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An inventory and condition survey of rangelands in the Ashburton River catchment, Western Australia

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Commissioned by the Pastoral Appraisement Board, Perth, Western Australia, 1975

AN INVENTORY AND CONDITION SURVEY OF RANGELANDS IN THE ASHBURTON RIVER CATCHMENT, WESTERN AUSTRALIA

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By: A. L. Payne, A. A. Mitchell and W. F. Holman
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CONTENTS

SUMMARY AND RECOMMENDATIONS

1. The area surveyed covers approximately 93 600 square kilometres and includes the catchment of the Ashburton River and part of the catchment of the Yannarie River. All of the Turee Creek and parts of the Onslow, Yanrey, Winning Pool, Wyloo, Edmund, Mt. Bruce, Mt. Egerton, Newman and Collier 1:250 000 map sheets are included.
2. The area is described in terms of climate, geomorphology, soils, pasture lands and land systems. Land system maps at 1:250 000 scale are presented.
3. Condition statements are presented for the whole survey area and for each land system, pasture land and station within the survey area.
4. Carrying capacity estimations for the pasture lands of the area, at three condition levels, are presented. These estimations are based on current knowledge of the pastures. They were used for calculating the recommended carrying capacity for present condition and the capability carrying capacity for original condition of each station.
5. About 65 per cent (61 130 sq. km) of the area is alienated into thirty pastoral leases grazing sheep and/or cattle. The remaining 35 per cent (32 470 sq. km) consists of reserves of various kinds and of vacant crown land which is unsuitable for pastoral purposes.
6. Of the alienated country, about 9.3 per cent (5 700 sq. km) is in bad range condition. Pastures are degraded to poor or very poor condition and soil erosion is common. Regeneration programmes, involving deferrment of grazing over growing seasons and complete control of stocking intensity at other times, are required.

   Within the country in bad range condition it has been possible to identify areas showing extreme landscape deterioration with severely degraded pastures and/or moderate or severe erosion. The total area in this category is 534 sq. km or 0.9 per cent of the alienated country. These areas are of considerable concern and special rehabilitation treatments, including complete withdrawal from use, are required.

   The extent and geographic location of the areas of extreme degradation are shown on the 1:250 000 land system maps.

   About 27 per cent (16 470 sq. km) is in fair range condition and 63.7 per cent (38 960 sq. km) is in good range condition.
7. The worst areas of degradation and erosion are on the most valuable pasture lands. These areas are readily accessible, close to permanent water supplies, and supported attractive pastures. They received preferential overuse in the early days of settlement and sensitive parts are now seriously degraded.
8. Stock numbers in the survey area peaked in 1934 at more than 800 000 sheep equivalents and from then until 1978, fluctuated between about 300 000 and 500 000 sheep equivalents. Stock numbers at the present time (1979) are about 252 000 sheep equivalents which is the lowest since records commenced in 1910.
9. The recommended livestock capacity **for present condition of all stations within the survey area,** is 368 800 sheep equivalents which is well above the actual numbers present (see 8 above). As a generalisation, the overall survey area is currently understocked due to the effects of seasonal conditions and the fact that some marginal properties are semi-abandoned and virtually without stock. A few stations are overstocked for present condition or need to distribute their existing stock more widely by providing additional watering points on undeveloped country.
10. Reports on each station describing land systems, pasture types, range condition, areas with severe degradation problems (if any), recommended carrying capacities for present and original condition and management methods are presented. Individual station maps at 1:100 000 scale showing land systems, areas of severe degradation, paddocks, tracks, watering points etc, have been compiled.
11. In order to promote recovery of the seriously degraded areas, co-operative programmes for rehabilitation should be planned and undertaken by station lessees and the Department of Lands and Surveys with assistance from the Department of Agriculture. These programmes will involve fencing, reductions in stock numbers or complete removal of stock in certain areas and cultivation and seeding in some parts.
12. Government assistance in the form of low interest rate loans for fencing, physical and technical assistance with cultivation works and possibly subsidised purchase of seed will be required to implement programmes recommended in 11 above.
13. An adequate network of range condition monitoring sites will need to be set up by Government on areas under rehabilitation and elsewhere on stations in order to measure the long term trends in range condition. Data obtained from this surveillance network will determine when severely degraded land can be again used and whether stock numbers on leases need to be adjusted in response to changes in range condition.

INTRODUCTION

As part of a continuing programme of pastoral land classification and evaluation, the survey of the Ashburton River Catchment reported here was commissioned in 1975 by the Pastoral Appraisement Board. This is the fourth survey of its type, the others having been undertaken in the Gascoyne River catchment (Wilcox and McKinnon 1972), the Fitzroy River catchment (Payne *et al* 1979) and on the Nullarbor plain (Mitchell *et al* 1979).

The Ashburton River catchment came to attention in 1973 following adverse reports of vegetation and soil conditions and the Pastoral Appraisement Board decided that a joint survey by personnel from the Department of Lands and Surveys and the Department of Agriculture would be undertaken.

Guidelines deciding the survey area were as follows —

- The survey would cover all stations in the Ashburton River catchment.
- Where stations were only partly within the catchment the full station would be surveyed wherever possible. This would allow recommendations to be made on a full station basis rather than on only part of the station.

Preliminary photograph interpretation work commenced in early 1976 and a reconnaissance survey through the whole catchment was undertaken in June 1976. The main field work involved seven trips each of approximately six weeks duration. One trip was undertaken in 1976, four in 1977 and two in 1978.

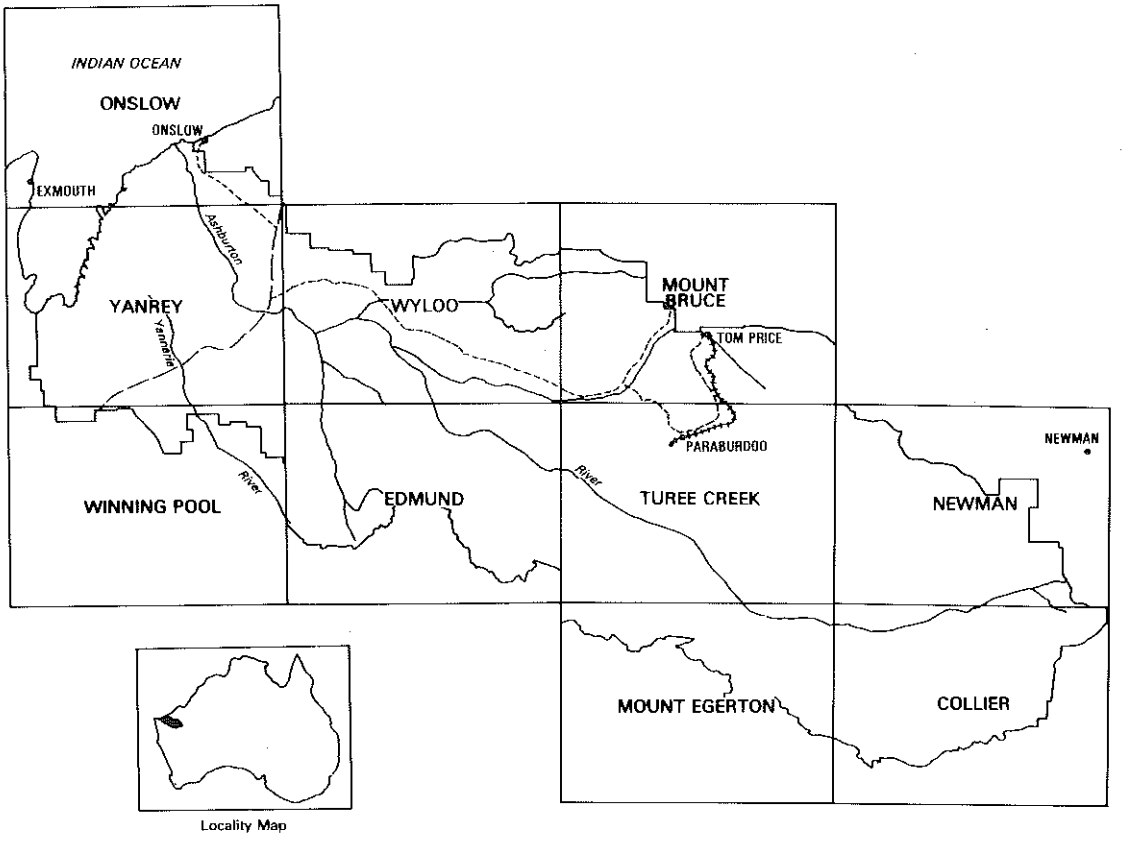
The aims of the survey were to:—

- Describe the catchment on a land system, land unit and pasture land basis.
- Map the catchment and individual stations on a land system and pasture land basis at 1:250 000 and 1:100 000 scale.
- Define and map the extent, location and severity of erosion and pasture degradation.
- Prepare reports on each station in the catchment describing land systems, pasture lands, erosion, pasture condition, optimum carrying capacity and recommended carrying capacity for present condition.
- Describe regeneration needs if required in terms of stock control and range management practices for each station.
- Select and lay out sites to be used to monitor range conditiou and trend in the future.
- Formulate Range Condition Guides for each land system on a pasture land basis to define:
  - (i) the optimum condition in terms of soil and vegetation.
  - (ii) the types of erosion and pasture composition trends likely to be encountered on the various pasture lands at different condition levels
  - (iii) the carrying capacity of each pasture land at different levels
  - (iv) desirable management practices

The area surveyed covered approximately 93 600 sq. km and is shown in Figure 1.

It included the catchments of the Ashburton River and Rous Creek, part of the catchment of the Yannarie River and the coastal strip from and including Marrilla Station in the south to the mouth of the Ashburton River in the north. Ten 250 000 map sheets were involved as a whole or in part. These were: Onslow, Wyloo, Mt. Bruce, Newman, Yanrey, Edmund, Turee Creek, Collier, Winning Pool and Mt. Egerton.

Figure 1 — Ashburton Survey Area showing 1:250 000 map sheets



SURVEY METHODS

This survey adopted the land system approach to resource description and evaluation as has been used for land surveys by CSIRO and for previous Western Australian Rangeland Surveys commissioned by the Pastoral Appraisement Board (Wilcox and McKinnon 1972, Payne *et al* 1979, Mitchell *et al* 1979).

Christian and Stewart (1953, 1968) define a land system as "an area or group of areas throughout which there is a recurring pattern of topography, soils and vegetation". Each land system has a characteristic pattern ou aerial photographs and is therefore a convenient mapping unit. Land systems consist of a number of smaller land units or elements each of which has a distinct photographic pattern. The relative proportion of the component units and their arrangement one to the other gives the overall photographic pattern which characterises the particular land system.

Preliminary office work on the survey involved drawing up tentative land system boundaries on 1:40 000 scale black and white aerial photographs of the area of interest. The preliminary photograph interpretation was followed by four weeks reconnaissance through the whole of the survey area in June 1976. This trip familiarised the survey party with the range of landscape and vegetation expressions found in the area and gave a broad overview of their condition. Tentative land system descriptions were drawn up. A number of broad pasture lands were defined and sampling and condition assessment methods to be used on the main survey clarified. More than 200 plant specimens were collected for later identification and preparation into field herbaria for use during the main survey.

The main field work commenced with one trip in late 1976. Four trips were undertaken in 1977 and two in 1978 and each trip lasted approximately six weeks. Land systems seen during each field session were further checked and delineated by additional photographic interpetation work undertaken in the office between trips. Land system boundaries were transferred to photograph scale chronoflex compilation sheets to be used later in the preparation of the 1:250 000 land system maps. Detailed descriptions of the land systems of the area are presented later in this report.

Basic field techniques were similar to those used in previous surveys and involved collecting data at fixed, pre-selected range sites or "query" points and whilst traversing. At the query sites, detailed information was collected on geomorphology, soils and vegetation. Traversing enabled rapid collection of erosion and pasture condition data on a land system by land system and station by station basis.

RANGE SITE METHOD

Sites were initially selected by examination of the various distinctive patterns on the aerial photographs. The sites were then visited on the ground where they could be identified as units of particular land systems. Site characteristics in terms of geomorphology, soil and vegetation were described and quantified. At each site care was taken to ensure that sampling was confined to the one selected pattern or land unit.

As many as possible of the photographic patterns were investigated in order to give a complete breakdown of the component patterns or units which went to make up the particular land system. Each pattern was investigated a number of times. This verified its repeatability in terms of the landscape unit and vegetation. It also obtained a measure of the range of expression of vegetation and erosion characteristics found at different condition levels.

Each site was permanently marked on the aerial photographs so that, if necessary, positive re-identification could be made at a future time. A ground photograph was taken at each site to complete the record.

At each site information was collected on —

- geomorphology
- soils and
- vegetation

and entered directly onto computer data preparation sheets. The data preparation sheets were modifications of those designed and used by Dawson *et al* (1974) for survey work in Queensland.

Geomorphology

This information was required in order to build up a general picture of the landscape, topography, soils and dominant vegetation of the various land units and for compiling final land system descriptions and block diagrams.

Data recorded included station name, rainfall, land system, land unit, land form, slope, relative relief, microrelief, geology, soil type and a vegetation summary. The erosion status of the site was recorded and a grazing capacity estimate made for present condition. A number of land use limitations (for pastoral purposes) were assessed and the distance to nearest stock water recorded.

Soils

The soil at each site was sampled to 1 m by means of a 50 mm auger and classified using Northcote's (1971) system.

Additional information such as surface characteristics, drainage, runoff, soil layers, consistency, pH and inclusions were recorded. Soil samples (0 to 10 cm) were taken from most sites for analysis for total soluble salts, nitrogen and phosphorus.

Vegetation

All vegetation species present on the site were recorded as major perennial species, major annual species or other species and the number of all major perennial species per hectare were determined by counting those present within three 100 m by 2 m wide transects. Total trees, total tall shrubs and total low shrubs per hectare were also recorded.

Projected foliage cover of major perennial species (except grasses) was recorded using the method described by Cooper (1963). The basal cover of perennial grasses was measured using a wheel point apparatus modified from that described by Tidmarsh and Havenga (1955). The height class, form, desirability and frequency of seedlings or young age class plants was recorded for all major perennials.

Other data recorded included the amount of litter present, the broad pasture group into which the site fell, the production potential and the overall condition of the site.

A total of 712 range sites on 60 land systems were

evaluated during the survey. All sites are shown on the 1:250 000 map sheets.

TRAVERSE METHOD

A traverse method was used to give comprehensive cover and a large number of condition assessments on each station. The method involved being accurately positioned on the aerial photographs at all times and visually assessing erosion and pasture condition from the vehicle while in motion. Traverse speed was 40km/hour or less. At this speed erosion assessments and species identification could be made with a high degree of confidence.

Whenever station boundaries or land system boundaries were crossed whilst traversing this was noted and, in the case of land system boundaries, checked with the previously interpreted boundaries on the photographs.

At each kilometre the land system and the land unit was recorded and the country given a numerical rating for wind erosion (four levels), water erosion (four levels), and pasture condition (five levels). These ratings actually referred to the piece of country seen over about the last 200 m of each kilometre. Two assessors were used at all times and agreement was necessary before the ratings were recorded.

The erosion and pasture condition ratings used during traversing were defined as follows:

Wind erosion

Severity	Rating	Comment
Nil	0	**No erosion**
Minor	1	**Litter build up and small scalds.** Small isolated scalds on which the surface shows some degree of polishing. Re-distribution of soil to the margins of the scald, or minor build up of soil material around obstacles.
Moderate	2	**Large isolated scalds and hummocks.** Stripping of the soil surface and build up against obstacles associated with large but generally discontinuous scalds; or, numerous small scalds scattered throughout the site.
Severe	3	**Major deflation of soil surface.** Active stripping resulting in large continuous scalds with polished and sealed surfaces. Frequent large hummocks against obstacles. In sandy systems major dune drift. Plant cover very sparse to absent.

Water erosion

Severity	Rating	Comment
Nil	0	**No erosion**
Minor	1	**Rilling or thin sheeting.** Patchy rilling and small gullies affecting small areas or thin sheeting (1 to 2 cm) and breaking of the surface seal on parts of the site. Some re-distribution of soil and litter downslope. Much undistributed ground between affected areas.
Moderate	2	**Gullies and/or sheeting on lower slopes.** Gullies on the lower slopes or more susceptible parts of the site, these being capable of extension to less susceptible areas. The gullies may be associated with extensive but discontinuous disturbance of the soil surface by sheet erosion and redistribution of soil material.
Severe	3	**Terracing or extensive gullies.** Severe sheeting or terracing affecting nearly all of the site. Redistribution of soil and exposure of sub-soil or rock material. The sheeting may be associated with or replaced by very extensive gullying over most of the site.

Pasture Condition

Rating	Comment
1	**Excellent pasture condition** Nearly all plants present are desirable species and ground cover is optimum for the site.
2	**Good pasture condition** Most plants present are desirable with intermediate perennials and annual types increasing in frequency; a few undesirable species may be present.
3	**Fair pasture condition** Intermediate value species usually predominate; desirable and undesirable species occupy similar proportions of the available ground space.
4	**Poor pasture condition** Undesirable and intermediate species predominate in the stand; desirable species are very infrequent and may occur only in small patches. The overall stand may be sparse with ground cover well below optimum for the site.
5	**Very poor pasture condition** Undesirable species or bare ground predominates; there are few intermediate species and virtually no desirable species in the stand.

A total of 8 608 traverse recordings on 62 land systems were made during the survey. One land system, Wona, was not traversed although it was visited on foot.

ANALYSIS OF THE FIELD DATA

The evaluation site data were collated and summarised on a land system basis using a simple sort-merge programme on the Cyber 72 computer at the University of W.A. computing centre. This information was used to draw up detailed land unit and land system descriptions which are presented later in this report.

The vegetation data were sorted and summarised using the Cyber 72 computer and this information used to assist in the preparation of Range Condition Guides for the Ashburton River catchment (Payne and Mitchell, in prep.)

The traverse data were also sorted on the Cyber 72 computer. The print out sheets (unpublished data) showed the number of recordings and percentages in each category of wind erosion (four levels), water erosion (four levels) and pasture condition (five levels) for each land system and its component land units. In addition expressions for total erosion and range condition were derived from the basic data. Print out sheets were produced showing condition statements for —

- each land system and its component land units on each station
- each station as a whole
- each land system and its component land units within the whole survey area
- the whole survey area

Total erosion

Total erosion was derived by combining the wind and water erosion traverse recordings into rational groupings as shown in Table 1.

Total erosion on each land system (and on each land unit of each system) was expressed as the percentages falling into nil, minor, moderate and severe categories as shown in Table 2.

Range condition

Assessments of overall range condition or range "health" were made by taking into account the condition of the two basic range resources — soil and

Table 1 — Derivation of total erosion

Wind erosion	+ Water erosion	= Total erosion	Rating
Nil	+ Nil	= Nil	0
Nil	+ Minor		
Minor	+ Nil	= Minor	1
Minor	+ Minor		
Nil	+ Moderate		
Minor	+ Moderate		
Moderate	+ Nil	= Moderate	2
Moderate	+ Minor		
Nil	+ Severe		
Minor	+ Severe		
Moderate	+ Severe		
Moderate	+ Moderate	= Severe	3
Severe	+ Nil		
Severe	+ Minor		
Severe	+ Moderate		
Severe	+ Severe		

Table 2—Total erosion as derived from wind and water erosion data—Land system: Firecracker

No. of recordings	Wind erosion (%)			
	Nil	Minor	Moderate	Severe
46 (total)	93	7	—	—
	Water erosion (%)			
	80	13	2	4
	Total erosion (%)			
	74	20	2	4

pasture. For the purposes of this report three levels of range condition were selected. These levels were termed good, fair or bad and were derived by combining total erosion and pasture condition data obtained on traverse into rational groupings as shown in Tables 3, 4 and 5.

Table 3 — Derivation of good range condition

Total erosion	+ Pasture condition	= Range condition
Nil	+ Excellent	
Nil	+ Good	
Minor	+ Excellent	= Good
Minor	+ Good	

Table 4 — Derivation of fair range condition

Total erosion	+ Pasture condition	= Range condition
Nil	+ Fair	
Nil	+ Poor	
Minor	+ Fair	
Minor	+ Poor	= Fair
*Moderate	+ Excellent	
*Moderate	+ Good	

* Combinations not encountered in the field — although theoretically possible they are unlikely to be encountered.

An example of a full print out sheet showing wind erosion, water erosion, total erosion, pasture condition and range condition for all land units of a particular land system on one station is shown in Table 6.

Table 5 — Derivation of bad range condition

Total erosion	+ Pasture condition	= Range condition
Nil	+ Very poor	
Minor	+ Very poor	
Moderate	+ Fair	
Moderate	+ Poor	
*Severe	+ Excellent	= Bad
*Severe	+ Good	
*Severe	+ Fair	
Severe	+ Poor	
Severe	+ Very poor	

*Combinations not encountered in the field

The traverse data print out sheets were used for preparing condition statements for the individual station reports which are presented later in this report. They were also used for preparing general condition statements for each land system which are presented later.

MAP PREPARATION

The final map production for previous surveys has been extremely labour intensive and time consuming. Newly acquired equipment (Gradicon digitiser) capable of transforming maps from graphic form to digital form was available and it was decided to produce the plans to calculate areas of land systems using this semi automated means.

The final boundaries of land systems and the traverse date were transferred onto transparent line compilation maps at photograph scale (1:40 000). This information was then digitised using the Gradicon, with each feature and line being identified by an alpha-numeric code. The data captured in this manner were then sorted and recognised by the computer into two separate formats, one for area calculations and the other for map plotting. The area of each land system for each pastoral lease was supplied and the map information replotted by machine at a scale of 1:250 000.

The 1:250 000 plots were photographically merged with the relevant base plans to provide the necessary topographic and cadastral detail. A descriptive key for the land systems was added using normal cartographic means. Each map sheet was then printed in a three colour format.

Individual station plans at 1:100 000 scale were produced by enlargement of the 1:250 000 maps and the addition of other relevant detail.

Table 6 — Example print out sheet

	No. of Recs	Wind erosion (%)				Water erosion (%)				Total erosion (%)				Pasture condition (%)					Range condition (%)		
		Nil	Min.	Mod.	Sev.	Nil	Min.	Mod.	Sev.	Nil	Min.	Mod.	Sev.	Exc.	Good	Fair	Poor	Very Poor	Good	Fair	Bad
Station — Giralia																					
Land system — Donovan																					
Unit — Calcrete platform	1	100	0	0	0	100	0	0	0	100	0	0	0	0	100	0	0	0	100	0	0
Unit — Wide drainage	12	100	0	0	0	75	25	0	0	75	25	0	0	0	17	50	33	0	17	67	17
Unit — Lower footslope	3	100	0	0	0	100	0	0	0	100	0	0	0	0	100	0	0	0	100	0	0
Unit — Alluvial plain	20	100	0	0	0	95	0	5	0	95	0	5	0	60	20	15	0	5	80	15	5
Unit — Gibber plain	6	100	0	0	0	100	0	0	0	100	0	0	0	0	50	50	0	0	50	50	0
Unit — Plain unspecified	23	87	13	0	0	70	26	4	0	65	30	4	0	9	0	17	39	35	9	43	48
Total	65	95	5	0	0	83	14	3	0	82	15	3	0	22	20	25	20	14	42	37	22

CLIMATE

INTRODUCTION

Meigs (1953) classifies the whole survey area as arid. Mabbutt (1969) describes the area as mountain and piedmont desert and sand desert and Beard (1975) refers to the climate as tropical desert receiving summer rain.

The area lies between the winter rainfall parts of the State to the south and summer rainfall parts to the north and the weather is dominated by dry anticyclonic high pressure cells which constantly traverse from west to east.

Annual rainfall varies from about 270mm near the coast to 210 mm in the east but is extremely irregular and unreliable especially in inland parts. About 60 to 70 per cent of total rainfall is received during the summer months from cyclones and thunderstorms. However, despite more rain falling in summer than in winter, an analysis of rainfall data shows that effective rain for plant growth occurs more often in winter than in summer.

Day temperatures are generally warm during winter and hot to very hot during summer whilst nights are generally cool to cold in winter and warm in summer.

MAJOR CLIMATIC PATTERNS

Summer patterns (November — April)

The summer season is characterised by prolonged periods of very hot, dry conditions created by the constant progression of anticyclones from west to east to the south of the survey area and the very high radiation receipts at this time of the year.

Hot, dry summer conditions are occasionally broken by thunderstorms or tropical cyclones. Thunderstorms develop as a result of convectional activity and produce only localised falls of rain. Tropical cyclones, developing over the Timor Sea and travelling in a southerly direction, usually cross the coast in the Kimberley or Pilbara regions, but occasionally travel further south and reach the survey area. Large amounts of rain fall in very short periods as a result of cyclone activity. For example — Paraburdoo received 166 mm in 24 hours from tropical cyclone Joan in December 1975. Rainfall of this type causes massive run off from the hills and consequent inundation of low lying areas and flood plains adjacent to the major rivers.

Winter patterns (May — October)

During the winter the anticyclone belt is usnally centred at about the latitude of the survey area and conditions are fine and warm during the day and cool at night. Radiation receipts are much less at this time of year than in summer and inland and upland areas may have occasional radiation frosts during cloudless nights.

Cool, dry winter conditions are sometimes broken by the incursion into the area of rain-bearing depressions from the sonth. These depressions do not consistently penetrate so far north every winter and hence the unreliable nature of the rainfall. Winter rains sometimes occur by the interaction of southern depressions with middle level disturbances moving through from the tropics.

SOURCES OF CLIMATIC DATA

Onslow township and Nyang station are the only two official Bureau of Meteorology climate stations (apart from Paraburdoo and Tom Price which have only been operational for a very short time), within the survey area and both are situated in the far west of the area. Three official stations at Meekatharra, Newman and Wittenoom, with relatively long records are close to the southern, eastern and northern boundaries respectively of the survey area. Climatic data from these stations has been used to help describe the climate of the survey area east of Nyang.

In addition to the official climate stations, nearly all pastoral stations in the area keep rainfall records and submit these to the Bureau of Meteorology. Rainfall records from some stations are continuous for over 65 years; other records are shorter or discontinuous. Records from individual stations were examined and used to describe the rainfall of the survey area.

CLIMATIC FACTORS

Rainfall

The area receives low and erratic rainfall because it lies at the interface of the arid tropics to the north and the winter rainfall areas to the south. It receives rain from both areas but not on a regular basis.

Average annual rainfall at a number of pastoral stations within the survey area is shown in Figure 2. Mininer station in the central east of the area has the lowest annual average (198 mm) and Mt. Stuart station in the north west has the highest (315 mm).

Central parts of the area receive less rain than either eastern or western parts. There is a steady increase in rainfall down the Ashburton River valley from Mininer station through to Ashburton Downs station (209 mm) and Kooline station (243 mm) to Wyloo and Nanutarra stations (both 284 mm) nearer the coast.

The area receives more summer rain than winter rain and February is the wettest month at each of the five stations examined (see Tables 7 and 8). In the west of the survey area rainfall declines in March and April following the summer peak and then peaks again during the winter months May and June. In the east of the area no secondary winter peak occurs. In all parts of the survey area rainfall rapidly falls off during July and August and is negligible between September and November.

Rainfall variability throughout the survey area is very high and average rainfall figures are of little value unless variability is also defined. For example, the mean annual rainfall at Kooline station is 243 mm, but the records show a minimum of 34 mm in 1936 and maximum of 596 mm in 1942.

Rainfall variability for each station was expressed by calculating monthly standard deviations for each station. This showed that variability was high but differed little between stations. We therefore averaged the monthly coefficient of variation for all stations and this is presented in Figure 3. This shows that rainfall over the summer and winter months is the least variable and rainfall in the dry spring months the most variable. However, in no month is the coefficient of variation less than 100 per cent.

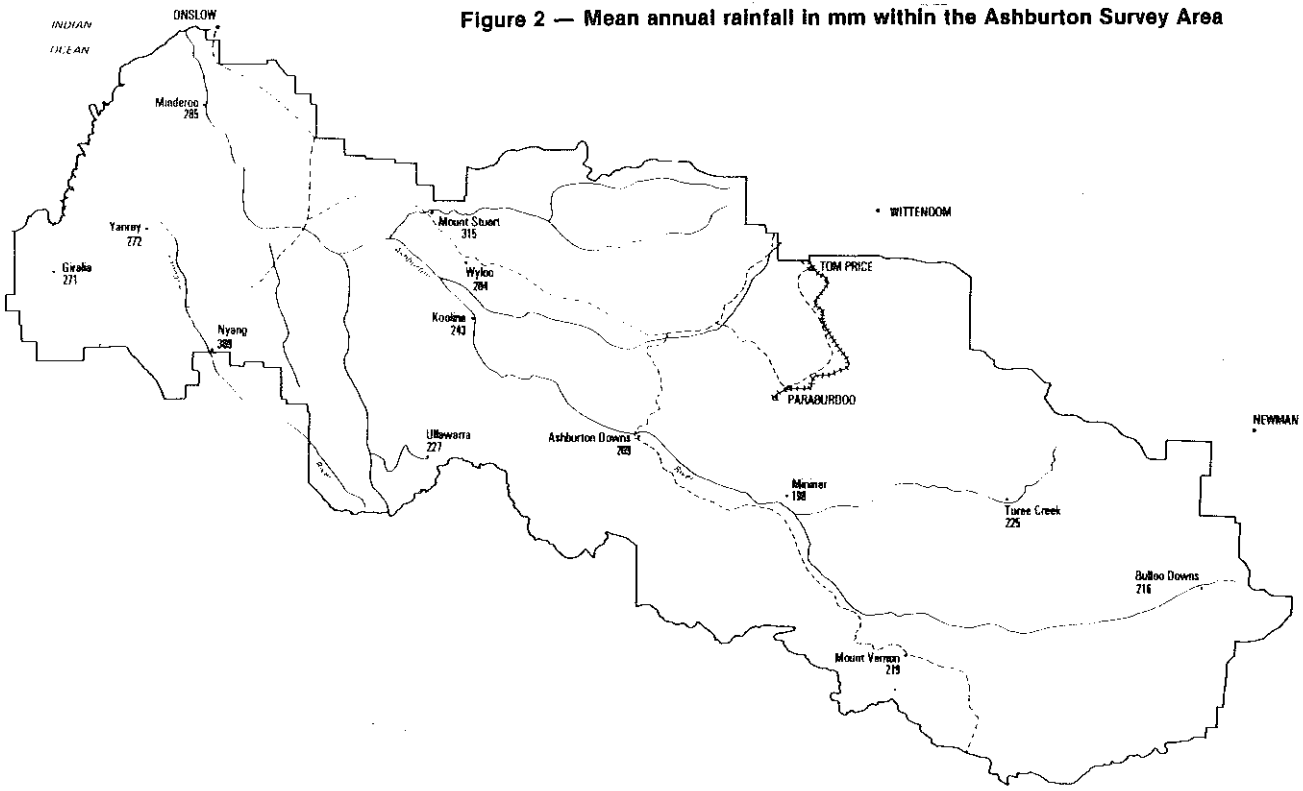


Figure 2 — Mean annual rainfall in mm within the Ashburton Survey Area

Table 7 — Mean monthly and total rainfall (mm) and mean number of rain days at five stations

	J	F	M	S	M	J	J	A	S	O	N	D	Annual
Bulloo Downs 1917 to 1976													
Rainfall	34	39	34	22	21	16	7	7	2	5	8	21	216
Rain days	3	3	3	2	2	2	1	1	0	0	1	2	20
Kooline 1896 to 1972													
Rainfall	41	52	35	15	26	31	16	10	1	1	4	11	243
Rain days	4	4	3	1	2	2	1	1	0	0	0	1	19
Mt. Stuart 1899 to 1977													
Rainfall	62	64	51	23	28	35	17	10	1	2	4	18	315
Rain days	4	4	4	1	2	2	1	1	0	0	0	2	21
Minderoo 1912 to 1978													
Rainfall	38	61	57	16	38	41	16	9	1	1	3	4	285
Rain days	3	4	3	1	3	3	2	1	0	0	0	1	21
Ullawarra 1895 to 1975													
Rainfall	33	56	34	14	27	29	13	6	1	3	2	9	227
Rain days	3	4	2	1	2	2	1	1	0	0	0	1	17

Table 8 — Percentage distribution of winter (May — October) and summer (November — April) rainfall at five stations.

Station	Winter	Summer
Bulloo Downs	27	73
Kooline	35	65
Minderoo	37	63
Mt. Stuart	30	70
Ullawarra	35	65

Temperature

Mean monthly maximum and minimum temperatures for Onslow and Nyang (coastal and western regions) and Newman (inland, eastern regions) are presented in Figure 4. No temperature data is available for central parts of the survey area but temperatures are expected to fall between those at Nyang and Newman.

In general, western and central parts of the survey area are marginally hotter in both snmmer and winter than eastern inland areas. At Nyang in the west the mean monthly maximum is 42.2 °C during February and 24 °C during Jnly. Inland at Newman maximum temperatures are marginally lower with a mean maximum of 39.7 °C during January and 22.2 °C during July. The mean minimum monthly temperatures range from 25.3 ° to 11.5 °C at Nyang to slightly lower (24.6 ° to 7.3 °C) at Newman. The differences between the two locations are due to altitude differences, Nyang being about 25 m and Newman 546 m above sea level. Frosts are quite common in winter in the higher inland areas but are rare on the coastal plains.

In areas right at the coast (for example Onslow) temperatures in summer are much cooler than elsewhere due to the oceanic effect. In winter, temperatures at the coast are similar to those at Nyang.

Figure 3 — Percentage coefficient of variation (mean of five stations) of monthly rainfall

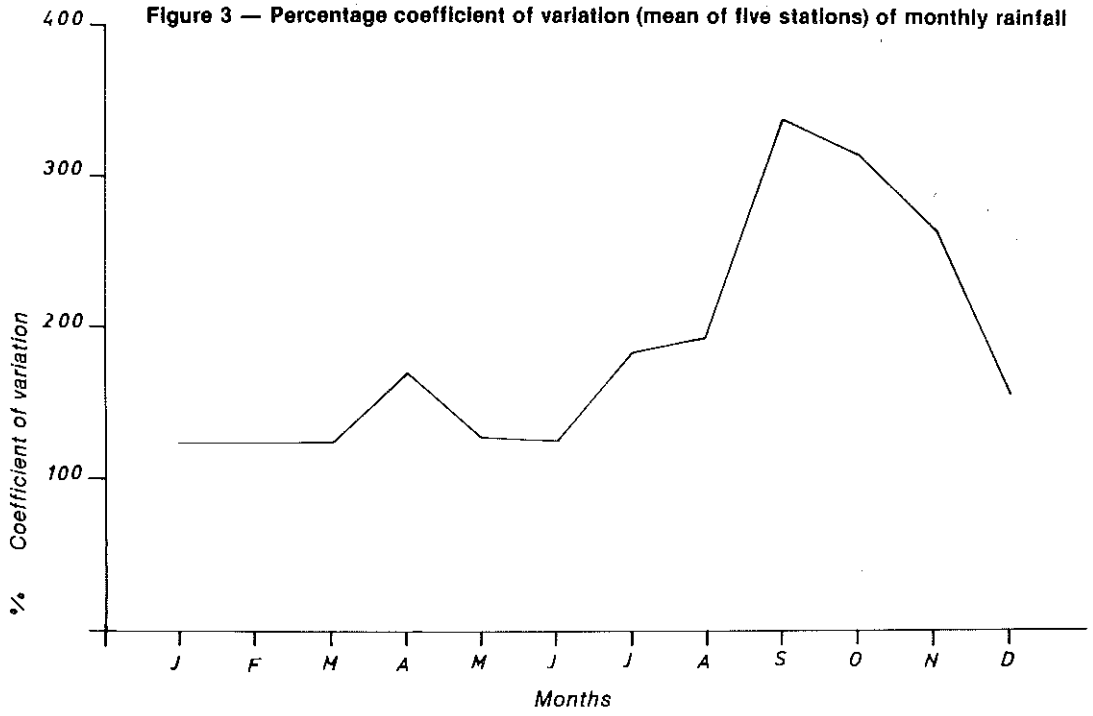
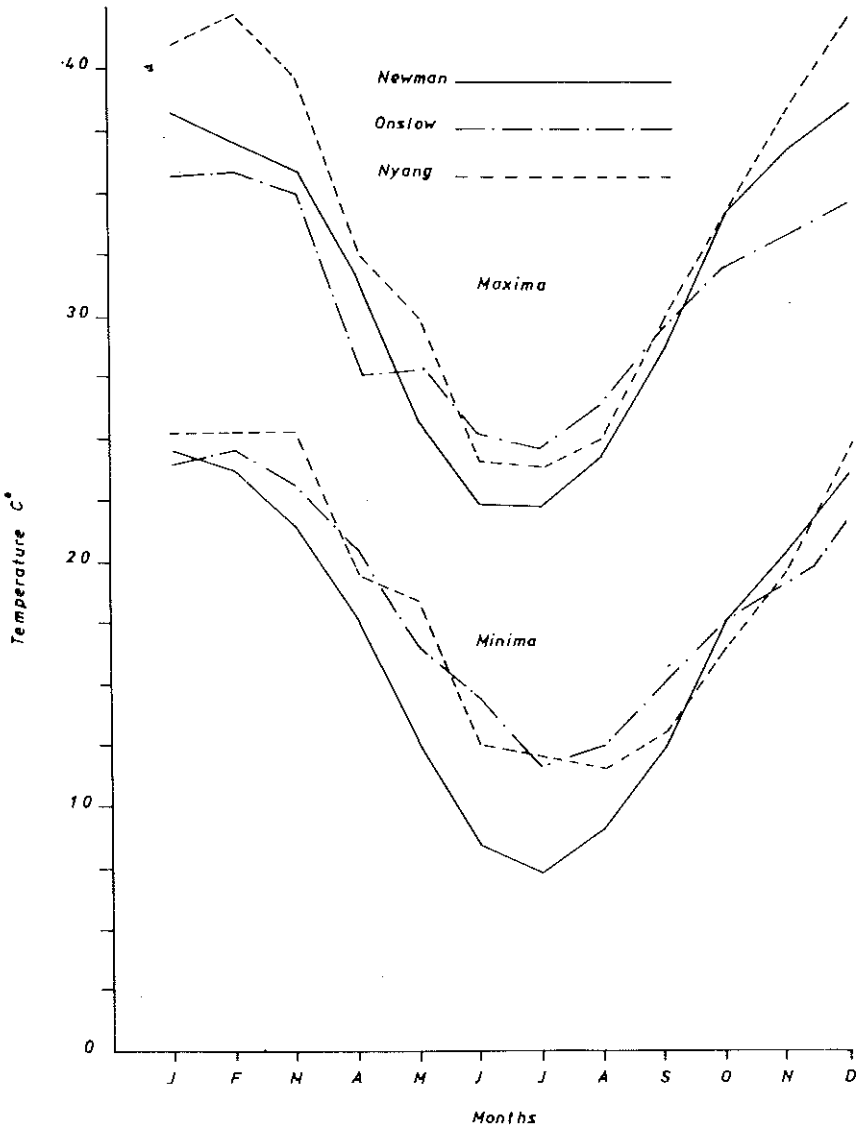


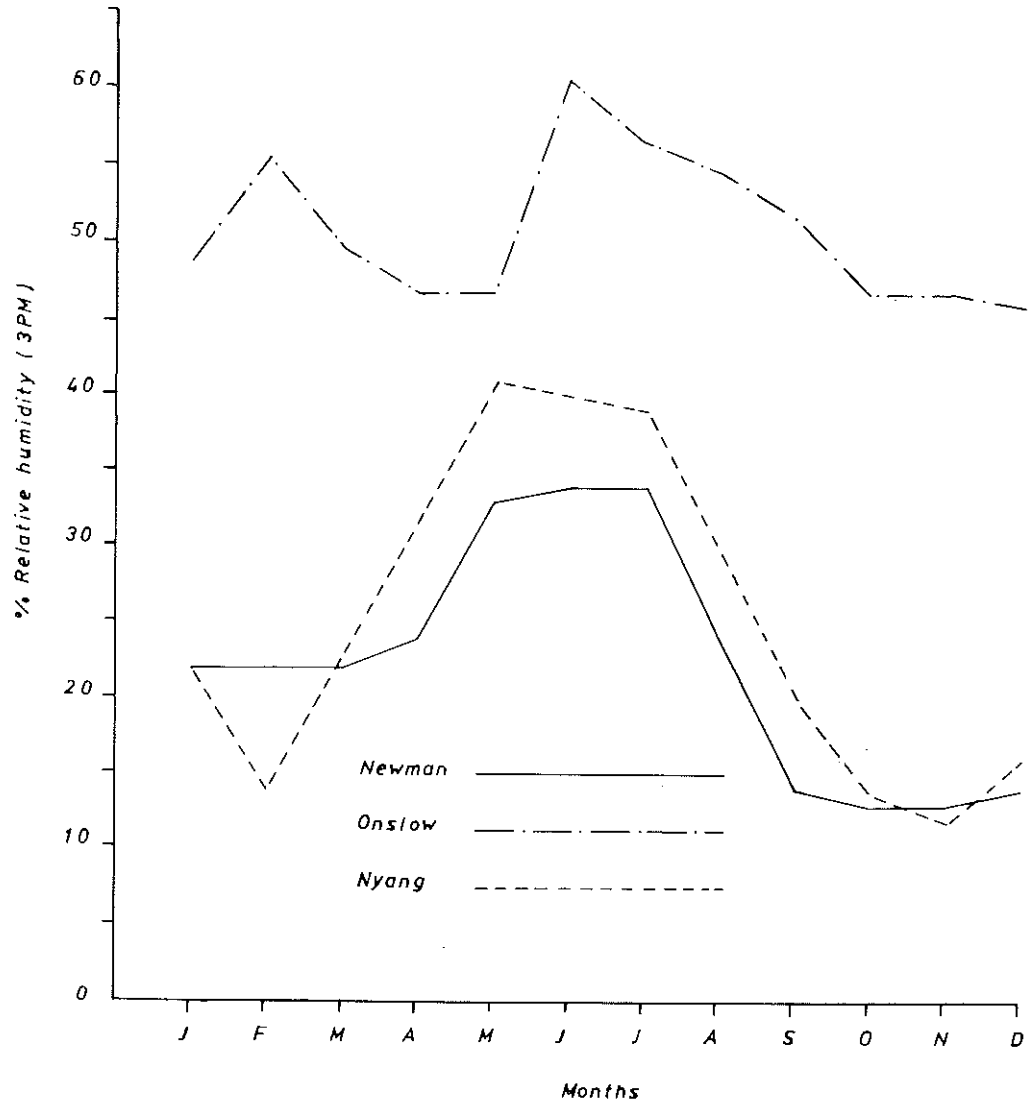
Figure 4 — Mean monthly temperatures at three centres



Humidity and dews

The area generally has low average humidity and few dews. Figure 5 shows the mean monthly relative humidity at Onslow, Nyang and Newman. Humidity in all areas, except those right on the coast, is very low from August to December and increases slightly during January to April from the effects of tropical cyclones and thunderstorms. Humidity increases during the winter months when temperatures decline and some rain falls. The humidity on the coast is much higher than in inland areas and there is less seasonal fluctuation.

Figure 5 — Mean monthly relative humidity at three centres



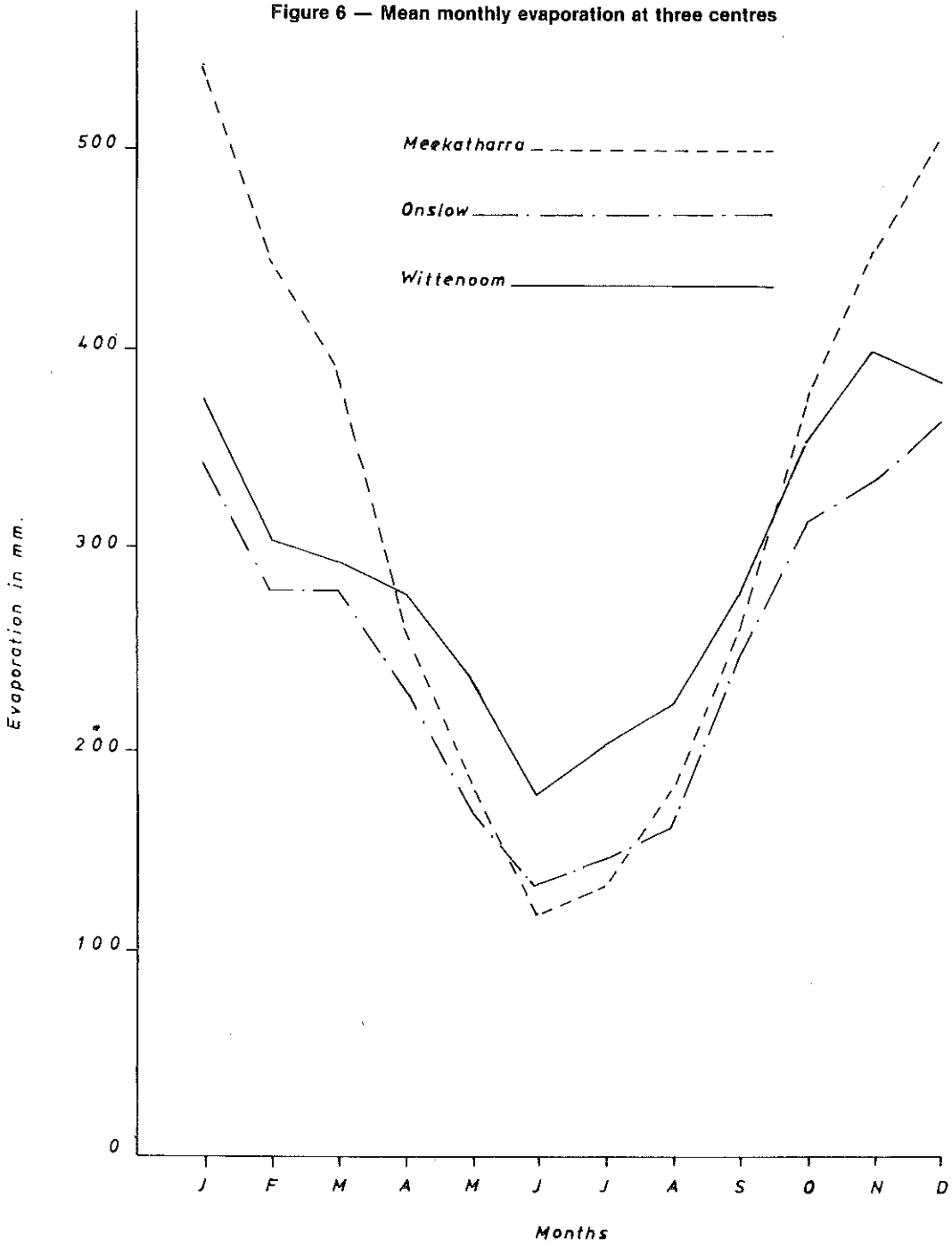
Evaporation

Evaporation records from Onslow within the survey area and from Wittenoom to the north and Meekatharra to the south-east are shown in Figure 6.

The records show that evaporation from inland areas is generally higher throughout the year than on the coast with highest evaporation rates in the summer months November to January and lowest rates in the winter months June to July.

Although the area receives more rain in summer than in winter (see Table 8) the very high evaporation rates in summer (400 to 500 mm per month) markedly reduce the effectiveness of summer rain for plant growth. Evaporation rates in winter are much lower and winter rains are more effective for plant growth than summer rains.

Figure 6 — Mean monthly evaporation at three centres



CLIMATE AND PLANT GROWTH

A computer model ARWATBAL after E.A. Fitzpatrick *et al* (1967) was used to determine the number of pentads (five day periods) of plant growth for any particular rainfall event. Continuous daily rainfall records at Bulloo Downs (56 years), Kooline (46 years), Minderoo (60 years) and Ullawarra (51 years) stations were used. These stations (see Figure 1) were selected for their continuity of records and because they are representative of various parts of the survey area.

The model also requires evaporation data to estimate growth periods. Onslow evaporation data was used to treat the Minderoo station rainfall figures. Evaporation rates for the inland pastoral stations were calculated using Wittenoom and Meekatharra data modified by a simple proportionate procedure based on the latitude of the stations in relation to Wittenoom and Meekatharra.

The ARWATBAL programme requires that the evaporation and rainfall data for the year be split into 73 pentads. The programme takes into account water loss from runoff and internal drainage and compares the incoming rainfall against a proportion of the potential evaporation presumed to be used for plant growth or germination. If water remains in the soil water store at the end of a pentad then plant growth is considered to have occurred over the pentad.

Table 9 shows the number of growth pentads, which may or may not be consecutive, recorded in summer and winter at the five stations.

More growth pentads occur in winter than in summer except at Mt. Stuart where pentads are evenly divided between summer and winter.

Minderoo station, representing the western coastal

Table 9 — Mean number of growth pentads recorded in summer and winter seasons

Station	Winter	Summer	Total
Bulloo Downs	3.3	2.1	5.4
Kooline	4.2	2.6	6.8
Minderoo	8.1	4.4	12.5
Mt. Stuart	4.3	4.4	8.7
Ullawarra	4.2	3.0	7.2

plains area of the survey, receives more than twice the total number of growth pentads per annum than eastern parts as represented by Bulloo Downs station. The coastal plains also receive considerably more growth pentads than central parts represented by Ullawarra, Kooline and Mt. Stuart stations.

The probability of rainfall supplying specified numbers of pentads of growth per annum is presented in Figure 7.

Figure 7 — Probability of rainfall supplying specified numbers of pentads of growth / annum

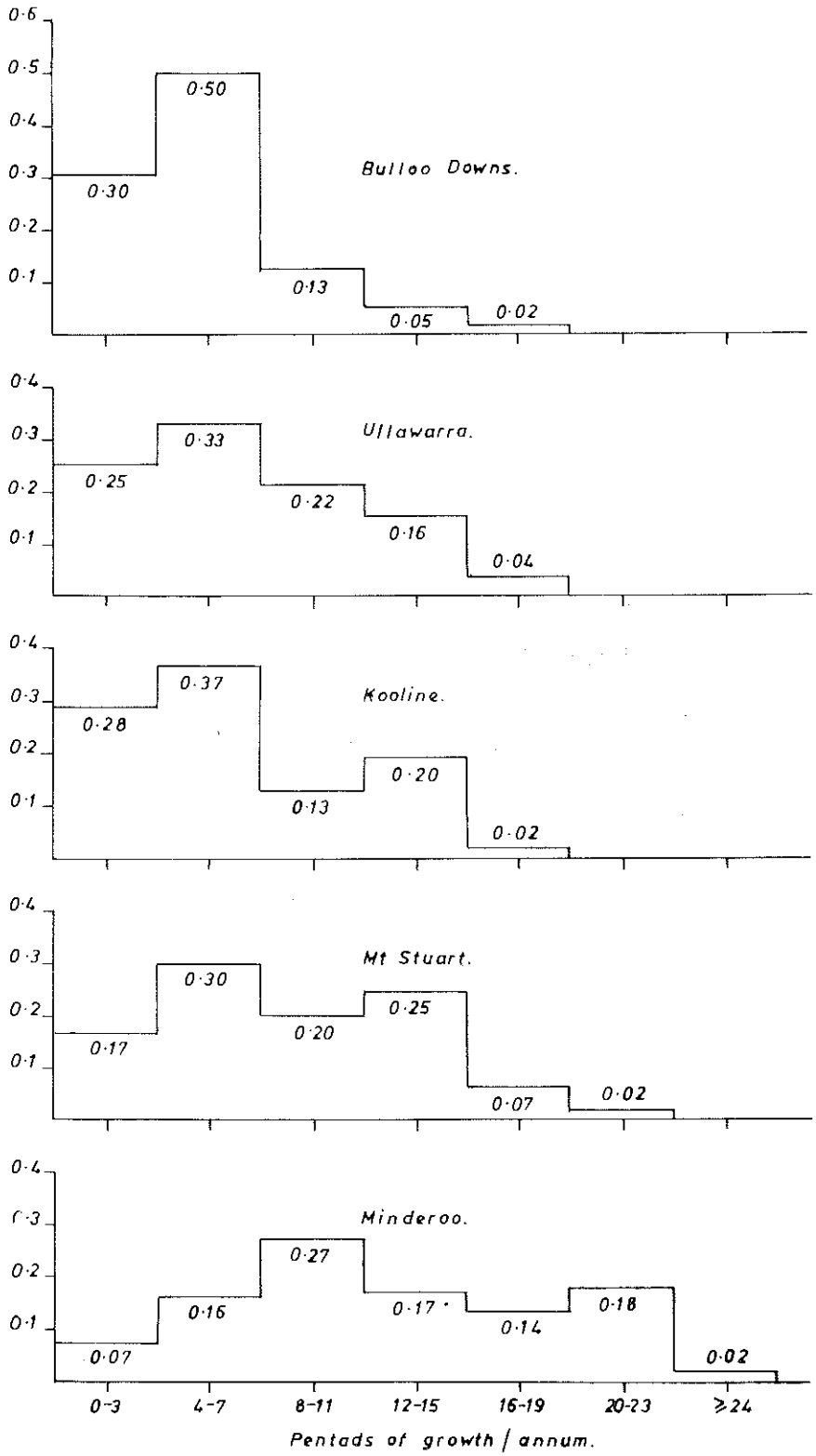
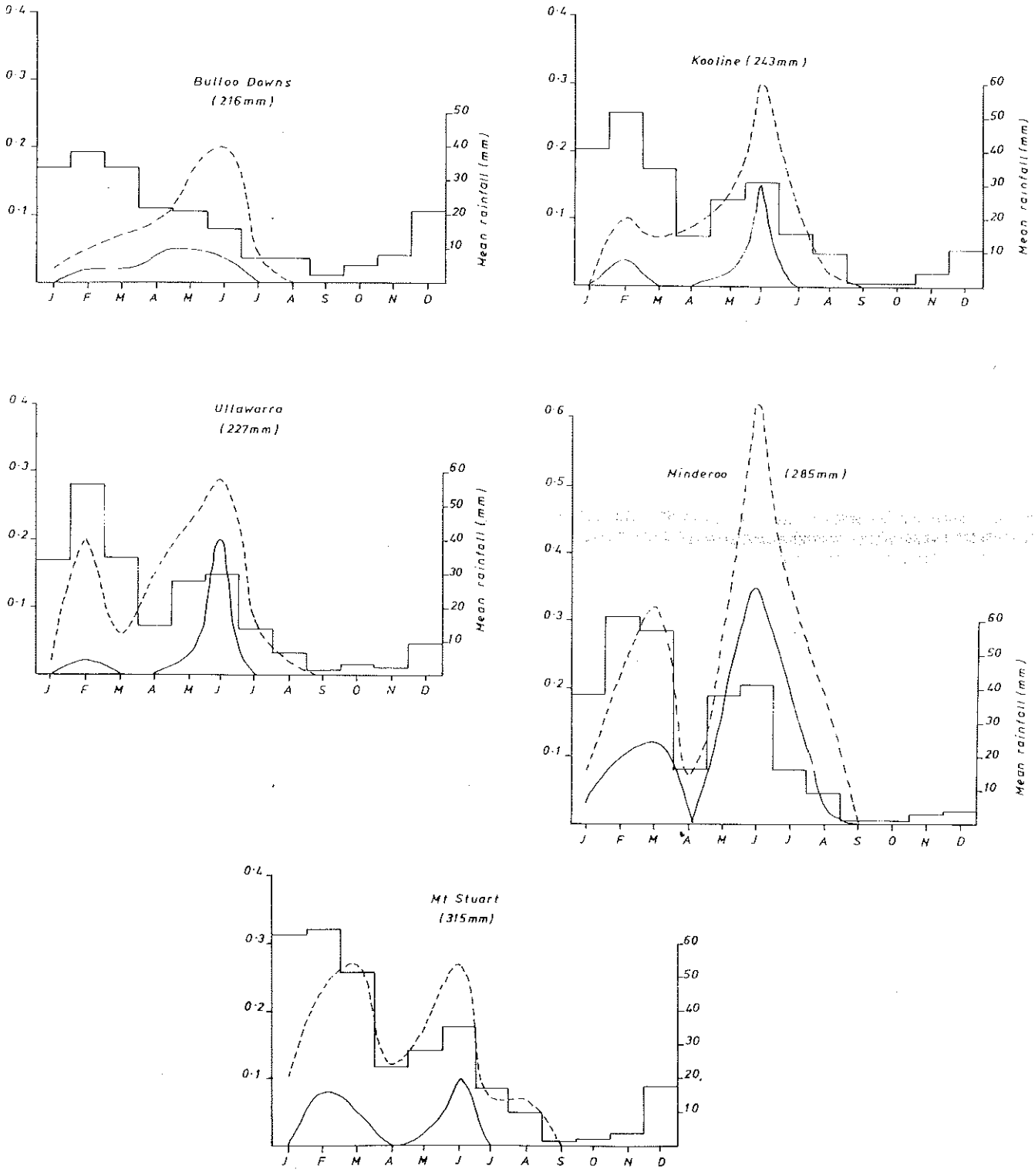


Figure 8 — Probability of growth periods. ⩾15 days (broken line - - - - - -). ⩾30 days (unbroken line ——). Rainfall (mm) shown as histogram.



The data shows that western coastal areas, as represented by Minderoo station, have the highest probability of receiving a large number of growth pentads and the probability of receiving a large number of pentads falls off rapidly in an easterly direction through Kooline station to Bulloo Downs station.

The data presented in Table 9 and Figure 7 do not indicate if any of the growth pentads are consecutive or not. Although a single growth pentad will stimulate some growth from perennial vegetation the effect of a number of consecutive pentads is greater. Rains which supply water for growth for periods less than 15 days can be regarded as being mainly ineffective.

Wilcox (1972) suggests that a 15 to 30 day period of moisture availability is likely to be adequate for the growth of perennial shrubs in the winter rainfall pastoral areas of Western Australia but that its effect on annual growth will be indifferent. Periods in excess of 30 days for two consecutive seasons are probably required for seedling establishment and survival.

Figure 8 shows the probabilities of growth periods greater than 15 days and 30 days for each month at each of the five stations. Mean monthly rainfall for each station is included. The figures show that the probability of receiving effective rain for growth is highest in winter at most stations. Mt. Stuart station is the exception in that the probability of effective rain in winter and summer is about equal. The seasonal advantage of the coastal plains is apparent as Minderoo has the highest probability of receiving winter growth periods greater than 15 days and greater than 30 days (June probability 0.62 and 0.35 respectively) of any station.

The probability data provide in Figure 8 are significant aids to defining stock and pasture management programmes. The highest nutritional stress time for breeding stock is in late pregnancy and when suckling and this time should coincide with the period of the year most likely to have the most feed. Obviously June, with the highest probability of effective rain, is the optimum month for lambing or calving down and other husbandry practices should be geared around this date.

Pasture management requires the constant maintenance of useful shrubs and perennial grasses under grazing and after drought. This means that germination and successful establishment must occur periodically. Although germination criteria are not well known Wilcox (1972) lists work with saltbushes and bluebushes indicating that 16 °C is the optimum temperature for germination and it is generally accepted that most useful shrubs germinate on late summer or early winter rains (February to May). Perennial tussock grass pastures which are important in the west of the survey area are favoured by summer rainfall but, because of mild temperatures, good growth and establishment can also occur after winter rain.

The probability of good germination of perennial shrubs (a 30 day or greater growth period) occurring over the period February to May varies considerably over the survey area but is generally low (0.05 to 0.15) except near the coast (Minderoo 0.4). In addition to germinating rains in late summer or early winter good winter rains are necessary to ensure permanent establishment. Management to promote establishment must involve spelling over at least one full winter season following good summer rains.

The capricious nature of the rainfall within the survey area has already been indicated (see Figure 3). Each year extended periods without plant growth occur and drought years are frequent. Anon (1974) defines drought in the winter rainfall areas of Western Australia as occurring when two summers and two winters elapse without a 30 day growth period. However, it is considered that the 30 day criterion does not apply well to areas receiving summer rainfall because, under summer rainfall conditions, perennial grasses grow and mature very rapidly. In this report we have therefore defined drought as occurring when two summers without a 20 day growth period and two winters without a 30 day growth period have elapsed. Using these criteria the incidenee and duration of drought periods at the five stations was calculated and is presented in Table 10.

Table 10 — Percentage of drought years and duration of droughts at the five stations

Station	Drought years %	No. of droughts of duration shown (years)						
		1	2	3	4	5	6	7
Bulloo Downs (56 years)	46	2	2	1		2		1
Kooline (46 years)	33	4			1		1	
Minderoo (60 years)	5	1	1					
Mt. Stuart (60 years)	22	2	1	1			1	
Ullawarra (51 years)	35	1				1	2	

In eastern parts of the survey area (for example Bulloo Downs statiou) droughts are very common and occur in about five years in 10 while coastal regions (for example Minderoo station) register only five in 100 years. In the central west of the area the incidence of drought is also high but declines from south (Ullawarra station) to north (Mt. Stuart station). Droughts of five years or more duration have occurred in parts of the survey area in the mid 1920s, late 1930s and late 1950s.

Management must plan to expect drought as a natural feature of the environment and to promote regeneration of perennial vegetation when drought breaking rains occur. In heavy seasons after drought, maximum opportunistic use should be made of annuals appearing on normally hard and unproductive rangelands and better quality pastures, such as chenopod shrublands, should be spelled.

GEOLOGY AND GEOMORPHIC PROVINCES

The survey area (see Fig. 1) occupies about 93 600 sq. km and falls within the Pilbaraland division as described by Jutson (1934). It lies between longitudes 114° 10'E and 119° 50'E and latitudes 22° 20'S and 24° 50'S, and covers the catchment of the Ashburton River and its tributaries and part of the catchment of the Yannarie River. It extends in a north-west to south-east direction for 580 km and is about 180 km wide. The northern boundary is the watershed between the Ashburton and Fortescue Rivers. The southern boundary is the watershed between the Ashburton and Gascoyne Rivers and coincides with the northern boundary of the Gascoyne Survey area (Wilcox and McKinnon 1972).

The Ashburton River is an intermittent stream which follows the direction of strike of the surrounding rock formations and passes in a west north-west direction through the centre of the survey area. Tributary rivers, such as the Angelo, Seven-Mile Creek and Turee Creek from the north and the Henry River and Irregully Creek from the south, are transverse rivers with some prominent gorges where they cut across the strike of the country rock. The Ashburton River, in its lower parts between Nanutarra and Onslow, meanders through extensive flood plains. Elsewhere it, and its major tributaries, have only reached maturity or early maturity with narrow marginal flood plains and stony plains, flanked by rough hill country.

The general geology of the survey area is well known, most having been mapped at 1:250 000 scale with explanatory notes (see references). About 90 per cent of the area is based on Proterozoic rocks of the Bangemall, Bresnahan, Wyloo, Hamersley and Fortescne geological groups. Sedimentary rocks such as sandstone, shale and dolomite predominate, but there are also large areas, especially in the north, of basalt and minor areas of acid volcanics. The Proterozoic rocks have been extensively folded and eroded and form the major hill and mountain land systems of the area. These land systems form the watersheds between the Ashburton and Fortescne Rivers and the Ashburton and Gascoyne Rivers.

The Proterozoic sequences unconformably overly Archaean basement granites and metamorphosed rocks. This basement is exposed as small inliers on Rocklea and Prairie Downs stations and forms the most ancient surfaces in the survey area.

No Palaeozoic rocks are exposed in the survey area and Mesozoic rocks of the Cretaceous period are confined to the western end of the area. Here Cretaceous marine limestones form low hills, mesas and plains.

Cainozoic rocks, colluvium and allnvium occur throughout the snrvey area with the largest single areas being in western coastal regions and in the south east. Extensive Tertiary valley fill deposits of calcrete and partly consolidated colluvium occur in the valleys of the Ashburton River and its tributaries. Rejuvenated drainage in late Tertiary times has resulted in some of these surfaces being dissected to form prominent low mesas, buttes and intensely dissected plains.

Quaternary alluvial and colluvial deposits flank rivers and creeks throughout the survey area and are the most recent surfaces. In the west broad plains of alluvium and colluvium extend for up to 70 kms, In parts these plains are overlain by Quaternary aeolian sand and linear sand dunes trending north-west and north become increasingly common near the coast.

GEOMORPHIC PROVINCES

The survey area falls within three broad natural ecological regions as recognised by Beard (1975), and originally suggested by Clarke in 1926. These are the Pilbara region, the Gascoyne region and the Carnarvon basin. The regions have distinctive characteristics of climate, geology, landform, soils and vegetation and approximate to the Botanical District divisions of Gardner and Bennett (1956). Beard also recognised a number of physiographic units or subdivisions within each region and eight of these units occur in the survey area.

The land systems encountered on this survey fell into a number of logical groupings or geomorphic provinces based on geology, landform and vegetation and these groupings correspond well with Beard's physiographic units. Eight geomorphic provinces were recognised and these are indicated in Fig. 9. The boundaries of the provinces correspond, with some minor variations, to the boundaries of Beard's physiographic units.

The areas of the geomorphic provinces within the snrvey area are indicated in Table 11.

Table 11 — Areas of geomorphic provinces within the survey area

Regions	Geomorphic provinces	Approx. area within survey	
		sq. km	%
Carnarvon Basin	Coastal Plain	15 370	16.4
	Giralia Anticline	870	0.9
Gascoyne	Ashburton Valley	13 860	14.8
	Bangemall	18 590	19.9
	Eastern Plains	16 090	17.2
	Maroonah Plains	2 130	2.3
Pilbara	Stuart Hills	5 280	5.6
	Hamersley Plateau	21 420	22.9
	TOTAL	93 610	100.0

The eight geomorphic provinces within the survey area are described, commencing from the coast and proceeding eastwards.

The Giralia Anticline Province (870 sq. km)

This small province is immediately south of the head of Exmouth Gulf and includes parts of Giralia and Marilla stations. The landforms and one of the vegetation communities (*Maireana polypterygia* — Gascoyne bluebush) are very distinctive and are exclusive to the province in the area studied.

The province is based on Cretaceous and Tertiary marine sediments, mainly calcarenite and other limestones, and bentonitic siltstone. It is elevated above the general level of the adjacent Coastal Plains province and is an area of dissected anticlinal hills and associated outwash plains. The highest central part of the province trends in a north north-east direction and drainage from it is by a series of short parallel flow lines running to the north-west and to the east. These streams fan out and disperse over the lower outwash plains of the province.

Land forms of the province are erosional surfaces of low hills, cuestas, undulating uplands and dissected limestone plains with relief up to 50 m and depositional surfaces of lower outwash plains. There are also small areas of sandy coastal plains and inter-tidal mudflats at the northern end of the province on Sandalwood peninsula.

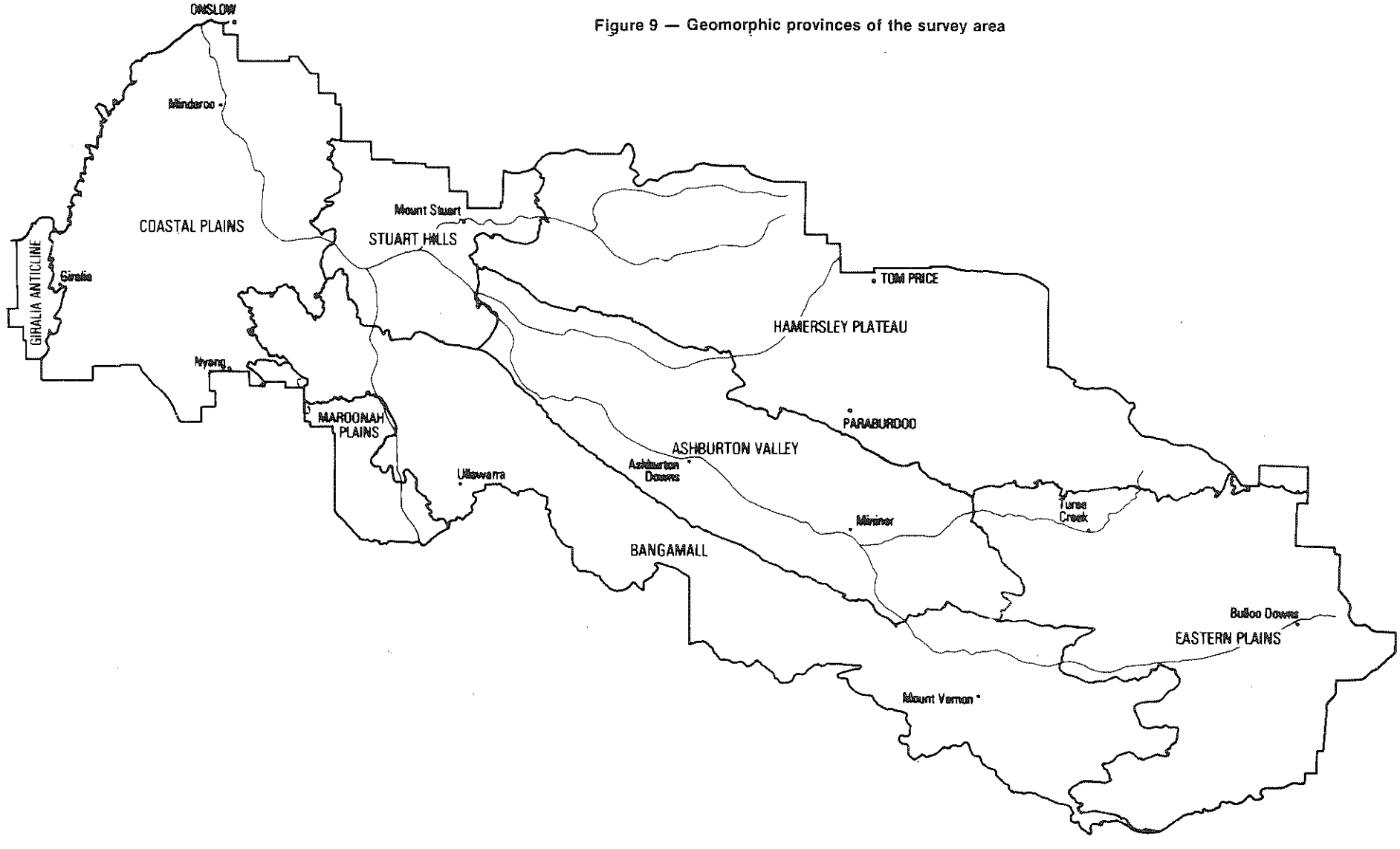


Figure 9 — Geomorphic provinces of the survey area

Four land systems are exclusive to the province. The most elevated of these are Jubilee and Firecracker associated with the Giralia Range. These systems consist of stony hills and undulating upland plains with shallow loamy soils overlying limestone.

The Donovan system lies below Jubilee and Firecracker and consists of gently dissected limestone plains and broad outwash alluvial plains and fans receiving run on from the higher systems. The Yarcowie land system, a small gilgai plains system derived from bentonitic siltstone and radiolarite, is exclusive to Marilla station and lies below the Firecracker and Jubilee systems.

The Coastal Plains Province (15 370 sq km)

This province commences at the coast and extends eastward for about 90 km to the vicinity of Nanutarra station and south to the boundary of the survey area. Quaternary alluvium, colluvium and aeolian sand covers nearly all of the province although small outcrops of Lower Cretaceous sedimentary rocks and Proterozoic granite and metamorphic rocks occur in the east. The eastern boundary of the province lies to the north of Nanutarra homestead where hills of the granites and metamorphic rocks become dominant in the landscape.

The province is characterised by extensive sandy plains with longitudinal dunes trending north-west or north and by broad clay plains with numerous bare claypans and circular grassy depressions. Relief in western and central parts of the province is very subdued although occasional dune crests may be up to 30 m higher than the surrounding plains. Isolated hills and low plateaux up to 40 m high occur in the east.

The Ashburton River meanders through the plains of the northern part of the province in a north north-west direction for about 110 km to the Indian Ocean near Onslow. No tributaries of any consequence flow into the Ashburton over this distance. The Yannarie River, an endoreic stream, drains into the middle of the province near Yanrey station.

Many of the land systems of the province are old flood plain deposits of the Ashburton River which appears to have altered its course across the plains a number of times. Alluvial plain systems Globe and Nanyarra flank the river to a width of up to 8 or 9 km but, at the present time, the river does not flood out more than 4 or 5 km from its course onto these systems.

Two gilgai plain systems, Cheetara and Yanrey, with cracking clay soils occur within the province and small areas of gilgai plains occur as minor units of other systems. The Yanrey system is subject to regular inundation by the Yannarie River which terminates on and disperses over the system.

Closer to the coast the clayey plains become increasingly masked by aeolian sand and a number of new systems such as Minderoo and Yankagee appear. Both these systems have substantial units of sandplain and linear dunes as well as clay plain units. A definitive characteristic of the Yankagee system is the presence between the dunes of numerous round and elongated claypans varying in extent from 20 m to 400 m or more. Dune land system which occurs at the coast adjacent to supratidal saline mudflats of the Littoral system consists entirely of reticulate dunes and sandy swales.

In the south of the province the typical landforms are large dunes up to 30 m high with broad swales 500 m to 2 km wide, and plains of the Giralia system. The plains of this system, and of the Uaroo system are often clayey and calcreted with only a thin veneer of surface sand.

Small areas of Lower Cretaceous sandstones and siltstones of the Nanutarra formation occur in the far east of the province. This formation has been dissected and eroded to form distinctive low buttes, mesas and plateaux of the Nanutarra land system. Also in the east small areas of hill systems such as Boolaloo and Capricorn occur as isolates surrounded by plains of the Uaroo system.

The Maroonah Plains Province (2 130 sq km)

This small province is restricted to the south west of the survey area. It is made up of broad stony plains and hills in about equal proportions. Its north-west boundary is de-limited by the start of the large sandy plain systems characteristic of the Coastal Plains province. In the east it is bounded by massive ranges and hills of the Bangemall province. The province encompasses the headwaters of the intermittent Yannarie River which trends to the north-west onto the coastal plains.

The oldest land surfaces in the province are based on Lower Proterozoic granite, granodiorites and metamorphic rocks. These form the rough low hill systems Prairie and Capricorn. Some small areas of Middle Proterozoic Bangemall group rocks are also exposed in the province and form the Collier and Augustus hill systems. These two systems are of minor significance in the province, but dominate the landscape immediately to the east in the Bangemall province.

Two land systems, Mundong and Nadarra, characterise the province and are exclusive to it.

The Mundong system consists of broad stony plains extending up to 30 km. The upper units of the system are erosional surfaces of low granite hills and undulating outcrop plains while the lower units are depositional plains of Quaternary colluvium and alluvium.

The Nadarra system of gently undulating stony calcareous plains and isolated low limestone mesas and hills extends for 25 km or more. It is based on Tertiary calcreted valley fill deposits which have partly weathered to expose Bangemall basement sediments of dolomite or dolomitic shale.

The Stuart Hills Province (5 280 sq. km)

This province lies to the east of the Coastal Plain province and is bounded by volcanics of the Hamersley Plateau province in the east, the Ashburton Valley province in the south-east and rugged hills of the Bangemall province in the south.

The province is based on granites and granodiorites of Lower Proterozoic age and metamorphic Wyloo group rocks of similar age. The Wyloo rocks have been regionally metamorphosed, but the control for this is not known. They have also been contact metamorphosed by the granite intrusions. The granitic and metamorphic rocks give rise to a number of distinctive land systems which dominate the province and occur only rarely in other provinces. On the western side of the province Mt Minnie and Bangemall group sedimentary rocks are exposed as a narrow strip trending northerly and extending for about 55 km to form the prominent Parry Range. In central and northern parts of the province there are considerable areas of Quaternary alluvium and colluvium and minor areas of Quaternary aeolian sand.

The Ashburton River runs in a north-west and west direction through the centre of the province and flood plains of Quaternary alluvium 3 to 8 km wide flank the river for most of its length. Flood plains are also well

developed along Duck Creek which flows through the north-east of the province and joins the Ashburton River near old Boolaloo station. The Henry River which heads in the rugged Bangemall province to the south is another major tributary and joins the Ashburton River near the southern end of the Parry Range.

As would be expected from the varied lithology many different landforms have evolved and the province consists of a mixture of broad plains of low relief, gently undulating pediplains with low hills and rugged hills and ranges.

The lowest and youngest surfaces in the province are the alluvial and colluvial plain land systems Ashburton, Globe and Dollar. These are well developed along the Ashburton River and Duck Creek and are common to other provinces. Stony hill systems such as Capricorn, Augustus and Kooline provide spectacular contrast, often rising abruptly for 100 m or more above the plains to form hill massifs and ranges such as Mt. Murray, Mt. Stuart and the Parry ranges. Hill systems found in this province are also common to other provinces.

Two large land systems, Boolaloo and Stuart, dominate the province and are characteristic of it.

The Boolaloo system is based on the Lower Proterozoic granites and granodiorites and consists of hill tracts and tor fields with marginal sandy plains. The Stuart system has upper units of low hills and stony plains of quartz muscovite sehist and other metamorphosed rocks of the Wyloo group and broad lower plains of Quaternary colluvium and alluvium. Broad, many branched and mostly unchannelled drainage zones with dense vegetation give the system its distinctive photo pattern.

The Bangemall Province (18 590 sq. km)

This province extends along the southern edge of the survey area where it forms the watershed between the Ashburton and Gascoyne Rivers. It is a continuation of the Bangemall province of the Gascoyne River catchment as described by Wilcox and McKinnon (1972).

The province consists mostly of rugged mountain, hill and ridge country of Bangemall series Middle Proterozoic sedimentary rocks. Differential weathering of the sedimeuts has influenced the extent and type of dissection, with the more resistant rocks, such as sandstone, forming massive parallel ridges and ranges usually trending north-west. The lower slopes, restricted valley plains and floors associated with the hills are invariably covered with a dense surface strew of rock fragments of variable lithology. The sediments are frequently intruded by dolerite dykes and sills which are now exposed to form rounded hills and ridges quite distinctive from those formed on the sediments.

The hill land systems have been differentiated from each other on their geology, position in the landseape, and general landform. Many of the systems are found in other provinces, but nowhere do they predominate as they do in the Bangemall province. Many systems are common to the Gascoyne River catchment and have been described by Wilcox and McKinnon (1972).

The highest, largest and most rugged hill system is Augustus based mainly on sandstone and shale. The Mulgul system, frequently associated with but generally lower than Augustus, is based on dolomite, dolomitic shales and minor chert and forms hills and low ranges with characteristic benched slopes. The Collier system is frequently found immediately below Augustus, but it may also form the major regional uplands of an area.

The Charley system has evolved from dolerite dykes and sills which intruded the Bangemall rocks. Weathering has now exposed the dolerite and formed hill lands which may be elevated amongst other hill systems such as Augustus, Mulgul and Collier or occur above surrounding, gently undulating plain systems such as Ruby and Ford.

In the south-east of the province on Mt. Vernon station calcrete valley fill deposits were laid down in the Tertiary period. These have eroded to form small plateaux and mesas of the Table land system. Elsewhere hardpan has developed in the soils of colluvial valley plains. The plains have become eroded to form the Egerton system of intensely dissected slopes and plains.

The Ashburton Valley Province (13 860 sq. km)

This province is based on Lower Proterozoic sedimentary rocks of the Wyloo group and Tertiary and Quaternary colluvial and alluvial deposits. It lies between the Hamersley Plateau province with its Fortescue group volcanic rocks and Hamersley group jaspilite to the north and the Middle Proterozoic Bangemall rugged hill province to the south.

The province is about 60 km wide and extends for 260 km in a north-west direction from Mt. Vernon station in the south-east to Wyloo station in the north-west. The Ashburton River runs through the full length of the province following the strike of the surrounding rocks. Major tributaries such as the Angelo River, Turee Creek, Seven Mile Creek, Hardy River and Irregully Creek join the Ashburton River in this province.

The Wyloo group rocks of the province have been exposed by the almost complete stripping of overlying Middle Proterozoic rocks of the Bresnahan and Bangemall groups. A few remnants of the older rocks, such as Mt. Boggola in the south-east, still exist. The Wyloo rocks are steeply dipping dark brown or maroon shales with minor greywacke, sandstone and dolomite and have weathered to give characteristic landforms of low hills of the Kooline land system and occasional large sandstone ridges of the Capricorn system.

The Kooline system is the largest in the province. It consists of many rows of rough, low hills of steeply dipping shale, restricted lower saline plains with dense mantles of white quartz fragments and saline drainage floors with braided channels. The system abuts directly onto or protrudes through younger, depositional, alluvial surfaces which flank the major rivers.

Quaternary alluvial deposits flank the Ashburton River for its full length through the province and also flank the lower parts of the major tributaries. These deposits make up the Ashburton land system which is the youngest and lowest system and consists of active flood plains with very deep loam and clay soils. The plains of the system are usually 3 or 4 km wide, but are occasionally up to 12 km wide.

Tributary alluvial plains of the Edward system typically occur between the outer margins of the Ashburton system and the adjacent Kooline hill system. The plains and broad through flow areas of the Edward system are usually saline and many have been degraded to hard, bare, sealed surfaces.

A number of other minor systems occur adjacent to the major rivers. These are based on Quaternary and Tertiary colluvial valley fill deposits, some of which are partly consolidated or calcreted. The Ethel system occurs as gently undulating cobble plains raised up to 15 m above surrounding alluvial plain systems. The Table system of low calcrete plateaux and mesas, up to 60 m high but usually much less, has resulted by dissection of old Tertiary valley fill deposits.

The Hamersley Plateau Province (21 420 sq. km)

This large province occupies the northern part of the survey area, stretching from Wyloo station in the west through Paraburdoo townsite to just north of Prairie Downs station. It forms the watershed between the Ashburton River and the Fortescue River in the north. The province includes the Hamersley Range National Park and the highest land in Western Australia.

The province is based on a complex series of Lower Proterozoic rocks of the Hamersley and Fortescue groups. These are predominantly jaspilite and basalt but there is also some dolomite, shale, siltstone and acid volcanics. Differential erosion of the sediments and volcanics has produced an area characterised by rugged terrain with high undulating plateaux, mountain ranges, strike ridges and hills with steep stony slopes and near vertical escarpments. Relative relief between plains and ridge crests can be up to 600m, but is usually about 200 m.

Hill and mountain land systems predominate and have been separated on geology and general topography. Newman is the highest system and is based on sedimentary rocks of the Hamersley group. It consists of high undulating plateaux and upstanding strike ridges of resistant jaspilite and associated steep footslopes and narrow valleys. The Rocklea system is based on basalts of the Fortescue group and occurs as large areas of rugged hills with restricted lower stony plains.

Two systems, Paraburdoo and Wona, are closely associated with the Rocklea hill system. The Paraburdoo system occurs below Rocklea and consists of valley plains and broad drainage floors and stony gilgai plains formed in situ from near horizontal basalt flows. The Wona system occurs on top of the Rocklea system as elevated plain and plateau surfaces based on basalt.

The oldest surfaces present in the province are undulating stony plains and low hills of the Prairie system. This system is based on exposures of Archaean basement granite and gneiss which occur as two small areas — one near Rocklea homestead and the other further east.

Small remnants of old Tertiary surfaces occur throughout the province and form the distinctive land systems Robe, Table and Platform. The Robe system consists of narrow mesas, plateaux and valley side benches of pisolitic limonite. The distribution of the system clearly shows that the pisolite surfaces were originally deposited in river channels and have since been dissected by rejuvenated streams. Outcrops of calcrete and low calcrete plateaux of the Table system occur as restricted areas in the valleys of Duck Creek and Boolgeeda Creek, and in many other places. The Platform system, based on partly consolidated valley fill deposits now partly dissected, typically occurs immediately below Newman hills and mountains.

Quaternary depositional surfaces of colluvium and alluvium are represented by the Boolgeeda and Brockman land systems. The Boolgeeda system consists of gently sloping stony valley plains beneath the footslopes of the Newman ranges. Gilgai plains and alluvial plains of the Brockman system are the lowest surfaces in the province. They are restricted in occurrence to some valley floors, notably along Duck Creek near Mt Brockman station homestead.

The Eastern Plains Province (16 090 sq. km)

This province lies at the far eastern end of the Ashburton River catchment between the Hamersley Plateau province to the north, the Ashburton Valley province to the west and the Bangemall province to the south-west.

The northern boundary of the province is clearly defined by the commencement of basalt rocks of the Fortescue formation and jaspilites of the Hamersely formation. To the west the boundary is defined by the Kooline land system based on Lower Proterozoic rocks. To the south-west the boundary is rather diffuse, but commences where rugged Bangemall hill systems, rather than plain systems, become dominant in the landscape.

The province consists of broad plains with shallow hardpan soils, stony plains and low hills and rocky ranges. The characteristic feature of the province is the predominance of hardpan plains derived from indurated Tertiary colluvial deposits. Many of these surfaces are almost flat and extend for more than 20 kilometres, others are dissected with numerous exposures of siliceous and calcreted hardpan. Other plain systems such as alluvial plains, sandy plains and gently undulating stony plains also occur.

Although the province is based on plain systems, there are also some very large and prominent hills and ranges such as the Kunderong, Lofty and Collier ranges. These are based on Middle Proterozoic rocks of the Bresnahan and Bangemall groups and are part of the Kunderong and Augustus land systems.

The oldest surfaces in the province are based on Archaean granites and metasediments which are exposed over a restricted area to the east of Prairie Downs homestead. Land systems Prairie and Nirran are based on the Archaean rocks and form a landscape of undulating plains and low hills. These systems display striking linear patterns on aerial photographs due to the presence of many dolerite dykes trending north, north-east and north-west.

On Bulloo Downs station, an old Proterozoic surface of Bangemall shales, is exposed where overlying Tertiary colluvial deposits have eroded away. Described as Ford land system it consists of undulating stony interfluves, drainage floors and a few low hills often below the general level of adjacent hardpan plain systems such as Nooingnin.

Throughout the province the Bangemall and Bresnahan sedimentary rocks have been intruded by dolerite sills and dykes which are now weathered and exposed to form the distinctive Charley land system.

As previously stated, Tertiary surfaces of broad almost flat plains with shallow hardpan soils are characteristic of the province. These are the Nooingnin, Jamindie, Cadgie and Three Rivers land systems. Where the hardpan plains have been partly dissected away they form the Egerton system which, because of its high intensity dendritic drainage, displays a distinctive photo pattern.

The Table system, consisting of low calcrete plateaux and mesas, occurs along some of the valleys of the province and is part of the old Tertiary surface probably contemporaneous with the hardpan surfaces.

The Divide land system occurs south of Turee Creek homestead, and elsewhere in the province, as large areas of Quaternary aeolian sand plain and dunes overlying colluvium and sandstone.

SOILS

The soils in the survey area were first mapped by Bettenay *et al.* (1967) at a scale of 1:2 000 000. Since then, the only soils work in the area has been on the morphology of hardpan (Bettenay and Churchwood, 1974).

Sampling methods

Soils were sampled and formally described at 710 sites during the course of the survey. The soils were described after Northcote *et al.* (1971) by sampling to 1 m with an auger rather than digging a pit to 1.5 m. A number of characteristics including pH, texture, colour, number of layers, depth, presence of lime, inclusions and structure were described in the field for each soil and entered onto data sheets. pH was estimated usiug the CSIRO soil pH test kit method while texture was estimated by hand. Colour was estimated with the aid of a Munsell chart and the presence or absence of lime was estimated by the addition of weak HCl: strong effervescence indicating the presence of lime. Structure was estimated by eye as were the type and percentage of inclusions.

At 354 of the sites, soil was collected from the top 10 cm and analysed by the Western Australian Government Chemical Laboratories for total soluble salts by an electrical conductivity method, nitrogen by the Kjeldahl procedure and available phosphorus by sodium bicarbonate extraction. The top 10 cm only was analysed due to restrictions on the number of samples and because this is the most important part of the soil in arid regions as regards available minerals (Charley and Cowling 1968, Dawson *et al* 1974). Nitrogen and phosphorous analyses have been expressed in the text as parts per million (ppm) and total soluble salts are expressed as percentage by weight.

For soil fertility descriptions later in the text the following levels were adopted.

Fertility	Phosphorus (ppm)	Nitrogen (ppm)
Very low	0 to 5	200
Low	6 to 10	201 to 300
Moderate	11 to 20	301 to 500
High	21 to 30	501 to 700
Very high	30 +	700 +

Soil genesis

The oldest soils in the survey area are lateritic soils which formed during the Tertiary period in a wet tropical environment. Today these soils form isolated mesas and benches. Presumably they once covered large areas but have since been stripped to leave the relics seen today.

Subsequent to the period of lateritization, Wiluna hardpan formed (Bettenay and Churchwood, 1974; Muhling *et al* 1976) on broad plains where it lies either at the surface or buried beneath a thin mantle of acidic loamy soil. The hardpan is considered by Teakle (1936), Litchfield and Mabbutt (1962) and Bettenay and Churchwood (1974) to have formed under conditions of episodic flooding, interspersed with dry periods, which is much the same as the present climate.

Wiluna hardpan and its associated calcretes are thought to have covered much of the survey area, but today it is only extensive in eastern parts. Here, broad flat hardpan plains consisting of cemented colluvium (including lateritic debris) up to 30 m deep completely mask the underlying geology. In the vicinity of Bulloo Downs Station the hardpan is being progressively stripped by headwater advancement along a series of low breakaway faces to expose basement rocks. Stripped surfaces west of the line of breakaways are not showing secondary hardpan deposition and are either covered by dissected relic hardpan, calcrete or cobble deposits. Extensive hill tracts occur with no soil development or skeletal soils; thin colluvial soils have developed on stony valley plains and deep alluvial loams and clays occur on flood plains flanking the Ashburton River and its major tributaries.

Soils of the broad coastal plains west of the Parry Range are of alluvial or aeolian origin. Fine textured alluvial soils have developed on active flood plains of the Ashburton and Yannarie Rivers and Rous Creek; elsewhere in the plains poorly sorted loamy and clayey soils have developed by sheet flooding and deflation reworking old superficial deposits from previous erosion cycles. During a period of drier climate in post-Tertiary times the area has been partly covered by aeolian deposits to give sand dunes, and plains with thin sand cover with sands and sandy gradational and duplex soils.

Highly calcareous parent material in the far west of the survey area has resulted in the development of distinctive soils. Calcareous earths formed from Tertiary and Cretaceous limestones occur over large areas while small areas of sedentary clay soils with gilgais have developed from bentonitic siltstone and claystone formations.

General morphological characteristics

Soils of the survey area are predominantly red or reddish brown uniform textured types with only minor accumulations of clay or salts down their profiles. These uniform soils can be either shallow or deep, with or without a cover of stone and are found on all parts of the landscape ranging from hills to flood plains. Gradational and duplex soils are also present but are much less common and are generally restricted to low specialised locations such as drainage floors.

Uniform textured soils predominate because the arid climate has kept leaching and soil development to a minimum and restricted vegetation to a sparse cover. Vegetation has played a minimal role in soil formation and soil features such as bleached A_2 horizons, organic horizons or organic soils which are associated with wetter, better vegetated areas are completely absent.

The general red or reddish brown colour of the soil results from hot oxidizing conditions which have produced free iron oxides in the soil and hence the red colour. Iron oxides are always associated with areas of free drainage (Jackson 1957). Even in areas of relatively reduced drainage such as depressions and low lying back plains adjacent to rivers the soils are red, even at 1 m.

A feature of the soils of the area is that they commonly show an alkaline reaction trend down the profile. This is due to the accumulation of sodium and calcium ions at relatively shallow depth in the profile and is characteristic of soils that are infrequently leached as is the case in this arid environment. Some important soils, notably the shallow loams over hardpan, are exceptions in that they are uniformly acidic throughout their profiles.

Highly saline soils (greater than 0.5 per cent total soluble salts) are found in some parts of the survey area. Bare, saline mud flats with clay and loam soils subject to episodic tidal inundation occupy large areas near the coastal fringe. Saline loams and duplex soils are common on hill footslopes, stony plains and broad drainage floors in central parts of the area. These soils have developed from highly saline parent material of the Ashburton shale formation.

Most clay soils of the area crack on drying and this feature is a reflection of the chemical composition and dry climate. Hallsworth (1955) suggests that cracking clay soils have to have a high montmorillonite clay content and be subject to dry conditions for at least six months of the year. Gilgai micro relief predominates on the clay soils of the area but there are also clay soils with near flat, non gilgaied surfaces.

Soil distribution

Topography influences the distribution of soils by dictating drainage conditions which in turn determine the distribution of soil formation products and therefore soils within a landscape. This catena or toposequence concept of differential soil formation due to topography was first described by Milne (1936) and has been used by others such as Gunn (1967) and Elliott and Charman (1980).

The distribution of the various soils in the survey area is described —

- on a texture group basis (Northcote 1971)
- on a regional basis after dividing the area into ten distinct soil regions, each of which is largely delineated on geological boundaries and has a distinctive catenary sequence. The catena technique describes the distribution and relationship of the geological formations and soils that go together to make up a regional landscape.

The information for the description of the catenary sequences came from the 710 "query" sites sampled during field work and used in compiling land system descriptions for the survey area. Observations showed that groups of land systems had similar lithology and soil types but the proportion of each soil per land system varied in response to topography. The data from groups of land systems with similar lithology and soils was combined to generate the information for each soil region.

The names and areas of the soil regions are listed in Table 12 and the regions are described in more detail later in this section. The geographic location of each region is shown in Figure 10.

Table 12 — Soil regions in order of size.

Region	Area (sq. km)	Percentage
Bangemall	19 175	20
Eastern Plains	17 295	19
Hamersley	11 691	12
Kooline	11 381	12
Coastal Plains	11 353	12
Fortescue	9 124	10
Alluvial	7 548	8
Stuart	3 326	4
Maroonah Plains	1 893	2
Giralia	824	1
TOTAL	93,610	100

Soil distribution by texture groups

Uniform coarse textured soils (Uc)

These soils are common in four of the 10 soil regions. In the Coastal soil region they occur on sand dunes (Uc 123) and on sand plains (Uc 511). A large area of sandy granitic soils (Uc 511), occur in the Stuart soil region. Large areas of acid sands (Uc 521) are found over-lying hardpan in the Eastern Plains soil region.

Small areas of sand (Uc 511) and sand dunes (Uc 123) are found associated with the Alluvial soil region.

Uniform medium textured soils (Um)

This group of soils is the most common in the survey area and occurs in all regions. The most widespread types are shallow stony loams (Um 521, 551 etc) which cover hills and footslopes and occupy perhaps 60 per cent of the survey ara. The most important soils in this group are the deep silty loams (Um 522) found on the flood plains of the Alluvial soil region and which support large amounts of forage after flooding.

Other common loams are shallow calcareous loams (Um 511) which are found in isolated patches formed on calcrete and the widespread acidic loams (Um 521) which are found over hardpan in the Eastern Plains soil region.

Uniform fine textured soils (Uf)

This texture group is not widely represented in the Ashburton River catchment area but are locally important. Most of the clays in the area crack on drying and are therefore Ug soils but non-cracking clays, (Uf 631) are sometimes found on drainage floors where they may form scalded surfaces. These scalds are often a result of the stripping of the A horizon from a duplex (Dr) soil which is now seen as a uniform clay soil. Uniform clays (Uf 612) are also found on claypans of the Coastal soil region.

Non-cracking, uniform clay soils (Uf 612, 621) are found on some flood plains in the Alluvial soil region and often grade into gilgai (Ug) soils.

Uniform seasonally cracking soils (Ug)

These soils are found in all 10 soil regions of the survey area. They are usually more than one metre deep, and most of them have been classified Ug 538. They are found in positions of slow and retarded drainage except where they are formed *in situ* on dolerite and basalt plateaux. These soils usually support perennial grasses, especially on the alluvium of Minderoo, Yanrey, and Mt. Brockman Stations.

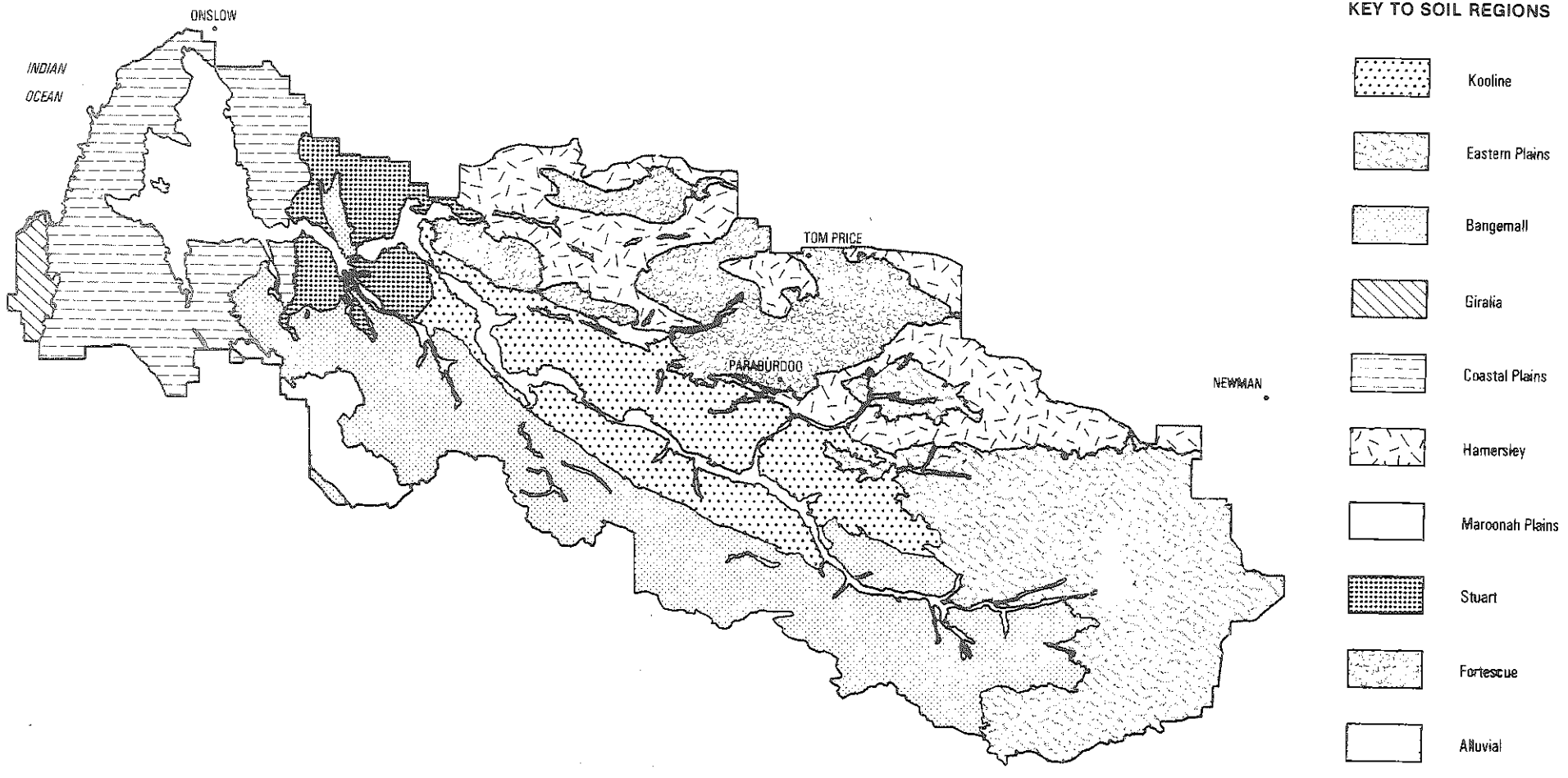
Gradational soils, calcareous throughout (Gc)

Soils with this profile form have a very limited distribution and are only common in the Giralia soil region. Here they occur as loams and clays (Gc 112, 222) on broad outwash plains and drainage floors of alluvium derived from limestone. They occur occasionally in other regions for example on lower plains developed on dolerite and calcareous shales in the Bangemall soil region and on calcrete platforms (Gc 112) and drainage floors (Gc 212) in the Maroonah Plains soil region.

