stratum as a whole. Species are described in terms of their habit and their frequency/abundance rating (see Appendix 1).

(Land unit species list: A complete list of species recorded for each land unit is available on request.)

Land Use: The following aspects are discussed:

- Type of animal
- Soil
- Herbage
- Response of herbage to rainfall
- Woody weeds
- Topfeed
- Poisonous plants
- Water resources
- Special management problems or techniques
- Condition and trend (see Appendix I)
- Development potential, if any.

LAND UNIT 1

Landform:

Gently undulating clay plains with long slopes to 2%.

Geology:

Fresh sediments of the Cretaceous Rolling Downs Group.

Soils:

Moderately deep to deep (75 - 120 cm) grey and brown cracking clays with strongly self-mulching surfaces. Slight gilgai microrelief. Stone cover is very light but stone pavements (billy gravel) occur locally in the western sector. The profile is generally moderately to strongly alkaline throughout. $CaCo_3$ and gypsum are present. Organic carbon (C) and total nitrogen (N) levels are very low to low. Replaceable and exchangeable potassium levels (K) are high. Acid extractable phosphorus (AP) is generally high, while bicarbonate extractable phosphorus (BP) is very low to low. The soils have a high cation exchange capacity (CEC) and clay content. They have very high available soil water capacity values (AWC). The surface 0-10 cm is non saline but salt content increases to high/very high values with depth. Chloride levels are very low at the surface and may increase slightly with depth. Soils often sodic at depth. Ug5.12, Ug5.22, Ug5.26, Ug5.27, Ug5.32, Ug5.33 (Ascot). Representative profile analysis: 14, 18, 23, 100, 119, 136, 145, 155, 179, 181, 221, 222, 223, 224, 225.
Bulk surface analysis: 10, 13, 17, 27, 34, 39, 46, 50, 54, 60, 61, 65, 88, 93, 94, 96, 98, 102, 103, 104, 105, 106, 107, 108, 109, 116, 117, 121, 135, 142, 144, 146, 147, 151, 154, 177, 182.

Vegetation:

Mitchell grass tussock grassland to open tussock grassland (Ht <1m; PFC 20-40%). Curly Mitchell grass (*Astrebla lappacea*) predominates with barley Mitchell grass (*A. pectinata*) and hoop Mitchell grass (*A. elymoides*) occasionally co-dominant. *Aristida latifolia* and, especially after a series of good seasons, *Dichanthium sericeum* subsp. *sericeum* are abundant without becoming dominant. Other ephemeral grasses which may become co-dominant include *Iseilema vaginiflorum* and *Panicum decompositum*. There is a high density of forbs, many of which are ephemeral and only seasonally significant. Frequent species include *Psoralea cinerea, Phyllanthus maderaspatensis, Rhynchosia minima* and *Sida fibulifera*. Low shrubs of mimosa bush (*Acacia farnesiana*) and occasionally *A. victoriae* occur throughout the grasslands at low densities (<25-50/ha).

Land Use:

Breeding ewes and wethers predominate. Substantial falls of rain required for pasture response due to heavy clay soils; Mitchell grass provides standover feed into winter-spring; herbage is dependent on rainfall sequence and grazing intensity; drought reserves very sparse, limited topfeed; water supplies adequate and reliable; overgrazing not generally detrimental, present condition good; few land use problems, further development unlikely as properties are well established.

LAND UNIT 2

Landform:

Minor drainage lines in gently undulating clay plains.

Geology:

Fresh sediments of the Cretaceous Rolling Downs Group.

Soils:

Deep, brown cracking clays with self-mulching surfaces. Sand and ironstone pebbles may occur on soil surface. Soil profile is moderately to strongly alkaline throughout with $CaCO_3$ and gypsum present. C and N are very low and K high. AP is high, BP fair. The surface soil is non saline and non sodic while subsoil is both saline and sodic. Ug5.32, Ug5.34 (Ascot).
Representative soil analysis: 214.
Bulk surface analysis: 91, 92, 152.

Vegetation:

Mitchell grass open-tussock grassland to tussock grassland (PFC 20-40%). *Astrebla lappacea* is generally predominant, but in poorly-drained situations, *A. squarrosa* may be co-dominant. Low shrubs of *Acacia farnesiana* are frequent, occasionally forming a low open-shrubland (Ht 1-2m; density 50-250/ha). Apart from *Astrebla* spp , major grass species include *Aristida latifolia, Iseilema vaginiflorum* and *Panicum laevinode*. Common forbs include *Psoralea cinerea, Sida fibulifera, S. trichopoda* and *Trianthema triquetra*.

Land Use:

Comments as for unit 1. More browse shrubs (mimosa).

LAND UNIT 3

Landform:

Scalded areas at base of slopes in gently undulating clay plains.

Geology:

Fresh sediments of Cretaceous Rolling Downs Group.

Soils:

Deep, scalded brown clays with a thin, hard surface crust. Soils are moderately to strongly alkaline throughout. C and N values are very low, with high K values. AP high to very high while BP is low and K fair. The surface soil is non saline and non sodic but tends to become highly saline and sodic with depth. Ug5.32 (Ardno, Ascot).

Bulk surface analysis: 16, 28, 44.

Vegetation:

Mitchell grass open tussock grassland (PFC 20-30%). Curly Mitchell grass (*Astrebla lappacea*) is the major species, with *Aristida latifolia, Panicum decompositum* and *Dichanthium sericeum* locally prominent. A variety of forbs occurs in this community, with *Psoralea cinerea* the most frequent. Scattered shrubs and low trees include *Acacia farnesiana, Eremophila maculata, E. mitchellii and Atalaya hemiglauca*.

Land Use:

Closely associated with Unit 1. These areas are seasonally scalded and re-vegetate to a degree following a run of good seasons.

LAND UNIT 4

Landform:

Gently undulating clay plains with sandstone outcrops.

Geology:

Fresh labile Cretaceous sandstone sediments.

Soils:

Shallow to moderately deep, brown and grey cracking clays; sandstone floaters may outcrop. The profile is strongly alkaline throughout with $CaCO_3$ present. OC and N are very low to low while rep. K is high. AP is high while BP varies low to fair. The surface soil is non saline and non sodic but becomes highly saline and sodic at depth. Ug5.32, Ug5.22 (Ascot).
Representative soil analysis: 29, 33.
Bulk surface analysis: 31, 36, 37, 45, 97, 120, 122, 153.

Vegetation:

Mitchell grass wooded open tussock grassland (PFC10-30%). Curly Mitchell grass (*Astrebla lappacea*) is generally the dominant species, although in some areas barley Mitchell grass (*A. pectinata*) may be co-dominant or perhaps even replace *A. lappacea*. Shrubs and low trees are frequent (up to 300/ha), with the major species being whitewood (*Atalaya hemiglauca*), boree (*Acacia tephrina*) and mimosa bush (*A. farnesiana*). Apart from Mitchell grasses, the major ground stratum species are *Aristida latifolia, Enneapogon polyphyllus, Panicum decompositum, Iseilema vaginiflorum* and the forb *Psoralea cinerea*

Land Use:

Breeding wethers and ewes predominate. Substantial falls of rain required for pasture response Mitchell grass provides standover feed into winter-spring. More shade than unit 1 but shade and browse are still limited to crests. Water supplies adequate; overgrazing not generally detrimental; present condition good; few land use problems, further development unlikely as properties are well established.

LAND UNIT 5

Landform:

Gently undulating clay plains with limestone outcrops.

Geology:

Fresh labile Cretaceous limestone sediments.

Soils:

Moderately deep, brown cracking clays with strongly self-mulching surfaces. Slight gilgai microrelief. Occasional stone. Profile is moderately to strongly alkaline throughout. $CaCO_3$ and gypsum are present. OC and N are low; rep K is high. AP is high throughout while BP is low. The surface soil is non saline but becomes strongly saline at depth. Chloride levels increase with depth. Soils sodic at depth. Ug5.32 (Ascot).
Representative profile analysis: 11.

Vegetation:

Mitchell grass tussock grassland to open tussock grassland (PFC 20-45%). Curly Mitchell grass (*Astrebla lappacea*) and hoop Mitchell grass (*A. elymoides*) predominate, with other common grasses being *Dichanthium sericeum*, *Panicum decompositum* and *Iseilema vaginiflorum*. Forbs are common, including *Psoralea cinerea*, *Goodenia strangfordii* and *Sclerolaena* spp.. Scattered shrubs and low trees of boree (*Acacia tephrina*), whitewood (*Atalaya hemiglauca*) and vinetree (*Ventilago viminalis*) may occur in this unit.

Land Use:

Breeding ewes and wethers predominate. Substantial falls of rain required for pasture response due to heavy clay soils; Mitchell grass provides standover feed into winter-spring; herbage is dependent on rainfall sequence and grazing intensity; some shade along crests; water supplies adequate; present condition good; the limestone parent material causes selenosis in stock - disturbance of this material is to be avoided.

LAND UNIT 6

Landform:

Flat clay plains on the Winton plateau.

Geology:

Tertiary mudstones.

Soils:

Moderately deep, grey cracking clays with strongly self-mulching surfaces. Broad, shallow gilgais common. Some sand encroachment from surrounding sandplain. The surface is neutral becoming mildly alkaline with depth. OC and N levels, are very low while rep K is fair, AP and BP levels are very low; surface soil is non saline, becoming saline at depth; chloride values are low at the surface. Ug5.22 (Tiree)
Representative profile analysis: 81.

Vegetation:

Mitchell grass (*Astrebla pectinata, A. elymoides*) open tussock grassland. (PFC 10-30%). Wire grass (*Aristida latifolia*) and Flinders grass (*Iseilema vaginiflorum*) are common species. In some places emergent shrubs of *Acacia farnesiana* and *Cassia phyllodinea* are present (Ht 5m; 25/ha). Other locally frequent grasses are *Dichanthium fecundum*, *Eulalia aurea*, *Eragrostis tenellula* and *E. xerophila*. Although grasses are the major component, herbs such as *Goodenia fascicularis*, *Neptunia monosperma*, *Sida fibulifera* and *Streptoglossa adscendens* are present.

Land Use:

Breeding wethers and ewes predominate; substantial falls of rain required for pasture response, Mitchell grass provides standover feed into winter-spring; drought reserves very sparse; shade limited; water supplies adequate; present condition good; water harvesting schemes operate by collecting runoff from surrounding mulga sandplain and spreading it over the heavy clay soils.

LAND UNIT 7

Landform:

Flat to very gently sloping plains.

Geology:

Quaternary sediments overlying Cretaceous sandstones.

Soils:

Deep, red cracking clays with self-mulching surfaces. Profiles are neutral throughout. OC and N levels are very low, while rep. K is high. Both AP and BP values are very low. The surface is non saline but becomes highly saline and sodic at depth. Chloride levels increase from very low in the surface to high at depth. Ug5.36 (Tiree).
Representative profile analysis: 133.

Vegetation:

Mitchell grass open tussock grassland (PFC 10-30%), predominantly *Astrebla pectinata* and *A. squarrosa* with *A. elymoides* locally common in some sites. Other important species in the grassland are *Eragrostis xerophila, Panicum laevinode, Dactyloctenium radulans* and *Iseilema vaginiflorum.* In some places emergent shrubs of *Cassia helmsii, Eremophila maculata* and *Acacia farnesiana* are common. Forbs include *Dissocarpus paradoxus, Rhynchosia minima, Sida fibulifera* and *Abutilon malvifolium.*

Land Use:

Breeding ewes and wethers predominate. Substantial falls of rain required for pasture response; Mitchell grass provides standover feed into winter-spring, drought reserves very sparse; limited shade; water supplies adequate; present condition fair.

LAND UNIT 8

Landform:

Gently undulating plains.

Geology:

Fresh Cretaceous sediments.

Soils:

Deep, brown cracking clays, usually with light stone cover. Profile is usually strongly alkaline throughout. Surface is strongly alkaline, becoming neutral with depth. Gilgais weakly to moderately developed. OC and N are very low to low while rep. K is high; AP and BP range high to very high. EC and Cl are very low at the surface but increase to high values at depth. Often sodic at depth. Ug5 32, Ug5.24 (Bibel).
Representative profile analysis: 12, 20.
Bulk surface analysis 139.

Vegetation:

Gidgee (*Acacia cambagei*) low open-woodland (Ht 6m, PFC 5-15%) with *Flindersia maculosa* common and *Atalaya hemiglauca, Geijera parviflora* and *Ventilago viminalis* less common. In places shrubs of *Eremophila mitchellii* can reach a density of 2000/ha, with areas of *Muehlenbeckia cunninghamii* in depressions. The ground layer is sparse (PFC <10%) but the grasses *Astrebla* spp., *Aristida latifolia, Dactyloctenium radulans, Enneapogon oblongus* and *Sporobolus actinocladus* are frequent components. The forbs *Enchylaena tomentosa, Portulaca oleracea, Salsola kali* and *Trianthema triquetra* are common.

Land Use:

These gidgee lands have been extensively developed by clearing and sowing buffel grass. They are used for both sheep and cattle production. Substantial falls of rain required for pasture response. Buffel grass is relatively drought resistant and has proven to be well suited in this region. Drought reserves are very sparse, water supplies adequate. Woody weeds (sandalwood) are a problem in some areas.

LAND UNIT 9

Landform:

Flat to gently undulating plains with local sand rises.

Geology:

Fresh Cretaceous sediments overlain in part by Quaternary material.

Geology:

Quaternary sediments overlying Cretaceous sandstones.

Soils:

Deep, red cracking clays with self-mulching surfaces. Profiles are neutral throughout. OC and N levels are very low, while rep. K is high. Both AP and BP values are very low. The surface is non saline but becomes highly saline and sodic at depth. Chloride levels increase from very low in the surface to high at depth. Ug5.36 (Tiree).
Representative profile analysis: 133.

Vegetation:

Mitchell grass open tussock grassland (PFC 10-30%), predominantly *Astrebla pectinata* and *A. squarrosa* with *A. elymoides* locally common in some sites. Other important species in the grassland are *Eragrostis xerophila, Panicum laevinode, Dactyloctenium radulans* and *Iseilema vaginiflorum.* In some places emergent shrubs of *Cassia helmsii, Eremophila maculata* and *Acacia farnesiana* are common. Forbs include *Dissocarpus paradoxus, Rhynchosia minima, Sida fibulifera* and *Abutilon malvifolium.*

Land Use:

Breeding ewes and wethers predominate. Substantial falls of rain required for pasture response; Mitchell grass provides standover feed into winter-spring, drought reserves very sparse; limited shade; water supplies adequate; present condition fair.

LAND UNIT 8

Landform:

Gently undulating plains.

Geology:

Fresh Cretaceous sediments.

Soils:

Deep, brown cracking clays, usually with light stone cover. Profile is usually strongly alkaline throughout. Surface is strongly alkaline, becoming neutral with depth. Gilgais weakly to moderately developed. OC and N are very low to low while rep. K is high; AP and BP range high to very high. EC and Cl are very low at the surface but increase to high values at depth. Often sodic at depth. Ug5 32, Ug5.24 (Bibel).
Representative profile analysis: 12, 20.
Bulk surface analysis 139.

Vegetation:

Gidgee (*Acacia cambagei*) low open-woodland (Ht 6m, PFC 5-15%) with *Flindersia maculosa* common and *Atalaya hemiglauca, Geijera parviflora* and *Ventilago viminalis* less common. In places shrubs of *Eremophila mitchellii* can reach a density of 2000/ha, with areas of *Muehlenbeckia cunninghamii* in depressions. The ground layer is sparse (PFC <10%) but the grasses *Astrebla* spp., *Aristida latifolia, Dactyloctenium radulans, Enneapogon oblongus* and *Sporobolus actinocladus* are frequent components. The forbs *Enchylaena tomentosa, Portulaca oleracea, Salsola kali* and *Trianthema triquetra* are common.

Land Use:

These gidgee lands have been extensively developed by clearing and sowing buffel grass. They are used for both sheep and cattle production. Substantial falls of rain required for pasture response. Buffel grass is relatively drought resistant and has proven to be well suited in this region. Drought reserves are very sparse, water supplies adequate. Woody weeds (sandalwood) are a problem in some areas.

LAND UNIT 9

Landform:

Flat to gently undulating plains with local sand rises.

Geology:

Fresh Cretaceous sediments overlain in part by Quaternary material.

Soils:

Deep, brown cracking clays and texture contrast soils. Moderate gilgai development. Stone cover light. OC and N values are low with high rep. K. AP and BP range very low to fair. The surface is non saline. Ug5.32 (Bibel), Dr2.13, Dy2.43 (Coorabah).
Bulk surface analysis: 2, 5, 7.

Vegetation:

Gidgee (*Acacia cambagei*) low woodland to low open woodland (Ht 6-7m, PFC 10-30%) with an occasional *Archidendropsis basaltica, Atalaya hemiglauca, Geijera parviflora, Santalum lanceolatum* and *Ventilago viminalis.* In places the low shrub understorey is well developed (up to 30% PFC and 5000/ha) and dominated by *Carissa lanceolata* and *Eremophila mitchellii* with occasional *Capparis lasiantha, Cassia nemophila* and *Myoporum deserti.* The ground layer is usually sparse (PFC 5-10%) due to the tree and shrub cover but in more open areas, the grasses *Aristida armata, Enneapogon oblongus* and *Sporobolus caroli* together with the forbs *Enchylaena tomentosa* and *Sida* sp. aff. *pleiantha* predominate. Other grasses present are *Cenchrus ciliaris, Enneapogon lindleyanus, Eragrostis* spp., *Panicum effusum* and *Sporobolus actinocladus.*

Land Use:

These gidgee lands have been extensively developed by clearing and sowing buffel grass. A woody weed problem (sandalwood) exists; limited drought reserves; water supplies adequate; present condition fair to good.

LAND UNIT 10

Landform:

Undulating plains and low hills.

Geology:

Fresh Cretaceous sediments

Soils:

Deep, brown cracking clays with dense stone and gravel cover. OC and N values are usually low. Rep. K is very fair. AP and BP are low to fair. EC and Cl are very low at the surface but increase rapidly with depth. Soils are sodic at depth. Ug5.31, Ug5.32 (Bibel)
Representative profile analysis: 62, 187.
Bulk surface analysis: 26, 56, 68.

Vegetation:

Gidgee (*Acacia cambagei*) open woodland (Ht 5-8m; density 100-500/ha) to open scrub (Ht 3m; density up to 5000/ha), (regrowth after fire or drought). *Atalaya hemiglauca, Canthium oleifolium* and *Santalum lanceolatum* are common associates. Frequently there is a low shrub layer of *Eremophila mitchellii, Apophyllum anomalum, Capparis lasiantha* and *Cassia* spp.. The ground layer is generally sparse (<5%) with areas of surface stone and gravel. When present, the grasses *Enneapogon oblongus and Sporobolus actinocladus* and the forb *Sida fibulifera* are most common. A wide diversity of other grasses and forbs occur including *Astrebla* spp., *Aristida* spp., *Enneapogon* spp., *Eragrostis* spp., *Sporobolus* spp together with *Abutilon* spp., *Sclerolaena* spp., *Hibiscus* spp. and *Sida* spp..

Land Use:

Clearing these steep, stony gidgee lands is not recommended because of erosion risk. Presently being used for breeding ewes and wethers. Drought reserves sparse; soils are actively eroding; present condition fair; best left undeveloped as shade areas.

LAND UNIT 11

Landform:

Flat to very gently sloping outwash sandplain.

Geology:

Quaternary sands overlying undifferentiated Cretaceous sediments.

Soils:

Deep sandy texture contrast soils. Grey cracking clays and claypan soils are associated with depressions. The texture

becomes very strongly alkaline at depth. OC and N are very low while rep. K is very fair. AP and BP are fair to very fair. EC and Cl levels are very low at the surface becoming high at depth. The subsoil is strongly sodic. Dy2 43 (Coorabah).
Representative profile analysis: 158.

Vegetation:

Gidgee (*Acacia cambagei*) low open woodland (Ht 7-10m; PFC 5-15%)frequently with scattered *Flindersia maculosa* and more occasionally *Archidendropsis basaltica, Atalaya hemiglauca, Lysiphyllum carronii, Canthium oleifolium, Geijera parviflora, Owenia acidula, Ventilago viminalis* and *Acacia excelsa. Eremophila mitchellii* and *Myoporum deserti* form a patchy shrub layer. Other species include *Apophyllum anomalum, Acacia* spp., *Cassia* spp., *Capparis lasiantha, Carissa lanceolata, Eremophila duttonii* and *Myoporum acuminatum.* Grasses dominate the sparse ground layer (PFC <10%) with *Enneapogon polyphyllus, Enteropogon acicularis, Eragrostis lacunaria, Sporobolus caroli* and *Tripogon loliiformis* being most frequent. Others include *Aristida* spp., *Chloris* spp., *Enneapogon* spp., *Eragrostis* spp., *Heteropogon contortus, Sporobolus actinocladus* and *Tragus australianus.* Forbs are less common with *Abutilon* spp., *Ammania multiflora, Sclerolaena* spp., *Pterocaulon sphacelatum, Sida* spp. and *Salsola kali,* scattered throughout.

Land Use:

Breeding ewes and wethers predominate; sandy soils responsive to small falls of rain; drought reserves (topfeed) limited; surface water supplies adequate although some springs are saline; pulling gidgee and sowing improved pastures not recommended as these pulled areas are prone to erosion and the development of scalds and claypans

LAND UNIT 12

Landform:

Flat to very gently sloping outwash sandplain.

Geology:

Quaternary sands overlying undifferentiated Cretaceous sediments.

Soils:

Deep sandy texture contrast soils. A thick (30 cm) A horizon overlies a yellow sandy clay. The surface is medium acid, becoming very strongly alkaline at depth. OC and TN are very low while rep. K is fair. AP and BP are very low. EC and Cl are very low at the surface. Dy2.43 (Coorabah).
Bulk surface analysis: 159.

Vegetation:

Mixed open shrubland to low open woodland (Ht 5-10m; PFC 5-10%). Frequent species are *Lysiphyllum carronii, Grevillea striata, Acacia excelsa, Atalaya hemiglauca, Canthium oleifolium* and *Owenia acidula.* There is a patchy low shrub layer consisting mainly of *Eremophila mitchellii, Myoporum deserti, Olearia subspicata* and *Carissa lanceolata.* The mid-dense ground layer is dominated by *Chrysopogon fallax, Eriachne mucronata* and *Perotis rara* being most frequent Other species are *Aristida* spp., *Chloris* spp., *Dactyloctenium radulans, Eragrostis* spp., *Heteropogon contortus* and *Schizachyrium fragile.* Some of the common forbs include *Sclerolaena birchii, Evolvulus alsinoides, Pterocaulon sphacelatum* and *Sida fibulifera.*

Land Use:

Breeding ewes and wethers; this unit occurs in close association with Unit 11 and Unit 21; sandy soils are responsive to small falls of rain; some poisonous shrubs present but at low densities; limited topfeed present; no development prospects.

LAND UNIT 13

Landform:

Very gently sloping plains grading into alluvia.

Geology:

Quaternary sands overlying Cretaceous sediments.

Soils:

Moderately deep to deep, brown and grey clays with light stone cover and slight gilgai microrelief; profile is neutral throughout. OC and TN are very low and rep. K fair, AP and BP are low; AWC values are medium to high; EC and

Cl levels are low at the surface becoming high at depth. Soils are sodic at depth. Ug5.28, Uf6.31, Db2.43 (Sumana), (Tiree).
Representative profile analysis: 173, 217.

Vegetation:

Blackwood (*Acacia argyrodendron*) low woodland to grassy low open-woodland (Ht 6-10m; density 150-400/ha) *Flindersia maculosa* occurs occasionally and *Eremophila mitchellii* may form a low shrub layer. The ground layer is generally sparse (PFC <5%) and in open areas is dominated by grasses, in particular *Astrebla squarrosa* and *Sporobolus actinocladus*. Other species also represented are *Astrebla pectinata, Brachyachne convergens, Oxychloris scariosa, Dactyloctenium radulans, Aristida latifolia, Enteropogon acicularis, Iseilema membranaceum, Paspalidium caespitosum, Sporobolus caroli, Tragus australianus* and *Tripogon loliiformis*. On the bare scalded areas *Sclerolaena* spp. are more common. Other forbs are *Boerhavia diffusa, Evolvulus alsinoides, Hibiscus sturtii, Portulaca filifolia, Sida* spp. and *Solanum* spp..

Land Use:

Breeding ewes and wethers predominate, cattle also present. Large falls of rain required for pasture response; drought reserves sparse, little standover feed; water supplies adequate; present condition good; some areas pulled and sown to buffel grass but establishment problems occur due to low soil fertility. Pulling of dense woodlands recommended.

LAND UNIT 14

Landform:

Gently undulating plains.

Geology:

Quaternary sands overlying Cretaceous sediments.

Soils:

Moderately deep to deep, sandy light clays with sinkholes throughout; ironstone present on soil surface and in profile; soils are medium to strongly acid throughout, OC and TN are very low to low, rep. K very fair; AP and BP are characteristically very low to low; AWC values are very low to low, EC and Cl values are very low throughout. Um1.43, Gn2.12, Uf6.43 (Webb), (Vergemont).
Representative profile analysis: 79, 132.
Bulk surface analysis: 80,130.

Vegetation:

Mulga (*Acacia aneura*) tall open shrubland to low woodland (Ht 7-8m; density 25-750/ha), often groved, interspersed with areas of grassland In some areas *Acacia brachystachya* is prominent and *Eremophila bowmanii* often forms a low shrub layer (density 25-375/ha). The ground layer (PFC 20-40%) is dominated by grasses, in particular, *Enneapogon polyphullus, Eriachne mucronata* and *Aristida* spp. (*A. pruinosa, A. jerichoensis, A. obscura* and *A. contorta)* *Amphipogan caricinus, Austrochloris dichanthoides, Eriachne armittii* and *Thyridolepis mitchellina* may be locally common. Forbs such as *Dysphania rhadinostachya, Goodenia heterochila, G. lunata, Maireana villosa* and the vines *Evolvulus alsinoides* and *Ipomoea muelleri* may be present.

Land Use:

Breeding ewes and wethers predominate; light falls of rain cause pasture response, drought reserves adequate with mulga topfeed; area in good condition with little evidence of erosion; development by timber clearing unlikely.

LAND UNIT 15

Landform:

Flat to gently undulating plains.

Geology:

Quaternary sands overlying Tertiary and Cretaceous sediments.

Soils:

Moderately deep to deep sandy red earths. Ironstone shot and ironstone pebbles occur on soil surface and in profile. Profiles are strongly acid throughout. OC and N values are low. AWC values are low. EC and Cl levels are very low. Gn2.12 (Webb).
Representative profile analysis: 110.
Bulk surface analysis: 69, 86.

Vegetation:

Mulga (*Acacia aneura*) open scrub to tall shrubland (Ht 6-7m; PFC 20-40%; density 100-3000/ha). Some areas have emergent *Atalaya hemiglauca* and *Eucalyptus terminalis*. Low shrubs of *Cassia helmsii, Eremophila bowmanii* and *E. longifolia* are generally present. The ground layer is sparse to mid-dense (PFC 15-30%) and includes the forbs *Dysphania rhadinostachya, Evolvulus alsinoides, Goodenia lunata* and *Maireana villosa* as well as the grasses *Aristida jerichoensis, A. obscura, Digitaria ammophila, D. brownii, Eriachne helmsii* and *Themeda triandra*.

Land Use:

Breeding ewes and wethers predominate but cattle more common where this unit is associated with less productive country; responds to small falls of rain; adequate drought reserves of mulga; water supplies variable; little evidence of overgrazing; present condition good, pasture productivity could be improved by selective clearing.

LAND UNIT 16

Landform:

Gently undulating to undulating plains.

Geology:

Chemically altered Cretaceous and Tertiary sediments.

Soils:

Very shallow to shallow red earths often with stone cover. Profiles are strongly acid. OC, TN, AP, BP, EC and Cl values are very low. Gn2.11 (Webb).
Bulk surface analysis: 131.

Vegetation:

Mulga (*Acacia aneura*) tall open-shrubland to low woodland (Ht 3-6m; PFC 15-30%). Occasionally on the slopes of residuals lancewood (*Acacia shirleyi*) may dominate. Other scattered trees include *Acacia cambagei* and *Eucalyptus thozetiana* in drainage lines. Shrubs of *Eremophila latrobei* are frequent, while *Eremophila bowmanii, Cassia helmsii, Dodonaea petiolaris* and *Hakea collina* can also be present. The ground layer is sparse (PFC<5-10%) and patchy, interspersed with open scalded areas. Common forbs are *Hibiscus sturtii, Maireana villosa* and *Sida filiformis*. The most frequent grasses are *Eragrostis lacunaria* and *Aristida contorta* with *Digitaria brownii, Aristida jerichoensis, Triodia pungens, Eriachne pulchella* and *Tripogon loliiformis* also widespread.

Land Use:

Limited use for both sheep and cattle production. Responds to small falls of rain; drought reserves limited; water supplies low; often overgrazed with severe sheet erosion evident; present condition poor; development unlikely with only conservative seasonal grazing recommended.

LAND UNIT 17

Landform:

Flat to gently sloping plains with isolated knolls.

Geology:

Quaternary sands overlying Cretaceous Winton Formation.

Soils:

Lithosols and very shallow light clays. Extensive cover of rock and rubble. Soils are extremely acid and very low in all nutrients. Uf1. (Corys).
Bulk surface analysis: 82.

Vegetation:

Tall shrubland to open-shrubland of lancewood (*Acacia shirleyi)* and/or mulga (*Acacia aneura*). (Ht 3m; PFC 5-20%). Scattered low shrubs of *Eremophila bowmanii* The ground layer is generally sparse and patchy, with large areas devoid of cover. Grasses include *Eragrostis lacunaria* and *Tripogon loliiformis*, with areas of *Triodia molesta.* The forbs *Sida filiformis* and *Ptilotus pedleyanus* are also frequent.

Land Use:

Limited use for cattle. Unit is severely eroded; drought reserves sparse; waters scarce; present condition poor; very unproductive unit with very limited seasonal grazing.

LAND UNIT 18

Landform:

Flat to gently undulating plains.

Geology:

Chemically altered Cretaceous Winton Formation sediments.

Soils:

Very shallow, strongly acid lithosols. Extensive outcropping of parent material. OC, TN values are very low; AP, BP values are low to fair; EC and Cl values are very low. Um1.43 (Corys).
Bulk surface analysis. 67, 129.

Vegetation:

Bastard mulga (*Acacia stowardii*) - mulga (*A. aneura*) low open shrubland (Ht 1-3m; PFC 5-15%) to tall open shrubland, tending in places to *A. aneura* tall shrubland to low woodland. There is a patchy, generally sparse ground stratum of spinifex (*Triodia pungens* and locally *T. molesta*) which may occasionally form an open-hummock grassland with scattered mulga or lancewood (*Acacia shirleyi*). Scattered shrubs of *Dodonaea petiolaris* and *Eremophila* spp. (*E. bowmanii, E. cordatisepala* and *E. latrobei*) may occur in this community. Apart from the dominant spinifex, the ground stratum consists of a variety of ephemeral forbs and grasses including *Sclerolaena* spp., *Dysphania* spp., *Maireana villosa, Polycarpaea* spp., *Aristida* spp., *Eriachne mucronata* and *Enneapogon polyphyllus.*

Land Use:

Limited use for beef cattle production; small falls of rain give limited pasture response as unit is severely scalded and eroded; drought reserves nil; no standover feed; inadequately watered; condition poor; limited seasonal grazing.

LAND UNIT 19

Landform:

Flat to gently undulating plains.

Geology:

Chemically altered Cretaceous Winton Formation sediments.

Soils:

Shallow, gravelly light clays with ironstone pavements. OC, TN, AP, BP, EC, Cl values are very low. Uf6.31, Ug5.32 (Ardno).
Bulk surface analysis: 78, 126.

Vegetation:

Low open shrubland to low open woodland of gidgee (*Acacia cambagei*) on lower slopes and drainage lines with lancewood (*Acacia shirleyi*) and mulga (*Acacia aneura*) on upper slopes. *Atalaya hemiglauca, Eucalyptus papuana* and *Grevillea striata* are occasionally present. Shrubs of *Eremophila mitchellii, E. bowmanii, Cassia oligophylla* and *C. pruinosa* may be locally abundant. The ground layer is patchy in between scalds and areas of ironstone gravel but is dominated by grasses such as *Sporobolus actinocladus, Enteropogon acicularis, Enneapogon polyphyllus, Triodia molesta* and *T. longiceps.* Forbs are infrequent but include *Sclerolaena glabra, S. minuta, Enchylaena tomentosa, Maireana triptera* and *Sarcostemma viminale* subsp. *australe.*

Land Use:

Limited seasonal grazing by sheep; extensive bare areas; drought reserves nil; standover feed nil; very limited topfeed; inadequately watered; condition poor.

LAND UNIT 20

Landform:

Flat plains adjacent to alluvia.

Geology:

Fresh Cretaceous sediments grading into recent alluvium.

Soils:

Deep, grey and brown cracking clays with strongly self-mulching surfaces. Profiles are strongly alkaline throughout. Lime and gypsum are present. OC and TN values are low; AP, BP values are very fair to high; surface EC, Cl are very low. Ug5.22, Ug5.32 (Thomson).
Bulk surface analysis: 15, 134.

Vegetation:

Mitchell grass (*Astrebla* spp.) - Flinders grass (*Iseilema vaginiflorum*) tussock grassland to open tussock grassland (PFC <40%), tending in places to wooded open tussock grassland or (low) open-woodland of boree (*Acacia tephrina*) There may be scattered low shrubs of *Acacia farnesiana* and *Eremophila* spp. (*E. maculata, E. mitchellii* and *E. polyclada*). The ground stratum is dominated by *Astrebla* spp. (*A. pectinata* and/or *A. lappacea* and less frequently *A. elymoides* and, in poorly drained situations, *A. squarrosa*). Other frequent species include *Iseilema vaginiflorum, Panicum decompositum* and the forbs *Abutilon malvifolium* and *Psoralea cinerea. Dichanthium sericeum* may become prominent after a series of good seasons.

Land Use:

Breeding ewes and wethers; substantial falls of rain required for pasture response; benefits from run-on water; some areas seasonally waterlogged; Mitchell grass provides standover feed into winter-spring; drought reserves sparse; limited topfeed; water supplies adequate; overgrazing generally not detrimental; some areas seasonally scalded, present condition good; few land use problems.

LAND UNIT 21

Landform:

Flat claypans.

Geology:

Recent alluvia.

Soils:

Very deep sandy grey clays with thick surface crusts. Ironstone, gypsum and manganese occur throughout the profile. OC, TN, AP, BP value are very low; surface EC, Cl values are very high. Uf6.13 (Ballygar).
Bulk surface analysis: 157.

Vegetation:

Open tussock grassland to open-herbland (sparse herbland in scalded areas.) Scattered tall shrubs of *Acacia stenophylla* and low shrubs of *Eremophila mitchellii* and *Myoporum* spp. (*M. deserti, M. acuminatum*) may be present. The ground stratum is extremely variable. Apart from the perennial grasses *Astrebla pectinata* and *Bothriochloa ewartiana*, ephemeral grasses and forbs tend to predominate, including *Sporobolus* spp , *Chloris* spp , *Panicum* spp., *Sclerolaena* spp. and *Epaltes australis.* The samphire *Halosarcia pergranulata* is locally common in saline areas.

Land Use:

Limited seasonal grazing of herbage for ewes and wethers; very low infiltration rates and seasonal water-ponding; extensive areas devoid of vegetation; topfeed limited, drought reserves sparse; adequate water supplies but may be salty; present condition poor; reclamation uneconomic.

LAND UNIT 22

Landform:

Sand dunes fringing flat claypans.

Geology:

Sand deposits overlying recent alluvia.

Soils:

Very deep, gleyed texture contrast soils. A thin layer (8 cm) of fine sand overlies sandy clays. The soil profile is very strongly alkaline throughout. OC, TN are very low while AP is high to very high throughout. BP values are very low to low. EC and Cl values are very low in the sandy A horizon but increases to high levels down the profile. Dg2.13 (Mueller).
Representative profile analysis: 215.