Gradational soils, not calcareous throughout (Gn)

These soils are found throughout the survey area but are restricted to the lower units in landscapes. They are common (Gn 112) on plains with thin sand cover and associated drainage lines in the Coastal soil region. They

Figure 10 — Geographic location of soil regions



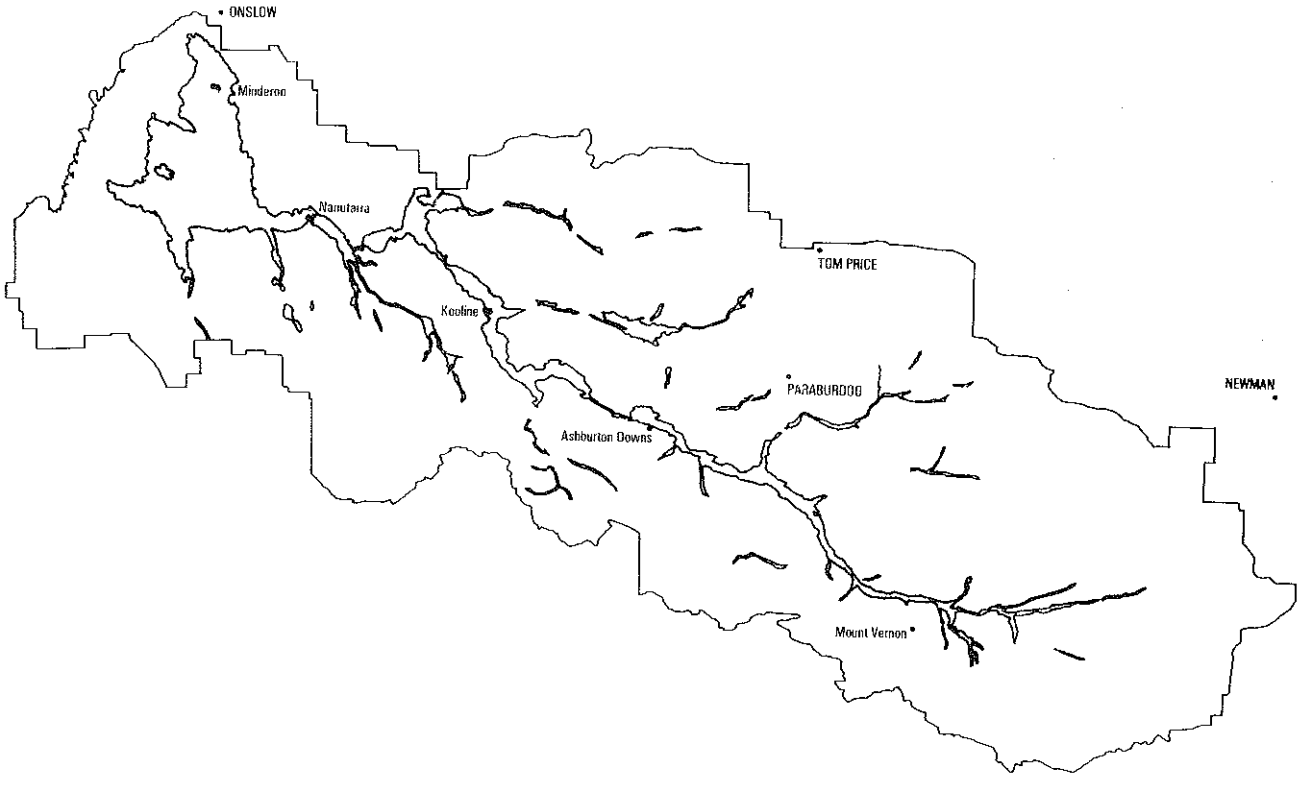
are also common on the lower plains and drainage floors of the Eastern Plains, Kooline, Maroonah and Stuart soil regions as Gn 112, 211, 212 and 213 soils.

Texture contrast soils (Dr)

Texture contrast (duplex) soils are common in six of the 10 soil regions. They are the most sensitive soils to any form of disturbance with the light textured surface horizons being rapidly removed by wind and water action once the vegetative cover is depleted. Large bare scalds develop on exposed B horizons of clay and these surfaces are extremely unfavourable euvironments for plant establishment. Texture contrast soils were once widespread on the Edward land system of the Kooline soil region but now only relics of the original soils remain in infrequently grazed areas. Soils are now mostly windpiled sands or clays with bare scalded surfaces. Elsewhere in the Kooline soil region, duplex soils (Dr 213) are common on drainage floors in good or fair condition.

Duplex soils (Dr 213, 412) occur quite commonly in the Coastal soil region on undulating stony plains, plains with thin sand cover and drainage floors in association with gradational (Gn) and sandy (Uc) soils. Duplex soils (Dr 312, 451) are found in the drainage floors of the Bangemall and Stuart soil regions and on undulating upper plains and some flood plains of the Maroonah and Alluvial soil regions respectively.

ALLUVIAL SOIL REGION (7 548 sq km)



The Alluvial soil region is restricted to flood plains and alluvial deposits of the Rous Creek, Yannarie River and the Ashburton River and its major tributaries such as the Hardy and Angelo Rivers and Duck Creek.

All the soil materials in the region were originally deposited by alluvial action but in some instances have been resorted to produce sands or duplex soils. The land systems, Ashburton, Cheela, Cheetarra, Globe, Minderoo, Nanyarra, River, Rous and Yanrey are included in the region.

The region is characterised by very large areas of deep silty loams and clays on broad plains, restricted areas of highly fertile clays in depressions and low back plains and the complete absence of skeletal soils.

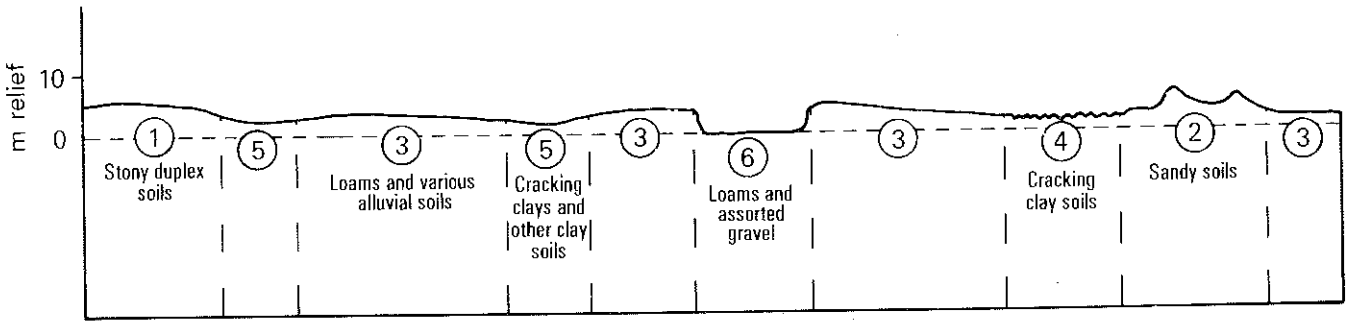
There are minor areas of sands in low dunes and isolated sand plains.

The deep loam and clay soils are subject to irregular flooding and after flooding support dense stands of annual herbage between perennial shrubs. Fertility levels are moderate (mean 290 ppm nitrogen, 17 ppm phosphorus). The loams become very powdery when dry and, where bare of vegetation, are susceptible to erosion. The cracking clay soils of the depressions and back plains are more regularly flooded and their natural fertility levels are good with high nitrogen (mean 500 ppm) and very high phosphorus (mean 37 ppm).

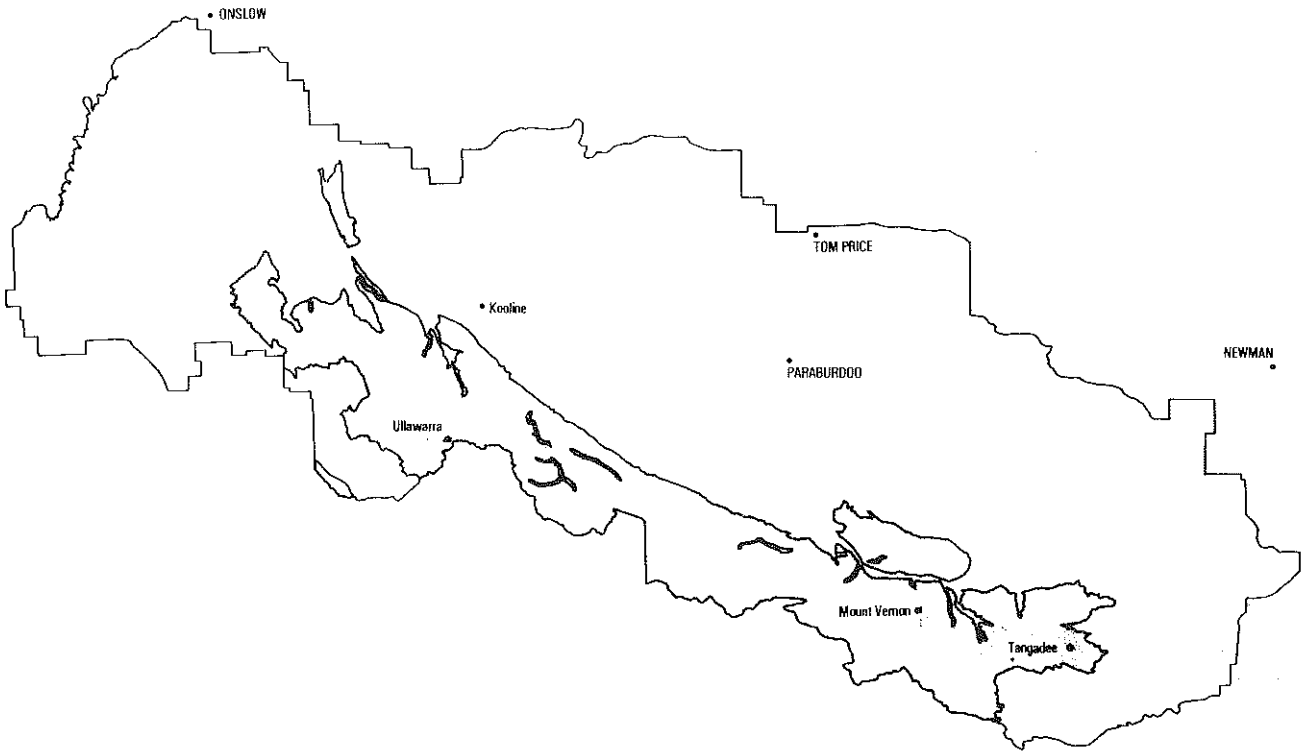
The sandy soils of the region are of low fertility but are marginally higher in phosphorus (mean 8 ppm) than sand of other regions (Coastal soil region, mean 3 ppm; Eastern plains soil region, mean 6 ppm).

Table 18 — Alluvial Soil Region

Unit No.	Soil description and position	% area	No. samples	Principal profile forms	Mean depth (cm)	Surface stone %	Mean pH	Mean tss (%)	Mean N (ppm)	Mean P (ppm)
1	Stony duplex soils (Slightly raised plains)	3	13	Dr 212(3, 453(2), 412, Uc 521(2), Gn 212, 213	100+	<50	7.5	0.4	247	13
					S.D. 0					
2	Sandy soils (Sand dunes and sand plains)	12	22	Uc 123(7), 511(12), 143	100+	0	7.0	.01	121	8
					S.D. 0					
3	Loams and various alluvial soils (Flood plains)	55	66	Um 522(6) 542(5), 512(2), Uc 511(5), 123(4), Uf 621(7), 612(4), Gn 212(3), 213(3), Dr 253(2)	100+	<50	7.5	.11	290	17
					S.D. 0					
4	Cracking clay soils (Gilgai plains)	12	29	Ug 538(29)	100+	0	8.0	.03	320	17
					S.D. 0					
5	Cracking clays and other clay soils (Depressions and low back plains)	9	19	Ug 538(8), Uf 671(2), Um 542(2)	100+	0	7.0	.03	501	37
					S.D. 0					
6	Loams and assorted gravel (Banks and channels)	7	4	Um 113, Uc 113	47	46	8.5	na	na	na



BANGEMALL SOIL REGION (19 175 sq km)



The Bangemall soil region flanks the southern boundary of the survey area. It is based on Bangemall Group geological formations which consist of sandstones, shales, dolomites and quartzites intruded by dolerite dykes and sills. Remnants of broad plains of Tertiary valley fill deposits occur but are restricted to small areas of hanging plains on the sides of large hills in south-eastern parts of the region.

Soils of the region have formed *in situ* on stripped surfaces or have accumulated on lower slopes and narrow drainage floors by colluvial and alluvial action. On the hills and upper slopes the soils are very shallow and stony and occur in pockets between rock outcrop; deeper soils occur on the more gentle footslopes and narrow drainage floors.

The Augustus, Bryah, Charley, Collier, Mulgul, Nirran, Ruby, Scoop, Tangadee and Ullawarra land systems are included in this soil region.

The rugged topography of the Bangemall soil region is responsible for its chief soil characteristic, which is the high proportion (70 per cent) of skeletal and shallow stony loams.

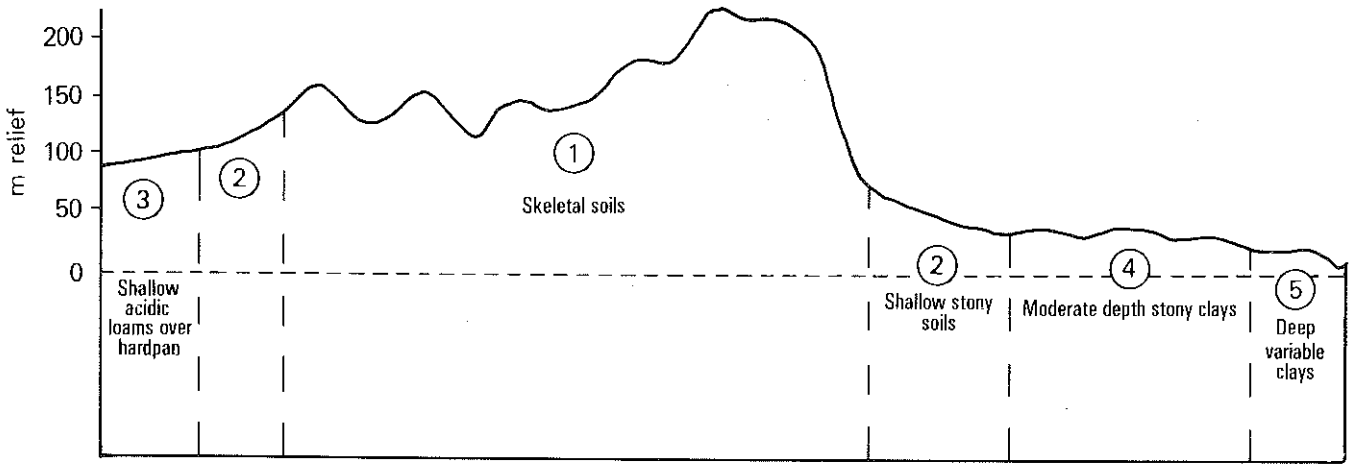
Cracking and non-cracking alkaline clays, which are sometimes saline, are characteristic of the lower plains (14 per cent) of the region. The narrow drainage floors (12 per cent) have widely different drainage conditions and, as a result, the soils are variable and may be sands, texture contrast soils or cracking clays.

Most soils in the region are alkaline and many contain accumulations of calcium carbonate. This reflects the calcareous nature of much of the parent material from which the soils are formed.

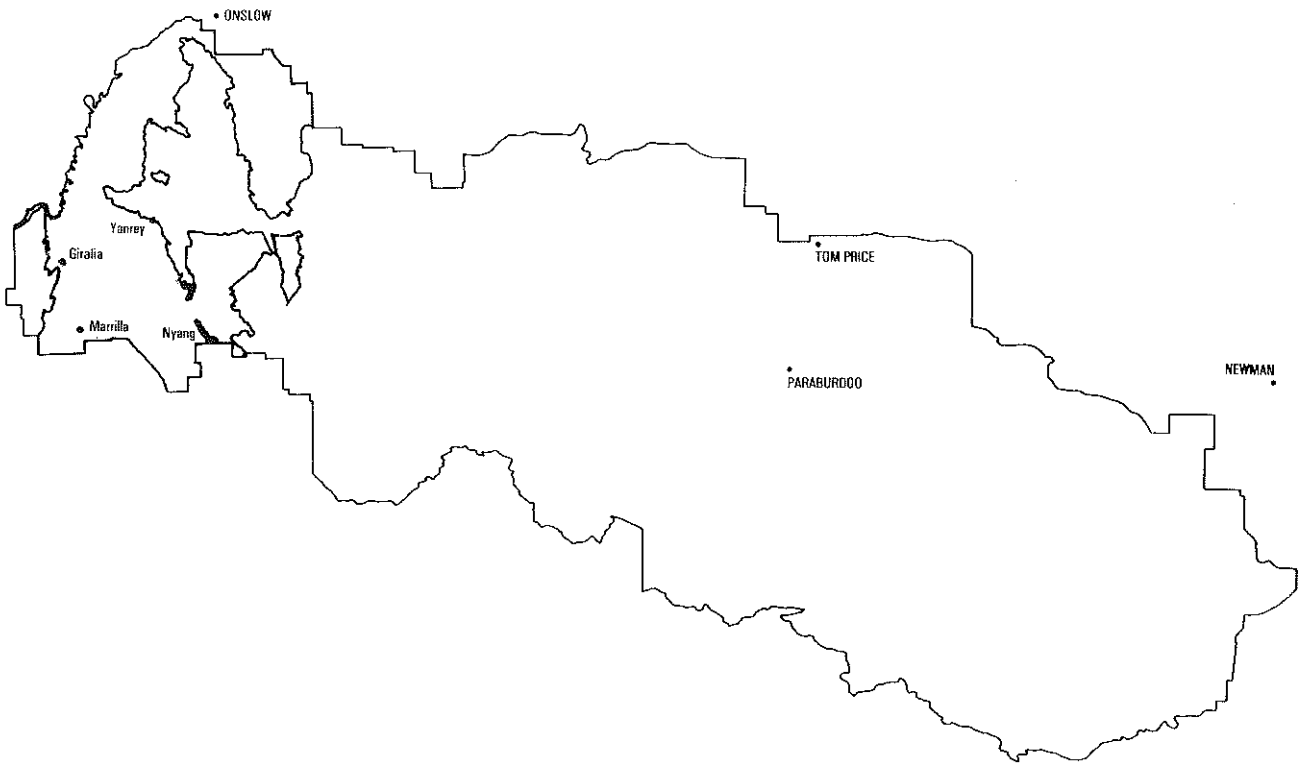
Relic hardpan soils (4 per cent) are very different from the other soils in the region because they are acidic (mean pH 6.0) and lower in phosphorus (mean 8 ppm).

Table 13 — Bangemall Soil Region

Unit No.	Soil description and position	% area	No. samples	Principal profile forms		Mean depth (cm)	Surface stone %	Mean pH	Mean tss (%)	Mean N (ppm)	Mean P (ppm)
1	Skeletal soils (Sandstone and dolomite hills)	55	13	Um 511(2), 521(2), 512, 143		26	>50	7.0	0.2	407	21
					S.D.	28					
2	Shallow stony soils (Footslopes)	15	7	Uc 511(2), 143, 512, Um 522, Uf 612, Gc 112		51	>50	8.0	.01	212	15
					S.D.	18					
3	Shallow acidic loams over hardpan (Hardpan plains)	4	4	Um 531(2), 143, 521		29	>50	6.0	.01	297	8
4	Moderate depth stony clays (Lower plains)	14	19	Uf 612(2), 621(2), Ug 538(3), Gc 112(2), Um 512(2)		72	<50	8.0	.24	273	11
					S.D.	31					
5	Deep variable sands and clays (Drainage floors and creeklines)	12	19	Uc 511(3), Gn 413(3), Dr 213(2), Ug 537(3), 538(5)		91	<50	8.0	.09	345	14
					S.D.	19					



COASTAL PLAINS SOIL REGION (11 353 sq km)



The Coastal Plains soil region consists of nearly flat sandy plains with no organised through drainage which extend for many kilometres. Sand dunes are common towards the coast and a few isolated low hills of metamorphosed Ashburton formation rocks and low mesas of flat-bedded Cretaceous sediments occur in the east. The region is bounded to the west by the Indian Ocean and to the east near Nanutarra station by rough hills and ranges.

The soils of the region are sands, sandy loams, sands over clay and gravels deposited and reworked by sheet flood and wind action. They are mostly very low in nutrients and as a result the predominant vegetation is hard spinifex *(Triodia lanigera)*.

The region is comprised of the Dune, Giralia, Littoral, Nanutarra, Onslow, Uaroo, Winning and Yankagee land systems.

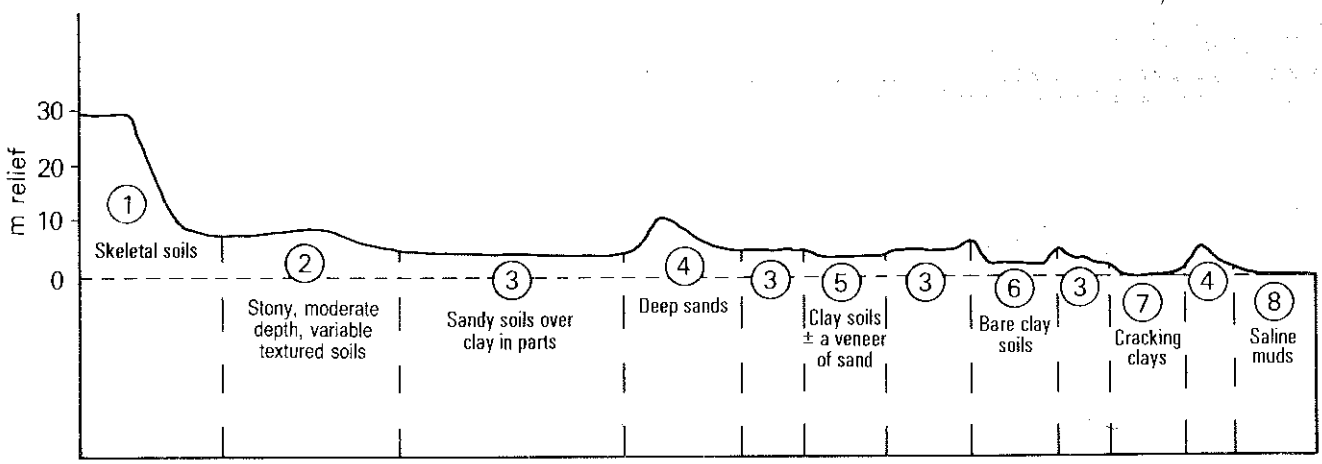
The unique feature of this soil region is the large area (58 per cent) of sand plain and plains with thin sand cover. Soils grade from uniform sands through gradational to texture contrast types. They are deep (1m+), generally neutral and very low in nitrogen (mean 138 ppm) and phosphorus (mean 3 ppm). A further characteristic is the sand dunes which occupy about 8 per cent of the region's area. These have deep, generally neutral, loose sand soils and very low nitrogen (mean 70 ppm) and very low phosphorus (mean 3 ppm). These levels are among the lowest of any soils in the survey area.

Claypans with uniform clay soils and tidal mudflats with dark saline clays are common and collectively occupy about 14 per cent of the region's area. Claypans occur only rarely in other soil regions and mudflats are exclusive to this region. The claypans have sealed deflation lag surfaces which are almost impervious to water and consequently the pans hold water for some time after rain. The clays of the pans and mudflats are highly alkaline, commonly with inclusions of gypsum or carbonate in the profile. The clays of the mudflats are usually highly saline with up to 2 per cent total soluble salts.

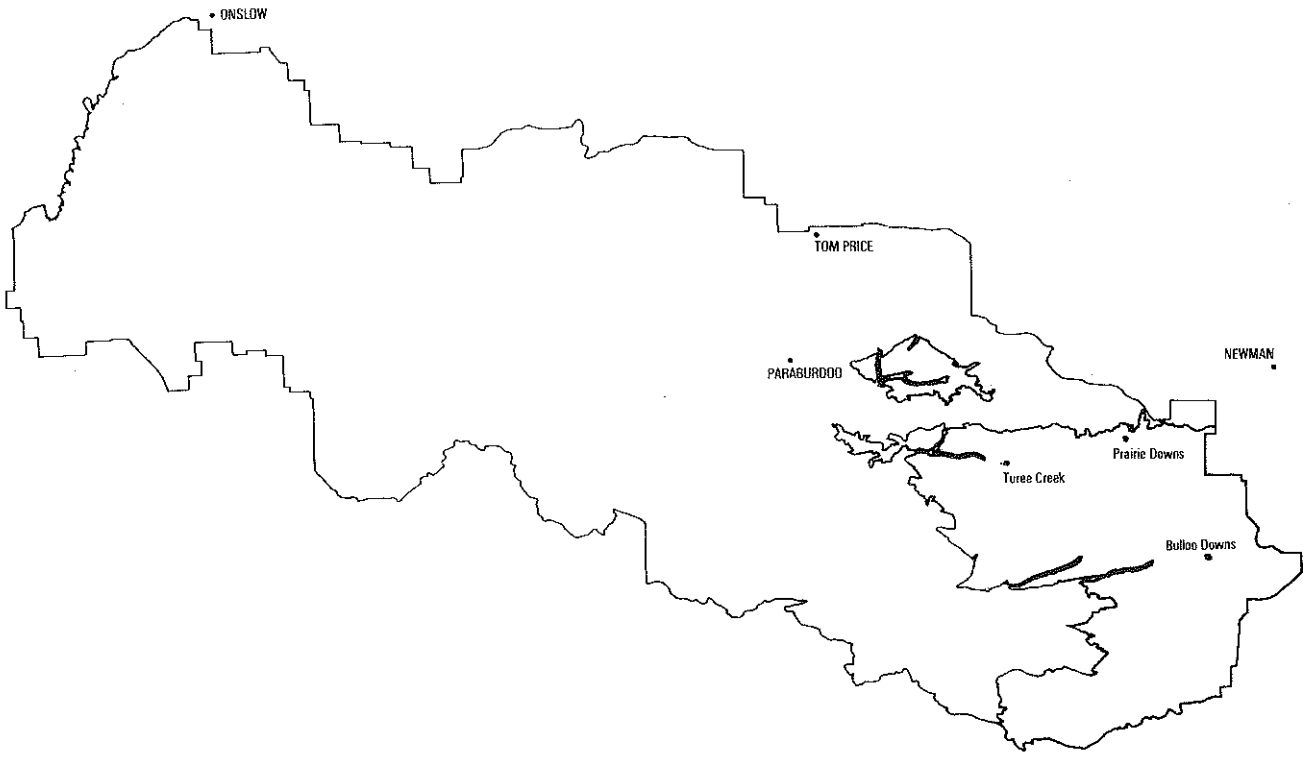
Broad, usually unchannelled, drainage floors occupy about 12 per cent of the region. Soils are weakly acidic to alkaline gradational loams over clay, uniform clays or duplex types with sand over clay. Some of these soils are susceptible to water erosion.

Table 17 — Coastal Plains Soil Region

Unit No.	Soil description and position	% area	No. samples	Principal profile forms	Mean depth (cm)	Surface stone %	Mean pH	Mean tss (%)	Mean N (ppm)	Mean P (ppm)
1	Skeletal soils (Low hills)	1	5	Um 113	11	>50	7.5	0.5	440	6
2	Stony, moderate depth variable textured soils (Stony plains)	5	16	Uc 113(3), Dr 413(2)	75	<50	7.5	.06	224	8
					S.D. 34					
3	Sand soils over clay in parts (Sandy plains)	58	15	Uc 511(5), 123(2), Gn 112(4), Dr 213(2)	100+	0	7.0	.01	138	3
					S.D. 0	0				
4	Deep sands (Sand dunes)	8	7	Uc 123(7)	100+	0	7.0	.01	70	3
					S.D. 0	0				
5	Clay soils ± a veneer of sand (Drainage floors)	12	21	Gn 112(5), 213(2), 242, Dr 413(2), 251, Uf 612(2), 621, 653	100	0	6.5	.30	312	15
					S.D. 0					
6	Bare clay soils (Claypans)	3	2	Uf 612, 671	100+	0	8.0	.08	160	16
7	Cracking clays (Swamps and depressions)	2	5	Ug 528, 538(3), Gn 212	100+	0	7.0	.23	275	21
8	Saline clays (Coastal mud flats)	11	4	Uf 133, 621	100+	0	9.0	.71	216	18



EASTERN PLAINS SOIL REGION (17 295 sq km)



The Eastern Plains soil region consists of broad, nearly flat hardpan plains, irregular plains on dissected hardpan and stony plains, hills and ranges of Bangemall and Bresnahan Group rocks. It is in the far east of the survey area and extends westward until the hardpan landforms no longer dominate the landscape in the vicinity of Bulloo Downs, Tangadee and Turee Creek stations.

The Cadgie, Divide, Egerton, Ford, Jamindie, Kunderong, Laterite, Nooingnin, Prairie, Spearhole, Tangadee, Three Rivers, Turee and Warri land systems comprise the region.

The predominant soils of the region have developed on broad plains of colluvial valley fill deposits now cemented by silica to form hardpan which may be up to 30 m deep. These soils are characteristic of the region and occur over about 36 per cent of the total area. They are acidic loams and sands underlain by hardpan at very shallow depth. In the areas of dense vegetation (groves) on the hardpan plains the soils are deeper than 1 m and the hardpan layer either occurs at greater depth or is absent. These trenches of deeper soil are aligned more or less on the contour transverse to the direction of sheet water flow and accumulate water shed from the adjoining upslope hardpan plains. The shallow loamy hardpan soils are generally higher in phosphorus (mean 14 ppm) than the deep soils of the groves (mean 8 ppm) but much lower in nitrogen (mean 250 ppm) than the deep soils (mean 640 ppm).

Sandy soils overlying hardpan occupy about 13 per cent of the region's total area. Depth to hardpan is variable and on sandplain may be in excess of 1 m. Where the sands are more shallow they often form low sandy banks between scalded areas with the hardpan very close to the surface. On the sands the levels of phosphorus are usually low or very low (mean 6 ppm) and the levels of nitrogen are very low (mean 118 ppm).

Shallow calcareous sands and loams in zones of dissected calcreted hardpan occupy about 16 per cent of the total area. Soils are extremely shallow, alkaline and very low in phosphorous (mean 2 ppm) and low in nitrogen (mean 230 ppm).

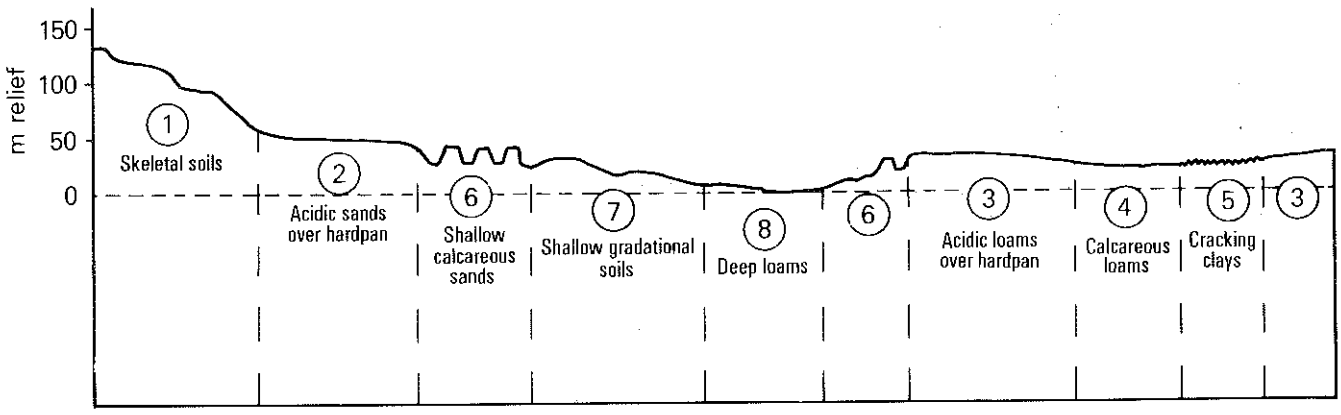
Gradational soils occupy 10 per cent of the area and are found as shallow to moderate depth, stony soils developed on plains stripped of hardpan to expose the underlying basement rocks. These soils are neutral, sometimes saline and have moderate levels of nitrogen (mean 360 ppm) and very low levels of phosphorus (meau 4 ppm).

Calcareous loams of variable depth occupy 3 per cent of the region and are common on low calcrete platforms and drainage zones within the hardpan plains.

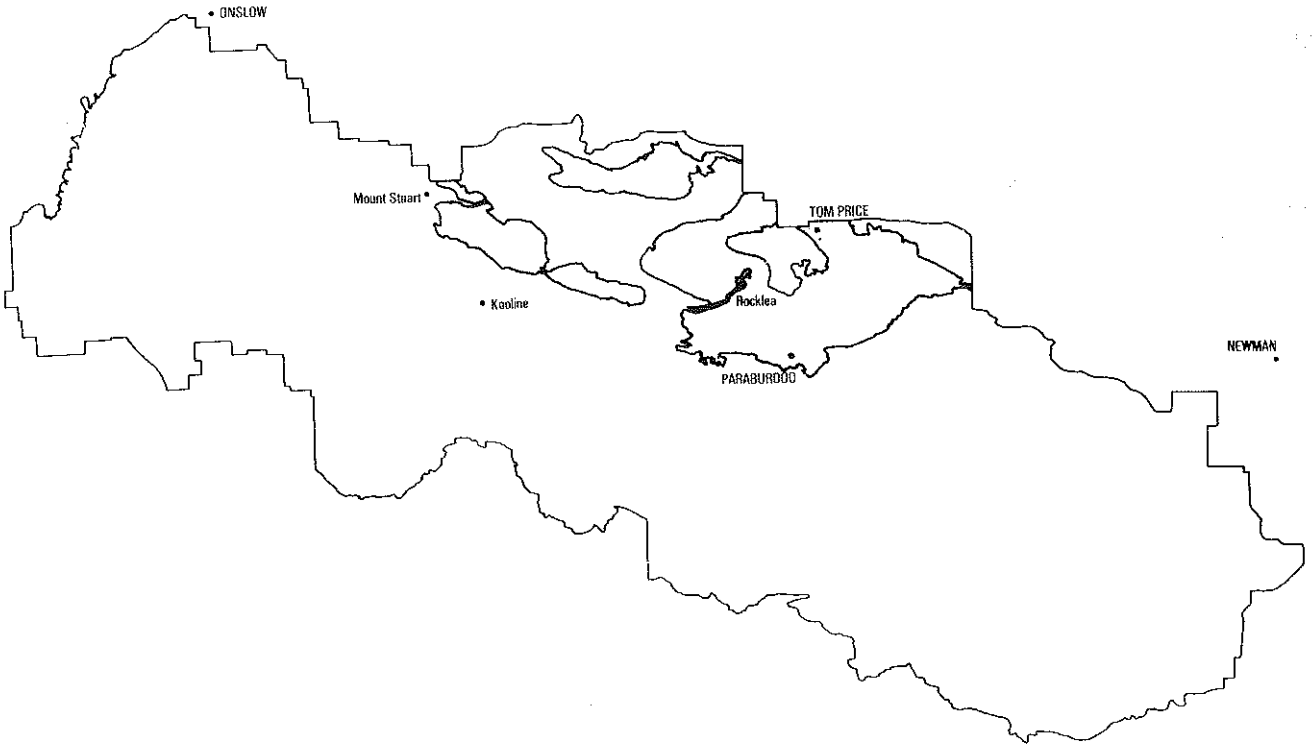
A further distinguishing feature of this soil region, when compared to some other regions, is the small proportion (7 per cent) of skeletal soils developed on ridges, hills and hill footslopes.

Table 14 — Eastern Plains Soil Region

Unit No.	Soil description and position	% area	No. samples	Principal profile forms		Mean depth (cm)	Surface stone %	Mean pH	Mean tss (%)	Mean N (ppm)	Mean P (ppm)
1	Skeletal soils (Sandstone and quartzite hills)	7	15	Uc 512(2), 511(2), 144, 123, Um 551(2), 521(2), 222		37	>50	7.0	0.1	210	9
					S.D.	27					
2	Acidic sands over hardpan (Sand plain)	13	18	Uc 511(7), 521(7), 123(2)		82	<50	6.0	.01	118	6
					S.D.	28					
3	Acidic loams over hardpan (Hardpan plains) Intergroves	35	25	Um 531(15), 521(10)		34	<50	6.0	.02	254	14
					S.D.	18					
	Groves	1	7	Um 522(6), 521		100+	<50	6.0	.01	640	7
					S.D.	0					
4	Calcareous loams (Calcrete platforms)	3	6	Um 511(4), Uc 511(2)		48	<50	8.5	.02	250	8
					S.D.	41					
5	Cracking clays (Gilgai plains)	4	19	Ug 537, 538(16)		100+	<50	7.0	.01	360	15
					S.D.	0					
6	Shallow calcareous sands and loams (Dissected hardpan plains)	16	3	Uc 512(2), Um 531		20	>50	8.0	.02	230	2
7	Moderate depth stony gradational soils (Interfluves)	10	8	Gn 213(3), 212, 222, Uc 521(2)		76	>50	7.0	.40	360	11
					S.D.	22					
8	Deep variable soils (Drainage floors)	10	23	Um 521(5), 522(4), 512(3), Uc 511(3), 521(3), Uf 631(2), Gn 212(3)		85	<50	7.0	.22	277	11
					S.D.	25					



FORTESCUE SOIL REGION (9 124 sq km)



The Fortescue soil region consists of hills, plateaux, valley plains and narrow drainage floors formed on basalts of the Fortescue Group and is located in the central northern parts of the survey area. The component land systems of the region are Paraburdoo, Rocklea and Wona.

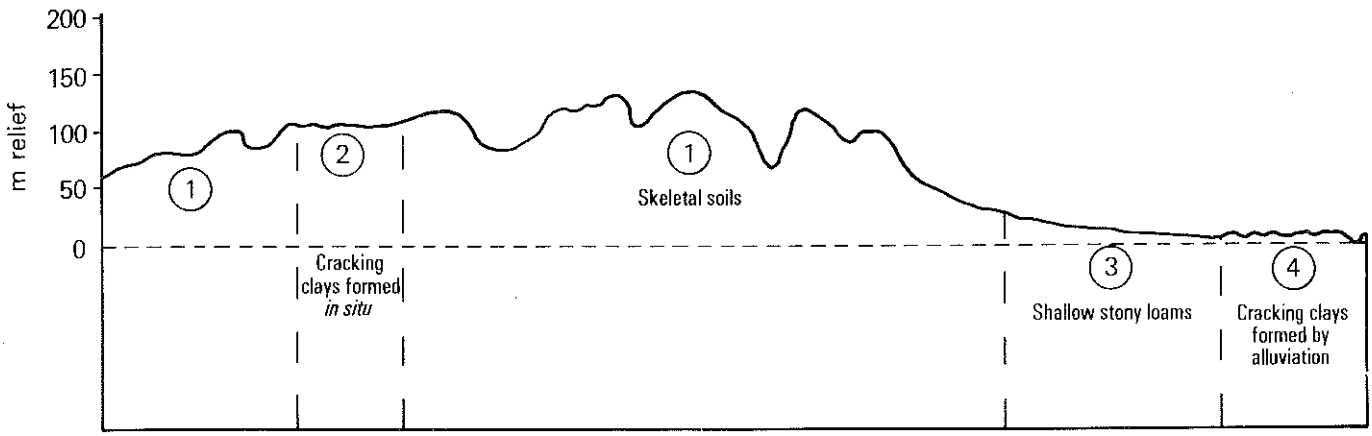
The region is characterised by a predominance (64 per cent of the area) of skeletal loams and areas with no soil development on basalt hills and hillsides and by infertile self-mulching cracking clays (6 per cent) developed *in situ* on basalt uplands and plateaux. The latter soils are usually greater than 1 m deep, alkaline, with a dense surface mantle of basalt pebbles and cobbles and have low nitrogen levels (mean 255 ppm) and very low phosphorus levels (mean 2 ppm). They support a unique low shrubland of *Cassia* aff *hamersleyensis*.

On gently sloping lower footslopes and pediments (15 per cent of the region) very stony alkaline loams and clays have developed. Depth to decomposing basalt parent material is variable but usually shallow. These soils are also widespread in other soil regions, but on different parent materials.

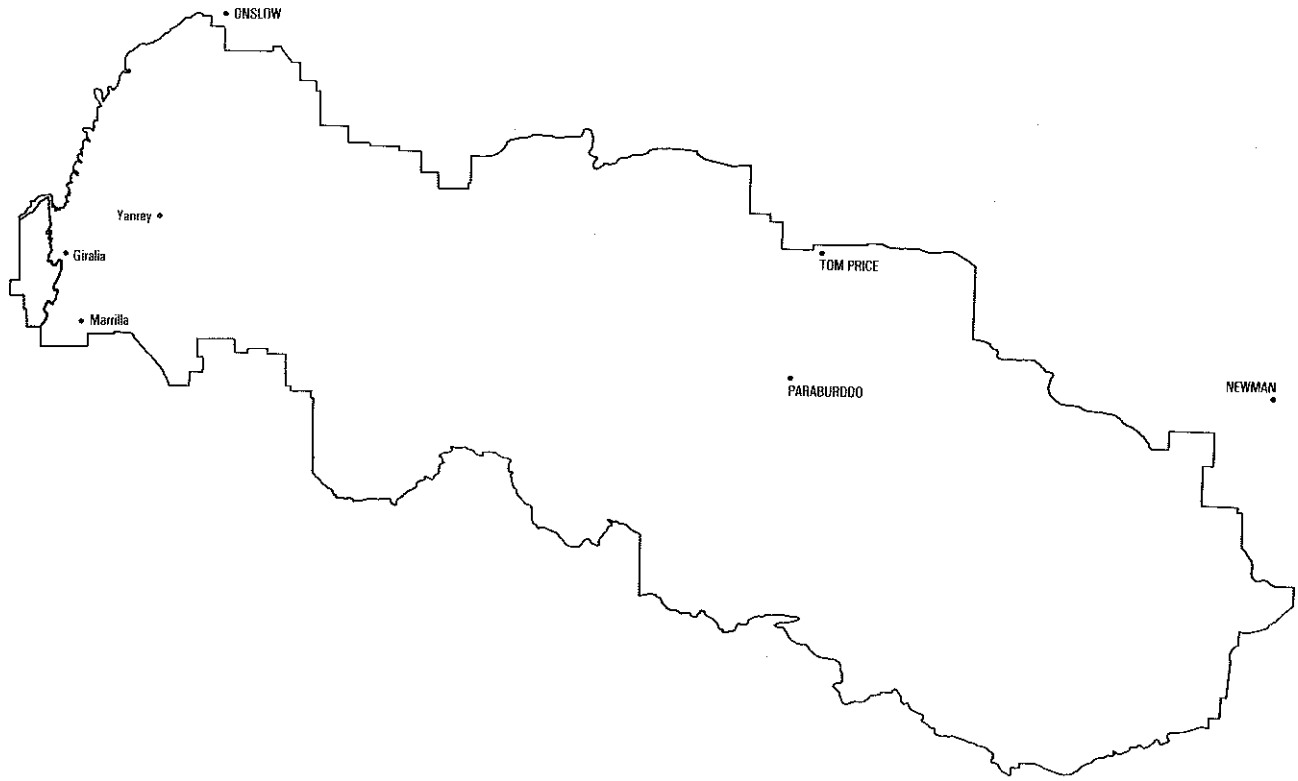
Alluvial soils (15 per cent) have accumulated in the lowest part of the landscape and, in this soil region, are mostly cracking clays with well developed linear gilgai or normal gilgai microrelief. They are rather more fertile (nitrogen mean 311 ppm, phosphorus mean 9 ppm) than the upland clays developed *in situ*. Due to overgrazing many of these soils support little vegetation and erosion, (in the form of thin sheeting, rilling and shallow gullying) is common.

Table 20 — Fortescue Soil Region

Unit No.	Soil description and position	% area	No. samples	Principal profile forms	Mean depth (cm)	Surface stone %	Mean pH	Mean tss (%)	Mean N (ppm)	Mean P (ppm)
1	Skeletal soils (Basalt hills)	64	3	Um 511, 551	22	>50	7.5	—	—	—
2	Cracking clays (Basalt plateaux)	6	4	Ug 538(4)	100+	>50	8.0	.03	255	2
3	Shallow stony loams (Lower footslopes and interfluves)	15	6	Um 511(2) 512, 521, Gc 122, Uf 631	60	>50	7.5	.11	340	10
					S.D. 33					
4	Cracking clays (Drainage floors)	15	12	Ug 537, 538(7), Uc 511, Uf 571	100+	>50	8.0	.04	311	9
					S.D. 0					



GIRALIA SOIL REGION (824 sq km)



The Giralia soil region is the smallest region and consists of low cuestas and hills of Tertiary and Cretaceous limestones and their associated outwash plains. It is located in the extreme west of the survey area and is comprised exclusively of the Donovan, Firecracker, Jubilee and Yarcowie land systems.

Calcareous gradational loams over clay and calcareous clays characterise the region and occupy about 89 per cent of the total area. They have developed *in situ* on undulating limestone plains and interfluves or have been deposited by alluvial action on lower outwash plains. They are generally moderately deep to full depth (greater than 1 m) and have no stony surface mantle.

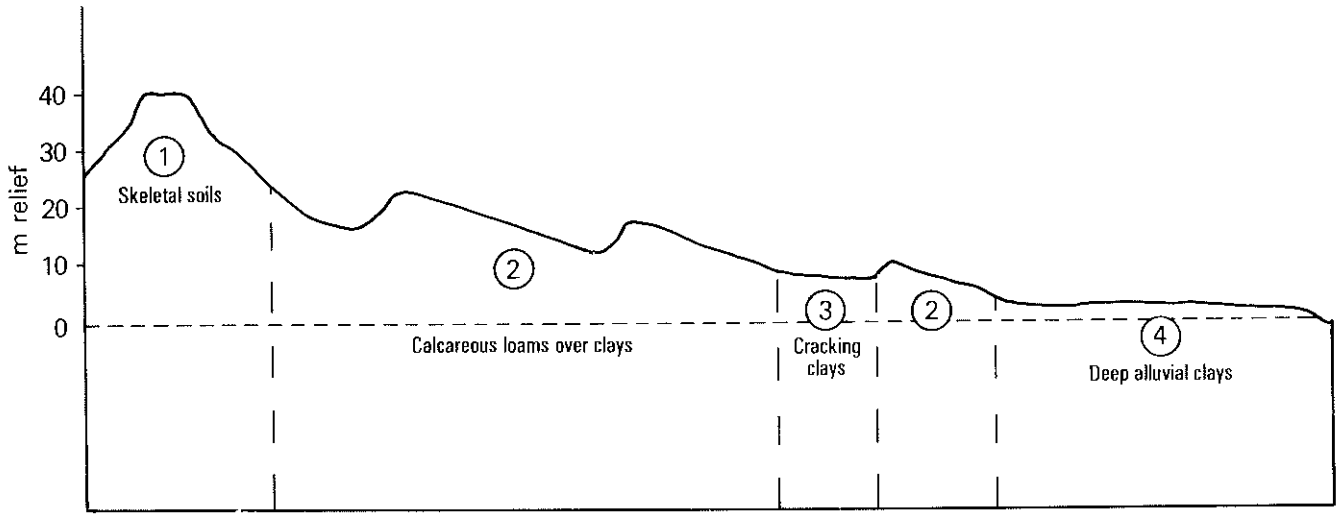
The region has only a small proportion (9 per cent) of stony skeletal loams and clays developed on limestone hills. Sedentary cracking clays (2 per cent) have developed from bentonitic siltstone of the Yarcowie land system.

All the soils in the region are highly alkaline and have higher mean nitrogen levels (420 to 910 ppm) than any other soils in the survey area. Their phosphorus levels are mostly moderate to high (10 to 27 ppm).

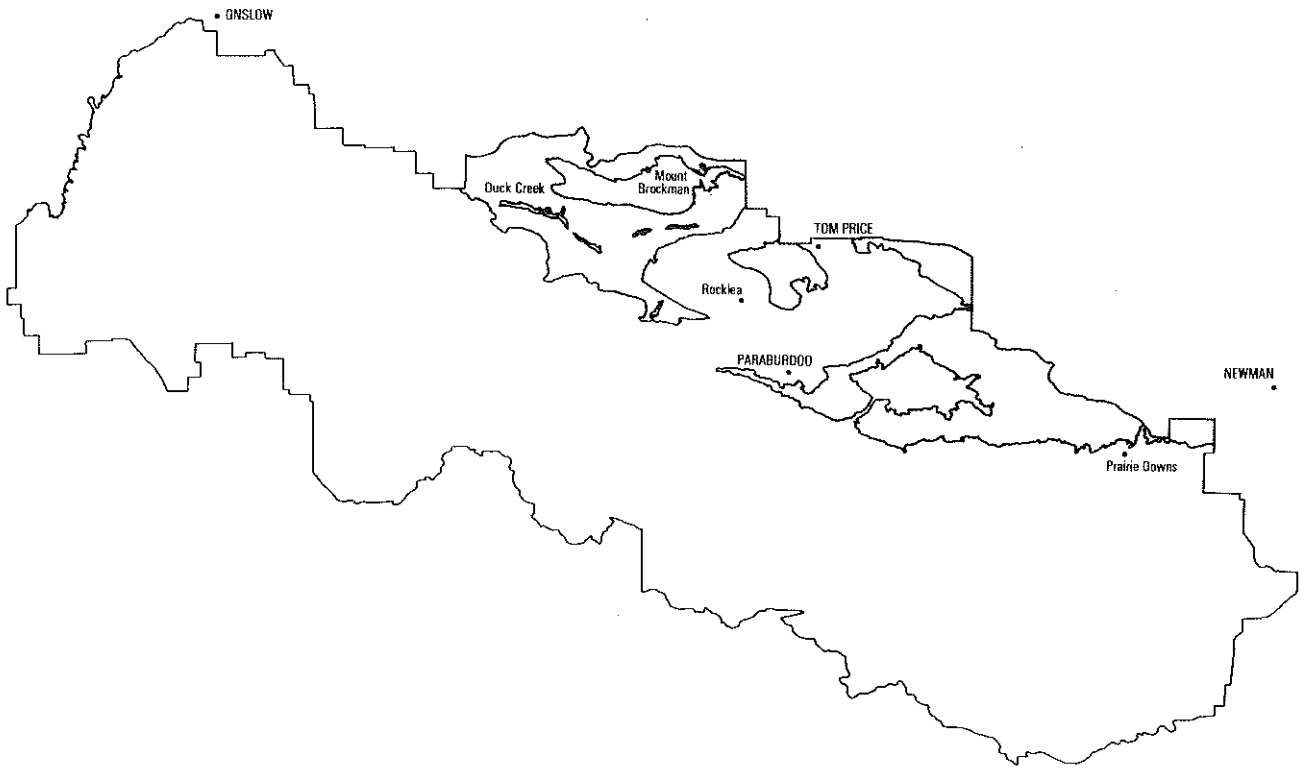
The gradational loams over clay are poorly coherent and are inherently susceptible to erosion, especially on long slopes which may be up to 2.5 per cent. Increased water runoff has occurred where vegetative cover has been depleted by grazing and some large gullies have formed along sheep pads and vehicle tracks heading downslope.

Table 22 — Giralia Soil Region

Unit No.	Soil description and position	% area	No. samples	Principal profile forms	Mean depth (cm)	Surface stone %	Mean pH	Mean tss (%)	Mean N (ppm)	Mean P (ppm)
1	Skeletal soils (Limestone hills)	9	3	Um 511, Uf 131	27	>50	8.5	.80	910	21
2	Calcareous loams over clays (Undulating limestone plains and interfluves)	67	13	Gc 112(5), 222, Um 512(4), 511, 613, Uf 621	83	<50	8.5	0.03	420	15
					S.D. 26					
3	Sedentary cracking clays (Gilgai plains)	2	1	Ug 538	100+	0	9.0	.03	540	10
4	Deep alluvial clays (Outwash plains)	22	5	Uf 621(2), Gc 222(2), Um 512	100+	0	8.5	0.04	656	15



HAMERSLEY SOIL REGION (11 691 sq km)



Rugged ironstone hills with narrow valleys and drainage floors, broad stony plains and low clay plains make up the Hamersley soil region which is situated in the central northern part of the survey area. The Boolgeeda, Brockman, Newman, Platform and Robe land systems comprise the region.

Soils in the area have been formed by weathering of the Hamersley ironstones and by concentration of the weathering products in low parts of the landscape. In the Tertiary period broad colluvial valley plains formed between the hills. Rejuvenated drainage has now removed most of these valley fill deposits except for dissected remnants which constitute the Platform and Robe land systems.

Present day soils and land surfaces consist of —

- Skeletal stony soil developed on large ironstone hills, ridges and plateaux.
- Shallow stony loams on relicts of the old Tertiary valley fill deposits which occur as dissected surfaces or lines of pisolitic mesas perched on hillsides or in valleys. The same soils also occur on the stony plains between the hills. These plains are lower than the old Tertiary surfaces and have formed by reworking of the old valley fill deposits.
- Variable depth loams on banks and narrow margins flanking streamlines.
- Cracking clay plains which have formed by alluvial action in a few of the broadest drainage floors of the region.

The region is characterised by a much larger proportion (46 per cent of the region's area) of shallow stony loams than are found in other soil regions. These soils are generally slightly acidic, occasionally saline and have moderate nitrogen levels (mean 380 ppm) and very low phosphorus levels (mean 4 ppm).

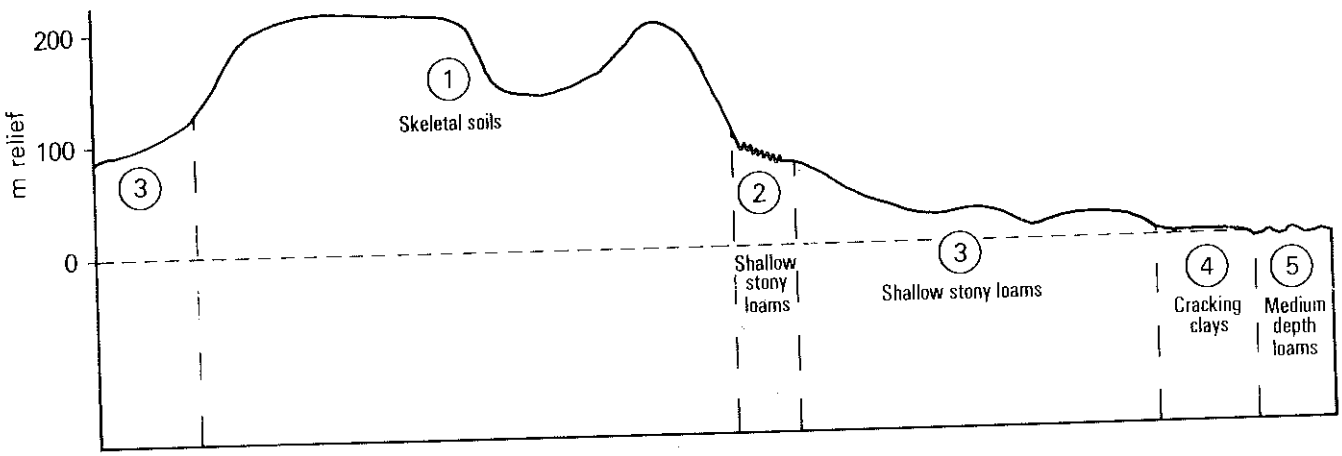
Skeletal soils or areas with no soil development cover about 47 per cent of the region. They consist of shallow pockets of extremely stony loams in areas of reduced slope surrounded by ironstone cobble and boulder-strewn hill surfaces and rock outcrop.

Cracking clay soils occupy only about 1 per cent of the region (the Brockman land system) and occur in isolated valley floors. These floors have flat, central, treeless gilgai plains supporting *Chrysopogon fallax* tussock grasslands surrounded by gently sloping plains. The gently sloping plains support dense woodlands of *Acacia aneura* and have characteristic linear gilgai microrelief arranged transverse to the direction of water flow. Phosphorus levels (mean 14 ppm) are much higher in the cracking clays than in the other soils of the region.

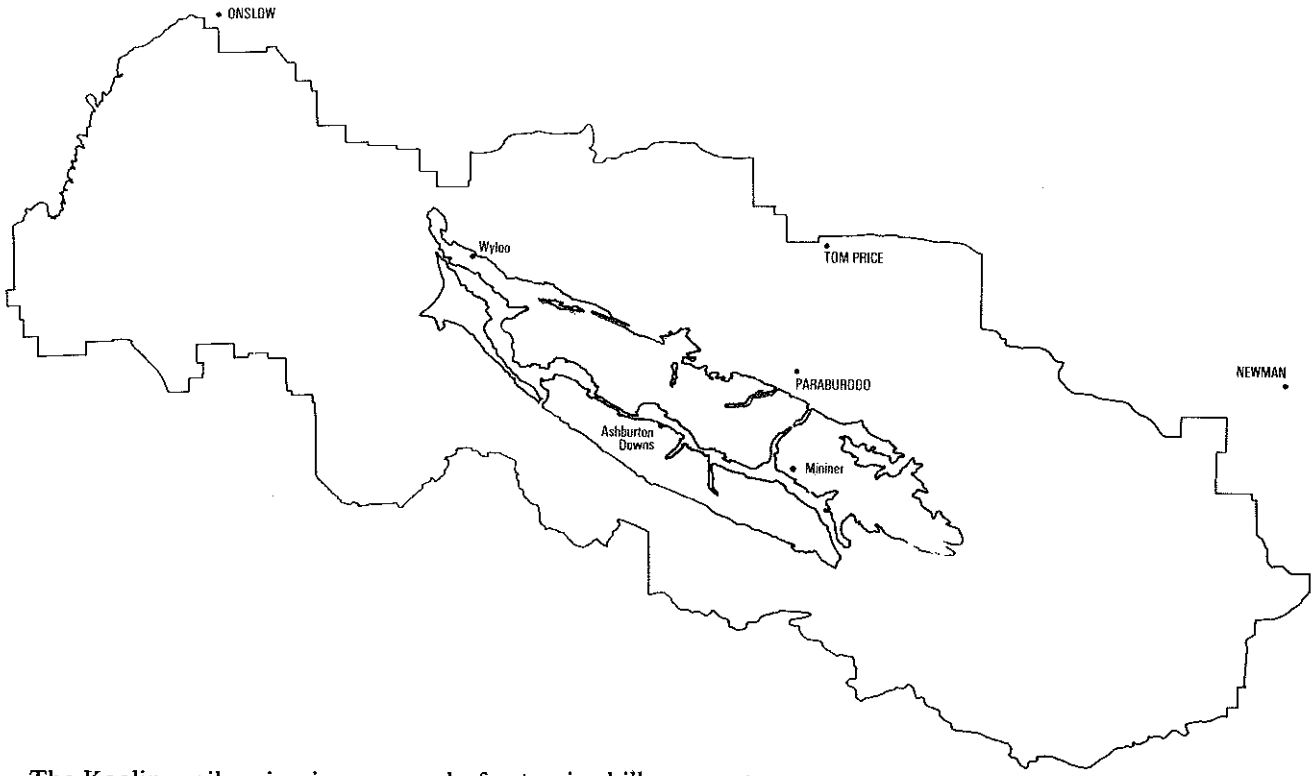
Loamy alluvial soils of variable depth associated with channels and creeklines occupy about 6 per cent of the region.

Table 15 — Hamersley Soil Region

Unit No.	Soil description and position	% area	No. samples	Principal profile forms	Mean depth (cm)	Surface stone %	Mean pH	Mean tss (%)	Mean N (ppm)	Mean P (ppm)
1	Skeletal soil (Banded ironstone hills)	47	2		0	>50	—	—	—	—
2	Shallow stony loams (Dissected colluvial plains)	6	1	Um 521	40	>50	—	—	—	—
3	Shallow stony loams (Footslopes and interfluves)	40	18	Um 521(6), 522, 551(2), 552, Uc 521, Gn 212, Dr 413	46	>50	6.5	0.71	380	4
4	Cracking clays (Alluvial plains)	1	7	Ug 538(5), 536(2)	100 +	<50	7.5	.02	410	14
					S.D. 0					
5	Medium depth loams (Flow zones, banks and channels)	6	7	Um 551(2), 552, Uc 121, Dr 251	59	<50	6.5	.03	560	5
					S.D. 34					



KOOLINE SOIL REGION (11 381 sq km)



The Kooline soil region is composed of extensive hill tracts, narrow drainage floors, broad outwash plains and stony plains based mainly on shales of the Ashburton formation (Wyloo Group) but also on greywacke and dolomite formations of the Wyloo Group. It is located in the centre of the survey area on either side of the Alluvial soil region along the Ashburton River and is comprised of the Capricorn, Dollar, Edward, Ethel and Table land systems.

The soils of the region are nearly all formed from decomposition products of the shale and dolomite hills. Many are shallow and skeletal on parent material and others have been deposited in drainage floors and outwash plains by colluvial and alluvial action.

The valleys of the region were filled with colluvial deposits in the Tertiary period but rejuvenated drainage has since stripped away most of these. Harder remnants of this previous surface occur as small isolated calcrete mesas and low plateaux (Table land system) along some trunk drainage lines. Calcareous loams of variable depth have formed on these remnants.

The Ashburton shales are inherently saline and many of the soils on hills, footslopes and drainage floors (Kooline land system) and alluvial plains (Edward land system) are highly saline. Soils of land systems derived from dolomite parent material (Capricorn and Dollar land systems) are generally not saline.

Skeletal soils and shallow stony loams with frequent outcropping parent material and dense platy surface mantles occur on hills and hillslopes and occupy about 64 per cent of the region's area.

Soils of the drainage floors and alluvial plains (11 per cent) consist of a variety of loams, clays and duplex types. They are generally deep, alkaline, sometimes saline and have moderate phosphorus (mean 15 ppm) and low nitrogen (mean 253 ppm). These soils have been profoundly disturbed by overgrazing and the resultant erosion. Relic sites which have not been subjected to overuse have duplex soils but elsewhere sandy surface horizons have been stripped by wind and water action to reveal hard clay B horizons which now constitute the soil surface. Many extensive drainage floors and plains of the Edward land system now have bare, sealed clay surfaces and only support annuals in season. It is doubtful if the original duplex soil types would be compatible with any grazing system in this environment. Reclamation of the bare clay plains will not be possible by destocking alone but will require cultural treatments and seeding.

Variable sandy, silty and loamy soils are found in flow zones with braided channels (8 per cent) in the lowest parts of drainage floors. There is considerable active redistribution of material in this zone and hence the soil variability.

Variable textured soils with dense mantles of rounded water-worn cobbles and pebbles occupy about 6 per cent of the area. They occur as slightly raised cobble plains (Ethel land system) adjacent to the major water courses. These soils are occasionally saline, usually acidic (mean pH 6.5) and are low in both phosphorus (mean 8 ppm) and nitrogen (220 ppm).

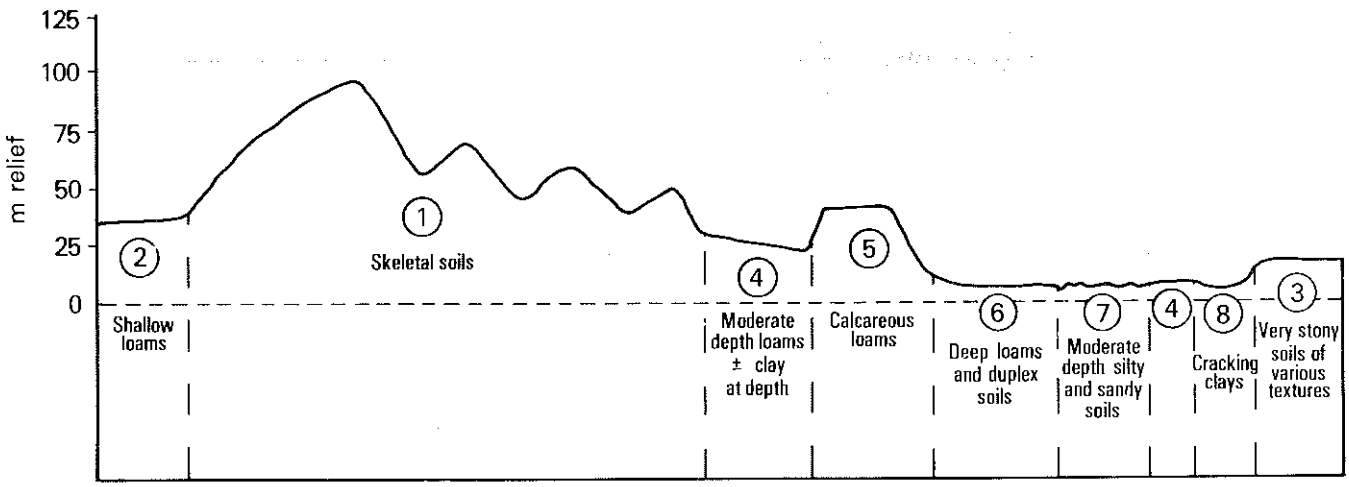
Shallow calcareous loams with moderate phosphorus (mean 14 ppm) and nitrogen (mean 475 ppm) have developed on the old Tertiary calcrete mesas and platforms. They occupy about 5 per cent of the region's area.

Stony gradational loams over clay and loam soils (3 per cent) are found on gently sloping plains developed on dolomite. These soils are generally greater than 1 m deep, alkaline and high in phosphorus (mean 19 ppm) and nitrogen (mean 520 ppm). They support a characteristic sparse shrubland of snakewood *(Acacia xiphophylla)*.

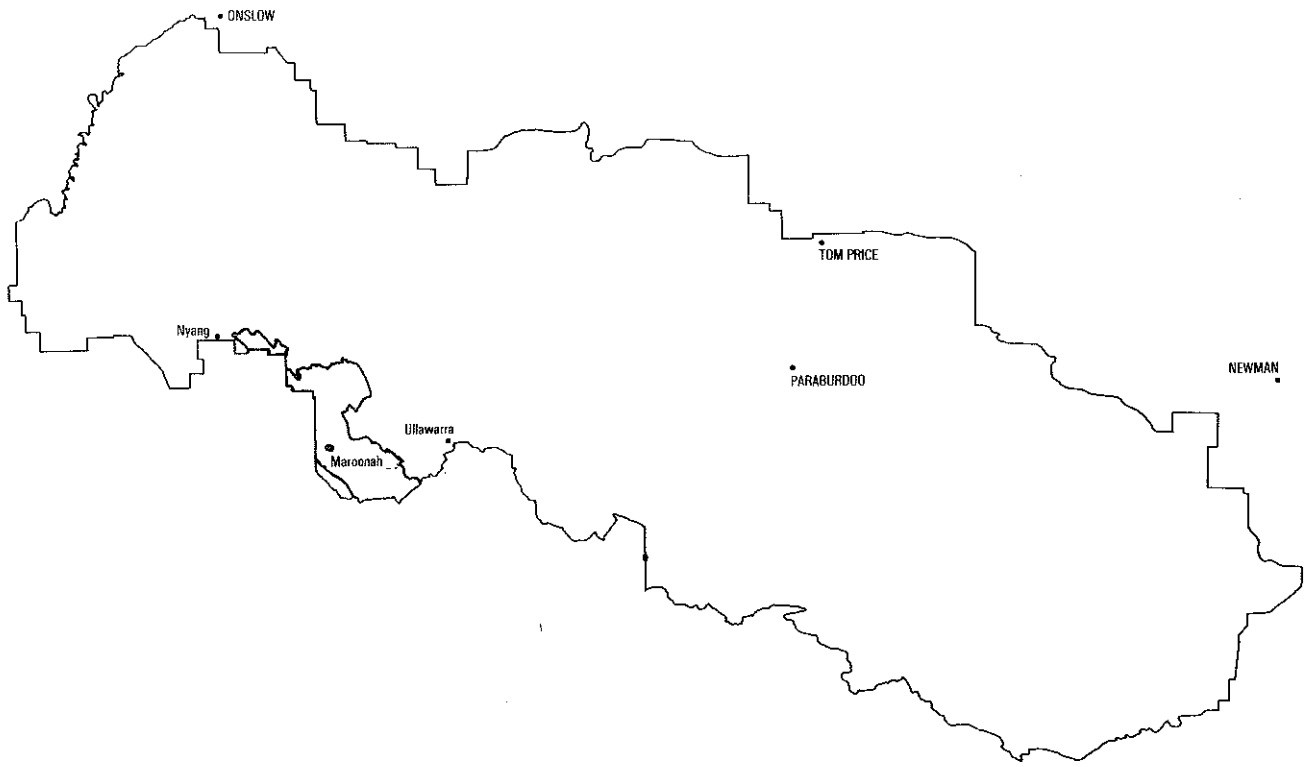
Cracking clay soils in this region are restricted to about 1 per cent of the area and occur in small drainage foci on stony plains and swampy depressions where tributary drainage plains abut flood plains of the adjacent Alluvial soil region. They are greater than 1 metre deep, alkaline and relatively fertile (mean 24 ppm phosphorus, 495 ppm nitrogen).

Table 16 — Kooline Soil Region

Unit No.	Soil description and position	% area	No. samples	Principal profile forms		Mean depth (cm)	Surface stone %	Mean pH	Mean tss (%)	Mean N (ppm)	Mean P (ppm)
1	Skeletal soils (Shale, greywacke and dolomite hills)	48	6			0	>50	—	—	—	—
2	Shallow loams (Footslopes)	18	9	Um 511(2), 512, 521(4), 552		53	<50	7.5	.72	263	7
					S.D.	37					
3	Very stony soils of various textures (Gibber plains)	6	11	Uc 123, 513, Um 143, 521, 531, 642, Ug 538(2), Gn 212, Dr 213		57	>50	6.5	.07	220	8
					S.D.	33					
4	Moderate depth loams and grad-ational soils (Plains)	3	12	Gn 213(2), 312, 392, Um 511(2), 521, 542, 552, 633		84	>50	7.5	.03	520	19
					S.D.	31					
5	Calcareous loams (Calcrete platforms)	5	8	Um 511(4), 512, Uc 511, Gc 112		53	<50	8.5	.03	475	14
					S.D.	34					
6	Deep loams clays and duplex soils (Drainage floors and outwash plains)	11	42	Um 522(7), 633(3), 512(2), Uf 632(2), Gn 212(2), Dr 213(5), 412(2)		93	<50	7.5	.52	253	15
					S.D.	17					
7	Moderate depth silty and sandy soils (Channelled flow zones)	8	21	Uc 123(2), 531(2), Um 542(3), 552(2), Gn 112(2)		77	<50	7.0	.03	240	12
					S.D.	30					
8	Cracking clays (Drainage foci and depressions)	1	18	Ug 538(13), 536(3)		99	<50	7.5	.03	495	23
					S.D.	47					



MAROONAH PLAINS SOIL REGION (1 893 sq km)



The small Maroonah Plains soil region consists of broad, gently to moderately undulating stony plains with outcropping granite and dolomite in parts, lower plains and drainage floors, restricted areas of rough granite hills and occasional calcrete residual mesas. It occurs on the south-west flank of the survey area near Maroonah station and is composed of the Mundong and Nadarra land systems, which are exclusive to the region, and part of the Prairie system which also occurs in the Eastern Plains soil region.

Soils of the region are variable in texture and ofteu only of shallow or moderate depth although full depth (greater than 1 m deep) soils do occur on lower units of the landscape. Soils are derived largely from grauite and, to a lesser extent, from dolomite and calcrete. The dominant and characteristic soils on the broad plains and iuterfluves (37 per cent of total area) are sands or sands over clay and are similar to those found on interfluves of the Stuart region. They are neutral in reaction and low in nitrogen (mean 80 ppm) and phosphorus (mean 4 ppm).

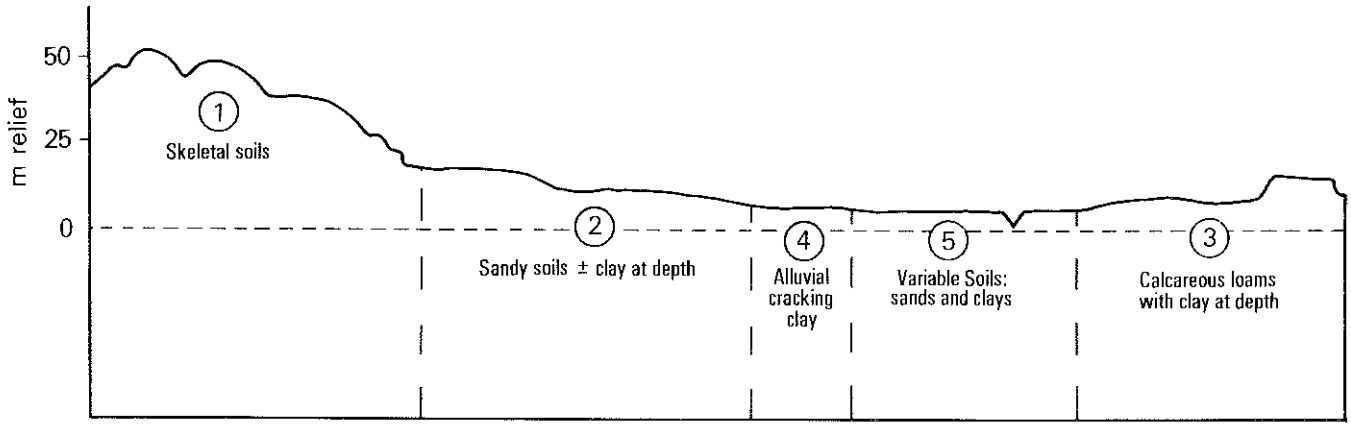
This region is further characterised by a relatively small proportion (25 per cent) having skeletal soils or no soil development and a small proportion (5 per cent) of cracking clays. The skeletal soils are clayey and occur in shallow, stony pockets between granite rocks and outcrops on hills and hill slopes. The cracking clay soils occur on restricted gilgai plains adjacent to drainage zones. They are alkaline and low in nitrogen (mean 282 ppm) and phosphorus (mean 8 ppm).

Uniform loams and calcareous loamy gradational soils have formed on calcretes and dolomites of the region but only occupy about 7 per cent of the total area. These soils are shallow or medium depth, highly alkaline and have a dense mantle of calcrete fragments. They have high nitrogen levels (mean 595 ppm) and moderate phosphorus (mean 17 ppm).

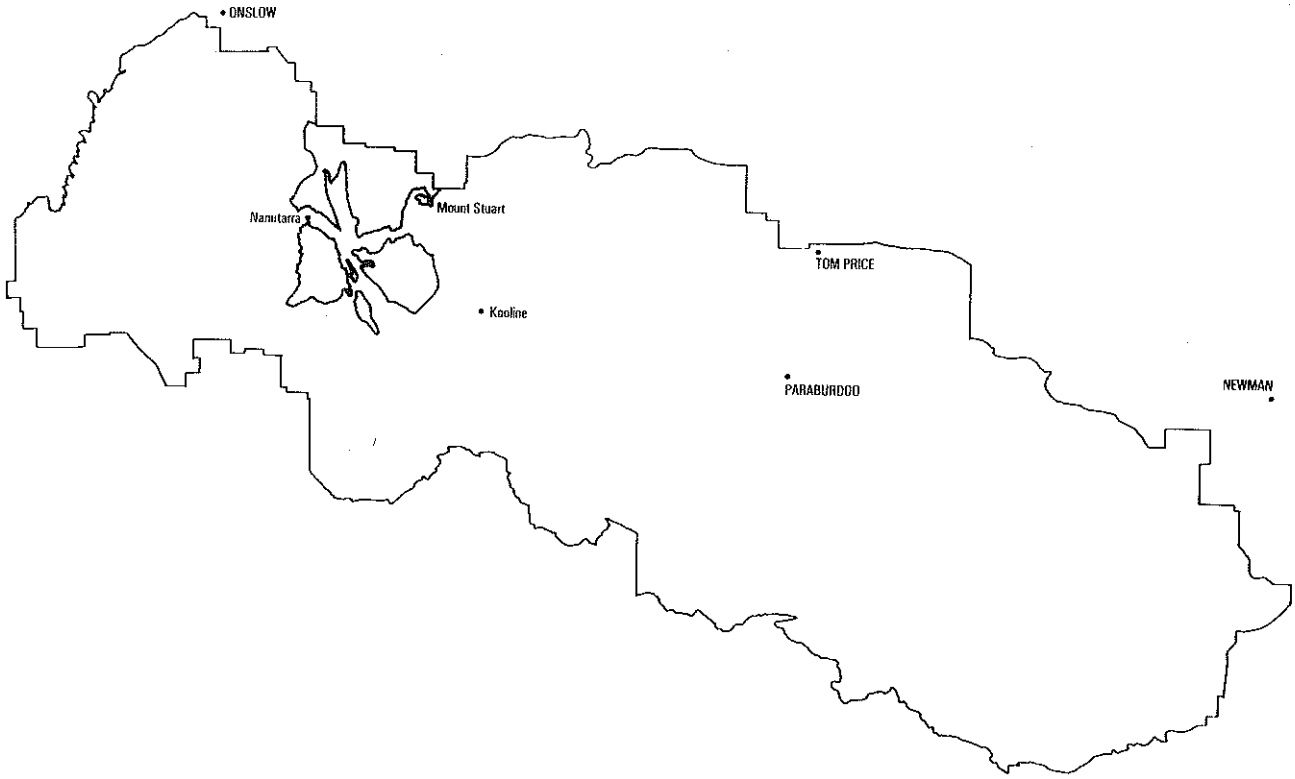
Drainage floors comprise about 25 per cent of the region's area. Soils are sands, clays and gradational types generally deep, neutral, low in nitrogen (mean 231 ppm) and phosphorus (mean 10 ppm) and occasionally saline.

Table 21 — Maroonah Plains Soil Region

Unit No.	Soil description and position	% area	No. samples	Principal profile forms	Mean depth (cm)	Surface stone %	Mean pH	Mean tss (%)	Mean N (ppm)	Mean P (ppm)
1	Skeletal soils (Granitic hills)	26	3	Uf 612(2), Um 131	60	>50	8.5	.04	435	5
2	Sandy soils ± clay at depth (Stony plains)	37	9	Uc 143(2), 123, 531, Dr 451(2), 213	73	>50	7.0	.05	190	8
				S.D.	32					
3	Calcareous loams with clay at depth (Calcrete plains and platforms)	7	5	Um 131, 511, 612, Gc 112(2)	54	<50	8.5	.05	595	17
4	Alluvial cracking clay (Gilgai plains)	5	5	Ug 538(5)	100+	<50	8.5	.03	282	8
5	Variable soils: sands and clays (Drainage floors and creeklines)	25	10	Uc 123, 143, 511, Uf 612, 621, Gn 112(3), Gc 212, Dr 413	94	<50	7.0	.44	231	10
				S.D.	13					



STUART SOIL REGION (3 326 sq km)



The Stuart soil region consists of undulating to nearly flat stony plains and sand plain and low hill tracts of intrusive granites and schists derived from metamorphosed Ashburton Formation shales. It is found in central western parts of the survey area west and south of Mt. Stuart to Nanutarra station. Two land systems, Boolaloo and Stuart, make up the region.

Soils of the region have been formed from granite and schist parent materials which have produced sands (or sands over clay) and loams over clay respectively.

The region is characterised by its large proportion (74 per cent) of gradational or duplex soils, moderate proportion (25 per cent) of skeletal soils and almost complete absence of either cracking or non-cracking clays. Most of the soils are acidic at the surface and alkaline at depth.

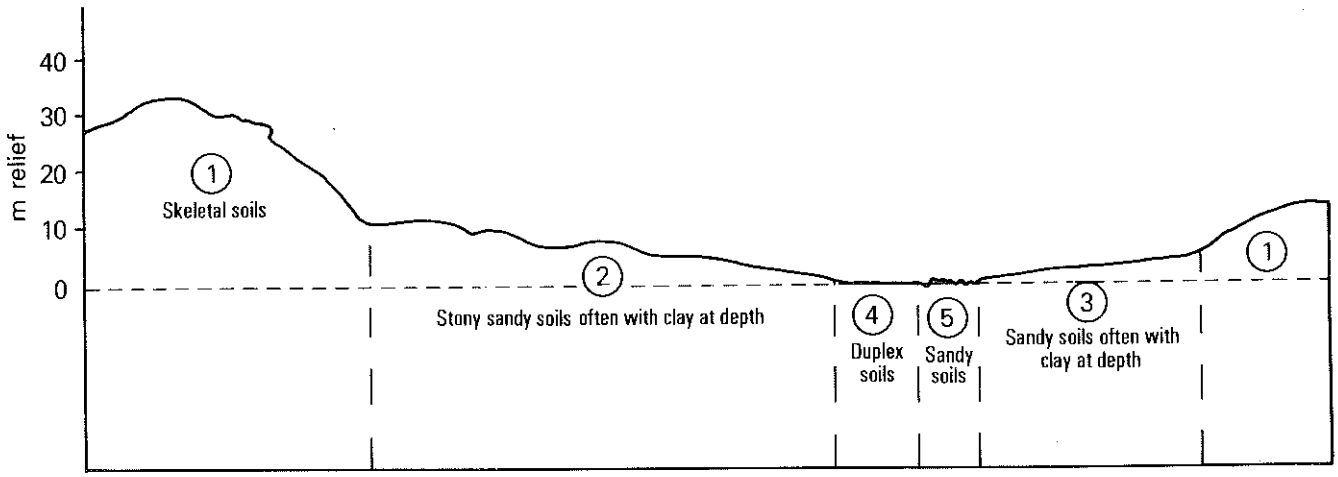
Soils developed on the low plains and interfluves of the area (50 per cent) are sands or gradational types with a moderately dense stony mantle of quartz or schist fragments. The gradational soils have sandy or loamy surface horizons with gradually increasing clay content with depth. Nitrogen levels are moderate (mean 315 ppm) while phosphorus levels are low (mean 8 ppm).

Soils of the sand plain area (10 per cent) are of granite origin and are deep acidic sands or duplex types without surface strew. Only one sample was analysed for nitrogen and phosphorus and levels were very low (110 ppm) and moderate (13 ppm) respectively.

Soils of the drainage floors of the region are predominantly duplex or gradational types, usually deep and without surface strew. They have acidic upper horizons becoming more alkaline with depth; levels of nitrogen are moderate (mean 430 ppm) while phosphorus levels are low (mean 7 ppm).

Table 19 — Stuart Soil District

Unit No.	Soil description and position	% area	No. samples	Principal profile forms	Mean depth (cm)	Surface stone %	Mean pH	Mean tss (%)	Mean N (ppm)	Mean P (ppm)
1	Skeletal soils (Granite and schist hills)	25	3	Um 521	5	>50	—	—	—	—
2	Stony sandy soils often with clay at depth (Interfluves and low plains)	50	8	Uc 111, 511(2), Gn 213, 313, Dr 213, 413	68	<50	7.0	.11	315	8
					S.D. 30					
3	Sandy soils often with clay at depth. (Sand plain)	10	2	Uc 511, Dr 251	100+	0	6.5	.01	110	13
4	Duplex and other soils (Drainage floors)	14	6	Dr 413, 451, 453, Gn 211, 312, Um 542	97	0	6.0	.01	430	7
					S.D. 8					
5	Sandy soils (Creeklines)	1	3	Uc 511, 521	83	0	6.5	.03	370	21



PASTURE LANDS AND CARRYING CAPACITY ESTIMATES

Sixteen broad pasture lands were defined during the survey. Table 26, presented at the end of this section, summarises these lands in terms of size and pasture characteristics for good condition and outlines present condition. More detailed descriptions of each pasture land are also presented later.

Although there is no productivity data for shrub pastures within the survey area there is information available from adjacent pastoral areas with similar pastures and environments. Wilcox and McKinnon (1972) preseut dry matter production figures for various pasture types in successive years. Many of these pastures such as chenopod, stony chenopod, mulga short grass forb and stouy short grass forb are the same as those found in the Ashburton River area. Wilcox and McKinnou also present stocking rates based on pasture productivity and these rates were adopted as a base for estimating carrying capacities for pastures of the survey area.

Burnside (W.A. Dept. Agric. unpublished reports) has measured the productivity of Gascoyne bluebush *(Maireana polypterygia)* pastures in the Gascoyne River catchment and this data is presented in Table 23.

Table 23 — Dry matter production of Gascoyne bluebush (CHMA) pastures in good condition

	Shrubs kg/ha	Herbage/grass kg/ha	Total kg/ha
1978	80	50	130
1979	60	40	100

On the basis of 50 per cent being a safe level of use on the shrubs and ground feed, then 50 to 65 kg/ha of material is available for grazing. The annual requirement of an adult sheep is about 450 kg of dry matter. Thus a safe stocking rate for Gascoyne bluebush pastures in good condition is in the range 7 to 9 ha per sheep unit.

Lay (1979) records that negligible deaths of saltbush *(Atriplex vesicaria)* and bluebush *(Maireana sedifolia)* occurred on South Australian rangelands where no more than 300 to 350 sheep had been regularly carried at each watering point but bush losses occurred where numbers exceeded this. Investigations on saltbush *(Atriplex vesicaria)* pastures in the Kalgoorlie area have suggested that up to 500 sheep can be run per watering point without causing pasture deterioration (Hacker, pers. comm.).

Most grazing activity by sheep is confined to an area up to 3.5 or 4 km from water and a central watering point therefore commands about 38 to 50 sq km of usable country. Based on a maximum of 500 sheep per water on saltbush pasture then carrying capacity commensurate with maintenance of the shrub stand is in the range of 7.6 to 10 ha per sheep unit. This is close to the figure of 8 ha per sheep unit adopted as the safe carrying capacity for good condition saltbush and bluebush (CHAT and CHMA) pastures in the survey area.

There is some productivity data for grass pastures from within the survey area. This data is for one season only but, combined with information from other areas, assisted in the preparation of carrying capacities for the tussock grass pasture lands of the survey area.

Table 24 summarises productivity and condition of some pasture lands on Minderoo Station.

Good condition buffel grass pastures in a reasonable season can be expected to produce 600 to 1000 kg of dry matter per hectare. Losses occur by natural decay, trampling and the effects of grasshoppers and termites and probably less than 30 per cent is available for use by livestock. On the basis of 30 per cent usage and an annual requirement of 450 kg per sheep unit the carrying capacity for buffel grass pastures in good condition is about 1.5 to 2.5 ha per sheep unit.

Table 24 — Dry matter production of various pasture lands at different condition levels at Minderoo station.

Pasture land	Condition	Perennial grasses kg/ha	Annual grasses kg/ha	Total kg/ha
Buffel grass (TGCE)	good	1082	464	1546
	good	615	263	878
	fair	388	166	554
	poor	319	136	455
	poor	299	128	427
	very poor	trace	68	68
Weeping grass (TGCH)	fair	435	187	622
Soft spinifex (SOSP)	good*	2742	—	2742
	good*	1904	—	1904

* Climax communities of old spinifex, very poor nutritive value and very low carrying capacity.

Soft spinifex pastures in the survey area are similar to those in the Pilbara and elsewhere. Stocking rates are dependent on the age of the soft spinifex and the amount of herbage and other grasses in the pasture rather than the total dry matter present. Subclimax stages oue or two years after a fire provide the most nutritious feed and have a moderately high carrying capacity. Old, closed communities may register more than 2000 kg of dry matter per hectare but are of very little use for grazing.

Payne *et al* (1974) assessed the carrying capacity of Kimberley soft spinifex pastures in good condition at 40 to 66 ha per cattle unit equivalent to 5.3 to 8.8 ha per sheep unit. Suijdendorp (pers. comm.) suggests 6 ha per sheep unit for subclimax soft spinifex pastures. For this survey 8 ha per sheep unit was adopted as a safe carrying capacity for good condition. Table 25 shows the estimated carrying capacity for all pasture lands, at three condition levels, within the survey areas.

As a result of the survey it was possible to determine which pasture lands (on a land system basis) occurred on each station and the area of each pasture land on each station. The condition of pasture lands on each station was known from traverse data. Thus, by using the carrying capacities shown in Table 25, it was possible to calculate the **estimated carrying capacity for present condition** of each station in the survey area. These calculations are detailed in the section of this report dealing with individual stations.

HARD SPINIFEX HILL (HSHI) PASTURE LAND

1. Area 21 940 sq. km (23.4 per cent)

2. Distribution

This pasture land occurs throughout the survey area but is concentrated and most widespread in northern parts. It is the dominant pasture land of the rugged Newman land system and the stony irregular plains of the Platform system. It is the dominant pasture land of the Boolgeeda land system which forms stony lower plains associated with the Newman system.

Table 25 — Carrying capacity of pasture lands at three condition levels.

Pasture land	Condition					
	Good		Fair		Poor	
	s.u. per sq km	ha per s.u.	s.u. per sq km	ha per s.u.	s.u. per sq km	ha per s.u.
Cassia short grass forb CSGF						
C. oligophylla	5.0	20	3.0	33	2.0	50
C. aff. *hamersleyensis*	5.0	20	3.0	33	1.0	100
Bluebush CHMA	12.5	8	7.1	14	2.5	40
Saltbush CHAT	12.5	8	8.3	12	2.5	40
Hard spinifex hills HSHI						
Hill systems and Platform land system	1.7	59	1.0	100	1.0	100
Other land systems	2.5	40	1.7	59	1.0	100
Hard spinifex sand plain HSSP						
Uaroo, Giralia land system	3.0	33	2.0	50	1.0	100
Divide, Weelarrana land system	2.0	50	1.5	67	1.0	100
Mulga short grass forb MSGF						
Augustus, Ullawarra, Mulgul and Charley land systems	2.0	50	1.5	67	1.0	100
Other land systems	4.0	25	3.0	33	2.0	50
Mulga creekline MUCR	12.5	8	5.5	18	3.3	30
Samphire SAMP	4.0	25	3.3	30	2.0	50
Soft spinifex SOSP						
Robe, Nanutarra land systems	6.25	16	4.2	24	1.7	59
Other land systems	12.5	8	8.3	12	3.3	30
Stony short grass forb SSGF						
Hardpan systems	2.0	50	1.5	67	1.0	100
Other land systems	3.0	33	2.0	50	1.5	67
Stony chenopod STCH	8.3	12	5.0	20	2.0	50
Roebourne plains grass TGER	16.7	6	8.4	12	3.3	30
Weeping grass TGCH	33	3	14	7	3.3	30
Buffel grass TGCE	50	2	20	5	3.3	30
Mitchell grass TGAS	33	3	14	7	3.3	30
Miscellaneous tussock grasses TGMI	16.7	6	8.4	12	3.3	30

Hard spinifex hill pastures are common on the Capricorn and Rocklea hill systems and also occur as minor inclusions on other hilly land systems.

Soils associated with this pasture land are invariably shallow and stony with parent rock outcropping or with a heavy mantle of cobbles and boulders.

3. Composition

The ground storey is always dominated by hard spinifex species such as *Triodia wiseana* or *T. lanigera* and ground cover can be up to 40 per cent. The upper storeys are variable and the structural form of the pasture land can vary from a hummock grassland to tall open shrubland or tall shrubland with a hard spinifex understorey. On the rocky hills of the Newman, Rocklea and Capricorn systems *Eucalyptus leucophloia* (snappy gum) forms a sparse tree layer. Shrubs such as *Acacia kempeana, A. xiphophylla* (snakewood), *Cassia pruinosa, C. luerssenii, Kallstroemia platyptera, Eremophila cuneifolia* and *Solanum lasiophyllum* (flannel bush) are fairly common. On stony plains of the Platform and Boolgeeda systems most of these species are found in association with hard spinifex and *Acacia aneura* (mulga) *Ptilotus obovatus* (cotton bush) and some small *Maireana* species.

4. Pastoral value

The pastoral value of this pasture land is very low to useless. Some of the more rugged parts are inaccessible to stock and are therefore unsuitable for pastoral use. Other areas are poorly accessible and nearly all components of the pasture are unattractive to stock and of very poor nutritional value. Large sections are unalienated and include the Hamersley Range National Park and the Barlee Range Wildlife Sanctuary.

5. Condition

No grazing-induced changes in condition status occur on this pasture land, as it is largely unused by livestock. The ground cover of hard spinifex varies depending on burning history and rainfall. However, because of the time required to build up sufficient fuel, fires are relatively infrequent. The shrub layers alter very slowly except after fire or prolonged drought.

There is no erosion on this pasture land and it is invariably in good range condition.

6. Management and carrying capacity

No special management is required — pastures supply very sparse rough grazing. Some inaccessible parts are rated at zero carrying capacity. Elsewhere estimated capacity for good condition is —

	Hectares per sheep unit
Land systems Boolgeeda, Stuart, Spearhole and Winning	40
All other systems	60

MULGA SHORT GRASS FORB (MSGF) PASTURE LAND

1. **Area** 19 585 sq. km (20.9 per cent)

2. **Distribution**

The mulga short grass forb pasture land is the second largest in the survey area. It is widely distributed and is especially common in central and southern parts. It occurs on many land systems and land forms, but predominantly on ranges, hills, ridges, footslopes and undulating stony plains and also on flatter hardpan plains and some calcrete plains. Soils on hill land forms are shallow loams with frequent rock outcrop and dense colluvial mantles; soils on flatter plains are loams over hardpan or calcrete.

3. **Composition**

The structure of this pasture land is a low open woodland or tall shrubland. *Acacia aneura* (mulga) is the most common species in the upper storey and may be in tree or tall shrub form. Cover values for the mulga vary from about 2 to 12 per cent and density is usually in the range of 50 to 400 per hectare although may be up to 900 per hectare. The tree *Acacia pruinocarpa* (gidgie) is quite common but is sparsely scattered.

Numerous other *Acacia* species occur with the mulga in the tall shrub layer. The most common are *Acacia tetragonophylla* (curara), *A. kempeana, A. cuthbertsonii* and *A. rhodophloia* (minnirichi).

The low shrub layer is well developed with *Eremophila* and *Cassia* species dominating. Common species are *Eremophila fraseri* (turpentine), *E. leucophylla* (Wilcox bush), *E. freelingii, E. cuneifolia, Cassia helmsii* (grey cassia), *C. oligophylla* (blood bush) and *C. leurssenii*. Other low shrubs are *Ptilotus obovatus* (cotton bush), *Kallstroemia platyptera,* and *Solanum lasiophyllum* (flannel bush). Annual grasses mainly *Aristida contorta* (windgrass) and forbs occur as a ground layer in season.

Density of the low shrub layer varies within the range 200 to 3000 per hectare according to site potential and condition. Total cover for the pasture land is usually between 10 and 20 per cent.

4. **Pastoral value**

Overall pastoral value is low. Ephemerals provide useful feed in season and there is a small but significant population of palatable and durable shrubs. Mulga provides subsistence feed in droughts.

At least 40 per cent of this pasture land is rugged, poorly accessible country not developed for use by livestock, the remainder is more readily accessible and is at least partly developed and utilised for grazing.

5. **Condition**

Most of this pasture land is in good range condition. Pastures are degraded to fair or poor condition in a few localised areas.

6. **Management and carrying capacity**

Control of stock numbers and control of season or period of use are the management practices available and thus adequate fencing and watering points are required.

Mulga short grass forb pastures can play an important role in the overall pasture management on a property in that they should be used in good seasons to hold stock from degraded country which requires spelling. Heavy, short term, opportunistic use should be made of the ephemerals in good seasons and, provided the period of grazing is controlled, no damage will occur to desirable shrub components. In more average years MSGF pastures can be grazed continuously at the levels recommended and, if they are in good or fair condition, will supply feed of sufficient quality for breeding livestock.

Grazing policy should be flexible in order to take advantage of favourable seasons or to respond to other factors such as obvious decline in pasture condition. Occasional complete spelling over a growing season may be required to improve the cover and vigour of shrubs.

Estimated carrying capacity (hectares per sheep) —

	Good condition	Fair condition	Poor condition
Land systems Augustus, Ullawarra, Mulgul and Charley	50	67	100
All other systems	25	33	50

STONY SHORT GRASS FORB (SSGF) PASTURE LAND

1. **Area** 16 605 sq. km (17.7 per cent)

2. **Distribution**

Stony short grass forb pastures are largely confined to the south and south-east of the survey area. They occur on a large number of different land forms. They are characteristic of the broad, nearly flat hardpan plains of land systems such as Cadgie, Jamindie, Nooingnin and Three Rivers and of the rough shale hills of the Kooline system. It is a major pasture type on the hills and footslopes of the Capricorn, Collier and Kunderong systems and an important component of other systems.

Soils associated with this pasture land are nearly always either skeletal stony loams with frequent rock outcrop and dense colluvial mantles or loams over hardpan at shallow depth.

3. **Composition**

This pasture land and the mulga short grass forb (MSGF) pasture land are similar in that many species and plant assemblages are common — however, the stony short grass forb pastures are usually much sparser. The form of the vegetation is usually a low (less than 2m) open shrubland with less than 10 per cent total projected foliage cover. Trees are absent except for rare stunted specimens such as *Acacia pruinocarpa* (gidgie). Tall shrubs such as *Acacia aneura* (mulga), *A. rhodophloia* (minnirichi) and *A. tetragonophylla* (curara) rarely exceed 200 per hectare.

Low shrubs commonly present include *Eremophila fraseri* (turpentine bush), *E. cuneifolia, E. freelingii, Cassia leurssenii, C. helmsii* (grey cassia) *Kallstroemia platyptera, Ptilotus obovatus* (cotton bush) and *Solanum lasiophyllum* (flannel bush). Numbers of low shrubs per hectare can be up to 2000 but are usually much less. Annual species *Aristida contorta* (wind grass), *Sclerolaena* spp. and a few herbaceous perennials such as *Ptilotus schwartzii* and *P. roei* from a sparse ground layer after rain.

4. Pastoral value

Because of rugged terrain or lack of waters some parts are poorly accessible to livestock but most are readily accessible. Overall pastoral value is very low. Opportunistic grazing can be made of ephemerals after rain and there is a very small component of useful shrubs such as *Ptilotus obovatus, Solanum lasiophyllum* and *Kallstroemia platyptera.*

A useful characteristic of this pasture land is that its stony surfaces rapidly shed water onto adjacent lower land systems or onto lower units within the same system. In the case of the Jamindie and Nooingnin systems, water shed from the stony hardpan plains accumulates in the grove units of the systems. The groves are relatively small in area but, because of favourable soil moisture conditions, support highly productive pastures.

5. Condition

Nearly all of this pasture land seen during survey was in good or fair range condition. Isolated areas were in poor condition with degraded pastures but no erosion.

6. Management and carrying capacity

Management practices on these pastures will vary depending on the pastoral value and relative proportions of associated pasture lands within the paddock or management unit.

Where stony short grass forb pastures are associated with other non-erodable lowly productive pasture lands they should be used for heavy, short term, opportunistic grazing in good seasons. Such short term grazing makes maximum use of the flush of ephemerals and will not damage the very small component of useful shrubs as the animals will be removed before the shrubs are over-utilised. Used in this manner stony short grass forb pastures can play an important role in the overall pasture management on a property. Their use in heavy seasons permits vital spelling on more valuable better quality shrub pasture lands.

Different management will be required where stony short grass forb pastures occur as a mosaic with other more durable pastures. For example. on the Nooingnin land system, stony short grass forb pastures of the hardpan plains and mulga creekline pastures (MUCR) of the groves form a complex mosaic which can only be managed as a whole. The groves support high quality durable shrubs and are subject to heavy preferential use in dry years. Paddocks or management areas within the Nooingnin system must be managed to maintain the more productive pastures. The system can be grazed year round at low rates but management must incorporate occasional spelling after good rains to promote seedling recruitment and shrub vigour. The frequency of spelling will depend on seasonal conditions and the condition of the vegetation within the groves.

Estimated carrying capacity (ha per sheep unit) —

	Good condition	Fair condition	Poor condition
Land systems Cadgie, Egerton, Jamindie, Nooingnin and Three Rivers	50	67	100
All other systems	33	50	67

SOFT SPINIFEX (SOSP) PASTURE LAND

1. Area 6,575 sq. km (7.0 per cent)

2. Distribution

Soft spinifex pastures are common and important on the western coastal plains of the survey area. They are minor pastures of some northern and eastern parts.

Soft spinifex is the main pasture of the Cadgie, Dune and Yankagee land systems. It is an important component of the Boolaloo, Donovan, Giralia, Jubilee, Minderoo, Onslow, Rous, Uaroo and Winning land systems where it grows on sandy soils. It occurs on the drainage floor units of the Boolgeeda and Stuart land systems. It is also found on some hilltops and slopes of the Nanutarra and Robe systems.

3. Composition

Triodia pungens (soft spinifex) and *Plectrachne schinzii* (oat-eared spinifex) are the dominant perennials found on this pasture land. These two species are usually mutually exclusive in their local distribution. *Plectrachne schinzii* is the less common and is restricted to sand dunes. *Triodia pungens* is found in a number of different habitats and these include creeks and flow lines, ironstone hills and slopes, coastal dunes, granitic sand plain and some calcrete plains.

In the climax situation the pasture land has a monospecific ground storey of soft spinifex with a maximum ground cover of about 40 per cent. However, after burning a wide range of annuals and semi-perennials such as *Eriachne aristidea* (false wandarrie grass), *Aristida contorta* (wind grass), *Bonamia rosea, Ptilotus calostachyus* and *Cleome viscosa* (mustard weed) appear as well as soft spinifex seedlings. These then gradually disappear as the spinifex reasserts dominance.

The species composition of the upper storey is variable. Soft spinifex pastures in the eastern end of the catchment have sparse tree and shrub layers of *Acacia aneura* (mulga), and other *Acacia* species, *Eremophila leucophylla* (Wilcox bush), *E. margarethae* (sand bank poverty bush) and *Rhagodia eremaea* (tall saltbush). In the west the upper storey ranges from very sparse to moderately dense. Common shrubs and trees are *Acacia wanyu* (wanyu), *A. ancistrocarpa, A. trachycarpa, A. translucens* (poverty bush), *A. inequilatera, Eucalyptus setosa* (sandplain bloodwood) and *Eremophila leucophylla.*

Dune crests and flanks with *Plectrachne schinzii* ground storeys have a characteristic upper storey including *Grevillea gordoniana, Owenia reticulata, Pityrodia paniculata, Scaevola sericophylla, Acacia murrayana* and other *Acacia* species.

4. Pastoral value

Soft spinifex pastures have moderate to high grazing value if correctly managed. Fire induced sub-climax stages have good grazing value provided by spinifex seedlings, annual and perennial grasses and forbs and can support breeding stock. However, pasture quality declines as the spinifex becomes older and dominant and grazing value decreases.

Young soft spinifex pastures are important fodder reserves in times of drought.

5. Condition

This pasture land is nearly always in good condition. There are occasional areas in poor condition and these are associated with severe overgrazing around watering points or with areas burnt in winter.

Minor wind erosion is common after burning and may become locally more severe if seasonal rains fail. However, taken over the whole catchment, soft spinifex pastures show no erosion.

6. Management and carrying capacity

Soft spinifex pastures in the climax state are of little use for grazing purposes because of the poor quality and palatability of material on offer. Management procedures must be aimed at maintaining the pastures in an attractive condition for livestock and encouraging high quality perennials, forbs and herbaceous species.

Regular burning coupled with deferred grazing, is the recommended management procedure. Studies on spinifex pastures have clearly shown that the season of burning and subsequent grazing management is critical.

Old spinifex stands should be burnt in summer in November/December to obtain a high intensity fire which will destroy most of the spinifex and shrubs. Grazing should be deferred for six to eight weeks over the following summer rainfall period. This ensures that desirable and intermediate species establish and set seed.

The post-burning subclimax of young spinifex seedlings and numerous annuals provides adequate forage for lactating ewes. Forage quality declines fairly rapidly in subsequent years as the spinifex gradually resumes dominance. Time to reach the spinifex climax depends on seasonal conditions, but is usually four to six years at which time the burning cycle should be repeated.

Winter burning is undesirable for a number of reasons. Winter fires are cooler than summer fires and often fail to kill mature spinifex and shrubs completely. Winter rains after a fire promote shrubs and woody herbs, many of which are undesirable or unpalatable, rather than spinifex and other grasses. Species such as *Acacia translucens, A. trachycarpa, A. ancistrocarpa, Cassia notabilis* (cockroach bush), *Corchorus walcottii, Tephrosia* and *Heliotropium* spp. are encouraged by winter burning and may dominate the stand.

Stations with soft spinifex paddocks should initiate a rotational summer burning and grazing deferment programme on a five or six year cycle. This means that about a fifth or sixth of the total soft spinifex country is burnt every year and that there will always be spinifex pastures available in the useful sub-climax stage.

Estimated carrying capacity (hectares per sheep unit) —

	Good condition	Fair condition	Poor condition
Robe and Nanutarra Land systems	16	24	59
All other systems	8	12	30

HARD SPINIFEX SAND PLAIN (HSSP) PASTURE LAND

1. Area 6 390 sq. km (6.8 per cent)

2. Distribution

This pasture land is widespread in western coastal section of the survey area where it occurs on broad sandy plains of the Giralia and Uaroo land systems.

Small areas of this pasture are also located in south-eastern parts of the survey area on the plains of the Divide land system.

Soils associated with this pasture land are deep sands or gradational soils with sandy surface horizons.

3. Composition

This pasture land is a hummock grassland with sparse trees and shrubs. A number of hard spinifex types occur. By far the most common of these are *Triodia lanigera* which dominates on the plains of the Giralia and Uaroo land systems and *Triodia basedowii* on the sandplains in the south eastern parts of the survey area. Another hard spinifex, *Triodia wiseana* is sometimes present and the soft spinifex *Triodia pungens* occurs rarely.

Fires are frequent on this pasture land and hummock size and ground cover varies depending on the time elapsed since the last burn. In unburnt stands the hard spinifex dominates to the virtual exclusion of other ground species and ground cover can reach 40 per cent. Other ground storey species are sparse and include *Eragrostis eriopoda* (wire grass), *Eriachne aristidea* (false wandarrie grass), *Bonamia rosea, Tephrosia* spp., *Sida* spp. and *Scaevola parviflora.*

The tree and shrub layer is poorly developed. The most common species include *Eucalyptus setosa* (sandplain bloodwood), *Acacia inequilatera, A. bivenosa, A. translucens* (poverty bush), *A. ancistrocarpa, Grevillea excelsior* and *Chorizema ericifolia.*

4. Pastoral value

Pastoral value is very low but can be improved by burning and stock management. The hard spinifexes are unattractive to stock at all stages of growth. Some of the remaining pasture components are palatable and useful to stock but their contribution to the total biomass on offer is small.

In some areas hard spinifex pasture lands contribute useful grazing for dry sheep but at low stocking rates. They are unsuitable for use by breeding ewes and provide very poor grazing for cattle.

5. Condition

Hard spinifex sandplain pastures in the survey area are nearly all in good range condition. There are small isolated areas showing moderate and severe scrub invasion (mainly *Acacia translucens).* There is no erosion.

6. Management and carrying capacity

From the grazing viewpoint, hard spinifex pasture lands are only of use in the subclimax stage when a range of small annuals and herbaceous species provides reasonably palatable and nutritious feed. The desirable subclimax can be induced by correct burning and grazing management.

The recommended time of burning is in the summer months, November to December with the object of obtaining a hot burn which completely destroys the mature spinifex. Summer rains can be reasonably expected to follow burning in November or December and these will germinate useful species as well as spinifex. Winter burning is not recommended as this will favour undesirable shrubs and unpalatable herbs.

Grazing should be deferred for about eight weeks after germinating rains. This will allow useful species to build up root reserves and set seed.

Dependent on seasonal conditions but usually over a period of four or five years the hard spinifex types gradually resume dominance. Pasture value will decline as this occurs but reasonable quality feed will be available for a few years after the fire. When the spinifex climax is reached a new cycle of burning and deferment should commence. Obviously not all the spinifex country on a property can be burnt in the same year. However, a system of burning and deferment on a different quarter of the spinifex country each year will establish a four year cycle and maintain most of the country in a useful subclimax condition.

Burning can be used as a management tool to reclaim poor condition hard spinifex pasture lands dominated by thick scrub such as *Acacia translucens*. It may be necessary to restrict grazing in the area for a few seasons to build up additional fuel under the shrubs. Burning should be in summer under the hottest possible conditions and with a good wind. Grazing should be deferred for about eight weeks after opening rains.

Estimated carrying capacity (hectares per sheep unit) —

	Good condition	Fair condition	Poor condition
Divide and Weelarrana land systems	50	67	100
All other systems	33	50	100

MULGA CREEKLINE (MUCR) PASTURE LAND

1. Area 4 520 sq. km (4.8 per cent)

2. Distribution

This pasture land occurs throughout the survey area as small inclusions in other broader pasture lands. It is found on 35 of the 65 land systems. It occupies a number of positions in the landscape all of which are favoured by run on from surrounding land units.

Typical units supporting mulga creekline pastures are groves of the eastern hardpan plains, narrow flow zones, channelled drainage floors, banks and narrow flood out areas associated with creeks and rivers and some alluvial fans. This pasture usually occupies a maximum of 15 per cent of a land systems area and is often the most productive pasture on the system. Adjoining parts of the systems frequeutly support much sparser mulga short grass forb (MSGF) or stony short grass forb (SSGF) pastures.

3. Composition

This pasture land is composed of a group of communities which have similar structure, habitat, and productivity. It is a tall shrubland or low woodland, usually of *Acacia aneura* (mulga), up to 8m tall. Some flow lines are dominated by *A. kempeana* or *A. wanyu* (wanyu) rather than mulga and other common species are *A. tetragonophylla* (curara) and *A. citrinoviridis*.

Usually a wide range of low shrubs are found beneath the tall shrubs and trees although, occasionally, if the upper layers are very thick, ground layers may be almost absent. Common low shrnbs are *Eremophila leucophylla* (Wilcox bush), *Rhagodia eremaea* (tall saltbush) *Cassia helmsii* (grey cassia), *C. oligophylla* (bloodbush) *Ptilotus obovatus* (cotton bush) *Enchylaena tomentosa* (ruby saltbush) and *Sida calyxhymenia*. Sparse perennial grasses such as *Chrysopogon fallax* (weeping grass) are common and soft spinifex *Triodia pungens* may also occur.

Total projected foliage cover of the pasture land is frequently 20 to 30 per cent.

4. Pastoral value

Pastoral value is high or very high. When in good condition there are large numbers of edible shrubs producing high quality drought durable forage capable of supporting breeding stock.

Because of the attractive pastures and because they provide shade, mulga creek line pastures are favoured by stock and are subject to heavy use.

5. Condition

Mulga creekline pastures are mostly in fair condition although both extremes of condition are quite common. Some groves and drainage floors show evidence of overuse with considerable loss of desirable shrubs. Erosion in the form of sheeting and shallow guttering with sharp incision is common on degraded drainage floors but is generally absent on degraded groves.

6. Management and carrying capacity

Although these pastures only occupy a small proportion of the area of any particular land system, paddock or management area they are usually much more valuable and durable than the surrounding pastures. Condition of the whole land system or paddock is judged by observing the groves and creeklines where mulga creekline pastures occur. Management must be aimed at maintaining desirable shrubs such as *Eremophila leucophylla, Rhagodia eremaea, Enchylaena tomentosa* and *Sida calyxhymenia* in the pasture. Where the number and vigour of these plants is obviously depleted the area should be spelled over a full growing season to promote recovery.

Estimated carrying capacity (hectares per sheep unit) —

Good condition	Fair condition	Poor condition
8	18	30

STONY CHENOPOD (STCH) PASTURE LAND

1. Area 3 680 sq. km (3.9 per cent)

2. Distribution

This pasture land is widely distributed through the survey area. It is the major pasture on the plain land

systems Bryah, Dollar, Mundong, Nadarra, Paraburdoo, Stuart, Scoop and Wona and occurs as a minor component on many other systems. It grows predominantly on clay soils or gradational soils with loamy surface horizons and clay subsoil. Stony surface mantles may or may not be present.

3. Composition

This pasture land is a tall shrubland or tall open shrubland of *Acacia xiphophylla* (snakewood) with an understorey of halophytic and other low shrubs and annual grasses and forbs in season. The snakewood grows from 1.5 m to 4 m tall with projected foliage cover from 4 to 14 per cent and density of about 100 to 600 per hectare. A few other scattered *Acacia* species such as *A. victoriae* (bardie bush) also occur.

The understorey of low shrubs and sparse perennial grasses is concentrated beneath the cover afforded by the *A. xiphophylla*. Common shrubs are *Enchylaena tomentosa* (ruby saltbush), *Cassia desolata, C. oligophylla* (blood bush) and other *Cassia* species, *Eremophila cuneifolia, Rhagodia eremaea* (tall saltbush) and small *Maireana* species. The perennial grass *Enteropogon acicularis* (windmill grass) is found in association with the low shrubs beneath the snakewood.

Total projected foliage cover of all the pasture components is usually in the range of 10 to 20 per cent.

4. Pastoral value

This pasture land is readily accessible to stock and has moderate pastoral value. Annuals supply useful feed but the amount on offer fluctuates markedly depending on seasonal conditions. Pasture durability is provided by the low shrubs many of which are attractive to stock and provide high quality feed. Snakewood itself is poor quality feed and is grazed only as a last resort.

5. Condition

The condition of this pasture land varies widely, depending on stocking history. Condition in the north-east of the area near Paraburdoo is mostly fair to good. Elsewhere pasture condition varies from good to very poor with almost complete loss of desirable shrubs in the latter case. Very little erosion occurs even when pastures are severely degraded.

6. Management and carrying capacity

Management of this pasture land, as with all others in the survey area, should be aimed at maintaining the productivity and vigour of the desirable low shrubs. Grazing can be on a continuous basis for a number of years but a programme of occasional spelling for three to six months after good rains, on a paddock by paddock basis, will be needed. Spelling over a number of consecutive growing seasons will be required if the pastures are in poor or very poor condition.

Estimated carrying capacity (hectares per sheep unit)—

Good condition	Fair condition	Poor condition
12	20	50

SALTBUSH (CHAT) PASTURE LAND

1. Area 3 540 sq. km (3.8 per cent)

2. Distribution

Saltbush pasture lands are scattered throughout the survey area on some broad alluvial plain land systems and on low saline plains and drainage floor units of other systems. The largest single areas, up to 2 or 3 km in extent, occur along the Ashburton River on the Ashburton land system. Here the saltbush pastures occur as patches with other pastures such as tall saltbush (CHMA pasture land) and buffel grass (TGCE pasture land). Saltbush pastures were once extensive on alluvial plains of the Cheela, Globe and Edward systems. They also occur as important small inclusions surrounded by poorer quality pasture lands on drainage floors and saline plains of land systems Ethel, Ford, Kooline, Paraburdoo, Scoop, Warri, Weelarrana and Yankagee.

Soils associated with saltbush are alkaline loams, clays and duplex types usually deeper than 1 m and with sparse or no surface mantle.

3. Composition

Saltbush pastures may be low shrublands or tall open shrublands with a dominent low shrub layer. When in good condition the low shrub layer contains a range of useful shrubs with *Atriplex bunburyana* (river saltbush) dominating. Other common low shrubs are *Cassia oligophylla* (blood bush), *C. desolata, Enchylaena tomentosa* (ruby saltbush), *Maireana pyramidata* (sago bush), *M. tomentosa, Rhagodia eremaea* (tall saltbush), and *Frankenia* and *Eremophila* species.

When the pastures are in good condition the density of *A. bunburyana* can vary from about 1500 to 4000 individuals per hectare depending on site potential. Projected foliage cover may be up to 10 per cent or more. On poorer condition sites the density and cover values for *A. bunburyana* are much less and, in some situations, it may be present only as rare moribund plants.

The tall shrub layer, if present, consists mainly of the ubiquitious *Acacia victoriae* (bardie bush) although *A. xiphophylla* (snakewood) sometimes dominates. *Acacia sclerosperma, A. aneura* (mulga) and a few other *Acacia* species are occasionally present. Total projected foliage cover for the pasture land depends on site potential and condition level but is generally within the range of 10 to 18 per cent.

4. Pastoral value

The high value of saltbush pastures have been recognised since early settlement. Saltbush and other shrubs of the pasture land supply high quality, durable feed suitable for breeding livestock and for carrying stock through dry periods.

All of this pasture land is developed (except a few areas with problems of water supply) and has received heavy use for many years. In many cases the saltbush stands have been seriously degraded and present pastoral value is considerably below potential value.

5. Condition

This pasture land is the most badly degraded of any in the survey area.

A few relic areas in good condition exist but condition generally throughout the area is poor or very poor. On the Edward and Cheela land systems some areas up to 5 km or more show extreme degradation with almost complete loss of all shrubs and severe deflation and scalding of the soil surface. These areas have been reduced from perennial shrublands to annual herb fields, and in order to bring about recovery, should be completely protected from grazing.

Saltbush pastures on saline plains and drainage floors of the Kooline, Paraburdoo and some other systems are considerably depleted and erosion in the form of rilling, scouring, wind scalding and hummocking is common.

In some cases where saltbush pastures have been eliminated they have been replaced by different communities which now form a stable disclimax. An example of this is on some floodplains of the Ashburton land system where *Cenchrus ciliaris* (buffel grass), together with *Rhagodia eremaea* (tall saltbush) and *Acacia victoriae* (bardie bush), has replaced the original saltbush.

6. Management and carrying capacity

Saltbush is more sensitive to the effects of grazing than other chenopod shrubs, such as the bluebushes, and complete control of numbers of livestock and season of use are necessary if saltbush stands are to be maintained.

Where large areas of saltbush pastures exist they should be paddocked as single entities without other pasture types as this will simplify management. However, in many cases, saltbush pastures occur within existing paddocks as minor inclusions surrounded by large areas of poor quality pasture lands. In these circumstances the saltbush is preferentially grazed and frequently over-used. Condition of the whole paddock should be monitored by observing the condition of the valuable saltbush pastures and stock need to be controlled so that excessive use is avoided.

Saltbush pastures in poor or fair condition should be spelled for at least six months during and after a good growing season. This will improve the vigour of the stand and enable seedlings to become established.

Adequate supplies of closely spaced, good quality stock waters are required to make maximum use of saltbush pastures and saline stock waters have restricted use in some areas. Saline water supplies coupled with high salt levels in saltbush pastures results in excessive salt intake by animals. Grazing radius is restricted and animal productivity markedly reduced.

Estimated carrying capacity (hectares per sheep unit) —

Good condition	Fair condition	Poor condition
8	12	40

ROEBOURNE PLAINS GRASS (TGER) PASTURE LAND

1. Area 1645 sq. km (1.8 per cent)

2. Distribution

Roebourne Plains grass pasture lands are important on parts of the coastal plains in the west of the area. Here they occur on gilgai plains up to 5 or 6 km in extent on the Cheetara, Yarcowie and Globe land systems.

This pasture land is also widely distributed in other parts of the survey area, but only as small inclusions surrounded by much larger, poorer quality pasture lands. It occurs on the lowest units of land systems which are favoured by run-on from surrounding units. Such units are small gilgai plains, sluggish drainage flats, narrow drainage floors and gilgaied drainage foci on the land systems Dollar, Jamindie, Mundong, Laterite, Turee and Warri. Soils associated with these pastures are invariably deep (1m+) red cracking clays with gilgai microrelief.

3. Composition

This pasture land consists of a tussock grassland or, less frequently, open shrubland with a prominent tussock grass ground storey dominated by *Eragrostis xerophila* (Roebourne plains grass) with a minor but important component of *Eragrostis setifolia* (neverfail grass). Basal cover of *E. xerophila* can range up to about 4 per cent but is usually less. *Eragrostis setifolia* rarely exceeds 1.5 per cent basal cover and tends to be patchy in distribution. Annuals including *Aristida contorta* (wind grass), *Sclerolaena* spp., *Boerhavia diffusa* (tar vine), *Trianthema oxycalyptra* and *Sida* sp. occur in the inter tussock spaces after rain.

Shrubs are usually very sparse with cover values of less than 5 per cent but in some localised situations may become more dense. The most common tall shrub is *Acacia victoriae* (bardie bush). *Acacia aneura* (mulga), *A. xiphophylla* (snakewood) and *A. tetragonophylla* (curara) are occasionally present. Common low shrubs are *Cassia oligophylla* (blood bush), *C. hamersleyensis, Solanum lasiophyllum* (flannel bush), *Eremophila leucophylla* (Wilcox bush) and *E. maculata* (fuchsia bush).

4. Pastoral value

This pasture land is of moderate pastoral value. Ephemerals, perennial grasses and sparse shrubs provide nutritious grazing after rains but feed attractiveness, quality and durability in drought is poor compared to some shrub pasture lands. Pastures are all accessible and have been fully developed for use by livestock.

5. Condition

Most of this pasture land is in fair range condition. Vegetation shows some degradation with depletion or disappearance of the most sensitive desirable species. There are a few localised areas with severely degraded vegetation. Taken overall there is no erosion.

6. Management and carrying capacity

Roebourne plains grass pasture lands are relatively stable and resistant to grazing. They can be used for grazing on a yearlong basis at the levels recommended, but palatability and feed quality when dry is poor and at this time the pastures supply a bare subsistance diet.

For good animal productivity the best use is by heavy, short term (four to six months) stocking when the pastures are green and actively growing. If this grazing policy is adopted it will be essential to spell the pastures occasionally for up to six months after a

good season. This will enable the grasses to recover by building up root reserves and establishing seedlings.

Although *Eragrostis xerophila* forms the bulk of the stand other minor components such as *Eragrostis setifolia* and desirable shrubs supply more valuable feed and are more sensitive indicators of condition. The vigour and number of these indicators should be closely observed and management should aim at maintaining their place in the pasture.

Estimated carrying capacity (hectares per sheep unit) —

Good condition	Fair condition	Poor condition
6	12	30

CASSIA SHORT GRASS FORB (CSGF) PASTURE LAND

1. Area 1585 sq. km (1.7 per cent)

2. Distribution

This pasture land is found in some central and south-eastern parts of the survey area on land systems with highly calcareous soils derived from dolomite, dolerite, shale or calcrete.

Two district communities occur — one dominated by *Cassia oligophylla* (blood bush) and the other by *C.* aff. *hamersleyensis*. The *C. oligophylla* community is the most important and widespread while the *C.* aff. *hamersleyensis* is so unique that it must be described separately.

Cassia oligophylla communities are restricted in distribution to highly alkaline, calcareous soils in the south-east of the area. They occur widely on undulating shaley plains of the Ruby land system, low calcrete mesas of the Table system and lower foot slopes of the Charley system. They also occur on small areas of other systems such as Ford and Mulgul.

Cassia aff. *hamersleyensis* communities are very restricted in distribution. They only occur on stony upland plains of the Ullawarra and Wona land systems where soils are stony, red, self-mulching clays derived from dolerite or basalt.

3. Composition

3.1 Cassia oligophylla (blood bush) communities

These communities consist of low shrublands dominated by *C. oligophylla* with a sparse overstorey of *Acacia aneura* (mulga) and occasional other *Acacia* species. In some cases *C. oligophylla* forms thick, almost monospecific stands with 3000 to 5000 or more individuals per hectare and projected foliage cover in excess of 10 per cent. Other sparse low shrubs include *Ptilotus obovatus* (cotton bush) *Eremophila leucophylla,* (Wilcox bush), *E. fraseri* (turpentine), *Rhagodia eremaea* (tall saltbush), *Cassia desolata,* and *C. helmsii* (grey cassia). Following rains a flush of annual grasses and herbs appear, the most important of which are *Enneapogon polyphyllus* and *Sclerolaena* species. Total cover value for the pasture land is usually within the range of 10 to 20 per cent.

3.2 Cassia aff. hamersleyensis communities

These communities consist of stands up to 0.5 m tall of the distinctive low shrub *C.* aff. *hamersleyensis*. Cover values and density depend on condition status and vary from 2 to 10 per cent and a few hundred to about 5000 per hectare respectively. There may be a very sparse and patchy overstorey of *Acacia xiphophylla* and a few other low shrubs such as *Ptilotus obovatus* and *C. hamersleyensis*. Numerous annuals including *Cleome viscosa* (mustard weed), *Pterigeron odorus* (smelly bush), *Nicotinia occidentalis* (wild tobacco), and *Enneapogon polyphyllus* grow after rain.

4. Pastoral value

Cassia short grass forb pastures are of moderate pastoral value. They produce abundant good quality annual grasses and forbs in season and have fair durability provided mainly by minor shrub components such as *Rhagodia eremaea, Eremophila leucophylla* and, to a lesser extent, *Ptilotus obovatus*. Although the *Cassia* species are edible they have only limited durability as they shed their leaves in response to prolonged dry conditions.

5. Condition

This pasture land is generally in good condition although there are some small areas that have been overgrazed and show considerable loss of desirable shrubs. There is no erosion.

6. Management and carrying capacity

Management practices will depend on a variety of factors including seasonal conditions, pasture condition and the type and condition of associated pasture lands. Properties with large areas of other less durable pastures may have to rely on CSGF pastures to provide yearlong grazing. Stocking rates should be at about the recommended levels and occasional wet season spelling will be necessary to maintain pasture condition.

Properties with other valuable shrub pasture types which may be in poor condition should make use of CSGF pastures to relieve graziug pressure on the other areas. Management should be flexible so that maximum opportunistic use can be made of CSGF pastures in some heavy seasons.

Estimated carrying capacity (hectares per sheep unit) —

	Good condition	Fair condition	Poor condition
C. oligophylla	20	33	50
C. aff. hamersleyensis	20	33	100

BLUEBUSH (CHMA) PASTURE LANDS

1. Area 1510 sq. km (1.6 per cent)

2. Distribution

Bluebush pasture lands occur scattered throughout the survey area as small inclusions among other less productive pastures and also as extensive areas covering many kilometres. The biggest single area of the pasture land occurs in the far west near the Giralia Range. Here bluebush pastures are found on

undulating limestone plains of the Firecracker land system and on flatter plains of the Donovan system.

Bluebush pasture lands are dominant on the calcareous plains of the Nadarra land system and the low interfluves and plains of the Winning system. They are co-dominant with saltbush (CHAT) and tussock grass pastures (TGCE) on the alluvial plains of the Ashburton land system. They also occur on stony plaius and narrow drainage floors of other systems.

Soils associated with bluebush pastures are alkaline loams, clays and duplex types usually 50 cm to 1m + deep and with variable stony mantles.

3. Composition

A number of easily recognised communities fall into the broad bluebush pasture land. These communities are all based on drought resistant chenopod shrubs of the genera *Maireana, Chenopodium* or *Rhagodia.* Some communities are only found in small specialised habitats and a single shrub species may dominate or be exclusive.

Communities included in bluebush pasture lands are listed in descending order of size and importance and described below. The last two communities are very small and of little significance over the whole catchment. They are occasionally of local importance:—

- *Maireana polypterygia* (Gascoyne bluebush)
- *Maireana pyramidata* (sago bush)
- *Rhagodia eremaea* (tall saltbush)
- *Chenopodium auricomum* (swamp bluebush)
- *Maireana aphylla* (spiny bluebush)

3.1 Maireana polypterygia (Gascoyne bluebush) communities

These communities are exclusive to the Firecracker and part of the Donovan and Nadarra land systems. *Maireana polypterygia* forms a distinctive low shrubland up to about 1m tall. Density can be in excess of 2000 plants per hectare and projected foliage cover varies from about 2 to 12 per cent depending on condition status. Other sparse low shrubs are *Atriplex bunburyana* (river saltbush), *Cassia desolata, Enchylaena tomentosa* (ruby saltbush) and *Maireana tomentosa.* Tall shrubs such as *Acacia victoriae* (bardie bush) *A. xiphophylla* (snakewood) and the tree *A. cuspidifolia* (wait a while) are sparse or very sparse. Numerous forbs and annual grasses form the ground storey in season.

3.2 Maireana pyramidata (sago bush) communities

Nowhere in the catchment do these communities occur over extensive areas, but they are common on some drainage floors, saline plains and alluvial plains. The communities are rather variable, but *Maireana pyramidata* is always a major component of the low shrub layer. The overstorey of tall shrubs and occasional trees varies in density from very sparse to moderately dense and commonly includes *Acacia aneura* (mulga), *A. xiphophylla* (snakewood), *A victoriae* (bardie bush), *A. cuspidifolia* (wait a while) and *A. kempeana.*

A wide range of low shrubs are associated with the sago bush, including *Atriplex bunburyana* (river saltbush), *Frankenia* sp., *Cassia desolata, C. oligophylla* (bloodbush), *Rhagodia eremaea* (tall saltbush), various small *Maireana* species and *Solanum lasiophyllum* (flannel bush). Numerous annual *Sclerolaena* species, forbs and annual grasses form the ground storey after rain.

3.3 Rhagodia eremaea (tall saltbush) communities

These communities occur on some flood plains with deep silty loam alluvial soils. They are common on floodplains of the Ashburton land system where they are probably a disclimax of the original *Atriplex bunburyana* (river saltbush) vegetation. They are included in the bluebush (CHMA) pasture land rather than saltbush (CHAT) because their reaction to grazing and their management requirements are closer to those of bluebush than saltbush.

The tall saltbush community is a dense tall shrub land of *Acacia victoriae* or *A. sclerosperma* with occasional *Eucalyptus coolabah* and numerous *Rhagodia eremaea* plants 1 to 2.5m in height. Projected foliage cover of *Rhagodia* can exceed 6 per cent. *Cassia oligophylla* (blood bush) frequently forms a dense low shrub layer with up to 12 per cent cover. In dry seasons the ground layer is absent or may consist of sparse tussocks of *Cenchrus ciliaris* (buffel grass). After good rains or flooding abundant annual herbs, such as *Ptilotus exaltatus* (purple mulla mulla), *P. macrocephalus, Trichodesma zeylanicum* and *Swainsona maccullochiana* (Ashburton pea) form a dense ground cover.

3.4 Chenopodium auricomum (swamp bluebush) community

This minor community occurs scattered throughout the catchment, but rarely extends over more than a few kilometres. It is found on internal drainage plains and swamps and depressions of land systems such as Ashburton, Bryah, Charlie and Kunderong. Soils associated with the community are self-mulching seasonal cracking clays with gilgai microrelief.

Structure of the community is a low shrubland with projected foliage cover of *Chenopodium* varying from less than 1 per cent up to 14 per cent depending on site potential and condition status. Shrub density can be up to about 1500 per hectare. Sparse tussock grasses *Eragrostis xerophila* (Roebourne plains grass), *E. setifolia* (neverfail grass) and *Eriachne flaccida* occur in the stand and there are numerous annual forbs and grasses after rain.

3.5 Maireana aphylla (spiny bluebush) community

This minor but distinctive community occurs occasionally within the catchment on small areas of seasonally waterlogged heavy clay soils. *Maireana aphylla* dominates and forms a low shrubland with up to 1500 or more individuals per hectare. Projected foliage cover can probably exceed 10 per cent. A few other shrubs such as *Acacia victoriae* are occasionally present. The ground layer may contain very sparse perennial grasses. Annual forbs such as *Sclerolaena* spp. are common in season.

4. Pastoral value

Bluebush pasture lands are of high pastoral value as the shrubs have good durability and drought resis-

tance, high resistance to grazing and high nutritive value. In addition, many of the ephemerals occurring in good seasons have high nutritive value although durability is poor.

The high value of these pastures has been recognised since the early days of settlement and most areas have been developed and receive heavy grazing use. An exception to this is an area of *Maireana polypterygia* (Gascoyne bluebush) in the far west of the area which was not fully developed for use by livestock until the mid 1960s.

5. Condition

As a generalisation this pasture is in fair range condition with little erosion. Both extremes of range condition occur and there are some localised areas with quite severe erosion problems. Problem areas occur on parts of the Firecracker system .

6. Management and carrying capacity

These high quality pastures must be managed to maintain the desirable shrubs as these provide the bulk of feed in normal seasons and valuable reserves in drought seasons. The bluebushes and *Rhagodia eremaea* (tall saltbush) are quite resistant to grazing and, when in good condition, can carry high numbers of animals relative to many other pastures. However excessive long term use will deplete the shrub population and severe degradation can occur.

Periodic spelling from grazing, during and immediately after heavy seasons, is recommended. Spelling at this time should be for as long a period as possible — preferably at least six months to enable seedlings to establish and build up root reserves and mature plants to build up food reserves and set heavy seed crops.

Because of their high nutritive value, bluebush pastures should ideally be reserved for use by breeding stock or young stock rather than dry animals. Closely spaced good quality water supplies must be provided if maximum pasture use and animal performance is to be achieved. Bluebush pastures are highly saline and if stock waters are also saline the high total intake of salt will severely restrict feed intake, grazing radius and stock productivity.

Bluebush pastures on country which is inherently prone to erosion require especially careful management. *Maireana polypterygia* (Gascoyne bluebush) communities on the Firecracker land system are in this category. In some cases dams have concentrated livestock and resulted in rill and gully erosion occurring along animal pads traversing down long slopes. To aid recovery it may be necessary to fence off the dams to prevent animal access and to pipe water to higher, more stable distribution points.

Estimated carrying capacity (hectares per sheep unit)—

Good condition	Fair condition	Poor condition
8	14	40

BUFFEL GRASS (TGCE) PASTURE LAND

1. Area 1460 sq. km (1.68 per cent)

2. Distribution

The introduced *Cenchrus ciliaris* (buffel grass) has become naturalised in central and western parts of the survey area where it occurs as small areas and occasional larger areas 3 or 4 km in extent.

Buffel grass pastures are associated with many of the major rivers of the area and occur on flood plains, alluvial plains, levee zones and channel banks of the Ashburton, Globe, Nanyarra, River, Rous and Yanrey land systems. They are also found on sand plains and sand dunes of the Onslow and Nanyarra systems in the north-west and along some narrow drainage floors and banks flanking minor rivers and creeks in other systems.

Generally the soils favoured by buffel grass are sands, sandy loams and loams with moderate to high phosphorus levels (11 to 30 ppm phosphorus). Exceptions to this occur and in some areas buffel grass is well established on clay soils and on soils with very low phosphorus status (less than 5 ppm phosphorus).

3. Composition

This pasture land consists of numerous communities with different structural forms but all communities have a common ground layer consisting of *Cenchrus ciliaris* (buffel grass) with basal cover varying from about 0.5 to 6 per cent. Structural form may be low woodland, tall shrubland, or, less commonly, tussock grassland with only a few shrubs.

The common tree of the pasture land where it occurs along the Ashburton River is *Eucalyptus coolabah* (coolibah) which may reach a height of 8 metres. Common tall shrubs in this situation are *Acacia victoriae* (bardie bush) and *A. sclerosperma* which vary in density from very sparse to moderately dense. Along small rivers and creeklines buffel grass pastures have a tree layer consisting of *Acacia aneura* (mulga), *A. coriacea* (river jam) and *A. citrinoviridis*. Common shrubs are *Acacia tetragonophylla* (curara), *Cassia oligophylla* (bloodbush), *C. helmsii* (grey cassia), *C. sturtii, Corchorus walcottii, Ptilotus obovatus* (cotton bush) and *Eremophila leucophylla* (Wilcox bush).

On sandplain and sand dune sites buffel grass occurs as a mixture with *Triodia pungens* (soft spinifex) or *Plectrachne schinzii* (oat-eared spinifex) or has completely replaced the spinifex. Shrubs such as *Scaevola seriophylla, Pityrodia paniculata, Acacia victoriae* and *A. translucens* (poverty bush) are very sparse although poverty bush sometimes increases considerably.

4. Pastoral value

Buffel grass pastures are of high or very high pastoral value. They respond rapidly to small falls of rain, provide good quality feed when green and, compared to native pastures, can be very heavily stocked without deteriorating. As with other grass pastures feed value falls fairly rapidly in dry times and in this regard they are not as nutritious or durable as some shrub pastures or good condition soft spinifex. When very dry they provide only a sub-maintenance ration for livestock. An attribute of buffel grass which is of significance and value to the pastoral industry is its ability to colonise and stabilise some badly degraded and eroded sites.

5. Condition

Buffel grass pastures are usually in good or fair condition and there is no erosion.

Buffel grass has stabilised or partly stabilised large areas of the Ashburton and Nanyarra land systems. On these systems there is evidence, in the form of extensive hummocking and massive redistribution of sand, of past erosion which probably occurred in the early years after settlement.

Some buffel grass pastures are in poor condition and active wind erosion is present. These sites originally supported native pastures such as *Atriplex bunburyana* (river saltbush) but with excessive use became severely degraded and eroded. Buffel grass is now acting as an invader and starting to colonise.

6. Management and carrying capacity

Buffel grass pastures in good or fair condition are stable and very resistant to grazing. They should be heavily stocked to maintain the stand in a fairly short condition as this will encourage and prolong the production of green shoot and leaf. Green material is available for at least six months of the year, given reasonable seasons and heavy stocking. Animal productivity over this time will be good. However, when the pastures are completely dry or if they are allowed to become tall and rank they are not particularly palatable to stock and animal performance will be poor.

Buffel grass is capable of setting some seed even with heavy grazing, however, occasional spelling for four to eight weeks over a growing season will ensure that the stand sets plentiful seed and remains vigorous. It is not necessary or desirable to spell for longer than eight weeks as the pasture will quickly become less attractive to livestock if left ungrazed.

Managing paddocks which contain buffel grass pastures and shrub pastures such as saltbush (CHAT) or stony chenopod (STCH) requires special care. Heavy stocking is required for best use of the buffel pasture. However, if high stocking rates are maintained into long dry periods, the shrub pastures will become more attractive to stock than the grasses and may be damaged by overuse. Levels of use on the shrubs in the paddock should be closely observed and stock shifted before severe defoliation occurs. Management is simplified if paddocks are arranged or can be arranged to exclusively contain one or other of the pasture types. Elsewhere where buffel pastures are associated with different native pastures such as hard spinifex (HSSP) or soft spinfex (SOSP) it is not necessary to paddock the different pastures separately. In fact, a buffel grass / soft spinifex pasture mixture is probably ideal and desirable. Both pasture types can sustain heavy use and the different virtues of each, such as rapid initial growth of the buffel and good drought value of the soft spinifex, complement each other.

Estimated carring capacity (hectares per sheep unit) —

Good condition	Fair condition	Poor condition
2	5	30

WEEPING GRASS (TGCH) PASTURE LAND

1. Area 1100 sq. km (1.2 per cent)

2. Distribution

The weeping grass pasture land is important on the coastal plains in the far west and north-west of the survey area. It also occurs on a few minor units of some land systems elsewhere in the area but is never extensive.

This pasture land is generally restricted to loams, loamy clays and cracking clay soils with gilgais and occupies low, wet positions in the landscape. It is the dominant pasture on the unique Yanrey land system which is a large drainage sump into which the endoreic Yannarie River flows. It occurs on some floodplains of the Minderoo and Yankagee systems and on swamps and low back plains of the Nanyarra system.

Fertility levels of the soils supporting weeping grass pastures are moderately high. Samples taken during the survey averaged 20 ppm phosphorus (range 5 to 59ppm) and 404 ppm nitrogen (range 150 to 900 ppm).

3. Composition

This pasture land consists of a number of different communities which have a common tussock grass ground layer of *Chrysopogon fallax* (weeping grass) and *Eriachne benthamii*. Maximum basal cover for these two grasses is about 6 to 7 per cent but is commonly much less. Other perennial tussock grasses such as *Astrebla elymoides* (weeping mitchell grass), *Eriachne flaccida* (crab hole grass), *Eragrostis setifolia* (neverfail grass), *E. xerophila* (Roebourne plains grass) and *Eulalia fulva* (silky brown top) occur occasionally.

Structural form of the pasture land may be low open woodland with sparse shrubs, tall open shrubland or tussock grassland with very sparse shrubs. The tree layer consists of *Eucalyptus coolabah* (coolibah) and the most common tall shrubs are *Acacia tetragonophylla* (curara) and *A. victoriae* (bardie bush). Low shrubs may or may not be present but, if present, are commonly *Cassia desolata* and other *Cassia* species, *Rhagodia eremaea* (tall saltbush) and *Scaevola spinescens* (currant bush).

4. Pastoral value

Weeping grass pasture is of very high pastoral value if maintained in good condition. After rains, it produces large quantities of good quality fodder which can support lactating stock. However, as the pasture dries off, its nutritional value declines and when dry it only supplies a maintenance diet.

This pasture is subject to flooding and the soils remain wet and boggy for some time after floods have receded. During these periods the pastures are poorly accessible to stock and receive a natural spell from grazing.

5. Coudition

The condition of this pasture land varies considerably. Areas that are regularly flooded are in good or excellent condition due to good soil moisture supplies and natural deferment from grazing. Areas that are less frequently flooded are mostly in fair to very poor condition. Sites with heavy clay soils show no erosion but the more loamy soils of some flood plains show severe surface sheeting and wind scalding resulting in bare flats which may extend for 3 km. The presence of dead *Eucalyptus coolabah* on these flats indicates that the areas once carried *Chrysopogon* tussock grass pastures.

6. Management and carrying capacity.

Management on this highly productive pasture should aim at maintaining the population and vigour of *Chrysopogon fallax* and other desirable perennial tussock grasses in the pasture as these provide the bulk of feed for stock. Grazing can be on a yearlong basis at the levels recommended but a routine of occasional spelling on a paddock by paddock basis over a growing season is required. This allows seed to set and seed already in the ground to germinate and establish.

Although grazing may be yearlong these grass pastures are of limited value when completely dry as protein and digestibility levels drop rapidly and animal performance declines markedly. An alternative to yearlong use is heavy grazing when green and shifting stock to other pastures later in the year. Such a system makes efficient use of the grasses when they are at their best and allows spelling of shrub pastures which will be relied on for durable feed later in the year.

Occasional spelling of the grass pastures over a growing season is necessary for maintenance.

Estimated carring capacity (hectares per sheep unit) —

Good condition	Fair condition	Poor condition
3	7	30

SAMPHIRE (SAMP) PASTURE LAND

Area 1160 sq. km (1.3 per cent)

Estimated carrying capacity (hectares per sheep unit) —

Good condition	Fair condition	Poor condition
25	30	50

MISCELLANEOUS TUSSOCK GRASS (TGMI) PASTURE LAND

Area 690 sq. km (0.7 per cent)

Estimated carrying capacity (hectares per sheep unit)—

Good condition	Fair condition	Poor condition
6	12	30

MITCHELL GRASS (TGAS) PASTURE LAND

Area 245 sq. km (0.3 per cent)

Estimated carrying capacity (hectares per sheep unit)—

Good condition	Fair condition	Poor condition
3	7	30

Table 26 — Pasture lands of the survey area

Pasture land	Area (sq km)	%	Pasture characteristics	Condition
Hard spinifex hill HSHI	21 940	23.4	Rugged hills and ranges, partly inaccessible — also stony plains; very shallow soils with frequent outcrop and dense surface mantles; sparse trees and variable shrubs with hard spinifex ground layer, very sparse forbs; negligible pastoral value.	Resistant to erosion. No pasture degradation.
Mulga short grass forb MSGF	19 585	20.9	Hills, ridges, undulating stony plains, hardpan plains and some calcrete plains; shallow soils with variable surface mantles, mulga shrublands with prominent low shrub layer mostly *Eremophila* and *Cassia* spp, forbs and annual grasses.	Generally resistant to erosion. Little pasture degradation except localised areas where minor to moderate loss of palatable shrubs is evident.
Stony short grass forb SSGF	16 605	17.7	Some hills, footslopes, stony outcrop plains — also extensive hardpan plains; shallow soils to parent material or hardpan, surface mantles may or may not be present; very sparse shrublands with forbs and annual grasses, low potential.	Generally resistant to erosion. Pasture condition mostly good or fair, some minor degradation.
Soft spinifex sand plain SOSP	6 575	7.0	Coastal sand plain, sand dunes, sandy drainage floors; hummock grassland of soft spinifex *(Triodia pungens, Plectrachne schinzii)* with sparse shrubs and occasional low trees.	Susceptible to wind erosion immediately after fire but stabilises rapidly after rain, generally vegetative cover sufficient to protect from erosion. Pasture condition mostly good, some localised increases in undesirable scrub.
Hard spinifex sand plain HSSP	6 390	6.8	Sand plains and plains with thin sand cover, sands and gradational soils; hummock grasslands of hard spinifex *(Triodia basedowii, T. lanigera)* with sparse shrubs and occasional low trees, very low potential.	Not susceptible to erosion except for short periods after fire. No vegetation degradation.
Mulga creekline MUCR	4 520	4.8	Groves, drainage foci and drainage lines of stony and hardpan plains, also narrow zones flanking rivers, creeks and channels throughout area; dense tall mulga shrublands with numerous low shrubs, forbs and annual grasses, high potential.	Some drainage floors and creekline zones susceptible to water erosion; sheeting, rills and shallow gullies with sharp incision, other units show little erosion. Pasture degradation common but varies from nil to very severe.

Pasture land	Area (sq km)	%	Pasture characteristics	Condition
Stony chenopod STCH	3,680	3.9	Footslopes interfluves and plains, stony gilgai plains; saline soils common, clays and gradational soils with clay subsoil, variable surface strew, sparse halophytic and other low shrubs, forbs and annual grasses, scattered overstorey of tall shrubs often snakewood *(Acacia xiphophylla).*	Generally not susceptible to erosion except where soils have no strew protection. Minor to moderate pasture degradation is common.
Saltbush CHAT	3,540	3.8	Alluvial plains, tributary drainage plains, drainage floors; saline and non saline loam, clay and duplex soils, surface strew sparse or absent, moderately dense low saltbush *(Atriplex bunburyana)* shrubs beneath variable tall shrub layer.	Susceptible to erosion especially duplex soil types, severe wind scalding and deflation common, some water sheeting and guttering. Pastures severely degraded.
Roebourne plains grass TGER	1,645	1.8	Clay plains, drainage foci, sluggish drainage flats, drainage floors; exclusively cracking clay soils with gilgais; tussock grasslands mostly with few shrubs, occasionally with prominent low and tall shrub layers.	Not susceptible to erosion. Pasture condition mostly fair with only minor degradation, a few areas of severe pasture depletion.
Cassia short grass forb CSGF	1,585	1.7	Gently undulating shaley plains and interfluves, calcrete platforms, gilgai plains derived from basalt; highly calcareous loam and clay soils; moderately dense bloodbush *(Cassia oligophylla)* shrublands with numerous other shrubs or low shrubland of *C.* aff. *hamersleyensis.*	Generally not susceptible to erosion. Little pasture degradation.
Bluebush CHMA	1 510	1.6	Gently undulating limestone plains, alluvial plains, internal drainage flats, drainage floors; alkaline loams, clays and duplex soils with variable stony mantles; bluebush *(Maireana polypterygia, M. pyramidata)* and other low chenopod shrubs, numerous tall shrubs.	Some systems (e.g. Firecracker) susceptible to erosion with gullies and microterracing, also some eroded drainage floors, elsewhere flat heavy soil sites not susceptible. Fair pasture condition, nearly all pastures show some degradation.
Buffel grass TGCE	1 460	1.6	Flood plains, alluvial plains, levee zones and banks flanking some major rivers, also sand plain and dune areas; loamy and sandy soils; open woodlands and tall shrublands with ground layer of introduced buffel grass *(Cenchrus ciliaris)*, also as mixture in soft spinifex grasslands.	Not susceptible to erosion once good stands of buffel grass have developed, buffel has ability to colonise and eventually stabilise degraded sites. Pastures generally stable but recently colonised sites with poor total cover are still seriously degraded.
Samphire SAMP	1 160	1.3	Samphire flats of littoral zone, dark saline clays, also restricted areas of highly saline lake margins, drainage floors and stony slopes; low shrublands of samphire and other halophytes, very low potential.	Not susceptible to erosion. Little grazed, no pasture degradation.
Weeping grass TGCH	1 100	1.2	Flood plains; low lying back plains, swamps and depressions in the west of the survey area; loams, loamy clays and cracking clay soils; woodlands and tall shrublands with prominent weeping grass *(Chrysopogon fallax)* ground storey.	Flat sites with heavy clay soils resistant to erosion; plains and through flow areas with loamy soils are susceptible to erosion, surface sheeting and wind scalding common. Pasture condition varies from excellent to severely degraded.
Miscellaneous tussock grasses TGMI	690	0.7	Clay plains near coast, swamps and depressions, tussock grasses *Sporobolus mitchellii, Eriachne gardnerii,* also *S. virginicus;* sandy banks in inland areas carry wandarrie grass *Monochather paradoxa.*	Clay plains and swamps not susceptible to erosion, little pasture degradation. Sandy banks susceptible to wind erosion if vegetation depleted, minor pasture depletion.
Mitchell grass TGAS	245	0.3	Restricted gilgai plains near coast, cracking clay soils; Mitchell grass *(Astrebla pectinata)* grasslands with very sparse shrubs.	Resistant to erosion. Minor pasture degradation.
No vegetation claypans, coastal mud flats, etc.	1 370	1.5		
	93 600	100.0		

CONDITION OF THE SURVEY AREA

As outlined in the section on Techniques of the Survey three levels of range condition were derived from assessments of pasture condition and erosion made whilst traversing through the survey area. The levels of range condition recognised were good, fair and bad.

Country in good range condition is in acceptable order, and its use for grazing, using the current management practices, can be continued.

Country in fair range condition may still be used for grazing, but careful management is required to ensure that condition does not deteriorate further. Changes in management practices may be necessary to maintain or improve condition.

Country in bad range condition is in unacceptable order, and changes in management to initiate improvement are required. It is frequently unstable, as pastures are badly degraded and/or moderate to severe erosion is present. In extreme cases complete protection from grazing for long periods and other special remedial treatments are required to effect recovery.

A condition statement can be made by examining all of the traverse data recorded during the survey. Table 27 shows the breakdown of range condition as sorted from the traverse data by the Cyber 72 programme. The table represents an overall summary of all usable areas of pastoral value obtained by traversing on as many station access tracks as possible. It was not possible to traverse some large areas of rugged hill country nor was this necessary as such country is of very low to negligible pastoral value and, as inspections on foot revealed, was invariably in good range condition.

Five per cent of the traverse observations recorded moderate erosion and three per cent recorded severe erosion.

Twenty-four per cent of the traverse observations recorded poor or very poor pasture conditions.

Fifty per cent of the traverse observations indicated good range condition. Thirty-four per cent of the traverse observations indicated fair range condition. Sixteen per cent of the traverse observations indicated bad range condition.

As well as condition statements derived by bulking all traverse data collected during the survey the condition of individual land systems has been derived from traverse data. Table 28 groups the land systems of the alienated parts of the survey area in decreasing order of pastoral value and indicates the area of each system found to be in good, fair and bad condition. Similar data for each unit of each land system is available, but is not presented here.

Table 28 also indicates the areas of **extreme degradation,** if present, on each land system. Such areas show extreme pasture degradation and/or severe erosion and are of particular concern. A total of 534 sq. km (0.9 per cent of the alienated country) shows extreme degradation. **Special remedial treatments, including complete removal from use, are required to bring about recovery.**

The extent and regional location of areas of extreme degradation are shown on the 1:250 000 maps accompanying this report. In general the patches of extreme degradation are confined to central and western parts of the survey area and are concentrated on plains flanking the Ashburton River from the vicinity of Mininer station downstream to the river mouth near Onslow.

Table 27 — Traverse summary, total over all land systems

Wind erosion %		Water erosion %		Total erosion %		Pasture condition %		Range condition %	
Nil	86	Nil	85	Nil	79	Excellent	20	Good	50
Minor	8	Minor	11	Minor	13	Good	29	Fair	34
Moderate	4	Moderate	3	Moderate	5	Fair	27	Bad	16
Severe	2	Severe	1	Severe	3	Poor	18		
						Very poor	6		

8 608 recordings were made on 62 land systems

Table 28 — Condition summary of alienated country within the survey area

Pastoral value	Land system	Area sq km	Area (sq km) in range condition shown			Extreme degradation	
			Good	Fair	Bad	Area (sq km)	% of system
Very high	Ashburton	2009	311	743	955	41.5	2.1
<5ha per sheep unit	Brockman	25	1	10	14	0	0
	Minderoo	1648	759	518	371	37	2.2
	Nanyarra	185	51	74	60	21	11.4
	River	692	373	229	90	1	0.1
	Rous	377	114	127	136	25	6.6
	Yanrey	112	29	83	0	0	0
Sub totals		5048	1638	1784	1626	125.5	
Percentage			32.5	35.3	32.2	2.5	
High	Cheela	203	0	11	192	96	47.3
5 to 10ha per sheep unit	Cheetara	407	51	301	55	6	1.5
	Donovan	293	124	117	52	3	1.0
	Dune	318	318	0	0	0	0
	Edward	1068	104	278	686	147	13.8
	Firecracker	175	66	83	26	3	1.7
	Globe	1237	152	538	547	97	7.8
	Onslow	432	344	88	0	0	0
	Winning	134	102	30	2	0	0
	Yankagee	1104	836	161	107	2	0.2
	Yarcowie	21	3	17	1	0.5	2.4
Sub totals		5392	2100	1624	1668	354.5	
Percentage			39.0	30.1	30.9	6.6	
Moderate	Boolaloo	800	749	51	0		
10 to 20ha per sheep unit	Bryah	29	21	8	0		
	Cadgie	138	80	38	20		
	Dollar	476	80	263	133	2.5	0.5
	Ford	605	108	362	135	1	0.2
	Giralia	3397	3155	242	0		
	Jubilee	326	305	21	0		
	Laterite	411	115	263	33	0.1	0.02
	Mundong	516	95	407	14		
	Nanutarra	93	56	37	0		
	Nadarra	264	152	112	0		
	Nooingnin	939	222	583	134	13.7	1.5
	Paraburdoo	622	92	377	153	13	2.1
	Robe	250	242	8	0		
	Ruby	184	101	67	16	1	0.5
	Scoop	141	73	28	40		
	Spearhole	26	26	0	0		
	Stuart	1214	755	432	27		
	Table	1051	647	342	62		
	Tangadee	288	95	179	14		
	Turee	356	10	280	66	2	0.6
	Uaroo	4486	4063	390	33	12	0.3
	Warri	365	86	214	65		
	Wona	53	23	20	10		
Sub total		17030	11351	4724	955	45.3	
Percentage			66.7	27.7	5.6	0.3	
Low	Charley	1101	769	256	76	2.5	0.2
20 to 30ha per sheep unit	Collier	1969	1604	349	16		
	Egerton	1871	1381	465	25		
	Ethel	925	556	316	53		
	Jamindie	1985	791	1078	116	4.2	0.2
	Kooline	6627	3256	2759	612	0.4	0.006
	Kunderong	566	21	488	57		
	Nirran	94	31	62	1		
	Prairie	1236	453	629	154		
	Three Rivers	222	47	147	28		
	Ullawarra	497	388	105	4		
	Weelarrana	38	33	5	0		
Sub total		17131	9330	6659	1142	7.1	
Percentage			54.5	38.9	6.6	0.04	

Pastoral Value	Land System	Area Sq km	Area (sq km) in range condition shown			Extreme degradation	
			Good	Fair	Bad	Area (sq km)	% of system
Very low	Augustus	7104	6817	274	13	0.3	0.004
>30 ha per sheep unit	Boolgeeda	939	668	231	40		
	Capricorn	2849	2426	373	50		
	Divide	310	284	26	0		
	Littoral	699	695	4	0		
	Mulgul	448	386	53	9	0.3	0.07
	Newman	1180	1180	0	0		
	Platform	108	107	1	0		
	Rocklea	2890	1975	715	200	1	0.03
Sub total		16527	14538	1677	312	1.6	
Percentage			88.0	10.1	1.9	0.01	
Total alienated		61128	38957	16468	5703	534	
Percentage			63.7	27.0	9.3	0.9	

Table 28 clearly shows that the best country with the highest potential pastoral value is the most degraded. The total area of alienated country covered by the survey is about 61,130 sq km. Only 5048 sq km. (8.3 per cent) of this is classified as of very high pastoral value. **About 1626 sq km or 32.2 per cent of this very high value country is in bad range condition.**

About 5392 sq km (8.8 per cent) of the alienated country is of high pastoral value. **1668 sq km or 31 per cent of this high value country is in bad range condition.**

About 17030 sq km (27.9 per cent) of the alienated country is of low pastoral value. **955 sq km or 5.6 per cent of this moderate value country is in bad range condition.**

About 17130 sq km (28 per cent) of the alienated country is of low pastoral value. **1142 sq km or 6.6 per cent of this low value country is in bad range condition.**

The remaining 16527 sq km (27 per cent) of the alienated country is of very low pastoral value. Some of it is useless for pastoral purposes. **Only 312 sq km or 1.9 per cent of this class of country is in bad range condition.**

In the following sections land systems with problems of degradation are discussed in some detail. Rehabilitation methods are outlined.

RANGE CONDITION OF LAND SYSTEMS OF HIGH AND VERY HIGH PASTORAL VALUE

A few high value land systems such as those based on soft spinifex are relatively stable and show little pasture degradation or erosion, but others such as **Ashburton, Minderoo, Nanyarra, Rous, Cheela, Edward** and **Globe** have extensive areas of severe landscape degradation. These systems are all alluvial plain systems associated with the Ashburton River and its major tributaries. They are readily accessible to stock, except when occasionally flooded for short periods, support attractive chenopod and perennial grass pastures and have received heavy use since early settlement. In many cases use has been excessive. **A total of 480 sq km or 4.6 per cent of high or very high pastoral value country shows extreme degradation and is of particnlar concern.**

Ashburton land system

Parts of the Ashburton land system support highly productive shrub and grass pastures in good or fair condition; in other areas pastures are badly degraded and wind erosion is active. About 955 sq km or 47.5 per cent of the system is in bad range condition and 41.5 sq km (2 per cent) show extreme degradation.

Before settlement the system supported saltbush *(Atriplex bunburyana)* and bluebush *(Maireana pyramidata)* pastures, relics of which can still be found. In the early days of settlement large numbers of stock were watered along the Ashburton River frontage and pastures became seriously degraded. Evidence of massive redistribution of soil material in the past indicates that much of **Ashburton** system became extremely unstable. Wind piles and hummocks up to 2 m high are widely distributed, but many of these are now stabilised or partly stabilised.

Stock numbers have fallen markedly from the early high levels and a complex pattern of vegetation recovery is emerging. The original areas of saltbush will never be restored. However, colonization of parts of the system by buffel grass *(Cenchrus ciliaris)* has occurred in the last twenty years, and this has stabilised the soil and improved carrying capacity. A stable disclimax vegetation based on buffel grass with an overstorey of bardie bush *(Acacia victoriae)* and tall saltbush *(Rhagodia eremaea)* is established. Elsewhere, where buffel grass is absent, the vegetation varies from dense shrublands of bardie bush, tall saltbush and bloodbush *(Cassia oligophylla)* with a profusion of ephemeral herbage species after flooding, to very sparse poor shrublands of bardie bush and little else.

The **Ashburton** system with its very deep silty loam and loamy clay soils has the ability (unlike some other systems such as Edward) to recover quickly after overuse. Severely degraded areas should be destocked completely for two or three years to encourage the recovery of perennial grasses and shrubs. The spread and establishment of buffel grass should be encouraged and, in most cases, this could be achieved without cultivation.

Minderoo land system

Condition of this system is extremely variable. About 371 sq km or 22.5 per cent is in bad range condition, and this includes 37 sq km (2.2 per cent) which shows extreme degradation. The remainder of the system is in good or fair condition.

The system is a complex mosaic of different units with different soil types and pastures. Units such as sand plain supporting soft spinifex *(Triodia pungens)* and gilgai plains with tussock grasses *(Chrysopogon fallax, Astrebla elymoides* and others) are relatively resistant to degradation and are in good to fair condition. Other units such as hummocky plains with snakewood *(Acacia xiphophylla)* and plains with through drainage are sensitive to use and are degraded and eroded. Such a mixture of units with different sensitivities makes overall management of the system difficult. Some loss of desirable shrubs such as saltbush is inevitable if maximum use is to be made of the other pasture components, but severe pasture depletion accompanied by erosion, as has occurred in some areas, is unacceptable.

Degraded areas should be closed to stock for a number of consecutive growing seasons and stocked conservatively at other times. Stocking rates for the pastures (in good, fair and bad condition) of the system are presented in Table 25 in the section of this report describing pasture lands.

Areas of extreme degradation should be completely closed to stock for a number of years. In some cases this could be done by closing existing paddocks (which also frequently enclose areas of extreme degradation on other land systems), but some additional fencing is also required. The recovery process could be hastened on severely scalded and denuded sections by strip cultivation to improve water penetration and to provide a seedbed for native and introduced plants. Bnffel grass *(Cenchrus ciliaris)* is well established on some sandy parts of the **Minderoo** system and also appears to be slowly colonising heavier soil types. Buffel and birdwood grass *(C. setigerus)* should be seeded into the cultivation workings.

Nanyarra laud system

This alluvial plain system is restricted to Minderoo Station in the north-west of the survey area. Approximately 60 sq km or 32.4 per cent of the system is in good range condition with dense perennial grass pastures, including introduced buffel grass *(Cenchrus ciliaris)* beneath an overstorey of bardie bush *(Acacia victoriae)* and coolibah *(Eucalyptus coolabah)*. About 74 sq km (40 per cent) and 51 sq km (27.6 per cent) of the system is in fair and bad range condition respectively.

Twenty-one sq km (11.4 per cent) shows extreme degradation with sealed, windswept soil surfaces and almost no perennial vegetation. Wind piling and hummocking of soil to a depth of 1.5 m is common at the margins of scalded areas.

Areas of extreme degradation should be completely spelled for a number of years and strip cultivation and seeding treatments with buffel and birdwood grasses imposed. In the future some additional fencing may be required to isolate specific problem areas, but a regeneration programme could start immediately within existing paddocks. It is not possible to indicate the time period necessary for full recovery, but reasonable recovery could be expected after four to five years at the end of which controlled grazing at conservative rates could re-commence.

Although parts are extremely degraded and are currently producing far below potential the Nanyarra system has the ability to recover rapidly if treated as outlined. Soils are very deep loams and loamy clays with good moisture-holding capacity, rainfall is more assured than more inland areas and buffel grass has proven ability to colonise and stabilise sites in the environment.

Rous land system

The Rous system occurs on Yanrey and Uaroo Stations in the west of the survey area. Condition of the system is about equally distributed between good, fair and bad. The 136 sq km that is in bad condition includes 25 sq km (6.6 per cent of the total area of the system) which is extremely degraded and is of particular concern. The worst areas fall within existing paddocks on Yanrey and Uaroo stations, and a regeneration programme involving complete protection from grazing and limited cultivation and seeding treatments is required. Good recovery could be expected after four or five years of treatment.

Cheela land system

This alluvial tributary plains system of 203 sq km occurs as a single area between the Beasley and Hardy Rivers on Wyloo station.

The original shrub and perennial grass pastures on the system are seriously degraded and considerable wind and water erosion has occurred in the past and is still occurring. The traverse data indicated that 192 sq km (94.6 per cent) of the system is in bad range condition and 96 sq km (47.3 per cent) is extremely degraded. Pastures are short-lived ephemerals after rain or episodic flooding. These supply nutritious short-term feed, but very few perennial shrubs are present and the pasture has no drought durability. For much of the year the ground surface is bare and completely exposed to the action of wind and water.

The area is well-equipped with artificial waters (but is entirely unfenced) to make opportunistic use of the flush of annual growth in season. However, the area has far higher potential for grazing livestock than it can realise in its present condition — it is presently assessed as producing at only 13 per cent of its capacity.

A regeneration programme is required as matter of urgency. Recovery of perennial vegetation and consequent stabilisation of the landscape can only be achieved if the area is closed to grazing for a number of years. To do this and for future management it is imperative that the area be fenced.

The area is suitable for strip cultivation and seeding treatments to hasten the recovery process. Buffel and birdwood grass and possibly some chenopod shrubs should be seeded in test areas. Because of the vagaries of the climate it is impossible to predict the length of time required for recovery with accuracy, but it is anticipated that the minimum time for closure to grazing would be five years.

Edward land system

This tributary drainage plain system occurs on many stations along the Ashburton River valley and is nearly always located on the outer margins of the **Ashburton** system and immediately below the **Kooline** system.

Much of the system is profoundly degraded and it contributes in a major way to the overall degradation problem on the catchment. About 686 sq km (64.2 per cent) of the system is in bad range condition and 147 sq km (13.8 per cent) shows extreme degradation.

The system once supported productive saltbush and bluebush pastures but it was extremely sensitive under grazing. On many plains the sandy surface layers of the original duplex soils have been entirely stripped away leaving hard, bare clay plains which may extend for up to 10 km but are usually smaller. Surfaces are sealed and poorly pervious to water and are extremely unfavourable environments for plant establishment. Erosion in the form of rilling, guttering, sheeting and hummocking is widespread on broad drainage floors of the system.

The bad condition of the **Edward** system is a serious problem and clearly shows the deficiencies of past management. Conservative stocking rates and complete control of season of grazing are essential on the few remaining areas in good or fair condition or they will rapidly degrade and erode. The system must be fenced, preferably as a separate entity, or with some adjoining **Kooline** system drainage floors which are similarly sensitive and have similar management requirements. **Edward** and **Ashburton** systems for example should not be included in the same paddock as they react differently to grazing and have different potential and carrying capacities. Unfortunately most old paddock systems have taken no account of the different management requirements of various classes of country.

All areas of extreme degradation need to be totally withdrawn from grazing. In a few cases this would be done by closing existing paddocks but in many cases additional fencing is required to isolate problem areas. Rapid regeneration will not occur simply by removing these areas from use.

Contour strip cultivation to improve water infiltration rates and provide a seedbed is required. Seeding with buffel and birdwood grass and a range of chenopod shrubs should be undertaken as there are virtually no natural sources of seed of desirable plants remaining.

There is no doubt that rehabilitation can be achieved but it will be a difficult and expensive task. The high costs of regeneration work are partially offset by the fact that parts of the system that are currently nearly useless for grazing have the potential to support valuable, drought tolerant, perennial vegetation. The time period for full regeneration cannot be accurately predicted, but it is anticipated that full recovery will require at least 10 years of complete protection from grazing coupled with cultural and seeding treatments.

Firecracker land system

This small system is exclusive to Giralia and Marrilla stations in the far west of the survey area. Much of this system has only been fully utilised for grazing since the mid-1960s when a number of dams were constructed. Prior to this there were no permanent waters in the area and grazing was minimal.

About 26 sq km (14.9 per cent) of the system is in bad range condition and 3 sq km (1.7 per cent) is extremely degraded. About 83 sq km (47.7 per cent) in in fair range condition and 66 sq km (37.7 per cent) is in good condition.

The system supports valuable Gascoyne bluebush *(Maireana polypterygia)* pastures and pasture condition varies from good to poor depending on the distance from watering points.

Pasture degradation has occurred in a relatively short time and is sometimes accompanied by moderate and severe erosion in the form of gullying, surface sheeting and micro-terracing. As yet the areas affected by erosion are not large, but much of the system has a very high inherent vulnerability due to its slope and the nature of its soils.

Ground cover provided by shrubs, annual grasses and forbs is vital to the stability of the system and control of intensity of use and season of use by livestock is essential. The inherent fragility of the system is only now becoming apparent and the ability of this country

to support stock has been over-estimated in the past. Special management techniques are required to enable grazing without landscape deterioration.

Dams have enabled grazing on the **Firecracker** system, but problems have arisen as a result. Heavy use and depletion of ground cover coupled with long slopes leading down to the dams and sensitive calcareous soils have resulted in instability with a strong likelihood of serious erosion problems in the future. Dams should be closed to stock and water piped to distribution points on higher more stable sites, preferably on the adjacent **Jubilee** land system. In some cases water is already piped from existing dams. Wherever possible pipelines should be left on the surface and not buried as any form of disturbance to the soil invariably results in rill and gully erosion. In this respect the siting of access tracks is also important, and tracks straight up slope should be avoided if possible.

A programme of spelling the **Firecracker** system over every 2nd or 3rd growing season is necessary in order to maintain pasture vigour and productivity. Such a programme could be implemented by using existing paddock systems. Although bluebush pasture lands in good condition have been rated as having a carrying capacity of 1 sheep unit per 8 ha on a yearlong basis, this rate may in fact be too high for this sensitive system. Proper grazing management must involve leaving a reasonable residue of plant material as ground cover to protect the soil surface.

Globe land system

This alluvial plain system flanks the Ashburton River in its lower reaches in the west of the survey area. It is an important system on Nanutarra, Yanrey and Koordarrie Stations.

The system is mostly in bad or fair range condition. About 547 sq km (44.2 per cent) is in bad condition and this includes 97 sq km (7.8 per cent) of extreme degradation with moderate and severe erosion in the form of thin sheeting, surface scalding and wind piling. Approximately 538 sq km (43.5 per cent) and 152 sq km (12.3 per cent) of the system is in fair and good condition respectively.

The component units of the system vary considerably in their reaction to grazing. The relatively small gilgai plain and low-lying back plain units support tussocky perennial grasses such as Roebourne plains grass *(Eragrostis xerophila)* and weeping grass *(Chrysopogon fallax)*. These pastures are resistant to grazing although they will degrade under excessive use. There is generally no erosion.

Reports by early explorers and surveyors and evidence from relic sites indicated that the alluvial plain unit of the system once supported productive saltbush *(Atriplex bunburyana)* pastures. However, these pastures were very sensitive to grazing and the duplex soils of the unit were inherently susceptible to erosive forces once the vegetation was depleted. The plains are now bare or wind-hummocked with patchy stands of snakewood *(Acacia xiphophylla)* and other *Acacia* species. Ground cover consists of poor low shrubs, extremely patchy buffel grass *(Cenchrus ciliaris)* and numerous ephemerals in season. The unit no longer has any worthwhile drought durability.

Areas of extreme degradation require special remedial treatments including complete withdrawal from use. Exclusion of stock will require some additional fencing or the closing up of existing paddocks.

Contour strip cultivation and seeding with buffel grass is required in order to ensure recovery within a reasonable time period. Buffel grass is already well established on restricted parts of the **Globe** system and elsewhere has a tenuous foothold. Cultivation and reseeding techniques are well known. Regeneration programmes involving destocking and cultivation would not commence in all areas at once, but would be progressive. It is not possible to indicate the time period necessary for full recovery, but reasonable recovery could be expected in four to five years at the end of which time controlled grazing could re-commence and treatments on other areas start.

RANGE CONDITION OF LAND SYSTEMS OF MODERATE PASTORAL VALUE

The traverse data (see Table 28) indicates that land systems of moderate pastoral value are mostly in good or fair condition. Some problem areas with badly degraded pastures and erosion exist but these only contribute in a minor way to the overall degradation problem on the catchment. A total of about 45 sq km (0.3 per cent) of extreme degradation exist and this is largely confined to three land systems.

Only those systems with problems of degradation are discussed below. In some cases all units of a system may be degraded, in others only sensitive areas such as drainage floors are effected.

Dollar land system

This system consists of almost flat or very gently undulating outcrop and gibber plains and through flow drainage plains with braided channels. Pastures of the plains are sparse stony chenopods beneath an overstorey of scattered snakewood *(Acacia xiphophylla)*. The vegetation becomes denser and more varied along flow zones and drainage foci.

About 133 sq km (27.9 per cent) is in bad range condition, with the remainder in fair or good condition. Broad, stony plains in bad condition show considerable loss of desirable shrubs but no erosion. However, on some drainage floor areas, degraded pastures are accompanied by moderate erosion in the form of thin sheeting, rilling and shallow gullying.

The condition of this system is ascertained by observing the shrub species present in drainage foci, under snakewood trees and along creeklines. Dense stands of desirable species such as ruby saltbush *(Enchylaena tomentosa)*, tall saltbush *(Rhagodia eremaea)* and weeping grass *(Chrysopogon fallax)* are found in these localities when in good condition. Controlled grazing involving spelling over growing seasons and conservative use at other times is required where desirable species are obviously depleted.

Ford land system

This gently undulating plain system with shaley interfluves, cobble plains and narrow saline drainage floors occurs mostly in the east of the survey area. It is an important land system on Bulloo Downs station.

The dominant pasture type of the system is mulga short grass forb but the most valuable and durable pastures consist of various chenopod and other shrubs found along the drainage floors. Pastures of the drainage floors are preferentially grazed and provide the bulk of drought feed. About 135 sq km (22.3 per cent) is in bad range condition indicating that excessive use has resulted in quite widespread pasture decline.

There are also restricted areas of erosion on some drainage floors.

The system supplies valuable short-term feed after rain but, because of the loss of desirable shrubs, no longer has much drought durability. Productivity can only be improved by a systematic programme involving periodic spelling and judicious stocking. Much of the system is unfenced and stock control can only be attempted by manipulating numbers on watering points.

Nooingnin land system

This large system occurs in eastern parts of the catchment and is important on Bulloo Downs, Prairie Downs and Turee Creek stations. The system consists of broad, flat hardpan plains extending for up to 8 km with narrow linear strips (groves) of dense vegetation arranged in a more or less parallel manner and transverse to the direction of sheet water flow. Other minor units are sandy banks, plains receiving concentrated sheet flow, saline plains and narrow drainage zones.

Pastures are predominantly stony short grass forbs of very low productivity. However, the groves, sandy banks and narrow drainage zones support dense stands of productive shrubby pastures and perennial grasses and are favoured by livestock.

There has been some loss of desirable perennial shrubs on most parts of the system but generally this is not severe and there is no erosion. However, about 134 sq km (14.3 per cent) of the system is in bad range condition with poor or very poor pasture condition and a small area (31.7 sq km) shows extreme degradation.

The groves and sandy banks are the units to observe when assessing condition. When in good condition the groves support numerous desirable species such as Wilcox bush *(Eremophila leucophylla)* ruby saltbush *(Enchylaena tomentosa),* tall sida *(Sida calyxhymenia)* and tall saltbush *(Rhagodia eremaea)* and some perennial grasses. Some groves and banks have been subjected to excessive use and show serious depletion of desirable species.

Degraded parts of the system require spelling over a number of consecutive growing seasons and conservative use at other times. Most of the system is grazed on the open range principle and stock control can only be partly achieved by manipulating numbers on watering points.

Paraburdoo land system

This system occurs in the mid-northern parts of the catchment where it forms valley plains beneath basalt hills of the **Rocklea** system. Units of the system are low interfluves, stony gilgai plains and drainage floors. Pastures are mostly useful stony chenopod, saltbush and mulga creekline types.

Because the **Paraburdoo** system supports more attractive pastures than those found on adjacent poorly accessible hill systems it has received preferential grazing and is now considerably degraded. Only about 92 sq km (14.8 per cent) of the system is in good range condition. 377 sq km (60.6 per cent) and 153 sq km (24.6 per cent) are in fair and bad range condition respectively. Pasture degradation on the more stony units of the system is not usually accompanied by erosion. However, on broad drainage floors where pasture degradation is often severe there is frequently moderate and severe water erosion in the form of active scouring and gullying.

The poor condition of the system clearly shows that past levels of use have been excessive. Grazing on the system needs to be controlled in terms of stock numbers and season of use and adequate control can only be achieved by fencing.

Turee land system

Nearly all of this system occurs on Turee Creek station near the headwaters of the Angelo River and Tunnel Creek. The system consists of flat plains with a mosaic of stony surfaces and large gilgaied depressions and drainage foci.

Pastures consist of low open shrublands of *Cassia* and *Eremophila* species with numerous perennial tussock grasses in the gilgais. Traverse data indicates that nearly all pastures are degraded to some extent with some extensive areas showing severe depletion of desirable shrubs and grasses. There is very little erosion. Badly degraded parts of the system now have much reduced drought durability although they still supply short-term annual feed after rainfall. Recovery can be readily achieved by complete spelling over a number of growing seasons and conservative grazing at other times. Perennial grasses and shrubs should not be grazed below about 50 per cent by weight.

Warri land system

The **Warri** system of low calcrete platforms and plains is widely scattered as small areas over the eastern half of the survey area. Pastures are mostly mulga short grass forbs although there are also useful areas of more productive mulga creekline and chenopod pastures on minor units of the system.

Only 86 sq km (23.6 per cent) is in good range condition. About 214 sq km (58.6 per cent) and 65 sq km (17.8 per cent) is in fair and bad condition respectively. Shrubby pastures are moderately depleted over large areas and severly depleted in some areas. There is some patchy minor erosion but the system does not contribute to the overall erosion problem in the survey area.

The system supports useful ephemerals in season but its major value is its ability, when properly managed, to support durable shrub pastures. Occasional spelling over a full growing season is required to maintain pastures that are already in fair or good condition but a number of consecutive spells coupled with light use at other times of the year will be required to promote recovery of badly degraded areas.

RANGE CONDITION OF LAND SYSTEMS OF LOW AND VERY LOW PASTORAL VALUE

Many of the systems in this category are hill and mountain systems (for example **Charley, Augustus, Newman** and **Rocklea**) difficult of access and supporting pastures such as hard spinifex which are unattractive to stock. The major units (hills, footslopes, stony plains) of these systems are nearly always in good or fair range condition and are not eroded. Some of the minor units such as narrow drainage floors and restricted saline plains are degraded because they support better quality pastures and have been preferentially grazed.

Other systems in this category are stony plain or hardpan plain systems (for example **Ethel** and **Jamindie**) which support depauperate stony short grass forb pastures with minor inclusions of more valuable chenopod or mulga creekline pastures. Condition of the stony short grass forb areas is good or fair and condition of the better quality pastures is usually fair to bad.

There is minor erosion on some drainage floor units of the systems but the large stony units are not eroded.

Some plain systems such as **Divide** and **Boolgeeda** support hard spinifex pastures. Although accessible to stock these systems are little used due to the unattractive nature of the vegetation. Pasture condition is invariably good and there is no erosion.

The following discussion describes in more detail only those few systems with serious degradation problems. In some cases the problems are confined to one or two minor units of the systems.

Charley land system

Most of this system consists of dolerite hills and ridges which are in good range condition. However, a minor unit, lower plains with sluggish drainage, which constitutes about 8 per cent of the total area of the system is frequently in bad range condition. Tussock grass pastures and swamp bluebush pastures are seriously degraded and there is occasional erosion.

One of the largest single areas of this unit and one of the most degraded is on Bulloo Downs station near Charley No. 2 bore. This area needs to be fenced and protected from grazing for a number of years.

Kooline laud system

This large system occurs widely in central parts of the survey area flanking the flood plain of the Ashburton River. It consists of rough shale hills, ridges and associated footslopes and saline sluggish drainage plains and flow zones with braided channels.

Hills and footslopes of the system constitute about 80 per cent of the area and support sparse stony short grass forb pastures which are mostly in good range condition. Saltbush and mulga creekline pastures occur on the saline plains and flow zones and these attractive pastures have been preferentially grazed and are often in poor or very poor condition. Many of the drainage floors have duplex soils which are inherently susceptible to erosion once the vegetative cover is depleted. Moderate and severe erosion in the form of wind scalding, surface sheeting, rilling and guttering is common.

Management for rehabilitation is difficult. In many cases the sensitive units are relatively small in area and are surrounded by large areas of unproductive hills. In these circumstances fencing is an uneconomic proposition and stock control can only be attempted by manipulating numbers on waters. However, in other cases drainage floor units of the system are immediately adjacent to large areas of severely degraded plains of the **Edward** land system. Fencing is required for rehabilitation of the **Edward** system and drainage floor units of the **Kooline** system could be readily incorporated within these fences.

Kunderong land system

This system is located mainly on Turee Creek and Prairie Downs stations. It consists basically of sandstone hills and outcrop plains but there are also a number of minor units such as drainage floors on dolerite, flow areas with groves and internal drainage flats. These latter units support the most valuable and attractive pastures of the system and range condition is about evenly distributed between fair and bad. There has been considerable loss of desirable perennial plants but there is generally no erosion. Degraded areas required spelling over growing seasons and conservative use at other times.

Prairie land systems

This land system is based on granite and gneiss and consists of low hills, footslopes, undulating stony plains and sandy drainage floors. Much of the system is in good or fair condition. However, about 154 sq km (12.5 per cent) is in bad range condition. The worst affected units are some sandy drainage floors where there is considerable loss of desirable shrubs and moderate and occasionally severe erosion. Such areas should be fenced so that a regular system of spelling to promote vegetation recovery can be implemented.

LAND SYSTEMS

Sixty three land systems are described in the following section. Nine of these have very close affinities with nine rangeland types described by Wilcox and McKinnon (1972) as occurring in the catchment of the Gascoyne River and the same names have been adopted. Minor variations between the descriptions presented here and those of Wilcox and McKinnon are due to regional differences between the two survey areas.

Table 29 indicates the pasture lands found on each land system. Table 30 shows the carrying capacity and pastoral value of each land system when in good range condition.

Table 29 — Land systems and their component pasture lands

Land system	1st Pasture land approx. %	2nd Pasture land approx. %	3rd Pasture land approx. %	Without vegetation approx. %
Ashburton	34 TGCE	33 CHAT	33 CHMA	—
Augustus	95 MSGF	05 MUCR	—	—
Boolaloo	55 HSHI	40 SOSP	05 STCH	—
Boolgeeda	95 HSHI	05 SOSP	—	—
Brockman	80 TGCH	20 STCH	—	—
Bryah	75 STCH	20 CHMA	05 SSGF	—
Cadgie	68 SOSP	32 SSGF	—	—
Capricorn	70 HSHI	25 SSGF	05 MUCR	—
Charley	55 MSGF	34 CSGF	11 TGER	—
Cheela	50 TGER	45 CHAT	05 TGCE	—
Cheetara	100 TGER	—	—	—
Collier	55 MSGF	25 SSGF	20 STCH	—
Divide	90 HSSP	10 MUCR	—	—
Dollar	80 STCH	15 MUCR	05 TGER	—
Donovan	53 CHMA	47 SOSP	—	—
Dune	87 SOSP	08 TGMI	—	5
Edward	86 CHAT	12 STCH	02 SSGF	—
Egerton	75 MSGF	16 SSGF	09 MUCR	—
Ethel	80 SSGF	15 CHAT	05 MUCR	—
Firecracker	100 CHMA	—	—	—
Ford	57 MSGF	25 SSGF	18 CHAT	—
Giralia	50 HSSP	50 SOSP	—	—
Globe	55 CHAT	39 TGER	06 SOSP	—
Jamindie	83 SSGF	12 MUCR	05 TGER	—
Jubilee	55 HSHI	40 SOSP	05 MUCR	—
Kooline	82 SSGF	10 MUCR	08 CHAT	—
Kunderong	76 SSGF	12 TGER	12 MSGR	—
Laterite	40 SSGF	40 MSGF	20 TGER	—
Littoral	06 SOSP	06 SAMP	04 STCH	84
Minderoo	55 TGCH	25 SOSP	15 STCH	5
Mulgul	75 MSGF	20 CSGF	05 MUCR	—
Mundong	57 STCH	25 TGER	18 SSGF	—
Nadarra	45 STCH	40 CHMA	15 HSHI	—
Nanutarra	85 SOSP	15 HSSP	—	—
Nanyarra	82 TGCE	18 TGCH	—	—
Newman	100 HSHI	—	—	—
Nirran	92 MSGF	08 MUCR	—	—
Nooingnin	75 SSGF	14 MUCR	11 TGMI	—
Onslow	49 SOSP	35 TGMI	14 TGCE	2
Paraburdoo	76 STCH	18 CHAT	06 SSGF	—
Platform	85 HSHI	15 SOSP	—	—
Prairie	44 MSGF	40 SSGF	16 MUCR	—
River	30 TGCE	35 MUCR	20 STCH	15
Rocklea	90 HSHI	05 STCH	05 MUCR	—
Robe	90 SOSP	10 HSHI	—	—
Rous	38 TGCE	35 STCH	20 SOSP	7
Ruby	73 CSGF	15 MUCR	12 STCH	—
Stuart	40 STCH	40 HSHI	20 SOSP	—
Spearhole	70 MSGF	15 MUCR	15 HSHI	—
Scoop	65 STCH	20 CHAT	15 MUCR	—
Table	50 MSGF	40 CSGF	10 MUCR	—
Tangadee	85 MSGF	10 CHMA	05 MUCR	—
Three Rivers	83 SSGF	17 TGMI	—	—
Turee	49 SSGF	41 TGER	10 MUCR	—
Uaroo	73 HSSP	27 SOSP	—	—
Ullawarra	77 MSGF	16 CHMA	07 CSGF	—
Warri	80 MSGF	10 CHAT	10 MUCR	
Weelarrana	35 SAMP	20 CHAT	20 HSSP	25
Winning	60 CHMA	25 SOSP	15 HSHI	—
Wona	95 STCH	05 HSHI	—	—
Yankagee	38 SOSP	22 TGCH	14 CHAT	26
Yanrey	77 TGCH	23 TGCE	—	—
Yarcowie	100 TGER	—	—	—

Table 30 — Carrying capacity (ha per s.u.) and pastoral value of land systems at good condition status

Land system	Hectares per sheep unit	Pastoral value
Ashburton	4.0 to 8.0	very high or high
Augustus	39.6	very low
Boolaloo	15.7	moderate
Boolgeeda	33.3	very low
Brockman	3.6	very high
Bryah	11.3	moderate
Cadgie	10.9	moderate
Capricorn	39.0	very low
Charley	21.6	low
Cheela	6.0	high
Cheetara	6.0	high
Collier	21.7	low
Divide	41.2	very low
Dollar	10.7	moderate
Donovan	8.0	high
Dune	8.2	high
Edward	8.5	high
Egerton	22.5	low
Ethel	20.4	low
Firecracker	8.0	high
Ford	18.9	moderate
Giralia	12.9	moderate
Globe	7.1	moderate
Jamindie	25.0	low
Jubilee	15.2	moderate
Kooline	21.2	low
Kunderong	21.0	low
Laterite	16.3	moderate
Littoral	75.6	very low
Minderoo	4.4	very high
Mulgul	32.0	very low
Mundong	10.6	moderate
Nadarra	11.1	moderate
Nanutarra	17.4	moderate
Nanyarra	2.1	very high
Newman	58.8	very low
Nirran	21.4	low
Nooingnin	19.7	moderate
Onslow	5.3	high
Paraburdoo	11.4	moderate
Platform	30.1	very low
Prairie	20.2	low
River	4.8 to 10.2	very high or high
Rocklea	38.9	very low
Robe	17.3	moderate
Rous	4.1	very high
Ruby	15.3	moderate
Stuart	14.7	moderate
Spearhole	19.8	moderate
Scoop	12.1	moderate
Table	19.0	moderate
Tangadee	19.0	moderate
Three Rivers	22.2	low
Turee	10.5	moderate
Uaroo	18.0	moderate
Ullawarra	25.7	low
Warri	17.5	moderate
Weelarrana	23.8	low
Winning	9.1	high
Wona	12.5	moderate
Yankagee	7.3	high
Yanrey	2.7	very high
Yarcowie	6.0	high

ASHBURTON LAND SYSTEM (2 203 sq km)

Active flood plains and backplains with deep silty loam and clayey soils, shrublands and tussock grasslands

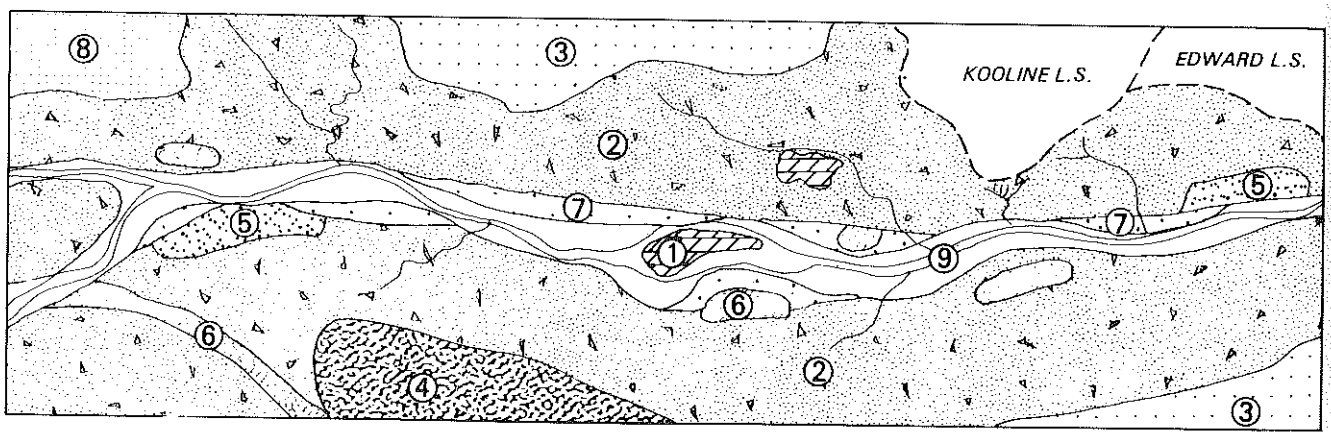
Location: Collier, Edmund, Mt. Egerton, Turee Creek and Wyloo 1:250 000 map sheets.

Geology: Quaternary alluvium

Geomorphology: Depositional surfaces — alluvial plains; — active floodplains, backplains and depressions, gilgai plains and minor cobble plains flanking the Ashburton River and its major tributaries, narrow poorly developed levee zones flanking major channels, relief mostly 1 to 2 m but up to 15 m.

Pastoral use: Degraded chenopod pastures of low productivity; tussock grass pastures including buffel grass of moderate productivity and durability, very dense ephemeral pastures after episodic flooding, high productivity and quality but limited durability; units 2 and 3 susceptible to wind erosion but now partly stabilised by buffel grass.

Estimated carrying capacity, good condition, 4 to 8 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	1	**Low hills:** shale hills and low ridges protruding through alluvium; up to 1 km long, relief up to 10 m.	Rock outcrop, no soil development.	Stunted *Acacia* spp. shrubland with very sparse low shrubs and forbs. SSGF pasture land.
2	60	**Floodplains:** almost flat plains, up to 4 or 5 km in extent, local slopes and slopes marginal to other units up to 1 per cent, hummocky surfaces up to 1 m.	Mostly uniform medium textured soils, reddish brown and red sandy and silty loams becoming more clayey with depth, strewless surfaces, 2 m+ deep. Uc 511, Um 512, 522, 542, 633 Gn 213	Tall shrubland of *Acacia victoriae* with dense low shrub understorey of *Atriplex bunburyana* or *Cassia oligophylla* and *Rhagodia eremaea. Cenchrus ciliaris* may form grass understorey, abundant forbs and herbs after flooding. CHAT, CHMA or TGCE pasture land
3	10	**Back plains:** up to 3 km in extent, slightly elevated above unit 2, gradients 1 in 200 or less.	Similar to unit 2	As for unit 2 but ground layers generally sparser. CHMA pasture land
4	5	**Gilgai plains:** up to 2 km in extent, gradients 1 in 200 or less, gilgai micro-relief usually less than 0.3 m deep.	Dark red clay soils 1 m+ deep with gilgais, exclusively Ug 538	Tussock grasslands of *Eragrostis setifolia, E. xerophila, Chrysopogon fallax* with sparse shrubs. TGER pasture land
5	5	**Cobble plains:** up to 2 km in extent, gradients 1 in 200 or less, raised slightly above other units, dense pebble and cobble mantle.	Reddish brown loamy soils becoming more clayey with depth, 1 m+ deep, dense cobble pavement.	Open shrubland with sparse *Acacia* and *Cassia* spp. SSGF pasture lands
6	5	**Depressions:** broad or linear, nearly flat depressions and plains slightly below general level of other units and subject to more regular inundation.	Reddish brown silty loams and clayey loams, 1 m+ deep Um 542	Low woodland of *Eucalyptus coolabah* with tussock grasses. *Chrysopogon fallax, Cenchrus ciliaris.* TGCH pasture land
7	5	**Levees:** poorly developed linear zones flanking major rivers, up to 400 m wide and raised up to 1 m.	Loose surfaced reddish brown silty loams 1 m+ Um 542	Low woodland of *Eucalyptus coolabah* with *Cenchrus ciliaris* tussock grass ground layer. TGCE pasture land
8	2	**Sand plains:** minor sandy plains 1 or 2 km in extent, slopes up to 1 per cent hummocky surfaces.	Loose surfaced loamy sands 1 m+ deep.	Low open shrubland *Acacia victoriae, Cassia* spp. with sparse tussock grass mainly *Eragrostis eriopoda.* TGMI pasture land
9	7	**Banks and channels:** single and multiple meandering and anastomosing channels up to 100 m wide and 15 m deep, bank with slopes up to 80 per cent, numerous permanent or semi-permanent pools.	Bedloads of sand, gravel, pebbles and cobbles, banks with deep loose surfaced silty loam soils.	Channels with fringing woodland communities *Eucalyptus camaldulensis, Melaleuca leucadendron;* banks *Eucalyptus camaldulensis, E. coolabah,* with tussock grasses. TGCE pasture land

AUGUSTUS LAND SYSTEM (11 884 sq km)

Rugged mountain ranges, hills, ridges and plateaux with skeletal soils and tall shrublands; hard spinifex grasslands in northern most parts.