Vegetation:

Porcupine spinifex (*Triodia longiceps*) open-hummock grassland (Ht <1m; PFC 15-20%). Ephemeral grasses occur within and between the hummocks; these include *Oxychloris scariosa, Enneapogon* spp., *Sporobolus* spp., *Tripogon loliiformis* and *Dactyloctenium radulans*. Forbs are also common, including *Streptoglossa adscendens, Trianthema triquetra* and *Sida* spp..

Land Use:

Limited seasonal grazing by ewes and wethers, no topfeed, drought reserves sparse; poisonous plants present; adequate water supplies but may be salty; present condition poor.

LAND UNIT 23

Landform:

Flat plains with salt springs and minor drainage lines.

Geology:

Recent alluvia.

Soils:

Deep, grey clays; often saline

Vegetation:

Black tea-tree (*Melaleuca bracteata*) - coolibah (*Eucalyptus microtheca*) low open-woodland to tall shrubland (Ht 3-4m; density <25/ha). *Melaleuca bracteata* tends to predominate, but *E. microtheca*, and *E. camaldulensis* occur along the better-defined drainage lines. Belalie (*Acacia stenophylla*) also occurs as a tall shrub. A ground stratum is generally lacking, but areas of cane grass (*Eragrostis australasica* and *Leptochloa digitata*) open grassland may be present.

Land Use:

Provides seasonal watering for sheep but some supplies are saline and unsuitable for stock.

LAND UNIT 24

Landform:

Braided streams draining gently undulating plains.

Geology:

Recent alluvia of fresh Cretaceous sediments.

Soils:

Deep, grey and brown clays with sand grains on peds and ironstone concretions and gravel throughout the profile Lime and gypsum concentrations common. OC, N values are low; AP high with BP low to fair, EC and Cl very low in the surface increasing to high values at depth. Ug5.24, Ug5.32, Ug5.34 (Cornish).
Representative profile analysis: 42.

Bulk surface analysis: 4, 19, 70.

Vegetation:

Coolibah (*Eucalyptus microtheca*) and/or river red gum (*E. camaldulensis*) woodland to open woodland (Ht 12m; density 100-200/ha). Belalie (*Acacia stenophylla*) is a common associated tall shrub and gidgee (*A. cambagei*) may be locally prominent. Other associated low trees/tall shrubs include *Lysiphyllum carronii, Archidendropsis basaltica* and *Alectryon oleifolius*. There may be a relatively open low shrub layer (Ht <2m; density 125-150/ha) which includes *Eremophila* spp. (especially *E. bignoniiflora* and *E. mitchellii*), *Acacia farnesiana* and *Muehlenbeckia cunninghamii*. The ground stratum is generally well-developed (PFC 25-30%) and dominated by grasses including *Astrebla* spp., *Bothriochloa ewartiana*, buffel grass (*Cenchrus ciliaris*) blue grasses (*Dichanthium* spp), *Chloris* spp. and *Eragrostis* spp.. Forbs are generally less abundant, although *Xanthium pungens* may be locally dominant after flooding.

Land use:

Breeding ewes and wethers predominate; substantial falls of rain required for pasture response on the heavy clay soils; channels and waterholes provide stock water; drought reserves and topfeed sparse; little active bank erosion; present condition good. Off-channel water storages could be improved in some areas.

LAND UNIT 25

Landform:

Interchannel areas of braided streams on gently undulating plains. Subject to seasonal flooding

Geology:

Recent alluvia on fresh Cretaceous sediments.

Soils:

Deep, grey and brown cracking clays, a thin surface crust may be present, surface quartz gravel occasionally present; ironstone, lime and gypsum throughout the profile; profiles moderately alkaline throughout; OC, TN very low; AP and BP variable, ranging high to low, AWC values high, EC and Cl are very low at the surface, grading to high values at depth. Ug5.24, Ug5.25, Ug5.33, Ug5.34 (Thomson).
Representative profile analysis: 90, 149.
Bulk surface analysis: 25, 40, 83, 99, 118, 148, 150, 183.

Vegetation:

Curly Mitchell grass (*Astrebla lappacea*) - feathertop spear grass (*Aristida latifolia*) open tussock grassland to tussock grassland (Ht <1m; PFC 15-40%). *Bothriochloa ewartiana*, Flinders grasses (*Iseilema vaginiflorum* $\pm$ *I. membranaceum*), blue grasses (*Dichanthium sericeum* subsp. *sericeum* and/or subsp. *polystachyum*), *Eulalia aurea* and *Sporobolus actinocladus* are locally prominent. Tall shrubs to low trees of coolibah (*Eucalyptus microtheca*) and belalie (*Acacia stenophylla*) and low shrubs of *Chenopodium auricomum* may also be present. In low-lying, poorly drained situations, bull Mitchell grass (*Astrebla squarrosa*), *Sporobolus mitchellii* and sedges, especially *Cyperus victoriae* and *C. bifax*, become dominant.

Land Use:

Predominantly breeding ewes and wethers, substantial falls of rain required for pasture response; topfeed scarce; Mitchell grass provides standover feed into winter-spring; usually adequately watered by channels and waterholes; limited seasonal scalding; present condition good; provision of additional watering points would allow greater use of dense pasture growth.

LAND UNIT 26

Landform:

Flat alluvial plains subject to seasonal flooding.

Geology:

Recent alluvia.

Soils:

Deep, brown and grey cracking clays. Profiles are alkaline throughout. Ironstone may occur on the surface and in the profile. OC, TN are very low while AP, BP are fair. Surface EC, Cl values are very low. Ug5.32, Ug5.24 (Ulva).
Bulk surface analysis. 6, 71, 77.

Vegetation:

Gidgee (*Acacia cambagei*) low open-woodland to open-shrubland (Ht 4-7m; density 75-375/ha). Coolibah (*Eucalyptus microtheca*) may be co-dominant and frequency emergent. Low trees or tall shrubs of *Lysiphyllum carronii* and *Eremophila bignoniiflora* are also present. The ground stratum is quite open (PFC <5%) and composed of predominantly ephemeral grasses and forbs, including *Sclerolaena* spp., *Portulaca* spp., *Boerhavia diffusa* sens. lat., *Sporobolus actinocladus* and *Chloris pectinata*. Perennial species include *Bothriochloa ewartiana, Enteropogon acicularis* and *Astrebla* spp..

Land Use:

Used for both cattle/sheep production; some areas have been developed by clearing and either sowing buffel grass or allowing native grasses to thicken up; substantial falls of rain required for pasture response on heavy clay soils; drought reserve sparse, topfeed sparse; usually adequately watered; tends to be overgrazed because of availability of more palatable species; some areas seasonally scalded; present condition fair.

LAND UNIT 27

Landform:

Flat alluvial plains.

Geology:

Old alluvia overlain by Quaternary sands.

Soils:

Deep, sandy grey cracking clays with quartz and ironstone throughout. Mottling occurs at depth. Dense concentrations of gypsum at depth. Profiles are neutral and tend to become acid at depth. Broad, shallow gilgais throughout. OC, TN, AP, BP values are very low. EC, Cl values are very low at the surface but increase to very high beyond 60 cm. Ug5.24, Ug5.27 (Tiree).
Representative profile analysis: 174.
Bulk surface analysis: 175.

Vegetation:

Open tussock grassland dominated in parts by Mitchell grasses (*Astrebla lappacea, A. pectinata, A. squarrosa*) and in others by blue grasses (*Dichanthium sericium* (including subspecies *humilius* and *polystachyum*) and *D. fecundum*). Flinders grasses (*Iseilema membranaceum* and *I. vaginiflorum* are frequent throughout. Other grasses are *Aristida latifolia, Bothriochloa ewartiana, Brachyachne convergens, Eragrostis tenellula, E. xerophila, Panicum laevinode, P. decompositum, Eulalia aurea* and *Sporobolus actinocladus*. Shrubs of *Eremophila polyclada* and *Acacia farnesiana* are common in some areas, while *Hakea leucoptera, Eremophila mitchelli* and trees of *Acacia sutherlandii* occur on grassland margins. Trees of *Acacia cambagei* and *Eucalyptus microtheca* are found along water courses. Forbs recorded in the ground layer are *Neptunia dimorphantha, N. monospermus, Boerhavia diffusa* sens lat., *Sclerolaena muricata, Solanum esuriale, Streptoglossa adscendens, Sida fibulifera and S. trichopoda.*

Land Use:

Breeding ewes and wethers predominate; substantial falls of rain required for pasture response; Mitchell grass provides standover feed into winter-spring; topfeed sparse; adequately watered; present condition good.

LAND UNIT 28

Landform:

Levees and banks of major drainage channels on braided alluvial plains.

Geology:

Recent clay alluvia.

Soils:

Very deep, grey clays. Surface silt and sand form a surface crust. Sand, silt bands common in the profile. Profile is alkaline. OC, TN values are very low while AP, BP values are very high. Surface EC, Cl are low. Ug5.2 (Cornish).
Bulk surface analysis: 138.

Vegetation:

Coolibah (*Eucalyptus microtheca*) (low) open-woodland (Ht 7-12m, density 25/ha), tending in places to wooded open tussock grassland. Scattered tall shrubs or low tree of *Acacia cambagei, A. salicina, A. stenophylla, Eremophila bignoniiflora* and *Lysiphyllum carronii* occur throughout this community. There is a patchy low shrub layer of lignum (*Muehlenbeckia cunninghamii*). The ground stratum is quite open (PFC <10) and dominated by the low shrub *Chenopodium auricomum*, the sedges *Cyperus victoriensis* and *C. bifax* and the Mitchell grasses *Astrebla lappacea* and *A. squarrosa*. Ephemeral forbs and graminoids are common, including *Iseilema* spp., *Panicum* spp., *Sclerolaena* spp., *Psoralea cinerea* and *Sporobolus* spp..

Land Use:

Breeding ewes and wethers predominate; substantial falls of rain required for pasture response; drought reserves and browse shrubs present; adequately watered; present condition good.

LAND UNIT 29

Landform:

Interchannel areas of braided channel country.

Geology:

Recent clay alluvia.

Soils:

Very deep, grey cracking clays. Surface silt and sand may form a crust. OC, TN values are low while AP, BP values are very high. Surface EC, Cl levels are very low. Ug5.24, Ug5.25 (Thomson).
Bulk surface analysis: 53.

Vegetation:

Bluebush (*Chenopodium auricomum*) - *Astrebla* spp. low open-shrubland to shrubby open tussock grassland (Ht <1m; density 200-500/ha). Common forbs include *Sclerolaena anisacanthoides, S. muricata, S. intricata, Neobassia proceriflora* and *Psoralea cinerea*, while apart from the perennial *Astrebla pectinata* and /or *A. lappacea* and *Sporobolus mitchellii*, ephemeral species may be quite significant, including *Sporobolus australasicus, Panicum decompositum, Dactyloctenium radulans* and *Iseilema vaginiflorum*.

Land Use:

Breeding ewes and wethers; substantial falls of rain required for pasture response; seasonal flooding promotes prolific pasture growth; drought reserves sparse; adequately watered; present condition good.

LAND UNIT 30

Landform:

Flat to gently sloping sandplain.

Geology:

Quaternary sands.

Soils:

Deep, sandy surfaced texture contrast soils. Surfaces are neutral and become alkaline with depth. OC, TN values are low while AP, BP values are very low. EC and Cl levels are very low throughout. AWC values are very low. Dy5.23, Dr3.12 (Coorabah).
Representative profile analysis: 1, 218.

Vegetation:

Poplar box (*Eucalyptus populnea*) open-woodland to low open-woodland (Ht 9-12m; density 150/ha). A well-defined tall shrub layer dominated by sandalwood (*Eremophila mitchellii*) is usually present (Ht 3-7m; density 100/ha). Scattered low shrubs (Ht 2m) of *Cassia* spp., and *Carissa ovata* may also occur. The ground stratum is variable (PFC 5-25%) and composed of forbs such as *Evolvulus alsinoides* and grasses, notably *Aristida holathera, Cenchrus ciliaris, Enneapogon polyphyllus* and *Heteropogon contortus*.

Land Use:

Breeding Cattle predominate due to grass seed problem and low pasture productivity; pastures respond to small falls of rain but soils are drought-prone; wire grasses and spinifex pastures are burnt to provide a green pick; topfeed species sparse; inadequately watered; sheet erosion in some areas; present condition fair to good; some areas have been cleared and sown with buffel grass with limited success due to low soil fertility.

LAND UNIT 31

Landform:

Upper slopes in gently sloping sandplains.

Geology:

Quaternary sands.

Soils:

Moderately deep to deep, sandy red earths, yellow earths and associated texture contrast soils. Surfaces are hard setting sandy loams which exhibit surface crusting. Ironstone shot occurs on the surface and in the profile. Soils are slightly acid throughout. OC, TN, AP, BP levels are very low. Gn2.12, Gn2.22 (Webb), Dr2.12 (Ludgate).
Representative profile analysis: C72.

Vegetation:

Silver-leaved ironbark (*Eucalyptus melanophloia*) open-woodland to woodland (Ht 10-12m; density 250/ha). Apart from the dominant *E. melanophloia, E. papuana, E. dolichocarpa* and *Lysiphyllum carronii* are also frequent. There is a well-defined tall shrub layer (Ht 3-8m; density 100/ha) which includes *Acacia coriacea, A. excelsa, Archidendropsis basaltica* and *Eremophila mitchellii*. Scattered low shrubs of *Carissa ovata* and *Cassia* spp. are present. The ground stratum is well defined (Ht 1-1.5m; PFC 30%) and composed mainly of grasses, including *Aristida* spp., *Cenchrus ciliaris*, and *Bothriochloa ewartiana*.

Land Use:

Breeding store cattle predominate due to grass seed problem and low pasture productivity; pastures respond to small falls of rain but soils are drought prone; wire grasses and spinifex are burn to provide a green pick; topfeed species sparse; inadequately watered; sheet erosion in some areas; present condition fair to good; some areas have been cleared and sown with buffel grass with limited success.

LAND UNIT 32

Landform:

Levee remnants and dunes of drainage lines on flat to gently undulating sandplain.

Geology:

Quaternary sands

Soils:

Very deep siliceous sands which may exhibit a fragile surface crust. Profiles are slightly acid throughout OC, TN, AP, BP, EC, Cl values are very low. Uc1.22, Uc5.11 (Tarella).
Bulk surface analysis: 3, 219.

Vegetation:

Long-fruited bloodwood (*Eucalyptus dolichocarpa*) - *Acacia* spp. low open woodland on river levees, tending to *Acacia* spp. - paper-barked tea tree (*Melaleuca nervosa*) tall open-shrubland on dunes associated with ephemeral lakes (Ht 3-14m; density 125-250/ha). *Acacia coriacea, A. torulosa, Eucalyptus terminalis* and *Petalostigma pubescens* are also frequent. There is an open low shrub layer which includes *Eremophila longifolia, Olearia subspicata* and *Myoporum* spp.. The ground stratum is extremely variable (PFC 15-40%) and composed of both forbs (*Tephrosia brachyodon, Dicerma biarticulatum, Sida rohlenae, Waltheria indica*) and grasses (*Aristida holanthera, A. sciuroides, Heteropogon contortus, Triodia pungens*).

Land Use:

Breeding store cattle predominate; sandy soils respond to small falls of rain but dry out rapidly; fodder trees sparse and limited standover feed; water supplies adequate; present condition good.

LAND UNIT 33

Landform:

Sand rises on flat to gently sloping sandplain.

Geology:

Quaternary sands.

Soils:

Very deep sandy red earths. Profiles are slightly acid throughout. All nutrient levels are very low Gn2.12 (Webb). Bulk analysis: 8.

Vegetation:

Desert gum (*Eucalyptus papuana*) - western bloodwood (*E. terminalis*) (low) open woodland (Ht 6-10m; density 50/ha). Tall shrubs (Ht 3-5m) of *Acacia coriacea* and *Eremophila mitchellii* are frequent, also *Archidendropsis basaltica*. Patchy low shrubs of *Carissa ovata* also occur, and there is a dense ground stratum (PFC 30%) dominated by the grasses *Heteropogon contortus* and *Triodia pungens*.

Land Use:

Breeding store cattle; sandy soils respond to small falls of rain; sparse topfeed and limited drought reserves; adequately watered; present condition fair to good.

LAND UNIT 34

Landform:

Flat to gently sloping sandplain.

Geology:

Quaternary sands.

Soils:

Deep sandy texture contrast soils. Surfaces crust and a bleached A2 horizon is common. Pisolitic ironstone may occur in the clay subsoil. OC and TN values are low; AP and BP values are very low; EC and Cl levels are very low throughout. Dr2.43, Dy3.12, Dy3.41, Dy3.43 (Shirley).
Representative profile analysis: 166, 211.
Bulk surface analysis: 162, 167, 168, 206.

Vegetation:

Reid River box (*Eucalyptus brownii*) open-woodland to low open-woodland (Ht 8-14m; density 150-300/ha). Apart from *E. brownii, E. whitei, Archidendropsis basaltica* and *Ventilago viminalis* occur in the upper stratum. Low shrubs are frequent (Ht 2m; density 125/ha), with *Eremophila mitchellii* and *Carissa lanceolata* the most common species. The ground layer is variable (PFC 15-40%) with a diversity of grasses (*Aristida* spp., *Enneapogon pallidus, Bothriochloa ewartiana, Eragrostis* spp. and *Triodia pungens*) and forbs (*Indigofera* spp., *Rostellularia adscendens, Evolvulus alsinoides, Sida* spp.).

Land Use:

Breeding cattle predominate; sandy soils respond to small falls of rain; topfeed sparse and limited drought reserves; adequately watered; sheet and gully erosion evident in overgrazed areas; present condition fair to poor.

LAND UNIT 35

Landform:

Upper slopes in gently sloping sandplain.

Geology:

Quaternary sands.

Soils:

Moderately deep to deep sandy texture contrast soils and sandy yellow earths. Ironstone gravel may occur on the soil surface and in the profile. Profiles are generally slightly acid throughout. All nutrient values are very low. Gn2.22 (Uanda), Dr3.12, Dy3.11, Dr2.13 (Cherhill).
Representative profile analysis: 156, 200, 204.
Bulk surface analysis: 141, 161, 163, 171, 186, 190, 197, 216.