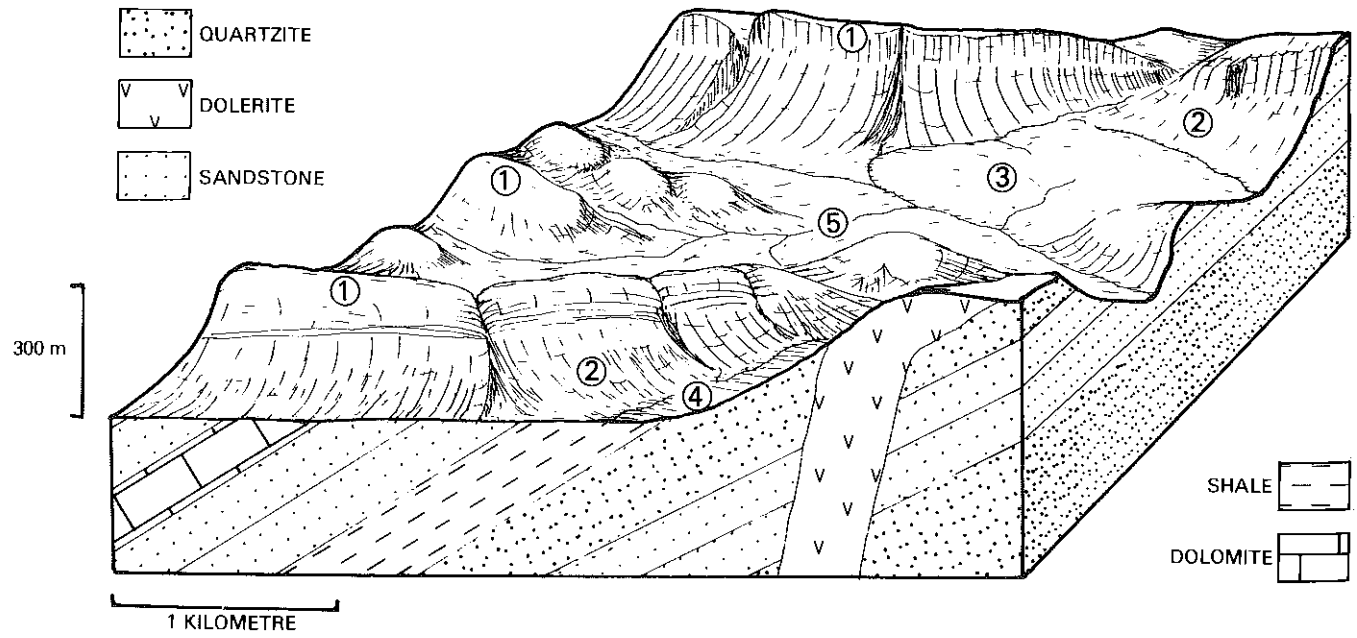
Location: Collier, Mt. Egerton, Turee Creek, Newman and Wyloo 1:250 000 map sheets.

Geology: Sandstone, quartzite, shale and dolomite Bangemall Group rocks of Middle Proterozoic age.

Geomorphology: Erosional surfaces — mountain ranges and hills with steep escarpments and upper slopes, restricted lower slopes and valley plains and narrow drainage floors; angular and rectangular drainage patterns of moderate intensity; relief up to 350 m. Forms the divide between the Gascoyne and Ashburton River valleys.

Pastoral use: Unit 1 poorly accessible, mulga short grass forb and hard spinifex hill pastures, very low productivity; ephemeral growth can be utilised but carrying capacity extremely low and drought resistance very poor.

Estimated carrying capacity, good condition, 40 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	65	**Ranges, hills, ridges and rocky uplands:** gently rounded summits, near vertical escarpments, upper scree slopes up to 50 per cent, relief up to 350 m.	Mainly rock outcrop	Mulga shrublands *Acacia aneura* with sparse low shrubs, forbs and annual grasses. Also hard spinifex *Triodia wiseana* grasslands. MSGF pasture land
2	20	**Lower foot slopes:** concave up to 5 per cent and up to 1 km long, rock outcrop and dense colluvial mantles.	Rock outcrop and bouldery skeletal soils.	Tall shrublands of mulga and other *Acacia* spp. with sparse low shrubs and forbs. MSGF pasture land
3	10	**Stony, undulating plains and interfluves:** up to 2 km long, slopes usually less than 4 per cent, dense cobble and pebble surface mantles; marginally dissected up to 20 m.	Shallow red loamy soils on parent material or hardpan Um 624	Mulga and other *Acacia* spp. shrublands, sparse low shrubs, forbs and annual grasses. MSGF pasture land
4	2	**Drainage floors:** up to 500 m wide, gradients 1 in 200 to 1 in 500.	Variable sandy and loamy alluvial soils.	Tall shrublands and open woodlands with *Acacia citrinoviridis, A. kempeana, A. aneura* and variable low shrubs. MUCR pasture land
5	3	**Channels and creeks:** up to 100 m wide and 10 m deep.	In upper parts creeks incised into bedrock, bedloads range from sand to boulders; banks sandy and loamy alluvial soils.	Fringing woodlands *Eucalyptus camaldulensis, Acacia coriacea, A. citrinoviridis* with numerous low shrubs. MUCR pasture land

BOOLALOO LAND SYSTEM (800 sq km)

Granite hills, domes, tor fields and sandy plains, spinifex grasslands and shrubby grasslands.

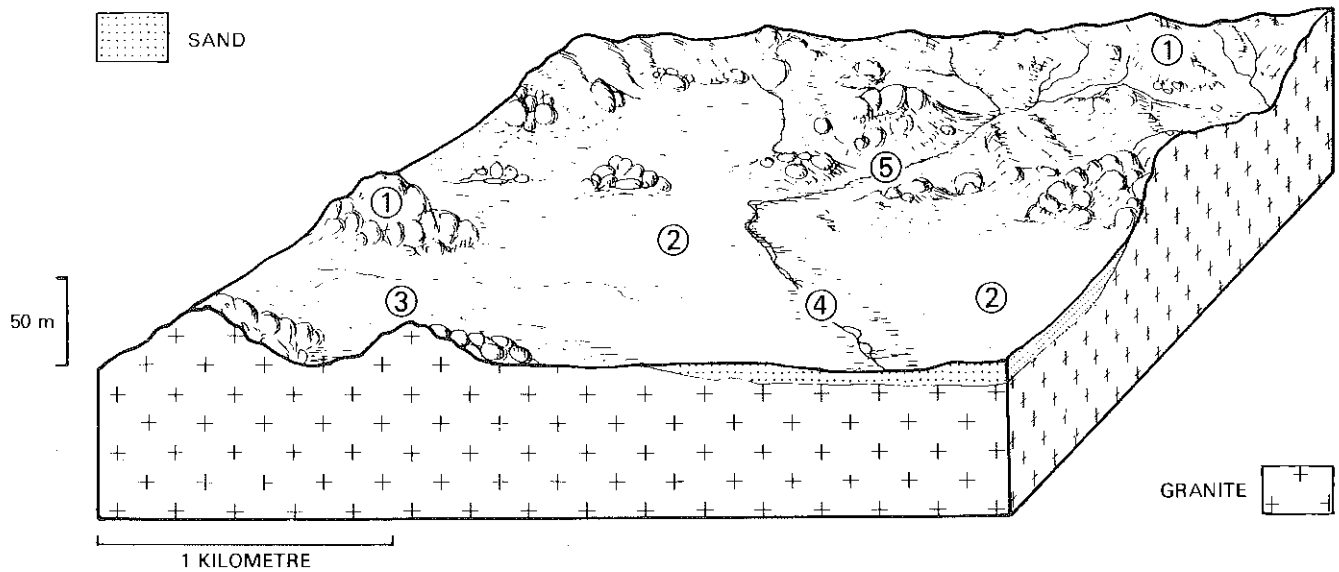
Location: Edmund, Wyloo and Yanrey 1:250 000 map sheets.

Geology: Lower Proterozoic granite, minor Quaternary sand.

Geomorphology: Erosional surfaces — hill lands and plains; — granite tors and hills with short boulder strewn slopes, shallow valleys and drainage floors, angular and dendritic drainage patterns of moderate intensity; sandy plains with poorly developed parallel through drainage; relief up to 50 m.

Pastoral use: Hard and soft spinifex pastures; unit 2 supplies useful grazing and can be maintained by burning and grazing deferment; unit 4 prone to degradation and erosion.

Estimated carrying capacity, good condition, 16 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	55	**Hills, tors and hill slopes:** rounded crests and tor slopes, convex up to 80 per cent, lower rocky slopes concave up to 10 per cent, relief mainly less than 50 m.	Granite outcrops and occasional pockets of skeletal sandy soils.	Much bare rock, scattered hummocks of hard spinifex *Triodia wiseana* and sparse shrubs and herbs. HSHI pasture land
2	25	**Sandy plains:** flat to 2 per cent slope, up to 3 km wide, flanking unit 1.	Mainly red sands, Uc 511, some duplex soils, Dr 251	Soft spinifex *Triodia pungens* grassland with sparse shrubs such as *Acacia ancistrocarpa, A. inequilatera.* SOSP pasture land
3	12	**Stony plains:** up to one and a half km in extent, slopes up to 2 per cent, sparse to dense quartzy colluvial mantle	Shallow red sands Uc 511 with granite outcrop and stony strew	Hard spinifex *Triodia lanigera* and soft spinifex *Triodia pungens* grasslands with sparse shrubs HSSP and SOSP pasture land
4	5	**Tracts receiving run on:** usually less than 1 km wide by 2 to 3 km long, gradients 1 in 100 to 1 in 300, scalded hummocky surfaces often transversed by rills and gutters.	Red duplex soils Dr 413, 453	Tall shrublands or open shrublands of snakewood *Acacia xiphophylla,* sparse low shrubs and soft spinifex *Triodia pungens.* STCH pasture land
5	3	**Narrow drainage floors and channels:** floors up to 200 m wide, channels up to 50 m wide and 3 m deep.	Bedloads deep sands, banks and floors deep reddish sands	Banks and floors — open woodland *Eucalyptus coolabah, E. dichromophloia* and soft spinifex *Triodia pungens.* SOSP pasture land

BOOLGEEDA LAND SYSTEM (2 589 sq km)

Stony plains with hard spinifex grasslands or mulga shrublands.

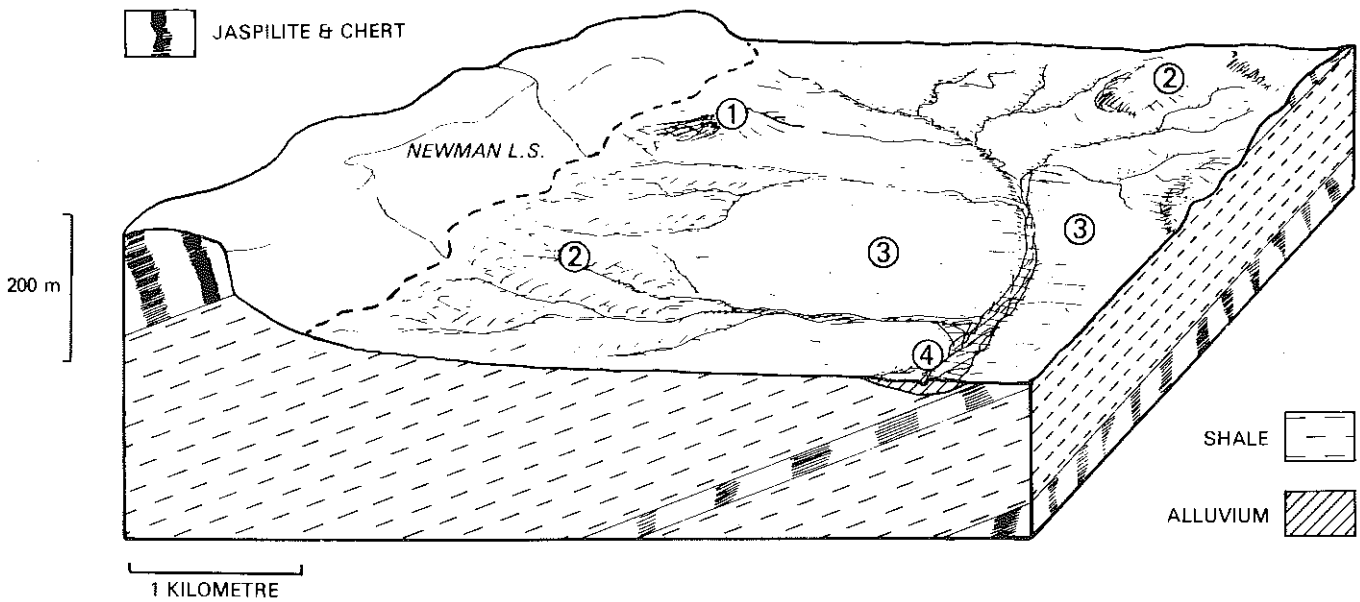
Location: Mt Bruce, Newman, Turee Creek and Wyloo 1:250 000 map sheets.

Geology: Quaternary colluvium.

Geomorphology: Depositional surfaces — stony plains; — gently sloping stony plains of unconsolidated and partly consolidated colluvium, sub parallel and dendritic drainage patterns of moderate intensity, relief up to 30 m.

Pastoral use: Stony mulga short grass forb and hard spinifex pastures, very low carrying capacity and drought durability, all units stable under use.

Estimated carrying capacity, good condition, 33 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	5	**Low hills and rises:** isolated hills and outcrop rises above plains, relief up to 30 m	Mainly rock outcrop	Sparse *Acacia* spp. shrublands or hard spinifex *Triodia wiseana, T. lanigera* grasslands HSHI pasture land
2	35	**Stony upper plains:** up to 2 km wide and 8 km long immediately below adjacent hill land systems, slopes up to 2.5 per cent, dense colluvial mantles, dissected up to 5 m by small creeks.	Shallow, stony red loamy soils, commonly Um 521	*Acacia aneura* (mulga) and other *Acacia* spp. tall open shrublands or low open woodlands, sparse under shrubs and forbs. Also hard spinifex *Triodia wiseana* grasslands with sparse shrubs. MSGF or HSHI pasture lands
3	55	**Lower plains:** up to 4 km in width, slopes mostly less than 0.5 per cent, dense colluvial mantles	Stony red loamy soils Um 522, Gn 112	As for unit 2
4	5	**Narrow drainage floors and channels:** floors up to 200 m wide, gradients 1 in 200 to 1 in 500, frequently with braided channels up to 50 m wide and 3 m deep	Stony alluvial soils on banks and floors, Um 552, 542; channel bedloads of gravel, pebbles and cobbles	Moderately dense mulga low woodlands with variable undershrubs and soft spinifex *Triodia pungens* ground storey SOSP pasture land

BROCKMAN LAND SYSTEM (87 sq km)

Alluvial plains with cracking clay soils supporting open tussock grasslands with low woodlands.

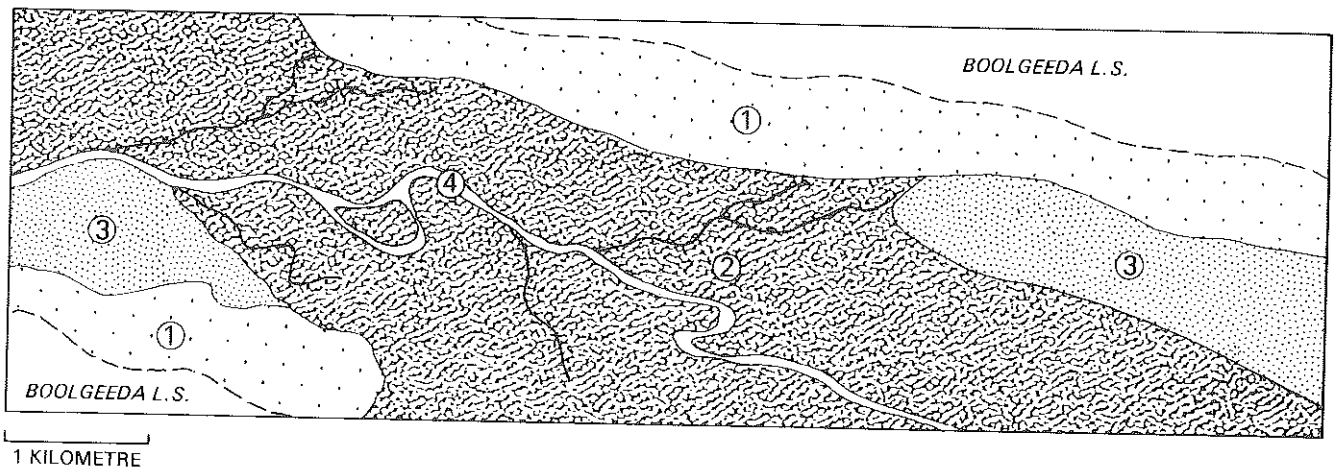
Location: Wyloo and Mt. Bruce 1:250 000 map sheets.

Geology: Quaternary alluvium

Geomorphology: Depositional surfaces — non-saline alluvial plains; — gradients usually below 1 in 1000, sluggish drainage zones on plains to main through going trunk channels, relief up to 5 m.

Pastoral use: Tussock grass pastures with high productivity, relatively high carrying capacity and moderate drought resistance; favoured grazing areas, controlled stocking essential to prevent preferential overuse; all units inherently resistant to erosion but vegetation degradation can occur if overgrazed.

Estimated carrying capacity, good condition, 4 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	20	**Marginal plains with mulga:** up to 2.5 km wide, slopes up to 1.5 per cent, stony mantles, mosaic of gilgai and flat microrelief	Gilgai areas — cracking red clay soils Ug 538 Non-gilgai areas — red clay soils Uf 631	**Gilgai areas:** dense mulga *(Acacia aneura)* low woodlands with *Eremophilia leucophylla, Chrysopogon fallax* and other perennial grasses. **Non-gilgai areas:** dense mulga low woodlands with low shrubs and sparse soft spinifex *Triodia pungens* TGCH pasture land
2	57	**Gilgai plains:** up to 5 km in extent, gradients below 1 in 100, sluggish drainage zones on margins up to 1 m below general level of plains.	Cracking red clays Ug 538	Tussock grasslands of *Chrysopogon fallax, Eragrostis setifolia,* also some Mitchell grasses *Astrebla* spp. TGCH pasture land
3	20	**Hummocky plains:** up to 4 km long by 1 km wide, alternating patterns of shrubland and open grassland, shrubland areas up to 400 m by 200 m with dense colluvial mantles and raised up to 1 m above intervening grassland zones.	Cracking red clays Ug 538	Mosaic of tall shrublands and grasslands. **Tall shrublands:** snakewood *Acacia xiphophylla* with low shrubs such as *Eremophila maculata, Cassia hamersleyensis,* and grasses. **Grasslands:** *Chrysopogon fallax, Eragrostis xerophila* and others. STCH pasture land
4	3	**Channels and banks:** banks up to 50 m wide and channels up to 5 m deep	Gravel and pebble bedloads; banks, shallow stony loamy soils	Low fringing woodlands, *Eucalyptus camaldulensis, Acacia citrinoviridis* with numerous low shrubs and herbs with some perennial grasses. TGMI pasture land

BRYAH LAND SYSTEM (29 sq km)

Stony plains and restricted internal drainage flats with sparse tall shrublands and low chenopod shrublands.

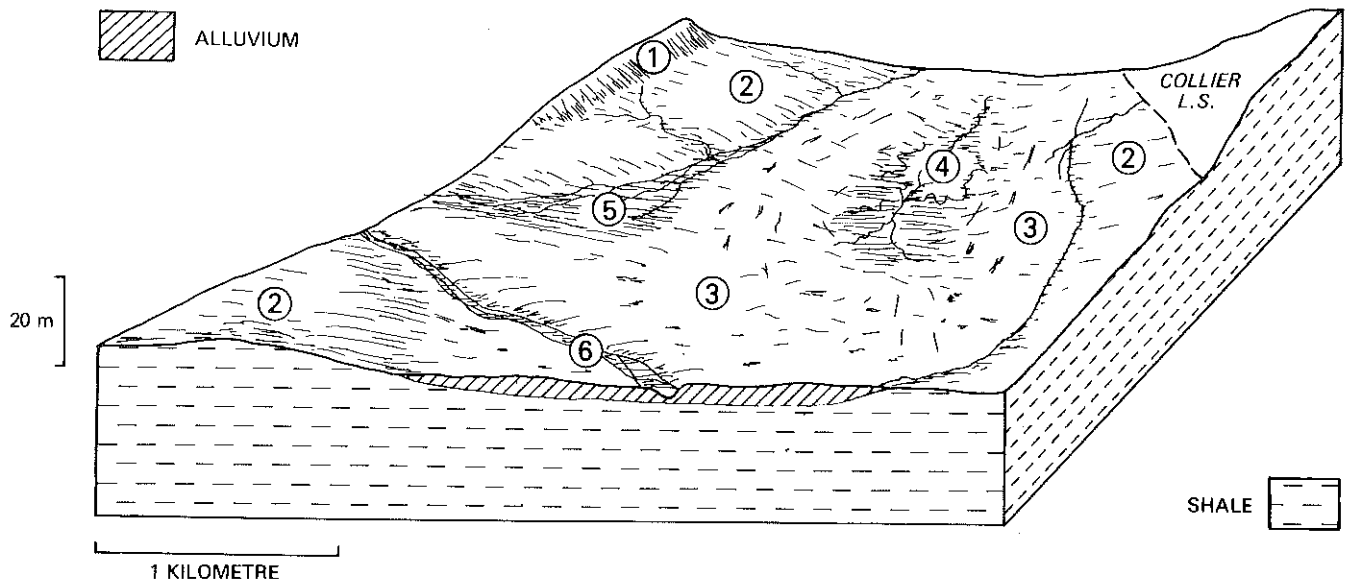
Location: Mt. Egerton and Turee Creek, 1:250 000 map sheets.

Geology: Quaternary colluvium and minor alluvium.

Geomorphology: Depositional valley fill surfaces; — minor ridges and hills, saline and non-saline stony plains, slopes up to 2.5 per cent; sluggish internal drainage, flats, through going drainage with branching tributaries, relief up to 25 m.

Pastoral use: Valuable and durable chenopod and tussock grass pastures, control of stocking is essential to prevent preferential overuse and vegetation degradation.

Estimated carrying capacity, good condition, 11 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	5	**Low hills and ridges:** usually at margins of plains, up to 1 km long, relief up to 25 m	Rock outcrop and shallow stony soils	Scattered tall shrubs *Acacia aneura* (mulga) and other *Acacia* spp., with sparse low shrubs and forbs. SSGF pasture land
2	15	**Stony slopes and low rises:** slopes up to 2.5 per cent, up to 1 km wide and 4 to 5 km long flanking adjacent hill land systems; isolated stony rises with gently rounded crests and marginal slopes about 1 per cent; dense colluvial mantles.	Stony clay soils of variable depth. Uf 141, some stony cracking clays Ug 538	Variable from sparse to dense tall shrublands *Acacia xiphophylla* (snakewood) and other *Acacia* spp. with sparse low shrubs, forbs and annual grasses STCH pasture land
3	45	**Plains with local gilgais and drainage foci:** up to 2 km long by 1 km wide, gradients 1 in 300 to 1 in 1000, patches with gilgai microrelief and drainage foci interspersed with surfaces without gilgais, dense colluvial mantles.	Gilgai areas and drainage foci — cracking red clay soils, Ug 538, dense stony strew. Non gilgai surfaces — non cracking clayey soils, dense stony strew.	Sparse tall shrublands *Acacia xiphophylla* and other *Acacia* spp., sparse low shrubs such as *Cassia hamerselyensis, Rhagodia eremaea,* forbs and annual grasses. Vegetation on gilgais and drainage foci similar but denser and includes perennial grasses. STCH pasture land
4	20	**Sluggish internal drainage tracts:** up to 1.5 km in extent, gradients mostly below 1 in 1000, sparse stony mantles, sinuous internal channels incised up to 1m	Cracking red clay soils, sparse stony strew, Ug 538	Low open shrublands *Chenopodium auricomum* (swamp bluebush) and other sparse chenopods, numerous forbs and annual grasses. CHMA pasture land
5	10	**Concentrated flow areas:** up to 1 km long, variable colluvial mantles, often traversed by shallow rills and gutters	Clay and loamy clay soils, variable surface strew	As for unit 3. STCH pasture land
6	4	**Channels and banks:** up to 100 m wide and 3 m deep	Bedloads of gravel, pebbles and cobbles; banks, shallow stony loams and clays	Usually dense mulga *Acacia aneura* woodlands or tall shrublands with scattered under shrubs, forbs and grasses. MUCR pasture land

CADGIE LAND SYSTEM (467 sq km)

Hardpan plains with thin sand cover and sandy banks supporting soft spinifex grasslands and mulga shrublands.

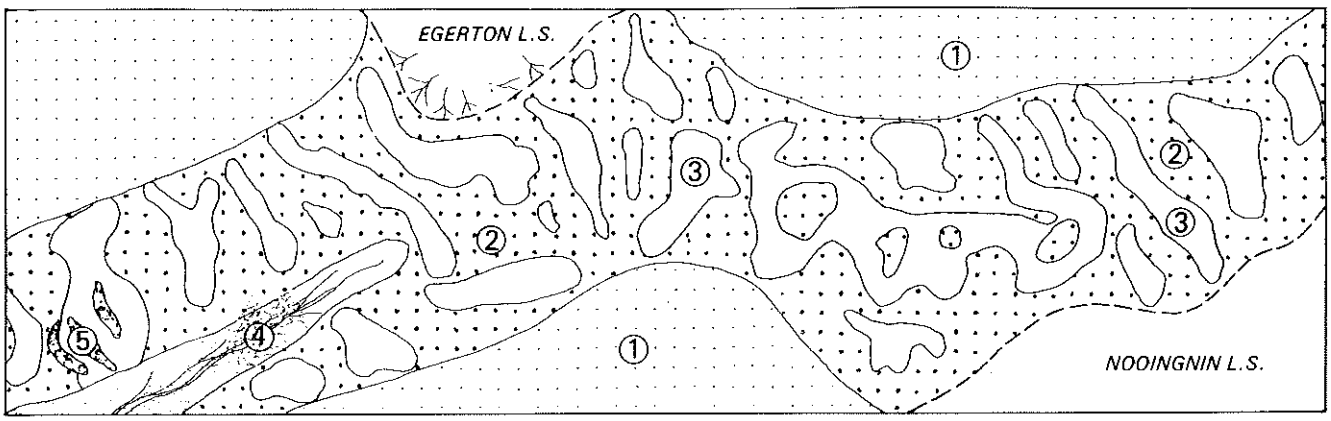
Location: Collier and Newman 1:250 000 map sheets.

Geology: Tertiary cemented colluvium and alluvium.

Geomorphology: Depositional surfaces — non-saline alluvial plains; — surfaces with thin sand cover extending up to 3 km by 2 km, slopes up to 1.5 per cent, elsewhere broad, almost flat plains up to 8 km in extent with low sandy banks and interbanks; plains subject to more concentrated flow with some shallow incision into hardpan; relief up to 5 m.

Pastoral use: Useful soft spinifex pastures, high drought durability, but low carrying capacity, all units moderately resistant to degradation and erosion.

Estimated carrying capacity, good condition, 11 ha per sheep unit.



1 KILOMETRE

Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	25	**Plains with thin sand cover:** surfaces up to 3 km by 2 km but commonly smaller, slopes up to 1.5 per cent, loose grit strew.	Reddish brown acidic loamy or clayey sands, variable depth to hardpan, commonly Uc 521	*Plectrachne schinzii* and *Triodia pungens* soft spinifex hummock grasslands and moderately dense *Acacia* spp. shrublands with soft spinifex. SOSP pasture land
2	43	**Sandy banks:** up to 1 km long by 500 m wide forming reticulate patterns more or less at right angles to sheet flow, surfaces up to 0.5 m above interbank areas, loose gritty strew.	As for unit 1	*Plectrachne schinzii* soft spinifex hummock grasslands with scattered shrubs. SOSP pasture land
3	30	**Interbanks:** hard surfaces between sandy banks, gradients 1 in 300 to 1 in 1000, hardpan exposures in parts.	Shallow red loamy soils on hardpan, commonly at less than 30 cm, Um 531	Very sparse mulga *Acacia aneura*, low shrubs, forbs and annual grasses SSGF pasture land
4	2	**Zones subject to more concentrated flow:** usually less than 500 m wide, sealed surfaces and shallow runnels, occasional channels incised up to 1 m in hardpan.	As for unit 3; no bed loads or bed loads of sand and grit on hardpan.	Sparse mulga with scattered low shrubs, forbs and grasses. SSGF pasture land
5	1	**Groves:** usually less than 200 m long and 20 m wide	Silty or clayey loams, hardpan deeper than 1 m	Moderately dense mulga with various low shrubs, forbs and sparse grasses. MUCR pasture land

CAPRICORN LAND SYSTEM (3 341 sq km)

Rugged hills and ridges with low shrublands or hard spinifex.

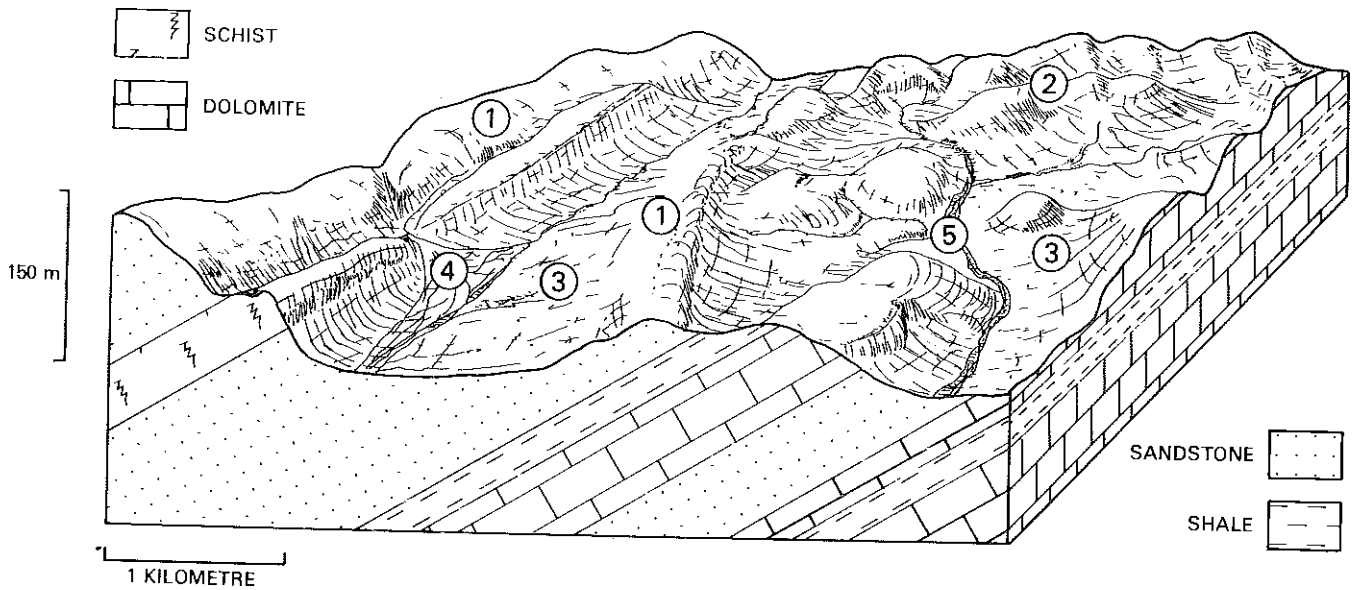
Location: Turee Creek, Edmund, Wyloo and Yanrey 1:250 000 map sheets.

Geology: Lower Proterozoic sandstone, greywacke, dolomite and shale (Wyloo Group) and minor schist.

Geomorphology: Erosional surfaces; — ranges and hills with steep rocky upper slopes, more gently sloping stony footslopes, restricted stony lower plains and valleys; angular and rectangular drainage patterns of moderate to high density; relief up to 150 m.

Pastoral use: Units 1 and 2 partly inaccessible to stock; very poor quality hard spinifex pastures of negligible use, stony short grass forb ephemeral pastures can be utilised but are poorly productive with very little drought durability.

Estimated carrying capacity, good condition, 39 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	35	**Sandstone, greywacke, minor schist ridges and hills:** rocky summits and upper slopes up to 80 per cent, dense stony mantle or outcropping parent material, relief up to 150 m.	Rocky outcrop, virtually no soil development.	Hard spinifex, *Triodia wiseana* with sparse low shrubs or stunted shrublands with scattered annual short grasses and forbs. HSHI or SSGF pasture lands.
2	35	**Dolomite hills:** rocky crests, benched slopes, convex and concave upper slopes up to 50 percent, dense mantle or outcrop of dolomite, relief 10 to 50 m.	Rock outcrop, some pockets of very shallow loamy soils Um 521.	Hard spinifex *Triodia wiseana* with sparse low shrubs and forbs. HSHI pasture land.
3	25	**Lower slopes and stony interfluves:** extending up to 1 km downslope from hills, slopes up to 3 per cent; convex margins sloping up to 10 per cent where dissected by drainage incised up to 3m, dense stony mantles.	Variable depth red loamy soils Um 512, 521, 552.	Tall open shrublands of *Acacia* spp., sparse low shrubs, annual grasses and forbs. SSGF pasture land.
4	1	**Alluvial fans:** up to 1 km long gradients 1 in 50 to 1 in 100.	Gravelly and pebble sands and loams, Uc 123.	Moderately dense mulga *Acacia aneura* and other *Acacia* spp., soft spinifex understorey with numerous low shrubs and forbs. SOSP pasture land.
5	4	**Narrow drainage floors and channels:** floors usually less than 200 m wide, single or multiple channels up to 50 m wide incised in bed rock.	Shallow, stony alluvial soils, bedloads range from sand to cobbles.	Moderately dense tall shrubland of *Acacia citrinoviridis* and other *Acacia* spp., numerous undershrubs and forbs. MUCR pasture land.

CHARLEY LAND SYSTEM (1 590 sq km)

Dolerite hills and ridges and restricted lower plains; tall and low shrublands.

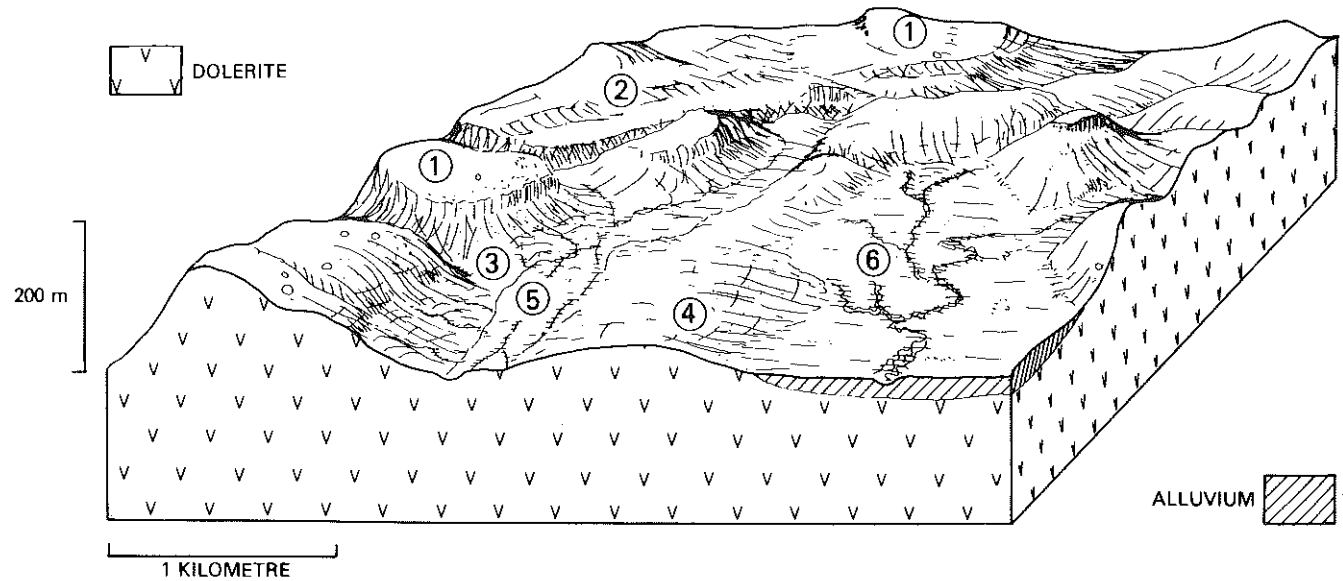
Location: Edmund, Turee Creek, Newman, Mt. Egerton and Collier 1:250 000 map sheets.

Geology: Proterozoic dolerite; dykes and sills intruded into Bangemall Group sediments.

Geomorphology: Erosional surfaces — hills and ridges; — hill lands and narrow ridges with steep upper slopes and benched upper slopes; lower scree slopes, restricted areas of gently undulating lower plains and nearly flat plains; sparse to moderately dense angular drainage patterns, sluggish internal drainage patterns on flat plains: relief usually less than 50 m but locally up to 200 m.

Pastoral use: Unit 1 poorly accessible to stock; mulga short grass forb and cassia short grass forb ephemeral pastures of low carrying capacity; unit 6 supports useful tussock grass or chenopod pastures, is preferentially grazed and prone to severe degradation and some erosion and requires controlled stocking.

Estimated carrying capacity, good condition, 22 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	55	**Dolerite hills and ridges:** stony summits and crests, upper slopes up to 70 per cent, dense mantle of dolerite cobbles and boulders; relief 20 to 200 m.	Dolerite outcrop and boulders with little soil.	Mulga *Acacia aneura* and other *Acacia* spp. shrublands with variable low shrubs, forbs and short annual grasses. MSGF pasture land.
2	7	**Upper benched slopes:** benches up to 1 km long by 50 m wide sloping up to 6 per cent, separated by short slopes up to 25 per cent, dense dolerite boulder mantle.	Shallow, very stony red seasonal cracking clay soils. Ug 537.	Low open shrubland of *Cassia* aff. *hamersleyensis* with other low shrubs, forbs and annual grasses. CSGF pasture land.
3	15	**Lower footslopes:** concave slopes up to about 3 per cent extending up to 500 m downslope, dissected up to 1 m by small runnels and creeks.	Reddish brown loamy soils of variable depth.	*Cassia oligophylla* low shrubland with scattered *Acacia* spp. tall shrubs, forbs and short annual grasses. CSGF pasture land.
4	12	**Low rises and gently undulating plains:** gently rounded surfaces up to 3 km in extent, marginal slopes up to 2 per cent, relief usually less than 15 m.	Calcareous reddish brown loamy and clayey sands of variable depth over decomposing dolerite, Gc 112, Uc 511.	Dense *Cassia oligophylla* shrubland with other sparse low shrubs and short annual grasses. CSGF pasture land.
5	3	**Drainage floors and channels:** floors up to 300 m wide, gradients 1 in 100 to 1 in 300 mostly small channels up to 5 m wide and incised to 1 m, occasional larger creek channels up to 25 m wide.	Calcareous sandy and loamy soils eg. Uc 511 Gn 313; bedloads of sand and pebbles and dolerite rock fragments.	Tall shrublands of mulga *Acacia aneura* and other *Acacia* spp. with various low shrubs, forbs and short annual grasses. MUCR pasture land.
6	8	**Lower plains with sluggish drainage:** nearly flat plains up to 3 km by 1 km in extent, gilgai microrelief, patches of dolerite cobbles on surface.	Reddish brown seasonal cracking clay soils on decomposing dolerite at 80 cm to 1 m + Ug 537, 538.	Very sparse low shrubs and scattered perennial grasses and forbs, degraded condition. TGER pasture land.

CHEELA LAND SYSTEM (204 sq km)

Degraded alluvial plains with very sparse shrublands.

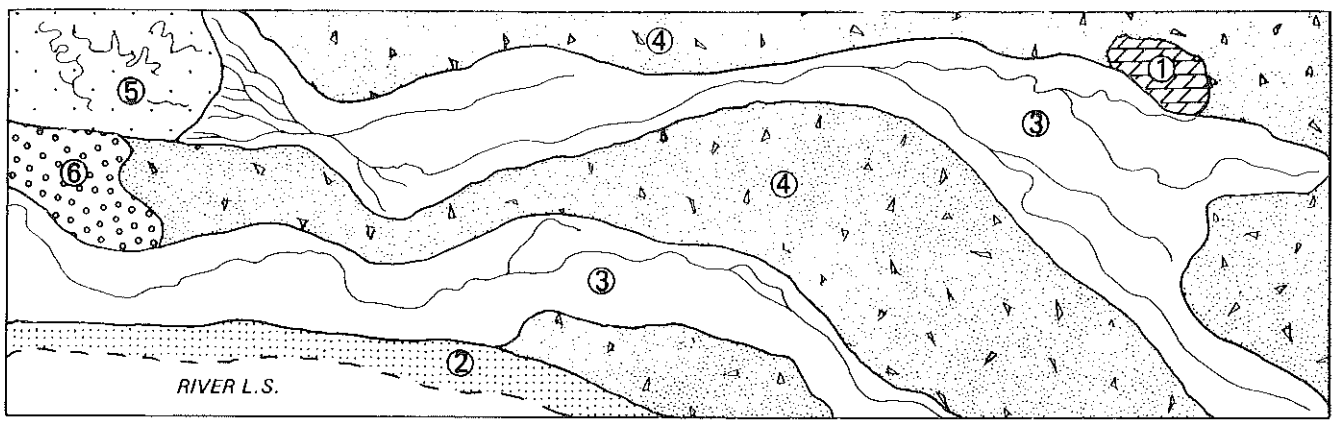
Location: Wyloo, Edmund, Mt. Bruce and Turee Creek 1:250 000 map sheets.

Geology: Quaternary alluvium

Geomorphology: Depositional surfaces — non-saline alluvial plains; — tributary plains extending up to 14 km downslope, gradients 1 in 200 to 1 in 1000, severely degraded plains with incised channels and gutters, slightly higher plains with banded vegetation patterns, restricted sandy surfaced outwash plains, restricted gilgai plains with internal drainage.

Pastoral use: Alluvial plains with abundant ephemerals after rain and some sparse perennial tussock grass pastures; moderate carrying capacity after rain but drought resistance very low; units 3 and 4 show severe pasture degradation and moderate wind and water erosion, control of stocking is essential, some potential for establishing introduced grasses.

Estimated carrying capacity, good condition, 6 ha per sheep unit.



1 KILOMETRE

Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	1	**Low hills:** isolated basalt hills up to 1 km long, short concave rocky slopes, relief up to 25 m.	Rock outcrop.	Sparse low shrubland of stunted mulga *Acacia aneura* and *Cassia* spp. with forbs and sparse grasses. SSGF pasture land.
2	6	**Sandy outwash plains:** up to 3 km long and 500 m wide, subject to shallow overflow and outwash from adjacent river systems, hummocky microrelief.	Coarse reddish brown sands or loamy sands Uc 511.	Low shrubland with *Eremophila leucophylla, Rhagodia eremaea* and *Cassia* spp. and perennial and annual grasses and numerous forbs. TGCE pasture land.
3	40	**Alluvial plains with channelled tracts:** surfaces extending up to 12 km downslope, gradients 1 in 300 to 1 in 1000, often gilgai microrelief; tracts with single or multiple flowlines, channels and gutters incised up to 2 m.	Dark red or reddish brown seasonal cracking clay soils Ug 538.	Degraded sparse low shrubland mainly *Cassia oligophylla* with sparse perennial grasses *Eragrostis setifolia, E. xerophila.* TGER pasture land.
4	43	**Alluvial plains:** broad surfaces up to 1.5 km wide and 3 to 4 km long, elevated up to 1 m above unit 3, gradients usually below 1 in 1000 but locally up to 1 in 200.	Reddish brown sandy to clayey loams Gn 212, Um 522.	Degraded shrublands of variable density; bands of dense shrublands of *Acacia victoriae* and other *Acacia* spp. with numerous low shrubs, forbs and grasses, interspersed with larger areas of almost bare surfaces supporting numerous forbs and annual grasses only after rain. CHAT pasture land.
5	8	**Internal drainage plains:** flat plains up to 4 km long by one and a half km wide, gilgai microrelief.	Dark red or reddish brown seasonal cracking soils Ug 538.	Mostly open tussock grasslands *Eragrostis setifolia, E. xerophila* with scattered low shrubs, some areas of tall shrublands of *Acacia victoriae* with grassy understorey. TGER pasture land.
6	2	**Calcrete platforms:** surfaces up to 800 m in extent, gradients usually below 1 in 300.	Dark red loams of variable depth on calcrete Um 522.	Low woodlands of *Eucalyptus dichromophloia* with numerous tall and low shrubs and grassy ground storey. CSGF pasture land.

CHEETARA LAND SYSTEM (407 sq km)

Alluvial clay plains with gilgais, mixed open tussock grasslands and tall shrublands.

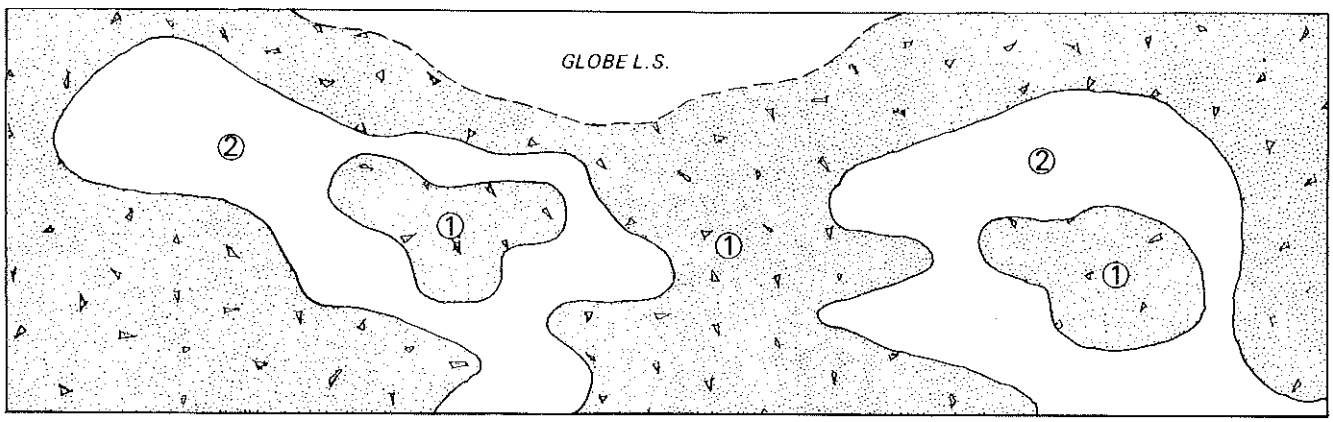
Location: Yanrey 1:250 000 map sheets.

Geology: Quaternary alluvium

Geomorphology: Depositional surfaces — non-saline alluvial plains; — broad clay plains up to 12 km in extent with and without gilgais, maximum relief 3 m, gradients usually below 1 in 1000, no channelled drainage but plains subject to sheet flow and inundation for short periods.

Pastoral use: Valuable tussock grass and shrub pastures with numerous forbs after rain, moderately high carrying capacity and fair drought durability; unit 1 has high inherent resistance to erosion, unit 2 moderate inherent resistance although some minor erosion is present, restricted areas of severe pasture degradation.

Estimated carrying capacity, good condition, 6 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	60	**Alluvial plains with gilgais:** broad surfaces up to 4 or 5 km in extent, gradients mostly less than 1 in 1000 hummocky microrelief with gilgais.	Dark red or dark reddish brown clay soils with gilgais, exclusively Ug 538.	Open tussock grasslands of *Eragrostis xerophila, E. setifolia, Eriachne benthamii* and *Chrysopogon fallax* with sparse shrubs; degraded in parts to forby herbfields. Some patches of tall shrub lands *Acacia victoriae* with low shrubs and sparse perennial grasses. TGER pasture land.
2	40	**Alluvial plains without gilgais:** broad tracts up to 4 or 5 km in extent, gradients mostly less than 1 in 1000, flat or concave microrelief, occasional locally developed gilgais.	Dark red or reddish brown clay soils. Uf 621, 653, 671, some Ug 538.	Tall shrublands or open shrublands of *Acacia victoriae* and *A. tetragonophylla* with low shrubs, sparse perennial grasses and forbs. TGER pasture land.

COLLIER LAND SYSTEM (3 087 sq km)

Undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands.

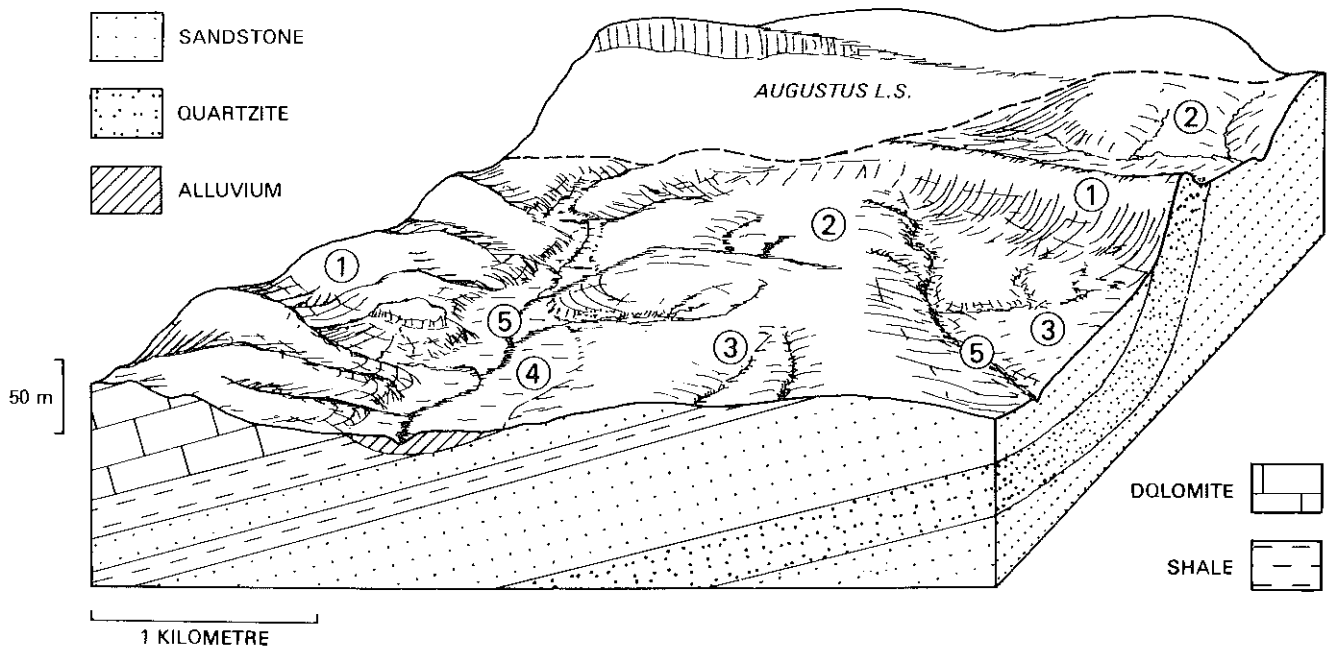
Location: Collier, Mt. Egerton, Newman, Turee Creek, Edmund, Wyloo and Yanrey 1:250 000 map sheets.

Geology: Dolomite, shale, siltstone, sandstone and chert of Middle Proterozoic age and Quaternary colluvium.

Geomorphology: Erosional surfaces — stony uplands and hills; — extensive areas of high undulating stony surfaces and low hills, relief up to 50 m, ridges up to 6 km long and 25 m high; stony lower slopes and lower plains mostly non-saline but occasionally saline, dense colluvial mantles; restricted saline and non-saline drainage floors; rectangular, angular and dendritic drainage patterns of sparse to moderate density.

Pastoral use: Mulga with stony short grass forb pastures and small inclusions of stony chenopod and chenopod pastures; short grass forb pastures should be heavily stocked in good seasons, generally carrying capacity and drought durability is low; chenopod pastures on unit 4 are preferentially grazed and frequently degraded, grazing on these pastures should be controlled if possible; units are inherently resistant to erosion although some erosion occurs on parts of unit 4.

Estimated carrying capacity, good condition, 22 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	30	**Low hills and ridges:** extensive areas of low rocky hills, short convex and concave upper slopes up to 45 per cent, lower concave slopes 2 to 5 per cent, outcrop and dense stony mantles, relief up to 50 m; isolated ridges up to 6 km long and 1 km wide, stony slopes, relief up to 25 m.	Outcrop and shallow loamy soils on variable parent rock. Um 511, 521.	Shrublands of mulga *Acacia aneura* and other *Acacia* spp. with scattered low shrubs, forbs and annual grasses; some hard spinifex *Triodia wiseana* grasslands. MSGF pasture land.
2	25	**Undulating stony uplands:** elevated almost flat or gently rounded stony surfaces above units 3, 4 and 5 and sometimes above unit 1, variable slopes up to 2 per cent, dense surface mantles.	Shallow red or reddish brown loamy soils of variable depth on parent rock or hardpan, Um 143, 521, 531, 552, dense surface strew pebbles and cobbles.	Sparse shrublands of mulga *Acacia aneura* and other *Acacia* spp. with scattered low shrubs, forbs and annual grasses. SSGF pasture land.
3	25	**Stony plains:** plains and interfluves up to 1.5 km wide and extending up to 3 km downslope, general slopes up to 1 per cent but 5 to 10 per cent at margins where dissected up to 5 km by creekline, dense stony mantles.	Variable red loamy and clayey soils Gc 121, Uf 621, dense surface strew of pebbles and cobbles.	Shrublands and open shrublands of mulga *Acacia aneura* and other *Acacia* spp. with low shrubs and forbs; some low open shrublands of samphire *Halosarcia* spp. MSGF pasture land.
4	15	**Drainage floors and lower plains:** saline and non-saline plains up to 1.5 km in extent, gradients 1 in 100 to 1 in 500, variable surface mantles.	Variable red loam and clay soils Gn 113, Ug 538, Uf 612, surface strew varies from sparse to dense.	Tall open shrublands of mulga *Acacia aneura* or snakewood *Acacia xiphophylla* with low shrubs, forbs and annual grasses; ground storey often halophytic including *Atriplex bunburyana, Maireana pyramidata,* also soft spinifex *Triodia pungens.* STCH pasture land.
5	5	**Channels and banks:** 10 to 20 m wide in upper parts with shallow incision into bedrock, major creek lines up to 100 m wide.	Bedloads vary from cobbles and stones to sand, banks alluvial sandy loam and sandy clay soils of variable depth.	Low woodlands of dense mulga *Acacia aneura, A. kempeana* and other *Acacia* spp. numerous low shrubs and sparse perennial grasses. MUCR pasture land.

DIVIDE LAND SYSTEM (1 506 sq km)

Sandplain and minor dunes with hard spinifex grasslands; in the south-east of the area.

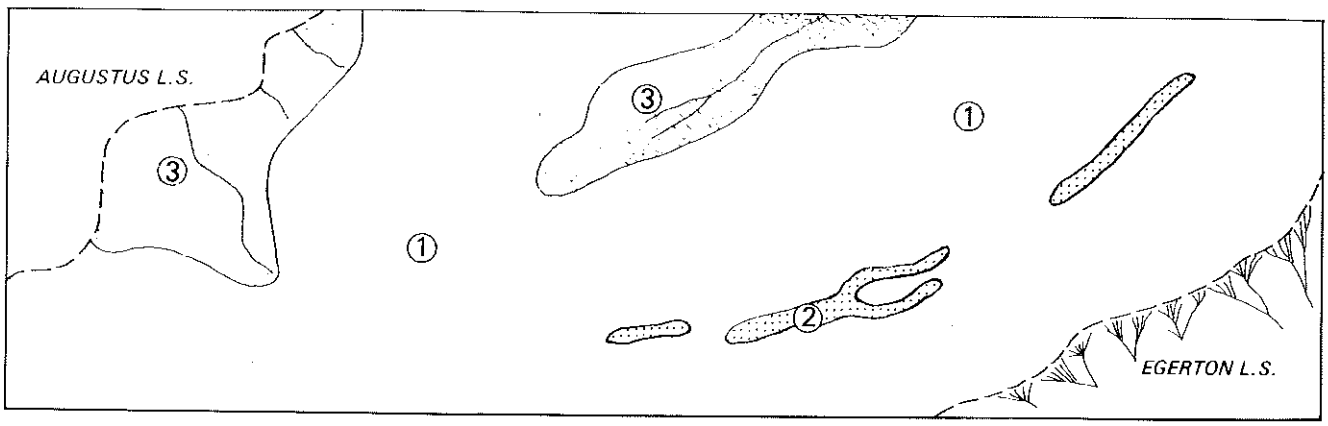
Location: Collier 1:250 000 map sheets.

Geology: Quaternary aeolian sand.

Geomorphology: Depositional surfaces — sandplain and dunes; — broad sandplain with occasional linear and reticulate dunes trending north-east, very little organised drainage but tracts receiving run-on from adjacent more elevated systems, these tracts mostly unchannelled but locally with sandy channels, relief up to 15 m.

Pastoral use: Hard spinifex pastures of low or very low productivity, run on areas with slightly better quality grassy pastures; spinifex requires periodic burning to promote edibile annuals and perennials, some susceptibility to wind erosion following burning but stabilization occurs rapidly after rain.

Estimated carrying capacity, good condition, 41 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	85	**Sandplain:** almost flat plains up to 10 km or more in extent, hummocky microrelief and loose surfaces.	Dark red or reddish brown acidic sands 1 m+ deep, Uc 511, 123.	Hard spinifex *Triodia basedowii* hummock grasslands with very sparse shrubs including *Acacia sclerosperma, Hakea suberea, Grevillea excelsior* and *Cassia* spp. HSSP pasture land.
2	5	**Sand dunes:** linear and occasionally reticulate, up to 10 m high and 2.5 km long, slopes up to 20 per cent, hummocky crests and loose surfaces.	Dark reddish brown acidic sands 1m+ deep, Uc 123.	Hard spinifex *T. basedowii* grasslands with various *Acacia* spp. and *Grevillea gordoniana* shrubs, also grasses such as *Eragrostis eriopoda, Aristida browniana* and forbs. HSSP pasture land.
3	10	**Tracts receiving run on:** up to 4 or 5 km in extent and sloping up to 2 per cent, mostly unchanneled but sometimes with sandy channels and outwash gutters incised to 1.5 m.	Dark reddish brown sands and sandy loams 1 m+ deep, Uc 521.	Dense tall shrublands with *Acacia aneura, A. kempeana, A. rhodophloia,* low shrubs such as *Eremophila leucophylla* and ground layer *Triodia basedowii, Eragrostis xerophila, Monachather paradoxa.* MUCR pasture land.

DOLLAR LAND SYSTEM (499 sq km)

Stony plains with open snakewood shrublands.

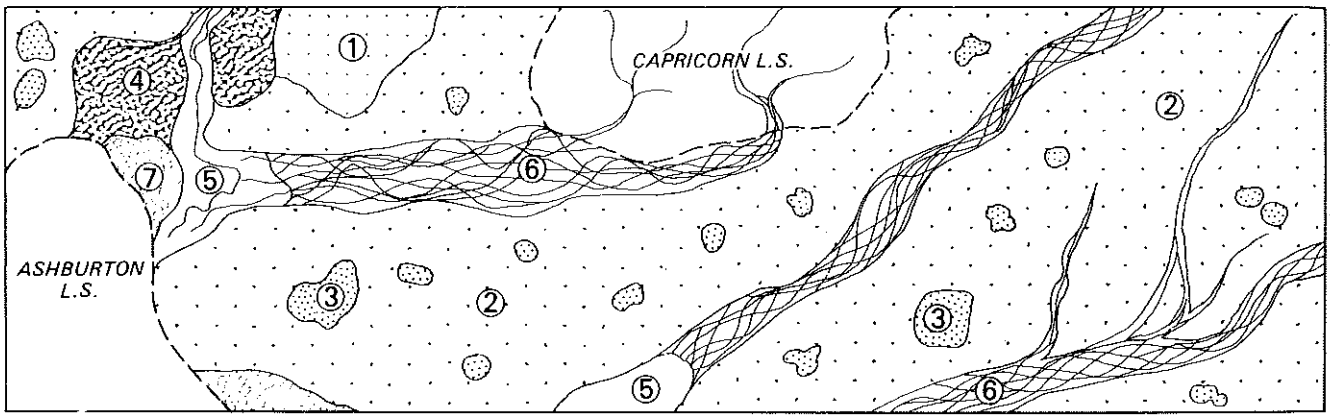
Location: Edmund, Mt. Bruce, Turee Creek and Wyloo 1:250 000 map sheets.

Geology: Quaternary colluvium and alluvium with minor areas of Lower Proterozoic dolomite.

Geomorphology: Depositional surfaces — stony plains; — broad, almost flat stony plains of unconsolidated colluvium, minor alluvial zones, outcrop plains and low dolomitic rises; sparse, through going sub parallel drainage with single and braided channels, relief usually less than 5 m but up to 10 m.

Pastoral use: Sparse stony chenopod and mulga short grass forb pastures, minor inclusions of better quality chenopod and tussock grass pastures, overall productivity and carrying capacity moderate, most units inherently resistant to erosion.

Estimated carrying capacity, good condition, 11 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	6	**Outcrop plains and low rises:** up to 1 km in extent, relief up to 10 m, variable surface strew of dolomitic rock fragments.	Shallow dark red loams with calcareous inclusions.	Low shrublands of *Acacia tetragonophylla, A. victoriae* and *Cassia* spp., forbs and sparse annual grasses. MSGF pasture land.
2	65	**Stony plains:** up to 6 km by 3 km in extent, gradients usually less than 1 in 200 but marginal slopes up to 1.5 per cent dense gravel and pebble mantle; drainage foci (unit 3) sparsely scattered over this unit.	Dark reddish brown or red silty loams and clay loams with stony pavement, 1 m + deep Um 521, 552, 633, Gn 213, 312.	Tall open shrubland of *Acacia xiphophylla* with sparse low shrubs such as *Cassia* spp, *Eremophila* spp and *Enchylaena tomentosa,* forbs and annual grasses. STCH pasture land.
3	8	**Drainage foci:** discrete but variable shaped foci occurring on unit 2, commonly 50 to 200 m in extent but up to 500 m.	Dark reddish brown or red silty loams and clays variable surface strew, 1m + deep Um 521, 522, Uf 621.	Dense tall *Acacia xiphophylla* and other *Acacia* spp shrublands with numerous low shrubs, forbs and annual grasses. STCH pasture land.
4	5	**Gilgai plains:** up to 1 km in extent, near flat to 1 in 200 gradient, linear and normal gilgai microrelief, stony mantle.	Surface cracking reddish brown clay soils, variable strew, 1m + deep Ug 538.	Open shrubland mostly *Acacia victoriae* with sparse low shrubs and tussock grasses. TGER pasture land.
5	5	**Drainage floors:** up to 400 m wide, gradients 1 in 100 to 1 in 500, central tracts with braided channels.	Dark reddish brown sandy or silty loams, also clays, usually strewless surfaces, 1m + deep Um 123, 542, 552, Ug 538.	Tall shrublands *Acacia citrinoviridis, A.* spp. with low shrubs, minor tussock grasslands *Cenchrus ciliaris* and hummock grasslands *Triodia pungens.* MUCR pasture land.
6	10	**Braided channels:** multiple channels 5 to 10 m wide over tracts up to 300 m wide, also individual major channels up to 50 m wide.	Stony reddish brown sandy loams, variable depth Uc 511, Um 551.	Dense tall shrubland *Acacia wanyu* and numerous other *Acacia* spp. sparse low shrubs and grasses. MUCR pasture land.
7	1	**Swamps and depressions:** up to 2 km in extent, moundy or gilgai microrelief.	Mostly surface cracking reddish brown loamy clay and clay soils, 1 m + deep Ug 538.	*Eucalyptus coolabah* woodlands and tall *Acacia* spp. shrublands with perennial grass understorey. TGCH pasture land.

DONOVAN LAND SYSTEM (293 sq km)

Gently sloping outwash plains and minor stony plains with alkaline loamy and clayey soils, tall snakewood and other *Acacia* spp. shrublands with chenopod and soft spinifex pastures.

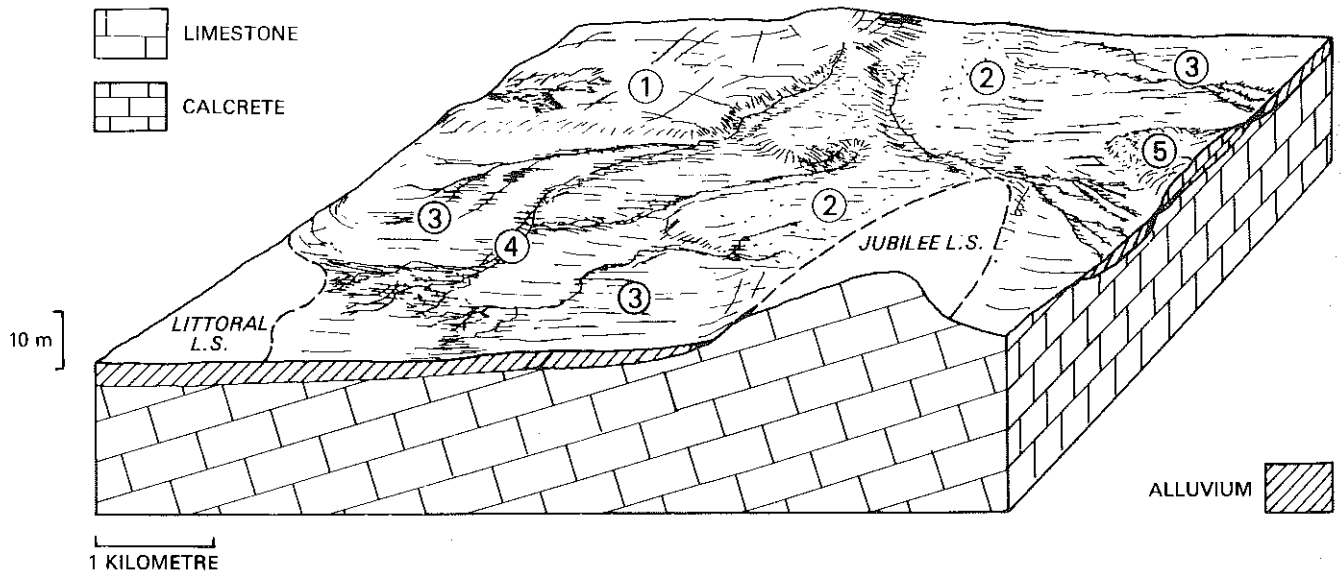
Location: Yanrey 1:250 000 map sheets.

Geology: Quaternary alluvium and colluvium, minor areas of limestone of Tertiary age.

Geomorphology: Depositional surfaces — outwash plains; — broad gently sloping outwash plains and fans, channelled and unchannelled drainage tracts receiving more concentrated sheet flow; minor stony outcrop plains with sparse parallel drainage patterns, relief up to 12 m.

Pastoral use: Useful chenopod and soft spinifex pastures of moderate to high productivity and good drought durability, the two pasture types require different management techniques and where possible should be paddocked separately, all units inherently resistant to erosion but units 4 and 6 supporting chenopod pastures are sensitive to overuse.

Estimated carrying capacity, good condition, 8 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	15	**Stony upper plains:** Up to 3 km in extent, gradients about 1 in 200 with steeper marginal slopes adjacent to occasional dissection zones to 5 m, variable stony mantle.	Reddish brown alkaline loams and clay loams often with dense surface strew of limestone rock fragments, variable depth to limestone parent material. Gc 222, Um 512.	Tall snakewood *Acacia xiphophylla* shrubland with numerous low shrubs and soft spinifex *Triodia pungens* ground storey. SOSP pasture land.
2	30	**Gently undulating plains:** 3 or 4 km in extent, gradients 1 in 200 or less, relief up to 8 m.	Reddish brown alkaline silty loams, calcrete inclusions throughout 1 m+ deep, Um 512.	Tall shrubland of *Acacia sclerosperma* and other *Acacia* spp. with sparse low shrubs and soft spinifex understorey. SOSP pasture land.
3	45	**Lower outwash plains and fans:** slightly below units 1 and 2, alluvial surfaces receiving sheet flow, up to 3.5 km wide by 8 km long, interspersed with shallow drainage tracts receiving more concentrated flow, gradients 1 in 100 or less, relief up to 5 m.	Reddish brown alkaline silty loams and silty clays, calcrete inclusions throughout 1 m+ deep, Gc 112, Uf 621.	Tall snakewood shrubland with chenopod low shrubs *Maireana polypterygia, Atriplex bunburyana* forbs and annual grasses. CHMA pasture land.
4	8	**Drainage tracts:** up to 3 km long by 1 km wide, gradients 1 in 100 to 1 in 500, unchannelled or with channels up to 10 m wide and incised up to 1 m.	Reddish brown alkaline silty loams and silty clays 1 m+ deep. Um 512, Uf 621, Gc 222.	Dense tall shrubland *Acacia sclerosperma, A. tetragonophylla,* and other *Acacia* spp., numerous low shrubs including *Rhagodia eremaea, Enchylaena tomentosa, Cassia* spp. and sparse tussock grasses. CHMA pasture land.
5	2	**Calcrete rises:** undulating surfaces up to 2 km in extent, slopes 1 to 5 per cent or more, variable gravel mantle, relief up to 10 m.	Variable depth red sandy loam to sandy clay loam with calcrete gravel in profile. Gc 112.	Hummock grassland of hard spinifex *Triodia* spp. and some soft spinifex *Triodia pungens,* sparse low shrubs *Acacia bivenosa, Melaleuca cardiophylla.* HSHI pasture land.

DUNE LAND SYSTEM (372 sq km)

Dune fields with soft spinifex and minor hard spinifex grasslands in coastal areas only.

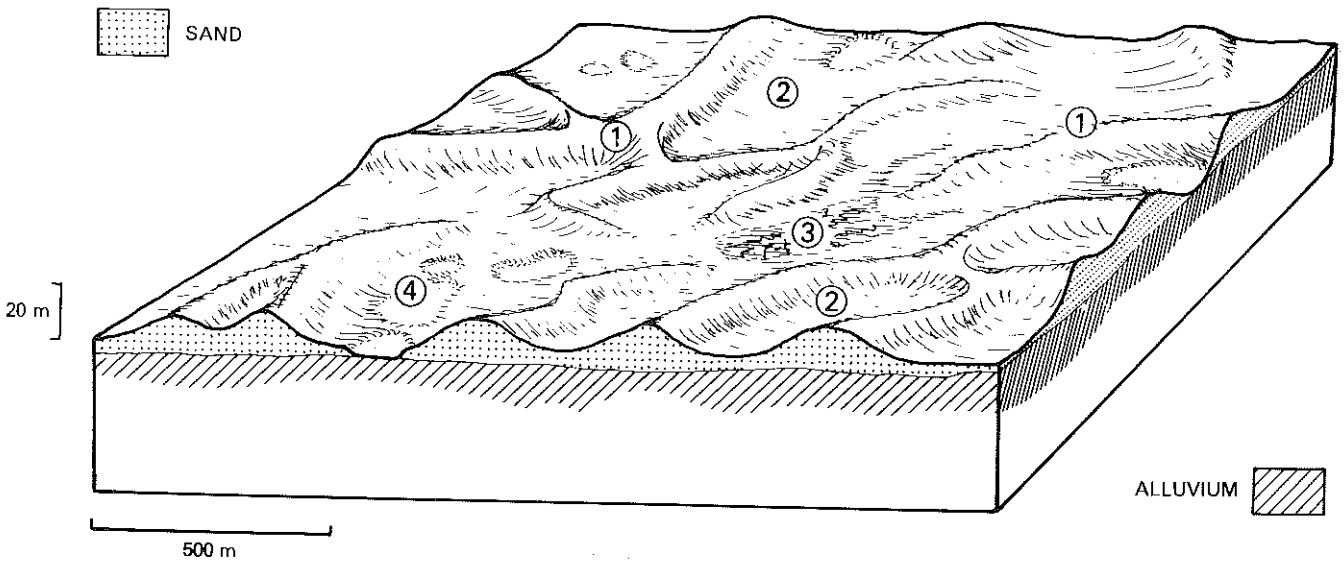
Location: Yanrey 1:250 000 map sheets.

Geology: Quaternary aeolian sands.

Geomorphology: Depositional surfaces — dune fields; — sand dunes and swales with no organised drainage, dunes trending approximately north-south and frequently becoming reticulate, narrow swales with minor area of claypans, swamps and depressions, relief up to 15 m.

Pastoral use: A small system supporting useful soft spinifex pastures, good drought durability, management involves burning on a regular four or five year basis, not fully utilised due to difficulty of obtaining suitable stock waters.

Estimated carrying capacity, good condition, 8 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	55	**Linear and reticulate dunes:** up to 15 m high and 2.5 km long by 100 to 200 m apart becoming reticulate, hummocky crests, flanks extending 100 m or so with steeper western sides to 20 per cent.	Dark red sands and loamy sands, 1 m+ deep, Uc 123.	Hummock grasslands of feathertop spinifex *Plectrachne schinzii* with numerous low shrubs, herbs and forbs. SOSP pasture land.
2	32	**Swales:** sandy surfaces 50 to 300 m wide between dunes.	As for unit 1.	Hummock grasslands mostly soft spinifex *Triodia pungens* but some hard spinifex *Triodia lanigera,* sparse low shrubs such as *Acacia translucens* and herbs and forbs. SOSP pasture land.
3	8	**Swamps and depressions:** low lying areas between dunes, circular or oval up to 500 m in diameter or extent.	Surface cracking reddish brown clay soils, 1 m+ deep Ug 538.	Low open woodland of *Eucalyptus coolabah* with *Muehlenbeckia cunninghamii* and perennial grasses such as *Sporobolus mitchellii* and *Eriachne benthamii.* TGMI pasture land.
4	5	**Claypans:** bare, circular, oval or elongated surfaces mostly less than 150 m in diameter or length but up to 500 m, up to 1.5 m below adjacent sandplains or swale with abrupt marginal slopes.	Dark red clay soils ofter with lime or gypsum in profile, sealed, glazed surfaces or crusted surfaces with dessication cracks. Uf 612, 621.	No vegetation.

EDWARD LAND SYSTEM (1 089 sq km)

Alluvial plains with sparse degraded saltbush, bluebush and other shrub pastures.

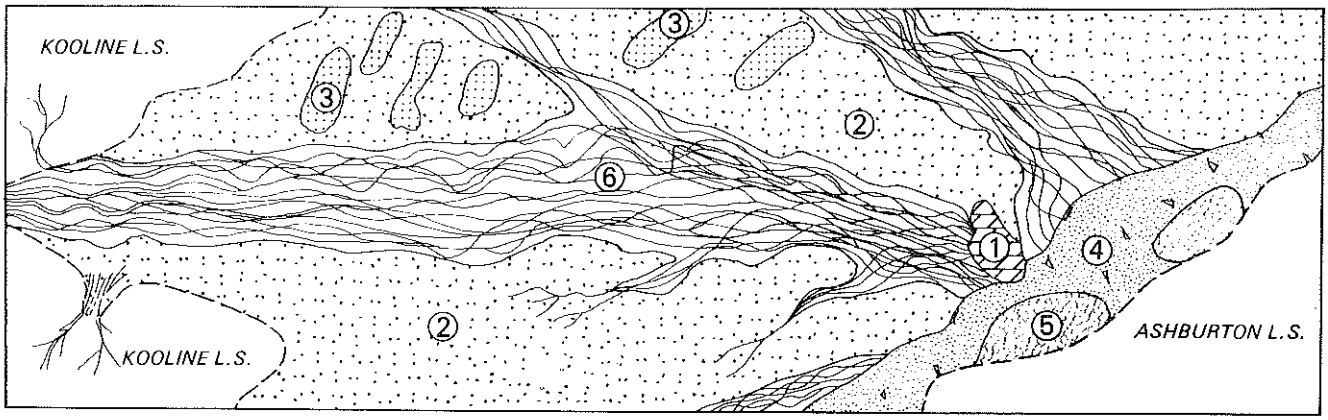
Location: Edmund, Newman, Turee Creek and Wyloo 1:250 000 map sheets.

Geology: Quaternary alluvium and colluvium derived from Ashburton formation (Wyloo Group) shale, minor Quaternary aeolian sand.

Geomorphology: Depositional surfaces — alluvial plains; — saline and non-saline tributary drainage plains up to 4 km in extent, often severely degraded with bare, scalded surfaces; through going drainage tracts with intensely braided and anastomising channels, minor sandy plains, dunes and sand banks, minor areas of flat internal drainage plains and depressions, occasional low shale hills, relief usually 1 to 5 m but up to 20 m.

Pastoral use: Potentially saltbush and other valuable halophytic pastures, now severely degraded and eroded, inherently sensitive to overuse and susceptible to erosion; control of intensity and season of grazing essential, some areas suitable for regeneration by seeding and cultural works.

Estimated carrying capacity, good condition, 9 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	2	**Low shale hills:** up to 750 m long and 20 m high, concave and convex stony slopes.	Much rock outcrop, little soil development.	Stunted *Acacia* spp. shrubland sparse low shrubs and forbs. SSGF pasture land.
2	45	**Degraded saline plains:** up to 4 km in extent, gradients 1 in 100 to 1 in 200 or less, hummocky surfaces; variable colluvial mantle frequently quartz, also bare claypan surfaces.	Duplex and other reddish brown and red soils, loamy or sandy surface horizons becoming clayey with depth, variable surface strew, mostly 1 m+ deep, Uc 531, Um 522, Dr 213, 412, 453.	Low open shrublands, often degraded, *Frankenia* spp., *Maireana* spp., *Atriplex bunburyana.* CHAT pasture land.
3	12	**Sandy banks and low dunes:** irregular and linear sandy banks to 1.5 m on some alluvial and saline plains, linear dunes up to 750 m long and 4 m high, slopes up to 6 per cent.	Loose surfaced reddish brown loamy sands, 1 m+ deep, Uc 511, 531.	Low open woodland *Acacia cuspidifolia* with other *Acacia* spp., *Cassia* spp., *Eremophila leucophylla,* some chenopod shrubs and grasses. STCH pasture land.
4	10	**Alluvial plains:** up to 2.5 km in extent receiving outwash and sheet flow from drainage tracts and saline plains, slopes 1 in 100 to 1 in 500.	Reddish brown and red loamy soils mostly uniform profiles but some graditional and duplex soils, 1 m+ deep, Um 512, 522, 633, Gn 282, Dr 213.	Tall and low shrublands and open shrublands, mostly *Acacia victoriae,* with *Cassia* spp., *Rhagodia eremaea* and other chenopod shrubs, sparse tussock grasses. CHAT pasture land.
5	5	**Depressions and internal drainage plains:** nearly flat, about 1 km in extent but up to 3.5 km, moundy or gilgai microrelief.	Reddish brown seasonal cracking clay loams and clays, some hard-setting silty loams, 1 m+ deep, Ug 539, Um 522, 633.	**Depressions:** open woodland *Eucalyptus coolibah* with *Rhagodia eremaea* and sparse tussock grasses. CHMA pasture land. **Internal drainage plains:** variable shrublands: *Acacia victoriae* and sparse tussock grasses or *Maireana aphylla, Eragrostis setifolia* or *Acacia farnesiana, Eulalia fulva* or *Chenopodium auricomum, Eragrostis setifolia.* CHMA pasture land.
6	26	**Broad drainage floors with braided channels:** up to 4 km long by 1 km wide, gradients 1 in 100 to 1 in 500 or less, frequently degraded; braided and anastomising channels up to 1 m deep by 10 m wide, also single major channels up to 50 m wide.	Reddish brown and red loamy and clayey soils, occasional duplex soil, 1 m+ deep, Um 542, 633, Uf 621, 631, 633, Dr 412, 413.	Degraded shrublands, *Acacia victoriae, A. wanyu, Cassia* spp., with sparse chenopod shrubs and tussock grasses. CHAT pasture land.

EGERTON LAND SYSTEM (3 402 sq km)

Highly dissected plain and slopes with sparse mulga shrublands.

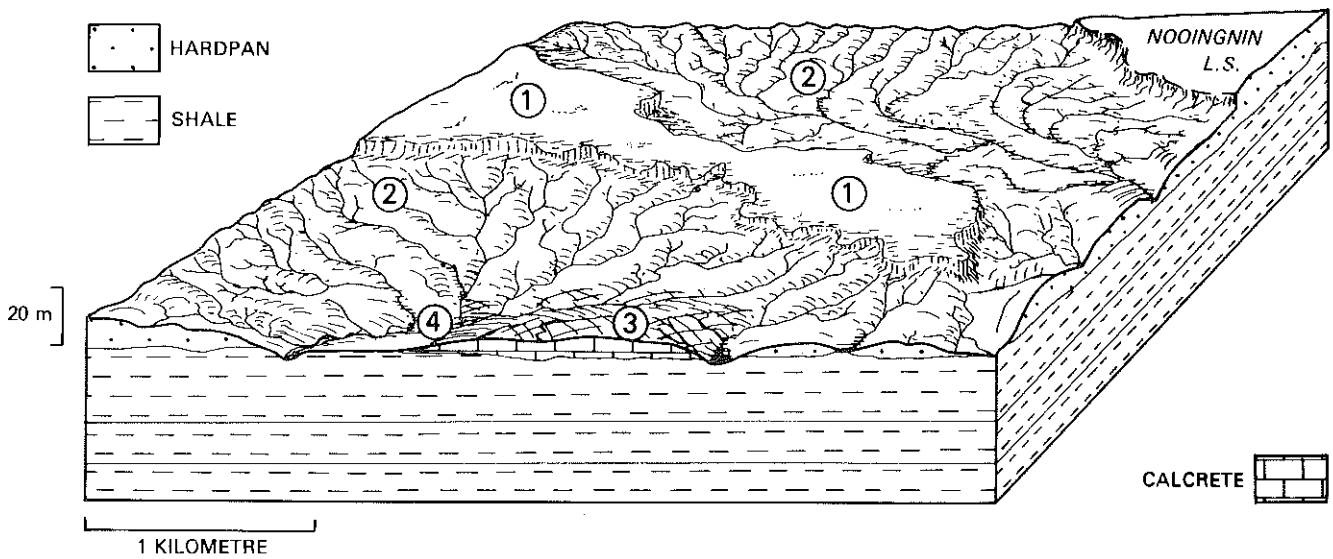
Location: Collier, Mt. Egerton, Newman, Turee Creek and Yanrey 1:250 000 map sheets.

Geology: Partly consolidated and cemented Tertiary colluvium.

Geomorphology: Surfaces formed by dissection of the old Tertiary plateau — dissected plains; — minor residual hardpan plains with extensive marginal dissection zones consisting of narrow interfluves and slopes, finely dendritic drainage patterns of very high intensity with narrow drainage floors leading to major through drainage, dissected slopes marginal to major drainage lines are often calcreted, relief up to 35 m.

Pastoral use: Mulga short grass forb pastures producing some useful ephemerals after rain but overall carrying capacity and durability is very low, not susceptible to erosion.

Estimated carrying capacity, good condition, 23 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	10	**Hardpan plains:** narrow elevated residual plains and divides between extensive dissected slopes of unit 2, sloping up to 2 per cent, dense pebbly mantles.	Red or reddish-brown acidic loamy sands and loams on hardpan at shallow depth, Uc 511, Um 521, 531.	Very sparse mulga *Acacia aneura* and other *Acacia* spp. shrublands with very sparse low shrubs *Eremophila fraseri*, *Cassia* spp., *Solanum lasiophyllum*, forbs and annual grasses. SSGF pasture land.
2	75	**Dissected slopes:** zones up to 3 or 4 km in extent consisting of stable narrow interfluves and short slopes with high intensity dendritic drainage lines incised up to 10 m, slopes mostly 1 to 10 per cent but margins sloping up to 50 per cent, hardpan exposures in parts; upper parts often with breakaway faces up to 3 m high.	Red or reddish-brown loamy sands and loams on hardpan at shallow depth, often with calcareous concretions in profile, Uc 121, 512, Um 512, 531, 561.	Sparse mulga *Acacia aneura* and other *Acacia* spp., shrublands with sparse *Eremophila* and *Cassia* spp., low shrubs, forbs and annual grasses. MSGF pasture land.
3	6	**Calcreted drainage margins:** up to 2 km in extent, narrow interfluves and dissected slopes adjacent to major drainage, gravelly mantles of calcrete fragments.	Reddish-brown alkaline loamy sands and loams on calcrete at variable depth, numerous calcareous concretions and nodules in profile, Uc 512, Um 511.	Hard spinifex *Triodia wiseana* grasslands with sparse trees *Eucalyptus socialis*, *E. dichromophloia* and scattered shrubs. HSHI pasture land
4	9	**Drainage floors and channels:** up to 500 m wide but mostly much less with central channels, gradients 1 in 100 to 1 in 500; major trunk drainage channels up to 100 m wide.	Weak red loams 50 cm to 1 m+ deep, Um 521, 522.	Dense low woodlands of mulga *Acacia aneura* with numerous tall and low shrubs including *Cassia* spp., *Eremophila leucophylla*, *Ptilotus obovatus*, *Enchylaena tomentosa*, forbs and annual grasses. MUCR pasture land.

ETHEL LAND SYSTEM (1 172 sq km)

Cobble plains with sparse mulga and other *Acacia* spp. shrublands.

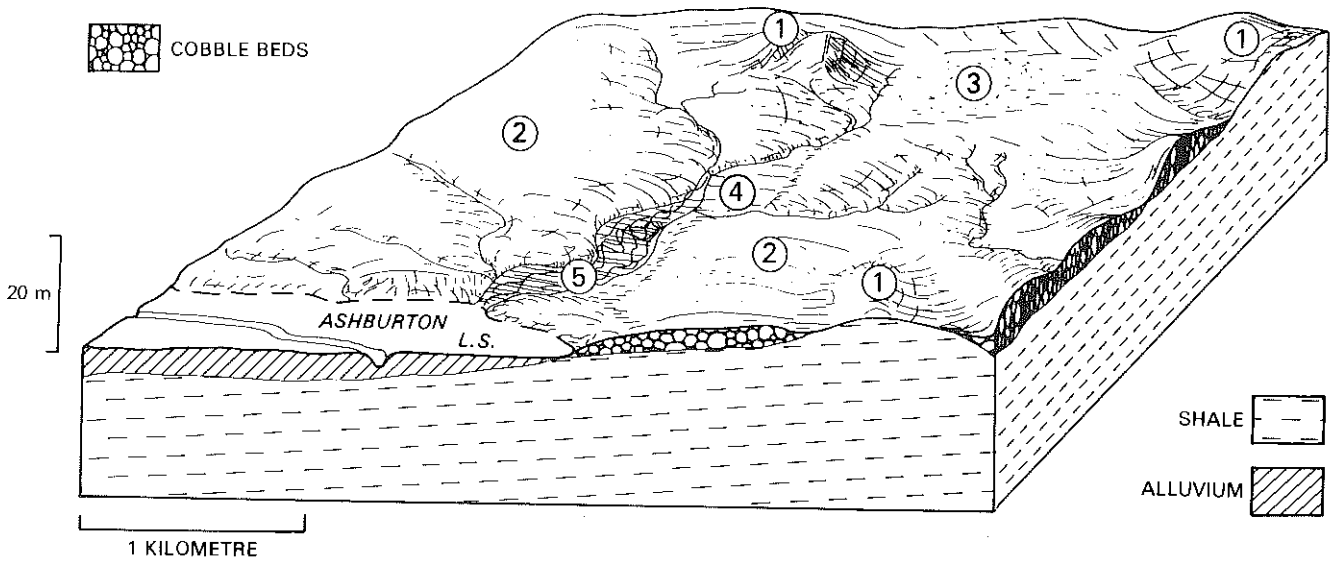
Location: Collier, Edmund, Mt. Egerton, Newman and Turee Creek 1:250 000 map sheets.

Geology: Unconsolidated Quaternary colluvium and alluvium.

Geomorphology: Depositional surfaces — stony plains; — extensive, slightly raised saline and non saline cobble plains, saline and non-saline alluvial drainage floors with sub-parallel drainage patterns of moderate intensity, minor low hills and stony rises, relief mostly less than 20 m.

Pastoral use: Mulga short grass forb, stony short grass forb and some samphire pastures of very low productivity and carrying capacity, small inclusions of better quality chenopod pastures on drainage floors; useful ephemeral growth after rain but drought resistance very low, inherently stable due to stony nature although some pasture degradation on drainage floors.

Estimated carrying capacity, good condition, 20 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	10	**Low hills and stony rises:** up to 1 km in extent, relief up to 15 m with marginal slopes 5 per cent or more, dense colluvial mantle.	Reddish brown loamy soils variable depth, gravel inclusions through profile, dense cobble surface strew. Um 143.	Tall open mulga *Acacia aneura* shrubland with sparse *Eremophila* spp. low shrubs, forbs and annual grasses. SSGF pasture land.
2	70	**Raised cobble plains:** gently undulating stony surfaces and interfluves, up to 4 km long by 1 km wide, gradients 1 in 100 or less, locally up to 1 in 50, dense colluvial mantle.	Dark reddish brown and dark red loamy and clayey soils, gravel inclusions in profile, dense pebble and cobble surface strew, 20 cm to 1 m deep.Um 521, 531, Uf 612, Gn 212, Dr 213, Ug 538.	Sparse low open shrublands of mulga and other *Acacia* spp. and *Cassia* and *Eremophila* spp., forbs and annual grasses. SSGF pasture land.
3	10	**Saline plains:** surfaces up to 1 km in extent occuring within unit 2, gradients up to 1 in 100, dense colluvial mantle, often stony gilgai microrelief.	Reddish brown and red clayey soils, dense pebble and cobble strew, 1 m+ deep. Dr 211, Ug 538.	Low open shrublands of *Halosarcia* and *Frankenia* spp. or *Atriplex bunburyana,* various forbs. SAMP and CHAT pasture lands.
4	5	**Drainage floors:** usually saline 100 to 200 m wide occasionally more, with central channelled tracts, gradients 1 in 100 to 1 in 500.	Reddish brown and red soils, loamy surface horizons becoming clayey with depth, variable gravelly strew, 1 m+ deep. Uf 552, 613, Gn 213, Dr 313.	Shrublands and open shrubland of sparse *Acacia victoriae* and other *Acacia* spp, tall shrubs, low shrubs *Atriplex bunburyana, Maireana pyramidata* and forbs. CHAT pasture land.
5	5	**Braided channels:** up to 10 m wide and 1 to 2 m deep with cobbly banks between, also single major channels up to 50 m wide and 4 to 5 m deep.	Shallow reddish brown sandy soils on shale Uc 123, Uc 513, Bedloads of sand, gravel, pebbles and cobbles.	Dense tall shrubland of various *Acacia* spp. with *Cassia* and *Eremophila* spp. low shrubs, forbs and annual grasses. MUCR pasture land.

FIRECRACKER LAND SYSTEM (175 sq km)

Undulating stony uplands and plains with low shrublands of Gascoyne bluebush; exclusive to the far west of the survey area.

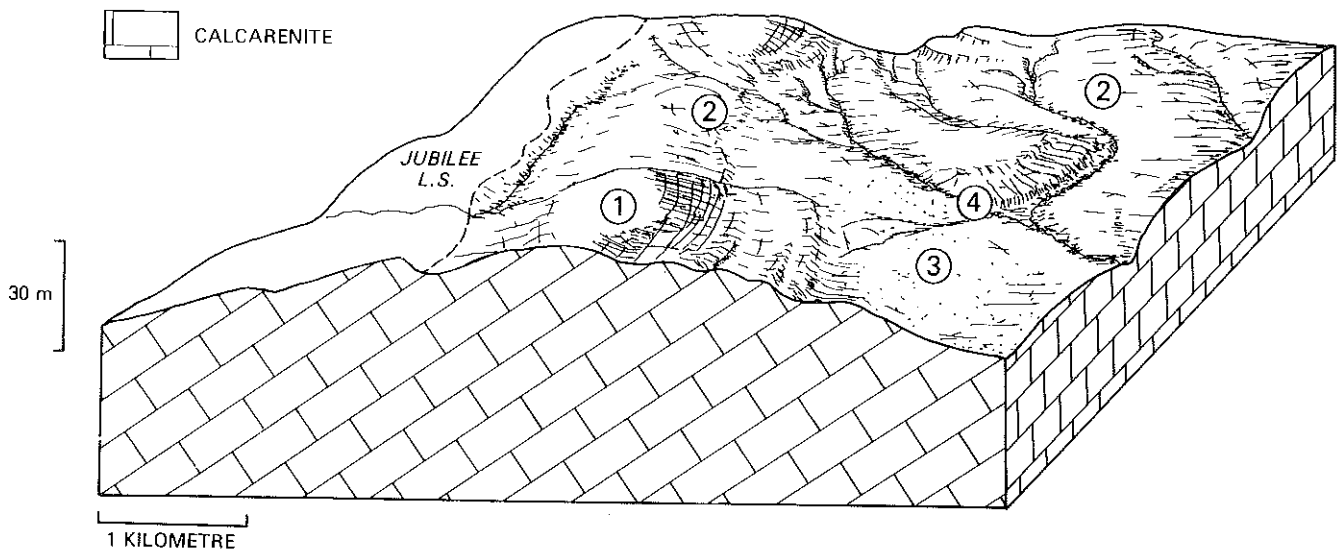
Location: Yanrey 1:250 000 map sheet.

Geology: Marine limestones of Cretaceous and Tertiary age.

Geomorphology: Surfaces formed by partial dissection of the Giralia anticline structure; —low hills and stony rises, extensive undulating uplands and plains, lower plains; sub parallel drainage patterns of low intensity becoming incised and dendritic in upper parts, relief up to 40 m.

Pastoral use: Gascoyne bluebush pastures of high productivity and good drought resistance; complete stock control is essential and care in location of watering points necessary as units 2 and 3 are sensitive to disturbance; active gullies and rills and pasture degradation in parts.

Estimated carrying capacity, good condition, 8 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	5	**Low hills:** up to 15 m high, 750 m long, convex or near flat crests, concave or benched slopes up to 10 per cent, dense mantle of limestone rock fragments.	Shallow stony calcareous reddish brown to reddish yellow silty clay and light clay soils, depth usually less than 50 cm Uf 131.	Low open shrubland of Gascoyne bluebush *Maireana polypterygia,* very sparse snakewood *Acacia xiphophylla* and *A. cuspidifolia;* also hard spinifex *Triodia wiseana* in parts. CHMA pasture land.
2	80	**Gently undulating stony uplands and plains:** plains up to 5 km in extent and 2.5 km between drainage lines; narrower rounded interfluves, slopes 1 to 3 per cent with prominent structural benching, relief about 10 m but up to 40 m.	Reddish brown alkaline soils, silty loam surface horizons to clay loam at depth, calcareous concretions through profile, variable limestone strew, depth 40 cm to 1 m+, susceptible to gully erosion. Um 511, 512.	Low open shrubland of Gascoyne bluebush *Maireana polypterygia* very sparse *Acacia xiphophylla* and *A. cuspidifolia,* forbs and annual grasses. CHMA pasture land.
3	12	**Lower plains:** restricted plains up to 3 km in extent but usually much less, slopes about 1 per cent, stony mantle.	Reddish brown alkaline loams and loamy clays, variable depth, Um 613.	Tall snakewood *Acacia xiphophylla* shrubland with undershrubs *Maireana polypterygia* and sparse *Rhagodia eremaea, Atriplex bunburyana,* forbs and annual grasses. CHMA pasture land.
4	3	**Incised drainage and creeklines:** intense pattern of incision up to 5 m in limestone bedrock in restricted upper parts, some active gullies downslope, major channels up to 20 m wide incised 1 to 3 m.	Very shallow stony alkaline soils or deeper sandy loam to silty clay soils.	Tall open shrubland of snakewood *Acacia xiphophylla* and *A. victoriae* with chenopod low shrubs, forbs and annual grasses. MUCR pasture land.

FORD LAND SYSTEM (870 sq km)

Gently undulating stony plains with a few low hills; mulga shrublands.

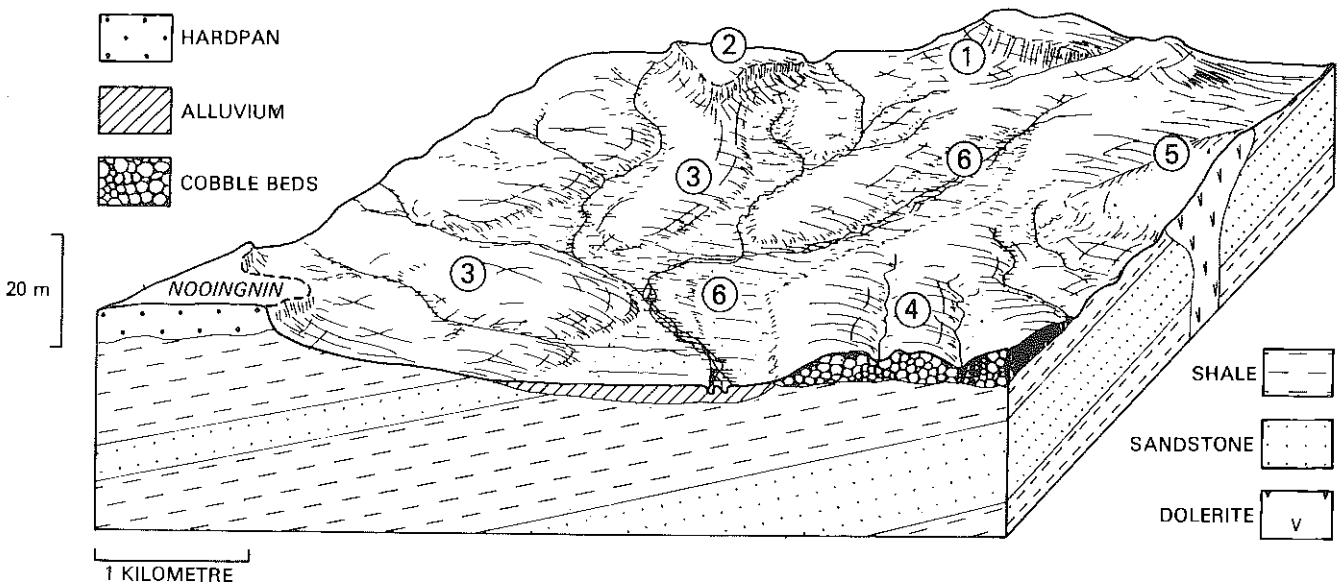
Location: Collier and Newman 1:250 000 map sheets.

Geology: Shale of Middle Proterozoic age (Bangemall Group), minor dolerite, Quaternary colluvium.

Geomorphology: Erosional surfaces — shaly plains; — plains and interfluves on shale, cobble plains, dendritic drainage patterns of moderate to high intensity, narrow saline drainage floors, occasional low shale hills, minor dissected hardpan residuals, minor plains on dolerite, relief mostly below 20 m.

Pastoral use: Mulga short grass forb pastures of low productivity and drought durability, inclusions of better quality stony chenopod and chenopod pastures on drainage floors have been preferentially grazed and are often degraded, controlled stocking necessary to facilitate recovery; system is inherently resistant to erosion.

Estimated carrying capacity, good condition, 19 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	5	**Low hills:** up to 20 m high and 1.5 m in extent, short footslopes up to 30 per cent, dense colluvial mantle of shale rock fragments.	Dark red or dark reddish brown loamy soils with shale inclusions, 20 to 80 cm deep, Um 511.	Low woodland of mulga *Acacia aneura* with low shrubs *Cassia* and *Eremophila* spp., forbs and sparse annual grasses. MSGF pasture land.
2	2	**Residual hardpan plains:** minor areas of hardpan plain up to 500 m in extent with dissected margins and breakaways up to 3 m high.	Dark red or reddish brown acidic loamy soils on hardpan at 10 to 40 cm, Um 531.	Sparse tall open shrubland of mulga and other *Acacia* spp., low shrubs *Cassia* and *Eremophila* spp., forbs and sparse annual grasses. MSGF pasture land.
3	50	**Interfluves and plains on shale:** gently undulating up to 2 km long, mostly less than 500 m between drainage lines, slopes up to 2 per cent, dense colluvial mantle of shale fragments.	Dark red or reddish brown loamy sand or sandy loam soils, gravelly strew of shale fragments, 30 to 50 cm deep to shale, Uc 144, Um 551.	Low open woodland or tall open shrubland of mulga and other *Acacia* spp., low shrubs *Cassia* and *Eremophila* spp., forbs and sparse annual grasses. MSGF pasture land.
4	25	**Cobble plains:** up to 2 km long by 500 m wide, almost flat crests with sloping margins dissected to 2 to 3 m, dense pavement of pebbles and cobbles.	Dusky red or reddish brown loams or loamy soils becoming clayey with depth, dense surface strew, 1 m+ deep, Uc 542, Gn 212.	Depauperate open shrubland *Acacia aneura, A.* aff. *palustris, Cassia* spp., *Eremophila* spp. and forbs. SSGF pasture land.
5	3	**Plains on dolerite:** gently undulating surfaces on dolerite, up to 1 km in extent, variable surface mantle of dolerite fragments.	Reddish brown or yellowish brown alkaline loamy sands on weathered dolerite at variable depth. Uc 511.	Low shrubland of *Cassia oligophylla* with sparse *Eremophila* and *Acacia* spp., also *Rhagodia eremaea* and annual grasses. CSGF pasture land.
6	15	**Saline drainage floors with braided channels:** mostly less than 200 m wide but up to 750 m and 2 to 3 km long, gradients 1 in 100 to 1 in 500, braided channels incised up to 1 m, major single channels up to 40 m wide and 2 to 3 metres deep.	Dusky red or dark reddish brown loams over loamy clay or clay, dense gravel and pebble surface strew, 40 cm to 1 m+ deep. Um 512, 521, Uf 631, Dr 212.	Drainage floors: low samphire *Halosarcia* spp., shrublands or tall open *Acacia* spp. shrublands with understorey of numerous chenopod low shrubs, forbs and annual grasses. CHAT pasture land. Braided channels: dense tall fringing shrubland with *Acacia coriacea, A. sclerosperma, A. citrinoviridis, A. aneura,* numerous low shrubs, forbs and annual grasses. MUCR pasture land.

GIRALIA LAND SYSTEM (3 410 sq km)

Linear dunes and broad sandy plains supporting hard and soft spinifex; exclusive to the coastal plain.

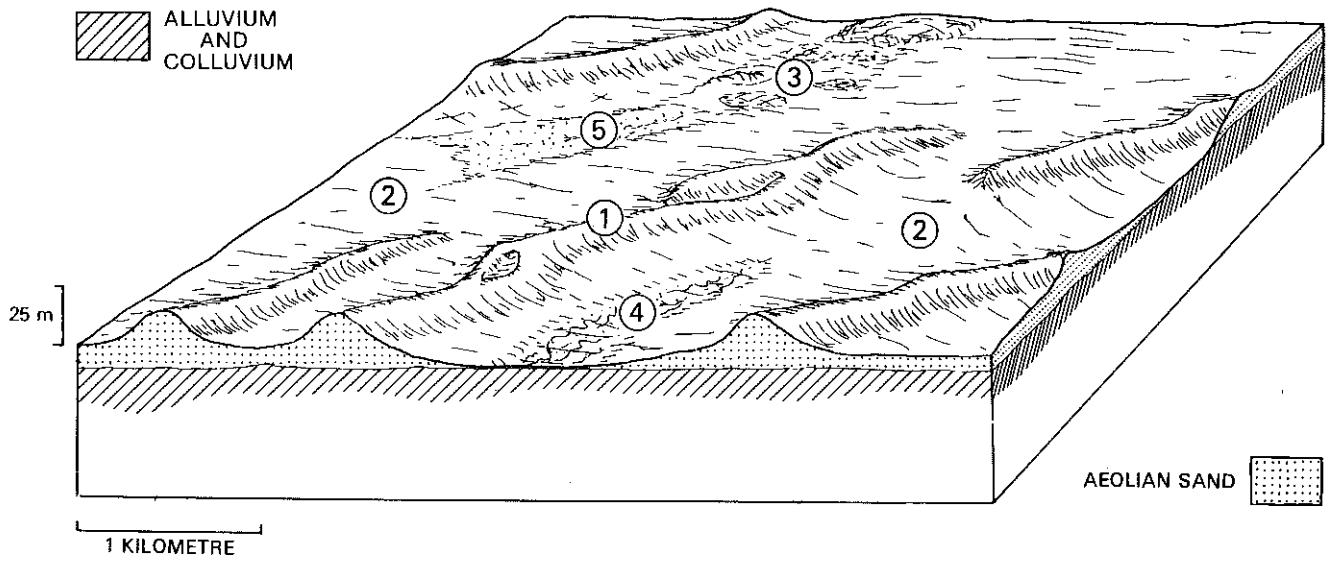
Location: Yanrey 1:250 000 map sheet.

Geology: Quaternary colluvium and aeolian sand.

Geomorphology: Depositional surfaces — sandy plains formed by sheet flood and wind action; — broad non-saline plains with thin sand cover and linear dunes trending north and south, no organised drainage but through flow areas receiving more concentrated sheet flow than adjacent plains; calcrete plains and minor calcreted drainage zones, dune relief up to 30 m.

Pastoral use: Hard spinifex pastures of very low productivity and soft spinifex pastures of moderate productivity and good durability; summer burning followed by a short deferment from grazing required every four or five years; pastures fairly resistant to over-use, some susceptibility to wind erosion after fires but rapid stabilization occurs after rain.

Estimated carrying capacity, good condition, 13 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	15	**Linear dunes:** Parallel dunes up to 30 m high and 12 km long, trending north-south, western dune flanks slope about 25 per cent, eastern slopes 5 to 15 per cent, hummocky surfaces especially on dune crests.	Loose dark red sandy soils 1 m+ deep, Uc 123.	Hummock grasslands of *Plectrachne schinzii* with an overstorey of *Grevillea gordoniana, Pityrodia* and *Tephrosia* spp, *Calytrix longiflora,* numerous annuals after fire. SOSP pasture land.
2	70	**Plains with thin sand cover:** 1 to 3 km wide and up to 50 km long running between dunes. Gradients 1 in 50 to 1 in 1 000.	Loose dark red sandy soils often with loam or clay at less than 1 m Uc 511, Gn 111, 112, 213.	Hummock grassland of hard spinifex *Triodia lanigera* and some soft spinifex *T. pungens* with an overstorey of *Acacia inequilatera, A. translucens, A. victoriae, Hakea suberea* and numerous annuals after fire. HSSP & SOSP pasture land.
3	5	**Calcrete plains:** up to 4 km in extent, with irregular exposures of calcrete producing moundy microrelief, slopes up to 2 per cent.	Dark red alkaline loamy sands on calcrete at 25 cm or less, heavy pebble strew with calcrete outcrop, Uc 113.	Hummock grassland of soft spinifex *Triodia pungens,* with *Acacia bivenosa, Cassia pruinosa, Chorizema* sp. and *Calytrix longiflora,* many annual herbs and grasses after fire. SOSP pasture land.
4	10	**Broad through flow zones:** flat surfaced low areas without channels, up to 1.5 km wide and 4 km long, receiving run off from units 1, 2 and 3, gradients up to 1 in 100.	Dark red acidic sands or sands becoming clayey with depth, 1 m+ deep, Uc 511; where associated with calcrete plains, soils are dark red loamy sands overlying calcrete at variable depth, Uc 123.	Hummock grassland of *Triodia pungens,* sparse tussock grasses, low shrubs, forbs and annual grasses; overstorey tall shrubs *Acacia inequilatera, A. sclerosperma, A. victoriae* or trees *Eucalyptus coolabah, E. setosa.* SOSP pasture land.
5	>1	**Narrow drainage floors associated with calcrete plains:** up to 150 m wide and 3 km long, up to 3 m below adjacent calcrete plains, usually unchannelled.	Crusting, alkaline dusky red clay soils, 1 m+ deep, Uf 612.	Hummock grasslands *Triodia pungens,* sparse tussock grasses, numerous low and tall shrubs *Acacia bivenosa, A. victoriae, A. sclerosperma, Cassia* spp., forbs and annual grasses. SOSP pasture land.

GLOBE LAND SYSTEM (1 261 sq km)

Degraded alluvial plains supporting snakewood shrublands and minor tussock grasslands.

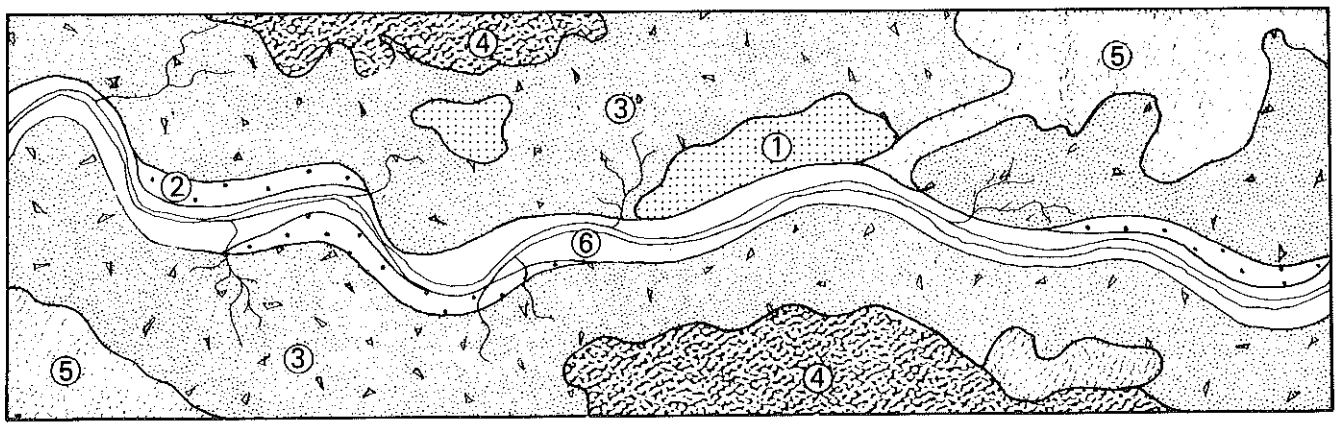
Location: Wyloo and Yanrey 1:250 000 map sheets.

Geology: Quaternary alluvium.

Geomorphology: Depositional surfaces — alluvial plains associated with the Ashburton River; — extensive infrequently flooded alluvial plains and gilgai plains, regularly flooded low lying back plains and depressions, sandy tracts adjacent to the river; channels, banks and poorly developed levees, relief up to 5 m.

Pastoral use: Degraded chenopod pastures of low productivity and durability, tussock grass pastures of moderate productivity and durability; unit 3 is sensitive to grazing and is degraded and eroded with extensive soil hummocking beneath snakewood, control of season and intensity of use essential, some areas suitable for regeneration by seeding and cultural works.

Estimated carrying capacity, good condition, 7 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	6	**Sandy tracts:** hummocky surfaces up to 5 km long and 1.5 km wide parallel and adjacent to the Ashburton River.	Loose surfaced dark red loamy sands, 1 m + deep Uc 511, 531.	Hummock grasslands of hard spinifex *Triodia wiseana,* and soft *Triodia pungens* with an overstorey of *Acacia trachycarpa, A. victoriae.* SOSP pasture land.
2	4	**Levees:** poorly developed up to 300 m wide, gradients about 1 in 100.	Loose surfaced, reddish brown fine loamy sand, 1 m + deep, Uc 113.	Open woodland of *Eucalyptus camaldulensis* and *E. coolabah* with an understorey of *A. trachycarpa, A. coriacea, A. victoriae* and *Cenchrus ciliaris.* TGCE pasture land.
3	55	**Alluvial plains:** generally degraded hummocky surfaces; stone mantle covering deflated areas, plains follow river and are many km long and up to 4 km wide, gradients 1 in 500 to 1 in 1000, infrequently flooded.	Hard setting dark red uniform clay or texture contrast soils, 1 m + deep with dense water worn pebble strew in parts, Uf 621, 653, 671, Dr 212, 213, 413 susceptible to wind erosion.	Patchy tall shrubland of snakewood *Acacia xiphophylla* with *A. victoriae, Cassia desolata, Rhagodia eremaea* and *Enchylaena tomentosa,* frequent bare areas. CHAT pasture land.
4	15	**Gilgai plains:** generally open plains 1 km in extent, with gilgai surfaces, slopes 1 in 1000 or less, infrequently flooded.	Seasonal cracking, dark red alkaline clay soils 1 m + deep. Ug 538 or Uf 621.	Open tussock grassland of *Eragrostis xerophila* with invading overstorey of *Acacia victoriae.* TGER pasture land.
5	15	**Low lying back plains and depressions:** surfaces up to 10 km long and 1 km wide, subject to regular inundation, gradients less than 1 in 1000.	Hard setting, dark red clays or loams, Um 542, Uf 671, Gn 112, Ug 538.	Tall shrubland or open woodland of *Acacia tetragonophylla, A. victoriae* or *Eucalyptus* species *nova* with a dense tussock grass understorey of *Chtysopogon fallax,* or *Eragrostis xerophila,* or *Eriachne benthamii.* TGCH pasture land.
6	5	**Channels and banks:** single or multiple meandering channels up to 150 m wide, numerous permanent or semi permanent pools, steep banks, up to 12 m high and 30 per cent slope.	Deep alluvial soil on banks, dense cobbles or sand in channels, calcrete exposed in parts.	Tall fringing woodland consisting of dense *Eucalyptus camaldulensis, Melaleuca leucodendron* and *Sesbania formosa; Cenchrus ciliaris* understorey on banks. TGCE pasture land.

JAMINDIE LAND SYSTEM (3 834 sq km)

Stony hardpan plains and stony rises with groved mulga shrublands.

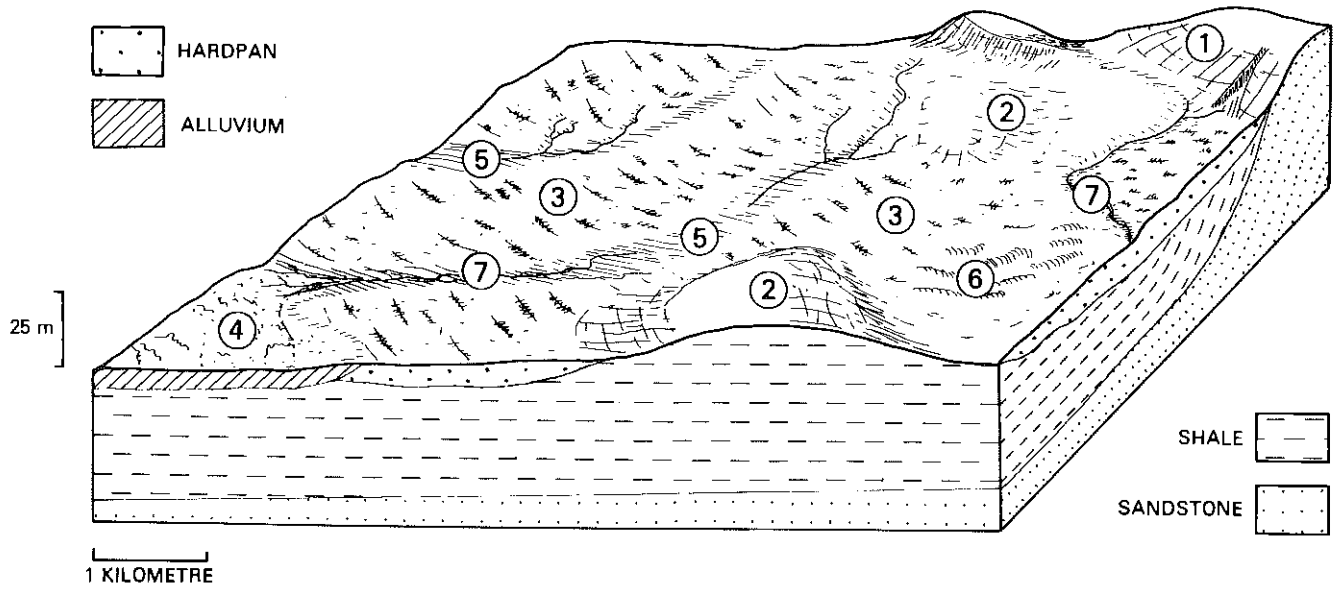
Location: Collier, Edmund, Newman and Turee Creek 1:250 000 map sheets.

Geology: Partly cemented Quaternary colluvium and alluvium, minor shale and siltstone of Middle Proterozoic age.

Geomorphology: Depositional surfaces — hardpan plains; — non-saline plains with hardpan at shallow depth and groved vegetation, stony upper plains and low rises on hardpan or rock at shallow depth, narrow drainage tracts with dendritic and sub-parallel drainage patterns of low intensity; minor stony gilgai plains, sandy banks and low ridges and hills, relief up to 30 m.

Pastoral use: The stony plains support mulga short grass forb or stony short grass forb pastures of very low productivity, runoff from these surfaces concentrates in restricted areas of groves and gilgai plains which support better quality pastures; useful ephemeral growth in favourable seasons but overall productivity, drought durability and carrying capacity is very low, inherently resistant to erosion.

Estimated carrying capacity, good condition, 25 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	10	**Low ridges and hills:** up to 25 m high and 1.5 km long, footslopes 2 to 10 per cent, rock outcrop or dense colluvial mantles.	Very shallow stony soils, much rock outcrop and dense stony strew.	Tall mulga *Acacia aneura* shrublands with low shrubs *Eremophila fraseri, Eremophila* spp., *Cassia* spp., forbs and short annual grasses. MSGF pasture land.
2	20	**Stony upper plains and low rises:** undulating surfaces up to 4 km in extent, up to 30 m above lowest units, slopes up to 5 per cent, dense colluvial mantles.	Dark reddish brown acidic loamy sands and silty loams on parent material usually at less than 50 cm, stony surface pavement, Uc 511, Um 521.	Tall open mulga shrublands with sparse low shrubs *Cassia* and *Eremophila* spp.; forbs and short annual grasses. SSGF pasture land.
3	53	**Hardpan plains with groves:** up to 10 km long by 4 or 5 km wide between shallow drainage tracts, gradients mostly less than 1 in 200 but locally up to 1 in 100, dense cobble and pebble mantle, hardpan exposure in parts; groves up to 400 m long and 20 m wide but commonly much less.	**Intergroves:** Dark reddish brown or dark red acidic loamy sands and silty loams on hardpan at variable depth, stony surface pavement Uc 521, Um 521, 531.	Sparse mulga and other *Acacia* spp. shrublands with sparse *Eremophila* spp. and other low shrubs, forbs and annual grasses; also soft spinifex *Triodia pungens* in northern areas. SSGF pasture land.
	5		**Groves:** dark reddish brown acidic sandy loams, 1 m+ deep, Um 522, 552.	Very dense tall mulga and other *Acacia* spp. shrublands, undershrubs *Cassia, Eremophila, Sida* spp., *Enchylaena tomentosa,* forbs and annual grasses. MUCR pasture land.
4	4	**Gilgai plains:** flat, usually less than 1 km in extent associated with unit 5 or as isolated areas within unit 3.	Dark reddish brown cracking clays 1 m+ deep. Ug 538.	Open shrublands *Acacia* spp. with variable low shrubs and sparse tussock grasses *Eragrostis setifolia, E. xerophila, Eriachne flaccida,* forbs and annual grasses. TGER pasture land.
5	5	**Drainage tracts:** through flow tracts in unit 3, usually 300 to 400 m wide but up to 1 km, channelled or unchannelled, gradients 1 in 200 or less, uneven microrelief, hardpan exposed in parts, variable stony mantle.	Dark reddish brown acidic loamy sands or silty loams usually on hardpan at shallow depth, Uc 511, Um 521.	Tall shrublands of mulga, also *Acacia pruinocarpa, A. citrinoviridis* with understorey of low shrubs and sparse grasses; also soft spinifex *Triodia pungens* understorey in northern areas. MUCR pasture land.
6	1	**Sandy banks:** up to 0.5 m high, mostly less than 100 m long and 10 to 20 m wide, on unit 3, loose hummocky surfaces.	Dark red acidic loamy sands, 1 m+ deep, Uc 511.	Shrublands with *Acacia* spp., *Canthium lineare, Eremophila leucophylla, Cassia* spp., and wandarrie grass *Monachather paradoxa, Eriachne helmsii* forbs and annual grasses. TGMI pasture land.
7	2	**Channels and banks:** 5 to 50 m in width, finely incised 1 to 2 m in hardpan on broad plains, up to 5 m in lower parts.	Bedloads of sand, gravel and pebbles on hardpan at varying depth or incised through hardpan; shallow loamy soils on low banks.	Fringing communities as for unit 5. MUCR pasture land.

JUBILEE LAND SYSTEM (326 sq km)

Limestone hills and undulating stony plains with hard and soft spinifex hummock grasslands, exclusive to the far west of the survey area.

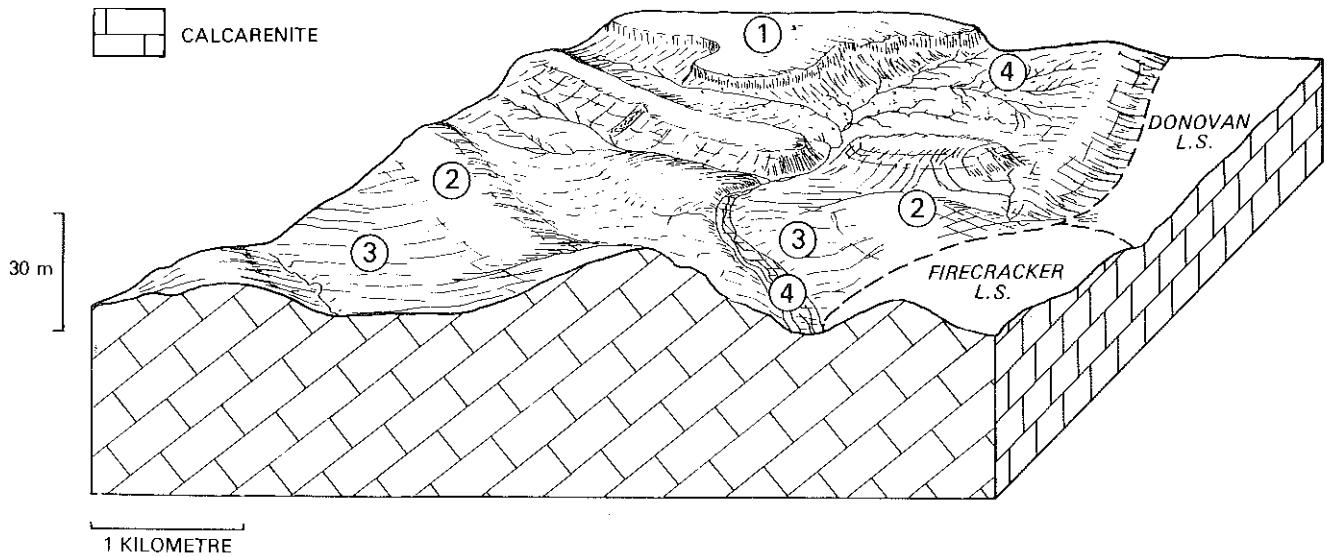
Location: Yanrey 1:250 000 map sheet.

Geology: Marine limestones of Cretaceous and Tertiary age.

Geomorphology: Erosional surfaces — hills and stony plains; — low cuestas with short stony footslopes, extensive undulating stony plains, lower more gently sloping plains; sub-parallel drainage patterns of low to moderate intensity becoming incised and more intense in upper parts, relief up to 40 m.

Pastoral use: Hard spinifex pastures of very low productivity; soft spinifex pastures of moderate productivity and good drought resistance, regular burning required to maintain pastures in attractive conditon for stock, all units inherently resistant to overuse and erosion.

Estimated carrying capacity, good condition, 15 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	20	**Low hills and cuestas:** dissected hill tracts up to 25 m high and several km in extent, near flat or rounded crests, stony slopes up to 40 per cent, strike aligned cuestas up to 5 m high and 5 km long, slopes 1 to 10 per cent with minor structural benches, dense mantle of limestone rock fragments.	Much rock outcrop and surface strew, little soil development.	Hummock grasslands of hard spinifex *Triodia lanigera, T. wiseana* with sparse *Acacia bivenosa* and other shrubs. HSHI pasture land.
2	35	**Undulating stony plains:** up to 4 or 5 km long and 1.5 km between drainage, slopes generally 1 to 2 percent locally up to 4 per cent, relief up to 15 m variable mantle of limestone fragments.	Reddish brown alkaline loams to silty clay loams, depth usually less than 70 cm, Gc 112, Um 511.	Hard spinifex *Triodia wiseana* hummock grassland, sparse low shrubs such as *Acacia retivenia, Melaleuca aff. cardiophylla;* also minor tall shrublands *Acacia xiphophylla, Cassia* spp. HSHI pasture land.
3	40	**Lower plains:** Surfaces mostly without stony mantle and up to 5 km in extent, below units 1 and 2, gradients 1 in 100 or less.	Dark reddish brown alkaline loamy soils becoming clayey with depth, calcareous inclusions throughout, 1 m+ deep, Gc 112.	Hummock grassland of soft spinifex *Triodia pungens* with sparse shrubs *Acacia sclerosperma, A victoriae, Cassia oligophylla* and forbs. SOSP pasture land.
4	5	**Incised upper drainage, narrow drainage floors and channels:** intense pattern of incision up to 5 m in limestone bedrock in restricted upper parts; drainage floors up to 100 m wide with channels 10 to 30 m wide, little incision.	Very shallow stony alkaline soils in upper parts; reddish brown alkaline clay loam to light clay soils in drainage floors, 1 m+ deep, Gc 222.	**Incised upper drainage:** Hard spinifex *Triodia wiseana* hummock grassland. HSHI pasture land. **Drainage floors:** Tall shrubland *Acacia sclerosperma, A. tetragonophylla* with numerous low shrubs, forbs and short grasses. MUCR pasture land.

KOOLINE LAND SYSTEM (8 716 sq km)

Rough shale hills, saline drainage floors and broad braided creeks with sparse shrubs.

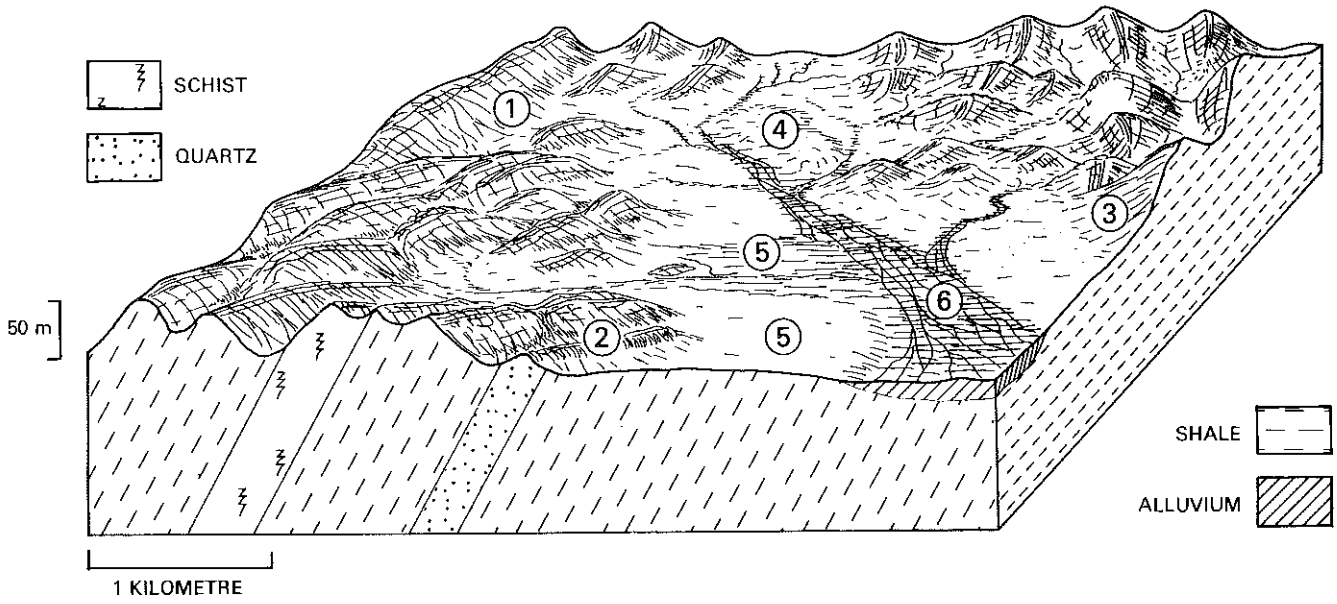
Location: Edmund, Newman, Turee Creek, Winning Pool, and Yanrey 1:250 000 map sheets.

Geology: Lower Proterozoic shales of the Ashburton Formation (Wyloo Group).

Geomorphology: Erosional surfaces — hill tracts; — ridges and hills of steeply dipping maroon shale, stony saline footslopes and saline plains, dendritic drainage patterns of very high intensity in hills, becoming sub-parallel on stony footslopes thence spreading broadly onto saline plains or draining into broad flow zones with characteristic braided channels; minor cobble plains, relief usually less than 50 m but up to 100 m.

Pastoral use: Sparse stony short grass forb pastures with small inclusions of better quality stony chenopod pastures; low productivity, saline ground water, hill parts mostly unsuitable for pastoral purposes, units 5 and 6 susceptible to degradation and erosion.

Estimated carrying capacity, good condition, 21 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	60	**Shale hills and ridges:** up to 100 m high, slopes up to 30 per cent, dense colluvial mantles and steeply dipping shale outcrop.	Pockets of very shallow, often saline soils between shale outcrop, dense platy surface strew.	Low shrubland of dwarf *Acacia aneura, A. tetragonophylla,* also *Cassia leursenii, C. pruinosa, Kallstromia platyptera* and *Eremophila cuneifolia;* isolated areas of hummock grassland dominated by *Triodia wiseana.* SSGF pasture land.
2	1	**Quartz ridges:** up to 50 m high and 1 km long by 0.5 km wide, steep rocky slopes.	Pockets of very shallow saline stony soil between areas of outcropping quartz, dense strew of white quartz fragments.	As for unit 1. SSGF pasture land.
3	20	**Lower footslopes:** up to 0.5 km in extent, concave with dense quartzy mantle; slopes between 0.8 and 1.5 per cent dissected to shale at 0.5 m by narrow creeklines.	Shallow, dark red saline loams often with clay at depth; dense surface strew of quartz pebbles Um 521, Gn 283.	Tall open shrubland of sparse *Acacia xiphophylla* with understorey of halophytic low shrubs; *Halosarcia* sp, *Frankenia* sp, and *Scaevola spinescens.* SSGF and SAMP pasture lands.
4	2	**Raised cobble plains:** up to 1 km in extent and raised 2 to 3 m above surrounding units, flattish surfaces, with short marginal slopes to 3 per cent, dense cobble mantle.	Dark red shallow loams dense stony pavement of pebbles or cobbles. Um 642.	Low open shrubland of *Eremophila freelingii* with overstorey of *Acacia aneura* and *A. victoriae.* SSGF pasture land.
5	8	**Saline sluggish drainage plains:** up to 0.5 km in extent, marginal to lower footslopes and braided flow lines, gradients 1 in 125 to 1 in 250, often with narrow gutters and flow lines.	Hard setting dark red saline loams, clays or texture contrast soils, 1 m+ deep, stony pavement of quartz pebbles, Um 542, Uf 631, 653, Gn 212, Dr 213.	Low open halophytic shrubland *Atriplex bunburyana,Frankenia* sp., *Maireana platycarpa* and *Halosarcia* sp. with overstorey of *Acacia victoriae.* CHAT pasture land
6	10	**Flow zones with braided channels:** up to 1.25 km wide and 10 km long, flat or guttered surfaces receiving run off from other units, braided channels up to 20 m wide incised up to 1.5 m, gradients 1 in 150 to 1 in 500.	Loose surfaced, dark red sands, loams or texture contrast soils, 1 m+ deep, without strew. Uc 511, 521, 531. Um 522, Gn 112, 211, Dr 213, 252, soils susceptible to erosion.	Tall shrubland of *Acacia wanyu* and *A. kempeana* with shrub understorey including *Cassia desolata, Eremophila leucophylla, Ptilotus obovatus* and sparse grasses *Chrysopogon fallax, Enteropogon acicularis* and forbs. MUCR pasture land.

KUNDERONG LAND SYSTEM (1 747 sq km)

Sandstone hills and outcrop plains covered in dwarf scrub, minor hardpan plains.

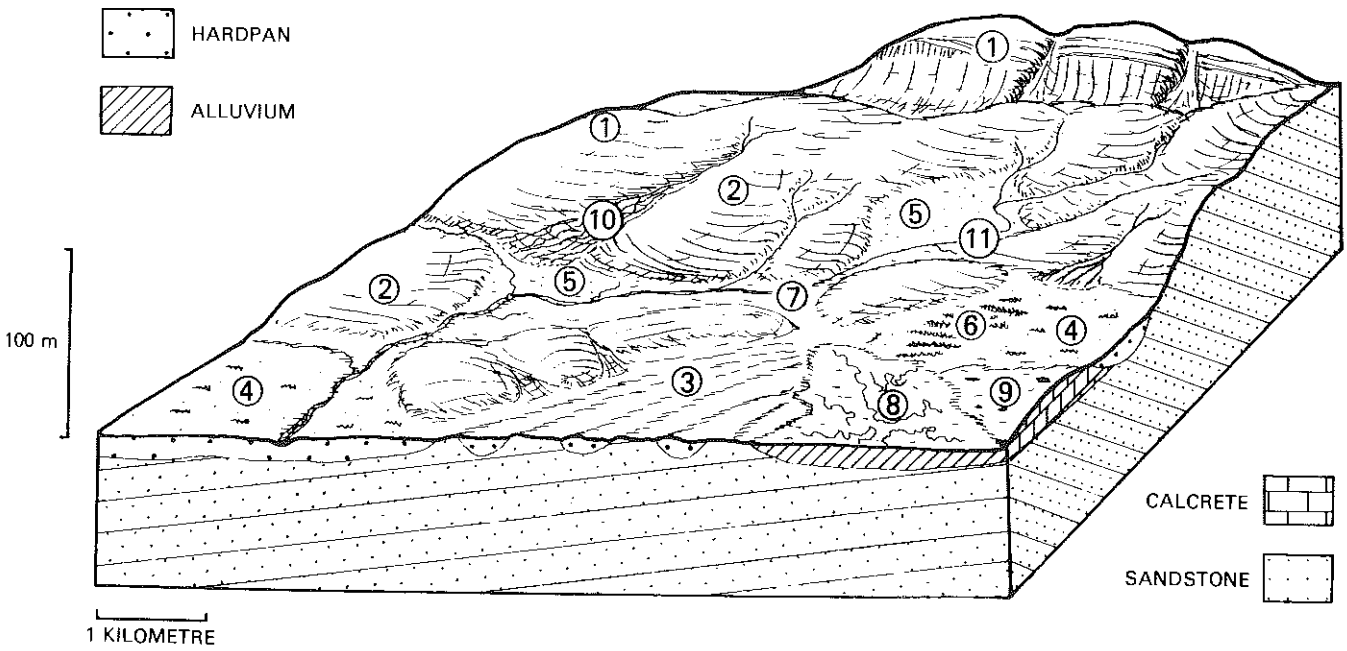
Location: Newman and Turee Creek 1:250 000 map sheets.

Geology: Middle Proterozoic Kunderong sandstone of the Bresnahan Group, in parts covered by a veneer of colluvium and alluvium and intruded by dolerite sills.

Geomorphology: Erosional surfaces — hills and plains; — low rounded hills with sparse radial drainage patterns, occasional more massive hills and ridges; gently undulating outcrop plains and hill spurs with sparse parallel drainage lines forming alluvial fans at the interface with adjacent hardpan plains; drainage floors on dolerite, minor groved through flow areas and minor internal drainage flats; relief mostly below 65 m but locally up to 150 m.

Pastoral use: Cassia short grass forb and stony short grass forb pastures of very low productivity and drought durability, marginally better mulga short grass forb pastures; restricted areas of good quality chenopod and tussock grass pastures mostly degraded and requiring periodic spelling; units 5, 6 and 7 moderately susceptible to erosion, other units stable.

Estimated carrying capacity, good condition, 21 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	26	**Low rounded hills, large ridges:** mostly less than 65 m high but some large ridges to 150 m or more, gently rounded hill crests, stony convex slopes with prominent structual benching and mostly sloping less than 9 per cent but locally greater, sandstone outcrop and dense flaggy mantle.	Isolated pockets of shallow soil between sandstone outcrop, dense surface strew of flaggy sandstone rock fragments.	Low shrubland of *Acacia tetragonophylla, Cassia leursenii, C. helmsii, C. cardiosperma, Eremophila freelingii, Corchorus macropetalus,* forbs and annual grasses. SSGF pasture land.
2	40	**Undulating outcrop plains:** up to 10 km long and 5 km wide, gently undulating with relief up to 10 m, gradients about 1 in 100 but locally greater, benched surfaces with outcropping saudstone in parallel bands 3 to 5 m apart, dense flaggy mautle.	Soil developed between parallel outcrops of sandstone; dark red acidic loamy sands mostly less than 30 cm deep, stouy pavement of flaggy sandstone, Uc 511.	Low shrubland of dwarf mulga *Acacia aneura, A. tetragonophylla,* and *Eremophila fraseri, Kallstroemia platyptera, Ptilotus obovatus,* forbs and annual grasses. SSGF pasture land.
3	10	**Outcrop and hardpan plains:** up to 3 km iu extent, gradients 1 in 250 or less, parallel outcrops of saudstoue 40 to 60 m apart, iutervening surfaces with hardpan at shallow depth; subject to sheet flow.	Dark red acidic silty loams on hardpan mostly at less than 30 cm, stony pavement of flaggy sandstone fragments, Um 531.	Low open shrubland of *Eremophila spathulata,* sparse *Rhagodia eremaea,* forbs and annual grasses. SSGF pasture land.
4	10	**Hardpan plains with groves:** up to 2 km wide and 4 km long, gradients 1 in 50 to 1 in 200, subject to sheet flow.	**Intergroves:** Hard surfaced, dark reddish brown loams, mostly less than 20 cm to hardpan. **Groves:** Dusky red silty clay loams 1 m+ deep on hardpan, Um 522.	Sparse mulga and other *Acacia* spp shrublands, sparse low shrubs, forbs and annual grasses. MSGF pasture land. Tall shrubland of *Acacia aneura, A. tetragonophylla* and *Canthium latifolium* with understorey of *Eremophila* aud *Cassia* spp, and sparse pereunial grasses. MUCR pasture land.
5	4	**Drainage floors on dolerite:** up to 2 km long and 1 km wide, gradients from 1 in 100 to 1 in 1000, dolerite exposures and sluggish flow liues.	Seasonal cracking dark red light clay, 1 m+ deep, variable strew of dolerite pebbles and cobbles, Ug 538.	Tussock grassland of *Eragrostis xerophila, E. setifolia* and *Eriachne flaccida,* with overstorey of sparse low shrubs *Cassia hamersleyensis, C. oligophylla, Solanum lasiophyllum.* TGER pasture land.
6	1	**Flow areas with groves:** draiuage zones associated with uuit 2, up to 2 km long and 0.5 km wide, gradients mostly less than 1 in 500.	**Intergroves:** Hard surfaced dark reddish brown loams, mostly less than 20 cm to hardpan. **Groves:** Seasonal cracking dark reddish brown, light clay,1 m+ deep onto sandstone, Ug 538.	Low open shrubland of *Eremophila incisifolia* with sparse mulga *Acacia aneura,* other shrubs, forbs and annual grasses. SSGF pasture land. Low open *Acacia aneura* woodland with moderately dense low shrubs *Eremophila fraseri, E.* spp, tussock grass *Chrysopogon fallax* forbs and anuual grasses. TGCH pasture land.
7	4	**Drainage floors associated with sandstone or calcrete:** up to 1 km long and 0.5 km wide, gradients about 1 in 300.	Reddish brown alkaline soils, silty loams at surface increasing clay content with depth, 1 m+ deep, moderate gravel strew, Gc 112.	Low woodland of *Acacia aneura* with understorey of *A. victoriae, Maireana pyramidata* and *M. tomentosa,* forbs aud annual grasses. CHMA pasture land.
8	2	**Internal drainage flats with linear gilgais:** flat plains up to 3.5 km loug and 2 km wide with sluggish meandering drainage tracts.	Seasonally cracking, dark reddish brown light clays with pebbly sandstone strew, 1 m+ deep, Ug 538.	Tussock grasslands of *Eragrostis xerophila* and *Eriachne flaccida* with sparse overstorey of low shrub *Chenopodium auricomum,* forbs and annual grasses. TGER pasture land.
9	1	**Calcrete platforms:** up to 1 km loug aud 0.5 km wide adjacent to major drainage lines, gradients up to 1 in 100.	Reddish browu alkaline loamy sands on calcrete at shallow depth, heavy mantle of gravel, Uc 512.	Tall mulga *Acacia aneura* shrubland, *Eremophila fraseri,* annual grasses especially *Enneapogon polyphyllus* and forbs in season. MSGF pasture land.
10	1	**Alluvial fans:** up to 1.5 km wide and 1 km long and sloping at 1 per cent, where flow lines from unit 2 meet units 3 or 4.	Dark red loamy soils, 1 m+ deep, Uc 521.	Tall shrublands of *Acacia aneura* with low shrubs such as *Eremophila leucophylla* and annual forbs and grasses in season. MUCR pasture land.
11	1	**Channels and creeklines:** up to 50 m wide, shallow incision up to 2 m, calcreted in parts.	Bedloads of loose sand, cobbles and sandstone rock fragments, banks and interchannel areas shallow alluvial deposits of dark red sands or clay loams, Uc 511, Um 511.	Fringing woodland of *Eucalyptus camaldulensis* or tall shrubland of *Acacia aneura, A. pruinocarpa* or *A. tetragonophylla* with low shrubs *Ptilotus obovatus, Cassia helmsii,* various perennial grasses *Themeda australis, Chrysopogon fallax,* forbs and annual grasses. MUCR pasture land.

LATERITE LAND SYSTEM (661 sq km)

Small laterite mesas and gravelly plains supporting sparse mulga shrublands.

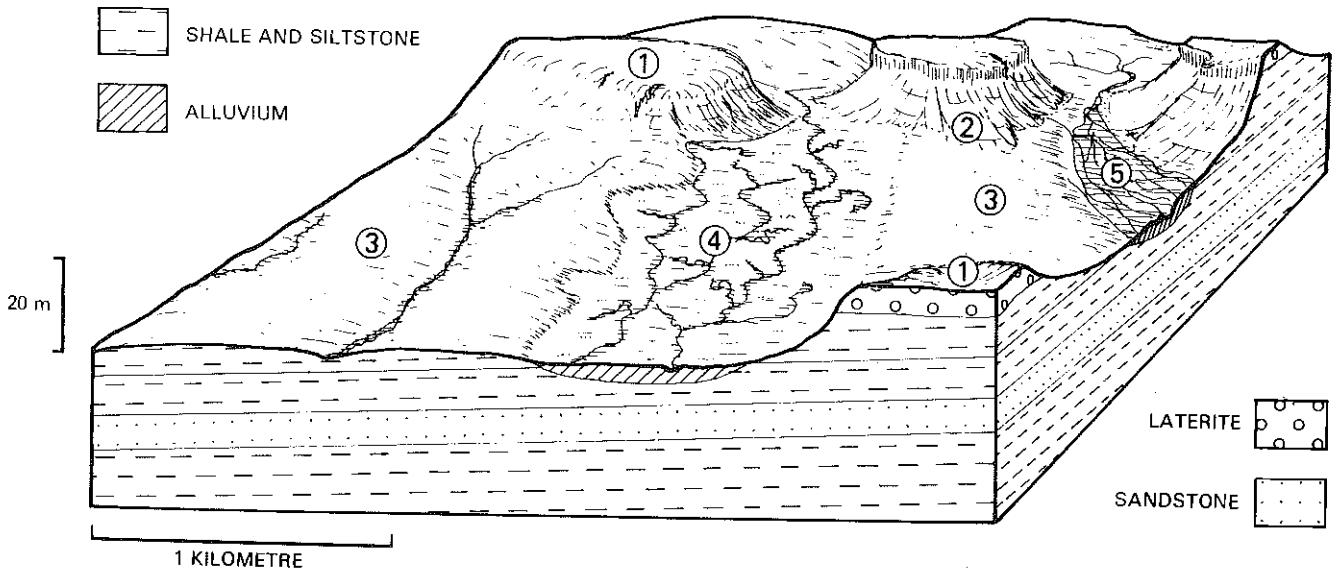
Location: Collier, Mt. Egerton and Turee Creek 1:250 000 map sheets in the east of the area.

Geology: Tertiary laterite and limonite overlying weathered lower Proterozoic (Bangemall Group) sediments.

Geomorphology: Surfaces formed by dissection of lateritised parts of the old Tertiary plateau;—low lateritised mesas and residuals with short vertical breakaway faces overlying pallid zone of weathered bedrock, gravelly footslopes and lower plains frequently saline; drainage tracts and floors with sluggish drainage or sub-parallel braided creeks; relief up to 30 m.

Pastoral use: Mulga short grass forb and stony short grass forb pastures of very low productivity with minor inclusions of better quality pastures along the drainage lines; ephemeral pastures should be used on an opportunistic basis, sparse perennials provide some drought reserves; most units inherently stable but some erosion and pasture deterioration occurs on unit 4.

Estimated carrying capacity, good condition, 16 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	30	**Mesas and low hills:** lateritized residuals up to 2 km long and 200 m wide, up to 25 m high; nearly flat mesa tops or rounded crests, vertical breakaway faces up to 3 to 4 m, dense mantle of dark lateritic gravel and pebbles.	Alkaline, reddish brown sandy clay loam, up to 50 cm deep, with dense lateritic gravel surface strews. Um 511.	Low mulga woodland*Acacia aneura* with an understorey of *A. victoriae, A. kempeana, A. tetragonophylla, Cassia pruinosa, Kallstroemia platyptera, Eremophila fraseri,* forbs and annual grasses. MSGF pasture group.
2	15	**Mesa footslopes:** extending up to 200 m downslope between shallow sub-parallel drainage lines, slopes up to 10 per cent often with dense surface mantle.	Reddish brown gradational soils 1 m+ deep, Gn 213, often with dense black lateritic strew covering a snuffy surface and gypsum accumulations in profile.	Tall shrubland of *Acacia aff. xiphophylla* with understorey of *Cassia pruinosa, Eremophila cuneifolia, Lepidium leptopetalum,* forbs and annual grasses. SSGF pasture land.
3	25	**Gravelly plains:** gently undulating plains and interfluves up to 1 km in extent, separated by parallel drainage lines; gradients 1 in 50 to 1 in 200.	Reddish brown gradational soils, silty loams near surface, increasing alkalinity and clay content at depth,1 m+ deep, dense black lateritic strew Gn 213, 222.	Low open shrubland of *Cassia pruinosa, Eremophila cunefolia, E. lachnocalyx, Lepidium leptopetalum, Maireana georgei,* and *Ptilotus obovatus* with a sparse overstorey of *Acacia victoriae, A. cuspidifolia,* forbs and annual grasses. SSGF pasture land.
4	20	**Sluggish drainage tracts:** up to 500 m wide and 5 km long, gradients up to 1 in 200, stony gilgai microrelief.	Reddish brown light-medium clay 1 m+ deep, dense black lateritic strew surrounding puffs and depressions which are bare of strew but have seasonal cracking self mulching surfaces, Ug 538, Uf 631.	Open tussock grassland of *Eragrostis xerophila* and *E. setifolia* with sparse overstorey of low shrubs,*Eremophila lachnocalyx, Halosarcia sp., Atriplex vesicaria* and *Acacia victoriae.* TGER pasture land.
5	10	**Floors with braided creeklines:** up to 200 m wide and 3 km long, gradients up to 1 in 150 numerous closely spaced braided flowlines with little incision.	Dark red gradational soils, silty loams near surface, increasing alkalinity and clay with depth,1 m+ deep, dense gravel strew, Gn 213.	Low open woodland *Acacia aneura* with dense understorey of *Acacia wanyu, Enchylaena tomentosa, Rhagodia eremaea, Ptilotus obovatus* and *Cassia oligophylla.* MUCR pasture land

LITTORAL LAND SYSTEM (1 142 sq km)

Extensive bare coastal mudflats flanked by mangroves and narrow sandy plains.

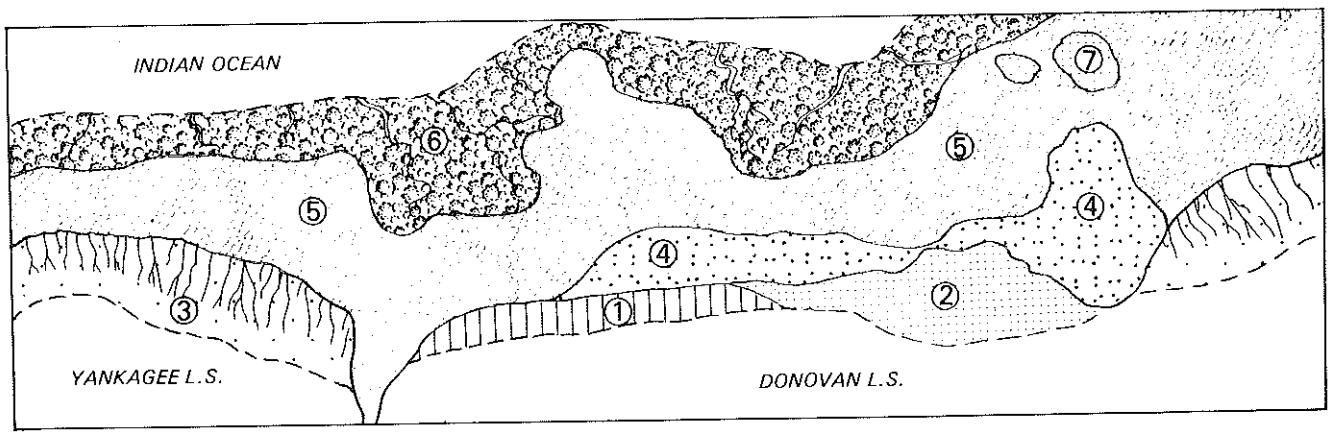
Location: Yanrey 1:250 000 map sheet.

Geology: Quaternary coastal mud and silty loam; aeolian sand.

Geomorphology: Depositional surfaces — saline coastal flats; — estuarine and littoral surfaces with extensive bare saline mudflats subject to infrequent tidal inundation, slightly higher samphire flats, mangrove seaward fringes with dense branching patterns of shallow tidal creeks, saline slopes marginal to mudflats and with intense parallel dissection patterns, minor linear dunes and sandy plains; relief up to 6 m.

Pastoral use: The mudflats (70 per cent) produce no pasture while the remainder consists of moderately productive soft spinifex pastures of good drought durability and samphire pastures of very low productivity; spinifex pastures should be burnt periodically.

Estimated carrying capacity, good condition, 76 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	2	**Dunes:** up to 4 m high and 4 km long, sloping up to 20 per cent, hummocky microrelief.	Loose white calcareous sand, 1 m+ deep. Uc 111.	Hummock grassland of soft spinifex *Triodia pungens* with low shrubs *Acacia translucens, Scaevola sericophylla,* also perennial grass *Cenchrus ciliaris.* SOSP pasture land.
2	3	**Sandy plains:** up to 2 km in extent associated with dunes and on landward margins of samphire flats.	Loose white calcareous sand, variable depth over limestone, or sand over clay. Uc 111.	Hummock grassland of *Triodia pungens* with*Chrysopogon fallax* and occasional *Atriplex bunburyana.* SOSP pasture land.
3	4	**Marginal slopes to mudflats:** up to 0.5 km wide and 6 km long, sloping up to 3 per cent, hummocky micro-relief, intense, short parallel drainage lines incised to 1 m.	Loose surfaced reddish brown saline silty clay developed by accumulation of deflation deposits from mudflats, 1 m+ deep, Uf 133.	Sparse tall shrubland of *Acacia victoriae* with *A. sclerosperma* with sparse *Atriplex bunburyana, Halosarcia halocnemoides* and *Spinifex* sp. STCH pasture land.
4	6	**Samphire flats:** flat plains slightly raised above and adjacent to bare mud flats, up to 2 km long and 0.5 km wide.	Hard setting reddish brown gradational soils changing from silty loam to silty clay with depth, calcareous throughout, 1 m+ deep, Gc 221.	Low shrubland of *Halosarcia auriculata, H. halocnemoides* and *Maireana amoena.* SAMP pasture land.
5	70	**Mudflats:** up to 15 km in extent, bare, near flat surfaces occasionally inundated by sea during peak tides.	Saline muds.	No vegetation.
6	14	**Mangrove outer margins:** up to 1 km wide flanking tidal creeks and in the tidal zone abutting adjacent mudflats.	Saline muds.	Dense mangrove *Avicennia marina* community.
7	1	**Sandy islands:** oval or circular, up to 2 km in extent, usually surrounded by bare mudflats.	Sandy soils.	Probably hummock grassland of *Triodia pungens.* SOSP pasture land.

MINDEROO LAND SYSTEM (1 648 sq km)

Alluvial plains supporting tall shrublands and tussock grasslands and sandy plains supporting hummock grasslands.

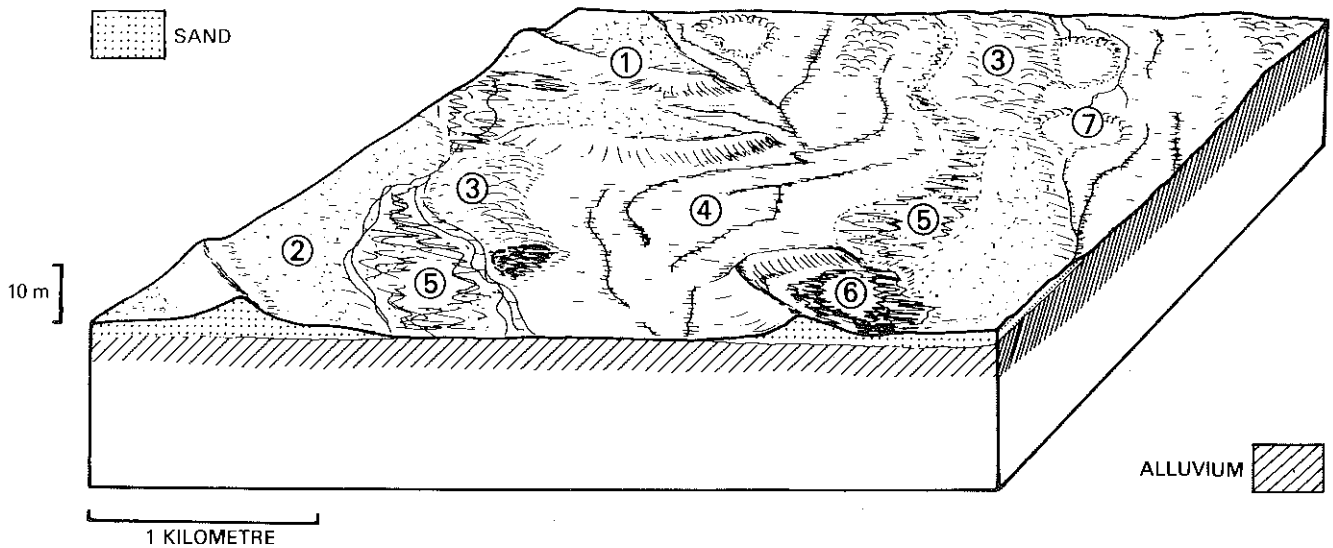
Location: Yanrey 1:250 000 map sheet.

Geology: Quaternary alluvial and aeolian deposits.

Geomorphology: Depositional surfaces — alluvial plains; — old flood plains associated with the Ashburton River and plains formed by sheet flood and deflation, no organised drainage; aeolian sand plain and dunes with up to 20 m relief, gilgai plains, plains receiving broad through flow; claypans, swamps and depressions.

Pastoral use: Valuable tussock grass and soft spinifex pastures, high carrying capacity with good drought durability, unit 3 is very sensitive to use, unit 4 also sensitive and both erode if overused, areas of severe erosion are present.

Estimated carrying capacity, good condition, 4 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	10	**Sand dunes:** linear, up to 4 km long by 100 m wide and 20 m high, usually less than 1 km apart and mostly trending north-west to south-west, also arcuate dunes around swamps and depressions, slopes mostly less than 7 per cent.	Loose surfaced dark red sand or sandy loam, 1 m+ deep, Uc 123.	Hummock grassland of *Plectrachne schinzii* with an overstorey of *Acacia murrayana, A. translucens, Corchorus walcottii,* and *Grevillea gordoniana* and the grass *Cenchrus ciliaris,* forbs and annual grasses. SOSP pasture land.
2	15	**Sand plains:** up to 1 km in extent with hummocky micro-relief, slopes up to 4 per cent.	Loose surfaced, dark red sand, often over clay, 1 m+ deep, Uc 123, 143, 511, Dr 113.	Hummock grassland of *Plectrachne schinzii* and *Triodia pungens* with an overstorey of *Acacia sclerosperma, A. tetragonophylla, A. victoriae, Eremophila leucophylla, Eucalyptus coolabah,* and *Rhagodia eremaea.* SOSP pasture land.
3	15	**Hummocky plains:** up to 1 km in extent, large hummocks 1 m+ under snakewood tall shrubs in disturbed areas, gradients mostly less than 1 in 200.	Hard setting, reddish brown, alkaline light-clays, 1 m+ deep, Uf 621.	Tall shrublands of *Acacia xiphophylla* with a mixed understorey of low shrubs *Atriplex bunburyana, Cassia desolata* and the grass *Eragrostis xerophila.* STCH pasture land.
4	30	**Plains with through drainage:** up to 5 km long and 0.5 km wide, gradients 1 in 200 to 1 in 1000, flat or truncated micro-relief; receives run-off from dunes, sand sheets and hummock plains.	Hard setting dark reddish brown alkaline clay loam or clay, 1 m+ deep Um 143, Uf 621, Gn 143, Ug 538.	Tall shrubland of *Acacia tetragonophylla, A. victoriae* and rarely understorey of *Cenchrus ciliaris* and *Chrysopogon fallax;* occasionally *Triodia pungens.* TGCH pasture land.
5	15	**Gilgai plains:** up to 2 km long and 1 km wide with slopes less than 1 in 1000, receiving run off from the through drainage plain.	Seasonally cracking, dark reddish brown alkaline light to medium clays,1 m+ deep, Ug 538.	Variable open tussock grassland of*Astrebla elymoides, Chrysopogon fallax* or *Eragostis xerophila* or *Eriachne benthamii* or *Sporobolus virginicus* with an open tall shrub overstorey of *Acacia tetragonophylla* and *A. victoriae.* TGAS pasture land.
6	10	**Swamps and depressions:** up to 300 m diam., flat, subject to inundation.	Seasonally cracking, dark reddish brown, light to medium clay, 1 m+ deep Ug 538.	Low open woodland of *Eucalyptus coolabah* with a low shrubby understorey of *Muehlenbeckia cunninghamii* with *Sporobolus virginicus* and other tussock grasses. TGMI pasture land.
7	5	**Claypans:** Circular or oval deflation lag depressions, up to 500 m wide and 3 m below the level of the surrounding sandplain.	Dark red clay soils, with glazed or crusted surfaces, 1 m+ deep, Uf 612, 621.	Usually bare but occasionally supports *Eriachne gardneri.*

MULGUL LAND SYSTEM 637 sq km)

Rough dolomite hills supporting sparse mulga and low shrubs.

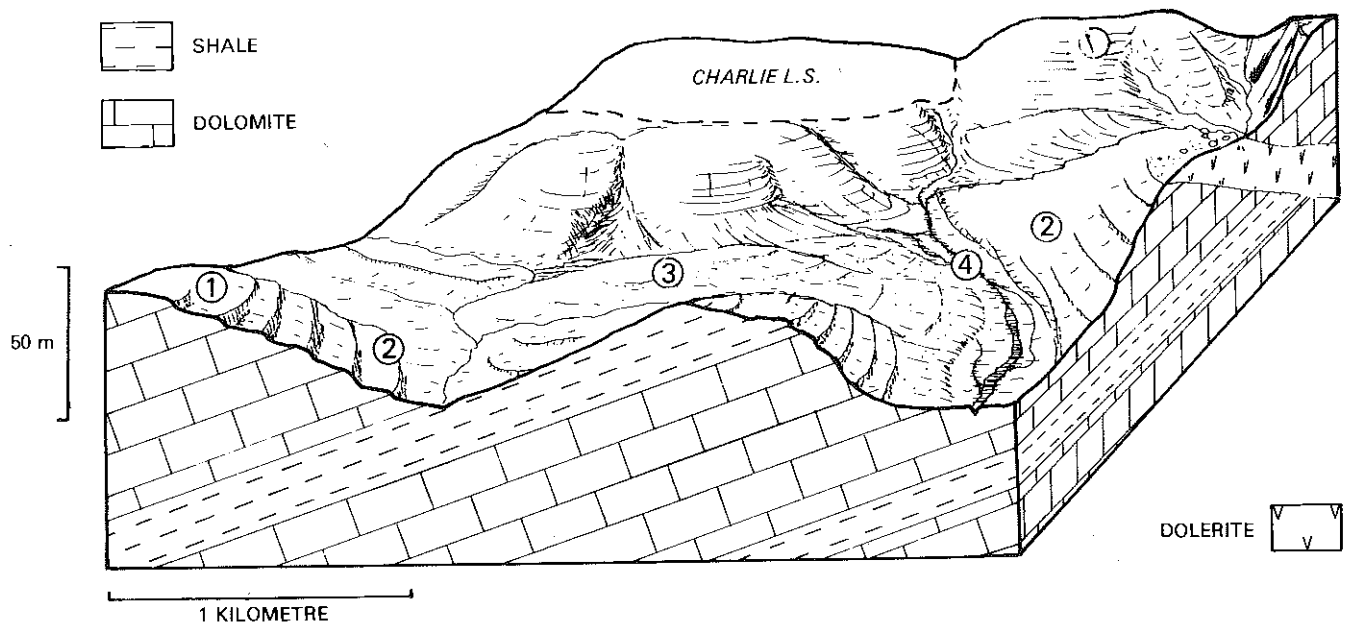
Location: Edmund, Mt Egerton and Collier 1:250 000 map sheets in the south-east of the area.

Geology: Strongly banded dolomites of the Middle Proterozoic Bangemall Group, including Devils Creek, Top Camp, Irregully and Discovery Chert Formations.

Geomorphology: Erosional surfaces — hill tracts; — dolomitic hills, parallel ridges and cuestas, isolated domes; steep benched slopes, sub-parallel drainage patterns of moderate intensity; relief up to 70 m.

Pastoral use: Mulga short grass forb and cassia short grass forb pastures of low productivity, useful ephemeral pastures after rain but with little durability; system mostly not susceptible to erosion but pasture degradation occurs with overuse.

Estimated carrying capacity, good condition, 32 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	75	**Dolerite hills, ridges and cuestas with benched slopes:** tracts up to 20 km in extent and 40 m high; rounded crests, concave and covex stony slopes up to 20 per cent with prominent structural benching formed on gently dipping sediments, dense colluvial mantle.	Isolated pockets of shallow reddish brown alkaline loams between dolomite outcrops, dense surface strew of platy dolomite rock fragments, Um 511, 551.	Low shrubland supporting *Acacia aneura, Cassia desolata, C. helmsii, C. leursenii, C. oligophylla, Eremophila leucophylla, E. exilifolia, Ptilotus obovatus* and *Rhagodia eremaea,* forbs and annual grasses. MSGF pasture land.
2	10	**Lower footslopes:** extending down slope for up to 0.5 km slopes up 3.5 per cent, shallow dissection by narrow parallel creeklines to form low spurs, rock outcrop and dense colluvial mantle.	Shallow, reddish brown calcareous loamy sands with gravel strew between parallel benches of outcropping dolomite Uc 511.	Tall open mulga *Acacia aneura* shrubland with low shrub understorey of *Cassia oligophylla, C. pruinosa, Eremophila lachnocalyx, Maireana georgei, M. tomentosa* and *Ptilotus obovatus* forbs and annual grasses. CSGF pasture land.
3	10	**Irregular outcrop plains:** up to 1 km in extent, slopes mostly less than 2 per cent but local benched surfaces to 5 per cent, dolomite outcrop.	As for unit 2.	As fo unit 2.
4	5	**Narrow drainage floors and creeklines:** up to 75 m wide, 2 km long with channels incised 1 to 2 m, occasional major channels up to 30 m wide and incised to 5 m.	Dark red alkaline clay loam over light clay, crusting surfaces, 1 m+ deep, Gn 413, Channel bedloads of sand, gravel and pebbles.	**Floors:** tall open woodland of *Acacia aneura* and *A. citrinoviridis,* with understorey of *A. tetragonophylla, A. victoriae, Cassia helmsii, Eremophila leucophylla, E. aff dielsii* and *Ptilotus obovatus* forbs and annual grasses. **Creeklines:** as for floors but much denser. MUCR pasture land.

MUNDONG LAND SYSTEM (666 sq km)

Gently undulating plains with open snakewood and mulga shrublands.

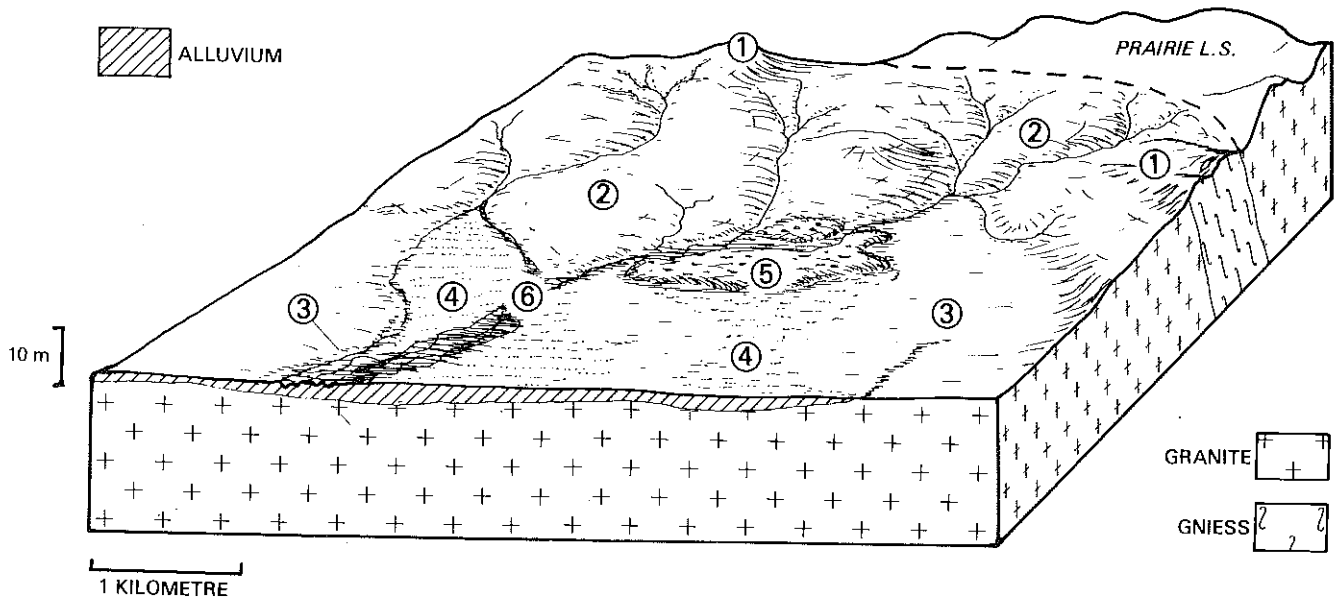
Location: Winning Pool and Edmund 1:250 000 map sheets.

Geology: Lower Proterozoic granites and metamorphosed Ashburton Formation (Wyloo Group), also Quaternary colluvium and alluvium.

Geomorphology: Erosional surfaces — stony plains and soil covered plains; stony rises, gently undulating stony plains, lower plains and gilgai plains flanking major drainage lines; finely dendritic drainage patterns of moderate to high intensity in upper parts forming broad flow lines emptying into major trunk drainage on lower plains; relief mostly less than 10 m but locally up to 25 m.

Pastoral use: Mostly stony chenopod pastures of low to moderate productivity and fair durability, some useful tussock grass pasture; vegetation frequently degraded but units generally not prone to erosion, controlled stocking required.

Estimated carrying capacity, good condition, 11 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	10	**Stony outcrop rises:** rounded upper interfluves up to 2 km in extent, often with intense finely etched drainage patterns, slopes 2 to 5 per cent, dense stony mantle and rock outcrop.	Very shallow dark red sandy soils, Uc 143, dense stone pavement of quartz and granite rock fragments and frequent granite outcrop.	Very sparse tall snakewood *Acacia xiphophylla* shrubland, with very sparse low shrubs *Eremophila latrobei* and *Kallstroemia platyptera,* and tussock grass *Eragrostis xerophila* numerous annuals after rain. SSGF pasture land.
2	32	**Gently undulating stony plains:** up to 1 km wide and extending up to 3 km downslope, slopes up to 1 per cent, vegetation patterns tend to be banded, dense quartzy mantle.	Dense pavement of quartz gravel over dark reddish brown sandy loam, 50 cm to 1 m+ deep, Uc 143, 512, 531, also Dr 213.	Tall shrubland of *Acacia victoriae, A. xiphophylla* and *A. aneura* with sparse low shrubs such as *Cassia desolata, C. helmsii* and *Eremophila cuneifolia,* forbs and annual grasses. STCH pasture land.
3	25	**Lower plains flanking major drainage lines:** up to 3 km in extent, gradients 1 in 500 to 1 in 1000, variable quartzy mantle.	Dark red gradational or duplex soils variable depth, loamy surfaces with clay at depth, Dr 413.	Tall shrubland of *Acacia xiphophylla, A. victoriae* with understorey of *Cassia desolata, Eremophila cuneifolia,* forbs and annual grasses. STCH pasture land.
4	15	**Gilgai plains:** up to 2 km wide and 5 km long flanking the major drainage lines, gradients less than 1 in 1000, normal and linear gilgai microrelief.	Seasonally cracking, dark red, alkaline medium clays, 1 m+ deep, Ug 538.	Open tussock grassland of *Eragrostis xerophila* with sparse understorey of *Acacia victoriae, A. xiphophylla, Cassia oligophylla, Solanum lasiophyllum* and forbs. TGER pasture land.
5	8	**Calcrete platforms:** surfaces up to 0.8 km in extent adjacent to major incised drainage lines.	Reddish brown alkaline loams with calcrete pebble strew, up to 30 cm deep, Um 511, Gc 112.	Hummock grassland of *Triodia wiseana* or tall shrubland of *Acacia victoriae, A. xiphophylla* with understorey of *Cassia desolata, C. helmsii* and *Eremophila cuneifolia.* HSHI or SSGF pasture land.
6	10	**Flow zones and channels:** up to 0.5 km wide and 8 km long frequently unchanneled or with only slight incision, becoming channeled in lower parts when joining major trunk drainage, gradients 1 in 600 to 1 in 1000.	Dark red acidic gradational soils, sandy surfaces increasing clay at depth, up to 1 m deep, Gn 112 and Uc 413; major channels with sandy bedloads.	Dense low woodland of *Acacia aneura* and *A. citrinoviridis* with numerous shrubs such as *A. xiphophylla, A. tetragonophylla, Cassia helmsii* and *Scaevola spinescens,* perennial grass *Chrysopogon fallax* and forbs. MUCR pasture land.

NADARRA LAND SYSTEM (264 sq km)

Plains and calcrete rises with chenopod shrublands and hard spinifex grasslands.

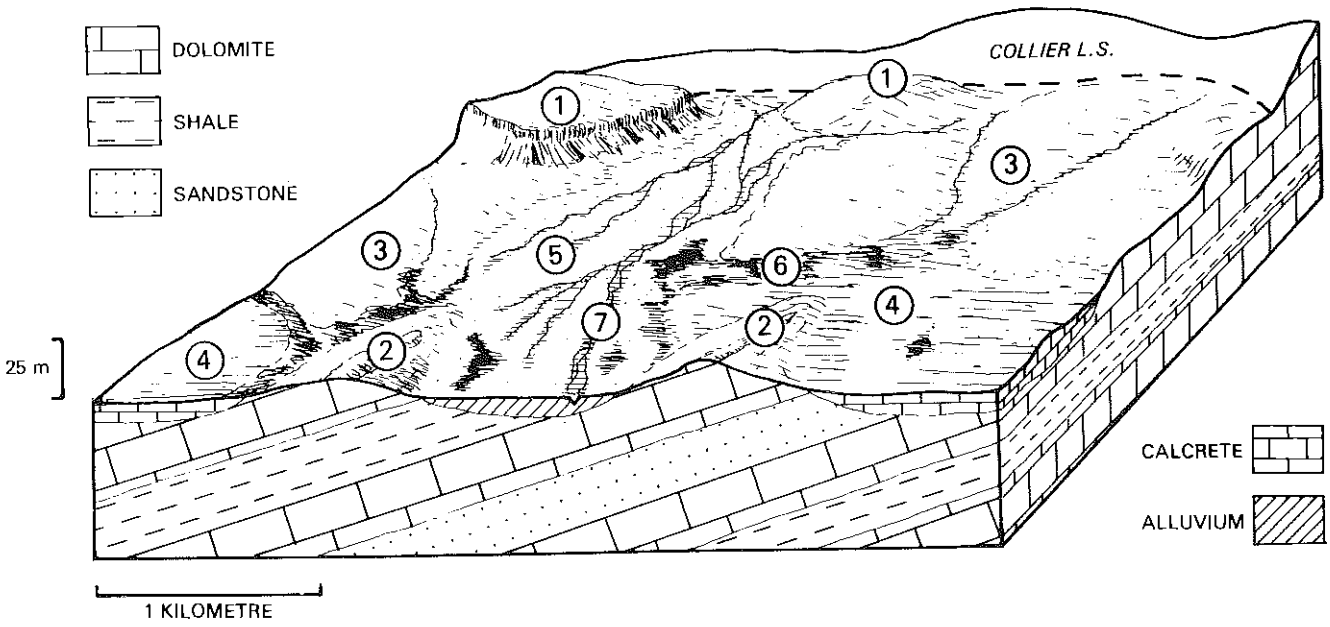
Location: Edmund 1:250 000 map sheet.

Geology: Tertiary calcrete and Middle Proterozoic dolomites of the Bangemall Group.

Geomorphology: Erosional surfaces — stony plains; — isolated calcrete residual mesas and low calcrete plateaux, stony rises and extensive stony plains on basement sediments with thin kankar veneer; dendritic drainage patterns of moderate intensity in higher parts, elsewhere broad drainage floors and flow zones with diffuse unchanneled flow and associated irregularly shaped drainage foci, major trunk drainage channels; relief mostly less than 20 m but occasionally up to 40 m.

Pastoral use: Mostly bluebush and other chenopod pastures of high productivity and good drought durability, minor areas of poor quality hard spinifex pastures; controlled stocking needed to maintain durable shrub components, unit 5 prone to degradation and erosion.

Estimated carrying capacity, good condition, 11 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	15	**Low calcrete mesas, plateaux, and hills:** up to 40 m high and 1 km in extent, mesas with slopes up to 40 per cent, flat summits; low hills with slopes up to 20 per cent, dense mantle calcrete fragments.	Reddish brown alkaline light clay or loams of variable depth with calcrete rubble throughout profile, dense strew of calcrete gravel and pebbles. Um 131, Uf 612.	Hummock grasslands of *Triodia wiseana* with sparse shrubby overstorey of *Templetonia egena, Acacia tenuissima* and *Cassia glutinosa.* HSHI pasture land.
2	10	**Low stony rises:** up to 1 km in extent and sloping up to 2.5 per cent, associated with quartz intrusions, dense mantle of quartz fragments.	Reddish brown gradational soil with calcareous and quartz inclusions, 1 m+ deep dense strew of quartz pebbles, Gc 112.	Very sparse shrubland of *Acacia victoriae* and *A. tetragonophylla,* with sparse low shrubs such as *Cassia desolata, Eremophila leucophylla, Ptilotus obovatus* and *Rhagodia eremaea,* forbs and annual grasses. STCH pasture land.
3	30	**Stony plains:** up to 2 km in extent, slopes less than 1 in 50, flanking drainage floors and flow zones, stony gilgai micro-relief in parts.	Dark red clayey and duplex soils; pH, calcrete inclusions and clay increasing with depth, 1 m + deep, dense pebble strew, Dr 453, Ug 538.	Tall shrubland of *Acacia xiphophylla* with low shrub understorey of *Cassia desolata, Eremophila cuneifolia* and *Scaevola spinescens,* forbs and annual grasses. Stony gilgai areas support *Eremophila maculata, Cassia aff. hamersleyensis* and *Eragrostis xerophila.* STCH pasture land.
4	26	**Kankar plains:** up to 2 km in extent, gradients less than 1 in 100, $CaCO_3$ has been exposed on the present surface after redeposition from the underlying calcareous parent material.	Exposed kankar and dolomite in parts with a cobble strew covering reddish brown calcareous loams up to 90 cm deep. Um 131, 612.	Tall open shrubland of *Acacia xiphophylla* and *A. victoriae* with a low shrub understorey of *Maireana polypterygia, M. georgei, Eremophila cuneifolia* and *Cassia desolata,* forbs and annual grasses. CHMA pasture land.
5	10	**Drainage floors and flow zones:** up to 0.5 km wide and 3 km long, gradients less than 1 in 150, draining into trunk drainage or large drainage foci, flat or guttered surfaces, sometimes with gilgaied micro-relief.	Variable soils including seasonal cracking clays and gradational calcareous soils, Ug 538, Uf 621, Gc 212.	Tall open shrubland of *Acacia victoriae, A. aneura,* with understorey including *Atriplex bunburyana, Eremophila maculata, Eragrostis xerophila* and *Maireana polypterygia,* forbs and annual grasses. CHAT pasture land.
6	4	**Drainage foci:** irregularly shaped foci and low plains up to 1 km in extent associated with units 4 and 5, gradients less than 1 in 300, periodically flooded by runoff from adjacent units.	Dark reddish brown alkaline clays of variable depth over calcrete, Uf 627.	Open tall shrubland of *Acacia aneura* and *A. victoriae* with extremely dense understorey of low shrubs *Atriplex bunburyana, Cassia oligophylla, Eremophila leucophylla, Ptilotus obovatus, Rhagodia eremaea* and *Ruellia primulosa.* CHAT pasture land.
7	5	**Creeklines and channels:** up to 100 m wide, with incised channels up to 3 m deep and 25 m wide.	Bedloads of sand, calcareous gravel and pebbles. Channel banks mostly reddish brown loams, 1 m + deep.	Dense low fringing woodlands of *Acacia aneura, A. citrinoviridis* and *Eucalyptus camaldulensis* with sparse shrubby understorey of *Eremophila leucophylla, Ptilotus obovatus* and assorted grasses. MUCR pasture land.

NANUTARRA LAND SYSTEM (93 sq km)

Low mesas and hills with soft and hard spinifex.

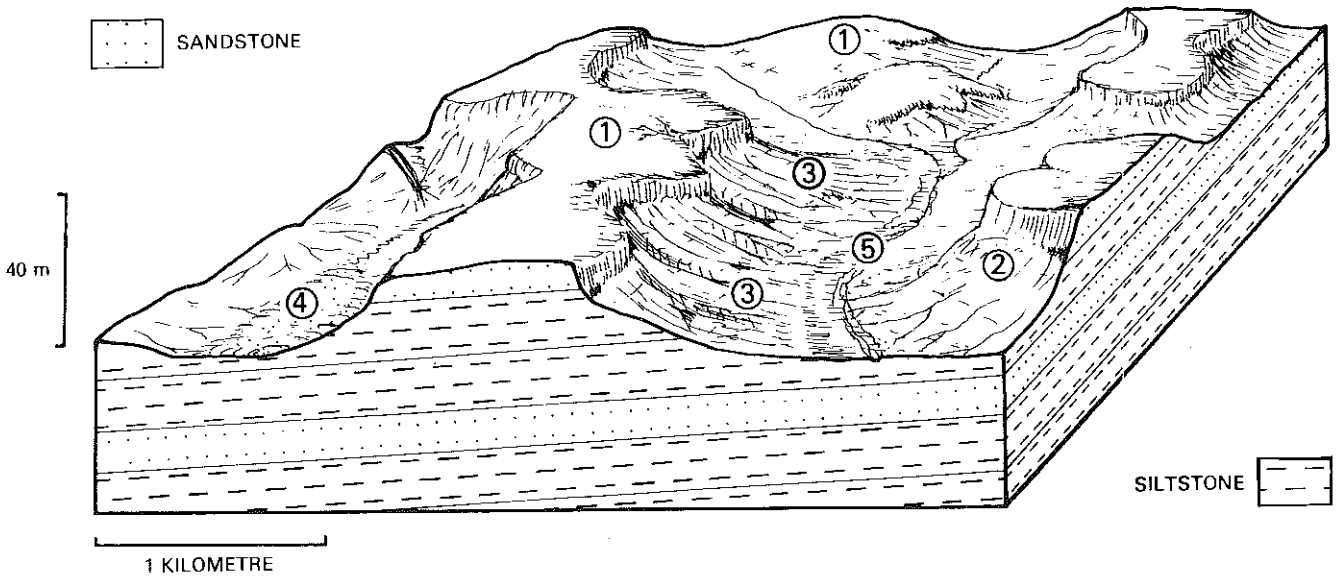
Location: Yanrey 1:250 000 map sheet.

Geology: Lower Cretaceous sandstone, siltstone and granule conglomerate of the Nanutarra Formation.

Geomorphology: Surfaces formed by partial dissection of an old plateau of marine sediments; — low plateaux; dissected plateaux, mesas, and buttes, also low hills with rounded crests; short stony footslopes with parallel and radial drainage patterns of moderate intensity, narrow mostly unchanneled drainage zones between dissected mesas, minor sandplain; relief up to 40 m.

Pastoral use: Sparse soft spinifex pastures of low to moderate productivity and good durability, occasional burning required to improve quality of pasture, not prone to erosion.

Estimated carrying capacity, good condition, 17 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	50	**Low plateaux, mesas, buttes and hills:** up to 35 m high, almost flat plateau and mesa tops up to 2 km in extent but mostly much less, also low hills with rounded crests, dense mantles.	Little soil development, rock outcrop and dense often ferruginised surface strew.	Sparse soft spinifex *Plectrachne* spp. and scattered shrubs such as *Acacia pruinocarpa* and *Cassia glutinosa.* SOSP pasture land.
2	10	**Upper footslopes:** concave, sloping up to 70 per cent often with short near vertical breakaway faces at top, dense mantles of stones and boulders.	Stony dark reddish brown loamy soils of variable depth.	Very sparse spinifex *Triodia pungens, T. lanigera* and occasional shrubs. SOSP pasture land.
3	25	**Lower footlopes:** concave, up to 300 m long and sloping up to 6 per cent dense stony mantles.	Dark reddish brown sands over clay loam mostly 1 m + deep, Dr 413.	Tall open snakewood *Acacia xiphophylla* shrublands with very sparse low shrubs *Eremophila cunefolia, Enchylaena tomentosa* and sparse spinifex *Triodia pungens,* forbs and annual grasses. SOSP pasture land.
4	13	**Sand plain:** low sandy surfaces up to 300 km in extent between mesas and hills, slopes up to 2 per cent.	Probably dark red sands becoming clayey with depth.	Hard spinifex *Triodia lanigera* grassland with sparse shrubs. HSSP pasture land.
5	2	**Narrow drainage zones:** up to 100 m wide, gradients 1 in 100 to 1 in 300, unchanneled or with minor channels incised up to 1 m.	Dark reddish brown sands over clay loams.	Open *Acacia xiphophylla* shrublands with sparse low shrubs and hard spinifex *Triodia lanigera* understorey. HSSP pasture land.

NANYARRA LAND SYSTEM (198 sq km)

Alluvial plains supporting tall shrublands and low woodlands with prominent tussock grasses.

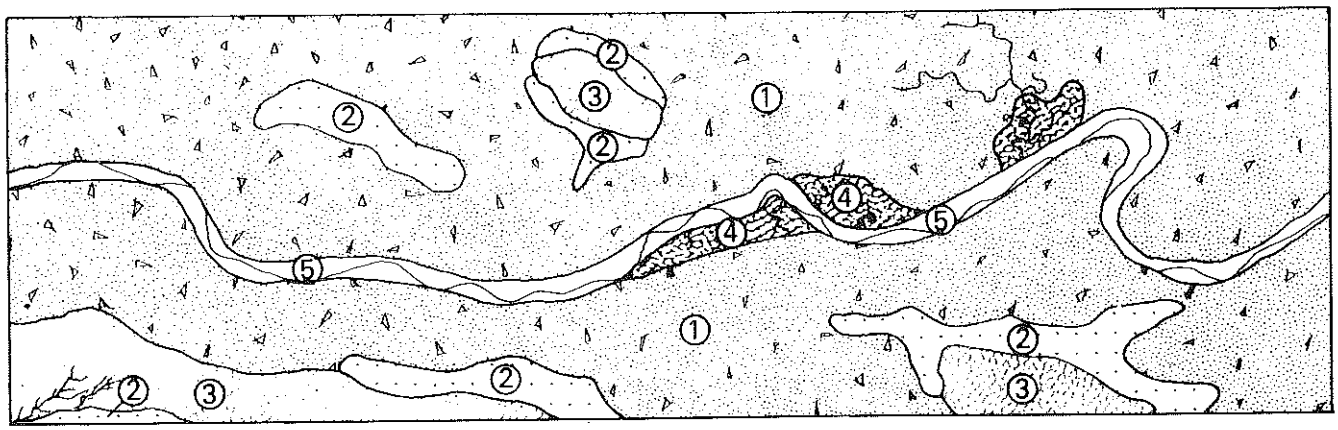
Location: Yanrey 1:250 000 map sheet, restricted to Minderoo Station.

Geology: Quaternary alluvium; minor areas of Quaternary aeolian sand.

Geomorphology: Depositional surfaces — alluvial plains; —plains subject to local flooding; river margins, swamps and low lying back plains subject to regular inundation; minor low sand dunes; meandering through going channels of the Ashburton River incised up to 20 m and with very steep banks.

Pastoral use: Tussock grass pastures, including introduced buffel grass, varying in condition from very poor to excellent; productivity and carrying capacity varies from low to very high, fair drought durability; past degradation cycles and partial recovery are evident; parts of unit 1 are severely degraded and eroded, controlled stocking and other remedial treatments necessary, other sections of unit 1 now stabilised with buffel grass and resistant to grazing and erosion.

Estimated carrying capacity, good condition, 2 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	70	**Alluvial plains:** up to 4 km wide flanking the Ashburton River, gradients between 1 in 500 and 1 in 1000.	Reddish brown loams or clays, 1 m+ deep, alkalinity increasing with depth; Um 123, 133 Uf 612, 621, soils often eroded with sealed surfaces.	Tall open shrubland of *Acacia victoriae, A. sclerosperma, A. tetragonophylla* with scattered *Eucalyptus coolabah,* tussock grass ground storey including dense *Cenchrus ciliaris* in parts, elsewhere pastures severely degraded. TGCE pasture land.
2	5	**Sand dunes:** irregular, roughly parallel and adjacent to Ashburton River or curved and associated with unit 3, up to 3 km long and 150 m wide, slopes vary from 2 to 18 per cent.	Dark red sandy soils, 1 m+ deep, Uc 123.	Open tussock grassland of *Cenchrus ciliaris* and *Eragrostis eriopoda* with an overstorey of *Acacia sclerosperma* and *A. translucens.* TGCE pasture land.
3	18	**Swamps and low back plains:** often round or oval, up to 2 km in extent, flat, sometimes with 0.5 m deep internal drainage lines, subject to inundation.	Dark reddish brown clay soils, 1 m+ deep with cracking surfaces, Ug 538.	Low open woodland of *Eucalyptus coolibah* with sparse shrubs *Acacia victoriae, Scaevola spinescens* and tussock grasses *Eriachne benthamii, Chrysopogon fallax.* TGCH pasture land.
4	2	**River margins with restricted drainage:** up to 1 km in extent, subject to inundation.	Dark reddish brown clays, 1 m+ deep, Uf 143, 612.	Low woodland of *Eucalyptus coolabah* with a sparse understorey of tussock grasses or shrubs such as *Rhagodia eremaea.* TGCE pasture land.
5	5	**Channels and banks:** channels up to 100 m wide and 20 m deep; banks steeply sloping up to 80 per cent, numerous permanent or semi-permanent pools.	Channel bedloads of sand and gravel; banks dark reddish brown loams 1 m+ deep, Um 511.	Tall fringing woodland of *Eucalyptus camaldulensis, Melaleuca leucadendron* and *Sesbania formosa* with a sparse understorey of tussock grasses. TGCE pasture land.

NEWMAN LAND SYSTEM (6 529 sq km)

Rugged jaspilite plateaux, ridges and mountains with hard spinifex.

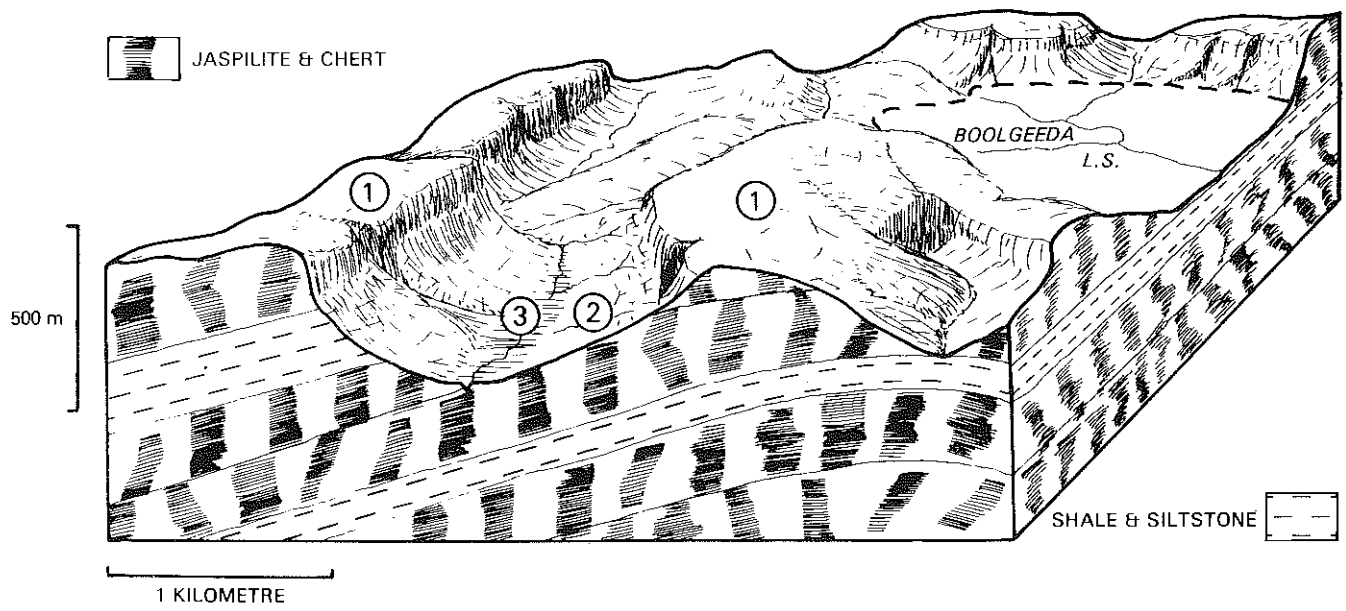
Location: Newman, Turee Creek, Mt. Bruce and Wyloo 1:250 000 map sheets.

Geology: Lower Proterozoic jaspilite, chert, siltstone and shale and minor acidic volcanics of the Hamersley and Fortescue Group.

Geomorphology: Erosional surfaces — plateaux and mountains; — extensive high plateaux, mountains and strike ridges with vertical escarpments, steep scree slopes, moderately dense branching and rectangular patterns of narrow, incised valleys, narrow drainage floors; relief up to 500 m.

Pastoral use: Mostly unsuitable for pastoral purposes, unattractive hard spinifex pastures of very poor productivity, unit 1 inaccessible or poorly accessible.

Estimated carrying capacity, good condition, 59 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	75	**Plateaux, ridges, mountains and hills:** jaspilite mountain tracts, plateaux and strike ridges, relief up to 500 m; gently sloping plateaux summits and mountain crests; ridges and indented escarpments with vertical upper cliff faces and steep upper slopes to 80 per cent, lower scree slopes 10 to 35 per cent.	Much rock outcrop and dense stony mantle, little soil development.	Hummock grassland or shrubland with v. sparse overstorey *Eucalyptus leucophloia;* hard spinifex, *Triodia wiseana, T. lanigera,* some soft *T. pungens,* shrubs include *Acacia aneura, Cassia* and *Eremophila* spp., *Kallstroemia platyptera.* HSHI pasture land.
2	20	**Lower slopes:** concave, up to 10 per cent, mostly less than 400 m wide, rock outcrop and dense colluvial mantle.	Dark reddish brown or dark red stony silt loams, mostly less than 60 cm deep, Um 551.	As for unit 1. HSHI pasture land.
3	5	**Narrow drainage floors with channels:** up to 400 m wide, gradients 1 in 200 to 1 in 300, marginal slopes up to 2.5 per cent, colluvial mantles; channels up to 20 m wide.	Red sandy soils, often shallow and stony; channels with bedloads ranging from sand to boulders.	Hard spinifex *Triodia wiseana* grassland with scattered trees *Eucalyptus leucophloia, E. dichromophloia* and numerous shrubs. HSHI pasture land.

NIRRAN LAND SYSTEM (95 sq km)

Undulating stony plains and low hills with mulga shrublands, in the east of the area.

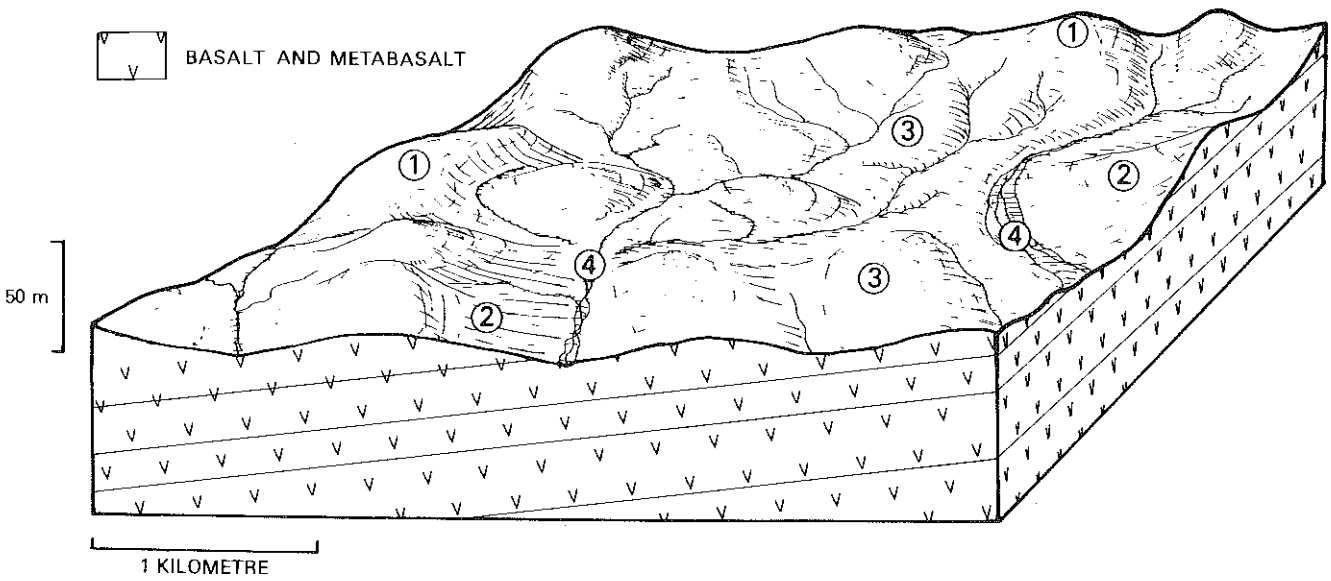
Location: Newman 1:250 000 map sheet.

Geology: Archaean basalt and metabasalt.

Geomorphology: Erosional surfaces — undulating plains; — low ridges and hills with narrow stony interfluves and undulating stony plains; dense pattern of branching incised tributary upper drainage joining strike controlled lower drainage incised between interfluves or with narrow poorly developed drainage floors; relief up to 30 m.

Pastoral use: Mulga short grass forb and stony chenopod pasture lands of low productivity and low to moderate drought resistance, useful ephemeral growth after rain, palatable shrub components should be preserved by controlled stocking; inherently resistant to erosion.