Vegetation:

White's ironbark (*Eucalyptus whitei*) low open woodland to open-woodland (Ht 6-12m; density 25-50/ha). *E. whitei* is predominant, often forming a more or less pure stand, but low trees of western bloodwood (*E. terminalis*) and desert gum (*E. papuana*) are scattered through the community, which is somewhat clumped (or groved). Tall shrubs of *Acacia coriacea* may occur, also *Grevillea parallela* and locally, *Melaleuca nervosa*. There is a patchy low shrub layer, dense in places, of *Carissa lanceolata* and *Acacia* spp. (especially *A. melleodora*, and *A. tenuissima*). The ground stratum varies considerably. In open (intergrove) areas, it is dominated by *Triodia pungens*, with various ephemerals such as *Schizachyrium fragile* and *Eragrostis lacunaria*. Amongst the trees it is more open and quite diverse with perennial grasses such as *Themeda triandra, Aristida calycina* and *Bothriochloa ewartiana*.

Land Use:

Breeding cattle predominate due to grass seed problem and poor quality of native grasses; pastures respond to small falls of rain; sparse topfeed and limited drought reserves; inadequately watered; spinifex burnt to provide green pick; sheet erosion occurs on unprotected surfaces; present condition good.

LAND UNIT 36

Landform:

Run-on areas in gently sloping sandplain.

Geology:

Quaternary sands.

Soils:

Very deep siliceous sands and sandy texture contrast soils. Profiles are slightly acid throughout Uc5.11 (Wowra). Dy3.12.

Vegetation:

White's ironbark (*Eucalyptus whitei*) woodland/open-woodland to low open-woodland (Ht 6-12m; density 30-200/ha). There is a patchy low shrub layer of *Carissa lanceolata* (Ht 1-2m). There is a sparse to moderately dense ground stratum (PFC 20-30%) with grasses particularly prominent, many of them ephemeral species. The most frequent include *Aristida holathera, A. calycina, A. inaequiglumis, Bothriochloa ewartiana, Digitaria brownii, Enneapogon polyphyllus, Eragrostis* spp., *Heteropogon contortus, Panicum effusum, Schizachyrium fragile* and *Triodia pungens*.

Land Use:

Very minor unit. Breeding cattle predominate. Pastures respond to small falls of rain; sparse topfeed; limited drought reserves; inadequately watered; present condition fair.

LAND UNIT 37

Landform:

Mesas and low rounded hills.

Geology:

Tertiary sandstones often with duricrust.

Soils:

Very shallow stony red earths and lithosols. Extensive cover of ironstone gravel. Soils are strongly acid and very low in nutrients. Um1.43, Gn2.12 (Corys).
Bulk surface analysis: 127, 169.

Vegetation:

Spinifex (*Triodia pungens*) open-hummock grassland, with scattered tall shrubs (5-6m) of *Eucalyptus* spp., (including *E. whitei* and *E. terminalis*) and patches of *Melaleuca tamariscina*, occasionally tending to *Eucalyptus whitei* woodland to open-woodland (*E. melanophloia* in the south). Apart from *Triodia pungens*, the most frequent ground stratum species include *Aristida* spp., (*A. holathera, A. calycina, A. jerichoensis*, etc.).

Land Use:

Breeding cattle predominate; no topfeed and limited drought reserves; inadequately watered, spinifex occasionally burnt for green pick; woody weeds (*Acacia* sp. and *Melaleuca* sp.) in some areas due to fires; limited use for grazing; present condition good.

LAND UNIT 38

Landform:

Mesas and low rounded hills.

Geology:

Tertiary sandstones often with duricrust.

Soils:

Very shallow lithosols with extensive cover of ironstone gravel. Soils are slightly acid and very low in nutrients. Um1.43, Dr2.12 (Cherhill).
Bulk surface analysis: 57, 85.

Vegetation:

Normanton box (*Eucalyptus normantonensis/E. persistens*) tall shrubland to tall open-shrubland (Ht 3-5m; density 75-175/ha). In western areas, lancewood (*Acacia shirleyi*) is a common associate. *Triodia pungens* may form a sparse to moderately dense ground stratum (PFC 15-30%) while south of Winton, *Triodia longiceps* is prominent in this community. Ground stratum species are otherwise infrequent and consist predominately of ephemeral grasses and forbs. Bare, scalded areas are frequent.

Land Use:

Breeding cattle predominate; no topfeed and limited drought reserves, inadequately watered; spinifex occasionally burnt for green pick; limited use for grazing; present condition good.

LAND UNIT 39

Landform:

Flat to gently sloping sandplain.

Geology:

Quaternary sands.

Soils:

Shallow to moderately deep, sandy yellow and red earths. Profiles are slightly acid and ironstone nodules are common both on the soil surface and in the profile. Nutrient levels are very low. Gn2.22, Gn2.12 (Uanda)
Bulk surface analysis: 140.

Vegetation:

White's ironbark (*Eucalyptus whitei*) low open-woodland. Desert gum (*E. papuana*) and western bloodwood (*E. terminalis*) are frequently associated with *E. whitei*, and low trees/tall shrubs of *Acacia coriacea* and *Melaleuca nervosa* are also common. On areas of deeper sand, *Melaleuca tamariscina* forms tall open-shrublands, generally with a well-developed lower shrub layer of *Acacia* spp., *Dodonaea viscosa* subsp. *angustissima, Grevillea pteridifolia*, etc. The ground stratum is dominated by soft spinifex (*Triodia pungens*), but other grasses are also frequent, including *Aristida calycina, A. ingrata, Cymbopogon bombycinus, Eriachne mucronata, Schizachyrium fragile* and (locally) *Themeda triandra*. Forbs are numerous, the most frequent including *Goodenia cycloptera, Euphorbia drummondii, Phyllanthus rhytidospermus* and *Sida* spp..

Land Use:

Breeding cattle predominate; pastures respond to small falls of rain; limited topfeed and drought reserves; inadequately watered; sheet and gully erosion where surface soil bare; pastures burnt for green pick; woody weed problem in some areas; present condition good.

LAND UNIT 40

Landform:

Margins of plateaux and tablelands.

Geology:

Chemically altered Tertiary sandstones.

Soils:

Shallow texture contrast soils. Dense ironstone gravel covers the soil surface and occurs throughout the profile. Profile is slightly acid throughout. Dr2.12 (Ludgate).

Vegetation:

Low woodland to low open-woodland (Ht 8-10m; density 20-25/ha) of White's ironbark (*Eucalyptus whitei*) and desert gum (*E. papuana*), tending to tall open-shrubland (4-5m), often with nutwood (*Eucalyptus setosa*) prominent. Other common shrub species include *Acacia coriacea, Dodonaea viscosa* subsp. *angustissima* and *Jacksonia* spp. (*J. ramosissima, J. vernicosa*). The ground stratum is dominated by *Triodia pungens*, other frequent species including the grasses *Aristida* spp., *Ancistrachne uncinulata, Cymbopogon bombycinus, Eriachne mucronata* and *Schizachyrium fragile*, also the forbs/subshrubs. *Sida filiformis, Solanum ellipticum* and *Acacia galioides.*

Land Use:

Breeding beef cattle predominate; soils respond readily to small falls of rain; limited topfeed and drought reserves; inadequately watered; fire has stimulated woody weeds; spinifex is burnt for green pick; present condition good.

LAND UNIT 41

Landform:

Clay depressions in flat sandplain.

Geology:

Quaternary alluvia.

Soils:

Grey cracking clays subject to seasonal waterlogging.

Vegetation:

Open-herbland on claypans and beds of ephemeral lakes, with coolibah (*Eucalyptus microtheca*), gidgee (*Acacia cambagei*) and low open-woodland (Ht 8-10m; density <25 trees/ha) on the margins. Associated with *E. microtheca* are tall shrubs (3-4m) of *Eremophila bignoniiflora.* The ground stratum consists predominately of ephemeral graminoids and forbs. Frequent species include the grasses *Uranthoecium truncatum, Iseilema* spp, (*I. vaginiflorum* and *I. membranaceum*), *Echinochloa colona, Panicum larcomianum, Brachyachne convergens, Dactyloctenium radulans, Desmodium filiforme* and *Diplachne fusca*, also the forbs *Eryngium plantagineum, Alternanthera angustifolia, Marsilea* spp., *Polymeria pusilla* and *Goodenia subintegra.*

Land Use:

Breeding cattle predominate; considerable falls of rain required for pasture response; no topfeed and pastures are not drought hardy; seasonally flooded and pastures preferred as waters recede; present condition good.

LAND UNIT 42

Landform:

Gently sloping tops of tablelands.

Geology:

Quaternary sands overlying Tertiary sediments.

Soils:

Deep sandy red earths and earthy sands. Profiles are moderately acid throughout. Ironstone shot occurs on soil surface and the profile. Nutrient levels are very low. Gn2.12, Gn2 11 (Webb), Uc5.11 (Tangorin).
Representative profile analysis: 172.
Bulk surface analysis: 165, 170.

Vegetation:

Yellowjacket (*Eucalyptus similis*) open-woodland to low open-woodland (Ht 8-15m; density 25-100/ha), commonly associated with bloodwood (*Eucalyptus brachycarpa*) and low trees (5-7m) of *Acacia coriacea*, and nutwood (*Eucalyptus setosa*). The trees have a groved pattern, with the intergroves dominated by *Triodia pungens*. Tall shrubs (2-5m) are locally abundant (up to 2 000/ha); common species include *Acacia stipuligera*, *Grevillea pteridifolia*, *Acacia cowleana* and *Alphitonia excelsa*. Apart from *Triodia pungens*, common ground stratum species include the grasses *Enneapogon pallidus*, *Eragrostis eriopoda*, *Aristida* spp. (*A. calycina*, *A. ingrata*), *Panicum effusum* and the forbs/subshrubs) *Sida rohlenae* and *Olearia subspicata*.

Land Use:

Breeding cattle; pastures respond readily to small falls of rain; sparse topfeed and only spinifex as drought reserve; inadequately watered; spinifex fired for green pick; fires have stimulated spread of heart leaf poison-bush and wattles; soils erode readily when surface is bare; present condition good to fair.

LAND UNIT 43

Landform:

Gently sloping tops of tablelands.

Geology:

Quaternary sands overlying Tertiary sediments.

Soils:

Deep sandy red earths. Profiles are moderately acid throughout. Ironstone shot occurs on the soil surface and in the profile. Gn2.12 (Webb).

Vegetation:

Tea-tree (*Melaleuca tamariscina*) tall open-shrubland (Ht 3m; density 125/ha). *Melaleuca tamariscina* predominates with scattered emergent *Eucalyptus* spp. (*E. setosa*, *E. whitei*, *E. exserta*). There is a low shrub layer (Ht 1m; density 175/ha) of predominantly *M. tamariscina*. The ground layer (PFC <10%) is composed mainly of grasses, especially *Triodia pungens*.

Land Use:

Breeding cattle; soils respond readily to small falls of rain; sparse topfeed and limited drought reserves; inadequately watered; pastures fired for green pick; soils erode readily when surface is bare; present condition good.

LAND UNIT 44

Landform:

Outwash sandplain.

Geology:

Quaternary sands.

Soils:

Deep sandy red earths and earthy sands. Profiles are moderately acid throughout. Nutrient levels are very low. Gn2.11, Uc1.43 (Webb).
Bulk surface analysis: 160.

Vegetation:

Bloodwood (*Eucalyptus brachycarpa*) woodland to open-woodland (Ht 12-18m; density 25/ha). *Eucalyptus terminalis* and *E. papuana* are locally prominent and *E. setosa* may form a low open-woodland in places. Low trees of *Acacia coriacea* are also common. There is often a dense tall shrub stratum (Ht 2-4m) of *Acacia* spp. (*A. melleodora, A. stipuligera, A. tenuissima, A. adsurgens* and *A. platyptera*), with *Dodonaea viscosa* subsp. *angustissima* also frequent. The ground stratum is generally sparse, especially where shrubs are dense, and consists of *Triodia pungens, Aristida* spp. (*A. calycina, A. inaequiglumis, A. ingrata*), *Enneapogon pallidus, Eragrostis eriopoda* and *Panicum effusum.*

Land Use:

Beef cattle predominate; pastures respond readily to small falls of rain; limited topfeed and drought reserves; inadequately watered; pastures fired for green pick; dense wattle regrowth in some areas; present condition fair.

LAND UNIT 45

Landform:

Stabilised fan plain.

Geology:

Quaternary sands.

Soils:

Very deep siliceous sands. Profiles are slightly acid throughout. Uc5.11 (Wowra).

Vegetation:

Bloodwood (*Eucalyptus brachycarpa / E. terminalis*) - desert gum (*Eucalyptus papuana*) open-woodland to low open-woodland (Ht 10-15m, density 75/ha). Tall shrubs of *Acacia cowleana, A. coriacea, A. platycarpa, Eucalyptus setosa, Petalostigma pubescens* and locally *Melaleuca nervosa* (Ht 3-5m) are frequent, with areas of low shrubs, notably *Acacia melleodora.* The sparse to mid-dense ground stratum (PFC 10-40%) is dominated by perennial tussock grasses including *Heteropogon contortus* and *Aristida ingrata*, while ephemeral grasses, including (*Aristida holathera, Schizachyrium fragile, Eriachne obtusa* and *Enneapogon pallidus*) are also frequent. Forbs include *Evolvulus alsinoides, Bonamia media* and *Waltheria indica.*

Land Use:

Breeding cattle predominate; pastures respond readily to small falls of rain; limited topfeed and wire grasses as drought reserves; inadequately watered; pastures fired for green pick; woody weed regrowth in some areas; soils subject to sheet and gully erosion; present condition good.

LAND UNIT 46

Landform:

Sandy infilled channels in stabilised fan plain.

Geology:

Quaternary sands.

Soils:

Very deep siliceous sands and sandy red earths. Profiles are slightly acid throughout. Nutrient levels are very low. Uc5.11 (Wowra), Gn2.12 (Webb).
Representative profile analysis: 193, 208.

Vegetation:

Bloodwood (*Eucalyptus terminalis*, less frequently *E. brachycarpa*), desert gum (*E. papuana*), White's ironbark (*Eucalyptus whitei*) low open-woodland to woodland (Ht 6-15m; density 100-150/ha), with *E. whitei* locally dominant. Tall shrubs/low trees of *Acacia coriacea, Petalostigma pubescens* and *Melaleuca nervosa* (Ht 3-5m) occur patchily, with dense areas of low shrubs, notably *Acacia melleodora, A. acradenia* and *Carissa lanceolata* also being frequent. The ground stratum (PFC 15-60%) is dominated by perennial tussock grasses notably *Aristida* spp. (*A. inaequiglumis A. ingrata*), *Bothriochloa ewartiana, Eragrostis* spp., *Eriachne mucronata, Heteropogon contortus* and *Themeda* spp. (both *T. avenacea* and *T. triandra*). Ephemeral grasses are also common, including *Schizachyrium fragile, Eriachne aristidea* and *Aristida holathera.* Perennial forbs include *Sida rohlenae* and *Waltheria indica.*

Land Use:

Breeding cattle; pastures respond rapidly to small falls of rain; sparse topfeed and limited drought reserves; inadequately watered; present condition good.

LAND UNIT 47

Landform:

Stabilised fan plain.

Geology:

Quaternary sands.

Soils:

Deep to very deep, sandy red earths and sandy texture contrast soils. Ironstone shot occurs on the soil surface and throughout the profile. Profiles are slightly acid throughout. Nutrient levels are very low. Gn2 12 (Webb), Dy3.42 Representative profile analysis: 207.

Vegetation:

White's ironbark (*Eucalyptus whitei*) woodland to low woodland (Ht 8-12m; density 75-200/ha). Tall shrubs (Ht 3-5m) occur infrequently, including *Acacia coriacea, Maytenus cunninghamii, Petalostigma pubescens* and *Bursaria incana*. Scattered low shrubs (Ht 1-2m) of *Carissa lanceolata* are frequent. The ground stratum is dominated by perennial grasses including *Aristida calycina, A. inaequiglumis, Bothriochloa ewartiana, Eragrostis lacunaria, E. elongata, Heteropogon contortus* and *Triodia pungens*. Forbs are also common, including *Glycine tomentella, Sida* spp , *Waltheria indica, Phyllanthus fuernrohrii* and *Rhynchosia minima*.

Land Use:

Breeding cattle; pastures respond rapidly to small falls of rain; sparse topfeed and limited drought reserves; inadequately watered; soils erode readily when their surfaces are unprotected; present condition good.

LAND UNIT 48

Landform:

Sandy infilled swamps in sandplain.

Geology:

Quaternary sands.

Soils:

Very deep siliceous sands. Uc5.11 (Tarella).

Vegetation:

Paper-barked teatree (*Melaleuca nervosa*) low woodland to woodland (Ht 6-15m; density 25-500/ha), sometimes with rough-barked apple (*Angophora floribunda*). Scattered *Petalostigma pubescens* (Ht 2-3m) occur frequently. The ground stratum is sparse (<10% PFC) and dominated by the perennial sedges *Fimbristylis caespitosa* and *Cyperus conicus*, with the perennial grass *Bothriochloa decipiens* var. *cloncurrensis* also frequent. Ephemeral grasses (*Digitaria brownii*) and forbs (*Euphorbia mitchellii*) may also be present.

Land Use:

Very minor unit; breeding cattle; pastures respond to small falls of rain; no topfeed and no drought reserves; inadequately watered; present condition fair.

LAND UNIT 49

Landform:

Flat to gently undulating plains.

Geology:

Fresh labile Cretaceous sediments, often overlain by Quaternary gravel.

Soils:

Moderately deep to deep, grey and brown cracking clays. Gravel cover common. Profiles are generally alkaline throughout and ironstone, quartz inclusions are common. Gypsum occurs at depth. OC, TN levels are low; AP, BP values are fair to low and EC, Cl values increase with depth. Ug5.32, Ug5.33 (Bibel).
Bulk surface analyses: 55, 89.

Vegetation:

Low open woodland to open shrubland of gidgee (*Acacia cambagei*), or (in eastern areas), blackwood (*A. argyrodendron*) (Ht 3-10m; density 75-100/ha). Whitewood (*Atalaya hemiglauca*) and boree (*Acacia tephrina*) are frequently present and may be locally dominant. The ground layer varies from sparse to mid-dense (PFC <5-20%) and is dominated by grasses, mainly *Astrebla* spp. (*A. pectinata, A. elymoides, A. lappacea), Aristida latifolia, Sporobolus actinocladus* and *Dactyloctenium radulans*. Occasional low shrubs are *Apophyllum anomalum* and *Eremophila polyclada* Forbs include *Sclerolaena glabra, S. calcarata, S. intricata, S. lanicuspis, Enchylaena tomentosa, Salsola kali, Sida fibulifera* and *S. trichopoda*.

Land Use:

Breeding sheep predominate; substantial falls of rain required for pasture response on these heavy clay soils; sparse topfeed and Mitchell grass provides standover feed, usually adequately watered; not easily eroded due to stone cover; valuable as shade/camping areas; present condition good.

LAND UNIT 50

Landform:

Flat to gently undulating plains.

Geology:

Fresh labile Cretaceous sediments, often overlain by Quaternary gravel.

Soils:

Deep, grey and brown cracking clays usually with dense stone cover. Soils are moderately alkaline throughout with lime and gypsum present. Ironstone occurs throughout.; OC, TN values are low; AP values range very fair to high while BP values range low to fair; EC levels are very low to low at the surface but rapidly increase to very high levels beyond 20 cm; Cl levels follow a similar trend. Ug5.22, Ug5.32 (Ascot, Bibel).
Representative profile analysis: 21, 164, 188.
Bulk surface analysis: 38, 51, 66, 101, 114.

Vegetation:

Boree (*Acacia tephrina*) grassy open woodland (Ht 6-10m; density 20-200/ha) to wooded open tussock grassland. *Atalaya hemiglauca, Alectryon oleifolius, Flindersia maculosa* and *Ventilago viminalis* occur as scattered low trees There is a patchy low shrub layer (Ht 1-3m; density up to 500/ha) of *Eremophila mitchellii* and less commonly *Apophyllum anomalum* and *Acacia farnesiana*. The ground layer ranges from dense (PFC up to 60%) in open areas to sparse (<5%) amongst trees and shrubs. The dominant species are *Astrebla* spp. (*A. lappacea/A. pectinata, A. elymoides*), *Aristida latifolia, Bothriochloa ewartiana* and *Iseilema vaginiflorum*. Other common grasses are *Dichanthium sericeum, Enneapogon* spp. (*E. oblongus, E. avenaceus*), *Panicum decompositum* and *Sporobolus actinocladus*. Forbs are infrequent but include *Psoralea cinerea, Rhynchosia minima, Sida fibulifera* and *Solanum esuriale*.

Land Use:

Breeding sheep predominate; substantial falls of rain required for pasture response on these heavy clay soils; sparse topfeed and Mitchell grass provides some standover feed; usually adequately watered; not easily eroded due to dense stone cover; valuable as shade/camping areas; present condition good.

LAND UNIT 51

Landform:

Flat to gently undulating plains.

Geology:

Fresh labile Cretaceous sediments.

Soils:

Shallow to moderately deep, grey and brown cracking clays and minor texture contrast soils. The soils are moderately to strongly alkaline throughout. Ironstone and lime occur in the profile. Stone cover is usually light. OC, TN values are low; AP high; BP low; EC and Cl levels are low at the surface and increase to medium levels at the base of the profile. Uf6.31, Ug5.22 (Ascot).
Representative profile analysis: 9.

Vegetation:

Eastern basaltica - Bauhinia (*Lysiphyllum carronii*) - *Acacia* spp. tall shrubland to open woodland (Ht 4-10m; density 350/ha). Apart from *L. carronii*, frequent species include *Atalaya hemiglauca, Alectryon oleifolius, Archidendropsis basaltica, Flindersia maculosa, Eremophila mitchellii, Acacia cambagei* and *A. tephrina*. Low shrub species include *Acacia farnesiana, A. victoriae* and *Apophyllum anomalum* but they are seldom abundant. The ground layer varies from relatively sparse to mid-dense(PFC 5-45%), consisting of grasses (*Astrebla* spp., *Enneapogon* spp., *Sporobolus* spp. *Cenchrus ciliaris*) and forbs (*Salsola kali, Sclerolaena* spp., *Malvastrum americanum*).

Land Use:

Breeding sheep predominate; substantial falls of rain required for pasture response on these heavy clay soils; topfeed present and Mitchell grass provides standover feed; usually adequately watered; some minor erosion where overgrazed; valuable as shade/camping areas; present condition good.

LAND UNIT 52

Landform:

Gently sloping sandplain.

Geology:

Quaternary sands overlying Tertiary and Cretaceous sediments.

Soils:

Moderately deep sandy red earths and minor sandy light clays. Soils are slightly acid throughout. Nodules of manganese and ironstone are present in the profile. OC, TN, AP, BP, EC, Cl values are very low. Gn2.12, Gn2.13, Uf6.13 (Vergemont).
Representative profile analysis: 59.
Bulk surface analysis: 58, 125.

Vegetation:

Mulga (*Acacia aneura*) - eastern dead finish (*Archidendropsis basaltica*) tall open shrubland to low open woodland (Ht 4-8m; density 50-400/ha), with emergent *Eucalyptus terminalis*. A well developed shrub layer 1-2m in height dominated by *Eremophila bowmannii* and including *Capparis lasiantha, Carissa lanceolata, Cassia helmsii, C. oligophylla, Eremophila latrobei, E. gilesii, E. longifolia* and *Hakea chordophylla*. The ground layer is a diverse mixture of grasses and forbs with the grasses *Aristida contorta, A. armata, A. holathera* and *A. pruinosa* most frequent. *Bothriochloa ewartiana, Enneapogon polyphyllus* and *Eragrostis eriopoda* are also present but in lower densities. Frequent forbs include *Gossypium australe, Maireana villosa, Sida platycalyx* and *Solanum quadriloculatum*.

Land Use:

Breeding sheep predominate; pastures respond to small falls of rain; mulga present as drought reserves; adequately watered; fire used for a green pick and has reduced mulga densities; woody weed regrowth has been stimulated by frequent fires; limited erosion; present condition good.

LAND UNIT 53

Landform:

Gently sloping sandplain.

Geology:

Quaternary sands overlying Tertiary and Cretaceous sediments.

Soils:

Moderately deep sandy red earths, sandy texture contrast soils. Ironstone gravel and lime inclusions occur in the profile. The soils are moderately alkaline. OC, TN values are very low and AP, BP levels are fair to low; EC, Cl values are very low. Dr2.13 (Ludgate), Uf6.31 (Vergemont).
Bulk surface analyses: 63, 64.

Vegetation:

Open shrubland to low open woodland (Ht 4-6m; density 200-250/ha) of variable composition. *Flindersia maculosa* and *Archidendropsis basaltica* dominate in some sites while in others *Acacia excelsa* and *Atalaya hemiglauca* can be locally common. In the low shrub layer *Carissa lanceolata* and *Eremophila mitchellii* are almost always present along with *Apophyllum anomalum, Capparis lasiantha, C. mitchellii, Cassia oligophylla, C. phyllodinia, Eremophila bowmannii* and *Hakea chordophylla*. The ground layer contains a diverse range of grasses and forbs. *Aristida* spp. predominate among the grasses with *Enneapogon* spp., *Eragrostis* spp., *Eriachne* spp. and *Themeda* spp. all occurring. Forbs include *Boerhavia diffusa, Evolvulus alsinoides, Indigofera linifolia, Solanum* spp and *Sida* spp..

Land Use:

Breeding sheep predominate; pastures respond readily to small falls of rain; topfeed present but less mulga present than unit 52; adequately watered; woody weed problem in some areas; limited erosion; present condition good.

LAND UNIT 54

Landform:

Swamps and shallow depressions in sandplain.

Geology:

Recent alluvia.

Soils:

Moderately deep, grey cracking clays with thick surface crusts. Profile is slightly acid throughout. Ug5.22 (Lydia).
Bulk surface analysis 84.

Vegetation:

Low open shrubland of lignum (*Muehlenbeckia cunninghamii*) in claypans and other depressions. The ground layer is sparse consisting of the sedge *Eleocharis pallens* around the high water mark, *Marsilia* spp., *Elytrophorus spicatus* and *Eragrostis setifolia*. On the edges of the claypans and gilgais there is often a low open woodland of *Eucalyptus microtheca* together with an occasional *Acacia cambagei*.

Land Use:

Minor unit in sandplain; breeding sheep predominate; depressions fill seasonally and are used for stock water; some feed available as water recedes; limited topfeed; condition variable.

LAND UNIT 55

Landform:

Gently sloping sandplain.

Geology:

Quaternary sands overlying altered Tertiary sediments.

Soils:

Moderately deep sandy red earths. Pisolitic ironstone often on the surface and occurs as a dense layer at shallow depths. Soils are slightly acid throughout. OC, TN, AP, BP, EC, Cl values are very low. Gn2.12, Um5.51 (Webb).
Representative profile analysis: 76, 124.

Vegetation:

Western bloodwood (*Eucalyptus terminalis*), tall (open) shrubland to low open woodland (Ht 3-7m; PFC <20%) interspersed with areas of low shrubland of *Carissa lanceolata, Cassia helmsii, C. oligophylla, Grevillea wickhamii* and *Petalostylis labicheoides*. In open areas the grasses *Triodia pungens* and *Eriachne mucronata* frequently dominate but the community may contain *Aristida* sp., *Astrebla* spp., *Cymbopogon* spp., *Digitaria* spp. and *Themeda* spp.. Forbs

include *Abutilon otocarpum, Apophyllum anomalum, Goodenia* spp., *Sida* spp., *Solanum* spp. and *Tephrosia* spp..

Land Use:

Breeding sheep predominate; pastures respond readily to small falls of rain; topfeed present and limited drought reserves; adequately watered; spinifex pastures regularly burnt for green pick; woody weed problem associated with fired areas; limited erosion; present condition good.

LAND UNIT 56

Landform:

Low sand dunes in gently sloping sandplain.

Geology:

Quaternary sands (aeolian).

Soils:

Deep siliceous sands Uc1.

Vegetation:

Western bloodwood (*Eucalyptus terminalis*) (low) open-woodland to wooded hummock grassland. Apart from *E. terminalis*, low trees of *Ventilago viminalis, Grevillea striata* and *Owenia acidula* are prominent. There is a patchy low shrub layer, dense in places, of *Acacia stipuligera* and *Cassia artemisioides*. The ground stratum is dominated by *Triodia pungens*, but other common grasses include *Eragrostis eriopoda, Aristida holathera* and *A. ingrata*.

Land Use:

Minor unit in sandplain, breeding sheep predominate; pastures respond rapidly to small falls of rain but are very drought prone; limited topfeed and drought reserves; adequately watered, limited value for grazing; present condition good.

LAND UNIT 57

Landform:

Flat alluvial plains with numerous shallow channels and sandy rises throughout.

Geology:

Recent alluvia overlain by Quaternary sand deposits.

Soils:

Deep, sandy grey clays and texture contrast soils with quartz throughout and lime concretions at the base of the profile. Moderately gilgaied. The profile is strongly acid at the surface, becoming strongly alkaline beyond 60 cm. OC, TN, AP, BP, EC, Cl values are very low. Dy2.13 (Coorabah), Uf6.31.
Representative profile analysis: 194.

Vegetation:

Gidgee (*Acacia cambagei*) low woodland to low open-woodland (Ht 6-8m; density 50-100/ha). Although *Acacia cambagei* is generally predominant, occasional low trees of *Geijera parviflora* and *Lysiphyllum carronii* may occur. There is frequently a low shrub layer of *Eremophila mitchellii* (Ht 2m; density 200/ha) with *Carissa ovata, C. lanceolata* and *Myoporum deserti* also present. The ground stratum depends upon the density of trees and the extent of gilgai development. It is generally sparse to mid-dense and made up largely of grasses, including *Paspalidium* spp. (esp. *P. caespitosum*), *Enteropogon acicularis* and *Sporobolus* spp.. There is a variety of forbs including *Sclerolaena* spp., *Sida* spp., *Alternanthera* spp., *Portulaca* spp. and *Einadia nutans* subsp. *linifolia*. In more open areas, *Dichanthium fecundum, Iseilema* spp. and *Bothriochloa ewartiana* are important, while *Astrebla squarrosa* and *Diplachne fusca* occur in moist, gilgaid situations.

Land Use:

Predominantly cattle breeding and fattening; substantial falls of rain required for pasture response; sparse topfeed and limited drought reserves; adequately watered; areas of gidgee have been cleared and sown to buffel grass with limited success; some gidgee regrowth; present condition good.

LAND UNIT 58

Landform:

Outer margins of flat alluvial plains.

Geology:

Recent alluvia overlain by Quaternary sands.

Soils:

Deep texture contrast soils with ironstone and quartz inclusions throughout the profile; the surface soil crusts and scalding is extensive; OC, TN, AP, BP values are very low. Dy3.12 (Shirley).
Representative profile analysis: 211.

Vegetation:

Open-herbland to open-tussock grassland (Ht <1m; PFC <30%). Major species include *Astrebla pectinata, Aristida* spp., *Chloris* spp., *Enneapogon* spp. and *Eragrostis* spp. Forbs are also abundant and include *Sclerolaena* spp., *Sida* spp., *Trianthema triquetra, Abutilon* spp., *Phyllanthus* spp. and *Portulaca oleracea*. There are frequently scattered low trees of *Eucalyptus* spp. (particularly *E. microtheca*), *Lysiphyllum carronii, Grevillea striata* and *Acacia cambagei*.

Land Use:

Predominantly cattle breeding; substantial falls of rain required for pasture response; sparse topfeed and very limited drought reserves; unit is extensively scalded and is a very unproductive unit; woody weed problem (sandalwood) in some areas; present condition poor.

LAND UNIT 59

Landform:

Interchannel areas and outer margins of flooded alluvial plains.

Geology:

Recent alluvia.

Soils:

Deep to very deep, grey and brown cracking clays with weakly self-mulching surfaces. Soil reaction is strongly alkaline. OC, TN are low and AP, BP fair. Ug 5.24 (Thomson).
Representative profile analysis: C13.

Vegetation:

Coolibah (*Eucalyptus microtheca*) open woodland (Ht 10-12m; density 125/ha) *E. microtheca* predominates, with occasional tall shrubs (Ht 4m; density 25/ha) of *Acacia farnesiana* and *Alectryon oleifolius*. A low shrub layer, dense in places (Ht <1m; density 175/ha), includes *Capparis mitchellii* and *Eremophila maculata*. There is a moderately dense ground stratum (Ht <1m; PFC 35%) of the grass *Panicum decompositum* and the forbs *Sclerolaena muricata, Enchylaena tomentosa, Malvastrum americanum, Portulaca oleracea, Sida trichopoda* and *Trianthema triquetra*.

Land Use:

Breeding sheep predominate; substantial falls of rain required for pasture response; sparse topfeed and Mitchell grass present as standover pasture; adequately watered, present condition good

LAND UNIT 60

Landform:

Foreshores of ephemeral lakes.

Geology:

Quaternary sands overlying recent alluvia.

Soils:

Siliceous sands overlying heavy grey clays.

Vegetation:

River red gum (*Eucalyptus camaldulensis*) low open woodland (Ht 4-6m; density 50/ha). Coolibah (*E. microtheca*) may also be present, and *Acacia stenophylla* is a frequent tall shrub. The may be a very dense low shrub layer (Ht <1m; density 1500/ha) of regenerating *Eucalyptus* spp., with areas of *Muehlenbeckia cunninghamii*. There is an open ground stratum (PFC 20%) dominated by graminoids, particularly sedges (*Cyperus conicus, Fimbristylis littoralis*) but also the creeping grasses *Pseudoraphis spinescens* and *Cynodon dactylon*.

Land Use:

Very minor unit; breeding cattle predominate; sparse topfeed and drought reserves; inadequately watered; pastures respond rapidly to small falls of rain but unit is very drought prone; present condition fair.

LAND UNIT 61

Landform:

Flat alluvial plains subject to flooding.

Geology:

Quaternary sediments.

Soils:

Deep, sandy texture contrast soils and sands.

Vegetation:

Reid River box (*Eucalyptus brownii*) low open-forest to low woodland (Ht 7-8m; density 25/ha). Coolibah (*E. microtheca*) and river red gum (*E. camaldulensis*) may also occur, also doolan (*Acacia salicina*). Some areas have a dense low shrub layer (Ht <2m) of regenerating *E. camaldulensis* and/or *E. microtheca*. The ground stratum is generally quite sparse (scalded), with *Cynodon dactylon* the main species . Noogoora burr (*Xanthium pungens*) may be seasonally abundant.

Land Use:

Breeding cattle; limited grazing value due to dense tree and sapling density; pastures respond rapidly to small falls of rain; sparse topfeed and very limited drought reserves; adequately watered; present condition fair.

LAND UNIT 62

Landform:

Flat alluvial plains subject to occasional flooding.

Geology:

Recent alluvia.

Soils:

Deep, grey clays with ironstone and quartz inclusions throughout. Profiles are slightly acid becoming strongly alkaline beyond 30 cm. Uf6.32, Dy2.42.
Representative profile analysis: 203.

Vegetation:

(*Acacia argyrodendron*) low woodland to low open-woodland, frequently groved (Ht 6-10m; density 100-200/ha). *Lysiphyllum carronii, Grevillea striata* and *Eucalyptus microtheca* occur infrequently in this community. There is often an open tall shrub layer of sandalwood (*Eremophila mitchellii*) (Ht 2-3m; density 150-200/ha). The ground layer is quite variable, depending on the extent of tree cover and presence or otherwise of gilgais. Amongst trees, the ground stratum is quite sparse and dominated by grasses *Paspalidium caespitosum, Enteropogon acicularis, Chloris* spp , *Sporobolus* spp. and *Eragrostis* spp.. Forbs include *Portulaca* spp., *Dipteracanthus australasicus, Alternanthera angustifolia* and *Trianthema triquetra*. In open (intergrove) areas there is a dense layer of grasses, notably *Astrebla pectinata* and (in moister situations) *A. squarrosa, Dichanthium fecundum, Aristida* spp., *Iseilema vaginiflorum* and *Eragrostis xerophila*. In gilgai areas, the depressions carry *Cyperus* spp., *Eragrostis tenellula, Leptochloa filiforme* and the forbs *Peplidium maritimum* and *Ammannia multiflora*.