Estimated carrying capacity, good condition, 21 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	15	**Low ridges and rounded hills:** relief up to 30 m above creeklines, gently rounded crests, mostly gentle slopes but locally up to 10 per cent, dense colluvial mantles.	Shallow alkaline silt loams with outcrop and dense pebbly strew.	Sparse tall shrubland with mulga *Acacia aneura* and other *Acacia spp.*, sparse low shrubs including *Cassia* spp., *Ptilotus obovatus,* forbs and annual grasses. MSGF pasture land.
2	10	**Hill footslopes:** short slopes up to 5 per cent and 150 m wide, dense colluvial mantles.	Alkaline silt loams or loamy sands, 50 cm to 1 m+ deep. Um 512, Uc 512, dense gravel and pebble strew.	Sparse mulga shrublands with mixed low shrubs, forbs and annual grasses. MSGF or STCH pasture land.
3	67	**Undulating stony plains:** plains and interfluves up to 1.5 km in extent, slopes 1 to 2 per cent locally up to 5 per cent near drainage lines.	Alkaline reddish brown silt loam over clay loam, mostly 1 m+ deep, Um 512, dense pebble strew.	Tall open mulga shrubland with otner *Acacia spp.*, low shrubs *Cassia* and *Eremophila* spp., *Ptilotus obovatus,* forbs and annual grasses. MSGF pasture land.
4	8	**Narrow drainage floors and creeklines:** floors up to 150 m wide with central channels, or incised creeklines between interfluves.	Reddish brown silt loam over clay loam, 1 m+ deep, Um 512; channel bedloads of sand, gravel and pebbles.	Moderately dense tall mulga shrubland with other *Acacia* spp., numerous low shrubs, forbs and annual grasses. MUCR pasture land.

NOONINGNIN LAND SYSTEM (1 137 sq km)

Hardpan plains with large groves and mulga shrublands; in the east of the area.

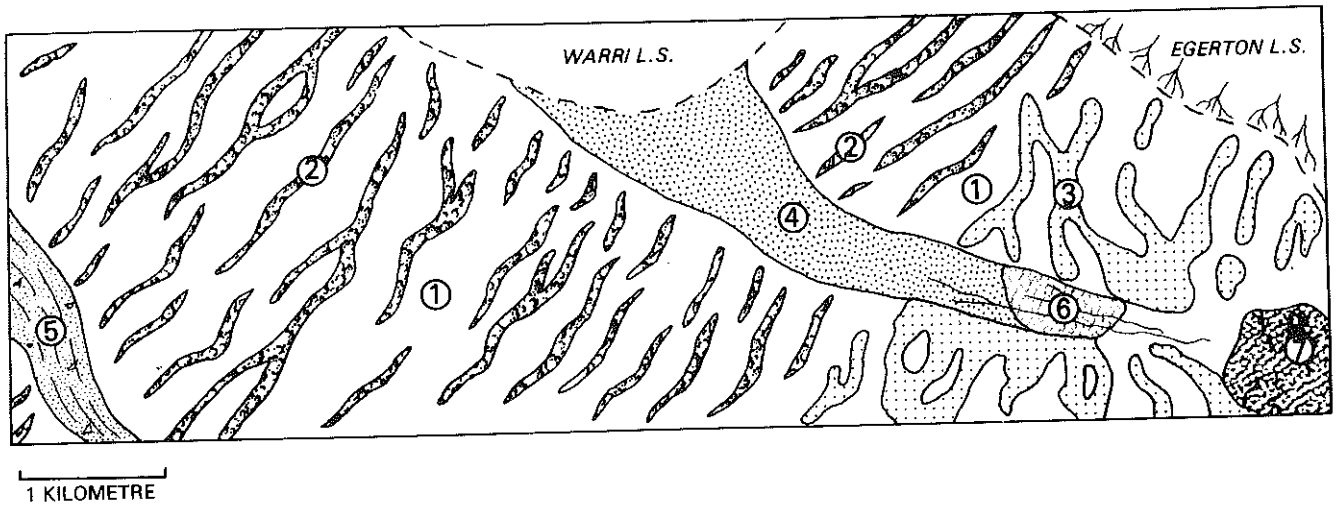
Location: Collier and Newman 1:250 000 map sheets.

Geology: Tertiary cemented colluvium and alluvium.

Geomorphology: Depositional surfaces — non-saline plains; — hardpan plains up to eight km in extent, subject to sheet flow and with very large groves and low sandy banks; plains and narrow drainage zones receiving more concentrated sheet flow; very minor saline plains and internal drainage flats, relief up to 3 m.

Pastoral use: Mulga short grass forb pastures with minor areas of wandarrie grass and chenopod pastures; overall productivity is low, useful ephemeral growth after rain should be heavily stocked; palatable and durable shrubs are concentrated on units 2, 3 and 6 and should be conserved by controlled stocking, these units degrade under excessive use and, in extreme situations, may erode.

Estimated carrying capacity, good condition, 20 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	65	**Hardpan plains with groves:** up to 8 km in extent, subject to sheet flow, gradients 1 in 500 to 1 in 200; banded or groved patterns of vegetation; groves mostly 500 m to 1 km long but up to 5 km long and 40 m wide arranged in parallel bands transverse to direction of sheet flow.	**Intergroves:** very shallow, acidic dark reddish brown or dark red loams on hardpan commonly at less than 25 cm, Um 531.	Sparse tall mulga *Acacia aneura* and other *Acacia* spp. shrubland, very sparse low shrubs, forbs and annual grasses. SSGF pasture land.
2	12		**Groves:** acidic dark reddish brown or dusky red loams, 1 m + deep, Um 522.	Very dense woodland or tall shrubland of mulga and other *Acacia* spp., dense low shrubs *Eremophila leucophylla, Ptilotus obovatus, Sida* spp., forbs and annual grasses. MUCR pasture land.
3	10	**Sandy banks:** up to 0.5 m high and 100 m wide, linear or reticulate up to 2 km long, hummocky surfaces with grit veneer.	Dark reddish brown acidic loamy sands and loams, variable depth 40 cm to 1 m +, Uc 511, Um 531.	Tall mulga and other *Acacia* spp. shrubland, numerous low shrubs especially *Eremophila spp.*, perennial grasses *Monachather paradoxa, Eragrostis eriopoda,* forbs and annual grasses. TGMI pasture land.
4	10	**Plains receiving concentrated sheetflow:** up to 1.5 km wide and extending up to 3 km downslope, gradients 1 in 300 or less.	Very shallow, acidic, dark reddish brown loams on hardpan commonly at less than 25 cm, Um 531.	Low sparse shrubland of *Eremophila spathulata* with occasional mulga and *Acacia tetragonophylla,* forbs and annual grasses. SSGF pasture land.
5	2	**Narrow drainage zones:** low zones within unit 1, up to 400 m wide and 6 km long, unchanneled or with shallow gutters.	Acidic dark reddish brown or dark red silty loams and clay loams, usually 1 m + deep, Um 522, 531, Gn 212.	Dense low woodland of mulga and other *Acacia spp.*, numerous low shrubs, sparse perennial grasses, such as *Chrysopogon fallax,* forbs and annual grasses. MUCR pasture land.
6	7	**Saline plains:** up to 1 km in extent almost flat, moundy micro-relief.	Dark red silty loam becoming more clayey and alkaline with depth, 1 m + deep, Um 542.	Low shrubland of *Eremophila maculata, Maireana pyramidata, Cassia hamersleyensis* and forbs. CHMA pasture land.
7	1	**Internal drainage flats:** up to 2 km in extent, receiving run on, gilgai micro-relief.	Brown or dark reddish brown seasonal cracking light medium clays, 1 m + deep, Ug 538.	Open *Eucalyptus coolabah* woodland with *Muehlenbeckia cunninghamii* or tussock grassland with *Eragrostis eriopoda, E. setifolia* and sparse low shrubs such as *Eremophila maculata.* TGER pasture land.

ONSLOW LAND SYSTEM (448 sq km)

Sand plain, dunes and clay plains with soft spinifex and tussock grasses.

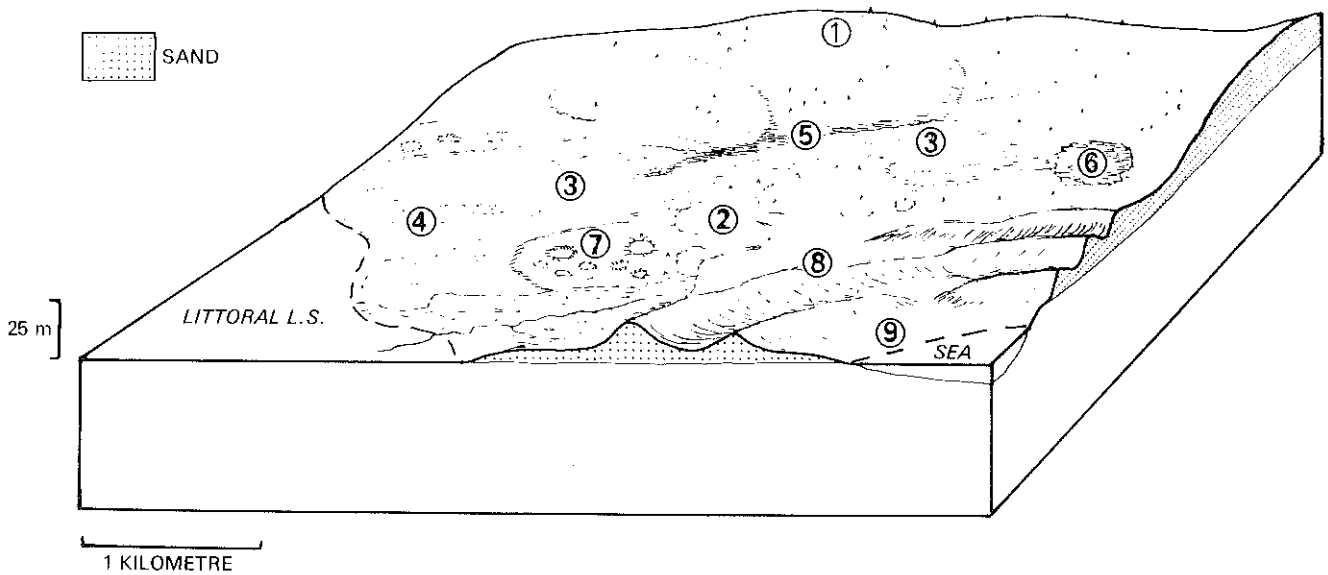
Location: Onslow and Yanrey 1:250 000 map sheets.

Geology: Quaternary sand, silt and clay.

Geomorphology: Depositional surfaces — sandy plains; — gently undulating sandplain with intervening non-saline clay plains subject to sheet flow, narrow drainage zones receiving more concentrated flow, minor depressions subject to inundation; coastal fringes of low sand plain, interspersed with slightly lower saline samphire flats, also minor claypans, coastal dunes and beach; relief up to 20 m.

Pastoral use: Soft spinifex and tussock grass pastures of moderate to high productivity and good durability — introduced buffel grass is well established and spreading into soft spinifex communities, spinifex requires burning every four or five years and controlled stocking, coastal sandy units susceptible to wind erosion when bared but revegetate rapidly after rain.

Estimated carrying capacity, good condition, 5 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	30	**Undulating sandplain:** up to 30 km in extent, low swales, slopes and sandy spurs sloping 1 to 5 per cent, elevated sand plains up to 20 m above low sections, numerous termite mounds up to 3 m.	Dark reddish brown sands and sandy loams 1 m+ deep. Um 113.	Hummock grasslands of soft spinifex *Triodia pungens* with very sparse shrubs such as *Acacia translucens,* near coast *Triodia pungens* and buffel grass *Cenchrus ciliaris* mixtures with buffel dominating in parts. SOSP pasture land.
2	28	**Low sandplain:** up to 3 km in extent, gradients 1 in 300 or less, hummocky micro-relief up to 2 m, numerous small claypans 5 to 40 m in diameter, loose surfaces.	As for unit 1.	Mixed grasslands of soft spinifex *Triodia pungens* and buffel grass *Cenchrus ciliaris.* SOSP or TGCE pasture land.
3	19	**Clay plains:** sinuous, nearly flat clay surfaces up to 3 km long by 1 km wide between sandplain, subject to sheet flow and becoming wider with scalded surfaces near the coast.	Reddish brown clay soils, occasionally seasonal cracking, 1 m+ deep. Uf 612, Ug 538.	Tussock grasslands of variable density, mostly *Sporobolus virginicus* and *Eriachne benthamii.* TGMI pasture land.
4	12	**Samphire flats:** flat saline plains marginal to adjacent Littoral system or between sandplain, mostly less than 1 km in extent but up to 2.5 km.	Reddish brown or dark red calcareous clay coils, 1 m+ deep, Uf 621, also inverted soils such as sandy clay loams over sand.	Dense low samphire shrublands *Halosarcia halocnemoides, H. auriculata, H. indica* with variable amounts *Sporobolus virginicus* and forbs. SAMP pasture land.
5	3	**Narrow drainage floors:** up to 200 m wide, sinuous tracts receiving concentrated flow, mostly unchannelled but occasionally with scour lines and minor channels.	Reddish brown loams over clay, 1 m+ deep, Gn 143.	Moderately dense to dense tussock grasslands including *Sporobolus virginicus, Chrysopogon fallax, Eragrostis setifolia, E. xerophila, Eulalia fulva,* variable shrubs such as *Acacia farnesiana* and occasional *Eucalyptus coolabah* trees. TGMI pasture land.
6	1	**Depressions:** circular or oval to 400 m in diameter, up to 2 m below surrounding surfaces.	Reddish brown clay soils 1 m+ deep.	Variable tussock grasslands mostly *Sporobolus virginicus* and *Eriachne benthamii* with fringing margins of *Eucalyptus coolabah* trees. TGMI pasture land.
7	2	**Claypans:** bare sealed surfaces with steep marginal slopes up to 3 m high to surrounding sand plain; circular, oval or irregularly shaped, mostly less than 50 m in extent but occasionally up to 600 m.	Dark red clays 1 m+ deep, hardsetting sealed surfaces.	No vegetation.
8	4	**Coastal dunes:** linear and parallel, up to 3.5 km long and 10 m high, slopes 10 to 20 per cent, crests up to 150 m apart with narrow swales between, loose surfaces.	Reddish brown calcareous sands, 1 m+ deep, Uc 113.	Hummock grassland of *Triodia pungens,* some buffel grass *Cenchrus ciliaris,* very sparse shrubs such as *Acacia translucens* and *A. coriacea.* SOSP pasture land.
9	1	**Beach:** up to 40 m wide above high water mark backed by narrow unstable foredunes.	Calcareous beach sands and shell fragments, foredunes light grey calcareous sands.	Foredunes with sparse *Spinifex longifolius* and other beach dune vegetation.

PARABURDOO LAND SYSTEM (761 sq km)

Basalt derived stony gilgai plains with snakewood shrublands.

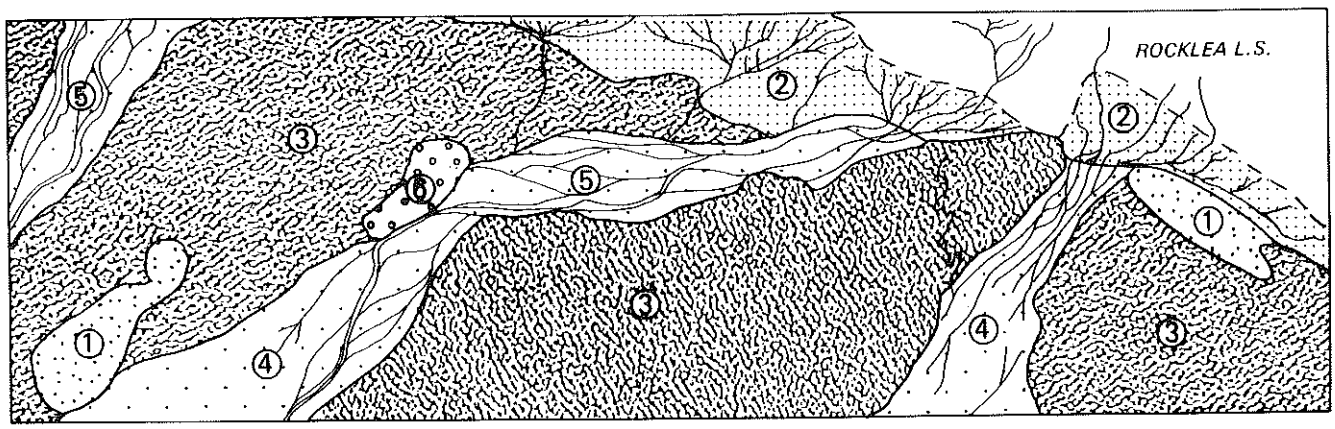
Location: Mt. Bruce, Turee Creek and Wyloo 1:250 000 map sheets.

Geology: Quaternary colluvium and alluvium derived mainly from basalt.

Geomorphology: Depositional surfaces — stony plains; — isolated low basalt hills, extensive stony gilgai plains; stony upper interfluves with moderately dense patterns of sub-parallel tributary drainage extending downslope into broad zones with moderately dense braided drainage and major trunk channels, relief mostly less than 8 m but isolated hills up to 25 m.

Pastoral use: Stony chenopod pastures with high drought durability but now considerably degraded, palatable shrubs should be conserved by controlled stocking, units 3 and 4 subject to pasture decline and unit 4 shows moderate erosion in parts.

Estimated carrying capacity, good condition, 11 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	5	**Low basalt hills and ridges:** up to 2 km long with rounded crests up to 25 m high, concave footslopes 5 to 20 per cent with rock outcrop and cobble mantle.	Very shallow reddish brown alkaline loams between rock outcrop, Um 511.	Low shrubland with *Corchorus Walcottii, Ptilotus obovatus, Cassia* spp., sparse overstorey *Acacia* spp., forbs and annual grasses. SSGF pasture land.
2	18	**Upper interfluves & slopes:** surfaces immediately below adjacent hill land systems, dissected to 3 m by parallel drainage lines to form interfluves 100 to 150 m wide extending up to 2 km downslope, slopes up to 3 per cent dense colluvial mantles.	Reddish brown or dark red alkaline silty loams and clay loams of variable depth, Um 512, 521, Gc 122.	Tall open snakewood *Acacia xiphophylla* and other *Acacia* spp. shrublands, numerous low shrubs, forbs and annual grasses; also hard spinifex *Triodia wiseana.* STCH or HSHI pasture land.
3	50	**Gilgai plains:** up to 4 km in extent, gradients 1 in 70 to 1 in 500, stony gilgai micro-relief.	Dark reddish brown or dark red seasonal cracking alkaline light and medium clays, 60 cm to 1 m+ deep, Ug 536, 537, 538.	Tall open snakewood and other *Acacia* spp. shrublands, low shrubs *Cassia* spp. *Enchylaena tomentosa* perennial grasses *Eragrostis xerophila, E. setifolia,* forbs and annual grasses. STCH pasture land.
4	18	**Drainage zones:** up to 1 km wide and many kilometres long, gradients 1 in 100 to 1 in 500, sometimes unchannelled but central tracts often with braided channels or major channels of truck drainage, linear gilgai micro-relief common, water scouring and erosion in parts.	Mostly dark reddish brown or dark red seasonal cracking clays, 1 m+ deep, some loamy soils, Ug 538, Um 522.	Tall open snakewood and *Acacia victoriae* shrubland with sparse degraded understorey including *Cassia* spp., *Maireana* spp., *Atriplex bunburyana, Rhagodia eremaea, Eragrostis xerophila,* forbs and annual grasses. CHAT pasture land.
5	8	**Braided creeklines and channels:** minor channels and runnels up to 10 m wide and 1.5 m deep, separated by narrow uneven loose surfaced flood banks of mixed alluvium; major channels up to 50 m wide and 5 m deep.	Variable sandy and loamy alluvial soils with gravel and pebbles, mostly less than 1 m deep, Uc 113, Um 552, Gc 112. Channel bedloads of sand and gravel.	Moderately dense shrubland *Acacia citrinoviridis* and other *Acacia* spp. variable low shrubs and sparse perennial grasses including *Cenchrus ciliaris,* annual forbs and grasses. MUCR pasture land.
6	1	**Calcrete platforms:** mostly less than 1 km in extent, nearly flat, raised up to 0.5 m above surrounding surfaces.	Shallow alkaline reddish brown loams over calcrete, dense surface strew of calcrete fragments, Um 511.	Moderately dense low shrubland mostly *Cassia oligophylla,* sparse tall shrubs *Acacia xiphophylla, A. victoriae,* forbs and annual grasses. CSGF pasture land.

PLATFORM LAND SYSTEM (982 sq km)

Narrow raised plains and extensive dissected slopes with hard spinifex and shrubs.

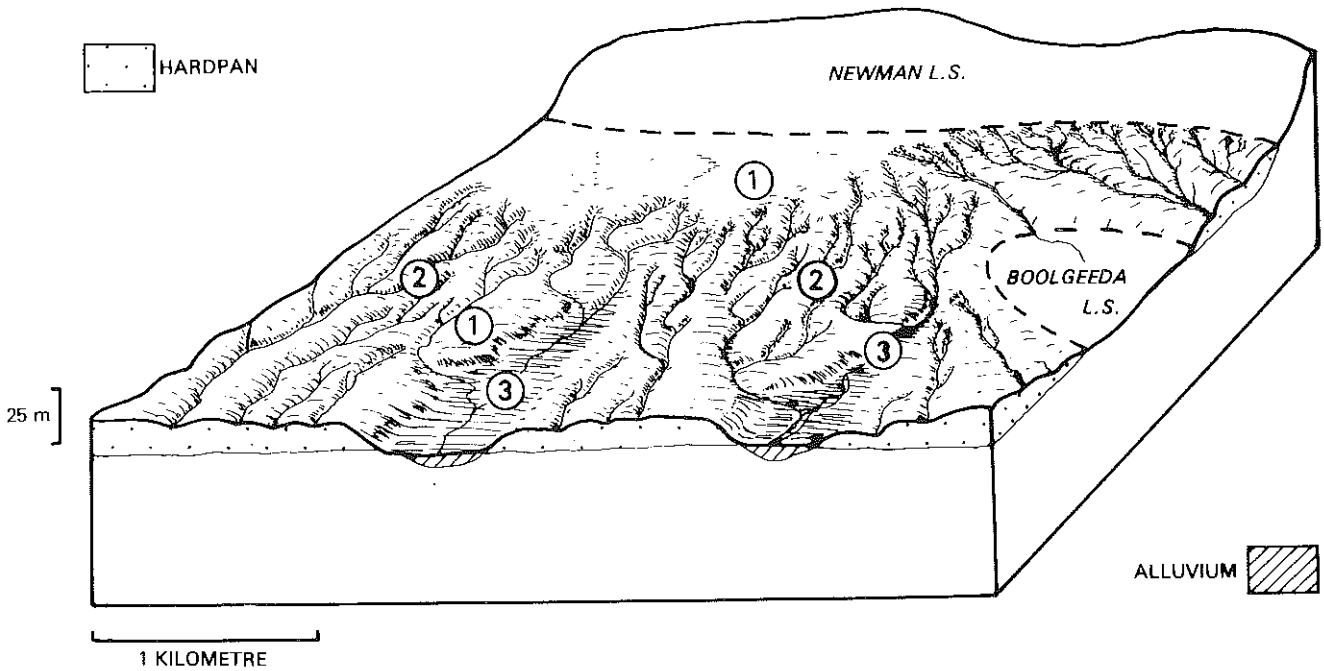
Location: Mt. Bruce, Newman, Turee Creek and Wyloo 1:250 000 map sheets.

Geology: Partly consolidated Tertiary colluvium.

Geomorphology: Erosional surfaces formed by partial dissection of the old Tertiary surface; — very gently sloping upper plains with extensive marginal dissection zones and slopes, intense branching or sub-parallel drainage patterns with narrow floors in upper parts, floors incised up to 15 m with steep stable marginal slopes and becoming much wider downslope, relief up to 30 m.

Pastoral use: Mostly hard spinifex pastures of negligible pastoral value, restricted areas of soft spinifex pastures; the system can only be utilised where associated with better quality land systems, however much of the system is adjacent to mountain systems unsuitable for pastoral use.

Estimated carrying capacity, good condition, 30 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	25	**Stony upper plains:** Upper surfaces occurring mostly as raised, narrow interfluves 50 to 200 m wide and 500 m to 1 km long interdigitated between dendritic or sub-parallel incised drainage, also as broader plains, slopes about 1 per cent but increasing rapidly near margins, dense colluvial mantles of pebbles and cobbles.	Shallow, very stony, dark, reddish brown loams.	Hummock grassland of hard spinifex *Triodia wiseana* with sparse shrub overstorey of *Acacia aneura* and other *Acacia* spp. HSHI pasture land.
2	60	**Dissected slopes with incised drainage:** convex and concave stable slopes 5 to 50 per cent with narrow creeklines incised up to 15 m below unit 1, dense cobbly and pebbly surfaces.	Very little soil development, cemented gravel, pebbles and cobbles.	Hummock grassland of hard spinifex with overstorey *Acacia aneura* and other *Acacia* spp., also sparse *Eucalyptus dichromophloia.* HSHI pasture land.
3	15	**Drainage floors:** up to 500 m wide and 3 or 4 km long, gradients 1 in 100 to 1 in 300, braided channels incised to 1 m in central areas, hummocky micro-relief with dense colluvial mantles.	Dark reddish brown loamy sands or loams with gravel and pebbles throughout profile.	Moderately dense tall shrublands of mixed *Acacia aneura, A. citrinoviridis, A. xiphophylla* and other *Acacia* spp., also *Eucalyptus dichromophloia,* numerous low shrubs including *Cassia* spp., *Ptilotus obovatus, Corchorus walcottii,* also soft spinifex *Triodia pungens.* *SOSP pasture land.*

PRAIRIE LAND SYSTEM (1 465 sq km)

Granite hills and undulating stony plains with low and tall shrublands.

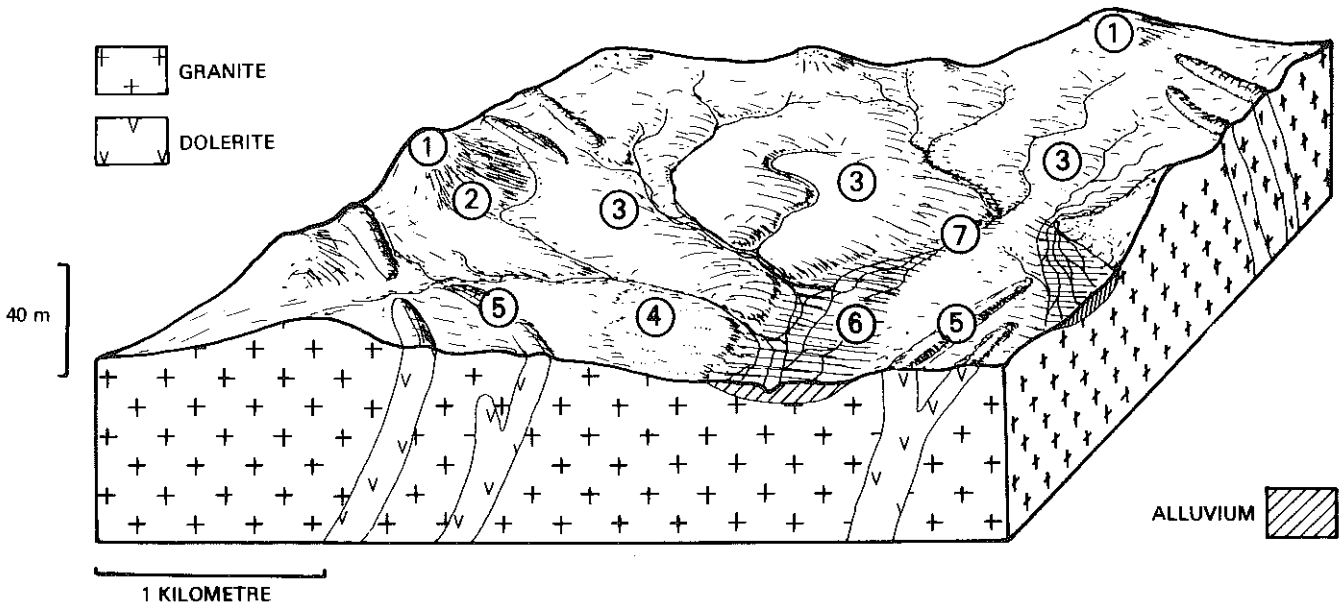
Location: Edmund, Mt. Bruce and Newman 1:250 000 map sheets.

Geology: Archaean granite and gneiss with minor dolerite intrusions (Mt. Bruce and Newman map sheets). Lower Proterozoic granite (Edmund map sheet).

Geomorphology: Erosional surfaces — low hills and stony plains; — low hills with rounded, boulder strewn crests and steep benched upper slopes, short gentle lower slopes; extensive gently undulating stony plains and interfluves sometimes showing striking patterns of narrow dolerite dykes trending north, north-east and north-west; moderately dense patterns of finely branching tributary drainage with narrow sandy floors and braided channels becoming sub-parallel with major channels in lower parts, relief up to 50 m.

Pastoral use: Short grass forb and minor chenopod pastures; abundant ephemeral growth after rains should be heavily stocked, shrub components provide fair drought durability and should be maintained by controlled stocking; most units inherently resistant to erosion due to stony nature, some erosion can occur on unit 6.

Estimated carrying capacity, good condition, 20 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	25	**Low granite hills:** relief up to 50 m, rounded or boulder strewn crests, benched upper slopes up to 70 per cent with boulders and tors.	Rock outcrop and pockets of very shallow sandy and sandy clay soils on granite.	Low shrubland of *Cassia helmsii, Eremophila* spp., *Ptilotus obovatus,* sparse overstorey *Acacia rhodophloia* and other *Acacia* spp; forbs and annual grasses. MSGF pasture land.
2	12	**Hill footslopes:** concave up to 5 per cent mostly less than 200 m long, sparse to moderately dense colluvial mantles.	Dark reddish brown or dark red loamy and clayey coarse sands mostly less than 1 m deep, Uc 521.	Low shrubland of *Cassia helmsii, Eremophila* spp., *Ptilotus obovatus,* sparse overstorey *Acacia rhodophloia* and other *Acacia* spp.; forbs and annual grasses. MSGF pasture land.
3	40	**Undulating stony plains and interfluves:** up to 500 m wide, rounded crests with slopes mostly less than 2 per cent, marginally dissected by drainage to 10 m with local slopes up to 8 per cent, dense stony mantles and local outcrop.	Stony reddish brown or dark red coarse sands or loamy sands over sandy clay, depth mostly less than 60 cm, Uc 123, Dr 451.	Sparse tall shrublands with *Acacia victoriae, A. rhodophloia* other *Acacia* spp., *Cassia helmsii, Eremophila* spp., forbs and annual grasses. SSGF pasture land.
4	4	**Saline plains:** Up to 500 m wide, slopes up to 1 in 200, gravelly surface mantles.	Red and yellowish red sandy soils with clays at depth, 1 m+ deep, Dr 223.	Low shrubland of *Halosarcia indica* ,pp. *leiostachya, Frankenia* spp., and forbs. SAMP pasture land.
5	3	**Low dolerite ridges:** Up to 5 m high and 50 m wide, usually 100 to 500 m long but occasionally several kilometres, footslopes up to 5 per cent, stony mantles.	Shallow reddish brown loamy sands over dolerite, Uc 512.	Low shrubland of *Cassia helmsii, Sida* spp., *Corchorus walcottii,* forbs and annual grasses. MSGF pasture land.
6	8	**Sandy drainage floors:** Up to 300 m wide, gradients 1 in 100 to 1 in 500, loose surfaces and gravelly patches.	Dusky red and dark reddish brown loamy and clayey sands, 1 m+ deep, Uc 511, 521.	Shrublands with various *Acacia* spp., *Cassia helmsii, Corchorus walcottii, Maireana pyramidata, Rhagodia eremaea,* numerous forbs and annual grasses. CHMA pasture land.
7	8	**Creeklines and channels:** Braided channels up to 10 m wide incised up to 1 m, sandy banks between channels; major channels up to 80 m wide.	Bedloads of coarse sand. Banks of sand and loamy sand.	Dense fringing low woodland or tall shrubland. *Acacia cyperophylla, A. aneura* various low shrubs, forbs and annuals. MUCR pasture land.

* On the Edmund map sheet the system becomes considerably more rugged than the type description with a higher proportion of hills and lower proportion of undulating stony plains.

RIVER LAND SYSTEM (829 sq km)

Narrow, active flood plains flanking major rivers and creeks with moderately dense tall shrublands.

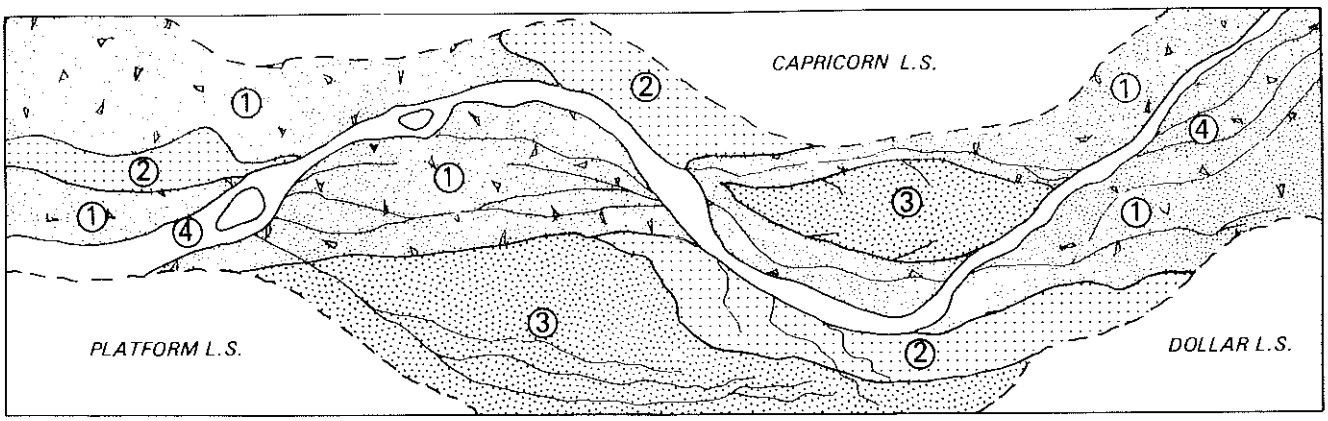
Location: Collier, Edmund, Mt. Bruce, Turee Creek and Wyloo 1:250 000 map sheets.

Geology: Quaternary alluvium.

Geomorphology: Depositional surfaces — alluvial plains; — flood plains with shallow runnels and minor channels immediately adjacent to main channels and regularly flooded by river bywash slightly higher sandy plains and stony clay plains not subject to regular flooding; meandering, anastomosing channels, relief mostly less than 5 m.

Pastoral use: Productive chenopod and other shrub pastures, also introduced buffel grass, high carrying capacity and good drought durability, system often adjacent to unproductive land systems and is subject to preferential use, controlled stocking necessary to maintain desirable shrubs, not prone to erosion.

Estimated carrying capacity, good condition, 5 to 10 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	45	**Flood plains:** up to 4 km long and 1 km wide immediately adjacent to major channels, gradients 1 in 70 to 1 in 500, hummocky and irregular microrelief with shallow runnels and minor channels, subject to regular flooding.	Variable dark red or dark reddish brown alluvial soils, textures range from sand to light clay, 1 m+ deep, Uc 123, 511, Uf 623, 671, Gn 212, 213.	Variable tall shrublands, moderately dense *Acacia victoriae, A. sclerosperma, A. citrinoviridis* sparse overstorey *Eucalyptus coolabah,* variable low shrubs including *Cassia* spp., *Atriplex bunburyana, Maireana pyramidata,* also *Cenchrus ciliaris* ground storey. CHAT or TGCE pasture land.
2	20	**Sandy margins:** raised up to 2 m above unit 1, mostly up to 2 km long and 300 m wide occasionally more extensive, gradients 1 in 50 to 1 in 500, loose, hummocky surfaces.	Dark red or dark reddish brown sands or sandy surfaced soils, 50 cm to 1 m+ deep, Uc 123, 511, Gn 112, Dr 253.	Variable shrublands depending on soil depth, *Acacia victoriae* and other *Acacia* spp., variable understoreys such as *Triodia pungens* or *Cassia* spp., *Eremophila leucophylla,* forbs and annual grasses. SOSP or MUCR pasture land.
3	20	**Stony plains:** up to 3 km long and 1.5 km wide raised up to 2 m above unit 1, gradients up to 1 in 100, sometimes gilgai micro-relief, dense colluvial mantles, not subject to regular flooding.	Stony, seasonal cracking dark red clay soils 1 m+ deep, Ug 538, also loamy soils of variable depth with stony surface pavement Uc 521.	Tall open shrubland with *Acacia xiphophylla, A. victoriae,* sparse low shrubs, including *Enchylaena tomentosa, Rhagodia eremaea, Cassia* spp., forbs and annual grasses. STCH pasture land.
4	15	**Channels and banks:** single or multiple minor channels up to 10 m wide and 2 m deep, hummocky flood banks between, main channels up to 100 m wide incised to 10 m with steep banks.	Channels — no soils, bedloads of sand, gravel, pebbles and cobbles. Banks — dark reddish brown sands and silty loams, Uc 113, Um 113.	Channels — no vegetation. Banks — woodland or dense tall shrubland fringing communities including *Eucalyptus coolabah, E. camaldulensis, Acacia citrinoviridis, A. sclerosperma,* numerous low shrubs, forbs and annual grasses. MUCR pasture land.

ROBE LAND SYSTEM (564 sq km)

Low plateaux, mesas and buttes of limonite with soft and hard spinifex pastures.

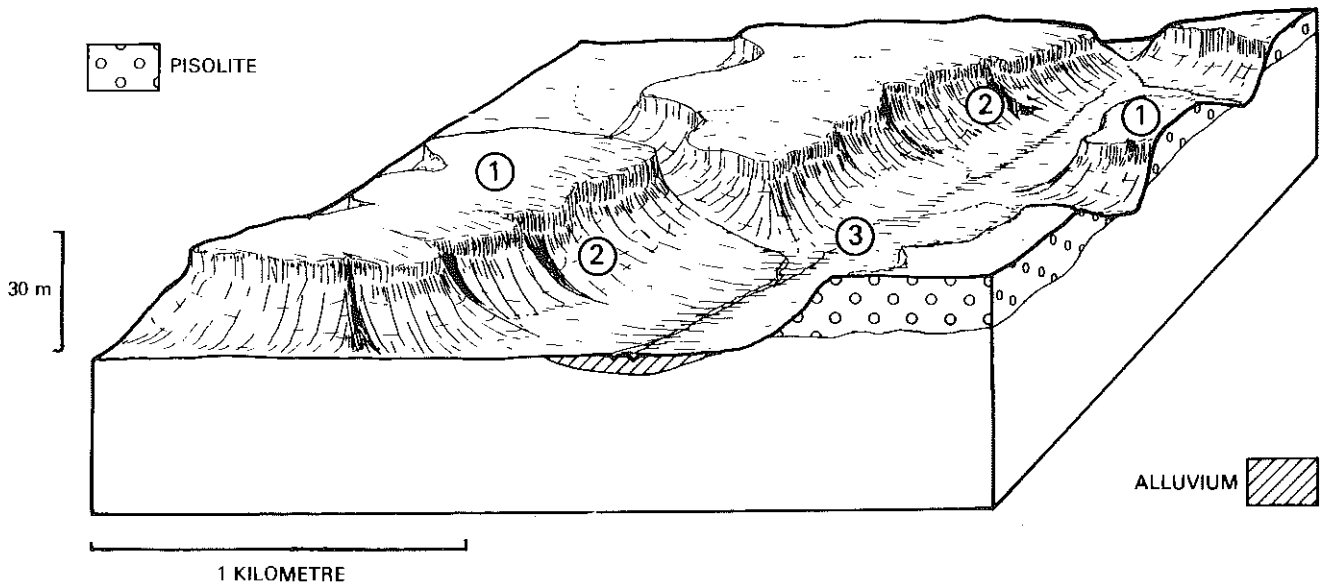
Location: Mt. Bruce, Newman, Turee Creek and Wyloo 1:250 000 map sheets.

Geology: Tertiary pisolitic limonite (Robe pisolite).

Geomorphology: Surfaces formed by partial dissection of old Tertiary surfaces — dissected plateaux and mesas; — long lines of low mesas along present and past river valleys, indented breakaway faces and steep slopes with limonite outcrop and pisolitic gravelly mantles, restricted gravelly lower slopes and narrow drainage floors, moderately dense branching drainage patterns; relief up to 40 m.

Pastoral use: Mixed soft and hard spinifex pastures; soft spinifex provides medium quality pastures after burning and moderate drought durability, not susceptible to pasture degradation or erosion.

Estimated carrying capacity, good condition, 17 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	80	**Low plateaux, mesas and buttes:** up to 40 m high, in lines often 20 km or more in length, near vertical breakaway faces up to 10 m, outcrops of limonite, gravelly slopes up to 45 per cent.	Little or no soil development, limonite outcrop, pisolitic gravel and limonite rock fragment surface strew.	Sparse soft spinifex *Triodia pungens* hummock grassland, very sparse over storey including stunted *Acacia pruinocarpa, A. ancistrocarpa* and occasional *Eucalyptus leucophloia.* SOSP pasture land.
2	10	**Lower slopes:** up to 3 per cent and rarely extending more than 200 m down slope, pisolitic limonite gravelly mantles.	Variable soils including brown alkaline silt loams over light clay, dense gravelly surfaces, variable depths, Gc 122.	Hard spinifex *Trioda wiseana, T. longiceps* hummock grassland with sparse low shrubs and forbs and occasional *Eucalyptus leucophloia.* HSH1 pasture land.
3	10	**Drainage floors and channels:** up to 300 m wide, gradients 1 in 300 or less, shallow central flow lines with little incision; also major channels up to 40 m wide cutting through system.	Reddish brown acidic gradational loams or duplex silt loams over light clay variable depths, Dr 251.	Soft spinifex *Triodia pungens* hummock grassland with sparse shrubs *Acacia ancistrocarpa, A. inaequilatera, Cassia* and *Sida* spp., occasional *Eucalyptus dichromophloia.* SOSP pasture land.

ROCKLEA LAND SYSTEM (8 096 sq km)

Basalt hills and restricted stony plains with hard spinifex.

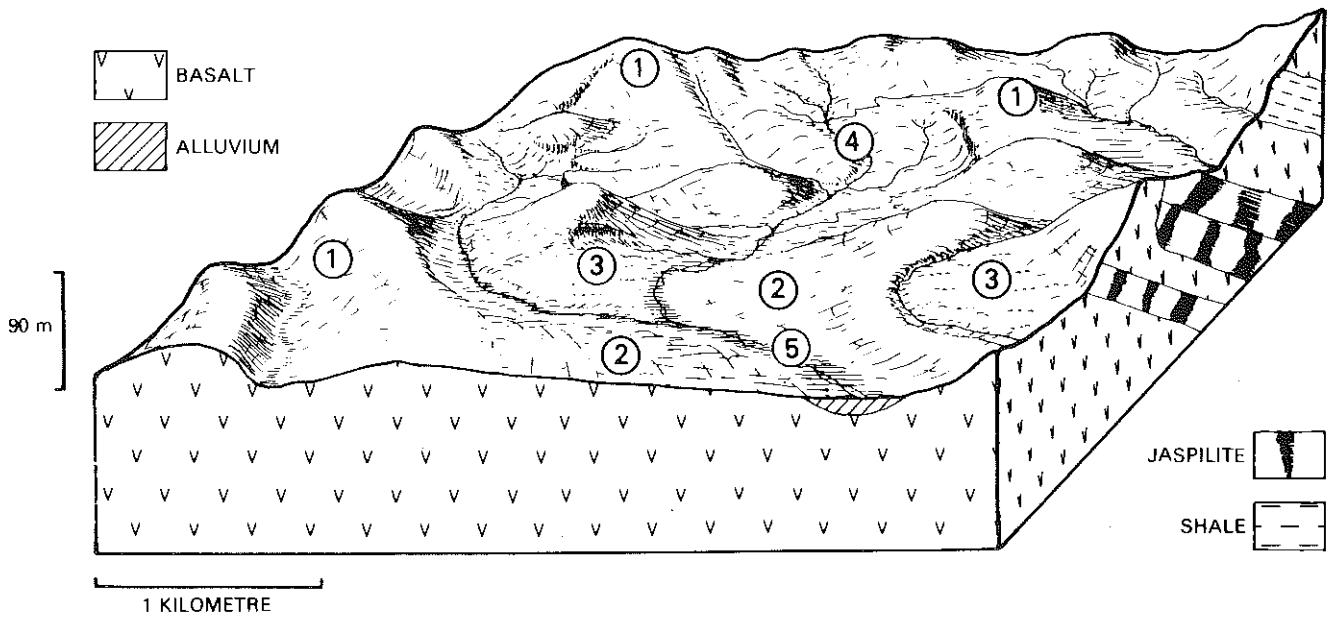
Location: Mt. Bruce, Newman, Turee Creek and Wyloo 1:250 000 map sheets.

Geology: Lower Proterozoic age basalt of the Fortescue and Wyloo Groups, also minor shale and jaspilite.

Geomorphology: Erosional surfaces — extensive hill tracts; — basalt hills and ridges with steep stony slopes, restricted lower slopes and stony interfluves, minor gilgai plains and narrow drainage floors, moderately dense to dense branching and rectangular patterns of incised drainage and narrow valleys, relief up to 110 m.

Pastoral use: Poorly accessible hard spinifex pastures of extremely low pastoral value, small areas of better quality stony chenopod and short grass forb pastures on stony plains and drainage floors, no erosion.

Estimated carrying capacity, good condition, 40 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	70	**Basalt hills, ridges and upper slopes:** up to 100 m high, rounded crests, convex and benched upper slopes up to 70 per cent, dense mantles of basalt cobbles and stones.	Much outcrop and strew, pockets of skeletal stony loams, Um 511.	Hard spinifex *Triodia wiseana, T. lanigera* grasslands or sparse stunted *Acacia* and *Cassia* spp., low shrubland. HSHI or MSGF pasture land.
2	15	**Lower slopes and stony interfluves:** concave up to 8 per cent extending up to 1 km downslope to form interfluves up to 5 m high and up to 400 m wide, dense gravel and pebble mantles.	Shallow, stony, reddish brown or dark red loams and clays, less than 60 cm deep, Um 511, Uf 631.	Tall shrublands of *Acacia xiphophylla, A. victoriae* with sparse low shrubs, spinifex *Triodia wiseana,* forbs and annual grasses. HSHI pasture lands.
3	5	**Gilgai plains:** up to 600 m in extent, slopes up to 1 per cent gilgai microrelief with variable surface mantles.	Seasonal cracking, alkaline, dark reddish brown or dark red clays, 1 m + deep, Ug 538.	Tall shrublands mostly *Acacia xiphophylla* with low shrubs *Cassia* spp., *Rhagodia eremaea, Enchylaena tomentosa,* sparse perennial grasses *Eragrostis xerophila,* forbs and annual grasses. STCH pasture lands.
4	5	**Incised upper drainage lines:** headwater valleys with branching channels up to 15 m wide incised up to 5 m, stony marginal slopes up to 10 per cent adjacent to channels.	Marginal slopes with stony reddish brown loams mostly less than 40 cm deep, Um 551, channels in parent material with bedloads of gravel, pebbles and cobbles.	Hard spinifex *Triodia wiseana, T. longiceps* with sparse shrubs various *Acacia* spp., occasional trees *Eucalyptus dichromophloia.* HSHI pasture lands.
5	5	**Drainage floors and channels:** floors rarely more than 400 m wide, gradients 1 in 200 or less, central tracts with braided channels; major trunk channels up to 50 m wide.	Floors with weak red or reddish brown loams and clays, variable surface strew, depth 30 cm to 1 m + Um 551, 552, Ug 537, channels with mixed bedloads.	Variable tall shrublands becoming denser along creeklines, includes *Acacia kempeana, A. victoriae, A. citrinoviridis,* numerous low shrubs, also *Triodia* spp., sparse perennial grasses, forbs and annual grasses. MUCR pasture lands.

ROUS LAND SYSTEM (386 sq km)

Alluvial plains flanking Rous Creek and Yannarie River, sand and duplex soils with snakewood and other shrublands.

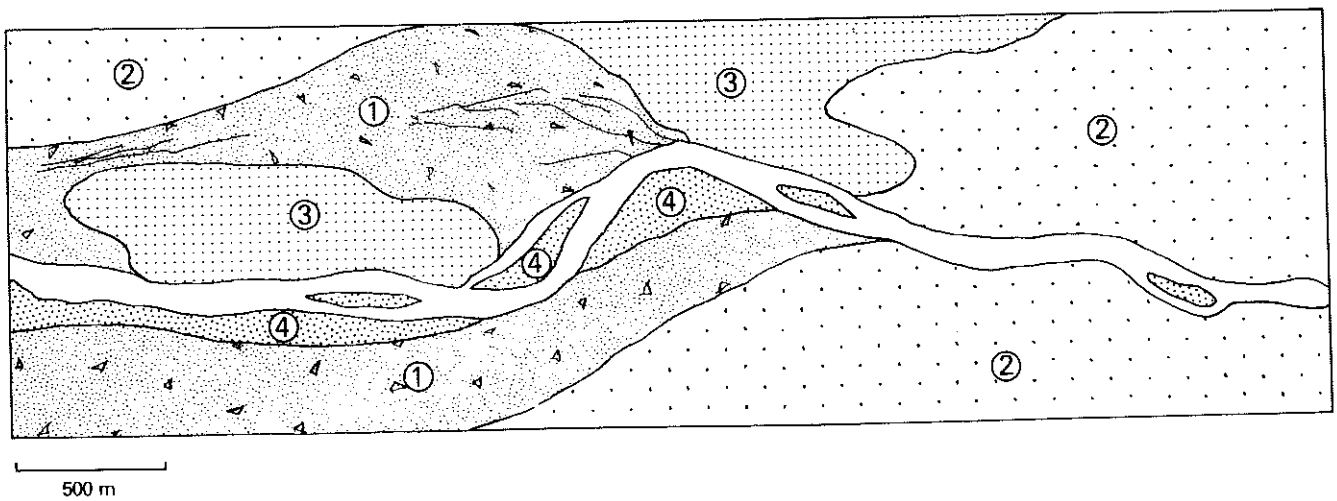
Location: Yanrey 1:250 000 map sheet.

Geology: Quaternary alluvium.

Geomorphology: Depositional surfaces — alluvial plains; — active flood plains and snakewood covered plains extending up to about 6 km, sandplain and poorly developed sandy levees; broad, anastomosing major channels, relief up to 5 m.

Pastoral use: Mixed tussock grass, stony chenopod and soft spinifex pastures, dense ephemerals in season; degraded and eroded in parts, productivity and durability varies from low to high depending on condition status, introduced buffel grass well established and assisting stabilisation, controlled stocking necessary.

Estimated carrying capacity, good condition, 4 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	30	**Flood plains:** up to 6 km in extent, subject to flooding from river bywash and sheet flow, gradients 1 in 100 to 1 in 500, moundy micro-relief, eroded in parts.	Duplex soils dark reddish brown or dark red sands over sandy clay; 1 m+ deep, Dr 252, 452, sandy surface horizons frequently removed by wind and water action.	Tall open shrublands mostly *Acacia victoriae, A. sclerosperma, A. tetragonophylla* with occasional trees *Eucalyptus coolabah,* sparse low shrubs, perennial grasses such as *Cenchrus ciliaris,* forbs and annual grasses. TGCE pasture land.
2	35	**Plains with snakewood:** alluvial surfaces up to 5 km in extent marginally higher than unit 1, gradients 1 in 70 to 1 in 300, moundy micro-relief, eroded in parts.	Dark red loams or duplex soils, sands over clay loam, 1 m+ deep, Uc 521, Um 552, Dr 453.	Tall open snakewood *Acacia xiphophylla* shrublands, also *A. victoriae,* sparse low shrubs, perennial grasses, forbs and annual grasses, also soft spinifex *Triodia pungens* ground storey. STCH pasture land.
3	20	**Sand plains:** up to 5 km in extent, gradients up to 1 in 100, moundy micro-relief, loose surfaces.	Dark red sands 1 m+ deep, Uc 511.	Shrublands with numerous *Acacia* spp., sparse trees such as *Hakea suberea,* variable ground layers including *Eremophila leucophylla* perennial grasses, soft spinifex, forbs and annual grasses. MUCR or SOSP pasture lands.
4	8	**Levees:** poorly developed levee zones raised up to 1 m above other units, up to 750 m wide and 3 km long, loose surfaces.	Dark reddish-brown or dark red sands, 1 m+ deep, Uc 521.	Tussock grasslands *Cenchrus ciliaris, C. setiger* with sparse shrubs *Acacia victoriae, Cassia* spp., forbs and annual grasses. TGCE pasture land.
5	7	**Channels and banks:** single and anastomosing channels up to 250 m wide with steep sandy banks up to 5 m high.	Channel bedloads of sand. Banks, sands and loams.	Channels — no vegetation, Banks — fringing communities *Eucalyptus camaldulensis, E. coolabah* with *Cenchrus ciliaris, C. setigerus* tussock grass ground storey. TGCE pasture land.

RUBY LAND SYSTEM (218 sq km)

Gently undulating shale plains with sparse mulga and cassia shrublands, in the south-east of the area.

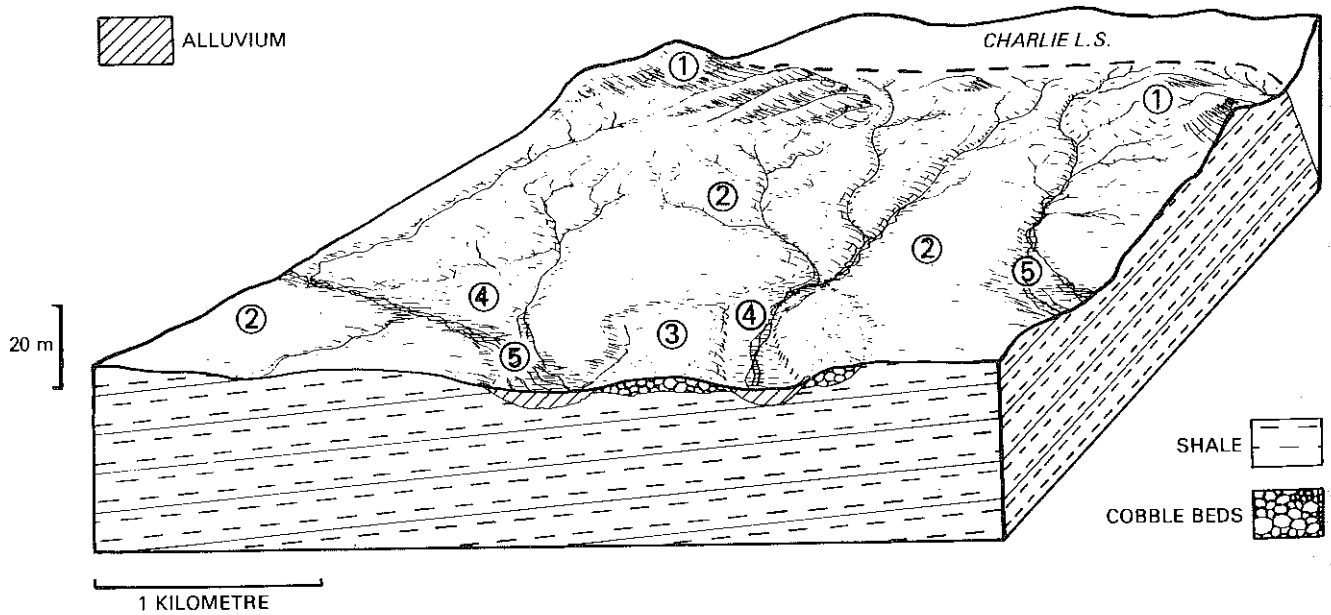
Location: Mt. Egerton 1:250 000 map sheet.

Geology: Middle Proterozoic shale and siltstone of the Bangemall Group (Kurabuka Formation) and Quaternary colluvium.

Geomorphology: Erosional surfaces — undulating plains; — shaly plains and interfluves with minor low shale hills; cobble plains adjacent to major trunk drainage lines, minor areas of saline plains and saline drainage floors, moderately dense patterns of dendritic and sub-parallel tributary drainage, relief mostly below 5 m but locally up to 20 m.

Pastoral use: Cassia short grass forb pasture with plentiful ephemerals and moderate productivity after rain, moderate drought durability; also minor areas of high quality halophytic pastures which are subject to preferential use, controlled stocking necessary to maintain desirable shrubs, mostly no erosion.

Estimated carrying capacity, good condition, 15 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	8	**Low shale hills:** up to 15 m high, rounded crests, short stony slopes up to 40 per cent.	Pockets of very shallow loamy soils, much shale outcrop and dense strew of shale fragments.	Tall open shrubland or low open woodland of mulga *Acacia aneura* with low shrubs such as *Cassia oligophylla, Ptilotus obovatus,* forbs and annual grasses. CSGF pasture land.
2	65	**Gently undulating shaly plains and interfluves:** up to 1.5 km long, raised up to 4 m and up to 500 m wide between drainage, slopes mostly up to 1 per cent but locally greater, dense mantle of fine shale rock fragments.	Reddish brown alkaline silty loams with shale inclusions throughout profile, depth 50 cm to 1 m +, Gn 283.	Low open shrubland of *Cassia oligophylla,* very sparse *Eremophila* spp., *Ptilotus obovatus,* forbs and annual grasses. CSGF pasture land.
3	12	**Cobble plains:** usually marginal to major drainage lines, up to 2.5 km in extent, slopes up to 1 per cent, dense surface mantles.	Dark red sandy and silty clay loams with dense surface strew of pebbles and cobbles, mostly 1 m+ deep. Gn 211.	Open shrublands *Acacia victoriae, Cassia pruinosa, Eremophila cuneifolia, Maireana georgei, Enchylaena tomentosa* forbs and annual grasses. STCH pasture land.
4	5	**Saline drainage floors:** Mostly less than 300 m wide but occasionally up to 2 km in extent, gradients 1 in 170 to 1 in 500.	Mostly reddish brown alkaline loamy and clayey soils, 1 m+ deep, Um 521, Dr 212.	Tall or low open shrublands, sparse *Acacia victoriae, A. kempeana* overstorey with understorey of *Cassia* spp., *Maireana pyramidata, Atriplex bunburyana,* numerous forbs and annual grasses. CHMA pasture land.
5	10	**Channels and creeklines:** braided channels up to 5 m wide and 10 to 30 metres apart, little sharp incision, also narrow single channels and major trunk channels up to 50 m wide and incised 3 to 4 m.	Bedloads of sand and gravel; between channel areas reddish brown gradational and duplex soils, mostly 1 m+ deep, Dr 212.	Dense tall shrubland fringing communities including *Acacia kempeana, A. aneura, Cassia* and *Eremophila* spp., numerous other low shrubs, forbs and annual grasses. MUCR pasture land.

SCOOP LAND SYSTEM (141 sq km)

Stony plains with snakewood and chenopod shrublands.

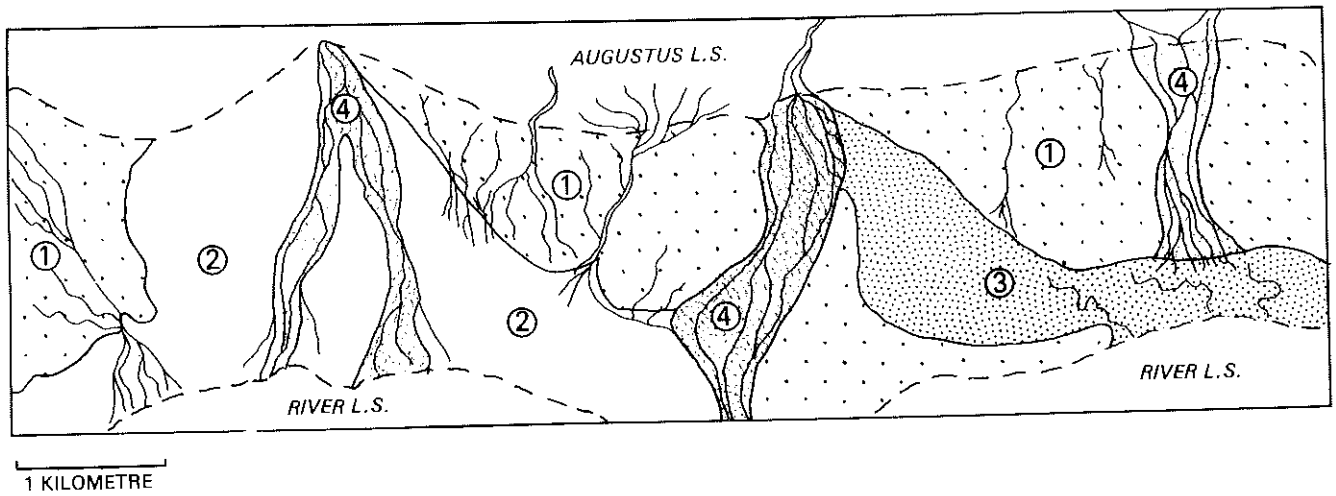
Location: Edmund 1:250 000 map sheet.

Geology: Quaternary colluvium and alluvium.

Geomorphology: Depositional surfaces — non-saline stony plains; — stony plains and interfluves raised slightly above lower plains and gilgai plains, drainage tracts with moderately dense patterns of parallel and braided channels; channels often dissipate onto lower units or may be through going to major trunk drainage; relief mostly less than 15 m.

Pastoral use: Stony chenopod and chenopod pastures of moderate to high productivity and good durability, controlled stocking required to maintain desirable shrubs, unit 4 likely to be susceptible to erosion.

Estimated carrying capacity, good condition, 12 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	55	**Stony plains and interfluves:** up to 1 km wide and extending up to 2 km downslope, sloping up to 2 per cent, locally greater; dense gravel, pebble and cobble mantles and occasional gilgai micro-relief.	Stony dark red alkaline clays, 1 m+ deep, some seasonally cracking, Uf 612, Ug 538.	Patchy tall snakewood *Acacia xiphophylla* shrublands with low shrubs such as *Enchylaena tomentosa, Cassia* aff. *hamersleyensis,* forbs and annual grasses. STCH pasture land.
2	20	**Lower plains:** up to 2 km in extent, up to 5 or 6 m below unit 1 and receiving sheet flow from it and unit 4, sloping up to 1.5 per cent, patchy gravel and pebble mantles, vegetation often clumped.	Dark red alkaline clay loams and clays on pebble and cobble beds at variable depth, Uf 612, Gn 413.	Tall clumped shrublands of *Acacia victoriae* with numerous low shrubs *Cassia* spp., *Atriplex bunburyana, Rhagodia eremaea, Maireana pyramidata, Ptilotus obovatus,* forbs and annual grasses. CHAT pasture land.
3	10	**Gilgai plains:** lower than unit 1 and up to 2 km in extent, gradients 1 in 300 or less, variable gravel and pebble mantles with gilgai micro-relief.	Dark reddish brown or dark red seasonal cracking alkaline clays, 1m+ deep, Ug 538.	Shrublands with *Acacia victoriae, Cassia* aff. *hamersleyensis, Enchylaena tomentosa, Rhagodia eremaea,* forbs and annual grasses — sometimes severely degraded to annual herbfields. STCH pasture land.
4	15	**Drainage tracts with braided channels:** up to 750 m wide; numerous small parallel or braided channels with little incision, gradients about 1 in 200.	Probably dark reddish brown sandy surfaced duplex and gradational soils.	Moderately dense tall shrublands with *Acacia aneura, A. wanyu, A. citrinoviridis,* low shrubs *Cassia* spp., *Ptilotis obovatus, Enchylaena tomentosa,* forbs and annual grasses. MUCR pasture land.

SPEARHOLE LAND SYSTEM (369 sq km)

Gently undulating hardpan plains with groved mulga shrublands; in the north-east of the area.

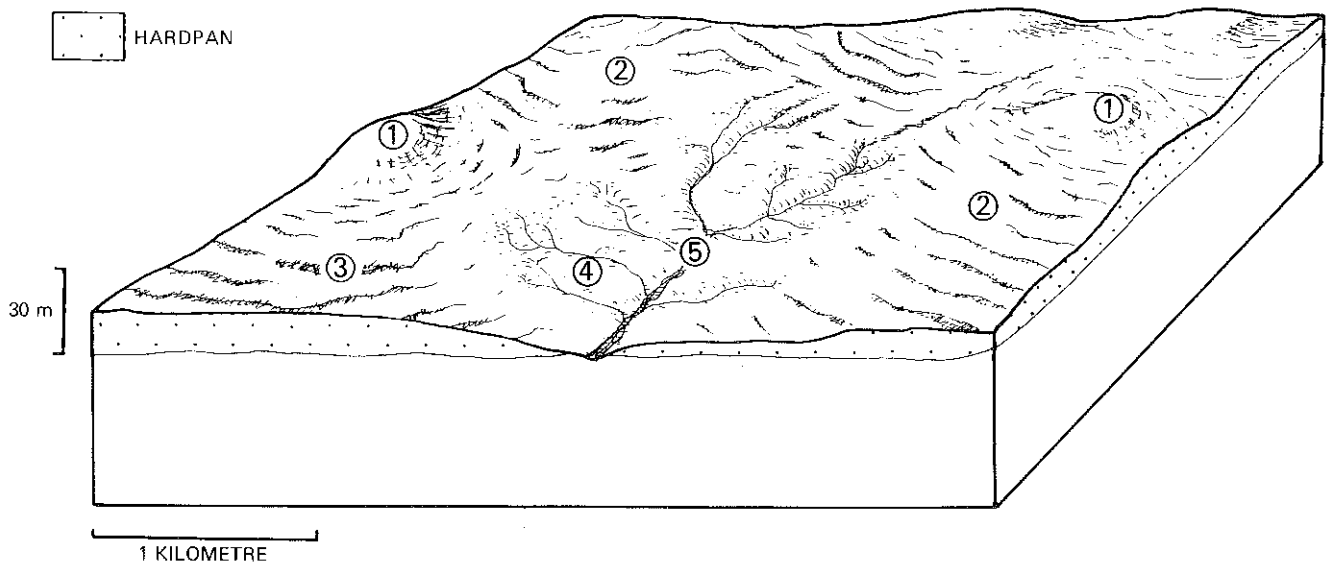
Location: Newman 1:250 000 map sheet.

Geology: Partly cemented Quaternary colluvium and alluvium.

Geomorphology: Depositional surfaces — hardpan plains; — gently undulating, non-saline plains with hardpan at shallow depth and groved vegetation, sparse patterns of dendritic drainage with restricted areas of shallow valleys and finely dissected slopes, relief up to 35 m.

Pastoral use: Mulga short grass forb pastures, also hard spinifex pastures; overall carrying capacity is low although the groves support valuable perennial shrubs which should be maintained by controlled stocking, mostly not sensitive to erosion.

Estimated carrying capacity, good condition, 20 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	15	**Low rises:** gently rounded crests and slopes up to about 3 per cent, extending up to 1 km and attaining up to 15 m relief above general level of surrounding plains, dense gravelly mantles.	Dark reddish brown silty loams overlying hardpan at variable depth, Um 531.	Mulga *Acacia aneura* shrublands, also *A. pruinocarpa*, sparse low shrubs *Ptilotus obovatus, Enchylaena leucophylla, Sida* spp., forbs and annual grasses. MSGF pasture land.
2	55	**Hardpan plains with groves:** up to 6 km or more in extent, gently undulating with gradients up to 1 in 100; groved patterns of vegetation, groves arranged approx. on contour in arcuate bands up to 1.5 km long and 100 m wide though commonly much smaller.	**Intergroves:** dark reddish brown acidic loams overlying hardpan at shallow depth.	Sparse mulga *Acacia aneura* shrublands with sparse low shrubs *Ptilotus obovatus, P. schwartzii, Solanum lasiophyllum,* forbs and annual grasses. MSGF pasture land.
3	15		**Groves:** dark red or dark reddish brown silty loams, 50 cm to 1 m+ deep, Um 531.	Dense low woodland with *Acacia aneura, A. kempeana,* and numerous shrubs *Eremophila leucophylla, Ptilotus obovatus Eremophila tomentosa,* forbs and annual grasses. MUCR pasture land.
4	10	**Dissected slopes:** marginal to hardpan plains and extending up to 1 km downslope to drainage lines or as stripped margins to other land systems, often intensely dissected up to 20 m to give series of narrow spur slopes and interfluves, slopes 2 to 5 per cent.	Reddish brown alkaline silty loams on calcareous hardpan at shallow depths, gravelly and pebbly strew, Um 511.	Hard spinifex *Triodia wiseana* hummock grassland with sparse overstorey of *Eucalyptus socialis, E. dichromophloia* and occasional shrubs. HSHI pasture land.
5	5	**Incised channels:** 10 to 40 m wide and incised 1 to 2 m into hardpan or centrally positioned in shallow valleys incised up to 20 m with flanking slopes of unit 4.	Channel bedloads of pebbles and cobbles. Banks mostly alkaline loamy sands of variable depth, Uc 512.	Fringing open woodlands with *Eucalyptus camaldulensis, E. dichromophloia, Acacia* spp., also low shrubs and prominent ground storey of hard spinifex *Triodia longiceps, T. wiseana.* HSHI pasture land.

STUART LAND SYSTEM (1 230 sq km)

Plains of low or moderate relief with snakewood and hard and soft spinifex hummock grasslands.

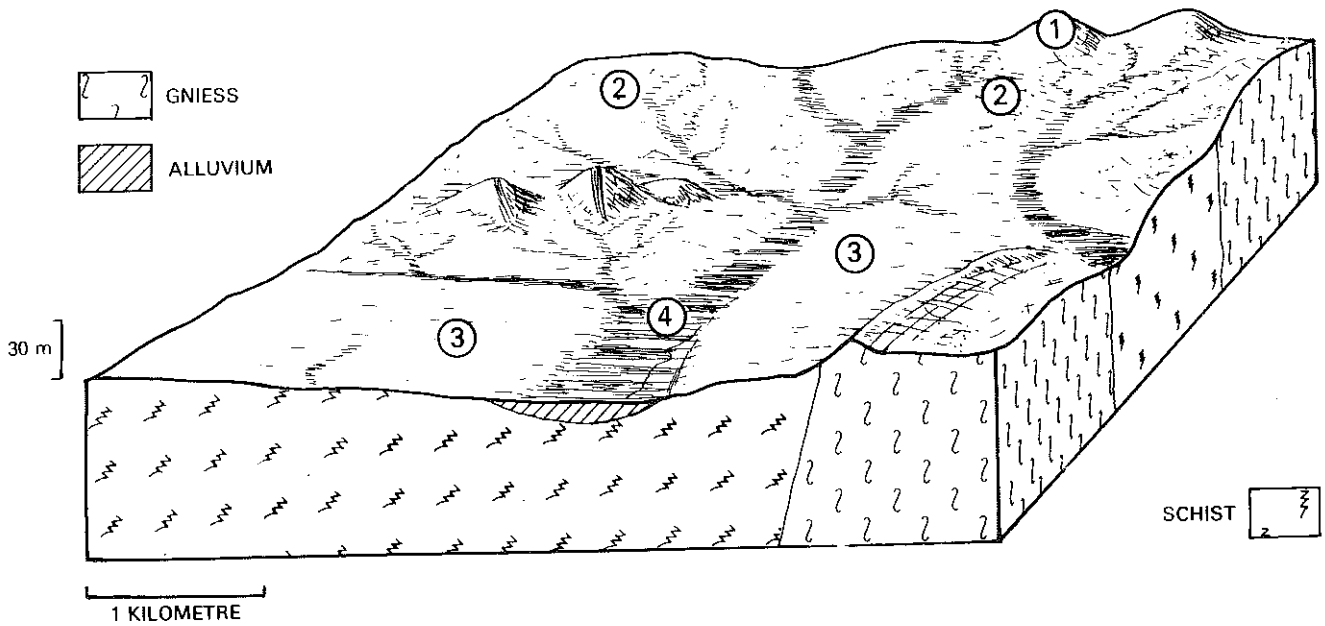
Location: Wyloo and Yanrey 1:250 000 map sheets.

Geology: Schist and gneiss of lower Proterozoic age, Quaternary colluvium and alluvium.

Geomorphology: Erosional surfaces — gently undulating plains; — minor hills, broad lower plains; through going drainage with moderately dense pattern of sub-parallel usually unchanneled alluvial floors with branching upper tributaries, relief up to 25 m.

Pastoral use: Hard spinifex pastures of very low productivity and carrying capacity, useful soft spinifex and stony chenopod pastures of moderate productivity and good durability; summer burning followed by a short deferment from grazing required every four or five years on spinifex; units inherently resistant to erosion, stony chenopod pastures degrade if over-used.

Estimated carrying capacity, good condition, 15 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	5	**Low hills:** isolated hill tracts up to 1.5 km in extent, convex slopes 3 to 10 per cent dense colluvial mantle and exposed; relief up to 25 m.	Shallow stony soils in pockets only, much outcrop of schist and other parent material.	Hummock grasslands of hard spinifex *Triodia wiseana,* with sparse low shrubs *Acacia bivenosa, A. ligulata.* HSHI pasture land.
2	35	**Undulating plains:** extensive flattish or gently sloping crests and interfluves with marginal stony slopes up to 2.5 per cent, dense colluvial mantle white quartzy fragments, relief up to 10 m.	Dark reddish brown sandy loams on parent material at less than 50 cm, stony surface pavement, Uc 111, 511.	Hummock grasslands of hard spinifex *Triodia wiseana, T. lanigera* with sparse *Acacia* spp., and other shrubs, forbs and annual grasses. HSHI pasture land.
3	40	**Lower plains:** broad surfaces usually 1.5 to 2 km in extent but up to 5 km, sloping up to 1.5 per cent, variable colluvial mantle, relief mostly less than 5m.	Dark reddish brown and dark red gradational soils, sandy or loamy surface horizons changing to clay at depth, variable surface strew, depth 80 cm to 1 m+, Gn 213, 313, Dr 213, 413.	Tall snakewood *Acacia xiphophylla* shrubland with understorey of sparse low shrubs, also *Triodia* spp., forbs and short annual grasses. STCH pasture land.
4	20	**Drainage tracts:** through flow mostly unchannelled tracts within units 2 and 3, extending many km downslope, up to 600 m wide in lower parts, narrower and branching in upper parts, gradients 1 in 100 to 1 in 300.	Dark reddish brown acidic soils, loamy surface horizons becoming more clayey, no surface strew, depth mostly 1 m+, Um 542, Gn 112, 211, 312, Dr 451.	Hummock grasslands of soft spinifex *Triodia pungens* with numerous shrubs *Acacia bivenosa, A. ancistrocarpa,* other *A.* spp., *Cassia* spp., tussock grasses and forbs. SOSP pasture land.

TABLE LAND SYSTEM (1 531 sq km)

Low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands.

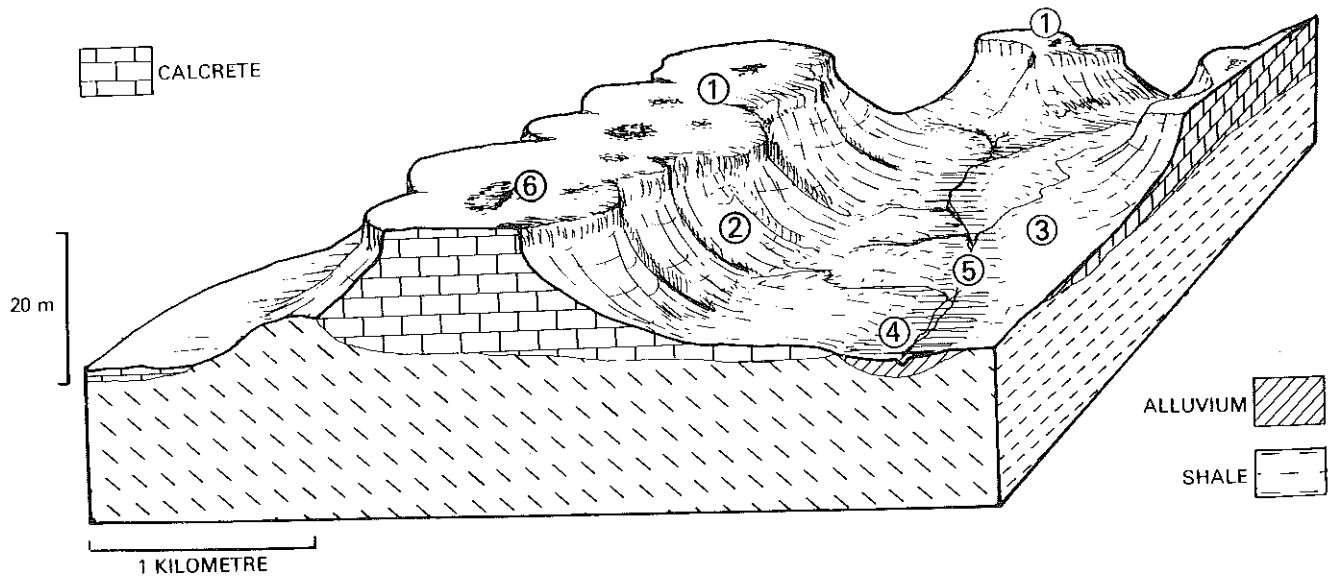
Location: Collier, Edmund, Mt. Egerton, Newman, Turee Creek and Wyloo 1:250 000 map sheets.

Geology: Tertiary calcrete valley fill deposits.

Geomorphology: Surfaces formed by dissection of the old Tertiary surface; — low dissected plateaux with tops up to eight km in extent and with numerous drainage foci; isolated mesas, buttes and low hills; short vertical breakaway faces, footslopes with sub-parallel drainage patterns of high intensity, restricted lower plains and drainage floors with through going drainage patterns of moderate or high intensity joining major trunk drainage, relief up to 60 m.

Pastoral use: Mulga short grass forb and cassia short grass forb pastures producing abundant ephemeral feed after rain, shrub component provides fair drought durability, controlled stocking desirable; system generally not prone to erosion.

Estimated carrying capacity, good condition, 19 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	50	**Calcrete mesas, low plateaux and hills:** up to 60 m high but mostly much less, plateaux tops up to 8 km in extent with numerous small drainage foci, gradients 1 in 200 or less, sparse mantle of calcrete fragments.	Dark red or reddish brown alkaline silt loams on calcrete at variable depth, usually less than 70 cm, Um 511.	Tall open mulga *Acacia aneura* shrubland and other *Acacia* spp., with low shrubs *Cassia oligophylla, Ptilotus obovatus,* forbs and annual grasses; also *Triodia wiseana* hummock grassland. MSGF or CSGF pasture land.
2	25	**Footslopes:** concave, sloping up to 70 per cent often with short vertical breakaway faces at top, up to 500 m long and dissected up to 3 m into narrow spurs, dense mantle of calcrete fragments.	Reddish brown calcareous fine sandy loam and silt loam on calcrete at variable depth, dense strew of calcrete gravel, Um 511, 512.	Shrublands with *Acacia xiphophylla, Cassia oligophylla,* other *Cassia* spp., *Eremophila* spp., *Ptilotus obovatus,* forbs and annual grasses; also *Triodia wiseana.* MSGF or CSGF pasture land.
3	15	**Lower plains:** beneath units 1 and 2, plains and interfluves up to 1.5 km in extent between narrow flow lines and small creeks incised up to 1 m, slopes up to 2 per cent, variable mantle of calcrete fragments.	Reddish brown calcareous loamy sands and loams, mostly 1 m+ deep, Uc 113, Um 512, Gc 112.	Tall shrubland of *Acacia aneura* and other *Acacia* spp., with *Cassia oligophylla, Eremophila* spp., *Ptilotus obovatus,* forbs and annual grasses. MSGF pasture land.
4	5	**Drainage floors:** mostly 100 to 200 m wide but up to 500 m, up to 3 km long between low calcrete plateaux or on unit 3, gradients 1 in 70 to 1 in 500, central areas with channels.	Dark red or reddish brown calcareous loams becoming more clayey with depth, 1 m+ deep, Um 512, 522, Gc 222, also some cracking clay soils, Ug 536.	Tall shrubland of *Acacia aneura* and other *Acacia* spp., numerous low shrubs *Cassia* spp, *Rhagodia eremaea Ptilotus obovatus,* forbs and grasses. MUCR pasture land.
5	4	**Channels and creeklines:** 5 to 20 m wide incised 0.5 to 2 m, occasional wider major river channels.	Bedloads of sand and calcrete gravel and pebbles.	Dense fringing tall shrublands of *Acacia aneura* and other *Acacia* spp., numerous low shrubs, forbs and grasses. MUCR pasture land.
6	1	**Drainage foci:** on unit 1 about 0.5 m below adjacent surfaces, oval or elongated 30 to 300 m in extent, occasionally up to 600 m, variable mantle of calcrete fragments.	Dark reddish brown or dark red calcareous cracking clays 80 cm to 1 m+ deep, Ug 536, 538.	Tall *Acacia aneura* shrubland with prominent low shrubs mostly *Cassia oligophylla,* tussock grasses *Eragrostis xerophila, Eriachne flaccida,* forbs and annual grasses. TGMI pasture land.

TANGADEE LAND SYSTEM (320 sq km)

Low shale hills and undulating plains with mulga woodlands, in the south-east of the area.

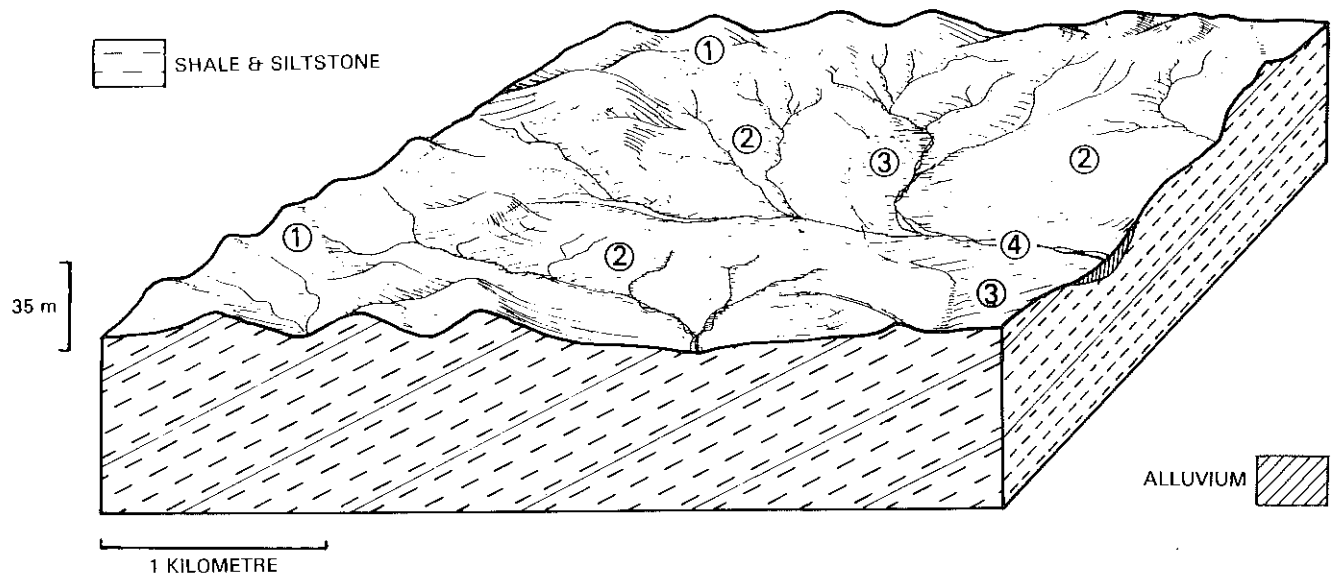
Location: Collier 1:250 000 map sheet.

Geology: Middle Proterozoic shale and minor siltstone and sandstone of the Bangemall Group.

Geomorphology: Erosional surfaces — low hills and undulating plains; — shale hills up to 35 m high, extensive undulating shale plains and narrow interfluves, minor lower plains and narrow drainage floors, dense patterns of dendritic and finely branching upper drainage becoming sub-parallel or rectangular in lower parts.

Pastoral use: Mulga short grass forb pastures of moderate productivity and durability, small areas of better quality halophytic pastures on unit 3, controlled stocking required to maintain palatable shrubs, not susceptible to erosion.

Estimated carrying capacity, good condition, 19 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	30	**Low hills, ridges and foot slopes:** up to 35 m high, rounded crests and short convex and concave slopes 5 to 50 per cent and mosly less than 300 m long, shale outcrop and dense mantles of shale fragments.	Much outcrop of weathered shale, skeletal reddish brown sands and loams 10 to 40 cm deep on shale, Uc 511.	Low open mulga *Acacia aneura* woodland with sparse low shrubs *Ptilotus obovatus, Cassia spp.*, forbs and annual grasses. MSGF pasture land.
2	55	**Undulating shale plains and interfluves:** up to 1.5 km long and 400 m wide but commonly much less, raised up to 10 m above drainage with gently sloping crests and short marginal slopes up to 25 per cent, dense mantles of small shale fragments.	Reddish brown gradational soils frequently calcerous throughout profile on weathered shale usually at less than 50 cm, Gc 112.	Low mulga woodland with moderately dense understorey of *Cassia oligophylla, C. helmsii, Ptilotus obovatus,* forbs and annual grasses. MSGF pasture land.
3	10	**Lower plains and drainage floors:** lower surfaces mostly less than 1 km long and 400 m wide, raised only 1 to 2 m above creek channels, slopes up to 2 per cent, patchy mantles.	Reddish brown loamy soils over clay on weathered shale at variable depth, Gn 213.	Low open shrubland of *Eremophila lachnocalyx, Cassia spp.*, and very sparse *Rhagodia eremaea, Maireana pyramidata,* forbs and annual grasses. CHMA pasture land.
4	5	**Creeklines and channels:** numerous headwater channels 5 to 10 m wide incised in bedrock, major channels up to 40 m wide.	Bedloads of coarse sand and gravelly shale fragments. Banks alkaline loamy and clayey sands, Uc 511.	Fringing communities of dense tall shrublands *Acacia kempeana, A. aneura* with variable low shrubs, forbs and annual grasses. MUCR pasture land.

THREE RIVERS LAND SYSTEM (288 sq km)

Broad hardpan plains with minor sandy banks and sparse mulga shrublands, in the far south-east of the area.

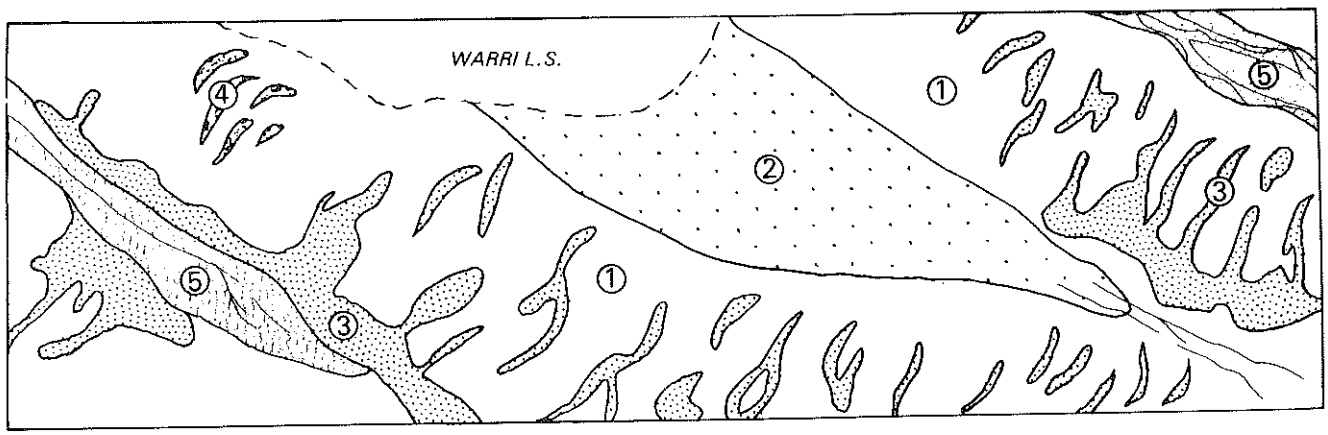
Location: Collier 1:250 000 map sheet.

Geology: Partly cemented Quaternary colluvium and alluvium.

Geomorphology: Depositional surfaces — hardpan plains; — broad, non-saline plains with hardpan at shallow depth and numerous sandy banks and occasional groves, plains receiving more concentrated flow, minor tracts with channelled through drainage shallowly incised into hardpan, relief up to 5 m.

Pastoral use: Stony short grass forb, mulga short grass forb and minor perennial grass pastures; sparse palatable shrubs and useful ephemeral growth in season but overall productivity, durability and carrying capacity is low, system as seen mostly in good condition but under excessive use units 1 and 2 can degrade and erode to hardpan and unit 3 susceptible to erosion.

Estimated carrying capacity, good condition, 22 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	60	**Hardpan plains: up** to 10 km or more in extent, gradients mostly less than 1 in 500, gravelly mantles, hardpan exposure in parts.	Dark reddish brown or dusky red acidic silty loams on hardpan at shallow depth, Um 521, 522.	Very sparse shrublands with occasional mulga *Acacia aneura* and *A. rhodophloia,* also *Eremophila fraseri, Solanum lasiophyllum,* forbs and annual grasses. SSGF pasture land.
2	20	**Plains receiving concentrated sheet flow:** up to 4 or 5 km long and 3 km wide, gradient 1 in 300 or less, variable gravelly mantles, some shallow scour lines in parts.	As for unit 1.	Low open shrublands with sparse *Acacia rhodophloia, Eremophila spathulata, Ptilotus schwartzii, Solanum lasiophyllum,* forbs and annual grasses. SSGF pasture land.
3	15	**Sandy banks:** up to 1 m high and 1 km long by 20 m wide occurring on unit 1, or as broader tracts adjacent to drainage zones; uneven, loose surfaces.	Dark reddish brown acidic sands or sandy loams, 1 m+ deep, Uc 513.	Moderately dense tall shrublands with *Acacia aneura, Canthium latifolium* and low shrubs *Eremophila leucophylla, E. margarethae,* also perennial grasses *Eragrostis eriopoda, Monachather paradoxa,* forbs and annual grasses. TGMI pasture land.
4	2	**Groves:** on unit 1, up to 400 m long and 20 m wide but commonly much less.	Dark reddish brown acidic silty loams, 1 m+ deep.	Dense tall mulga and other *Acacia* spp. shrublands, moderately dense low shrubs *Cassia, Eremophila, Sida* spp., *Enchylaena tomentosa,* forbs and annual grasses. MUCR pasture land.
5	3	**Channelled drainage zones:** up to 1 km wide with shallow gutters and central channels incised up to 3 m, frequent hardpan exposures.	Dark reddish brown acidic silty loams and clay loams on hardpan at shallow depth.	Tall open shrublands or low open woodlands of mulga and other *Acacia* spp., becoming denser along channels, low shrubs *Eremophila* and *Cassia* spp., forbs and annual grasses. MSGF pasture land.

TUREE LAND SYSTEM (362 sq km)

Stony plains with numerous gilgaied depressions supporting tussock grasses and very sparse low shrublands, in the east of the area.

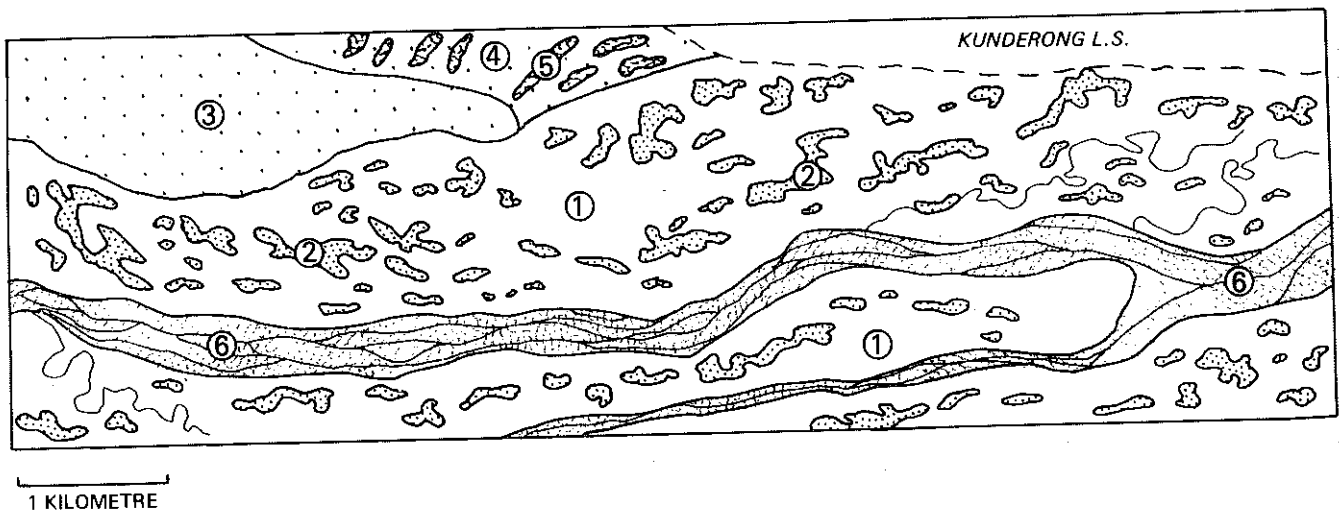
Location: Newman 1:250 000 map sheet.

Geology: Tertiary colluvial valley fill deposits and Quaternary alluvium.

Geomorphology: Depositional surfaces —non-saline, stony and gilgaied plains; — extensive plains with a mosaic of stony non-gilgaied surfaces and large gilgaied depressions and drainage foci, minor hardpan plains subject to sheet flow, minor hardpan plains with mosaic of linear gilgais; through drainage tracts with channels, very few tributary drainage patterns on gilgai plains, relief mostly less than 10 m.

Pastoral use: Tussock grass and mixed shrub pastures of moderate to high productivity and durability interspersed with stony short grass forb pastures of very low durability, ephemerals after rain can be heavily utilised but controlled stocking necessary to maintain desirable perennials, pastures considerably degraded in parts but units have little susceptibility to erosion.

Estimated carrying capacity, good condition, 10 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	37	**Stony plains with gilgaied drainage foci:** extending up to 30 km parallel and immediately adjacent to major drainage lines such as Tunnel Creek; up to 6 km wide, gradients 1 in 100 to 1 in 500 or less; unit is an irregular mosaic of areas of stony pavements, 50 m to 1.5 km in extent, and slightly lower gilgaied drainage foci as discrete areas up to 200 m in diameter or as linked irregular or linear areas up to 1 km in extent.	**Stony areas:** dark reddish brown or dark red loams and loams over clay, mostly 1 m+ deep, dense gravel and pebble strew, Um 542, Dr 213, 412.	Very sparse low shrublands of *Cassia oligophylla, Eremophila cuneifolia, E. lachnocalyx,* forbs and annual grasses. SSGF pasture land.
2	37		**Gilgaied drainage foci:** dark reddish brown or dark red seasonal cracking light clays, 80 cm to 1 m+ deep, gravelly surface strew varies from sparse to dense, Ug 537, 538.	Degraded tussock grasslands with *Eragrostis xerophila, E. setifolia, Eriachne flaccida* and sparse *Acacia, Cassia* and *Eremophila* spp., shrubs and forbs. TGER pasture land.
3	8	**Hardpan plains:** up to 9 km long and 1 km wide, parallel to but not immediately adjacent to major drainage, gradients mostly less than 1 in 500.	Dark red silty loams on hardpan usually at less than 25 cm, Um 531.	Sparse low shrublands of *Eremophila punicea, E. incisifolia* and *Cassia* spp., forbs and annual grasses, occasional tall shrubs such as *Acacia rhodophloia.* SSGF pasture land.
4	4	**Hardpan plains with linear gilgais:** up to 6 km long and 2 km wide, gradients 1 in 100 to 1 in 500, unit as a mosaic of hardpan plain areas 100 to 500 m in extent and linear or linked gilgai areas up to 500 m in length.	**Hardpan areas:** dark red loamy soils on hardpan at shallow depth.	Sparse low shrublands of *Eremophila* and *Cassia* spp., *Solanum lasiophyllum,* forbs and annual grasses. SSGF pasture land.
5	4		**Gilgai areas:** dark reddish brown seasonal cracking light clays, 1 m+ deep, Ug 538.	Patches of mulga *Acacia aneura* trees with numerous low shrubs including *Cassia hamersleyensis, C. oligophylla Solanum lasiophyllum, Eremophila* spp., sparse perennial grasses and numerous forbs. TGER pasture land.
6	10	**Channelled drainage tracts:** through going tracts up to 500 m wide, 3 to 4 m below and with short pebble strew marginal slopes to adjacent plains, anastomosing channels up to 40 m wide in central areas; gravel, pebble and cobble strew surfaces.	Reddish brown silty and clayey loams, 1 m+ deep, Um 512.	Low woodlands and tall shrublands with moderately dense *Acacia citrinoviridis, A. coriacea,* sparse *Eucalyptus* spp., low shrubs *Ptilotus obovatus, Solanum lasiophyllum,* sparse perennial grasses, forbs and annual grasses. MUCR pasture land.

UAROO LAND SYSTEM (4519 sq km)

Broad sandy plains with hard and soft spinifex grasslands, in the west of the area.

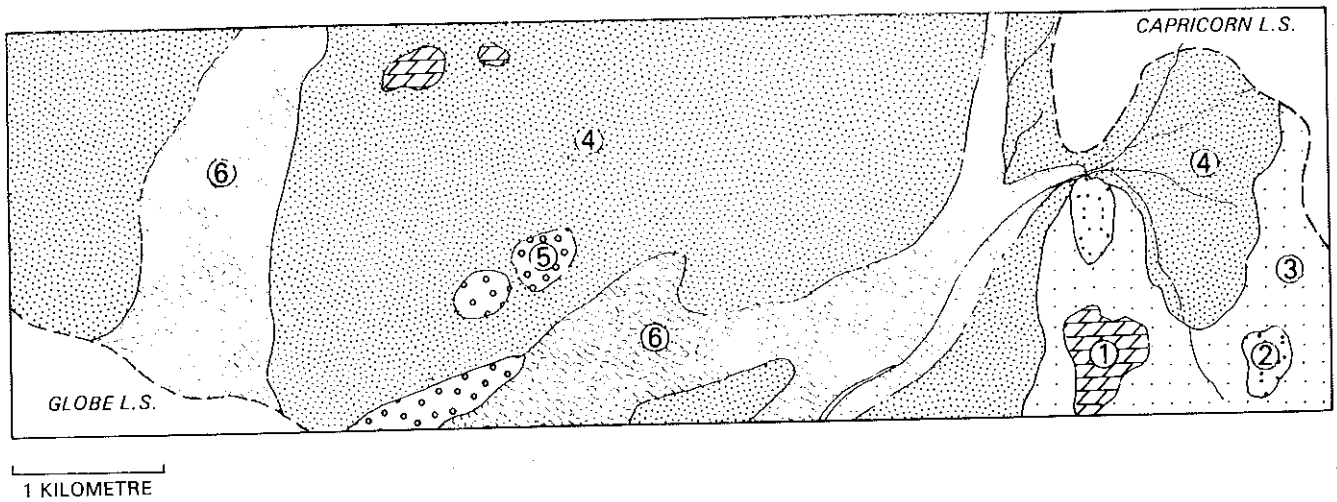
Location: Winning, Wyloo and Yanrey 1:250 000 map sheets.

Geology: Quaternary colluvium and alluvium.

Geomorphology: Depositional surfaces — sandy plains; — non-saline sandy plains 10 km or more in extent, little organised through drainage; pebbly surfaced plains and plains with calcrete at very shallow depth; broad mostly unchannelled tracts receiving more concentrated sheet flow, minor low stony hills and rises; relief mostly less than 5 m but isolated hills up to 30 m.

Pastoral use: Mostly hard spinifex pastures of very low productivity; some useful soft spinifex pastures of moderate productivity and good durability; summer burning followed by a short deferment from grazing required every four or five years, some erosion and pasture decline evident in drainage tracts but generally the system is not susceptible to erosion or significant pasture degradation.

Estimated carrying capacity, good condition, 18 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	1	**Low hills:** isolated hills and ridges up to 1 km long, steep stony footslopes, relief up to 30 m above surrounding plains.	Little soil development, much rock outcrop and dense stony mantles.	Hummock grasslands of hard spinifex *Triodia lanigera, T. wiseana* with variable shrub overstorey. HSHI pasture land.
2	2	**Low stony rises:** raised surfaces up to 2 km in extent, sloping up to 2 per cent, dense stony mantle and frequent rock outcrop, relief up to 15 m.	Stony reddish brown or dark red sands and loams, dense pebbly surface strew, variable depth to parent material, Uc 123, Um 143.	Hummock grasslands of soft spinifex *Triodia pungens* or tall shrublands of snakewood *Acacia xiphophylla* with sparse low shrubs and *Triodia* spp. SOSP pasture land.
3	10	**Pebbly plains:** up to 3 km in extent, marginal to or as patches within unit 4, gradients 1 in 100 to 1 in 300, dense pebble and gravel mantle.	Dark reddish brown or dark red gradational soils; sand and sandy loam surface horizons merging to sandy clay, depth 50 cm to 1 m, dense surface strew. Gn 112, 212, 213, Dr 413.	Hummock grasslands of hard spinifex *Triodia* spp, and soft spinifex *T. pungens,* also minor tall shrublands of snakewood *Acacia xiphophylla* with sparse low shrubs. HSSP and SOSP pasture lands.
4	67	**Sandy plains:** frequently 10 km or more in extent, gradients usually 1 in 1000 or less but locally up to 1 in 200, micro-relief often moundy, no surface mantle.	Dark red loose surfaced sands also loamy sands becoming clayey with depth, 1 m+ deep, Uc 511, Gn 112, Dr 212.	Hummock grasslands of hard spinifex *Triodia lanigera* with shrub overstorey *Acacia ancistrocarpa, A. inequilatera* and few low trees such as *Eucalyptus setosa, E. aspera,* minor soft spinifex *Triodia pungens* grasslands. HSSP and SOSP pasture lands.
5	5	**Calcrete plains:** surfaces associated with unit 4; up to 3 km in extent, gradients up to 1 in 100, dense mantle of calcareous gravel.	Dark red alkaline loamy sands and silty loams on calcrete usually at less than 25 cm, dense strew of calcareous gravel. Uc 113, Um 133.	Hard spinifex *Triodia wiseana, T. lanigera* hummock grassland. HSSP pasture land.
6	15	**Tracts receiving sheet flow:** up to 3 km wide extending downslope through unit 4 for many kilometres, gradients 1 in 100 to 1 in 1 000, unchannelled or rarely with narrow braided creeklines, no surface mantle.	Dark reddish brown and dark red soils, mostly loams becoming clayey with depth, some sands and duplex soils, 1 m+ deep. Gn 112, 212. Dr 213, 251, Uc 531, Um 552.	Dense tall *Acacia* shrublands including *A. tetragonophylla, A. ancistrocarpa, A. wanyu, A. aneura* with numerous low shrubs and soft spinifex *Triodia pungens* and tussock grass ground layer. SOSP pasture land.

ULLAWARRA LAND SYSTEM (497 sq km)

Dolerite and shale hills, restricted stony plains and drainage floors; mulga and minor chenopod shrublands.

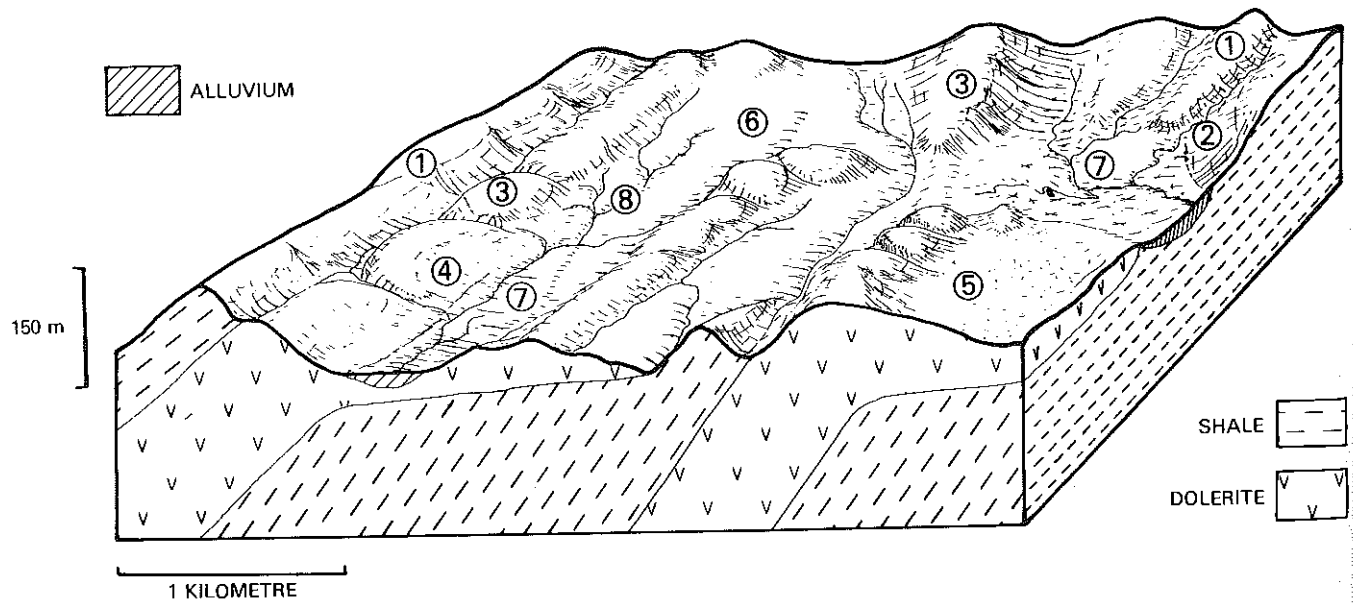
Location: Edmund and Mt. Egerton 1:250 000 map sheets.

Geology: Middle Proterozoic shale and siltstone of the Ullawarra Formation (Bangemall Group) with many dolerite intrusions.

Geomorphology: Erosional surfaces — hills and ridges; — shale and dolerite hills and ridges in strike belts up to 25 km or more in length, gentle lower slopes on shale and dolerite, raised stony gilgai plains, restricted lower plains and drainage floors; moderately dense patterns of rectangular drainage, relief commonly 20 to 50 m but locally up to 150 m or more.

Pastoral use: Mulga short grass forb pastures of low to moderate productivity and fair durability, minor inclusions of valuable but degraded chenopod pastures on units 6 and 7, controlled stocking required on these areas, unit 7 susceptible to erosion.

Estimated carrying capacity, good condition, 26 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	25	**Shale and siltstone hills and ridges:** hills and parallel strike ridges in tracts up to 25 km or more in length, up to 150 m high although commonly much less, stony rounded crests, upper slopes up to 70 per cent, shale outcrop and dense mantles.	Much rock outcrop, pockets of skeletal dark red loams mostly less than 20 cm deep, Um 143.	Tall shrublands of *Acacia pruinocarpa, A. aneura* with numerous low shrubs *Cassia* and *Eremophila* spp., *Ptilotus obovatus,* forbs and annual grasses. MSGF pasture land.
2	10	**Lower slopes on shale and siltstone:** concave up to 10 per cent extending up to 250 m downslope, dense shaley mantles.	Shallow dark red and reddish brown loams.	As for unit 1.
3	30	**Dolerite hills and ridges:** hills and strike ridges in tracts up to 25 km or more in length, up to 150 m high although commonly much less, gently rounded crests, benched upper slopes mostly below 50 per cent but locally greater, dolerite outcrop and dense pebble and cobble mantles.	Rock outcrop and dense surface strew, pockets of shallow alkaline loamy and clayey soils.	Tall shrublands of mulga *Acacia aneura* and other *Acacia* spp., with numerous low shrubs such as *Cassia oligophylla, Ptilotus obovatus,* forbs and annual grasses; also hummock grasslands of *Triodia wiseana* with very sparse shrubs. MSGF and HSHI pasture lands.
4	12	**Lower slopes on dolerite:** concave or benched slopes up to 8 per cent extending up to 250 m downslope, dense mantles of gravel and pebbles.	Reddish brown alkaline loams and clays on dolerite, 50 cm to 1 m+ deep, Um 512, Uf 612, Gc 112.	Tall *Acacia aneura* shrublands or low woodlands with low shrubs *Cassia oligophylla, Ptilotus obovatus,* forbs and annual grasses. MSGF pasture land.
5	7	**Raised gilgai plains on dolerite:** up to 2 km in extent, surfaces frequently elevated on gently sloping crests or upper slopes of dolerite hill tracts, slopes 1 to 6 per cent often with structural benching, numerous dolerite cobbles and boulders, stony gilgai micro-relief.	Dark red seasonal cracking clay soils with variable strew of dolerite cobbles and boulders, 1 m+ deep, Ug 538.	Low shrublands of *Cassia* aff., *hamersleyensis,* forbs and annual grasses. CSGF pasture land.
6	5	**Stony lower plains:** stony interfluves up to 1.5 km long by 1 km wide below hill units, sloping 0.5 to 2 per cent, mantles of shale, siltstone and dolerite rock fragments.	Reddish brown clayey soils of variable depth, patchy gravel and pebble strew, Uf 612.	Sparse tall shrublands of *Acacia xiphophylla, A. victoriae* with low shrubs *Cassia* spp., *Maireana pyramidata,* forbs and annual grasses. CHMA pasture land.
7	8	**Drainage floors:** up to 2 km long by 500 m wide but usually much less, slopes 1 in 100 to 1 in 500, dense stony mantles and gilgai micro-relief.	Dark red or reddish brown cracking clay soils with dense gravel and pebble strew, 1 m + deep, Ug 538.	Very sparse degraded shrublands with *Acacia victoriae, Cassia* spp., *Maireana pyramidata,* forbs and annual grasses. CHMA pasture land.
8	3	**Channels and banks:** 10 to 20 m wide in upper parts incised into bedrock, major creeklines up to 100 m wide.	Bedloads of sand, gravel, pebbles and cobbles, banks alluvial sandy loams and sandy clays of variable depth.	Fringing woodlands of dense *Acacia aneura, A. citrinoviridis* with low shrubs *Cassia* spp., *Ptilotus obovatus* and sparse perennial grasses. MUCR pasture land.

WARRI LAND SYSTEM (443 sq km)

Low calcrete platforms and plains with mulga and cassia shrublands.

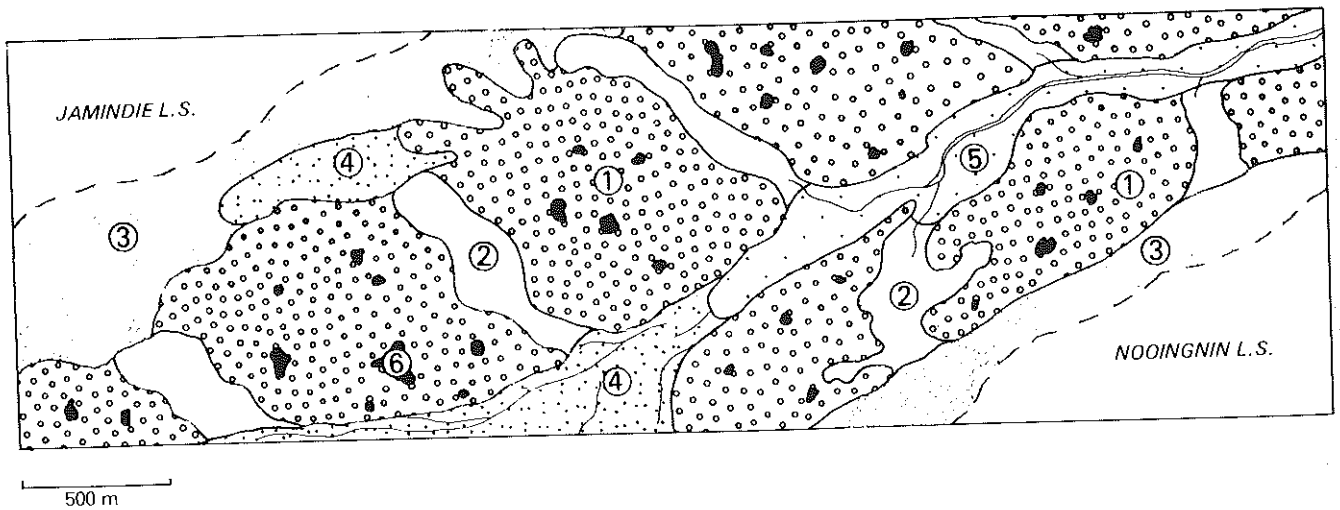
Location: Collier, Newman and Turee Creek 1:250 000 map sheets.

Geology: Tertiary calcrete, calcareous gravel and opaline silica partly overlain by cemented Quaternary colluvium.

Geomorphology: Depositional surfaces — calcreted valley fills; — nearly flat plains with a mosaic of calcrete tables elevated up to three metres above surrounding surfaces, narrow inter-table areas and drainage floors with restricted channel drainage, broader saline plains, overall relief mostly below 5 m.

Pastoral use: Mulga short grass forb and cassia short grass forb pastures producing abundant ephemerals after rain and with useful durable shrubs, minor valuable chenopod pastures now partly degraded, controlled stocking necessary to maintain desirable shrubs; unit 4 is susceptible to erosion.

Estimated carrying capacity, good condition, 18 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	60	**Calcrete tables:** almost flat surfaces often oval or rounded in shape, mostly 500 m to 1.5 km in extent but locally up to 5 km, elevated up to 3 m above surrounding units, variable mantles of calcrete gravel and rubble.	Dark reddish brown or dark red calcareous sandy and silty loams on calcrete at 10 to 50 cm, Uc 511, Um 511.	Moderately dense shrublands with *Acacia aneura, A. sclerosperma, Cassia oligophylla, Ptilotus obovatus, Rhagodia eremaea,* numerous forbs and annual grasses, also hard spinifex *Triodia wiseana* grasslands with scattered shrubs. MSGF and HSHI pasture lands.
2	10	**Intertable areas:** up to 400 m wide and slightly lower than tables, gradients 1 in 100 to 1 in 500, variable mantles.	Dark reddish brown or dark red calcareous silty loams often over hard pan at shallow depth, Um 521.	Sparse shrublands with *Acacia aneura, Cassia* spp., *Eremophila fraseri, Solanum lasiophyllum* and sparse forbs. MSGF pasture land.
3	10	**Marginal hardpan plains:** up to 2 km in extent on outer margins of system, gradients 1 in 200 to 1 in 500, gravelly mantles.	Dark red acidic silty loams on hardpan at 20 to 50 cm, Um 521, 531.	Tall shrublands of variable density, with *Acacia aneura, A. quadrimarginea,* numerous *Eremophila* spp., sparse forbs and annual grasses. MSGF pasture land.
4	9	**Saline plains:** nearly flat surfaces associated with units 3 and 5 and up to 2 km in extent, subject to sheet flooding.	Reddish brown silty loams and clays of variable depth.	Degraded shrublands, very sparse *Acacia aneura* and low shrubs *Eremophila maculata, Enchylaena tomentosa, Ptilotus obovatus,* forbs and grasses. CHAT pasture land.
5	10	**Drainage floors:** zones of through flow extending up to 5 or 6 km between calcrete tables, up to 500 m wide and 3 m below adjacent tables, gradients from nearly flat to 1 in 300, central tracts may be channelled or unchannelled.	Reddish brown silty and clayey loams of variable depth, also seasonal cracking clays, Um 522, Gn 212, Ug 537.	Woodlands with *Acacia aneura, Eucalyptus coolabah, Hakea lorea,* sparse shrubs including *Cassia nemophila, Rhagodia eremaea,* sparse perennial grasses, forbs and annual grasses. Also open tussock grasslands *Eragrostis xerophila, E. setifolia, Eriachne flaccida* and numerous forbs. MUCR and TGER pasture lands.
6	1	**Drainage foci and sinkholes** on unit 1 up to 1 m below adjacent surfaces, oval or elongated 10 m to 250 m in extent, variable mantles of calcrete fragments.	Dark reddish brown or dark red calcareous cracking clays, 80 cm to 1 m+ deep, Ug 538.	Moderately dense tall shrubs *Acacia aneura* and other *Acacia* spp. with low shrubs such as *Cassia oligophylla, Ptilotus obovatus* also sparse tussock grasses *Eragrostis xerophila,* numerous forbs and annual grasses. TGER pasture land.

WEELARRANA LAND SYSTEM (86 sq km)

Salt lakes, with fringing saline plains and sandy islands; in the far east of the area.

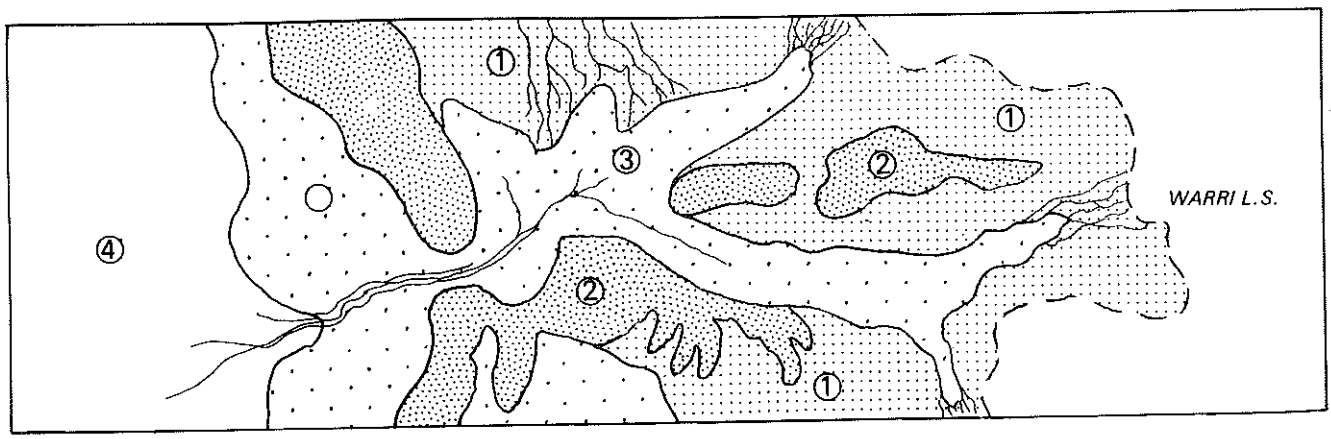
Location: Collier 1:250 000 map sheet.

Geology: Quaternary lacustrine deposits of saline sand, silt, and clay, and aeolian sand.

Geomorphology: Depositional surfaces — salt lake and sand plains; — lakes with bare surfaces, fringing samphire flats with shallow channels and flow lines, slightly more elevated saline plains, irregular sandy banks and islands, relief up to 5 m.

Pastoral use: Chenopod and hard spinifex pastures; palatable shrubs on unit 1 have high drought durability and should be maintained by controlled stocking, hard spinifex pastures have very low productivity, samphire can be little utilised due to high salinity, unit 1 susceptible to erosion.

Overall carrying capacity, good condition, 24 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	20	**Saline plains:** up to 2 km in extent, mostly on outer margins of system, gradients 1 in 200 to 1 in 500, gravelly mantles of variable density.	Reddish brown gradational sandy and silty clay loams on carbonate hardpan, Gn 213, also probably duplex soils.	Low open halophytic shrublands with *Maireana pyramidata, Atriplex vesicaria, Frankenia* spp., forbs and annual grasses. CHMA pasture land.
2	20	**Sandy banks and islands:** raised up to 3 m above units 1 and 3, linear and irregular banks up to 1 km long and 200 m wide or islands up to 1.5 km in extent; loose, hummocky surfaces.	Dark red sandy loams and sandy clay loams, 1 m+ deep, calcareous concretions through profile, Uc 511.	Low open shrubland *Melaleuca* spp., *Acacia aneura, Eremophila leucophylla* with a prominent hard spinifex *Trodia* spp., ground layer. HSSP pasture land.
3	35	**Samphire flats and lake margins:** gentle slopes and plains marginal to and raised up to 1 m above unit 1, soft saline surfaces.	Saline loams and clays, probably gypsiferous.	Low moderately dense to dense samphire *Halosarcia* spp., shrublands with sparse forbs and annual grasses. SAMP pasture land.
4	25	**Salt lake beds:** flat, bare saline surfaces extending for 3 or 4 km.	Highly saline loams and clays, probably gypsiferous.	No vegetation.

WINNING LAND SYSTEM (135 sq km)

Low hills and broad lower plains with snakewood shrublands and chenopod and soft spinifex pastures, in the west of the area.

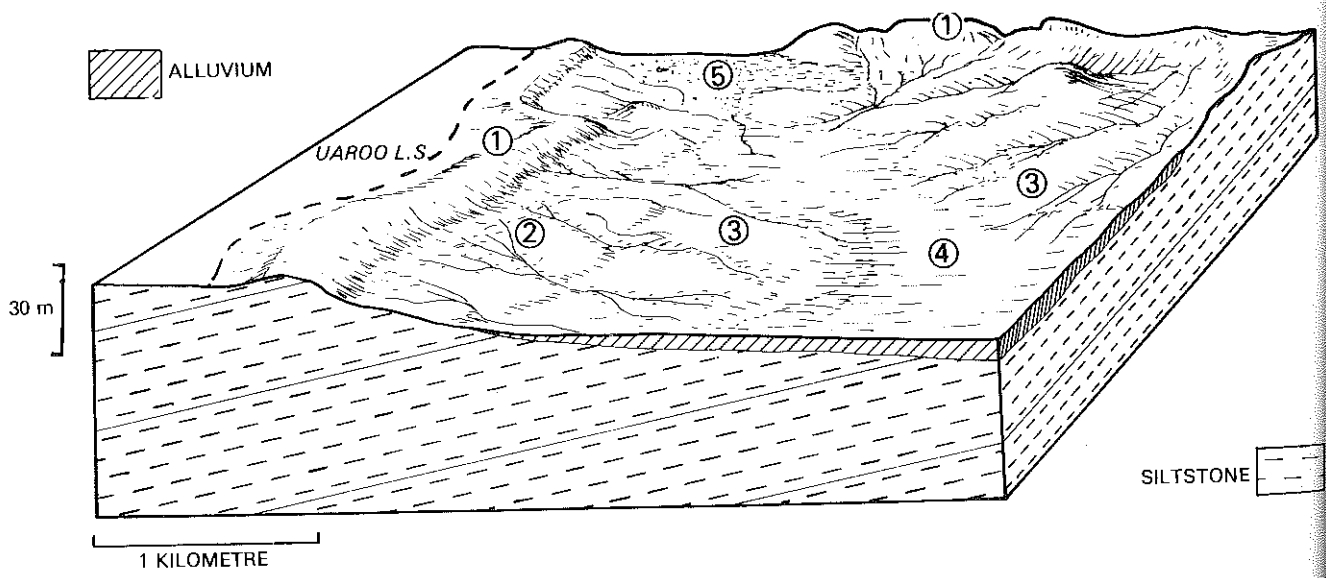
Location: Winning Pool 1:250 000 map sheet.

Geology: Lower Cretaceous siltstones of the Winning Group.

Geomorphology: Erosional surfaces — saline and non-saline interfluves and plains below low hills and stripped margins; — low hills, stony rises and stripped surfaces marginal to other units, short dissected slopes, low interfluves and extensive often saline lower alluvial plains, minor sandy plains; little organised drainage on lower units but moderately dense patterns of parallel or branching drainage on dissected slopes and interfluves often fanning out onto lower plains; relief up to 30 m.

Pastoral use: Chenopod and soft spinifex pastures of moderately high productivity and good durability, controlled stocking necessary to prevent preferential overuse of desirable shrubs, pastures degraded in parts but no erosion evident, unit 4 may be susceptible to erosion.

Estimated carrying capacity, good condition, 9 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	15	**Low hills, stony rises and stripped margins:** up to 25 m high occurring as marginal stripped uplands extending for up to 6 km or as isolated rises and hills, rounded or nearly flat crests, short upper slopes mostly less than 20 per cent but locally greater with shallow, parallel dissection; dense stony mantles.	Mainly outcrop, pockets of very shallow skeletal soils with dense stony strew.	Sparse hummock grasslands of hard and soft spinifex *Triodia lanigera, T. pungens,* sparse overstorey of shrubs such as *Acacia bivenosa* and *Cassia* spp. HSHI and SOSP pasture land.
2	15	**Dissected slopes:** sloping up to 4 per cent and extending up to 50 m downslope below unit 1, numerous closely spaced gutters parallel or fanning out into lower units, incised 0.5 to 1 m; dense mantles of calcareous gravel.	Reddish brown calcareous sandy loams on calcrete at variable depths, Um 113.	Sparse soft spinifex *Triodia pungens* grassland with sparse overshrubs *Acacia, Cassia, Eremophila* spp., forbs and annual grasses. SOSP pasture land.
3	30	**Low interfluves:** up to 2 km long and 1 km wide raised up to 3 to 4 m above drainage lines, slopes up to 2 per cent gravelly mantles of variable density.	Dark red calcareous and gypsiferous sandy loams and sandy clays, 1 m+ deep, Gc 212, Uf 612.	Sparse shrublands with *Acacia xiphophylla* overstorey and low shrubs *Eremophila cuneifolia, Maireana pyramidata, M. triptera, Enchylaena tomentosa,* forbs and annual grasses. CHMA pasture land.
4	30	**Lower plains:** often saline, up to 3 km in extent receiving sheet flow and shallow channelled flow from other units, gradients 1 in 100 to 1 in 500.	Dark red texture contrast soils, sands and loams over clay, 1 m+ deep, Dr 213, 413.	Degraded shrublands with *Acacia xiphophylla* overstorey and various low shrubs *Eremophila, Cassia,* and *Maireana* spp., *Rhagodia eremaea, Enchylaena tomentosa,* also sparse perennial grasses, forbs and annual grasses. CHMA pasture land.
4	10	**Sandy plains:** nearly flat surfaces extending up to a few km, partly overlying or below unit 1 or occurring as isolated low plains.	Dark red loamy sands or loamy sands over clay, 1 m+ deep, Dr 213.	Soft spinifex *Triodia pungens* grasslands with scattered tall shrubs such as *Acacia xiphophylla, A. victoriae.* SOSP pasture land.

WONA LAND SYSTEM (176 sq km)

Basalt upland plains with snakewood or very sparse low cassia shrublands; in the north-west of the area.

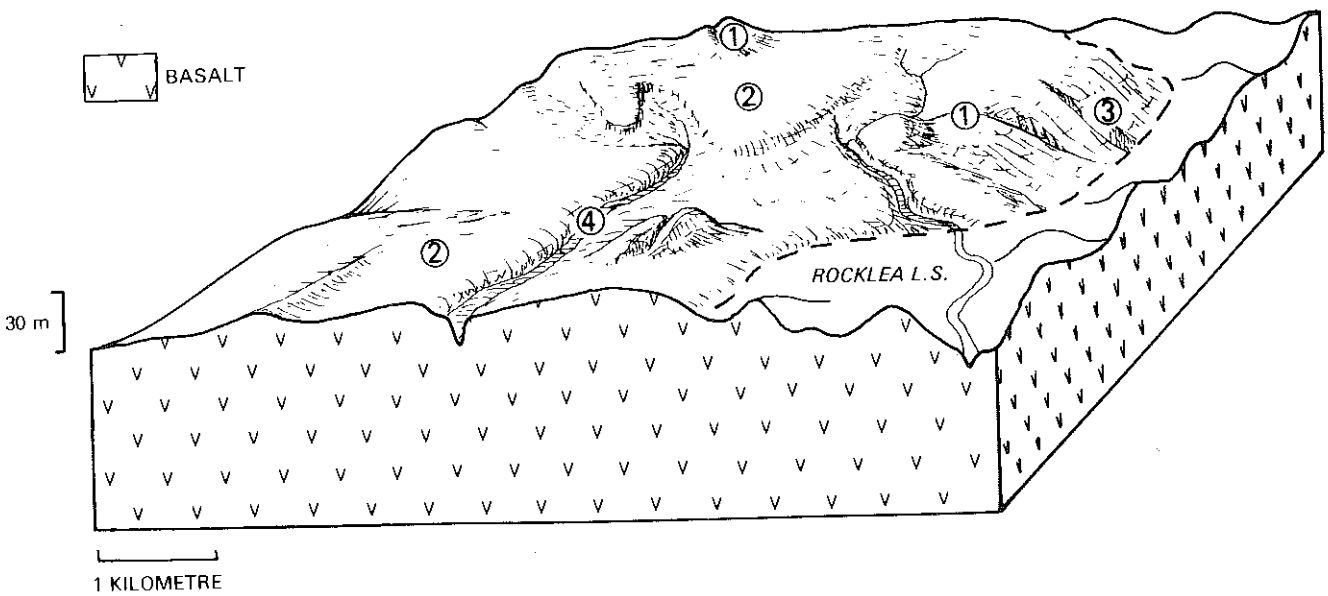
Location: Mt. Bruce and Turee Creek 1:250 000 map sheets.

Geology: Lower Proterozoic basalts of the Fortescue Group.

Geomorphology: Erosional surfaces — basalt uplands; — subdued plateaux and gently sloping stony gilgai uplands, minor basalt hills and benched slopes; sparse patterns of incised drainage with narrow valleys and steep stony slopes, relief up to about 30 m.

Pastoral use: Stony chenopod and stony short grass forb pastures with abundant ephemerals after rain but with little durability, surrounded by rugged country and of limited pastoral use, not prone to erosion.

Overall carrying capacity, good condition, 13 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	5	**Low basalt hills:** isolated hills up to 20 m high and 400 m long, slopes with basalt cobbles and boulders.	Much outcrop and strew, pockets of skeletal stony loams.	Hard spinifex *Triodia wiseana, T. lanigera* grasslands with sparse stunted *Acacia* and *Cassia* spp. shrubs. HSHI pasture land.
2	80	**Stony gilgai upland plains:** elevated surfaces up to 4 km in extent, sloping up to 3 per cent locally greater at margins, gilgai micro-relief with dense mantle of basalt cobbles, stones and boulders.	Stony red self mulching seasonal cracking clay soils 1 m+ deep, Ug 538.	Tall snakewood *Acacia xiphophylla* shrublands with sparse low shrubs *Enchylaena tomentosa, Eremophila cuneifolia, Rhagodia eremaea, Cassia* aff. *hamersleyensis,* forbs and annual grasses or very sparse low shrublands of *C.* aff. *hamersleyensis,* forbs and annual grasses. STCH and CSGF pasture lands.
3	10	**Rocky slopes:** benched slopes at margins of unit 1 or leading to incised drainage, mostly less than 300 m long, sloping up to 60 per cent, dense mantles of basalt boulders.	Probably shallow, stony, reddish brown or hard red loams and clays of variable depth.	Probably *Acacia xiphophylla* shrublands with sparse undershrubs *Eremophila* spp., *Enchylaena tomentosa, Cassia* aff. *hamersleyensis,* forbs and annual grasses. STCH pasture land.
4	5	**Incised drainage lines:** channels up to 15 m wide and incised to form narrow valleys with steep stony marginal slopes.	Channel bedloads of gravel, pebbles and cobbles. Marginal slopes probably shallow, stony reddish brown loams.	As for unit 3.

YANKAGEE LAND SYSTEM (1 111 sq km)

Plains with dunes and numerous claypans, soft spinifex and snakewood shrublands; in the west of the area.

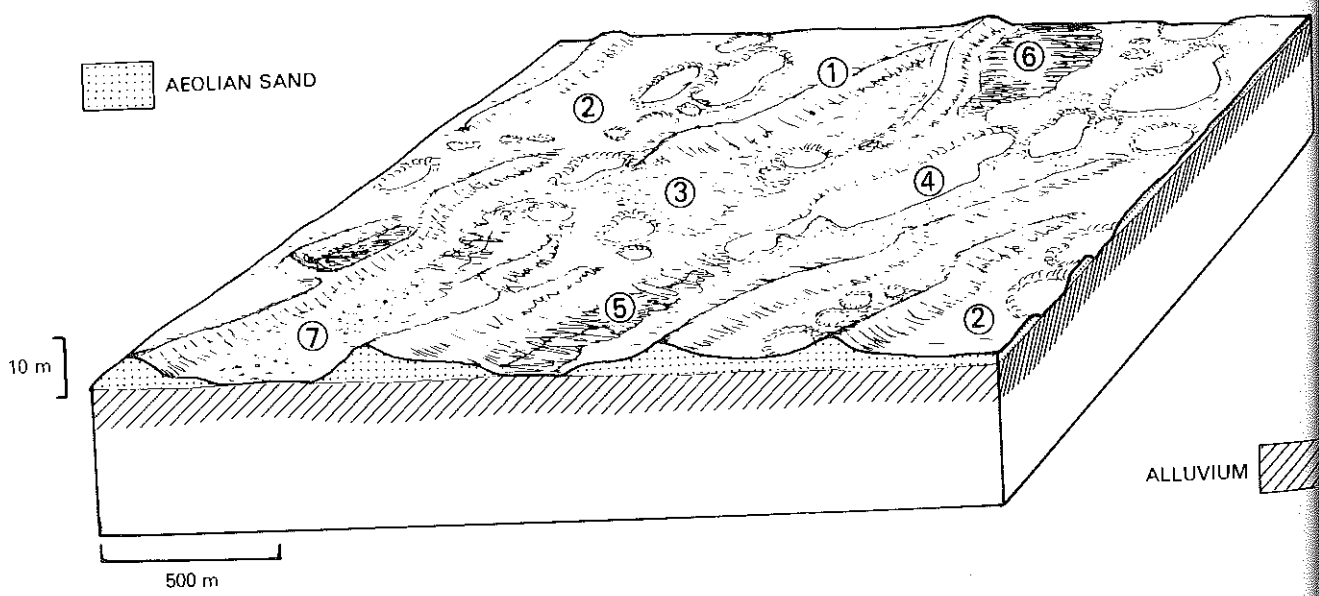
Location: Onslow and Yanrey 1:250 000 map sheets.

Geology: Quaternary alluvium, poorly sorted clay, silt, sand and gravel and aeolian sand.

Geomorphology: Depositional surfaces — saline and non-saline plains formed by sheet flood and deflation; — extensive clay plains with linear and reticulate sand dunes, shallow sandplain overlying clay, numerous small and large claypans with bare deflation lag surfaces; no organised drainage but clay plains are subject to sheet flow which becomes concentrated in some areas, numerous swamps and depressions subject to regular inundations but not holding permanent water; relief up to 15 m.

Pastoral use: Soft spinifex, chenopod shrubs and tussock grass pastures of moderate to high productivity and good durability, spinifex requires summer burning every four or five years, controlled stocking required to maintain palatable shrubs; pastures on units 3 and 5 are degraded in parts and moderately susceptible to erosion.

Estimated carrying capacity, good condition, 7 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	12	**Dunes:** linear and some reticulate, up to 5 km long and 12 m high, flanks slope 10 to 20 per cent, hummocky crests and loose surfaces.	Dark red sands, 1 m+ deep, Uc 123.	Soft spinifex *Triodia pungens* hummock grasslands with sparse shrubs such as *Acacia translucens.* SOSP pasture land.
2	26	**Swales and sandplain:** swales 300 m to 1 km wide with flat floors and concave marginal slopes up to 2 per cent, irregular sandplain areas up to several km in extent with numerous claypans, loose surfaces.	Dark red sands and sands over sandy clays, 1 m+ deep, Dr 413.	Soft spinifex *Triodia pungens* grasslands with sparse shrubs, forbs and annual grasses. SOSP pasture land.
3	14	**Hummocky plains:** up to 1.5 km in extent but often as smaller areas marginal to units 2 and 5, gradients 1 in 100 to 1 in 500, humocky micro-relief.	Dark reddish brown or dark red alkaline clays and duplex soils, 1 m+ deep, Uf 621, Gc 112, Dr 413, 543.	Snakewood *Acacia xiphophylla* shrublands with sparse undershrubs *Enchylaena tomentosa, Atriplex bunburyana, Maireana* spp., *Rhagodia eremaea,* forbs and annual grasses. CHAT pasture land.
4	26	**Claypans:** round, oval and elongated flat surfaces mostly between 20 to 400 m in extent but up to 1.5 km, up to 2 m below adjacent sandplain with short steep or truncated sandy marginal slopes; hardsetting, bare surfaces.	Dark red alkaline clays 1 m+ deep, sealed strewless surfaces, Uf 612, Uf 621.	No vegetation or occasionally very sparse perennial grasses *Eriachne benthamii, E. gardneri.*
5	10	**Plains receiving concentrated flow:** up to 2 km in extent, almost flat, as interdunal corridors or broader diffuse areas receiving sheet flow, some channelling and scouring up to 1 m deep.	Dark reddish brown or dark red alkaline clays 1 m+ deep, Uf 621, 653.	Tall shrublands with *Acacia tetragonophylla, A. xiphophylla, A. victoriae* and sparse low shrubs and perennial grasses *Eriachne benthamii, Eulalia fulva, Chrysopogon fallax.* TGCH pasture land.
6	12	**Swamps and depressions:** round, oval and elongated flat surfaces mostly between 100 to 500 m in extent but occasionally up to 2 km, up to 2 m below adjacent surfaces, subject to regular inundation.	Dark red seasonal cracking clays 1 m+ deep, Ug 538.	Low woodlands of *Eucalyptus coolabah* with very sparse undershrubs such as *Scaevola spinescens, Meuhlenbeckia cunninghamii* and perennial grass *Sporobolus mitchellii.* TGMI pasture land.
7	<1	**Gilgai plains:** isolated flat interdunal plains up to 500 m wide and 2 km long, gilgai micro-relief.	Dark red seasonal cracking clays 1 m+ deep, Ug 538.	Open tussock grasslands of *Astrebla elymoides, Eragrostis xerophila, E. setifolia.* TGAS pasture land.

YANREY LAND SYSTEM (112 sq km)

Active flood plains with grassy woodlands, in the west of the area.

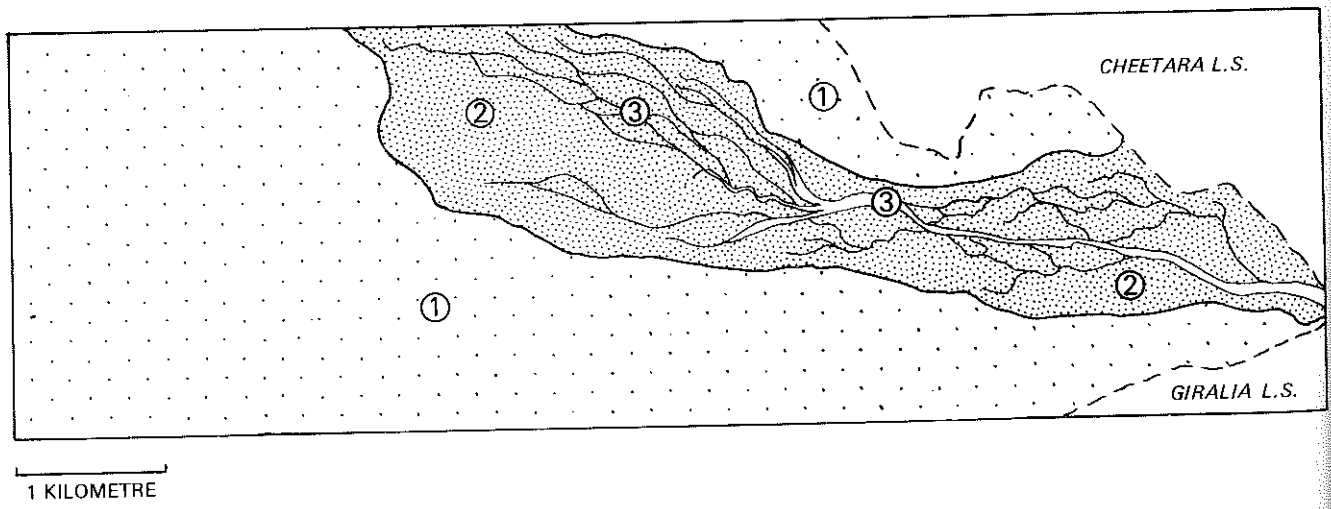
Location: Yanrey 1:250 000 map sheet.

Geology: Quaternary alluvium.

Geomorphology: Depositional surfaces — alluvial plains; — active flood plains with cracking clay soils, sandy outwash plains receiving overflow from adjacent channels, anastomosing and braided channels of the endoreic Yannarie River becoming dispersed and terminating on the plains.

Pastoral use: Tussock grass pastures of high productivity and good durability, controlled stocking required, some pasture decline evident on less frequently flooded margins of plains, not susceptible to erosion.

Estimated carrying capacity, good condition, 3 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	77	**Flood plains:** almost flat plains up to 4 km wide and 15 km or more long, occasional sandy rises, banks and margins up to 1 m high and 500 m in extent; mostly gilgai micro-relief up to 1.5 m deep.	Mostly dark reddish brown seasonal cracking clay soils, also silt loams and sandy clay loams, 1 m + deep, Ug 538, Um 542.	Open woodlands of *Eucalyptus coolabah* with variable but usually sparse shrub layer and prominent tussock grasses *Eulalia fulva, Chrysopogon fallax, Eriachne benthamii, E. flaccida.* TGCH pasture land.
2	20	**Sandy outwash areas:** tracts receiving direct concentrated overflow from shallow anastomosing and braided channels; gradients up to 1 in 100, hummocky and convex micro-relief, loose surfaces.	Dark red or dark reddish brown sands and loams, 1 m + deep, Uc 511.	*Eucalyptus coolabah* woodlands with sparse tall shrubs including *Acacia ancistrocarpa, A. sclerosperma* and dense buffel grass *Cenchrus ciliaris.* TGCE pasture land.
3	3	**Channels:** braided and anastomosing, 5 to 30 m wide, incised 1 to 3 m.	Channel bedloads of sand, banks of sand and sandy loam.	Fringing woodlands, as for unit 2. TGCE pasture land.

YARCOWIE LAND SYSTEM (21 sq km)

Gilgai plains with tussock grasses and very sparse shrubs; exclusive to the far west of the area.

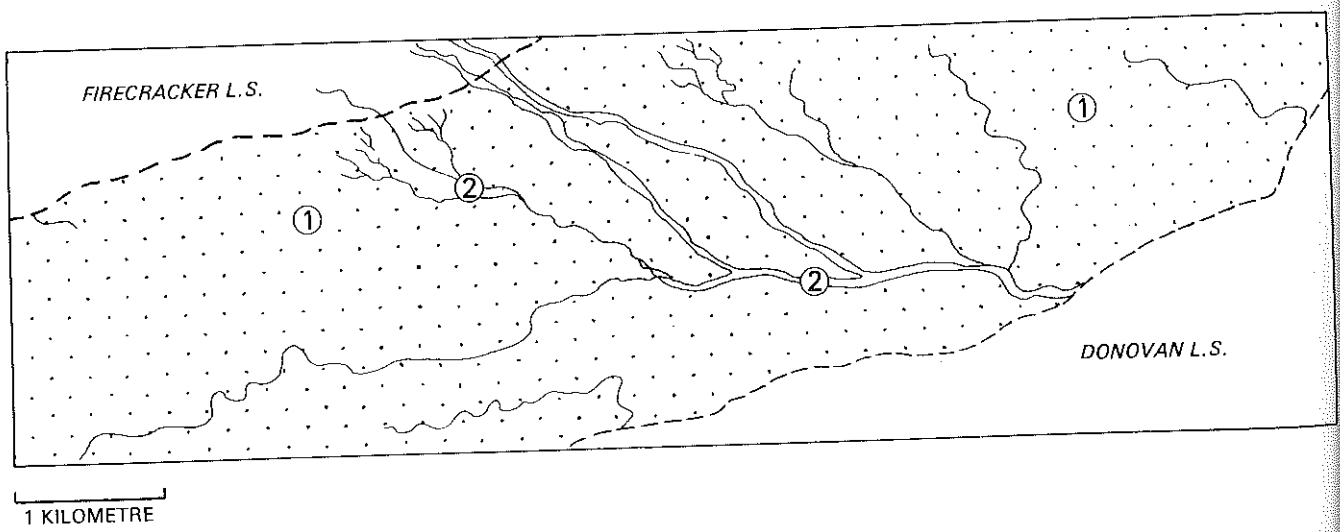
Location: Yanrey 1:250 000 map sheet.

Geology: Lower Cretaceous bentonitic siltstone and radiolarite.

Geomorphology: Erosional plains; — nearly flat gilgai plains developed in situ on weathered siltstone with restricted more sloping margins and sparse patterns of branching and meandering channels, relief mostly less than 4 m.

Pastoral use: Perennial grass pastures of moderate productivity and durability now somewhat degraded with palatable shrub components largely removed, control of intensity and season of stocking required, sloping margins of plains are susceptible to water erosion.

Estimated carrying capacity, good condition, 6 ha per sheep unit.



Unit	Approx. Area (%)	Land forms	Soils	Vegetation
1	96	**Gilgai plains:** up to 9 km in extent, gradients mostly less than 1 in 500 but margins to plains up to 1 in 100, gilgai micro-relief.	Reddish brown alkaline clays with calcareous concretions throughout profile, 1 m+ deep, Ug 538.	Tussock grassland of *Eragrostis xerophila* with very sparse shrubs such as *Maireana polypterygia, Eremophila maculata, Acacia xiphophylla* and forbs. TGER pasture lands.
2	4	**Channels:** up to 10 m wide, meandering, incised up to 1.5 m, some active gully erosion to 1 m deep on sloping margins to plains.	Fine silty sands and silty loams over clay in channel beds and on banks.	Channel banks with fringing vegetation the same as for unit 1.

INDIVIDUAL STATION REPORTS

Station reports are presented alphabetically, using a standardised format. Reports should be read in conjunction with the relevant 1:100 000 station plans which show watering points, fences, major topographic features, land system boundaries, traverse routes, traverse recordings and range evaluation sites.

Each report presents a summary description of land systems on the station, including their relative areas and pastoral value. Condition statements derived from traverse records are presented for each land system. Condition statements for component units of each land system are not presented here, but this data is available on computer print out.

Descriptive statements of the range condition of each land system are made together with management recommendations where necessary.

The table at the end of each station report lists all land systems and their component pasture lands present on the station. The areas of each pasture land in good, fair and bad range condition as determined from traverse records obtained during survey are indicated. Carrying capacities for each level of condition have been established for each pasture land. (See Table 25 in the section in this report dealing with pasture lands). Thus the carrying capacity of each pasture land and land system on each station can be determined.

The table for each station shows the **recommended sheep unit capacity** of the land systems **for their present rauge conditiou** and the **capability sheep unit capacity** if the systems **were all in good range condition.** Recommended and capability sheep capacities for the whole station are obtained by summation and are rounded to the nearest ten.

A sheep unit is defined as an adult animal, such as a dry ewe or wether with a body weight of about 45 kg. Total sheep numbers are approximated by multiplying sheep units by 1.25.

In the case of cattle stations, sheep unit capacities have been converted to cattle units and are presented in the tables at the end of the station reports. A cattle unit is defined as an adult steer or dry cow with a body weight of about 340 k. Two conversion ratios, 5:1 and 7.5:1 are shown. The former is as currently stipulated in the Lands Act, but is too low. The **7.5:1 ratio is more realistic and is recommended for adoption.** This ratio is based on the relative feed requirements of sheep and cattle. Daily dry matter requirements per unit of body weight are essentially the same for sheep and cattle, and thus the conversion ratio is directly related to relative liveweights, that is the conversion ratio sheep to cattle equals

$$\frac{\text{av.body weight cattle unit}}{\text{av. body weight sheep unit}} = \frac{340}{45} = 7.5{:}1$$

Total cattle numbers are approximated by multiplying cattle units by 1.25.

A summary (Table 31) of all stations is presented before the individual reports. The table includes a column showing the ratio of recommended sheep unit capacity:capability sheep unit capacity. This figure gives an indication of how far removed the present range condition of each station is from original condition and is a measure of the degree of degradation that has occurred. A figure of 1.0 indicates that present condition equals original condition. The lower the fraction the greater the departure from original condition or the more degradation there is. The figures enable rapid comparisons of the relative condition of stations.

Individual reports presented here are for the following stations:

Amelia, Ashburton Downs, Bulloo Downs, Dooley Downs, Duck Creek, Giralia, Glenflorrie, Kooline, Koordarrie, Maroonah, Marrilla, Minderoo, Mininer, Mt. Brockman, Mt. Minnie, Mt. Stuart, Mt. Vernon, Nanutarra, Nyang, Pingandy, Prairie Downs, Rocklea, Tangadee, Turee Creek, Uaroo, Ullawarra, Urala, Wanna, Wyloo, Yanrey.

TABLE 31 — CONDITION AND CARRYING CAPACITY SUMMARY OF STATIONS

Station	Area (sq km)	Range condition sq km			Extreme degradation (sq km)	Total sheep (S) or cattle (C) capacity		Ratio recommended: capability	Present Stock Nos. (1979) Sheep (S) Cattle (C)	Remarks
		Good	Fair	Bad		Recommended	Capability			
Amelia	2497	2497	—	—	—	1640(C)	1640(C)	1.0	Nil	Rugged, poorly accessible; good range condition; no potential for development, doubtful viability.
Ashburton Downs	3006	944	1497	529	36	2240(C)	4240(C)	0.53	300(C)	About 60% rough hills, plain systems in variable condition; Edward system severely degraded.
Bulloo Downs	3472	1380	1622	465	4.8	1710(C)	2660(C)	0.64	3116(C)	Low potential hardpan plain and hill systems, vegetation degraded, no erosion; overstocked.
Dooley Downs	1174	1049	124	1	—	640(C)	690(C)	0.93	75(C)	Rugged low productivity country, non-viable as independent unit.
Duck Creek	1390	1352	26	12	—	630(C)	710(C)	0.89	450(C)	Mostly rugged country unsuitable for livestock, no potential for development, non-viable unit.
Giralia	2776	2437	272	62	5	24940(S)	27130(S)	0.92	18000(S) 17(C)	Spinifex country in good condition, Firecracker system degraded with some erosion — needs special management.

Table 31 (Cont.)

Station	Area (sq km)	Range condition sq km			Extreme degradation (sq km)	Total sheep (S) or cattle (C) capacity		Ratio recommended: capability	Present Stock Nos. (1979)	Remarks
		Good	Fair	Bad		Recommended	Capability		Sheep (S) Cattle (C)	
Glenflorrie	1973	1417	421	134	1	1090(C)	1450(C)	0.75	950(C)	Rough country mostly good or fair condition, limited potential for development.
Kooline	2043	839	499	632	73	1290(C)	3640(C)	0.35	1085(C)	About 50% rough hills; plain systems mostly bad condition, Edward system severely degraded and eroded.
Koordarrie	1186	684	323	164	15	16260(S)	24710(S)	0.66	7269(S)	About half station unused due to lack of water, condition mostly fair to good, some patches severe degradation.
Maroonah	1558 (part station)	1011	538	9	—	8500(S)	10860(S)	0.78	2970(S) 120(C)	About 40% rough hills of low productivity, plain systems in fair condition.
Marrilla	1328	1142	173	12	1.5	11940(S)	13110(S)	0.91	12000(S)	All accessible, mostly fair or good condition, Firecracker system partly degraded needs special management.
Minderoo	2250	1127	649	430	44	29690(S)	53260(S)	0.56	26149(S) 422(C)	All accessible, range condition varies from good to bad, some extensive areas of severe degradation.
Mininer	2220	1116	764	307	33	1380(C)	2190(C)	0.63	500(C)	About 40% rough low value hills, plain systems vary from good to bad condition, Edward system severely degraded and eroded.
Mt. Brockman	610	576	20	14	—	300(C)	390(C)	0.77	57(C)	Mostly very rugged hills some of no pastoral value, Brockman system overused and degraded, non-viable unit.
Mt. Minnie	1115	1050	656	—	—	8590(S)	8760(S)	0.98	3000(S) (1978)	Spinifex country in good condition, considerable areas not used due to lack of water.
Mt. Stuart	2071	1358	476	221	16.5	1560(C)	2640(C)	0.59	694(C) 100(S)	Hilly systems good condition, plain systems vary from good to bad condition, patches severe degradation.
Mt. Vernon	4047	2391	1330	324	2	2760(C)	3890(C)	0.71	1200(C)	Mixture of rugged hill country and stony and alluvial plains, condition mostly fair to good.
Nanutarra	3690	2791	645	191	62.5	24990(S)	32350(S)	0.77	15808(S) 300(C)	Hill and spinifex country in good condition, alluvial plains mostly fair or bad condition, Globe system severely degraded.
Nyang	1248	984	249	15	—	9360(S)	10430(S)	0.90	6988(S)	Station mostly spinifex country, considerable areas not watered, condition mostly good.
Pingandy	1544	1294	207	43	—	850(C)	990(C)	0.85	400(C)	Rugged low productivity country, condition mostly good, doubtful viability.
Prairie Downs	2274	1178	983	113	—	1280(C)	1750(C)	0.73	877(C)	Rough hill and plain country, condition generally fair to good, some bad condition on Prairie system, additional waters required.
Rocklea	1849	926	649	265	9	1180(C)	1780(C)	0.66	1200(C)	Mostly rugged hills in good condition, plain systems fair to bad condition.
Tangadee	1864	1148	651	65	—	1200(C)	1350(C)	0.89	700(C)	Rough hills and plains condition fair to good, restricted areas of degraded pastures.
Turee Creek	2777	1009	1501	248	19	1660(C)	2540(C)	0.65	1522(C)	Hill areas in good condition, pastures on plain systems vary from good to very poor condition, some serious degradation.
Uaroo	2470	1906	474	68	21.7	13430(S)	17240(S)	0.78	10000(S) 100(C)	Spinifex plains and hills mostly in good condition, some restricted areas of severe degradation.

TABLE 31 (cont.)

Station	Area (sq km)	Range condition sq km			Extreme degradation (sq km)	Total sheep (S) or cattle (C) capacity		Ratio recommended: capability	Present Stock Nos. (1979) Sheep (S) Cattle (C)	Remarks
		Good	Fair	Bad		Recommended	Capability			
Ullawarra	1632	1439	176	17	—	860(C)	990(C)	0.87	900(C)	Rough hill country mostly in good range condition, minor pasture degradation in valley floors.
Urala	560	507	53	—	—	6090(S)	6530(S)	0.93	3335(S)	Coastal spinifex, perennial grass and samphire country, good condition.
Wanna (Part station)	1338	1233	105	—	—	680(C)	730(C)	0.93	280(C)	Rough hilly country of low productivity, good range condition.
Wyloo	3280	1256	1367	532	125	1710(C)	3690(C)	0.46	1500(C)	Rugged hill country in good condition, plain country in fair to bad condition with some extensive areas of extreme degradation.
Yanrey	2508	1412	720	311	65	30040(S)	47740(S)	0.63	12731(S) 1102(C)	All accessible, spinifex country good condition, alluvial plain systems vary from good to bad condition, some extensive areas of extreme degradation.
Totals	61750	39453 (63.9%)	16579 (26.8%)	5184 (8.4%)	534 (0.9%)	24660(C) 183830(S) = 368780 sheep equiv.	37960(C) 252120(S) = 536820 sheep equiv.		17867(C) 118350(S) = 252353 sheep equiv.	

AMELIA STATION — West Pilbara and Upper Gascoyne Shires

Location

Amelia station is located on the Edmund and Turee Creek 1:250 000 map sheets. There is no homestead and few other developments.

Access to the lease from the south is via Wanna station and from the east via Ullawarra station. The lease has common boundaries with Ashburton Downs, Dooley Downs, Kooline, Pingandy, Ullawarra and Wanna stations.

Area within survey

Most of the station, 241 510 ha is within the survey area. The remaining 8 173 ha falls within the Gascoyne River catchment and has been previously mapped. However, this report has considered the entire area (249 683ha) of the lease.

Description

The lease consists of large areas of rugged hill country with narrow valleys. Rugged country comprises about 91 per cent of the area being principally large sandstone hills and ridges of the Augustus and Capricorn land systems and low shale hills of the Kooline system. There are lesser areas of Mulgul, Charley and Ullawarra systems.

The remainder of the lease consists of stony uplands of the Egerton, Boolgeeda and Ethel systems (5 per cent) and the productive valley systems, Ashburton, River and Scoop (4 per cent).

A total of 17 land systems are found on the station. The four largest, Augustus (44 per cent), Kooline (23 per cent), Capricorn (12 per cent), and Ullawarra (5 per cent), collectively occupy 84 per cent of the total area. The systems are briefly described and their pastoral value for good range condition status indicated in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) are summarised in Table 2. These statements are derived from traverse records.

Range evaluation sites

Detailed descriptions and measurements of land form, vegetation, soils and range condition were made at 7 sites on 3 land systems.

Range condition and recommendations

1. **Augustus land system** (44.3 per cent of the total station area)

   The overall condition of the large Augustus land system is good. The bulk of the system is composed of rugged sandstone hills supporting mulga short

Table 1 — LAND SYSTEMS ON AMELIA STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hills, ridges, and plateaux with skeletal soil supporting tall shrublands	44.3	
	Capricorn — rugged hills and ridges with low shrublands or hard spinifex	11.9	
	Mulgul — rough dolomite hills supporting low shrubs and sparse mulga	3.1	
	Boolgeeda — stony plains with hard spinifex and mulga shrublands	0.5	
			59.8
Low (20 to 30ha/s.u.)	**Kooline** — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	22.7	
	Ullawarra — dolerite and shale hills and restricted stony plains and drainage floors with mulga and minor chenopod shrublands	5.2	
	Ethel — cobble plains with sparse shrublands	3.4	
	Charley — dolerite hills and ridges and restricted lower plains; tall and low shrublands	3.3	
	Egerton — highly dissected plains and slopes with sparse mulga shrublands	1.2	
	Collier — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	0.2	
	Jamindie — stony hardpan plains and stony rises with groved mulga shrublands	0.1	
			36.0
Moderate (10 to 20ha/s.u.)	**Scoop** — stony plains with snakewood and chenopod shrublands	2.0	
	Table — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	0.2	
	Laterite — small laterite mesas and gravelly plains with mulga shrublands	0.1	
			2.2
High (5 to 10ha/s.u.)	**River** — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	1.0	
	Ashburton — active floodplains flanking major rivers and creeks with moderately dense tall shrublands	1.0	
	Edward — alluvial plains with sparse saltbush, bluebush and other shrub pastures	0.1	
			2.0
Very high (<5ha/s.u.)	—	—	
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS

(39 recordings on 4 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Augustus	3	67	33	—	—	33	33	—	33	—	67	—	33
Ethel	4	100	—	—	—	—	100	—	—	—	100	—	—
River	9	100	—	—	—	78	22	—	—	—	100	—	—
Scoop	20	100	—	—	—	75	25	—	—	—	100	—	—
Table	3	100	—	—	—	—	33	67	—	—	33	67	—
Total over all land systems	39	97	3	—	—	69	23	5	3	—	92	5	3

grass forb pastures (MSGF) of very low productivity and which are inherently stable. Small inclusions of better quality pasture are generally in good to fair condition as there are few stock on the lease.

2. **Kooline land system** (22.7 per cent)

   The overall condition of the large Kooline land system is good. The bulk of the system is composed of low rough shale hills supporting stony short grass forb pastures (SSGF) of low productivity. Inclusions of better quality pasture are in good to fair condition.

3. **Capricorn land system** (11.9 per cent)

   The overall condition of this land system is good. It consists of sandstone hills and mountains supporting either stony short grass forb (SSGF) or hard spinifex pastures (HSHI).

4. The condition of the remaining 14 land systems is good.

5. Amelia Station does not have a homestead or any operating man-made watering points. The only improvements on the property are a series of yards situated adjacent to natural waters and a few broken-down mills. The stock present are wild cattle.

6. The property appears to be operated on a spasmodic opportunistic basis. Further development of the station with more watering points and fencing is impractical because of the rugged and unproductive nature of the country. The lease cannot be regarded as a viable unit.

7. Present condition of the country on Amelia is very close to original or pristine and the recommended cattle unit capacity for present condition (assuming that the station could be fully developed) is the same as the capability cattle unit capacity. The estimate of capacity is 1 130 adults or 1 640 total cattle.

INDIVIDUAL STATION REPORT

AMELIA STATION **249 683 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Augustus	1 106	MSGF	995	—	—	—	1 990	1 990
		MUCR	111	—	—	—	1 388	1 388
Kooline	567	SSGF	465	—	—	—	1 395	1 395
		MUCR	57	—	—	—	712	712
		CHAT	45	—	—	—	562	562
Capricorn	297	HSHI	208	—	—	—	416	416
		SSGF	74	—	—	—	222	222
		MUCR	15	—	—	—	187	187
Ullawarra	129	MSGF	99	—	—	—	198	198
		CHMA	21	—	—	—	263	263
		CSGF	9	—	—	—	45	45
Ethel	85	SSGF	68	—	—	—	204	204
		CHAT	13	—	—	—	162	162
		MUCR	4	—	—	—	50	50
Charley	83	MSGF	46	—	—	—	92	92
		CSGF	28	—	—	—	140	140
		TGER	9	—	—	—	150	150
Mulgul	76	MSGF	53	—	—	—	106	106
		CSGF	15	—	—	—	75	75
		MUCR	8	—	—	—	100	100
Scoop	50	STCH	32	—	—	—	266	266
		CHAT	10	—	—	—	125	125
		MUCR	8	—	—	—	100	100
Egerton	28	MSGF	21	—	—	—	84	84
		SSGF	4	—	—	—	12	12
		MUCR	3	—	—	—	38	38
River	26	MUCR	21	—	—	—	263	263
		STCH	5	—	—	—	41	41
Ashburton	25	CHAT	13	—	—	—	162	162
		CHMA	12	—	—	—	150	150
Boolgeeda	13	HSHI	12	—	—	—	30	30
		SOSP	1	—	—	—	12	12
Collier	5	MSGF	3	—	—	—	12	12
		SSGF	1	—	—	—	3	3
		STCH	1	—	—	—	8	8
Table	5	MSGF	2	—	—	—	8	8
		CSGF	2	—	—	—	10	10
		MUCR	1	—	—	—	13	13
Laterite	1	SSGF	1	—	—	—	3	3
		TGER	—	—	—	—	—	—
		MSGF	—	—	—	—	—	—
Jamindie	1	SSGF	1	—	—	—	3	3
		MUCR	—	—	—	—	—	—
		TGER	—	—	—	—	—	—
Edward	0.1	CHAT	0.1	—	—	—	1	1
		STCH	—	—	—	—	—	—
		SSGF	—	—	—	—	—	—
TOTALS	2 497		2 497	—	—	—	9 801	9 801

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	1 960	2 450	1 310	1 640
Capability cattle unit capacity	1 960	2 450	1 310	1 640

Declared stock numbers (1979) ..... Nil cattle

ASHBURTON DOWNS STATION — West Pilbara Shire

Location

Ashburton Downs station is located on the Edmund and Turee Creek 1:250 000 map sheets. The nearest town is Paraburdoo, about 110 km to the east-north-east. The main access track to the station branches off the Nanutarra-Wittenoom Gorge road at Cheela Plain and heads south to the station. Secondary access is available along the old river road through Mininer to the east and Kooline to the west. Ashburton Downs has common boundaries with Amelia, Kooline, Mininer, Pingandy, Rocklea, Turee Creek and Wyloo stations and vacant crown land.

Area within survey

Entire station, 300 573 ha.

Description

About 57 per cent of the station is hill country of very low pastoral value. The remainder consists of stony plains and alluvial plains with pastoral value varying from low to very high.

The Ashburton River runs south-west through the property for about 75 km. Flood plains (Ashburton land system) flank both sides of the river and vary in width from about 1 km near the western boundary to a maximum of 8 km near the homestead. The flood plains are flanked by low red shale hills (Kooline land system) except where tributary plains break through the hills and where a rugged sandstone range of the Capricorn land system runs for 35 km on the south side of the flood plain.

The Kooline land system (60.4 per cent of the station area) is the largest on the station and consists of distinctive shale hills with steeply dipping strata and restricted saline plains and drainage floors. The tributary plains system, Edward (10.4 per cent), invariably occurs immediately below shale hills of the Kooline system and fronts the Ashburton floodplain. The Edward system is notable for its poor condition and bare scalded clay plains and flats often extend for several kilometres. A total of twelve land systems are found on this station. All these are briefly described in Table 1.

Condition statements for land systems and for the whole station have been prepared from data collected whilst traversing on the station and are presented in Table 2.

Rangeland evaluation sites

Detailed descriptions and measurements of land form, vegetation, soils and range condition were made at 30 sites on 7 land systems.

Range condition and recommendations

1. **Kooline land system** (60.4 per cent of the station area)

   This system consists mainly of stony short grass forb (SSGF) pastures in fair to good condition. Lesser areas of better quality mulga creekline (MUCR) pasture occur along the large flat creeks and saltbush pastures (CHAT) occur on the drainage floors. These pastures are preferentially grazed. Condition is poor to fair and erosion is common.

2. **Edward land system** (10.4 per cent)

   This system consists of large tributary plains formed on outwash areas below the Kooline land system. The system is flat and accessible to stock and originally supported productive saltbush (CHAT) and stony chenopod (STCH) pastures. Its soils were duplex types with a thin sandy surface overlying massive clay.

Table 1 — LAND SYSTEMS ON ASHBURTON DOWNS STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Capricorn** — rugged hills and ridges with low shrublands or hard spinifex	8.8	
	Boolgeeda — stony plains with hard spinifex grasslands or mulga shrublands	0.2	
	Rocklea — basalt hills and restricted stony plains with hard spinifex	0.1	
			9.1
Low (20 to 30ha/s.u.)	**Kooline** — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	60.4	
	Ethel — cobble plains with sparse mulga and other Acacia spp. shrublands	2.3	
			62.7
Moderate (10 to 20ha/s.u.)	**Dollar** — stony plains with open snakewood shrublands	4.3	
	Paraburdoo — stony gilgai plains derived from basalt with snakewood shrublands	1.4	
	Table — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	0.7	
	Robe — low plateaux, mesas and buttes of limonite with soft and hard spinifex	0.1	
			6.5
High (5 to 10ha/s.u.)	**Edward** — alluvial plains with sparse degraded saltbush, bluebush pastures	10.4	10.4
Very high (<5ha/s.u.)	**Ashburton** — active floodplains and backplains with deep silty loam and clayey soils, shrublands and tussock grasslands	9.9	
	River — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	1.4	
			11.3
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(352 recordings on 9 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod	severe	exc	good	fair	poor	v. poor	good	fair	bad
Ashburton	50	68	20	12	—	—	32	32	32	4	32	40	28
Capricorn	21	95	5	—	—	5	33	43	19	—	38	57	5
Dollar	33	82	12	6	—	—	18	33	46	3	18	64	18
Edward	67	13	31	31	25	—	6	24	25	45	6	18	76
Ethel	26	77	23	—	—	—	31	45	12	12	31	46	23
Kooline	146	67	21	8	4	1	18	34	37	10	19	55	26
Paraburdoo	2	100	—	—	—	—	—	50	50	—	—	100	0
River	2	50	50	—	—	—	100	—	—	—	100	—	—
Table	5	50	50	—	—	20	—	20	40	20	—	40	60
Total over all land systems	352	60	21	12	7	1	20	32	32	15	20	46	34

When in good condition the Edward system is inherently sensitive to grazing. Wherever the system is found on the station it is now profoundly degraded to broad clay flats with extremely sparse vegetation or no vegetation.

A total of 35 sq. km is so badly degraded that it should be completely protected from grazing. Areas in this category occur near Lime bore, Black Hill bore, No. 9 well and No. 17 mill on the Six Mile Creek. Regeneration will not occur simply by protecting these areas from grazing because the hard, sealed clay surfaces have very poor water infiltration and seedbed characteristics. Severely degraded areas will need to be strip cultivated to improve infiltration rates and provide a seedbed. They will also need to be seeded with a range of grasses and possibly chenopod shrubs as there are virtually no natural seed sources remaining.

The time period required to regenerate the Edward system fully cannot be accurately predicted, but it is anticipated that partial recovery will require at least 5 years of complete protection from grazing and the cultural treatments previously mentioned.

3. **Ashburton land system** (9.9 per cent)

This flat system is an active flood plain with deep alluvial soils and permanent water in river pools. Before settlement the system supported saltbush (CHAT) pastures, relics of which can still be found. In the early days of settlement large numbers of stock were watered on the river and the floodplain was overgrazed. Stock numbers built up to very large numbers; for example, Ashburton Downs had 48 000 sheep in 1909, most of which were run on the frontage. Consequently, the saltbush pastures were degraded and stock numbers eventually fell from the early high numbers.

The colonisation of the system by buffel grass in the last twenty years has largely stabilised the soil and improved carrying capacity. Pastures of the system now consist of a mixture of buffel grass (TGCE) and tall saltbush (CHMA) with a small area of relic saltbush (CHAT) pasture on the Mininer boundary.

At present, the majority of the system is in fair condition with limited areas in good and bad condition. Notable areas in bad condition are the Ram paddock west of the homestead and a patch along the road to Kooline east of the Six Mile Creek.

With the exception of some paddocks near the homestead the system is unfenced and effective control is not possible. Fencing is essential in order to improve or maintain pasture condition. Controlled stocking on two large paddocks near the homestead has resulted in these areas improving to excellent stands of buffel grass.

This system, unlike others (e.g. Edward) on the station has the ability to recover quickly after overuse. No special treatments for recovery are required other than control of stock.

4. **Dollar land system** (4.3 per cent)

This stony plains system which supports stony chenopod (STCH) and mulga creekline (MUCR) pastures is generally in fair condition.

5. The remaining eight land systems collectively occupy 15 per cent of the station area and are mostly in fair or good range condition. Some restricted areas of saltbush (CHAT) and mulga creekline (MUCR) pastures are degraded to poor condition, and there is occasional minor erosion. However, taken overall, there are no serious problems on these systems.

6. Ashburton Downs was once well developed for sheep with many paddocks and watering points. Many of the artificial watering points were highly saline and were marginal for use by livestock. The change to cattle saw the removal or abandonment of the sheep fences and the abandonment of some of the saline bores. The only large paddocks on the station at present are located on the Ashburton land system near the homestead, and these are used for bullocks and weaners. With the exception of these paddocks the rest of the station is run on the open range principle. Under this system control of grazing pressure on pastures is difficult and can only be attempted by manipulating the numbers of cattle on artificial watering points.

7. The Ashburton land system is the most productive on the station and carries most of the stock. For proper management it should be fenced and paddocked to allow complete control of stock numbers and season of grazing. Pasture condition could be improved and the further spread of buffel grass encouraged by judicious stocking and periodic spelling. In the long term overall productivity of the system would be improved.

8. High priority should be given to commencing a programme of fencing and regenration on the Edward land system. This programme would be progressive and would not be expected to commence immediately on all problem areas.

   The high costs involved in regeneration are offset by the fact that the Edward system, once recovered, will be highly productive. In its present very poor condition the system is capable of supporting only about one-quarter of the livestock that it could if condition was good.

9. The recommended cattle unit capacity for present condition and assuming full development is 1 790 adults or 2 240 total cattle.

10. The capability cattle unit capacity if all country was in good range condition is 3 390 adults or 4 420 total cattle.

INDIVIDUAL STATION REPORT

ASHBURTON DOWNS STATION

300 573 ha

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Kooline	1 816	SSGF	596	893	—	—	3 574	4 467
		MUCR	36	86	60	—	1 124	2 275
		CHAT	13	33	99	—	686	1 816
Edward	312	CHAT	—	42	192	35	829	3 363
		STCH	11	7	19	—	167	315
		SSGF	—	6	—	—	12	18
Ashburton	297	TGCE	40	61	47	1	3 375	7 450
		CHMA	40	61	47		900	1 850
Capricorn	264	SSGF	98	141	12	—	594	753
		MUCR	6	7	—	—	114	163
Dollar	131	STCH	14	63	28	—	487	872
		MUCR	—	15	5	—	99	250
		TGER	3	3	—	—	75	100
Ethel	69	SSGF	20	26	9	—	126	165
		CHAT	—	3	7	—	42	125
		MUCR	—	4	—	—	22	50
Paraburdoo	43	STCH	8	25	—	—	191	274
		CHAT	—	8	—	—	66	100
		SSGF	—	2	—	—	4	6
River	41	TGCE	12	—	—	—	600	600
		MUCR	12	—	3	—	160	188
		STCH	4	4	—	—	53	66
		No veg	6	—	—			
Table	22	MSGF	8	3	—	—	41	44
		CSGF	7	2	—	—	41	45
		MUCR	1	1	—	—	18	25
Boolgeeda	6	SSGF	5	1	—	—	17	18
		SOSP	—	—	—	—		
Rocklea	3	HSHI	3	—	—	—	5	5
		STCH	—	—	—	—		
		MUCR	—	—	—	—		
Robe	2	SOSP	2	—	—	—	12	12
		HSHI	—	—	—	—		
TOTALS	3 006		945	1 497	528	36	13 442	25 411

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	2 690	3 360	1 790	2 240
Capability cattle unit capacity	5 080	6 350	3 390	4 240

Declared stock numbers (1979) ..... 300 cattle

BULLOO DOWNS STATION — Meekatharra Shire

Location

Bulloo Downs station is located on the Collier and Mt. Newman 1:250 000 map sheets. The homestead is about 15 km west of the Great Northern Highway and about 95 km south by road from Newman. The station has common boundaries with Prairie Downs, Sylvania, Weelarrana and Tangadee stations and vacant crown land.

Area within survey

Entire station 347 240 ha.

Description

About a third of Bulloo Downs station consists of broad, undissected hardpan plain country of the Nooingin, Jamindie and Cadgie land systems. These plains are up to 20 km in extent and are distributed throughout the station. They support sparse mulga short grass forb (MSGF) and stony short grass forb (SSGF) pastures and are of low pastoral value. Highly dissected hardpan plains of the Egerton land system which are associated with and usually peripheral to the undissected plains country occupy 14 per cent of the station.

Other landforms found on the station include undulating shaley plains of the Ford land system and calcareous plains and low plateaux of the Warri and Table systems respectively. These three systems collectively occupy about 23 per cent of the total station area and are of moderate pastoral value.

Tracts of low hills and rugged country occur scattered throughout the station. The most obvious of these are the characteristic basalt hills of the Charley land system and the low dissected lateritic mesas and buttes of the Laterite system. Generally these hilly areas are still readily accessible to stock and provide some reasonable grazing.

The most rugged country of the station occurs in the south and south-east and consists of large sandstone hills of the Augustus land system. Pastoral value is low or very low.

A total of 18 land systems are present on the station; the smallest 9 collectively occupy less than 11 per cent of the area. All systems are briefly described and their pastoral value for good range condition status shown in Table 1.

Condition statements for land systems and for the station as a whole (total over all lands systems) are presented in Table 2. These statements were derived from traverse records.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 32 sites on 9 land systems.

Table 1 — LAND SYSTEMS ON BULLOO DOWNS STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hills, ridges, and plateaux with tall shrublands	8.4	
	Divide — sand plain and minor dunes with hard spinifex grasslands	2.3	
	Mulgul — rough dolomite hills supporting low shrubs and sparse mulga and cassia shrublands	1.4	
			12.1
Low (20 to 30ha/s.u.)	**Jamindie** — stony hardpan plains and stony rises with groved mulga shrublands	17.1	
	Egerton — highly dissected plains and slopes with sparse mulga shrublands	14.0	
	Charley — dolerite hills and ridges and restricted lower plains; tall and low shrublands	7.2	
	Collier — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	5.3	
	Ethel — cobble plains with sparse mulga shrublands	1.1	
	Weelarrana — salt lakes, with fringing saline plains and sandy islands	1.1	
	Nirran — undulating stony plains and low hills with mulga shrublands	0.1	
			45.9
Moderate (10 to 20ha/s.u.)	**Ford** — gently undulating stony plains with a few low hills, mulga shrublands	15.5	
	Nooingnin — hardpan plains and large groves with mulga shrublands	14.0	
	Warri — low calcrete platforms and plains with mulga and cassia shrublands	4.5	
	Laterite — small laterite mesas and gravelly plains with mulga shrublands	3.3	
	Table — low calcrete plateaux, mesas and lower plains with mulga	3.0	
	Cadgie — hardpan plains with thin sand cover and sandy banks, soft spinifex and mulga	1.2	
	Tangadee — low shale hills and undulating plains with mulga woodlands	0.4	
			41.9
High (5 to 10ha/s.u.)	**River** — narrow active flood plains flanking major rivers and creeks, moderately dense tall shrublands	0.1	0.1
Very high (<5ha/s.u.)	—	—	
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(522 recordings on 17 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Augustus	9	78	22	—	—	—	33	45	22	—	33	45	22
Cadgie	12	75	25	—	—	—	50	33	17	—	50	33	17
Charley	26	69	19	12	—	—	8	31	38	23	8	57	35
Collier	3	—	—	—	—	—	—	67	33	—	—	100	—
Divide	1	100	—	—	—	—	100	—	—	—	100	—	—
Egerton	77	90	9	1	—	—	38	35	27	—	38	54	8
Ethel	8	88	13	—	—	—	50	25	25	—	50	50	—
Ford	101	65	24	10	1	2	8	36	44	10	10	60	30
Jamindie	82	84	16	—	—	—	26	46	24	4	26	62	12
Laterite	12	83	17	—	—	—	8	58	25	8	8	75	17
Mulgul	4	50	50	—	—	—	—	50	25	25	—	50	50
Nirran	2	100	—	—	—	—	100	—	—	—	100	—	—
Nooingnin	116	69	28	3	—	—	16	44	32	8	16	58	26
River	3	—	33	67	—	—	—	33	—	67	—	—	100
Table	19	84	16	—	—	—	32	42	26	—	32	52	16
Warri	43	70	30	—	—	—	12	23	46	19	12	55	33
Weelarrana	4	100	—	—	—	50	25	25	—	—	75	25	—
Total over all land systems	522	75	21	4	—	1	20	39	32	8	21	57	22

Range condition and recommendations

1. **Jamindie land system** (17.1 per cent of total station area)

   This hardpan plain system is mostly in fair range condition with little or no erosion. The small grove units and lower plain units of the system which support the most productive pastures receive preferential grazing and are more degraded than the poorer pastures of the broad plains.

2. **Ford land systems** (15.5 per cent)

   About 60 per cent of the traverse recordings made on this system indicate fair range condition and 30 per cent indicate bad range condition. The vegetation is considerably degraded with substantial losses of desirable shrubs, especially on drainage floors of the system. Vegetation degradation on the drainage floors is frequently accompanied by minor and moderate erosion in the form of thin surface sheeting and rilling. A reduction in grazing pressure is required to encourage recovery of desirable shrubs.

3. **Nooingnin land system** (14 per cent)

   This flat hardpan system is largely in fair condition although substantial parts are also in bad condition. Durable shrubby vegetation of the most productive units of the system, such as the groves, is frequently degraded. Consequently the system has lost much of its original drought durability. Control of season of use and intensity of use are the only management tools that can be used to improve pasture condition.

4. **Egerton land system** (14 per cent)

   Pastures on this large but poorly productive system are about evenly distributed between good, fair and poor condition. There is no erosion.

5. **Charley land system** (7.2 per cent)

   The Charley system consists of basalt hills (about 62 per cent) footslopes of undulating plains (27 per cent) and lower plains and drainage tracts (11 per cent). Condition of the hills is good, condition of the footslopes is fair with partly degraded pastures and some minor rilling and condition of the lower plains and drainage tracts is invariably very bad with severely degraded pastures and some erosion. It is obvious that the lower plains have received preferential overuse. An area of about 2 sq. km near Charleys bore is so severely degraded that it should be removed from use for a number of years. A small severely degraded area also occurs near Monkey well.

6. **Warri land system** (4.5 per cent)

   This calcrete based system shows very little erosion, but 66 per cent of the traverse records indicate poor or very poor pasture condition. The paddocked areas around Ilgarari outcamp should be spelled over a number of consecutive seasons to allow palatable shrubs to regenerate.

7. The remaining twelve land systems collectively occupy about 28 per cent of the area. Broadly speaking they are in fair range condition (see Table 2 for detailed breakdown). Small inclusions of halophytic and other high quality shrub pastures are all degraded to a greater or lesser extent. There is no erosion.

8. The station is run on the open range principle with very few fences for stock control. However, it is reasonably well developed with regard to watering points for cattle and some degree of control of season of use could be exercised by periodically shutting off waters. Intensity of use could also be partly controlled by limiting the numbers of cattle placed at each watering point.

9. From the degraded condition of shrub pastures it is obvious that the station has carried and is still carrying excessive numbers of livestock. As a result the station has largely lost what drought durability it originally possessed.

10. A reduction in overall stock numbers is required if pasture recovery is to be effected. Attempting to maintain present numbers will result in the station becoming increasingly susceptible to large losses and fluctuations in numbers in poor seasons.
11. Recommended cattle unit capacity for present condition is 1 370 adults or 1 710 total cattle.
12. The capacity of this country to carry stock has been over-estimated in the past. Capability cattle unit capacity, if all the station was in good range condition, is estimated at 2 130 adult cattle or 2 660 total cattle.

INDIVIDUAL STATION REPORT

BULLOO DOWNS STATION — **347 240 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Jamindie	593	SSGF	113	320	59	0.2	765	984
		MUCR	18	35	18	—	477	888
		TGER	—	30	—	—	252	501
Ford	537	MSGF	31	213	61	1	885	1 224
		SSGF	44	90	—	—	312	402
		CHAT	—	24	73	—	382	1 213
Nooingnin	488	SSGF	51	226	88	0.7	529	730
		MUCR	—	68	—	—	374	850
		TGMI	18	23	13	—	537	902
Egerton	486	MSGF	204	160	—	—	1 296	1 456
		SSGF	29	49	—	—	132	156
		MUCR	—	24	20	—	198	550
Augustus	290	MSGF	276	—	—	—	552	552
		MUCR	8	4	2	—	129	175
Charley	249	MSGF	137	—	—	—	274	274
		CSGF	8	43	34	—	237	425
		TGER	—	9	16	2	128	451
Collier	185	MSGF	102	—	—	—	408	408
		SSGF	40	6	—	—	132	138
		STCH	22	11	4	—	246	307
Warri	156	MSGF	31	69	24	—	379	496
		CHAT	5	—	11	—	90	200
		MUCR	—	16	—	—	88	200
Laterite	113	SSGF	—	45	—	0.1	68	135
		MSGF	—	45	—	—	135	180
		TGER	—	12	11	—	137	384
Table	104	MSGF	19	26	7	—	168	208
		CSGF	16	20	6	—	152	210
		MUCR	—	5	5	—	44	125
Divide	80	HSSP	72	—	—	—	144	144
		MUCR	8	—	—	—	50	50
Mulgul	50	MSGF	37	—	—	—	74	74
		CSGF	4	3	3	0.3	35	52
		MUCR	—	3	—	—	17	38
Cadgie	43	SOSP	23	—	6	—	279	363
		SSGF	4	8	2	—	22	28
Ethel	39	SSGF	21	10	—	—	83	93
		CHAT	—	6	—	—	50	75
		MUCR	—	2	—	—	11	25
Weelarrana	38	SAMP	10	3	—	—	50	52
		CHAT	6	2	—	—	92	100
		HSSP	8	—	—	—	16	16
		No veg	9	—	—	—	—	—
Tangadee	13	MSGF	5	6	—	—	38	44
		CHMA	—	1	—	—	7	13
		MUCR	—	1	—	—	6	13
River	5	MUCR	—	—	2.5	0.5	8	38
		STCH	—	1	—	—	5	8
		No veg	0.5	—	—	—	—	—
Nirran	3	MSGF	—	2.8	—	—	8	11
		MUCR	—	0.2	—	—	1	3
TOTALS	3 472		1 379.5	1 622	465.5	4.8	10 256	15 964

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	2 050	2 560	1 370	1 710
Capability cattle unit capacity	3 190	3 990	2 130	2 660

Declared stock numbers (1979) ..... 3 116 cattle

DOOLEY DOWNS STATION — Upper Gascoyne Shire

Location

Nearly all of Dooley Downs station is located on the Mt. Egerton and Turee Creek 1:250 000 map sheets with very small areas extending on to the Edmund and Mt. Phillips sheets. The station has common boundaries with Pingandy, Mts. Augustus, Wanna and Amelia stations and vacant crown land. The station is extremely isolated with access to the south through Mt. Augustus station and then west to Carnarvon or south to Meekatharra.

Area within survey

Sixty-eight per cent (80 270 ha) of the station falls within the survey area. The remainder is in the Gascoyne River catchment and was mapped during the Gascoyne River catchment survey (1970), but no station report was compiled. The whole station (117 448 ha) is considered in this report.

Description

This station consists of rugged hills and ranges with narrow valleys and drainage floors and some extensive areas of undulating stony plains and uplands. Hill and mountain tracts of the Augustus, Charley and parts of the Collier system occupy about 75 per cent of the station's area. Some of this country is sufficiently rugged and inaccessible to be of no pastoral value and the remainder is of very low or low value.

Only 4.2 per cent of the area is classed as being of moderate pastoral value and consists of stony plains and restricted drainage flats of the Collier, Bryah, Ruby and Sugarloaf land systems. No systems classified as having high or very high pastoral value occur on the station.

A total of 14 land systems are present and these are briefly described according to their pastoral value, landform and vegetation in Table 1.

Condition statements for land systems and the whole station (total over all land systems) are presented in Table 2. These statements were derived from data recorded whilst traversing on the station.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 10 sites on 4 land systems.

Range condition and recommendations

1. Sixty-eight per cent of the 128 traverse recordings made on the station indicate good range condition, 30 per cent indicate fair condition and 2 per cent indicate bad condition.

   Pastures of the hills, hill slopes and stony plains are mulga short grass forb (MSGF) and stony short grass forb (SSGF) and these are invariably in good or very good condition. Small inclusions of better quality pastures on drainage floors and lower plains show some minor degradation in parts. No erosion occurs on the station.

2. The station is operated on a spasmodic, opportunistic basis. Grazing is on the open range principle as there is virtually no fencing. At the time

Table 1 — LAND SYSTEMS ON DOOLEY DOWNS STATION

Pastoral value	Land systems	Per cent of area
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hills, ridges, and plateaux with skeletal soils and tall shrublands, or hard spinifex grasslands	56.5
	George — long stony slopes beneath large hills, very sparse low shrubs and mulga	3.1
	Mulgul — rough dolomite hills supporting low shrubs and sparse mulga	1.0
		60.6
Low (20 to 30ha/s.u.)	**Collier** — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	23.4
	Charley — dolerite hills and ridges and restricted lower plains; tall and low shrublands	6.2
	Jamindie — stony hardpan plains and rises with groved mulga shrublands	3.0
	Ethel — cobble plains with sparse mulga and other Acacia spp. shrublands	1.7
	Ullawarra — dolerite and shale hills, restricted stony plains and drainage floors; mulga and minor chenopod shrublands	0.5
	Three Rivers — broad hardpan plains with minor sandy banks and sparse mulga shrublands	0.3
	Egerton — highly dissected plains and slopes with sparse mulga shrublands	0.1
		35.2
Moderate (10 to 20ha/s.u.)	**Bryah** — stony plains and restricted internal drainage flats with sparse tall shrublands and low chenopod shrublands	2.4
	Ruby — gently undulating shale plains with sparse mulga and cassia shrublands	1.2
	Sugarloaf — undulating dolomitic plains and drainage floors	0.5
	Laterite — small laterite mesas and gravelly plains with mulga shrublands	0.1
		4.2
High (5 to 10ha/s.u.)	—	—
		—
Very high (<5ha/s.u.)	—	
		100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(128 recordings on 9 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Augustus	4	100	—	—	—	75	25	—	—	—	100	—	—
Bryah	11	100	—	—	—	55	36	9	—	—	91	9	—
Charley	1	100	—	—	—	—	—	100	—	—	—	100	—
Collier	78	99	1	—	—	19	51	29	1	—	69	31	—
Jamindie	3	100	—	—	—	—	—	67	33	—	—	100	—
Laterite	3	100	—	—	—	33	34	33	—	—	67	33	—
Ruby	8	100	—	—	—	49	38	13	—	—	87	13	—
Three Rivers	6	83	17	—	—	—	—	50	33	17	—	67	33
Ullawarra	14	93	—	7	—	—	64	29	7	—	64	29	7
Total over all land systems	128	97	2	1	—	23	44	28	4	1	68	30	2

of survey (1978) nearly all of the artificial waters on the property were either not in use or derelict and very few cattle were seen.

3. Most of the Augustus land system (56.5 per cent of the station area) especially in the northern third of the property is of no use for pastoral purposes.

4. Recommended cattle unit capacity for present condition and assuming full development is 510 adults or 640 total cattle.

5. Capability cattle unit capacity assuming all country was in good range condition is 550 adults or 690 total cattle.

6. The station is not a viable pastoral unit. Any further transfer as a single entity should not be permitted. Consideration could be given to amalgamation with Pingandy or else the property should revert to crown land.

INDIVIDUAL STATION REPORT

DOOLEY DOWNS STATION — **117 448 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Augustus	663	MSGF	630	—	—	—	1 260	1 260
		MUCR	33	—	—	—	413	413
Collier	274	MSGF	112	39	—	—	565	604
		SSGF	50	18	—	—	186	204
		STCH	39	16	—	—	404	457
Charley	73	MSGF	40	—	—	—	80	80
		CSGF	15	10	—	—	105	125
		TGER	4	4	—	—	100	134
George	36	SSGF	36	—	—	—	108	108
Jamindie	34	SSGF	14	14	—	—	49	56
		MUCR	2	2	—	—	36	50
		TGER	1	1	—	—	25	33
Bryah	29	STCH	20	2	—	—	176	183
		CHMA	—	6	—	—	43	75
		SSGF	1	—	—	—	3	3
Ethel	20	SSGF	16	—	—	—	48	48
		CHAT	2	1	—	—	33	38
		MUCR	1	—	—	—	13	13
Ruby	14	CSGF	10	—	—	—	50	50
		MUCR	1	1	—	—	18	25
		STCH	1	1	—	—	13	17
Mulgul	12	MSGF	9	—	—	—	18	18
		CSGF	2	—	—	—	10	10
		MUCR	1	—	—	—	13	13
Ullawarra	6	MSGF	4	1	—	—	10	10
		CHAT	—	1	—	—	8	13
		CSGF	—	—	—	—	—	—
Sugarloaf	5	MSGF	2	—	—	—	8	8
		STCH	—	2	—	—	10	17
		MUCR	—	1	—	—	6	13
Three Rivers	5	SSGF	—	3	1	—	6	8
		TGMI	—	1	—	—	8	17
Laterite	2	SSGF	1	—	—	—	3	3
		MSGF	1	—	—	—	4	4
		TGER	—	—	—	—	—	—
Egerton	1	MSGF	1	—	—	—	4	4
TOTALS	1 174	—	1 049	124	1	—	3 836	4 114

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	770	960	510	640
Capability cattle unit capacity	820	1 030	550	690

Declared stock numbers (1979) ..... 75 Cattle

DUCK CREEK STATION — West Pilbara Shire

Location

Duck Creek station is found on the northern edge of the Ashburton River catchment. The major part of the station is located on the Wyloo 1:250 000 map sheet while a smaller area occurs on the Mt. Bruce map sheet. The property is accessible from the west via Mt. Stuart station or from the east via a very rough mining track.

The station has a boundary with Mt. Stuart station to the west and elsewhere is surrounded by vacant crown land.

Area within survey

Entire station 139 036 ha.

Description

The station consists of narrow river valleys flanked by massive mountains, hills and plateaux. The access tracks follow the valleys formed by the Duck and Serpentine Creeks and the tracks frequently follow along the actual creek beds for many kilometres.

The station is largely made up of rugged ironstone and basalt mountains and hills (71 per cent of total station area) of extremely low pastoral value. Much of the area is sufficiently inaccessible and unproductive as to be of no use for pastoral purposes. Stony unproductive plains constitute 17.7 per cent of the station area and low mesas and buttes of limonite and calcrete a further 7.4 per cent. The only area of good pastures of very high pastoral value is along Duck Creek on River land system which constitutes only 3.6 per cent of the station area.

Short descriptions of all 8 land systems found on the station are presented in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) are summarised in Table 2. These statements were derived from observations made whilst traversing on the station.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soil and condition were made at 8 sites on 4 land systems.

Range condition and recommendations

1. **Newman land system** (51.8 per cent of the station area)

   This system consists of rugged ironstone hills and mountains which support very poor, hard spinifex (HSHI) pastures with small inclusions of better quality soft spinifex (SOSP) pastures. The system is in good range condition throughout the station. It is of very little use for grazing.

2. **Rocklea land system** (18.0 per cent)

   This system consists of rugged basalt hills and mountains and supports mostly very poor quality hard spinifex pastures (HSHI) with small inclusions of better quality soft spinifex (SOSP) and tussock grass pastures. The system is mostly in good range condition with small areas of degradation on the better quality pastures of the lower more accessible units of the system.

3. **Boolgeeda land system** (17.1 per cent)

   This system consists of broad, hard spinifex plains beneath the ironstone hills and mountains of the Newman system. Pastures are mostly hard spinifex (HSHI) which is unattractive to stock but there are inclusions of better quality soft spinifex (SOSP) pastures in and along the creeklines. The system is in good range condition.

4. **River land system** (3.6 per cent)

   This land system is found in the narrow valleys on the station. It is the most productive country on the station and supports most of the cattle. It supports

Table 1 — LAND SYSTEMS ON DUCK CREEK STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Newman** — rugged jaspilite plateaux, ridges and mountains with hard spinifex	51.8	
	Rocklea — basalt hills and restricted stony plains with hard spinifex	18.0	
	Boolgeeda — stony plains with hard spinifex grasslands or mulga shrublands	17.1	
	Capricorn — rugged hills and ridges with low shrublands or hard spinifex	1.5	
	Platform — narrow raised plains and extensive dissected slopes with hard spinifex and shrubs	0.6	
			89.0
Low (20 to 30ha/s.u.)			0
Moderate (10 to 20ha/s.u.)	**Robe** — low plateaux, mesas and buttes of limonite with soft and hard spinifex	6.5	
	Table — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	0.9	
			7.4
High (5 to 10ha/s.u.)			0
Very high (<5ha/s.u.)	**River** — narrow, active flood plains flanking major rivers and creeks with moderately dense tall shrublands	3.6	3.6
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS

(140 recordings on 7 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Boolgeeda	71	97	3	—	—	89	7	4	—	—	96	4	—
Capricorn	3	100	—	—	—	33	34	33	—	—	67	33	—
Newman	28	100	—	—	—	85	11	4	—	—	96	4	—
River	26	73	19	—	8	30	8	27	23	12	38	43	19
Rocklea	5	100	—	—	—	60	20	—	20	—	80	20	—
Robe	1	100	—	—	—	100	—	—	—	—	100	—	—
Table	6	100	—	—	—	67	—	33	—	—	67	33	—
Total over all land systems	140	94	5	0	1	74	9	10	5	2	83	14	4

tussock grass pastures including good stands of introduced buffel grass (TGCE) and mulga creekline (MUCR) pastures which are regularly flooded. These pastures are generally in fair condition with small areas in good and bad condition.

5. The remaining four land systems on the station make up 9.6 per cent of its area. They are all in good range condition.

6. This property at present is derelict. None of the mills are working and the homestead has been abandoned. Cattle are spasmodically mustered off the station when market conditions are good.

7. Recommended cattle unit capacity for present condition is 500 adults or 630 total cattle.

8. Capability cattle unit capacity if all country was in good range condition is 570 adults or 710 total cattle.

9. Much of the country is unsuitable for pastoral pursuits and should revert to crown land. A small area of good quality country at the western side of the property could be considered for inclusion in Mt. Stuart Station.