Land Use:

Breeding cattle and sheep; substantial falls of rain required for pasture response; sparse topfeed and Mitchell grasses constitute main drought reserves; adequately watered; areas have been developed by clearing the timber to encourage build up of native grasses; some woody weed regrowth (sandalwood and blackwood); present condition good.

LAND UNIT 63

Landform:

Scarp retreat zone in dissected tablelands.

Geology:

Altered Cretaceous sediments. Fresh sediments may be exposed on lower slopes.

Soils:

Very shallow loamy lithosols. Areas of exposed rock common.

Vegetation:

Bendee (*Acacia catenulata*) and/or lancewood (*A. shirleyi*) low open woodland to tall open shrubland (Ht 3-5m; density 50-500/ha). Yapunyah (*Eucalyptus thozetiana*) often occurs as an emergent tree and may become dominant, forming an open woodland. *Acacia spania* and *A. microcephala* are locally common in eastern areas near Aramac. Low shrubs are common, with *Eremophila latrobei* being most frequent and abundant. Other low shrub species include *Acacia* spp., *Cassia artemisioides, C. oligophylla* and *Olearia xerophila*. The ground stratum is generally quite sparse with scattered perennial grasses (*Paspalidium* spp., *Eriachne mucronata, Triodia pungens* and *Eragrostis lacunaria*) and forbs (*Maireana georgei, Ptilotus obovatus* and *Sida* spp., especially *S. filiformis*).

Land Use:

Naturally unstable and unproductive; extremely low grazing capacity; no topfeed and no drought reserves; stock water limiting; extremely low fertility; present condition poor.

LAND UNIT 64

Landform:

Undulating plains and dissected low hills.

Geology:

Tertiary sediments, overlain by a thin cover of Quaternary sand.

Soils:

Very shallow loamy lithosols. Dense stone cover and parent material exposed.

Vegetation:

Mulga (*Acacia aneura*) - western dead finish (*Acacia tetragonophylla*) tall open-shrubland (Ht 2-4m; density 100/ha). On lower slopes gidgee (*Acacia cambagei*) becomes a significant component of the community. Other tall shrub/low tree species include *Archidendropsis basaltica, Atalaya hemiglauca, Eucalyptus papuana* and *Owenia acidula*. Low shrub species include *Eremophila bowmanii, Dodonaea petiolaris* and *Cassia artemisioides*. The ground layer is generally quite open (depending on season) and made up of many ephemeral forbs (*Dysphania rhadinostachya, Calotis hispidula, Hibiscus burtonii*) and grasses (*Neurachne munroi, Aristida contorta, Digitaria brownii*) as well as perennials, e.g. *Sida filiformis* and *Themeda triandra*.

Land Use:

Naturally unstable and unproductive; extremely low grazing capacity; no topfeed and no drought reserves, stock water limiting; severe sheet and gully erosion, present condition poor.

LAND UNIT 65

Landform:

Scarp retreat zones and crests of dissected tablelands.

Geology:

Chemically altered Cretaceous sediments.

Soils:

Bare rock outcrops and very shallow loamy lithosols. Very acid and very infertile. Um1 (Corys).
Bulk surface analysis: 72.

Vegetation:

Lancewood (*Acacia shirleyi*) tall (open-) shrubland to low shrubland (Ht 2-5m; density 50-250/ha). There is a patchy low shrub layer of *Cassia oligophylla* and the open ground stratum is dominated by *Triodia longiceps* and/or *T. pungens* and/or *Cymbopogon bombycinus*.

Land Use:

Naturally unstable and unproductive; no topfeed; no drought reserves; stock water very limited, of no value for grazing; present condition poor; of some value for opal mining.

LAND UNIT 66

Landform:

Undulating plains and dissected low hills.

Geology:

Fresh Cretaceous sediments, often overlain by rocks and gravel as erosion detritus of overlying formations.

Soils:

Shallow to moderately deep, brown cracking clays and desert loams. Dense surface stone cover is common and gravel occurs throughout the profile. OC, TN, AP, BP levels are very low and EC, Cl are low. Ug5.32, Dr2.12, Um5.41 (Thornton).
Bulk surface analysis: 74, 128.

Vegetation:

Gidgee (*Acacia cambagei*) low woodland to low open-woodland (Ht 4-7m; density 50-200/ha). Occasional low trees to tall shrubs of whitewood (*Atalaya hemiglauca*) and leopardwood (*Flindersia maculosa*). Patchy low shrubs of *Cassia artemisioides*, *C. oligophylla*, *Eremophila mitchellii* and *Apophyllum anomalum*. The ground layer is quite sparse, with many open scalded areas, with a variety of forbs and grasses. The forbs include *Sclerolaena* spp. (*S. glabra, S. lanicuspis*), *Enchylaena tomentosa, Salsola kali* and *Ptilotus exaltatus*, while the grasses comprise both perennial (*Astrebla pectinata, Enteropogon acicularis, Paspalidium caespitosum* and *Triodia longiceps*) and ephemeral species (*Sporobolus* spp., *Enneapogon avenaceus* and *Dactyloctenium radulans*).

Land Use:

Breeding cattle; no topfeed and limited drought reserves; unproductive unit; stock water limiting; present condition poor.

LAND UNIT 67

Landform:

Flat to gently undulating plains.

Geology:

Altered Cretaceous sediments.

Soils:

Shallow red clays with neutral soil reaction. Black ironstone pavements are characteristic Dr2.52, Uf1.42

Vegetation:

Usually devoid of vegetation, but scattered forbs may occur (Ht <0.3m; PFC <1%), including *Sclerolaena lanicuspis, Boerhavia diffusa, Portulaca oleracea, Salsola kali* and *Trianthema triquetra*.

Land Use:

An unproductive unit capable of producing only very limited, very low grazing capacity ephemeral pastures; fair fertility, of no significant use; present condition poor.

LAND UNIT 68

Landform:

Inner lake floors.

Geology:

Recent alluvia.

Soils:

Alluvial saline clays, salt encrusted during dry seasons.

Vegetation:

Open-forbland to open-grassland on lake floors. Prominent forbs include *Marsilea* spp., *Eryngium plantagineum*, *Alternanthera angustifolia*, *Polymeria pusilla* and *Goodenia subintegra*. Common grasses include *Uranthoecium truncatum*, *Echinochloa colona* and *Diplachne fusca*. There may be scattered shrubs of *Eremophila bignoniiflora* and *Muehlenbeckia cunninghamii*.

Land Use:

An unproductive unit of no significant use.

LAND UNIT 69

Landform:

Undulating plains and scarp retreat zones.

Geology:

Altered Cretaceous sediments.

Soils:

Very shallow loamy lithosols. Extensive cover of rocks and gravel.

Vegetation:

Mineritchie (*Acacia cyperophylla*) - mulga (*Acacia aneura*) tall shrubland to tall open shrubland (Ht 3-8m; density 100-500/ha), occasionally forming a low open-woodland. *A. cyperophylla* dominates and may form a more or less pure fringing community along watercourses. Low shrubs are frequent, including *Dodonaea petiolaris*, *Cassia artemisioides* and *Eremophila* spp. (*E. latrobei*, *E. bowmanii*). The ground layer is quite open, with predominately ephemeral forbs and grasses, and occasional perennials (*Indigofera leucotricha*, *Sauropus rigens*, *Themeda triandra* and *Triodia pungens*). Common ephemerals include *Enneapogon* spp., *Sporobolus carolii*, *Cleome viscosa* and *Rostellularia adscendens*.

Land Use:

An unstable and unproductive unit of little value for grazing; stock water limited; present condition poor.

LAND UNIT 70

Landform:

Flat to gently sloping tops of mesas and buttes.

Geology:

Tertiary sediments.

Soils:

Very shallow loamy lithosols. Dense surface cover of ironstone gravel.

Vegetation:

Eastern dead finish (*Archidendropsis basaltica*) - mulga (*Acacia aneura*) low open-woodland. Scattered low trees of whitewood (*Atalaya hemiglauca*) and leopardwood (*Flindersia maculosa*). There are scattered low shrubs of *Sauropus rigens, Eremophila latrobei* and *Indigofera leucotricha.* The ground stratum is an open-grassland (PFC <30%) with *Eriachne mucronata, Aristida* spp., *Enneapogon* spp. and areas of *Triodia pungens.* Forbs also common, including *Sida filiformis* and *Abutilon calliphyllum.*

Land Use:

Stable yet unproductive unit; of limited value for grazing; depends on stock water from the plains below; spinifex occasionally fired; present condition fair to good.

LAND UNIT 71

Landform:

Undulating plains and scarp retreat zones.

Geology:

Altered Cretaceous sediments.

Soils:

Very shallow loamy lithosols. Extensive cover of surface gravel and rocks.

Vegetation:

Tall open-shrubland to low open-woodland of *Eucalyptus eucentrica* and *E. normantonensis.* There is a patchy ground stratum of spinifex (*Triodia longiceps* and/or *T. pungens*). Minor species include *Paspalidium* spp., *Eriachne mucronata, Sida fibulifera* and *Tripogon loliiformis.* This unit occurs only between Vergemont Creek and the Mayne River.

Land Use:

An unstable and unproductive unit; of limited value for grazing, stock water limiting; spinifex occasionally burnt, of some value for opal mining; present condition fair to good.

LAND UNIT 72

Landform:

Lower slopes of scarps in undulating plains and dissected tablelands.

Geology:

Fresh Cretaceous sediments.

Soils:

Shallow, brown gravelly clays with cover of silcrete and ironstone gravel. The soils are strongly acid and gravel is present throughout the profile. OC, TN, AP, BP are very low. Uf6.34 (Bibel).
Bulk surface analysis: 87.

Vegetation:

Open-herbland to sparse herbland (PFC<10%). Ephemeral grasses and forbs predominate, including *Aristida contorta, Sporobolus actinocladus, Oxychloris scariosa, Enneapogon intermedius, Tragus australianus, Salsola kali, Sclerolaena muricata, S. Divaricata, S. lanicuspis* and *Solanum esuriale.* Perennial grasses include *Aristida latifolia, A. strigosa, Astrebla pectinata, Enteropogon acicularis* and *Triodia longiceps.* Low shrubs of *Hemichroa mesembryanthema* may be locally dominant. Scattered shrubs or low trees of *Acacia cambagei, Atalaya hemiglauca* and *Flindersia maculosa.* Large areas mostly devoid of vegetation (scalds).

Land Use:

Sheep breeding; unstable unit because of slope gradients; substantial falls of rain required for pasture response; no topfeed and limited drought reserves; adequate stock water; gully erosion common; present condition fair.

LAND UNIT 73

Landform:

Single channel streams draining the 'desert' country.

Geology:

Recent alluvia.

Soils:

Alluvial soils of varying textures; bed load of sand.

Vegetation:

Woodland to open-woodland of river red gum (*Eucalyptus camaldulensis*) and less frequently coolibah (*E. microtheca*) (Ht 8-12m; density 25-50/ha). Along Torrens Creek, paper-barked tea tree (*Melaleuca nervosa* var. *pendulosa*) may be a co-dominant. Low trees of *Melaleuca linariifolia* and *Acacia stenophylla* are also frequent. There are patchy low shrubs of *Carissa lanceolata* and *Myoporum* spp. (*M. deserti, M. acuminatum*). The ground stratum is quire variable, depending on seasonal conditions, with a range of graminoids, notably *Sporobolus* spp., *Leptochloa digitata, Eragrostis elongata, Paspalidium jubiflorum, Pseudoraphis spinescens* and *Cyperus* spp..

Land Use:

Breeding cattle; small falls of rain required for pasture response; limited topfeed and sparse drought reserves; streams are only seasonal but may cause flash flooding; present condition fair to good.

APPENDIX VI

SUPPLEMENTARY LIST OF RECENT REFERENCES

Agnew, J.R. (1988), *Queensland Bluegrass Community*, Proceedings of Woodland Management and the Control of Woody Plants Workshop, QDPI and AMLRDC, May 1988.

Baker, D.E., Miles, R.L. and Eldershaw V.J. (1992), Vegetation cover classes and soil nutrient status of the Mulga Lands of south-west Queensland, *The Australian Rangeland Journal* **14(1)**, 40-48.

Bastin, G.N. (1991), Rangeland reclamation on Atartinga Station, Central Australia, *Australian Journal of Soil and Water Conservation* **4(2)**, 18-25.

Beale, I.F. and Holmes, W.H. (1984), Effect of grazing pressure on sheep production from mitchell grass, *Queensland Merino Stud Year Book*, 39.

Beale, I.F., Mills, J.R. and Pressland, A.J. (1984), Use and conservation of arid rangeland in Queensland, *Proceedings of Symposium on Rural research into Arid Zone Problems*, Mt Isa Queensland Department of Primary Industries.

Beale, I.F., Orr, D.M., Holmes, W.E., Palmer, N., Evenson, C.J. and Bowly, P.S. (1984), The effect of forage utilization levels on sheep production in the semi-arid south west of Queensland, In P.J. Joss, P.W. Lynch and O.B. Williams, (Eds.) *Rangelands: a resource under siege*, Proceedings of 2nd International Rangeland Congress, Adelaide, Australian Acadamy of Science: Canberra, p. 30.

Beale, I.F., Orr, D.M. and Mills, J.R. (1985), Pastoral impact on the ecosystem, *Proceedings of The Mulga Lands Symposium, Royal Society of Queensland, Brisbane.*

Beale, I.F. (Ed.) (1985), *Animal-plant interactions in native pastures of western Queensland*, Queensland Department Primary Industries, Final Project Report to Australian Wool Corporation.

Beale, I.F. (Ed.) (1986), *Final report to Australian Wool Corporation - Grazing land productivity and stability (WRTF K/2/900(B))*, Queensland Department Primary Industries, Mimeo.

Brown, R.F. (1981), Drought forage utilization, and their effects on the survival and recruitment of grasses of the mulga *(Acacia aneura)* woodlands, *Proceedings of 3rd Biennial Conference, Australian Rangeland Society, Alice Springs*, 213-19.

Brown, R.F. (1981), Potential fuel biomass production in rangelands, *Proceedings of National Conference on Fuels from Crops, National Science Centre, Melbourne*, 33.1- 33.7.

Brown, R.F. (1982), Seed dormancy in *Aristida armata, Australian Journal of Botany* **30**: 67-72.

Brown, R.F. (1982), Tiller development as a possible factor in the survival of the two grasses *Aristida armata* and *Thyridolepis mitchelliana, Australian Rangeland Journal* **4**, 34-38.

Brown, R.F. (1985), The effect of severe defoliation on the subsequent growth and development of five rangeland pasture grasses of south-western Queensland, *Australian Journal of Ecology* **10**, 335-43.

Brown, R.F. (1985), The growth and survival of young mulga (*Acacia aneura* F. Muell.) trees under different levels of grazing, *Australian Rangeland Journal* **7**, 143-48.

Brown, R.F. (1986), The effects of burning, fertilizing and clipping on populations of *Aristida armata, Thyridolepis mitchelliana* and *Monachather paradoxa* in a mulga woodland pasture, *Australian Rangeland Journal* **8**, 4-10.

Brown, R.F. (1987), Defoliation regrowth and dry matter partitioning in the two arid zone grasses *Aristida armata* and *Thyridolepis mitchelliana, Australian Journal of Agricultural Research* **38**, 881-93.

Brown, R.F. (1987), Germination of *Aristida armata* under constant and alternating temperatures and its analysis with the cumulative Weibull distribution as a model, *Australian Journal of Botany* **35**, 581-91.

Brown, R.F. and Mayer, D.G. (1988), Representing cumulative germination. 1. A critical analysis of single-value germination indices, *Annals of Botany* **61**, 117- 25.

Brown, R.F. and Mayer, D.G. (1988), Representing cumulative germination. 2. The use of the Weibull function and other empirically derived curves, *Annals of Botany* **61**, 127-38.

Burrows, W.H. (1980), Range management in the dry tropics with special reference to Queensland, *Tropical Grasslands* **14**, 281-87.

Burrows, W.H. (1985), Potential ecosystem productivity, *Proceedings of the Mulga Lands Symposium, Royal Society of Queensland, Brisbane.*

Burrows, W.H., Beale, I.F., Silcock, R.G., and Pressland, A.J. (1985), Prediction of tree and shrub population changes in a semi-arid woodland, In J.C. Tothill and J.J. Mott, (Eds.), *Ecology and management of the world's savannas*, Australian Academy of Science, Canberra.

Burrows, W.H., Carter, J.O., Anderson, E.R., and Bolton, M.P. (1986), Prickly acacia (*Acacia nilotica*) invasion of mitchell grass (*Astrebla* spp.) plains in central and north-west Queensland. *Proceedings of 4th Biennial Conference, Australian Rangeland Society, Armidale, August 1986.*

Burrows, W.H., and Scanlan, J.C. (1982), *Report on regrowth problems - central Queensland*, Queensland Department Primary Industries, Report.

Burrows, W.H., Scanlan, J.C., and Anderson, E.R. (1988), Plant ecological relations in open forests, woodlands and shrublands, In W.H. Burrows, J.C. Scanlan and M.T. Rutherford (Eds.), *Native pastures in Queensland: the resources and their management*, Queensland Department of Primary Industries, Information Series QI87023, pp. 66-82.

Burrows, W.H., Scanlan, J.C. and Rutherford M.T. (Eds.) (1988), *Native pastures of Queensland: the resources and their management*, Queensland Department of Primary Industries Information Series Qi 87023.

Butcher, G., Eady, S. and Smith, F. (1984), Preliminary observations on some factors which influence the tensile strength of wool, *Proceedings of Australian Society of Animal Production* **15**, 125.

Cameron, D.G. (1982), *Notes on selected legumes native to Queensland*, Queensland Department of Primary Industries, Miscellaneous Publication QM82001.

Carter, J.O. and Cowan, D.C. (1988), Phenology of *Acacia nilotica* (subspecies indica) in north-west Queensland, *Working Papers, 5th Biennial Conference, Australian Rangeland Society, Longreach, Queensland, 14 to 17 June 1988*, pp. 9-12.

Carter, J.O., and Johnston, P.W. (1986), Modelling expected frequencies of fuel loads for fire at Charleville in western Queensland, *Proceedings of 3rd Queensland Fire Research Workshop, Gatton.*

Carter, J.O., Jones, P. and Cowan, D.C.(1991), *Control of woody weeds in western Queensland*, (DAQ 25P), Final Project Report to the Australian Wool Corporation.

Christianos, N.G. (1988), *Survey in Jarvisfield (Winton)*, Queensland Department of Primary Industries, Internal Report.

Christie, E.K. (1981), Biomass and nutrient dynamics in a C4 semi-arid Australian grassland community, *Journal of Applied Ecology* **18**, 907-18.

Christie, E.K. (1984), Arid land management, *Australian Journal of Environmental Education* **1**, 5-10.

Christie, E.K., and Hughes, P.G. (1983), Interrelationships between net primary production, ground-storey condition and grazing capacity of the *Acacia aneura* rangelands of semi-arid Australia, *Agricultural Systems* **12**, 191-211.

Clarke, M.R. (1987), Beating drought in mulga country cattle herds, *Queensland Agricultural Journal* 113, 181.

Clewett, J.F. (1985), *Shallow storage irrigation for sorghum production in north-west Queensland*, Queensland Department of Primary Industries, Bulletin QB 85002.

Clewett, J.F., and Pritchard, D.A. (1980), Regional forage systems - north western, *Proceedings of Workshop on Forage Crops and regional forage systems in Queensland* **13**, 1-15.

Clewett, J.F., and Weston, E.J. (1981), *Evaluation of shallow storage cropping on the mitchell grass plains of north-west Queensland*, Queensland Department of Primary Industries, Final report to Australian Wool Corporation, 1-45.

Cobon, D.H., Bird, A.R., Rudwick, V.J. and Carter J.O. (1988). The effect of toxic plants on lamb survival in north-west Queensland. *Working Papers, 5th Biennial Conference, Australian Rangeland Society, Longreach, Queensland, 14 to 17 June 1988*, pp. 37-40.

Cornack, K.M. (1988), Roo farming: a viable alternative, *Proceedings 5th Biennial Conference Australian Rangeland Society, Longreach, 14-17 June 1988* pp 58-61.

Day, J.R., and Silcock, R.G. (1984), *Review of plant introduction in central and south-west Queensland*, Plant introduction and evaluation workshop, Queensland Department of Primary Industries, Conference Series QC85005.

Day, J.R., and Sullivan, M.T. (1985), Management to sustain animal productivity and stability in the mulga zone, *Proceedings of The Mulga Lands Symposium, Royal Society Queensland, Brisbane.*

Dowling, A.J., Webb, A.A. and Scanlan, J.C. (1986), Surface soil chemical and physical patterns in a brigalow - Dawson gum forest, Central Queensland, *Australian Journal of Ecology* **11**, 155-162.

Eady, S.J. and O'Rourke, P.K. (1987), Lambing performance of mature Merino ewes in north western Queensland, *Australian Association of Animal Breeding and Genetics, Perth, Feb 1987* p5.

Evenson, C.J. (1988), A technique to find what stock eat, *Proceedings of 5th Biennial Conference Australian Rangeland Society, Longreach, 14-17 June 1988* pp 147-48.

Filet, P.G. (1988), Pasture management. In N. O'Dempsey (Ed.), *An Introduction to South-west Queensland*, Queensland Department of Primary Industries, Charleville, pp. 16-19.

Filet, P.G. (1988), *Evaluation of animal performance and pasture persistence under continuous stocking of sown pastures on sandy mulga soils (WRDF DAQ08P)*, Final Report to Australian Wool Corporation, Queensland Department of Primary Industries, Charleville Pastoral Laboratory.

Filet, P.G. (1989), Strategic use of cattle for reducing the proportion of white spear (*Aristida leptopoda*) in mitchell grass (*Astrebla* spp.) pastures, In *A.W.C. Review Conference on Weeds, Pests and Diseases, Ballarat*, Australian Wool Development Corporation.

Forster, B.A., Gilbert, E.J. and Passmore, J.G.I. (1988), *Preliminary investigation proposed Cave Hill Dam, Cloncurry*, Queensland Department of Primary Industries, Project Report QO 88014.

Glanville, S. and Mills J.R. (1986), Preliminary observations on run-off from mulga lands in different condition states, *Proceedings 4th Biennial Conference, Australian Rangeland Society, Armidale, August 1986.*

Green, D.R. (1989), Rangeland reclamation projects in western new South Wales, *The Australian Rangeland Journal* **11**, 110-116.

Griffin, G.F. and Friedel, M.H. (1985), Discontinuous change in Central Australia: some implications of major ecological events for land management, *Journal of Arid Environments* **9**, 63-80.

Hall, T.J. (1981), The nitrogen and phosphorus concentrations of some pasture species in the *Dichanthium-Eulalia* grasslands of north-west Queensland, *Australian Rangeland Journal* **3**, 67-73.

Hall, T.J. (1982), Species association in a grassland on a heavy cracking clay soil in north-west Queensland: their structure, soil associations and effect of flooding, *Australian Journal of Ecology* **7**, 249-59.

Hall, T.J. and Lee, G.R. (1980), Response of an *Astrebla* spp. grassland to heavy grazing by cattle and light grazing by sheep in north-west Queensland, *Australian Rangeland Journal* **2**, 83-93.

Hall, T.J., Weston, E.J. and Bishop, H.G. (1987), Adaptation of introduced pasture, shade and crop species on cracking clays (vertisols) in north-west Queensland, *Australian Plant Introduction* Review **19**(1).

Harrington, G.N., Mills, D.M.D., Pressland, A.J. and Hodgkinson, K.C. (1984), Management of semi-arid woodland ecosystems. In G.N. Harrington, A.D. Wilson, and M.D. Young (Eds.), *Management of Australia's Rangelands*, CSIRO, Melbourne, pp. 189-207.

Holmes, W.E. (1983), *Blackall downs economic survey 1972-73 to 1980-81.* Queensland Department of Primary Industries, Rural Information Publication No. **2.**

Holmes, W.E. (1983), Economic surveys in western Queensland resource regions, *Beef Cattle Husbandry Branch Workshop, Yeppoon, June 1983.*

Holmes, W.E. (1985), Economic aspects of mixed sheep and cattle grazing in western Queensland mulga, *Proceedings of The Mulga Lands Symposium, Royal Society of Queensland, Brisbane.*

Holmes, W.E. (1986), *Profitability of western Queensland mixed sheep-cattle grazing properties 1973-73 to 1983-84 (Charleville, Blackall and Julia Creek districts)*, Queensland Department of Primary Industries, Rural Information Publication No. **3**, 1-69.

Holroyd, R.G., O'Rourke, P.K., Clarke, M.R. and Loxton, I.D. (1983), Influence of pasture type and supplement on fertility and liveweight of cows, and progeny growth rate in the dry tropics of northern Australia, *Australian Journal of Experimental Agriculture and Animal Husbandry* **23,** 4-13.

Hughes, P.G. and Christie, E.K. (1983), Ecosystem processes in semi-arid grasslands. III. A simulation model for net primary production, *Australian Journal of Agricultural Research.*

Johnson, R.W. and Burrows, W.H. (1981), *Acacia* tall open forests, woodlands and shrublands. In R.H. Groves, (Ed.), *Australian vegetation*, Cambridge University Press: London.

Johnston P.W. and Carter, J.O. (1986), The role of fire in production systems in western Queensland, *Proceedings of 3rd Queensland Fire Workshop, Gatton.*

Johnston, P.W. and Wilcocks, J. (1988), Rainfall analyses for western Queensland - what do they tell us? *Proceedings of 5th Biennial Conference, Australian Rangeland Society, Longreach, 14-17 June 1988* pp 161-62.

Jones, P., Reynolds, J.A. and Muller, F.W. (1992), *Woody weeds management in western Queensland*, (DAQ 12), Final Project Report to the Australian Wool Corporation.

Lambert, F.J. and Whalley, R.D.B. (1986), Sowing depth requirements of *Astrebla lappacea* (Curly mitchell grass), *Proceedings of 4th Biennial Conference, Australian Rangelands Society, Armidale, August 1986.*

Lee, G.R., Orr, D.M. and Hall, T.J. (1980), Controlling feathertop in the mitchell grass country. *Queensland Agricultural Journal* 106, 521-4.

Lewis, A.J. and Filet, P.G. (1988), Animal production and pasture persistance of sown pasture established on mulga soil, *Proceedings of 5th Biennial Conference, Australian Rangeland Society, Longreach, 14-17 June 1988* pp 167-68.

Lloyd, P.L. (1988), *Plains of promise to fragile heritage: changing perceptions of Queensland's Outback*, Queensland Geographical Journal, Series 4, Volume 2.

Lloyd, P.L. and Burrows, W.H. (1988), The importance and economic value of native pastures in Queensland, In W.H. Burrows, J.C. Scanlan and M.T. Rutherford (Eds.), *Native pastures in Queensland: the resources and their management*, Queensland Department of Primary Industries, Information Series QI87023, pp 1-8.

Lorimer, M.S. (1981), Forage selection studies. 2. Diet quality, liveweight change and wool production of sheep grazing *Astrebla* spp. pastures in NW Queensland, *Tropical Grasslands* **15**, 183-92.

McKeon, G.N., Carter, J.O., Johnston, P.W. and Orr, D.M. (1988), Native pasture production in Queensland - a methodology for research (GUNSYND), *Proceedings of 5th Biennial Conference, Australian Rangeland Society, Longreach, 14-17 June 1988 pp 115-18.*

McLennan, S.R., Beale, I.F., Hendricksen, R.E., Winks, L. and Miller, C.P. (1988), The nutritive value of native pastures. In W.H. Burrows, J.C. Scanlan and M.T. Rutherford (Eds.), *Native pastures in Queensland: the resources and their management*, Queensland Department of Primary Industries, Information Series QI 87023, pp. 115-143.

McMeniman, N.P., Beale, I.F. and Murphy, G.M. (1980), The digestion of mulga nettle (*Halorhagis odontocarpa*) by sheep, *Australian Rangeland Journal* **2,** 214-216.

McMeniman, N.P., Beale, I.F. and Murphy, G.M. (1986), Nutritional evaluation of south-west Queensland pastures. I. The botanical and nutrient content of diets selected by sheep grazing on mitchell grass and mulga/grassland associations, *Australian Journal of Agricultural Research* **37**, 289-302.

McMeniman, N.P., Beale, I.F. and Murphy, G.M. (1986), Nutritional evaluation of south-west Queensland pastures. II. The intake and digestion of organic matter and nitrogen by sheep grazing on mitchell grass and mulga grassland associations, *Australian Journal of Agricultural Research* **37**, 303-14.

McMeniman, N.P., Beale, I.F. and Payne, G. (1989), The nutrient status of sheep grazing on a dry mitchell grass pasture association in central-western Queensland, *Australian Rangeland Journal* **11**, 7-14.

McMeniman, N.P., Kondos, A.C. and Beale, I.F. (1986), Nutritional evaluation of south-west Queensland pastures. III. The amino acid composition of pasture plants in a mitchell grass association and their digestibility by grazing sheep, *Australian Journal of Agricultural Research* **37**, 315-22.

McMeniman, N.P., Niven, D.R., Crowther, D., Gartner, R.J.W. and Murphy, G.M. (1981), Studies on the supplementary feeding of sheep consuming mulga (*Acacia aneura*). 5. The effect of cobalt and cottonseed meal supplementation, *Australian Journal of Experimental Agriculture and Animal Production* **21**, 404-09.

McMeniman, N.P. and Pepper, P.M. (1982), The influence of environmental temperature and rainfall on the water intake of sheep consuming mulga (*Acacia aneura*), *Proceedings Australian Society of Animal Production* **14**, 443-46.

Meppem, A.J. and Johnston, P.W. (1988), Simulation based analysis of income and risk under varying levels of pasture utilization, *Proceedings of 5th Biennial Conference, Australian Rangeland Society, Longreach, 14-17 June 1988*, 87-90.

Miles, R.L. (1989), *Discussion Paper Lands Department: Review of carrying capacity*, Lands Department, Internal Report.

Miles, R.L. (1989), *Soils of Rosebank Research Station, Longreach*, Queensland Department of Primary Industries.

Miles, R.L. (1989), *Monitoring of range condition and soil loss in the western mulga lands of Queensland*, Report to National Soil Conservation Programme, Queensland Department of Primary Industries, (in press).

Miles, R.L. (1989), *A review of the impact of kangaroos on primary production*, Queensland Department of Primary Industries, Internal Publication.

Miles, R.L. and Baker, D.L. (1990), Nutrient status of the western mulga lands of south west Queensland, *Australian Journal of Soil Science.*

Mills, J.R. (1982), *Land degradation in the arid zone of Queensland - interim report*, Queensland Department of Primary Industries, Mimeo.

Mills, J.R. (1985), Degradation and rehabilitation of the mulga ecosystem, *Proceedings of The Mulga Lands Symposium, Royal Society of Queensland, Brisbane.*

Mills, J.R., Boyland, D.E. and Ahern, C.R. (1980), *Western Arid Region Land Use Study - Part 2*, Queensland Department of Primary Industries, Division of Land Utilisation Bulletin No. 22.

Mills, J.R. and Cummins, V.G. (1988), Landscape degradation in native pastures, In W.H. Burrows, J.C. Scanlan and M.T. Rutherford (Eds.), *Native pastures in Queensland: the resources and their management*, Queensland Department of Primary Industries, Information series QI 87023, pp. 157-79.

Mills, J.R., Turner, E.J. and Caltabiano, T. (1989), *Land degradation in south-western Queensland,* Queensland Department of Primary Industries, QO89008.

Monckton, B.I., Stewart, L. and Leach, G.J. (1992), *Rangelands rehabilitation in central and western New South Wales*, Queensland Department of Primary Industries, Study Tour Report QS 92002.

Muller, S. (1992), How cattle are managed in central Queensland, *Paper for 7th Triennial Conference, Australian Rangeland Society, Cobar,* pp 330-332.

Murray, D.M., Schmidt, P.J. and Yeates, N.T.M. (1981), Effects of nutritional state on response of Hereford steers to enforced exercise in a hot environment, *Australian Journal of Agricultural Research* **32**, 149-59.

Myles, D.J., Pressland, A.J. and Fleming, P.D. (1988), Ground cover influences surface runoff in grazing lands of the semi-arid tropics of Queensland, *Working papers, 5th Biennial Conference, Australian Rangeland Society, Longreach, Queensland, 14 to 17 June 1988*, pp. 29-32.

Neldner, V.J. (1991), *Vegetation survey of Queensland - Central Western Queensland*, Queensland Department of Primary Industries, Queensland Botany Bulletin No. 9.

Newman, P.A. (1992), *Profitability of grazing properties on the combined mitchell grass regions*, (DAQ 37), Final report to Australian Wool Corporation.

Newman, P.A. (1992), The impact of changing equity levels and debt structures on western Queensland grazing properties and associated investment issues, *Paper for 7th biennial conference, Australian Rangelands Society, Cobar*, pp 162-168.

Niven, D.R. (1983), Mulga supplementation of sheep in south west Queensland, *Queensland Agricultural Journal* **109**, 207-09.

Niven, D.R. and Entwistle, K.W. (1983), The supplementary feeding of sheep consuming mulga (*Acacia aneura*) with low levels of molasses and urea under field conditions, *Australian Rangeland Journal* **5**, 74-78.

Niven, D.R. and McMeniman, N.P. (1983), Effects of mineral and protein supplements on sheep fed mulga under field conditions, *Queensland Journal of Agricultural and Animal Science* **40**, 67-74.

Novelly, P.E. and O'Rourke, P.K. (1988), Analysis of plant and animal relationships in grazing trials, *Proceedings of 5th Biennial Conference, Australian Rangeland Society, Longreach, 14-17 June 1988*, 53-57.

Orr, D.M. (1980), Effects of sheep grazing *Astrebla* grasslands in central Queensland. I. Effects of grazing pressure and livestock distribution, *Australian Journal of Agricultural Research* **31**, 797-806.

Orr, D.M. (1980), Effects of sheep grazing *Astrebla* grassland in central western Queensland. II. Effects of seasonal rainfall, *Australian Journal of Agricultural Research* **31**, 807-20.

Orr, D.M. (1981), Changes in the quantitative floristics in some *Astrebla* spp. (mitchell grass) communities in south-western Queensland in relation to trends in seasonal rainfall, *Australian Journal of Botany* **29**, 533-45.

Orr, D.M. (1981), Population dynamics in *Astrebla* grassland - implications for drought management, *Proceedings of 3rd Biennial Conference, Australian Rangeland Society, Alice Springs, 1981*, 206-12.

Orr, D.M. (1983), Blackall pasture studies, *Tropical Grasslands* **17**, 42-43.

Orr, D.M. (1983), Effects of stocking intensity on the vegetation, *Tropical Grasslands* **17**, 42-43.

Orr, D.M. (1983), Application of the utilization concept, *Tropical Grasslands* **17**, 44.

Orr, D.M. (1983), White speargrass problem, *Tropical Grasslands Society Newsletter* Jan, 3.

Orr, D.M. (1984), *Methodology for the study of plant population biology in native pastures*, Report of study tour Sept-Dec, 1983, Queensland Department of Primary Industries, Mimeo.

Orr, D.M. (1984), *Grazing management and its effect on reproduction,* Report on terminated project (Australian Wool Corporation K/2/1018) Queensland Department of Primary Industries, Mimeo.

Orr, D.M. (1986), *Factors affecting the vegetation dynamics in Astrebla* spp. *grasslands*, Ph. D. Thesis, University of Queensland.

Orr, D.M. Bowly, P.S. and Evenson, C.J. (1984), Effects of grazing management on the basal area of perennial grasses in *Astrebla* grassland, In P.J. Joss, P.W. Lynch, and O.B. Williams (Eds.), *Rangeland: a resource under siege*, Proceedings of 2nd International Rangelands Congress, Adelaide, Australian Academy of Science: Canberra, pp. 56-57.

Orr, D.M. and Evenson, C.J. (1985), Influence of rainfall and grazing on the vegetation dynamics of a semi-arid grassland in south west Queensland, In J.C. Tothill, and J.J. Mott (Eds.), *Ecology and management of the world's savannas*, Australian Academy of Science: Canberra.

Orr, D.M., Everson, C.J., Jordan, D.J., Bowly, P.S., Lehane, K.J. and Cowan, D.C. (1988), Sheep productivity in an *Astrebla* grassland of south-west Queensland, *Australian Rangeland Journal* **10**, 39-47.

Orr, D.M. and Holmes, W.E. (1984), Mitchell grasslands, In G.N. Harrington, A.D. Wilson and M.D. Young (Eds.), *Management of Australia's rangelands*, CSIRO, Melbourne, pp. 241-54.

Pepper, P.M. and McMeniman, N.P. (1980), Modelling lamb and wool production, *Proceedings of 4th Biennial Conference, Simulation Society of Australia*, 172-78.

Poensgen, M. (1990), Land use and pastoral management in semi-arid Australia - with special reference to two grazing properties: "Coolatai" in CW and "Shelbourne" in SW Queensland, *Diplomarbeit am Geographischen Institut der Eberhard - Karls Universität Tübingen*, 1-291+.

Pressland, A.J. (1980), Regional forage systems - far south western and central western, *Forage crops and regional forage systems in Queensland Workshop, Queensland Department of Primary Industries, 20-22 May, 1980, Toowoomba*, 1-9.

Pressland, A.J. (1981), Drought and the mulga lands of Queensland, *Proceedings of 3rd Biennial Conference, Australian Rangeland Society, Alice Springs*, 168-173.

Pressland, A.J. (1981), Woody weeds in Australian Rangelands: Is prevention easier than cure?. *Proceedings of 6th Australian Weeds Conference, Gold Coast, 1981*, 169-174.

Pressland, A.J. (1982), The effect of water stress on three native mulga grasses and one exotic grass, *Queensland Journal of Agriculture and Animal Husbandry* **39**, 131-140.

Pressland, A.J. (1982), Water use efficiency of three native mulga grasses and one exotic grass, *Queensland Journal of Agricultural and Animal Science* **39**, 177-81.

Pressland, A.J. (1982), Fire in the management of grazing lands in Queensland, *Tropical Grasslands* **16**, 104-12.

Pressland, A.J. (1983), *Land degradation and erosion in western Queensland*, Proceedings of Queensland Department of Primary Industries - Lands Department Workshop, Charleville Pastoral Laboratory Mimeo.

Pressland, A.J. (1984), A review of productivity and management of western Queensland's rangelands, *Australian Rangeland Journal* **6**, 26-45.

Pressland, A.J. (1985), Land degradation in the mulga lands: processes and consequences. *Queensland Agricultural Journal* **111**, 113-15.

Pressland, A.J. (1986), Vegetation dynamics in semi-arid woodland ecosystems, In P.J. Joss, P.W. Lynch and O.B. Williams (Eds.), *Rangelands: a resource under siege*, Australian Academy Science/Cambridge University Press: Canberra, pp. 60-61.

Pressland, A.J. and Cowan, D.C. (1987), Response of plant growth to removal of surface soil of the rangelands of western Queensland, *Australian Rangeland Journal* **9**, 74-78.

Pressland, A.J., Cowan, D.C., Evenson, C.J. and Bowly, P.S. (1986), Benefits of infrequent fire in the mulga (*Acacia aneura*) rangelands of Queensland, In P.J. Joss, P.W. Lynch and O.B. Williams (Eds.), *Rangelands: a resource under siege*, Australian Academy Science/Cambridge University Press: Canberra, p. 608.

Pressland, A.J. and Graham, T.W.G. (1989), Approaches to the restoration of rangelands - the Queensland experience, *The Australian Rangeland Journal* **11(2)**, 101-109.

Pressland, A.J. and Lehane, K.J. (1980), Production and water use of a wiregrass (*Aristida* spp.) pasture in south western Queensland, *Australian Rangeland Journal* **2**, 217-21.

Pressland, A.J. and Lehane, K.J. (1980), Run-off from natural and simulated rainfall in the mulga communities of south western Queensland, *Australian Rangeland Journal* **2**, 217-221.

Pressland, A.J. and Lehane, K.J. (1982), Runoff and the ameliorating effect of plant cover in the mulga communities of south western Queensland, *Australian Rangeland Journal* **4**, 16-20.

Pressland, A.J., McLennan, S.R., Clem, R.L. and Rickert, K.G. (1988), The role of fire in native pasture management, In W.H. Burrows, J.C. Scanlan and M.T. Rutherford (Eds.), *Native pastures in Queensland: the resources and their management*, Queensland Department of Primary Industries, Information Series QI87023 pp. 103-114.

Pressland, A.J., Scanlan, J.C. and McLennan, S. (1981), The role of fire in the grazing lands of Queensland, In B.R. Roberts (Ed.), *Proceedings of 1st Queensland Fire Research Workshop*, DDIAE, Toowoomba, pp. 45-59.

Pritchard, D.A. (1988), Studies on the productivity of high and low producing sheep in western Queensland, *M. Sc. Thesis, Department of Tropical Veterinary Science, James Cook University.*

Pritchard, D.A. and Mills, J.R. (1985), Drought and its significance, *Proceedings of the Mulga Lands Symposium, Royal Society of Queensland, Brisbane.*

Pritchard, D.A., Suter, G. and Stephenson, R.G.A. (1988), Supplementation strategies to improve wool growth of sheep grazing mulga (*Acacia aneura*), *Proceedings of the 5th Biennial Conference Australian Rangeland Society, Longreach, Queensland, 14 to 17 June 1988.*

Pritchard, D.A., Weiden, G.C. and Hopkins, P.S. (1985), The effect of polyethylene glycol on voluntary intake of sheep consuming mulga, *Recent Advances in Animal Nutrition Conference, Armidale.*

Reynolds, J.A. and Carter, J.O. (1990), Woody weeds in central western Queensland. *Proceedings of 6th Australian Rangelands Society Conference, Carnarvan*, pp 304-306.

Rhodes, J. (1985), Beekeeping in south-west Queensland, *Proceedings of The Mulga Lands Symposium, Royal Society of Queensland, Brisbane.*

Roberts, G.M. and O'Rourke, P. (1989), Pests identified by graziers in central western Queensland. *Proceedings of conference - weed, disease and invertebrate pests of Australia's sheep pastures, Ballarat 1989* (Australian Wool Corporation: Melbourne).

Sargent, O.C. and Eady, S.J. (1988), Causes of mulga land degradation and practical options to improve stability - the landholders' perspective, *Proceedings of 5th Biennial Conference, Australian Rangeland Society, Longreach, 14-17 June 1988*, 135-38.

Scanlan, J.C. (1980), Effects of spring wildfires on *Astrebla* (mitchell grass) grasslands in north-west Queensland under varying levels of growing season rainfall, *Australian Rangeland Journal* **2**, 162-68.

Scanlan, J.C. (1983), Changes in tiller and tussock characteristics of *Astrebla lappacea* (curly mitchell grass) after burning, *Australian Rangeland Journal* **5**, 13-19.

Scanlan, J.C. (1984), Aspects of the ecology and management of eucalypt and brigalow communities in central Queensland, *Master of Agricultural Science thesis, University of Queensland.*

Scanlan, J.C. (1986), Influence of the tree basal area on pasture yield and composition, In P.J. Joss, P.W. Lynch and O.B. Williams (Eds.), *Rangelands: a resource under siege*, Australian Academy Science/Cambridge University Press: Canberra, pp. 66-67.

Scanlan, J.C. and O'Rourke, P.K. (1982), Effects of spring wildfires on *Iseilema* (flinders grass) populations in the mitchell grass region of north-western Queensland, *Australian Journal of Botany* **30**, 591-600.

Scanlan, J.C. and Pressland, A.J. (1984), *Major woody weeds of western Queensland and their control*, Queensland Department of Primary Industries, Information Series QI84017, 1-69.

Scattini, W.J., Orr, D.M., Miller, C.P., Holmes, W.E. and Hall, T.J. (1988), Managing native grasslands, In W.H. Burrows, J.C. Scanlan and M.T. Rutherford (Eds.), *Native pastures in Queensland: the resources and their management*, Queensland Department of Primary Industries, Information Series QI87023, pp. 48-65.

Silcock, R.G. (1980), Seedling growth on mulga soils and the ameliorating effects of lime, phosphate fertilizer and surface soil from beneath poplar box trees, *Australian Rangelands Journal* **2**, 142-50.

Silcock, R.G. (1980), Seedling characteristics of tropical pasture species and their implications for ease of establishment, *Tropical Grasslands* **14**, 174-80.

Silcock, R.G. (1981), *Management and development of soft mulga country*, ADAB Course Notes, June, 1981, Queensland Department of Primary Industries, Charleville, 1-7.

Silcock, R.G. (1984), *Plant introduction, evaluation and establishment of introduced and native pasture species*, Report on terminated project Australian Wool Corporation K/2/900 (A). Queensland Department of Primary Industries, Mimeo.

Silcock, R.G. (1985), Agriculture, impact of clearing and pasture introduction, *Proceedings of the Mulga Lands Symposium, Royal Society of Queensland, Brisbane.*

Silcock, R.G. (1986), Strategies for plant introduction and reseeding of semi- arid pastoral lands, In P.J. Joss, P.W. Lynch, and O.B. Williams (Eds.), *Rangelands: a resource under siege*, Australian Academy Science/Cambridge University Press: Canberra, pp. 268-74.

Silcock, R.G., and Beale, I.F., (1986), Complete destocking will not reclaim some Australian rangelands, *Proceedings of 4th Biennial Conference, Australian Rangeland Society, August 1986, Armidale.*

Silcock, R.G., Brown, R.F. and McKeon, G.M. (1988), Effect of plant morphology and physiology on native pasture, In W.H. Burrows, J.C. Scanlan and M.T. Rutherford (Eds.), *Native pastures in Queensland: the resources and their management*, Queensland Department of Primary Industries, Information Series QI 87023, pp. 31-47.

Silcock, R.G. and Smith, F.T. (1981), Phosphate fertilizer coats for buffel grass sown on infertile soils, *Proceedings 3rd Biennial Conference, Australian Rangeland Society, Alice Springs pp 142.*

Silcock, R.G. and Smith, F.T. (1982), Seed coating and localised application of phosphate for improving seedling growth of grasses on acid, sandy red earths, *Australian Journal of Agricultural Research* **33**, 7785-802.

Silcock, R.G. and Smith, F.T. (1983), Soluble oxalates in summer pastures on a mulga soil, *Tropical Grasslands* **17**, 169-181.

Silcock, R.G. and Smith, F.T. (1984), Storage life of fertilizer coated *Cenchrus ciliaris* seed, *Proceedings of Australian Seeds Research Conference, Lawes, Sept. 1984*, pp 324-327.

Silcock, R.G. and Smith, F.T. (1984), Soils on which buffel grass seedlings respond to phosphate fertilizer, *Queensland Journal of Agricultural and Animal Science* **41**, 49-55.

Silcock, R.G., Williams, L.M. and Smith, F.T. (1985), Seasonal distribution of dry matter from sandplain mulga country, Charleville, *Australian Rangeland Journal* **7**.

Skerman, P.J., Fisher, A.E. and Lloyd, P.L. (1988), *Guiding Queensland Agriculture 1887 - 1987*, Queensland Department of Primary Industries.

Smith, F.T., Crowther, D.E., Bowly, P.S., Evenson, C.J., Lehane, K.J., Beale, I.F., Roberts, B.R. and Burrows, W.H. (1986), A photographic record of vegetation changes in two semi-arid woodlands, In J.C. Tothill and J.J. Mott (Eds.), *Ecology and management of the world's Savannas*, Australian Academy of Science: Canberra, p. 37.

Smith, F.T. and Silcock, R.G. (1986), Guidelines for new plant introduction research projects in semi-arid rangelands, In P.J. Joss, P.W. Lynch and O.B. Williams (Eds.), *Rangelands: a resource under siege*, Australian Academy of Science /Cambridge University Press: Canberra, pp. 308-09.

Stephenson, R.G.A., Martin, P., Pritchard, D.A., Cobon, D.H. and Sullivan, M. (1986), The value of native pasture hay in western Queensland, *Proceedings of Australian Society of Animal Production* **16**, 363-66.

Stephenson, R.G.A., Pritchard, D.A., Pepper, P.M. and Connelly, P.T. (1985), The effect of different pasture management strategies in north-west Queensland on liveweight gain and wool growth rate of several groups of young sheep, *The Australian Rangeland Journal* **7(2)**, 75-79.

Strachan, D.B., Pritchard, D.A., Clarke, M.R. and O'Rourke, P.K. (1988), Effect of polyethylene glycol:tannin ratio on dry matter intake and digestibility of mulga leaves by steers, *Proceedings of 5th Biennial Conference, Australian Rangeland Society, Longreach, 14-17 June 1988*, 177-78.

Sullivan, M.T. (1984), The role of fire in the control of woody weeds, *Proceedings of Woody Weed Control Workshop, Gympie, The Weed Society of Queensland Part 3.*

Sullivan, M.T. (1984), Use of woody weed monitoring sites, *Proceedings of Woody Weed Control Workshop, Gympie, The Weed Society of Queensland Part 4.*

Sullivan, M.T., Cowan, D.C. and Pressland, A.J. (1987), Management of shrub control burns in western Queensland, In B.R. Roberts (Ed.), *Proceedings of 2nd Queensland Fire Research Workshop*, DDIAE, Toowoomba.

Sullivan, M.T., Day, J.R., Clarke, M.R. and Dunlop, L.B. (1985), Management to sustain animal productivity and stability in the mulga zone, *Proceedings of the Mulga Symposium, Royal Society of Queensland, Brisbane.*

Sullivan, M.T. and Pressland, A.J. (1988), The effects of fire on woody weed control and composition of ground flora in south-western Queensland, *Queensland Department of Primary Industries, Report on Terminated Project W.R.D.F. DAQ03P* : 1-48.

Weston, E.J. and Thompson, P.J. (1988), Medics and other legumes selected for the red and black soils, *Australian Institute of Agricultural Science No. 36. Pastures for the Nineties Seminar, Moree.*

Wilson, A.D., Harrington, G.N. and Beale, I.F. (1984), Grazing management, In G.N. Harrington, A. D. Wilson and M.D. Young (Eds.), *Management of Australia's rangelands*, CSIRO: Melbourne, pp. 63-78.

Wilson, K.J., Edwards, J.C. and Scanlan, J.C. (1980), Supplementing weaner sheep in north-west Queensland, *Queensland Agricultural Journal* **106**, 2-5.

Young, M.D., Gibbs, M., Holmes, W.E. and Mills, D.M.D. (1984), Socio-economic influences on pastoral management, In G.N. Harrington, A.D. Wilson and M.D. Young (Eds.), *Management of Australia's rangelands*, CSIRO: Melbourne.

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	1	2	3	4	5	6	7	8	9	10	11
A	*Table 1* Org. C	*Table 13* EC	*Table 21* Exch. Na	*Table 28* –⅓ Bar	Soil group G	Soil group F,G	*Table 55* Bicarb. P	*Table 67* Total K	*Table 74* Silt	SPC A2	SPC I1
B	"	*Table 14* Chloride	"	*Table 29* –15 Bar	Soil group G	Soil group G,H	"	"	*Table 75* Fine Sand	SPC A2	SPC K3
C	*Table 2* Total N	"	*Table 22* CEC	"	Soil group H	Soil group H,I	*Table 56* Exch. K	*Table 68* Total S	"	SPC B1	SPC K3,all
D	"	*Table 15* Field pH	"	*Table 30* Available soil water	Soil group H	Soil group J,K	"	"	*Table 76* Coarse Sand	SPC B1	SPC A1,A2
E	*Table 3* Rep. K	"	*Table 23* Clay	"	Soil group I	Soil group L,M	"	*Table 69* Exch. Ca	"	SPC C1	SPC A2,B1
F	"	*Table 16* Total P	"	ANALYSIS SUMMARY	Soil group I	Soil group all data	*Table 62* pH 1:5	"	*Table 77* Air Dry Moisture	SPC C1,D1	SPC B1,C1
G	*Table 4* Acid P	"	*Table 24* Silt	Soil group A	Soil group J	**SPC'S**		*Table 70* Exch. Mg	"	SPC D1,F3	SPC C2,D1
H	"	*Table 17* Total K	"	Soil group B	Soil group J,K	*Table 51* Org. C	*Table 63* EC	"	*Table 78* –⅓ Bar	SPC F3	SPC E2,F3
I	*Table 5* Bicarb. P	"	*Table 25* Fine Sand	Soil group B	Soil group K,L	*Table 52* Total N	"	*Table 71* Exch. Na	"	SPC F3,F5	SPC F3,F4,F5
J	"	*Table 18* Total S	"	Soil group C	Soil group L,M	"	*Table 64* Chloride	"	*Table 79* –15 Bar	SPC F5	SPC F5,G1
K	*Table 6* Exch. K	"	*Table 26* Coarse Sand	Soil group C	Soil group M	*Table 53* Rep. K	"	*Table 72* CEC	"	SPC F5,G1	SPC G1,H1
L	"	*Table 19* Exch. Ca	"	Soil group D,E	Soil group all data	"	*Table 65* Field pH	"	*Table 80* Available soil water	SPC G1	SPC I1,J1
M	*Table 12* pH 1:5	"	*Table 27* Air Dry Moisture	Soil group E	Soil group A	*Table 54* Acid P	"	*Table 73* Clay	"	SPC G1,H1	SPC J1,K2,K3
N	"	*Table 20* Exch. Mg	"	Soil group F	Soil group B,C	"	*Table 66* Total P	"	ANALYSIS SUMMARY SPC A1	SPC H1	SPC L1,all
O	*Table 13* EC	"	*Table 28* –⅓ Bar	Soil group F	Soil group C,D,E	"	"	*Table 73* Silt	SPC A1	SPC H1,I1	

Table prepared by Craig Eldershaw