10. The station is not a viable pastoral unit and any future transfer as a single entity should not be permitted.

INDIVIDUAL STATION REPORT

DUCK CREEK STATION — **139 036 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Newman	720	HSHI	720	—	—	—	1 224	1 224
Rocklea	250	HSHI	226	—	—	—	384	384
		STCH	3	6	3	—	61	100
		MUCR	3	6	3	—	80	150
Boolgeeda	238	HSHI	226	—	—	—	565	565
		SOSP	11	1	—	—	146	150
Robe	90	SOSP	81	—	—	—	506	506
		HSHI	9	—	—	—	23	23
River	50	TGCE	2	10	3	—	310	750
		MUCR	18	—	—	—	225	225
		STCH	4	3	3	—	54	83
		No veg	7	—	—	—		
Capricorn	21	HSHI	15	—	—	—	26	26
		SSGF	5	—	—	—	15	15
		MUCR	1	—	—	—	13	13
Table	12	MSGF	6	—	—	—	24	24
		CSGF	5	—	—	—	25	25
		MUCR	1	—	—	—	13	13
Platform	9	HSHI	8	—	—	—	14	14
		SOSP	1	—	—	—	13	13
TOTALS	1 390		1 352	26	12		3 721	4 303

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	740	930	500	630
Capability cattle unit capacity	860	1 080	570	710

Declared stock numbers (1979) ..... 450 cattle

GIRALIA STATION — West Pilbara Shire

Location

Giralia station is located wholly on the Yanrey 1:250 000 map sheet. The homestead is about 45 km north-west by road from the North West Coastal Highway and about 36 km east from the Carnarvon-Exmouth road.

The station has common boundaries with Yanrey, Marilla and Bullara stations and also fronts Exmouth Gulf.

Area within survey

Entire station 277 568 ha.

Description

With the exception of bare coastal mudflats of the Littoral land system, all of Giralia station is usable grazing country.

Nearly half of the station (48.8 per cent) is sand plain, sand dunes or broad swales of the Giralia land system. Broad plains with thin sand cover of the Uaroo system occupy an additional 7.2 per cent of the area. These two systems are located in central, southern and eastern parts of the station. They support a mixture of hard and soft spinifex pastures and, provided they are correctly managed by burning, are of moderate pastoral value.

A number of other sandy spinifex systems occur on the station. These are Dune (4 per cent), Onslow (2.2 per cent) and Yankagee (2.1 per cent) in the north where they often front the bare saline mudflats of the Littoral system. These systems support soft spinifex with some small inclusions of shrub and tussock grass pastures. Their pastoral value is high.

In the western parts of the station there are a number of distinctive land systems based on limestones of the Giralia anticline. These are the Donovan system (8.5 per cent) consisting of gently sloping outwash plains, the Firecracker system (3.7 per cent) consisting of undulating limestone plains and uplands and the Jubilee system (9.6 per cent) consisting of limestone hills, cuestas and undulating stony plains.

The Donovan system supports valuable Gascoyne bluebush and soft spinifex pastures, the Firecracker system supports Gascoyne bluebush, and the Jubilee system supports mixed soft and hard spinifex. Pastoral value of the first two systems is high and that of the Jubilee system is moderate.

There are small areas of other systems on the station, but these are of little significance.

All systems on the station are summarised in Table 1.

Condition statements for land systems and for the station as a whole (taken over all systems) have been prepared from traverse data and are presented in Table 2.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 22 sites on 7 land systems.

Range condition and recommendations

1. **Giralia land system** (48.8 per cent of station area)

   This, and other spinifex-based land systems on the station, are all predominantly in good range

Table 1 — LAND SYSTEMS ON GIRALIA STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Littoral** — extensive bare coastal mudflats flanked by mangroves and narrow sandy plains..	13.6	13.6
Low (20 to 30ha/s.u.)			0
Moderate (10 to 20ha/s.u.)	**Giralia**— linear dunes and broad sandy plains supporting hard and soft spinifex.....	48.8	
	Jubilee — limestone hills and undulating stony plains with hard and soft spinifex hummock grasslands.....	9.6	
	Uaroo — broad sandy plains with hard and soft spinifex grasslands.....	7.2	
			65.6
High (5 to 10ha/s.u.)	**Donovan** — gently sloping outwash plains and minor stony plains with alkaline loamy and clayey soils, tall snakewood and other Acacia spp. shrublands with chenopod and soft spinifex pastures.....	8.5	
	Dune — coastal dune fields with soft spinifex and minor hard spinifex grasslands.....	4.0	
	Firecracker — undulating stony uplands and plains with low shrublands of Gascoyne bluebush.....	3.7	
	Onslow — sand plain, dunes and clay plains with soft spinifex and tussock grass.....	2.2	
	Yankagee — plains with dunes and numerous claypans, soft spinifex and snakewood shrublands.....	2.1	
	Winning — low hills and broad lower plains with snakewood shrublands, chenopod and soft spinifex pastures.....	0.2	
	Yarcowie— gilgai plains with tussock grasses and very sparse shrubs.....	0.1	
			20.8
Very high (<5ha/s.u.)	**Minderoo** — alluvial plains supporting tall shrublands and tussock grasslands and areas of sand supporting hummock grassland.....	.01	
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(324 recordings on 7 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Donovan	65	82	15	3	—	22	20	24	20	14	41	37	22
Firecracker	19	63	21	5	11	0	58	37	5	—	52	32	16
Giralia	168	98	2	—	—	69	21	8	1	1	91	8	1
Littoral	40	97	3	—	—	42	39	13	3	3	82	13	5
Uaroo	9	100	—	—	—	67	33	—	—	—	100	—	—
Yankagee	3	67	33	—	—	67	—	33	—	—	67	30	—
Total over all land systems	324	92	6	1	1	53	26	13	5	3	79	15	6

condition. Hard spinifex (HSSP) and soft spinifex (SOSP) pastures are in good condition and there is no erosion.

Hard spinifex is rarely grazed, but soft spinifex has moderate value with good drought durability. Old, mature spinifex stands are useless for grazing and management must be aimed at maintaining the pastures in as attractive condition to stock as possible. Spinifex should be burnt on a regular basis about every 4 to 5 years, and burning should be late in the year. Burnt areas should not be grazed for about 8 to 10 weeks over the growing season following the fire in order to encourage establishment of durable grasses, shrubs and spinifex seedlings. Such a management programme can be readily implemented on a paddock by paddock basis and is, in fact, implemented on the station.

The spinifex land systems are generally resistant to degradation, although some wind erosion may result if a prolonged dry spell occurs after burning. However, there is rapid re-establishment of vegetation and return to stability after rain.

2. **Littoral land system** (13.6 per cent)

This is the second largest land system on the station, but about 84 per cent of it is bare saline mudflats or inaccessible outer margins with mangroves which are useless for pastoral purposes. In terms of the total area of the station this means that 11.4 per cent has no use for grazing. The remainder of the system consists of narrow sandy plains, slopes and samphire flats fronting the mudflats. Range condition is good.

3. **Jubilee land system** (9.6 per cent)

This limestone-based system of low hills, cuestas and stony plains supports a mixture of hard spinifex (HSHI) and soft spinifex (SOSP) pastures. Pasture condition is good and there is no erosion.

4. **Donovan land system** (8.5 per cent)

This system consists of low plains on limestone and broad, outwash alluvial plains. The vegetation is moderately dense snakewood and other tall *Acacia* spp. shrubs with ground pastures of soft spinifex (SOSP) or Gascoyne bluebush (CHMA). Range condition varies from good to bad with some units of the system in considerably poorer condition than others. Plains supporting soft spinifex show little degradation, but other alluvial plains show considerable depletion of bluebush and other desirable shrubs.

In order to encourage pasture recovery parts of the Donovan system should be spelled over a number of consecutive growing seasons and stocked conservatively for the rest of the year. At least 3 sq. km has severe pasture degradation and should not be grazed. One area of concern is in the vicinity of Middle Tank and another is the small holding paddocks near Nabbawarra Bore.

5. **Firecracker land system** (3.7 per cent)

Much of this system has only been fully utilised for grazing since the mid 1960s when a number of dams were constructed. Before this there were no permanent waters in the area and gazing was minimal.

The system supports valuable Gascoyne bluebush (CHMA) pastures and pasture condition varies from good to poor depending on the distance from watering points.

Pasture degradation has occured in a relatively short time and is sometimes accompanied by moderate or severe erosion in the form of gullying, surface sheeting and micro-terracing. As yet the areas affected by erosion are not large, but much of the system has a very high inherent vulnerability to erosion due to its moderate slope and the nature of its soils. Ground cover provided by shrubs, annual grasses and forbs is vital to the stability of the system and control of intensity of use and season of use by livestock is essential. The inherent fragility of the system is only now becoming apparent and, in the opinion of the survey group, the ability of the country to support livestock has been over-estimated in the past.

Special management techniques are required to enable grazing use without landscape deterioration on this system, and some of these have been adopted by the present management.

About 2 sq. km of the country adjacent to Bungarra dam is badly degraded with some severe active gullies forming along water courses and sheep pads. The dam should be closed to stock as a watering point and consideration given to further piping of water for distribution at adjacent, higher and more stable sites on the Jubilee land system. In a number of cases water is already piped for several kilometres to storage tanks and troughs on higher more stable country, and this practice is to be commended. However, the practice of burying polythene pipe on long slopes with soils sensitive to disturbance should not be continued as there is gully and rill erosion in nearly every case where pipelines have been buried in the past.

A programme of spelling the Firecracker system over every second or third growing season is

essential in order to maintain vigour and productivity of the pastures. Such a programme could be readily implemented within the existing paddock system.

Although bluebush pastures (CHMA) in good condition have been rated as having a carrying capacity of 1 s.u./8 ha on a yearlong basis, this rate may in fact be too high for this sensitive system. Proper grazing management must aim to preserve a reasonable plant residue as ground cover to protect the soil surface.

6. The remaining land systems Uaroo (7.2 per cent), Dune (4 per cent), Onslow (2.2 per cent), Yankagee (2.1 per cent), Winning (0.2 per cent), Yarcowie (0.1 per cent) and Minderoo (0.01 per cent) are nearly all in good range condition. Most of the systems are spinifex-based and are stable under grazing. Management involves burning coupled with grazing deferment as outlined for the Giralia system (see 1).

7. Parts of Giralia are well-improved in terms of paddocks and watering points but about 25 per cent of the station is poorly utilised or not utilised due to the lack of stock waters. A number of old bores and wells in the east of the station are unserviceable or derelict and considerable areas of Giralia and Uaroo systems in this vicinity and in the south are not used. Although both these systems support much poor hard spinifex (HSSP) pasture they also support useful soft spinifex (SOSP). If the systems were burnt and managed as they are elsewhere on the property they would provide useful grazing for dry stock.

In the north of the station large areas of the Yankagee, Dune and Onslow system are poorly utilised due to the lack of permanent water points. Pastures are useful soft spinifex with minor, but valuable, inclusions of tussock grasses and saltbush.

Parts of the Sandalwood peninsula in the north-west of the station near the coast are poorly utilised due to the lack of permanent waters. This country is capable of supporting breeding livestock.

8. A development programme is required to bring the country outlined in 7 progressively into production. This would enable a more equitable distribution of stock over the station and facilitate spelling programmes and stock reductions required in paddocks where decline in range condition is evident.

9. In the opinion of the survey group the carrying capacities of the Firecracker and parts of the Donovan systems have been over-estimated in the past. The systems have carried more stock than can be safely maintained in the long-term without causing serious pasture and landscape deterioration.

It is considered that, between 1970 and 1977, the station as a whole carried stock numbers considerably in excess of its capability.

10. The recommended sheep unit capacity for present condition and assuming full development and use of the property (which is not the case at present, see 7) is 19 950 adults or 24 940 total sheep.

11. The capability sheep unit capacity if all country was in good range condition is 21 700 adults or 27 130 total sheep.

INDIVIDUAL STATION REPORT

GIRALIA STATION — **277 568 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km) Good	Fair	Bad	E/D*	Sheep unit capacity Recommended	Capability
Giralia	1 354	HSSP	609	68	—	—	1 963	2 031
		SOSP	609	68	—	—	8 177	8 463
Littoral	378	SOSP	23	—	—	—	288	288
		SAMP	23	—	—	—	92	92
		STCH	15	—	—	—	125	125
		No veg	317	—	—	—	—	—
Jubilee	266	HSHI	146	—	—	—	365	365
		SOSP	98	9	—	—	1 300	1 338
		MUCR	7	6	—	—	121	163
Donovan	236	CHMA	22	59	41	3	796	1 563
		SOSP	81	26	4		1 242	1 388
Uaroo	200	HSSP	146	—	—	—	438	438
		SOSP	54	—	—	—	675	675
Dune	111	SOSP	97	—	—	—	1 213	1 213
		TGER	9	—	—	—	150	150
		No veg	5	—	—	—	—	—
Firecracker	101	CHMA	49	33	17	2	889	1 263
Onslow	62	SOSP	30	—	—	—	375	375
		TGMI	22	—	—	—	367	367
		TGCE	9	—	—	—	450	450
		No veg	1	—	—	—	—	—
Yankagee	58.5	SOSP	22.5	—	—	—	281	281
		TGCH	13	—	—	—	429	429
		CHAT	8	—	—	—	100	100
		No veg	15	—	—	—	—	—
Winning	6	CHAT	4	—	—	—	50	50
		SOSP	2	—	—	—	25	25
		HSHI	—	—	—	—	—	—
Yarcowie	3	TGER	—	3	—	—	25	50
Minderoo	0.5	TGCH	0.5	—	—	—	17	17
		SOSP	—	—	—	—	—	—
		STCH	—	—	—	—	—	—
		No veg	—	—	—	—	—	—
TOTALS	2 776		2 437	272	62	5	19 953	21 699

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

Recommended sheep unit capacity	19 950 adults	24 940 total
Capability sheep unit capacity	21 700 adults	27 130 total
Declared stock numbers (1979)	18 000 sheep, 17 cattle	

GLENFLORRIE STATION — West Pilbara Shire

Location

Glenflorrie station is located on the Wyloo and Edmund 1:250 000 map sheets. Access to the homestead is via Uaroo station about 72 km to the west and thence to the North West Coastal Highway. The station has common boundaries with Nanutarra, Mt. Stuart, Wyloo, Kooline, Ullawarra, Maroonah and Uaroo stations and the Barlee Range Wildlife Sanctuary.

Area within survey

Entire station 197 268 ha.

Description

Rugged country of the Barlee Range Wildlife Sanctuary effectively separates the southern part of the station into western and eastern sections. Two large tributaries of the Ashburton River, namely the Henry River and Wannery Creek run through the western and eastern sections respectively.

About 84 per cent of the station consists of rugged mountains, ridges, hills and stony plains of low or very low pastoral value. Some large areas are unsuitable for pastoral pursuits.

About 9.7 per cent is of moderate pastoral value. A total of nine land systems on the station fall into this category with the three largest systems being Stuart, consisting of stony plains, Boolaloo with granite hills and sandy plains and Table with low calcrete mesas and lower plains.

The River land system, consisting of narrow active flood plains and including the channels and banks of the major rivers, occupies 6 per cent of the station area. Pastoral value is high.

A total of 18 land systems occur on the station and the characteristics of these are further outlined in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) are presented in Table 2. These statements were derived from observations made whilst traversing on the station.

Land evaluation sites

Detailed description and measurements of landform, vegetation, soil and condition were made at 22 sites on 8 land systems.

Table 1 — LAND SYSTEMS ON GLENFLORRIE STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hills ridges, and plateaux, with skeletal soils and tall shrublands or hard spinifex grasslands	31.8	
	Boolgeeda — stony plains with hard spinifex grasslands or mulga shrublands	4.6	
	Capricorn — rugged hills and ridges with low shrublands or hard spinifex	4.0	
			40.4
Low (20 to 30ha/s.u.)	**Kooline** — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	27.0	
	Prairie — granite hills and undulating stony plains with low and tall shrublands	10.3	
	Collier — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	6.0	
	Egerton — highly dissected plains and slopes with sparse mulga shrublands	0.2	
			43.5
Moderate (10 to 20ha/s.u.)	**Stuart** — plains of low or moderate relief with snakewood shrublands and hard and soft spinifex hummock grasslands	3.0	
	Boolaloo — granite hills, domes, tor fields and sandy plains, spinifex grasslands and shrubby grasslands	2.5	
	Table — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	2.1	
	Dollar — stony plains with open snakewood shrubland	0.9	
	Scoop — stony plains with snakewood and chenopod shrublands	0.5	
	Robe — low plateaux, mesas and buttes of limonite with soft and hard spinifex pastures	0.3	
	Laterite — small mesas and gravelly plains with mulga shrublands	0.2	
	Uaroo — broad sandy plains with hard and soft spinifex grasslands	0.1	
	Mundong — gently undulating plains with open snakewood and mulga shrublands	0.1	
			9.7
High (5 to 10ha/s.u.)	**River** — narrow, active flood plains flanking major rivers and creeks with moderately dense tall shrublands	6.0	
	Ashburton — active flood plains and backplains with deep silty loams and clayey soils, shrublands and tussock grasslands	0.4	
			6.4
Very high (<5ha/s.u.)			0
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS

(284 recordings on 14 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Ashburton	1	100	—	—	—	—	100	—	—	—	100	—	—
Augustus	53	94	4	2	—	64	25	9	—	2	89	9	2
Boolaloo	6	83	—	17	—	17	49	17	17	—	66	17	17
Boolgeeda	15	87	13	—	—	33	27	33	7	—	60	33	7
Collier	27	100	—	—	—	56	33	7	4	—	89	11	—
Capricorn	9	100	—	—	—	45	44	—	11	—	89	11	—
Dollar	12	75	25	—	—	8	42	25	17	8	50	25	25
Kooline	89	78	13	8	1	21	31	21	23	4	52	28	20
Mundong	2	100	—	—	—	50	50	—	—	—	100	—	—
Prairie	2	50	—	50	—	—	—	—	100	—	—	50	50
River	35	71	20	3	6	—	14	57	29	—	14	63	23
Robe	1	100	—	—	—	—	100	—	—	—	100	—	—
Scoop	6	17	33	50	—	—	17	66	17	—	17	33	50
Stuart	14	79	21	—	—	36	7	43	14	—	43	50	7
Table	12	75	—	25	—	33	—	59	8	—	33	42	25
Total over all land systems	284	82	11	6	1	32	26	25	15	2	58	28	14

Range condition and recommendations

1. **Augustus land system** (31.8 per cent of station area)

   This is the largest system on the station and consists of rugged hills and ranges supporting mulga short grass forb (MSGF) pastures. Much of it is sufficiently rugged as to be of negligible value for grazing. Range condition is good.

2. **Kooline land system** (27.0 per cent)

   This system consists of large areas of rough shale hills, restricted areas of saline lower plains and broad drainage floors with braided channels.

   The hill units support unproductive stony short grass forb (SSGF) pastures and are poorly attractive to stock. Range condition of the unit is invariably good or fair.

   The other units of the system support mulga creekline (MUCR) and saltbush (CHAT) pastures which are preferentially grazed by stock. Pasture condition is fair to very poor and erosion in the form of surface stripping, rills and gutters is common on drainage floors.

   A large stony plain area of the system near the aerodrome to the north west of the homestead shows severe pasture degradation. It requires protection from grazing over a number of consecutive growing seasons and very light use at other times of the year. However, at the present time the area is unfenced and control of stock would be inadequate to implement such a programme.

3. **Prairie land system** (10.3 per cent)

   This system was not adequately sampled but its condition is expected to be similar to that seen elsewhere in the survey area. Granite hills are the largest unit of the system. These support mulga short grass forb (MSGF) pastures and condition is invariably good. Stony plains and creekline areas may be in good condition, but also frequently show varying degrees of pasture degradation to fair or bad condition. Erosion is not a problem.

4. **River land system** (6.0 per cent)

   This system supports productive mulga creekline (MUCR) pastures and is favoured by livestock. The majority of the system is in fair range condition although both extremes of condition are also present. Parts of the system require spelling over a number of growing seasons to promote pasture recovery, but such a programme could probably not be implemented due to inadequate control of stock.

   Proper management on this valuable system requires complete control of grazing intensity and season of use. This can only be achieved by fencing and paddocking. The existing paddocking system is inadequate in that many fences are derelict.

5. Condition of the remaining 12 land systems on the station is indicated in Table 2 and in the summary table at the end of this report. As a generalisation all the hill, footslope and stony plain units of the system supporting mulga short grass forb (MSGF) stony short grass forb (SSGF) and hard spinifex (HSHI) pastures are in good range condition. Inclusions of better quality pastures are invariably degraded to some extent. However, taken overall, the condition of these systems is acceptable and there are no erosion problems.

6. Glenflorrie is run on the open range principle. On much of the property such a system is acceptable as landscape instability will not be induced. However, fencing and controlled stocking is required in order to maintain pasture condition and productivity on the more accessible and productive land systems and units of systems.

7. The recommended cattle unit capacity for present condition is 870 adults or 1 090 total cattle.

8. The capability cattle unit capacity if all country was in good range condition is 1 160 adults or 1 450 total cattle.

INDIVIDUAL STATION REPORT

GLENFLORRIE STATION — **197 268 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Augustus	628	MSGF	555	42	—	—	1 173	1 194
		MUCR	23	5	3	—	323	388
Kooline	533	SSGF	280	144	13	—	1 148	1 311
		MUCR	19	11	23	—	374	663
		CHAT	—	7	36	—	148	538
Prairie	203	MSGF	89	—	—	—	356	356
		SSGF	19	57	5	—	179	243
		MUCR	7	12	14	—	200	413
River	119	MUCR	—	53	24	—	371	963
		STCH	5	15	4	—	125	199
		No Veg	18	—	—	—	—	—
Collier	118	MSGF	65	—	—	—	260	260
		SSGF	29	—	—	—	87	87
		STCH	21	3	—	—	189	199
Boolgeeda	90	HSHI	74	12	—	—	205	215
		SOSP	1	2	1	—	32	50
Capricorn	78	HSHI	55	—	—	—	94	94
		SSGF	19	—	—	—	57	57
		MUCR	2	2	—	—	36	50
Stuart	60	STCH	8	16	—	—	146	199
		HSHI	24	—	—	—	60	60
		SOSP	5	7	—	—	121	150
Boolaloo	50	HSHI	28	—	—	—	48	48
		SOSP	20	—	—	—	250	250
		STCH	—	2	—	—	10	17
Table	41	MSGF	21	—	—	—	84	84
		CSGF	2	12	2	—	50	80
		MUCR	—	4	—	—	22	50
Dollar	18	STCH	8	6	—	—	96	116
		MUCR	1	—	2	—	19	38
		TGER	—	1	—	—	8	17
Scoop	10	STCH	2	2	3	—	33	58
		CHAT	—	1	1	—	11	25
		MUCR	—	1	—	—	6	13
Ashburton	7	CHAT	—	—	3	1	8	50
		CHMA	—	3	—	—	21	38
Robe	6	SOSP	5	—	—	—	31	31
		HSHI	1	—	—	—	2	2
Laterite	5	SSGF	2	—	—	—	6	6
		MSGF	2	—	—	—	8	8
		TGER	—	1	—	—	8	17
Egerton	3	MSGF	2	—	—	—	8	8
		SSGF	1	—	—	—	3	3
		MUCR	—	—	—	—	—	—
Uaroo	2	HSSP	2	—	—	—	6	6
		SOSP	—	—	—	—	—	—
Mundong	2	STCH	1	—	—	—	8	8
		TGER	1	—	—	—	17	17
		SSGF	—	—	—	—	—	—
TOTALS	1 973		1 417	421	134	1	6 547	8 679

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	1 310	1 640	870	1 090
Capability cattle unit capacity	1 740	2 180	1 160	1 450

Declared stock numbers (1979) ..... 950 cattle

KOOLINE STATION — West Pilbara Shire

Location

Kooline station is located on the Wyloo and Edmund 1:250 000 map sheets some 230 km west-south-west by road from the township of Tom Price. The station has common boundaries with Wyloo, Ashburton Downs, Amelia, Ullawarra and Glenflorrie stations and vacant crown land.

Area within survey

Entire station 204 322 ha.

Description

The Ashburton River runs through the centre of the station for about 90 km and is flanked by flood plains varying in width from 4 km to 10 km. The flood plains are flanked on both sides by low rough shale hills of the Kooline land system. On the south-west and south sides of the river there are also large, very poorly accessible sandstone hills of the Augustus and Capricorn systems. These two hill systems collectively occupy 26.3 per cent of the total station area and their pastoral value is extremely low.

The largest land system on the station is Kooline (32.5 per cent) which supports very poor stony short grass forb (SSGF) pastures on its shale hills and more productive mulga creekline (MUCR) and saltbush (CHAT) pastures on drainage floors and small saline plains. Overall pastoral value is low.

The Ashburton land system (29.0 per cent) with its active flood plains and deep silty loams and clayey soils is the most productive and valuable system on the station. It supports patchy tall shrublands mostly of bardie bush *(Acacia victoriae)* with a prominent low shrub layer including saltbush and tall saltbush (CHAT and CHMA) pastures in variable condition. The ground layer consists of patchy buffel grass (TGCE pasture land) and dense forbs and herbs after flooding.

Tributary alluvial plains of the Edward land system (7.1 per cent) occur at the outer margins of the Ashburton system and immediately below and adjacent to low shale hills of the Kooline system. The Edward system supports extremely degraded chenopod (CHAT and STCH) pastures and its pastoral value although potentially high is now very low.

A number of other land systems of minor importance occur on the station. All systems are briefly described and their pastoral value for good range condition status indicated in Table 1.

Condition statements for land systems and for the station as a whole (total overall land systems) are presented in Table 2. These statements were derived from traverse records.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soil and range condition were made at 19 sites on 4 land systems.

Range condition and recommendations

1. **Kooline land system** (32.5 per cent of total station area)

   An examination of the detailed traverse data for individual units of the system (this data not presented here) clearly shows that condition status varies from unit to unit.

   Hills and footslopes which are the largest unit of the system are little grazed by livestock and pasture condition is fair or good and there is no erosion. Saline plains and broad drainage zones with braided creeklines support pastures attractive to stock and have received preferential use. The condition of these units indicates that past use levels have been excessive — for example 5 per cent, 48 per cent and

Table 1 — LAND SYSTEMS ON KOOLINE STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hill, ridges and plateaux with skeletal soils and tall shrublands or hard spinifex grasslands	17.4	
	Capricorn — rugged hills and ridges with low shrublands or hard spinifex	8.9	
	Boolgeeda — stony plains with hard spinifex grasslands or mulga shrublands	2.0	
			28.3
Low (20 to 30ha/s.u.)	**Kooline** — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	32.5	
	Charley — dolerite hills and ridges and restricted lower plains; tall and low shrublands	0.4	
	Ethel — cobble plains with sparse mulga and other Acacia spp. shrublands	0.3	
	Collier — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	0.3	
			33.5
Moderate (10 to 20ha/s.u.)	**Scoop** — stony plains with snakewood and chenopod shrublands	1.6	
	Dollar — stony plains with open snakewood shrublands	0.5	
			2.1
High (5 to 10ha/s.u.)	**Edward** — alluvial plains with sparse degraded saltbush, bluebush and other shrub pastures	7.1	7.1
Very high (<5ha/s.u.)	**Ashburton** — active flood plains and backplains with deep silty loam and clayey soils, shrublands and tussock grasslands	29.0	29.0
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(272 recordings on 9 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Ashburton	125	18	21	27	34	2	7	24	43	24	9	20	71
Augustus	1	100	—	—	—	—	—	100	—	—	—	100	—
Boolgeeda	9	33	67	—	—	—	22	33	45	—	22	45	33
Capricorn	1	100	—	—	—	—	—	—	100	—	—	100	—
Dollar	2	100	—	—	—	—	—	—	50	50	—	50	50
Edward	42	17	26	17	40	—	5	19	7	69	5	21	74
Ethel	1	—	100	—	—	—	—	—	—	100	—	—	100
Kooline	77	56	34	6	4	8	17	29	30	16	25	36	39
Scoop	14	7	58	21	14	—	—	43	50	7	—	29	71
Total over all land systems	272	29	29	18	24	3	10	26	34	27	13	27	60

47 per cent of the 19 recordings made on the saline plain unit indicate good, fair and bad range condition respectively. Condition of drainage zones with braided creeks is worse than the saline plains with 68 per cent of the recordings indicating bad range condition. Twenty four per cent of recordings showed moderate or severe erosion.

2. **Ashburton land system** (29 per cent)

The Ashburton system is mostly in bad range condition with pastures in poor or very poor condition. Vegetative cover is very patchy with quite dense stands of shrubs alternating with bare areas. Although shrub pastures are considerably degraded the system still provides large quantities of high quality annual pasture after flooding and, in parts, still has fair durability due to shrubs and buffel grass. However, the whole system is producing at well below its potential.

Moderate and severe wind erosion in the form of patchy hummocking and scalding is common. There is evidence of past erosion cycles where massive wind redistribution of soil has occurred. Some old hummocks are now partly stabilised by shrubs and introduced buffel grass while others are still actively eroding. Severe gullying occurs near new No. 4 bore and this bore should be closed down.

About 12 sq. km mostly in North 13 Mile, Ram and Gum Corner paddocks is so severely degraded that it should not be used for grazing. Recovery would occur fairly rapidly by spelling for a number of years and by actively promoting the spread of buffel grass.

Proper management on the system requires control of stock numbers and season of grazing. This control could be achieved in paddocks in northern parts of the property, but no paddocks exist in the south and a fencing programme is required.

3. **Augustus and Capricorn land systems** (collectively 26.3 per cent)

These two hill systems receive little grazing and are in good range condition.

4. **Edward land system** (7.1 per cent)

Thirty one (74 per cent) of the 24 traverse recordings made on the Edward system indicate bad range condition with severely degraded pastures and erosion. Seventeen (40 per cent) of the recordings show severe erosion in the form of wind scalding and hummocking.

About 61 sq. km is so severely degraded that special treatments will be required in order to effect recovery. The areas should be fenced off and closed to grazing and cultivation and seeding treatments imposed. The largest single area of severe degradation is a few kilometres north of the outcamp where a bare clay scald extends for about 8 km. Other large areas occur in the northern half of the station.

The Edward system is capable of supporting useful saltbush (CHAT) and other chenopod pastures, but the system is extremely sensitive to grazing. The original duplex soils of the system were inherently very susceptible to erosion once the vegetative cover was removed.

The bad condition of the Edward system is a matter of considerable concern and clearly shows the deficiencies of past management systems. Complete control of stock in terms of numbers and length of grazing is essential for rehabilitation and for maintenance of pastures and landscape stability. This means that the system must be fenced as a separate entity or with some adjoining Kooline land system drainage floors which are similarly sensitive and have similar management requirements. Edward and Ashburton systems should not be included in the same paddock as they react differently to grazing and have different potential and carrying capacity. Unfortunately the old fences and paddocks on Kooline have taken little account of the different management requirements of various classes of country.

5. **Scoop land system** (1.6 per cent)

Vegetation on this small system which flanks the Ashburton River in the vicinity of Cube Hill bore and Alexander bore is badly degraded and 35 per cent of recordings indicate moderate or severe erosion. Grazing needs to be controlled.

6. The remaining 6 land systems on the station are of little significance. They are mostly hard, stony and unproductive. Pastures are partly degraded; there is no serious erosion.

7. Except in northern areas Kooline is poorly fenced for cattle and a number of old watering points are

unserviceable. Control and distribution of stock is poor.

8. Recommended cattle unit capacity for present condition is 1 030 adults or 1 290 total cattle.

9. Capability cattle unit capacity if all the station was in good range condition is 2 910 adults or 3 640 total cattle.

INDIVIDUAL STATION REPORT

KOOLINE STATION — **204 322 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km) Good	Fair	Bad	E/D*	Sheep unit capacity Recommended	Capability
Kooline	665	SSGF	245	245	55	—	1 308	1 635
		MUCR	8	13	46	—	323	838
		CHAT	3	25	25	—	308	663
Ashburton	592	TGCE	22	43	137	—	2 412	10 100
		CHAT	—	49	134	12	742	2 438
		CHMA	—	53	142	—	731	2 438
Augustus	355	MSGF	337	—	—	—	674	674
		MUCR	12	6	—	—	183	225
Capricorn	182	HSHI	126	—	—	—	216	216
		SSGF	46	—	—	—	138	138
		MUCR	5	4	—	—	85	113
Edward	145	CHAT	2	11	51	61	244	1 563
		STCH	—	13	4	—	73	141
		SSGF	3	—	—	—	9	9
Boolgeeda	41	HSHI	10	19	10	—	67	98
		SOSP	—	2	—	—	17	25
Scoop	33	STCH	—	5	16	—	57	174
		CHAT	—	1	6	—	23	88
		MUCR	—	3	2	—	23	63
Dollar	10	STCH	—	4	4	—	28	66
		MUCR	—	1	—	—	6	13
		TGER	—	1	—	—	8	17
Charley	8	MSGF	4	—	—	—	8	8
		CSGF	3	—	—	—	15	15
		TGER	1	—	—	—	17	17
Ethel	6	SSGF	5	—	—	—	15	15
		CHAT	—	1	—	—	8	13
Collier	6	MSGF	3	—	—	—	12	12
		SSGF	2	—	—	—	6	6
		STCH	1	—	—	—	8	8
TOTALS	2 043		839	499	632	73	7 764	21 829

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1 adult	total	At Conversion rate 7.5:1 adult	total
Recommended cattle unit capacity	1 550	1 940	1 030	1 290
Capability cattle unit capacity	4 370	5 460	2 910	3 640

Declared stock numbers (1979) ..... 1 085 cattle

KOORDARRIE STATION — West Pilbara Shire

Location

Nearly all the station is located on the Yanrey 1:250 000 map sheet with a small section extending onto the Onslow sheet. The homestead is about 79 km south by a road from Onslow. The station has common boundaries with Urala, Minderoo and Yanrey stations.

Area within survey

Entire station 118 559 ha.

Description

All of Koordarrie is usable grazing country consisting of broad coastal sandy plains with low dunes and extensive alluvial clay plains.

The Minderoo land system is the largest on the station (34.8 per cent of total area) and occurs in the centre of the property. The system consists of clayey and sandy plains supporting tall shrubs, tussock grasses and soft spinifex. Pastoral value is very high.

Westward towards the coast the landscape consists of sand plaiu and sandy corridors between low parallel duues of the Yankagee, Dune and Onslow land systems. The Yankagee system is characterised by numerous round or oval claypans, usually between 20 and 400 m in diameter, but occasionally much larger. These three systems, together with the clay plain systems Globe and Cheetara in the east of the station, collectively occupy 63.6 per cent of the total area and are of high pastoral value.

The only other land systems on the station are Littoral and Uaroo (collectively 1.6 per cent), and these are of little significance for grazing. Characteristics of all land systems on the station are briefly summarised in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) have been prepared from data collected whilst traversing on the station and are presented in Table 2.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 18 sites on 6 land systems.

Range condition and recommendations

1. **Minderoo land system** (34.8 per cent of station area)

Range condition of the productive Minderoo system is extremely variable as the units of the system vary markedly in their sensitivity to grazing.

Sand plain and occasional sand dunes comprise 25 per cent of the system and support soft spinifex (SOSP) pastures. These units are relatively resistant to grazing. Pasture condition is good and there is no erosion.

Plains with through draiuage, gilgai plains and swamps and depressions comprise about 55 per cent of the system and support a range of tussock grass pastures such as weeping grass (TGCH) and mitchell grass (TGAS). Range condition is mostly fair although considerable areas are also in good and bad condition. Due to the lack of slope and heavy clay soils of the gilgai plaius and swamps no erosion occurs even when pastures are severely depleted. Plains with through drainage are inherently more susceptible and some minor erosion is evident.

Plains supporting snakewood occupy about 15 per cent of the system and this unit is very sensitive to grazing. The unit supports stony chenopod (STCH) and saltbush (CHAT) pastures. Pasture condition is mostly fair although both extremes of condition are also seen. There are some patches of minor erosion, mostly in the form of wind hummocking and surface stripping.

An area of about 3 sq. km in South paddock is severely degraded and requires protection from grazing for such time as is uecessary for recovery to be effected.

Table 1 — LAND SYSTEMS ON KOORDARRIE STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Littoral** — extensive bare coastal mudflats, flanked by mangroves and narrow sandy plains	1.0	1.0
Low (20 to 30ha/s.u.)			0
Moderate (10 to 20ha/s.u.)	**Uaroo** — broad sandy plains with hard and soft spinifex grasslands	0.6	0.6
High (5 to 10ha/s.u.)	**Yankagee** — plains with dunes and numerous claypans, soft spinifex and snakewood shrublands	33.0	
	Globe — degraded alluvial plains supporting snakewood shrublands and minor tussock grasslands	17.1	
	Dune — coastal dune fields with soft spinifex grasslands	10.0	
	Cheetara — alluvial clay plains with gilgais, mixed open tussock grasslands and tall shrublands	2.1	
	Onslow — sand plain, dunes and clay plains with soft spinifex and tussock grasses	1.4	
			63.6
Very high (<5ha/s.u.)	**Minderoo** — alluvial plains supporting tall shrublands and tussock grasslands and areas of sand supporting hummock grassland	34.8	34.8
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS

(151 recordings on 6 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Cheetara	7	71	29	—	—	—	14	14	29	43	14	43	43
Dune	4	100	—	—	—	100	—	—	—	—	100	—	—
Globe	51	55	27	12	6	—	12	43	29	16	12	55	33
Littoral	1	100	—	—	—	100	—	—	—	—	100	—	—
Minderoo	57	79	12	9	—	16	33	23	21	7	49	32	19
Yankagee	31	77	10	3	10	52	19	16	3	10	71	16	13
Total over all land systems	151	71	17	8	4	20	21	27	20	12	41	36	23

2. **Yankagee land system** (33.0 per cent)

About 38 per cent of this system consists of sand plain and dunes supporting soft spinifex (SOSP) pastures. Pasture condition is good and there is no erosion. The remaining units of the system are plains with snakewood, plains receiving concentrated flow, and swamps and depressions. These units support saltbush (CHAT) and tussock grass pastures such as weeping grass (TGCH). Generally condition is fair although some considerable areas are in good and bad condition.

Parts of the Yankagee system in the south-west and elsewhere are poorly utilised due to the lack of stock waters. Range condition is understandably good and pastures include stands of saltbush beneath snakewood. This vegetation association is rarely seen elsewhere in the survey area as the saltbush has been almost completely depleted. The unused portions of the system should be brought into production by constructing dams at suitable locations.

About 2 sq. km of the Yankagee system near No. 4 dam in the north-west of the station is seriously degraded and requires protection from grazing. Additional watering points are required in the area so that stock can be more widely spread and so that No. 4 dam can be temporarily closed to livestock to encourage pasture recovery.

Fire is an important management tool on the spinifex units of this and the Minderoo and Dune land systems. Young soft spinifex is of moderate grazing value and has good drought durability. However, old mature spinifex stands are of very little use for grazing and management must be aimed at maintaining the pastures in as attractive condition to stock as possible. Spinifex must be burnt on a regular basis about every 4 or 5 years, and burning should be late in the year. Burnt areas should be deferred from grazing for 8 to 10 weeks over the growing season following the fire in order to encouage establishment of desirable grasses, shrubs and spinifex seedlings.

Spinifex country is generally resistant to degradation, although some wind erosion can occur if a prolonged dry spell occurs after burning. Re-establishment of vegetative cover and stabilisation occurs rapidly after rain.

3. **Globe land system** (17.1 per cent)

Condition of the system varies from good to bad. The alluvial plain unit which supports snakewood is inherently more sensitive to grazing and erosive forces than other units and is consequently more degraded.

Although, taken over all, the system is in fair condition there are some areas which are of concern. About 6 sq. km of country in the vicinity of Cement well is severely degraded and eroded and should not be grazed. The affected areas are in Woolly, Cement and South paddocks with the largest area in the latter paddock which also contains some severely degraded country of the Minderoo system (see 1).

A regeneration programme should be initiated in South paddock and be extended to Cement and Woolly paddocks in subsequent years. South paddock should be closed to grazing for at least two years and remedial treatments involving strip contour cultivation and seeding with buffel and birdwood grass undertaken. Although the degradation is severe the country still has good potential for recovery given reasonable seasons and an absence of livestock.

4. **Cheetara land system** (2.1 per cent)

This system is mostly in fair or bad condition. The system consists of flat clay plains with and without gilgais and supports Roebourne plains grass (TGER) pastures as a grassland or as a ground layer beneath tall shrubs. In the degraded situation the grass tussocks become extremely sparse and, in extreme cases, are absent. In the latter case the pastures are degraded to annual herb fields with no durability. Parts of the system require spelling over a number of consecutive growing seasons and this could be readily implemented within the existing paddock system.

5. Range condition of the remaining land systems (Dune 10 per cent, Onslow 1.4 per cent, Littoral 1 per cent and Uaroo 0.6 per cent) on the station is good. Pastures are predominantly spinifex and the only special management requirement is regular burning (see 2).

6. The station is poorly developed in terms of artificial watering points, and only half of the station is currently being utilised. Some mills are unserviceable, and in many cases groundwater supplies are too saline for development. However, much of the unused country, particularly in the west, could be brought into production by the construction of dams at suitable sites. This country is of high pastoral value, and a development programme is required.

Many of the fences on the station are in very poor condition, and an upgrading programme is required so that proper pasture and animal practices can be implemented.

7. The recommended sheep unit capacity for present condition and assuming full development and use of the property (which is not the case at present, see 6) is 13 010 adults or 16 260 total sheep. The station is currently (1978) running about 7 300 total sheep on about half the station area, and this number is considered to be satisfactory for present condition.

8. The capability sheep unit capacity if all country was in good range condition is 19 770 adults or 24 710 total sheep.

INDIVIDUAL STATION REPORT

KOORDARRIE STATION **118 559 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Minderoo	413	TGCH	93	93	41	—	4 506	7 491
		SOSP	91	12	—	—	1 238	1 288
		STCH	15	23	20	4	280	515
		No veg	21	—	—	—	—	—
Yankagee	391	SOSP	127	21	—	—	1 762	1 850
		TGCH	21	21	42	2	1 126	2 838
		CHAT	22	22	11	—	485	688
		No veg	102	—	—	—	—	—
Globe	203	CHAT	9	56	40	7	677	1 400
		TGER	20	59	—	—	830	1 319
		SOSP	6	6	—	—	125	150
Dune	119	SOSP	103	—	—	—	1 288	1 288
		TGMI	10	—	—	—	167	167
		No veg	6	—	—	—	—	—
Cheetara	25	TGER	3	10	10	2	167	418
Onslow	16	SOSP	8	—	—	—	100	100
		TGMI	6	—	—	—	100	100
		TGCE	2	—	—	—	100	100
Littoral	12	SOSP	1	—	—	—	13	13
		SAMP	1	—	—	—	4	4
		No veg	10	—	—	—	—	—
Uaroo	7	HSSP	5	—	—	—	15	15
		SOSP	2	—	—	—	25	25
TOTALS	1 186		684	323	164	15	13 008	19 769

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

Recommended sheep unit capacity.....13 010 adults — 16 260 total
Capability sheep unit capacity.....19 770 adults — 24 710 total

Declared stock numbers (1978).....7 269 sheep

MAROONAH STATION — West Pilbara Shire

Location

Nearly all of Maroonah station is located on the Edmund 1:250 000 map sheet with a small section extending on to the Winning sheet. Access to the station is via Gascoyne Junction in the south or to the North West Coastal Highway via Nyang station in the north-west.

The station has common boundaries with Towera, Lyndon, Mangaroon, Gifford Creek, Edmund, Ullawarra and Glenflorrie Stations and with the Barlee Range Wildlife Sanctuary.

Area within survey

About 79 per cent (155 849 ha) of the station falls within the survey area. The remainder falls within the catchment of the Gascoyne River and was mapped during the Gascoyne River catchment survey (1970), but no station report was prepared. This report deals only with that part of the station falling within the Ashburton River catchment.

Description

About 22.5 per cent of the area surveyed consists of rugged mouutains, hills and ridges of the Augustus and Capricorn land systems. The large Augustus system (19.8 per cent of the area) occurs mostly in the north east. Some parts of both systems are poorly accessible and are virtually unused by livestock. Pastures are mostly mulga short grass forbs (MSGF) and hard spinifex (HSHI) and overall pastoral value is very low.

A further 45.7 per cent of the area consists of land systems of low pastoral value. These include rough granite hills and stony plains of the Prairie system (19.7 per cent), low hills, ridges and stony uplands of the Collier system (18.2 per cent), dolerite hills and ridges of the Charley system (4.6 per cent) and two other minor systems.

The most useful grazing country is of moderate pastoral value and is located in the west along the Yannarie River and in the centre of the station. Gently undulating stony plains of the Mundong system (14.6 per cent) occur in the west and calcrete plains and rises of the Nadarra systems (17 per cent) occur in the centre.

There are no land systems of high or very high pastoral value within the surveyed area.

A total of 11 land systems are present on the station and summary descriptions are presented in Table 1.

Condition statements for land systems and the whole station (total over all land systems) were derived from data obtained whilst traversing on the station and are presented in Table 2.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 24 sites on 5 land systems.

Range condition and recommendations

1. **Augnstus land system** (19.8 per cent of area surveyed)

   This is the largest system within the surveyed area. Narrow valleys and footslopes provide some rough grazing, but much of this very rugged system is of negligible pastoral use. Overall range condition is good.

2. **Prairie land system** (19.7 per cent)

   This system consists of low, rough granite hills,

Table 1 — LAND SYSTEMS ON MAROONAH STATION

Pastoral value	Land systems	Per cent of area
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hills, ridges, and plateaux with skeletal soils and tall shrublands or hard spinifex grasslands	19.8
	Capricorn — rugged hills and ridges with low shrublands or hard spinifex	2.7
	Boolgeeda — stony plains with hard spinifex grasslands or mulga shrublands	0.01
		22.5
Low (20 to 30ha/s.u.)	**Prairie** — granite hills and undulating stony plains with low and tall shrublands	19.7
	Collier — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	18.2
	Charley — dolerite hills and ridges and restricted lower plains; tall and low shrublands	4.6
	Kooline — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	1.7
	Jamindle — stony hardpan plains and stony rises with groved mulga shrublands	1.5
		45.7
Moderate (10 to 20ha/s.u.)	**Nadarra** — plains and calcrete rises with chenopod shrublands and hard spinifex grasslands	17.0
	Mundong — gently undulating plains with open snakewood and mulga shrublands	14.6
	Table — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	0.2
		31.8
High (5 to 10ha/s.u.)		0
Very high (<5ha/s.u.)		0
		100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(246 recordings on 8 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Augustus	11	100	—	—	—	55	18	27	—	—	73	27	—
Charley	5	100	—	—	—	80	—	20	—	—	80	20	—
Collier	47	100	—	—	—	36	39	19	6	—	74	26	—
Capricorn	11	82	18	—	—	9	55	27	9	—	64	27	9
Kooline	9	78	22	—	—	—	11	67	22	—	11	89	—
Mundong	95	96	4	—	—	1	7	54	36	2	8	88	4
Nadarra	46	98	2	—	—	15	30	42	13	—	46	54	—
Prairie	22	95	5	—	—	14	40	41	5	—	54	41	5
Total over all land systems	246	96	4	—	—	16	23	41	19	1	39	59	2

footslopes and restricted rocky plains and drainage floors. Although rough the system is generally accessible to stock and is utilised to some extent. The hills and stony plains support mulga short grass forb (MSGF) and stony short grass forb (SSGF) pastures which are mostly in good condition. Small inclusions of better quality pastures such as mulga creekline (MUCR) pastures occur along drainage floors and creeklines. These are largely in good condition although deterioration to fair aud bad condition is evident in parts. The overall condition of the system is acceptable and no special management other than occasional spelling of the more accessible parts is required.

3. **Collier land system** (18.2 per cent)

This system of low hills and stony uplands is largely in good range condition with smaller areas in fair condition. The stony nature of the system means that it is not susceptible to erosion.

4. **Nadarra land system** (17 per cent)

This system of plains and calcrete rises supports useful and durable bluebush (CHMA) and stony chenopod (STCH) pastures with smaller areas of poor hard spinifex (HSHI) pastures. Condition of the major units of the system is about equally distributed between good and fair. There is obvious decline in desirable shrubs on some stony plains, but no erosion as most units of the system have a dense stony surface mantle and are inherently resistant. Exceptions to this are some drainage floors and flow zones (about 10 per cent of the system) which are susceptible to erosion once the vegetation is depleted. A few floors and flow zones are seriously degraded, but the general condition of the whole system is acceptable.

Proper pasture management on the system requires complete control of stock numbers and season of use. Occasional complete spelling over a grazing season or two consecutive growing seasons is necessary to maintain or improve pasture condition and this could be done using existing paddocks.

5. **Mundong land system** (14.6 per cent)

This accessible plain system supports useful stony chenopod (STCH) and tussock grass (TGER) pastures beneath snakewood and mulga. Pasture condition varies from good to poor with the bulk showing moderate deterioration to fair condition. Overall range condition is fair and there is no erosion.

The system is well paddocked and a systematic programme of spelling over growing seasons on a paddock by paddock basis is required to improve pasture condition. In its present condition, the system should not be stocked in excess of about 1 s.u./18 ha on a yearlong basis.

6. The remaining six systems on the surveyed area are all in good or fair range condition. There are no problems of serious pasture deterioration or erosion.

7. All the accessible parts of the station are well developed in terms of waters and paddocks although some fences may require upgrading. Good control of stock is possible on much of the station, thus enabling sound husbandry of vegetation and animal resources.

8. The recommended safe sheep unit capacity for present condition of the surveyed area is 6 800 adults or 8 500 total sheep.

9. The capability sheep unit capacity if all of the surveyed section of the station was in good range condition is 8 690 adults of 10 860 total sheep.

INDIVIDUAL STATION REPORT

MAROONAH STATION — **Area surveyed 155 849 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Augustus	309	MSGF	294	—	—	—	588	588
		MUCR	—	15	—	—	83	188
Prairie	306	MSGF	135	—	—	—	540	540
		SSGF	46	76	—	—	290	366
		MUCR	33	8	8	—	483	613
Collier	283	MSGF	119	37	—	—	587	624
		SSGF	71	—	—	—	213	213
		STCH	25	31	—	—	363	465
Nadarra	264	STCH	56	63	—	—	780	988
		CHMA	64	42	—	—	1 098	1 325
		HSHI	32	7	—	—	61	66
Mundong	228	STCH	—	130	—	—	650	1 079
		TGER	7	50	—	—	537	952
		SSGF	—	41	—	—	62	123
Charley	71	MSGF	47	—	—	—	94	94
		CSGF	24	—	—	—	120	120
Capricorn	43	HSHI	30	—	—	—	51	51
		SSGF	11	—	—	—	33	33
		MUCR	—	2	—	—	11	25
Kooline	27	SSGF	3	19	—	—	47	66
		MUCR	—	2	1	—	14	38
		CHAT	—	2	—	—	17	25
Jamindie	24	SSGF	10	10	—	—	35	40
		MUCR	1	2	—	—	24	38
		TGER	—	1	—	—	8	17
Table	3	MSGF	2	—	—	—	8	8
		CSGF	1	—	—	—	5	5
		MUCR	—	—	—	—	—	—
Boolgeeda	0.1	HSHI	—	—	—	—	—	—
		SOSP	—	—	—	—	—	—
TOTALS	1 558		1 011	538	9	—	6 802	8 690

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

Recommended sheep unit capacity ..... 6 800 adults — 8 500 total

Capability sheep unit capacity ..... 8 690 adults — 10 860 total

Declared stock numbers (1979) ..... 2 970 sheep, 120 cattle

MARRILLA STATION — Carnarvon and West Pilbara Shires

Location

Marrilla station is located on the Yanrey and Winning Pool 1:250 000 map sheets. The homestead is about 16 km north-west by road from the North West Coastal Highway and about 264 km north of Carnarvon. The station has common boundaries with Giralia, Yanrey, Nyang, Winning, Cardabia and Bullara stations.

Area within survey

Entire station 132 800 ha.

Description

Marilla station consists of an eastern and a western block which are almost separate entities as they abut only at a single point.

The eastern block consists almost entirely of sand dunes, broad swales and sandy plains of the Giralia and Uaroo land systems. If correctly managed by burning and grazing deferment, these spinifex based systems are of moderate pastoral value. In the south of the eastern block there is a small area of the Winning land system which consists of low hills and broad lower plains and interfluves supporting soft spinifex (SOSP) and bluebush (CHMA) pastures. Pastoral value is high.

The western block also contains a considerable area of Giralia and Uaroo systems and some of the Winning system. In addition, in the west and north-west of this block there are four distinctive land systems based on limestone and siltstones associated with the Marilla anticline. The largest of these is the Firecracker system (5.6 per cent of total station area) which consists of undulating stony plains. The Jubilee system (4.5 per cent) consists of limestone hills, cuestas and undulating stony plains. The Donovan system (4.3 per cent) is found below Jubilee and Firecracker and consists of minor stony plains and extensive gently sloping alluvial outwash plains. Pastures of the systems consist of soft spinifex (SOSP), Gascoyne bluebush (CHMA) and hard spinifex (HSHI) in varying proportions.

Pastoral value is moderate or high. The Yarcowie system (1.2 per cent) consists of flat or very gently sloping gilgai plains supporting Roebourne plains grass (TGER) pastures and sparse shrubs. Pastoral value is relatively high.

Characteristics of all seven land systems on the station are briefly summarised in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) were derived from observations made whilst traversing on the station and are presented in Table 2.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range conditions were made at 19 sites on 6 land systems.

Range conditions and recommendations

1. **Giralia and Uaroo land systems** (collectively 80.7 per cent of total station area)

   Both these spinifex based sandy plains systems are in good range condition. Both systems support hard and soft spinifex with the former type generally predominating.

   Hard spinifex pastures are of little use for grazing, but soft spinifex is of moderate value and has good drought durability. Old, mature spinifex stands are almost useless for grazing and management must be aimed at maintaining the pastures in a young and as attractive condition to stock as possible. Spinifex pastures must be burnt on a regular basis about every 4 or 5 years and burning should be late in the year. Burnt areas should be deferred from grazing for 8 to 10 weeks over the growing season following the fire in order to allow desirable grasses, forbs, low shrubs and spinifex seedlings to become well established. Such a burning management

Table 1 — LAND SYSTEMS ON MARRILLA STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)			0
Low (20 to 30ha/s.u.)			0
Moderate (10 to 20ha/s.u.)	**Giralia**— linear dunes and broad sandy plains supporting hard and soft spinifex	56.5	
	Uaroo — broad sandy plains with hard and soft spinifex grasslands	24.2	
	Jubilee — limestone hills and undulating stony plains with hard and soft spinifex hummock grasslands	4.5	
			85.2
High (5 to 10ha/s.u.)	**Firecracker** — undulating stony uplands and plains with low shrublands of Gascoyne bluebush	5.6	
	Donovan — gently sloping outwash plains and minor stony plains with alkaline loamy and clayey soils, tall snakewood and other Acacia spp. shrublands with chenopod and soft spinifex pastures	4.3	
	Winning — low hills and broad lower plains with snakewood shrublands, chenopod and soft spinifex pastures	3.7	
	Yarcowie— gilgai plains with tussock grasses and very sparse shrubs	1.2	
			14.8
Very high (<5ha/s.u.)			0
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS

(212 recordings on 7 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Donovan	24	96	4	—	—	4	46	42	8	—	50	46	4
Firecracker	27	81	19	—	—	—	22	63	11	4	22	71	7
Giralia	85	100	—	—	—	87	11	2	—	—	98	2	—
Jubilee	8	100	—	—	—	38	49	13	—	—	87	13	—
Uaroo	39	100	—	—	—	61	26	8	5	—	87	13	—
Winning	23	96	4	—	—	9	22	43	22	4	30	66	4
Yarcowie	6	100	—	—	—	—	17	50	33	—	17	83	—
Total over all land systems	212	97	3	—	—	48	22	22	7	1	71	27	2

programme is regularly carried out on a paddock by paddock basis by the present lessee.

2. **Firecracker land system** (5.6 per cent)

Most of this system has only been fully utilised by livestock since the early 1960s when a number of dams were constructed. Prior to this there were no permanent water supplies in the area and grazing was minimal.

Condition of the valuable Gascoyne bluebush pastures on the system is variable and is dependent mainly on distance from water. Fair condition with some pasture degradation is most common, but smaller areas are in both good and poor condition. An area of about 1 sq. km. near Boongerooda dam is very severely degraded with pastures in very poor condition and active gully and rill erosion. Condition of the system in the vicinity of other dams, especially Donovan's dam, is also poor with depleted pastures and erosion in the form of gutters and shallow gullies, often forming down sheep pads or tracks.

Partial pasture degradation accompanied by patchy erosion has occurred in a relatively short time. As yet the areas affected by erosion are not large, but much of the system has a very high inherent vulnerability to erosion due to its moderate slopes and the nature of its soils.

Ground cover provided by shrubs, annual grasses and forbs is vital to the stability of the system and control of intensity of use and season of use by livestock is essential. The inherent fragility of the system is only now becoming apparent and, in the opinion of the survey group, the ability of this country to support stock has been over-estimated in the past. Special management techniques are required to enable grazing without landscape deterioration on this system.

Dams have enabled grazing on the Firecracker system, but problems have arisen as a result. Heavy use and depletion of pastures coupled with long slopes leading down to the dams and sensitive calcareous soils have resulted in instability with a strong likelihood of serious erosion problems in the future. Dams should be closed to stock and water piped to several distribution points on adjacent higher more stable sites, preferably on the Jubilee system. In the case of Condalong dam water is already piped several kilometres to additional watering points, and this practice should be extended to other dams.

Because of erosion in the vicinity of Boongarooda dam high priority should be given to closing the dam to stock and providing alternative water points by pipeline. Wherever possible pipelines should be left on the surface and not buried as any form of disturbance to the soil invariably results in rill and gully erosion. In this respect the siting of access tracks is also important and tracks straight up slopes should be avoided if possible.

A programme of spelling the Firecracker system over every second or third growing season is necessary in order to maintain pasture vigour and productivity. Such a programme could be implemented by using the existing paddock system.

Although bluebush pastures (CHMA) in good condition have been rated as having a carrying capacity of 1 s.u/8 ha on a year long basis, this rate may in fact be too high for this sensitive system. Proper grazing management must involve leaving a reasonable plant residue as ground cover to protect the soil surface.

3. **Jubilee land system** (4.5 per cent)

Condition of the low limestone hills, cuestas and stony undulating plains of this system is nearly all good. The hard and soft spinifex pastures of the system are inherently resistant to grazing and the stony nature of the landscape means that there is no accelerated erosion. Proper management of the system involves periodic burning of old spinifex stands.

4. **Donovan land system** (4.3 per cent)

Overall condition of this system is mostly fair or good, and there is no erosion. Virtually no pasture degradation is evident on areas supporting soft spinifex, but varying degrees of depletion of bluebush pastures found beneath snakewood shrub communities is evident.

A regular system of spelling over every third or fourth growing season is required in order to maintain pasture vigour and productivity. Such a system could be readily implemented, using the existing paddock arrangement although Condalong paddock is rather large and could conveniently be subdivided by about 5.5 km of fencing.

5. **Winning land system** (3.7 per cent)

This system supports soft spinifex pastures which are in good condition and bluebush pastures which all show some loss of shrubs and are in fair condition. There is no erosion. Occasional spelling over a growing season is required to encourage pasture recovery. Stocking rates on the system (on a year long basis) should not exceed about 1 s.u./13 ha.

6. **Yarcowie land system** (1.2 per cent)

This almost flat gilgai plains system is in fair range condition. Roebourne plains grass (TGER) pastures have been subjected to heavy use since Yarcowie dam was constructed. This grass is relatively resistant to grazing, but there is evidence of partial degradation and a suggestion that useful shrub components of the pasture have been eliminated. In its present fair condition the whole system can carry about 1 s.u./10 ha or a total of 170 s.u. on a year-long basis.

7. Although the station is well developed in terms of paddocks it is poorly equipped with permanent watering points. A great deal of effort has been expended in attempting to locate groundwater supplies, but many boreholes have been duds. The problem has been partly alleviated by the construction of dams and provision of water points supplied by pipeline from the dams. However, there are still considerable areas of the station that are only partly utilised or not utilised because of the lack of permanent waters.

The problem of insufficient waters has meant that existing supplies have, in some cases, been stocked at levels in excess of that which can be sustained in the long term by the surrounding pastures. This is considered to be the case on the dams in the west of the station where partial degradation of bluebush pastures has occurred in a relatively short time since development and is a matter of concern.

The northern and central parts of the eastern block of the station are quite inadequately watered with only two permanent waters to supply a very large area of the Giralia land system. Attempts should be made to develop additional waters either by drilling or by constructing small dams if suitable locations can be found.

Additional waters are also required in southern parts of the western block. Additional waters would not mean that extra stock could be run, but rather that existing stock could be better distributed over the station and that grazing pressure on sensitive parts of the station could be reduced.

8. It is considered that the station has been stocked for some years at levels somewhat above its long term sustainable capacity. The great majority of the station consists of spinifex country in good condition which is expected to remain stable under future grazing.

However, condition of the bluebush and grass pastures in the west of the station is likely to decline further if the present grazing pressure is maintained and the prospect of accelerated erosion on the Firecracker system is very real.

9. The recommended safe sheep unit capacity for present condition and assuming full development and use of all of the property (which is not the case at present, see 7) is 9 550 adults or 11 940 total sheep.

10. The capability sheep unit capacity if all the station was in good range condition is 10 490 adults or 13 110 total sheep.

INDIVIDUAL STATION REPORT

MARRILLA STATION **132 800 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Giralia	750	HSSP	375	—	—	—	1 125	1 125
		SOSP	375	—	—	—	4 688	4 688
Uaroo	321	HSSP	204	30	—	—	672	702
		SOSP	76	11	—	—	1 041	1 088
Firecracker	74	CHMA	17	50	6	1	583	925
Jubilee	60	HSHI	33	—	—	—	83	83
		SOSP	19	5	—	—	279	300
		MUCR	2	1	—	—	31	38
Donovan	57	CHMA	4	22	4	—	216	375
		SOSP	17	10	—	—	296	338
Winning	49	CHMA	—	28	2	—	204	375
		SOSP	10	2	—	—	142	150
		HSHI	7	—	—	—	18	18
Yarcowie	17.5	TGER	3	14	—	0.5	168	284
TOTALS	1 328.5		1 142	173	12	1.5	9546	10 489

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

Recommended sheep unit capacity ..... 9 550 adults — 11 940 total
Capability sheep unit capacity ..... 10 490 adults — 13 110 total
Declared stock numbers (1979) ..... 12 000 sheep

MINDEROO STATION — West Pilbara Shire

Location

Minderoo station is located on the northern part of the Yanrey 1:250 000 map sheet and extends onto the southern part of the Onslow sheet. The homestead is located 45 km south by road from Onslow. The station has common boundaries with Peedamulla, Mt. Minnie, Nanutarra, Yanrey, Koordarrie and Urala stations.

Area within survey

Entire station 224 994 ha.

Description

The station flanks both sides of the Ashburton River which runs for about 80 km in a north-north-west direction through the centre of the property. Landforms consist of broad alluvial plains associated with the Ashburton River and sandy coastal plains and dunes. All of the station is accessible and can be used for grazing livestock.

About 44 per cent of the station area (the Minderoo and Nanyarra land systems) is classified as having very high pastoral value. A further 41 per cent is of high pastoral value with mixed tussock grass and soft spinifex pastures. About 14 per cent of the area is of moderate pastoral value and less than one per cent is of low or very low value.

A total of 12 land systems occur on the station. These are briefly described and their pastoral value for good range condition status indicated in Table 1.

Condition statements for land systems for the station as a whole (total over all land systems) are presented in Table 2. These statements were derived from traverse records.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 41 sites on 8 land systems.

Range condition and recommendations

1. **Minderoo land system** (36.1 per cent of total station area)

Condition of the Minderoo land system is extremely variable. Twenty-one per cent of the 104 recordings made on the system indicate bad range condition with degraded pastures and moderate and severe wind erosion. A total of about 15 sq. km in North Edgadee, South Edgadee, Wyloo and 10 Mile paddocks are very severely affected and require spelling for a number of years to promote regeneration. These paddocks also contain about 21 sq. km of severely degraded country of the Nanyarra system.

A programme of regeneration is essential but would not need to commence in all areas at once. In the future some additional fencing may be required to isolate specific problem areas but the programme could start immediately without requiring new fencing. One or two of the worst paddocks should be selected to be completely closed to stock for an indefinite period and strip cultivation treatments imposed. The cultivation workings should be seeded with buffel and birdwood grass. It is not possible to indicate the time period necessary for full recovery but reasonable recovery could be expected in 5 years at the end of which time controlled grazing could re-commence and treatments on other severely degraded paddocks commence.

Table 1 — LAND SYSTEMS ON MINDEROO STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Littoral** — extensive bare coastal mudflats flanked by mangroves and narrow sandy plains..	0.6	0.6
Low (20 to 30ha/s.u.)			0
Moderate (10 to 20ha/s.u.)	**Uaroo** — broad sandy plains with hard and soft spinifex grasslands.....	10.4	
	Giralia— linear dunes and broad sandy plains supporting hard and soft spinifex.....	2.3	
	Boolaloo — granite hills, domes, tor fields and sandy plains, spinifex grasslands and shrubby grasslands.....	1.2	
	Nanutarra — low mesas and hills with soft and hard spinifex.....	0.1	
			14.0
High (5 to 10ha/s.u.)	**Globe** — alluvial plains supporting snakewood shrublands and minor tussock grasslands...	13.7	
	Yankagee — plains with dunes and numerous claypans, soft spinifex and snakewood shrublands.....	15.5	
	Onslow — sand plain, dunes and clay plains with soft spinifex and tussock grass.....	5.4	
	Cheetara — alluvial clay plains with gilgais, mixed open tussock grasslands and tall shrublands.....	4.3	
	Dune — dune fields with soft spinifex and minor hard spinifex grasslands.....	2.2	
			41.1
Very high (<5ha/s.u.)	**Minderoo** — alluvial plains supporting tall shrublands and tussock grasslands and areas of sand supporting hummock grassland.....	36.1	
	Nanyarra — alluvial plains supporting tall shrublands and low woodlands with prominent tussock grasses.....	8.2	
			44.3
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(445 recordings on 9 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Boolaloo	1	100	—	—	—	100	—	—	—	—	100	—	—
Cheetara	15	80	7	13	—	—	13	60	20	7	13	74	13
Giralia	8	100	—	—	—	25	75	—	—	—	100	—	—
Globe	72	53	25	15	7	1	13	37	32	17	14	46	40
Minderoo	104	70	15	9	6	3	37	37	20	3	40	39	21
Nanyarra	134	62	16	6	16	2	30	36	19	13	32	40	28
Onslow	15	87	13	—	—	40	47	13	—	—	87	13	—
Uaroo	26	100	—	—	—	50	50	—	—	—	100	—	—
Yankagee	70	76	7	10	7	34	33	17	10	6	67	14	19
Total over all land systems	445	68	14	8	8	12	31	30	18	9	43	34	23

Elsewhere on the station large areas of the Minderoo land system support productive grass and soft spinifex pastures in good or fair condition and there is no erosion.

2. **Yankagee land system** (15.5 per cent)

The large sandy plains units of the Yankagee system supporting soft spinifex pastures are in good or excellent condition and there is no erosion. Other units of the system support grass and shrub pastures and range condition varies from good to bad. There are isolated patches of moderate and severe erosion especially in Wonongarra paddock.

3. **Globe land system** (13.7 per cent)

The system is mostly in either fair or bad range condition. Shrub and grass pastures are all degraded to some extent, some considerably so, and minor and moderate erosion is quite common. A system of grazing deferment over a number of consecutive growing seasons in selected paddocks would encourage pasture recovery. Barluthau paddock at the southern end of the station should be given top priority in such a programme. An area around Telegraph dam in 16 Mile paddock is severely degraded and requires remedial treatment.

4. **Nanyarra land system** (8.2 per cent)

The condition of this potentially very highly productive system is extremely variable. Approximately 32 per cent of the system is in good range condition with dense perennial grass pastures including the introduced buffel grass beneath an overstorey of bardie bush and coolibah. About 41 per cent and 27 per cent of the system is in fair and bad range condition respectively. About 21 sq. km is degraded to the extent that it is almost devoid of perennial vegetation. It should be removed from grazing and given special remedial treatments as outlined for the Minderoo land system (see I).

5. **Cheetara land system** (4.3 per cent)

Three-quarters of this clay plain system is in fair range condition with the remaining area about equally distributed between good and bad condition. The system is inherently resistant to erosion but, in extreme situations, where it has been completely bared of perennial grass cover, wind erosion can occur. The only area which is of concern on Minderoo is on Crow Plaiu in the previously mentioned Barluthan paddock (see Globe land system). Here an area of about 4 sq. km is severely degraded with no perennial grass cover. The area will only recover if it is spelled from grazing for some considerable time and consideration should be given to closing off Crow Plain bore.

6. In terms of paddocks and artificial watering points, Minderoo is very well developed. The presence of these improvements means that a systematic programme of grazing deferment over growing seasons can be readily implemented on a paddock basis.

7. The distribution of severely degraded areas indicates that, in the past, paddocks to the north of the homestead have received excessive use and suggests that stock distribution over the whole property may not have been equitable. Every effort should be made to distribute stock throughout the property and to make maximum use of the relatively stable soft spinifex pasture in the west and east so that grazing pressure can be reduced on some of the more degraded and susceptible areas aloug the Ashburton River frontage.

8. The recommended sheep unit capacity for present condition is 23 750 adults or 29 690 total sheep.

9. The capability sheep unit capacity, if all country was in good range condition, is 42 610 adults or 53 260 total sheep.

INDIVIDUAL STATION REPORT

MINDEROO STATION — **224 997 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Minderoo	812	TGCH	112	192	143	—	6 856	14 751
		SOSP	165	30	8	—	2 338	2 538
		STCH	20	38	49	15	454	1 013
		No veg	40	—	—	—	—	—
Yankagee	349	SOSP	126	7	—	—	1 633	1 663
		TGCH	16	33	28	—	1 082	2 541
		CHAT	12	13	24	—	318	613
		No veg	90	—	—	—	—	—
Globe	308	CHAT	8	83	75	4	977	2 125
		TGER	—	64	56	—	723	2 004
		SOSP	14	4	—	—	208	225
Uaroo	233	HSSP	170	—	—	—	510	510
		SOSP	63	—	—	—	788	788
Nanyarra	185	TGCE	34	58	39	21	2 989	7 600
		TGCH	17	16	—	—	785	1 089
Onslow	121	SOSP	59	—	—	—	738	738
		TGMI	—	42	—	—	353	701
		TGCE	17	—	—	—	850	850
		No veg	3	—	—	—	—	—
Cheetara	97	TGER	17	68	8	4	910	1 620
Giralia	51	SOSP	26	—	—	—	325	325
		HSSP	25	—	—	—	75	75
Dune	50	SOSP	44	—	—	—	550	550
		TGER	6	—	—	—	100	100
Boolaloo	28	HSHI	16	—	—	—	27	27
		SOSP	11	—	—	—	138	138
		STCH	—	1	—	—	5	8
Littoral	14	SOSP	1	—	—	—	13	13
		SAMP	1	—	—	—	4	4
		STCH	—	—	—	—	—	—
		No veg	12	—	—	—	—	—
Newman	2	HSHI	2	—	—	—	3	3
TOTALS	2 250		1 127	649	430	44	23 752	42 612

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

Recommended sheep unit capacity ..... 23 750 adults — 29 690 total
Capability sheep unit capacity ..... 42 610 adults — 53 260 total
Declared stock numbers (1979) ..... 26 149 sheep, 422 cattle

MININER STATION — West Pilbara Shire

Location

Mininer station is located wholly on the Turee Creek 1:250 000 map sheet. The homestead is located a few kilometres north of the Ashburton River and is approximately 60 km and 216 km south by road from Paraburdoo and Tom Price, respectively. The station has common boundaries with Turee Creek, Ashburton Downs, Mt. Vernon, and Rocklea stations and vacant crown land.

Area within survey

Entire station 221 993 ha.

Description

About 8 per cent of the station consists of rugged, poorly accessible hill and mountain country of the Capricorn and Newman land systems. Pastoral value is negligible.

The Kooline land system, which consists of low rough shale hills and saline drainage floors with broad braided creeks, occupies about 40.5 per cent of the station. Pastoral value is low. An additional 17.7 per cent of country is also of low pastoral value. This country consists mainly of cobble plains, dissected slopes and hardpan plains with sparse mulga shrublands.

About 11.5 per cent of the station is of moderate pastoral value and consists of low calcrete plateaux and mesas of the Table land system and stony plains of the Dollar and Paraburdoo systems.

In its southern part the station has about 24 km of frontage to the Ashburton River. The river is flanked by active floodplains of the Ashburton land system (7.4 per cent) which, when in good condition, is of very high pastoral value. Other alluvial plain systems of potentially high pastoral value occupy about 13 per cent of the station area.

A total of fifteen land systems are found on the station and all are briefly characterised in Table 1.

Condition statements for land systems and for the whole station (total over all land systems) were derived from observations made whilst traversing on the station and are presented in Table 2.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 22 sites on 6 land systems.

Range conditions and recommendations

1. **Kooline land system** (40.5 per cent of total station area)

   About 80 per cent of the Kooline system consists of shale hills and footslopes supporting very poorly productive stony short grass forb pastures (SSGF) which are in good or fair condition and show no erosion. The remaining units of the system are saline plains and flow zones with braided streams. These support useful saltbush (CHAT) and mulga creekline (MUCR) pastures. Range condition varies from good to bad. The broad flow zones are susceptible to erosion once the vegetative cover is depleted and patchy minor erosion is present.

   Control of intensity of grazing and season of grazing is required on the sensitive units of the Kooline system. In the absence of paddocks a degree

Table 1 — LAND SYSTEMS ON MININER STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Capricorn** — rugged hills and ridges with low shrublands or hard spinifex	5.6	
	Newman — rugged jaspilite plateaux, ridges and mountains with hard spinifex	2.2	
	Boolgeeda — stony plains with hard spinifex and mulga shrublands	1.0	
	Rocklea — basalt hills and restricted stony plains with hard spinifex	0.2	
			9.0
Low (20 to 30ha/s.u.)	**Kooline** — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	40.5	
	Ethel — cobble plains with sparse mulga shrublands	10.1	
	Egerton — highly dissected plains and slopes with sparse mulga shrublands	7.0	
	Jamindie — stony hardpan plains and stony rises with groved mulga shrublands	0.5	
	Platform — narrow raised plains and extensive dissected slopes with hard spinifex and shrubs	0.1	
			58.2
Moderate (10 to 20ha/s.u.)	**Table** — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	6.4	
	Dollar — stony plains with open snakewood shrublands	2.9	
	Paraburdoo — stony gilgai plains derived from basalt with snakewood shrublands	2.2	
			11.5
High (5 to 10ha/s.u.)	**Edward** — alluvial plains with sparse saltbush, bluebush and other shrub pastures	10.9	10.9
Very high (<5ha/s.u.)	**Ashburton River** — active floodplains and backplains with deep silty loam and clayey soils, shrublands and tussock grasslands	7.4	
	River — narrow active flood plains flanking major rivers and creeks with moderate tall shrublands	3.0	
			10.4
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS

(232 recordings on 11 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Ashburton	37	40	14	32	14	—	3	41	53	3	3	41	56
Capricorn	3	67	33	—	—	33	33	34	—	—	67	33	—
Dollar	15	66	27	7	—	7	27	66	—	—	33	60	7
Edward	45	22	29	29	20	—	13	29	42	16	13	20	67
Egerton	7	86	14	—	—	—	71	29	—	—	71	29	—
Ethel	22	95	—	5	—	5	58	32	5	—	63	32	5
Kooline	64	77	17	6	—	—	59	25	14	2	58	31	11
Paraburdoo	2	—	100	—	—	—	50	50	—	—	50	50	—
Platform	3	100	—	—	—	—	33	—	67	—	33	67	—
River	8	62	25	13	—	—	50	25	25	—	50	25	25
Table	7	71	29	—	—	—	57	29	—	14	57	29	14
Total over all land systems	213	59	19	15	7	1	37	32	25	5	37	33	30

of control can be achieved by manipulating stock numbers on artificial waters or by periodically closing down waters.

The saline plain and flow zone units of the Kooline system are often adjacent to the Edward system and in the future could be incorporated into a paddocking programme required for the latter system (see 2).

2. **Edward land system** (10.9 per cent)

This alluvial plain system is capable of supporting useful saltbush (CHAT) and bluebush (CHMA) pastures, but it is inherently sensitive to overuse and its duplex soils are highly susceptible to erosion once the vegetative cover is depleted.

Two-thirds of the 45 traverse recordings made on the system indicate bad range condition with badly degraded pastures and erosion. Almost half the recordings indicate moderate or severe erosion in the form of scalding, hummocking and surface sheeting.

About 27 sq. km is so severely degraded that special remedial treatments will be required in order to effect recovery. The three areas of concern are near Beefwoodgate bore, just north of the homestead and a few kilometres north of Mt. Elephant. These areas should be completely closed to grazing and a fencing programme to do this is required.

Protection from grazing alone will not effect recovery within a reasonable time period as, in most cases, there are no longer any natural seed sources of desirable shrubs. The areas are suitable for and have potential to be rehabilitated by cultivation and seeding with a range of grasses and chenopod shrubs. It is not possible to stipulate the length of time required for full recovery. However, partial recovery could be anticipated in five years if a regeneration programme of cultivation and seeding, coupled with complete protection from grazing, was implemented. The high costs of such a programme are partially offset by the fact that the Edward system has the potential to support valuable drought tolerant perennial vegetation.

Open range grazing is not an acceptable management practice on the sensitive Edward land system. Complete control of grazing intensity and season of use is essential in order to maintain pasture productivity and stability. It is clearly evident from the survey on this and other stations that inadequate stock control inevitability leads to severe pasture degradation and erosion.

A long-term fencing development programme to bring all of the Edward system (and also adjacent sensitive units of the Kooline system) under control is required.

3. **Ethel land system** (10.1 per cent)

The bulk of this system supports stony short grass forb pastures (SSGF) which are not very productive, but are in fair or good condition. Smaller inclusions of better quality pastures such as mulga creekline (MUCR) and saltbush (CHAT) vary in condition from good to bad. The cobble plains of the system are inherently resistant to erosive forces and no erosion was observed.

4. **Ashburton land system** (7.4 per cent)

This productive alluvial plains land system is nearly all in fair or bad range condition. Shrub pastures are considerably degraded, but the system still provides large quantities of high quality annual pasture after flooding. Twenty-two of the 37 recordings made on the system (i.e. 60 per cent) show some degree of erosion.

At least 6 sq. km of the system is very severely degraded and should not be grazed. Most of the severe degradation is to the south of Coombooarie well and the area requires fencing so that stock can be excluded until reasonable recovery occurs.

Buffel grass has proven ability to colonise on the more sandy and loamy parts of this system and its spread and establishment should be actively encouraged.

5. The condition if the remaining land systems which collectively occupy about 31 per cent of the area of the station, is also indicated in Table 2. Generally they are in good or fair range condition and show only minor pasture degradation and little erosion.

6. Mininer station has only recently been enlarged in size by the acquisition of additional country to the north and east of the original block.

Although pastures on the newly acquired area are mostly only of low or moderate pastoral value, they are generally in fair or good condition and must be

brought into use to relieve grazing pressure on the Ashburton River frontage and its tributary plains. A programme to develop waters and paddocks (on the most sensitive systems within the new area) is required.

7. The recommended cattle unit capacity for present condition and assuming full development is 1 100 adults or 1 380 total cattle.

8. The capability cattle unit capacity if all country was in good range condition is 1 750 adults or 2 190 total cattle.

INDIVIDUAL STATION REPORT

MININER STATION — **221 993 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Kooline	953	SSGF	414	368	—	—	1 978	2 346
		MUCR	38	29	28	—	727	1 188
		CHAT	50	18	8	—	794	950
Edward	230	CHAT	12	41	118	27	785	2 475
		STCH	9	10	9	—	143	232
		SSGF	4	—	—	—	12	12
Ethel	213	SSGF	111	51	8	—	447	510
		CHAT	13	11	8	—	174	400
		MUCR	4	5	2	—	84	138
Ashburton	157	CHAT	2	31	43	3	390	988
		CHMA	2	31	42	3	350	975
Egerton	148	MSGF	79	32	—	—	412	444
		SSGF	17	7	—	—	45	48
		MUCR	9	4	—	—	135	163
Table	135	MSGF	39	20	9	—	234	272
		CSGF	31	16	7	—	217	270
		MUCR	7	4	2	—	116	163
Capricorn	127	HSHI	89	—	—	—	151	151
		SSGF	21	11	—	—	85	96
		MUCR	3	2	1	—	52	75
River	64	MUCR	21	11	10	—	356	525
		STCH	7	3	3	—	79	108
		No veg	9	—	—	—	—	—
Dollar	62	STCH	11	34	5	—	271	415
		MUCR	3	3	3	—	64	113
		TGER	1	1	1	—	18	50
Newman	47	HSHI	47	—	—	—	80	80
Paraburdoo	46	STCH	18	17	—	—	234	291
		CHAT	4	4	—	—	72	100
		SSGF	3	—	—	—	9	9
Boolgeeda	21	HSHI	20	—	—	—	50	50
		SOSP	1	—	—	—	13	13
Jamindie	11	MSGF	8	—	—	—	32	32
		MUCR	2	—	—	—	25	25
		TGER	1	—	—	—	17	17
Rocklea	4	HSHI	4	—	—	—	7	7
Platform	2	HSHI	2	—	—	—	3	3
TOTALS	2 220		1 116	764	307	33	8 226	13 101

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	1 650	2 060	1 100	1 380
Capability cattle unit capacity	2 620	3 280	1 750	2 190

Declared stock numbers (1979) ..... 500 total cattle

MT. BROCKMAN STATION — West Pilbara Shire

Location

Mt. Brockman station is located on the Mt. Bruce 1:250 000 map sheet near the headwaters of Duck Creek. The nearest town is Tom Price which is about 90 km to the south-east. The station has a common boundary with Hamersley station in the east and elsewhere is surrounded by rugged, mountainous vacant crown land.

Area within snrvey

Entire station 60 958 ha.

Description

The station consists predominantly of rough hills, mountains and plateaux. Hill systems Rocklea based on basalt and Newman based on jaspilite collectively occupy 66.4 per cent of the station area. Low stony plains of the Boolgeeda system (20.4 per cent) lie beneath the hill systems. Pastures of all three systems are mostly hard spinifex (HSHI) and pastoral value is very low.

About 8.4 per cent of the area consists of low limonite plateaux, mesas and buttes of the Robe land system. Pastures consist of a mixture of hard (HSHI) and soft spinifex (SOSP) and pastoral value is moderate.

The only country of high pastoral value on the station occurs as Alluvial clay plains of the Brockman system along Duck Creek in the north and north-east. Pastures are mainly tussock grasses (TGCH).

Descriptions of all land systems on the station are presented in Table 1.

Condition statements for each land system and for the station as a whole (total over all land systems) are summarised in Table 2. These statements were derived from observations made whilst traversing on the station.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 10 sites on 4 land systems.

Range condition and recommendations

1. **Rocklea land system** (52 per cent of station area)

   This system of rugged hills and mountains supports poorly productive hard spinifex (HSHI) pastures which are unattractive to livestock. Pasture condition is good or excellent. Small inclusions of better quality stony chenopod (STCH) and mulga creekline (MUCR) pastures occur in some areas, and these are in good condition.

2. **Boolgeeda land system** (20.4 per cent)

   This stony plains system supports unproductive hard spinifex (HSHI) pastures with some small areas of soft spinifex (SOSP) along creeklines. The system is generally unattractive to stock. Range condition is good.

3. **Newman (14.4 per cent) and Robe (8.4 per cent) land systems**

   Most of the extremely rugged Newman system is unsuitable for pastoral purposes. Spinifex vegetation is in original condition and there is no erosion. Soft spinifex pastures of the Robe system provide some useful grazing and are in good range condition.

4. **Brockman land system** (4.2 per cent)

   This readily accessible cracking clay plain system is preferentially grazed by stock and nearly all stock on the station have concentrated on it in the past. Levels of use have been excessive.

   The system is capable of supporting dense, highly productive perennial grass (TGCH) pastures, but is now mostly degraded to bad range condition. Perennial grasses are very sparse and patchy and there is much bare ground. Although there is occasional minor erosion the system is generally resistant to erosion due to its flat topography and heavy clay soils.

   The system supplies a flush of annual feed in season, but no longer has drought durability. Complete control of stock is essential, and the system needs complete spelling over two or three

Table 1 — LAND SYSTEMS ON MT. BROCKMAN STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Rocklea** — basalt hills and restricted stony plains with hard spinifex	52.0	
	Boolgeeda — stony plains with hard spinifex grasslands or mulga shrublands	20.4	
	Newman — rugged jaspilite plateaux, ridges and mountains with hard spinifex	14.4	
	Table — low calcrete plateaux, mesas and lower plains with hard spinifex	0.6	
			87.4
Low (20 to 30ha/s.u.)			0
Moderate (10 to 20ha/s.u.)	**Robe** — low plateaux, mesas and buttes of limonite with soft and hard spinifex	8.4	8.4
High (5 to 10ha/s.u.)			0
Very high (<5ha/s.u.)	**Brockman** — alluvial plains with cracking clay soils supporting open tussock grasslands and low woodlands	4.2	4.2
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(212 recordings on 7 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Boolgeeda	73	99	—	1	—	10	79	7	4	—	89	10	1
Brockman	11	64	36	—	—	—	—	19	36	45	—	45	55
Newman	8	100	—	—	—	25	75	—	—	—	100	—	—
Platform	4	100	—	—	—	25	75	—	—	—	100	—	—
Rocklea	39	100	—	—	—	58	36	3	3	—	95	5	—
Robe	7	100	—	—	—	—	100	—	—	—	100	—	—
Table	2	100	—	—	—	100	—	—	—	—	100	—	—
Total over all land systems	139	98	1	1	—	25	63	6	5	1	89	9	2

consecutive growing seasons and very light use for the remainder of the year. In its present condition the whole system (25 sq. km) should not carry more than 40 cattle over nine months of the year. Provided that stocking is controlled the pastures of the system have the potential to recover quite rapidly.

5. Except for the valley along Duck Creek in the north where there are some block fences and artificial watering points the station is undeveloped and does not warrant development. The only piece of useful grazing country (Brockman system) is seriously degraded.

6. Recommended catle unit capacity for present condition is 240 adults or 300 total cattle.

7. Capability cattle unit capacity if all country was in good range condition is 310 adults or 390 total cattle.

8. The station is not a viable pastoral unit and any future transfer as a single entity should not be permitted. The area should revert to crown land.

INDIVIDUAL STATION REPORT

MT. BROCKMAN STATION — 60 958 ha

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Rocklea	317	HSHI	285	—	—	—	485	485
		STCH	15	1	—	—	130	133
		MUCR	16	—	—	—	200	200
Boolgeeda	125	HSHI	111	8	—	—	291	298
		SOSP	5	1	—	—	71	75
Newman	88	HSHI	88	—	—	—	150	150
Robe	51	SOSP	46	—	—	—	288	288
		HSHI	5	—	—	—	13	13
Brockman	25	TGCH	—	7	13	—	141	660
		STCH	1	3	1	—	25	42
Table	4	HSHI	4	—	—	—	7	7
		MUCR	—	—	—	—	—	—
TOTALS	610		576	20	14	—	1 801	2 351

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	360	450	240	300
Capability cattle unit capacity	470	590	310	390

Declared stock numbers (1979) ..... 57 cattle

MT. MINNIE STATION — West Pilbara

Location

Most of Mt. Minnie station is located on the Onslow and Yanrey 1:250 000 map sheets with very small areas extending on to the Wyloo and Yarraloola sheets. The homestead is situated some 68 km south-east by road from Onslow and about 23 km north-west from the North West Coastal Highway. The station has common boundaries with Peedamulla, Cane River, Nanutarra and Minderoo stations.

Area within survey

Entire station 111 530 ha.

Description

All of the station is usable grazing country consisting of broad sandy plains with some sand dunes and minor areas of stony plains.

The Uaroo and Giralia land systems which support a mixture of hard and soft spinifex pastures (HSSP and SOSP) collectively occupy 93.4 per cent of the station area. If the spinifex vegetation is properly managed the pastoral value of the systems is moderate. Small areas of the Stuart land system, which is also of moderate pastoral value, occur in the east of the station. This system supports snakewood shrub communities with sparse stony chenopod (STCH), hard spinifex (HSSP) and soft spinifex (SOSP) pastures.

The only other land systems of importance on the station are Minderoo (2 per cent) and Yankagee (0.9 per cent) which occur at the western edge of the station. These systems are of high or very high pastoral value and support mixed soft spinifex and tussock grass pastures.

The seven land systems found on the station are further described in Table 1.

Condition statements for land systems and for the station as a whole have been prepared from data collected whilst traversing on the station and are presented in Table 2.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and condition were made at 6 sites on 3 land systems.

Range condition and recommendations

1. Condition of nearly all pastures and land systems on Mt. Minnie station is good and there is no erosion. The only exception to this is some minor degradation of stony chenopod (STCH) pastures on the Stuart land system.

2. Pastures on the station are predominantly hard and soft spinifex. Hard spinifex is of very little use for grazing, but soft spinifex is of moderate value and has good drought durability. Old, mature spinifex stands are useless for grazing, and management must be aimed at maintaining the pastures in as attractive condition to stock as possible. Spinifex pastures must be burnt on a regular basis about every 4 or 5 years and burning should be late in the year. Burnt areas should be deferred from grazing for 8 to 10 weeks over the growing season following the fire in order to encourage establishment of grasses, desirable shrubs and spinifex seedlings.

   The land systems supporting spinifex are generally resistant to degradation, although some wind erosion can occur if a prolonged dry spell occurs after burning. Re-establishment of vegetative cover and stabilisation occurs rapidly after rain.

3. Only the eastern half of Mt. Minnie is being utilised for grazing due to the lack of stock waters in the west. The unused sections in the north-east include some of the best soft spinifex country (Giralia land system) on the station. If fully developed with additional watering points the unused area could carry about 3 500 adult sheep.

Table 1 — LAND SYSTEMS ON MT. MINNIE STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Capricorn** — rugged hills and ridges with low shrublands or hard spinifex	0.1	0.1
Low (20 to 30ha/s.u.)			0
Moderate (10 to 20ha/s.u.)	**Uaroo** — broad sandy plains with hard and soft spinifex	80.8	
	Giralia— linear dunes and broad sandy plains supporting hard and soft spinifex	12.6	
	Stuart — plains of low or moderate relief with snakewood shrublands and hard and soft spinifex hummock grasslands	3.6	97.0
High (5 to 10ha/s.u.)	**Yankagee** — plains with dunes and numerous claypans, soft spinifex and snakewood shrublands	0.9	
	Onslow — sand plain, dunes and clay plains with soft spinifex and tussock grass	.01	0.9
Very high (<5ha/s.u.)	**Minderoo** — alluvial plains supporting tall shrublands and tussock grasslands and areas of sand supporting hummock grassland	2.0	2.0
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(119 recordings on 3 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Giralia	15	100	—	—	—	40	60	—	—	—	100	—	—
Stuart	8	100	—	—	—	—	38	37	25	—	38	62	—
Uaroo	96	99	1	—	—	46	48	5	1	—	94	6	—
Total over all land systems	119	99	1	—	—	42	48	7	3	—	91	9	0

4. The recommended sheep unit capacity for present condition and assuming full development of the station is 6 870 adults or 8 590 total sheep.

5. Because of the generally good condition of the country on Mt. Minnie the capability sheep unit capacity if all country was in good condition is only marginally higher than the recommended capacity (see 4) for present condition.

   The capability sheep unit capacity is 7 010 adults or 8 760 total sheep.

INDIVIDUAL STATION REPORT

MT MINNIE STATION **111 530 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Uaroo	901	HSSP	619	39	—	—	1 935	1 974
		SOSP	228	15	—	—	2 975	3 038
Giralia	140	HSSP	70	—	—	—	210	210
		SOSP	70	—	—	—	875	875
Stuart	40	STCH	5	11	—	—	97	133
		HSHI	16	—	—	—	40	40
		SOSP	8	—	—	—	100	100
Minderoo	22	TGCH	12	—	—	—	396	396
		SOSP	6	—	—	—	75	75
		STCH	3	—	—	—	25	25
		No Veg	1	—	—	—	—	—
Yankagee	10	SOSP	4	—	—	—	50	50
		TGCH	2	—	—	—	66	66
		CHAT	1	—	—	—	13	13
		No Veg	3	—	—	—	—	0
Capricorn	1	HSHI	1	—	—	—	2	2
		SSGF	—	—	—	—	—	—
		MUCR	—	—	—	—	—	—
Onslow	1	SOSP	1	—	—	—	13	13
		TGMI	—	—	—	—	—	—
		TGCE	—	—	—	—	—	—
		No Veg	—	—	—	—	—	—
TOTALS	1 115		1 050	65	—	—	6 872	7 010

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

Recommended sheep unit capacity ..... 6 870 adults — 8 590 total
Capability sheep unit capacity ..... 7 010 adults — 8 760 total
Declared stock numbers (1979) ..... n.a.

MT. STUART STATION — West Pilbara Shire

Location

Mt. Stuart station is located on the Wyloo 1:250 000 map sheet. The homestead is situated a few kilometres north of the Nanutarra-Tom Price road about 63 km east of the Nanutarra bridge crossing on the Ashburton River.

The station has common boundaries with Nanutarra, Cane River, Red Hill, Duck Creek, Wyloo and Glenflorrie stations and vacant crown land.

Area within survey

Entire station 207 100 ha.

Description

A total of 16 land systems occur on the station with many diverse landforms and different pasture types. The Ashburton River runs through the south western corner of the station and is joined by Duck Creek which flows from the east through the centre of the property. These major water courses are flanked by broad floodplains of the Ashburton land system and narrower plains of the River system. These two systems which collectively occupy 14.4 per cent of the station area are the most productive on the station and are of very high pastoral value.

About 41.5 per cent of the station is of moderate pastoral value and consists of plains of low to moderate relief of the Stuart land system, granite hills and sandplain of the Boolaloo system, stony plains of the Dollar system and a number of other minor systems. The Stuart system which is the largest (19.3 per cent) on the station occurs in the north-west associated with hills of the Boolaloo and Capricorn systems.

Rugged hill systems and unproductive stony plains occupy 42.4 per cent of the station area and are of very low pastoral value. Systems in this category are Rocklea with rough basalt hills, Capricorn with hills and ridges of dolomite, shale and some metamorphosed rocks and Newman with massive jaspilite plateaux, ridges and mountains. The hill systems are confined mostly to southern and eastern parts of the station, although hills of the Capricorn system are widely scattered throughout the station.

Further brief descriptions of all the land systems found on the station are presented in Table 1.

Condition statements for land systems and for the station as a whole have been prepared from data collected whilst traversing on the station and are presented in Table 2.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and condition were made at 29 sites on 8 land systems.

Table 1 — LAND SYSTEMS ON MT. STUART STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Rocklea** — basalt hills and restricted stony plains with hard spinifex	17.6	
	Capricorn — rugged hills and ridges with low shrublands or hard spinifex	17.2	
	Boolgeeda — stony plains with hard spinifex grassland or mulga shrublands	5.5	
	Newman — rugged jaspilite plateaux, ridges and mountains with hard spinifex	1.4	
	Augustus — rugged mountain ranges, hills, ridges, and plateaux with skeletal soils and tall shrublands or hard spinifex grasslands	0.7	
			42.4
Low (20 to 30ha/s.u.)	**Kooline** — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	1.5	
	Ethel — cobble plains with sparse mulga and other Acacia spp. shrublands	.01	
			1.5
Moderate (10 to 20ha/s.u.)	**Stuart** — plains of low or moderate relief with snakewood shrublands and hard and soft spinifex hummock grasslands	19.3	
	Boolaloo — granite hills, domes, tor fields and sandy plains, spinifex grasslands and shrubby grasslands	10.0	
	Dollar — stony plains with open snakewood shrublands	6.0	
	Uaroo — broad sandy plains with hard and soft spinifex grasslands	2.7	
	Robe — low plateaux, mesas and buttes of limonite with soft and hard spinifex pastures	1.9	
	Paraburdoo — stony gilgai plains derived from basalt with snakewood shrublands	1.6	
			41.5
High (5 to 10ha/s.u.)	**Edward** — alluvial plains with sparse degraded saltbush, bluebush and other shrub pastures	0.2	0.2
Very high (<5ha/s.u.)	**Ashburton** — active floodplains and backplains with deep silty loam and clayey soils, shrublands and tussock grasslands	12.1	
	River — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	2.3	
			14.4
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(340 recordings on 12 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Ashburton	61	39	40	13	8	2	18	30	34	16	18	34	48
Boolgeeda	18	94	6	—	—	44	17	33	6	—	61	33	6
Boolaloo	21	81	14	5	—	47	29	19	5	—	76	19	5
Capricorn	32	100	—	—	—	38	59	3	—	—	97	3	—
Dollar	29	70	24	3	3	3	35	35	24	4	38	38	24
Kooline	12	92	8	—	—	—	—	50	50	—	—	92	8
Paraburdoo	11	27	46	18	9	—	—	18	55	27	—	36	64
River	13	92	—	—	8	15	62	8	15	—	77	15	8
Rocklea	58	84	9	5	2	31	38	12	17	2	69	21	10
Robe	6	100	—	—	—	50	50	—	—	—	100	—	—
Stuart	71	97	3	—	—	34	36	23	7	—	70	27	3
Uaroo	8	100	—	—	—	—	13	87	—	—	13	87	—
Total over all land systems	340	79	14	4	3	23	33	23	17	4	55	29	16

Range condition and recommendations

1. **Stuart land system** (19.3 per cent of station area)

This system is the largest on the station and consists of gently undulating stony upper plains supporting hard spinifex (HSHI) pastures, broad lower plains with snakewood and stony chenopod (STCH) pastures and drainage tracts with soft spinifex (SOSP) pastures. Some pasture degradation has occurred but this is not severe and condition is mostly fair. There is no erosion.

Management of the spinifex plains of the system must involve burning regularly about every four or five years. Old spinifex stands should be burnt late in the year and deferred from grazing for 8 to 10 weeks over the following growing season to encourage durable shrubs, grasses and spinifex seedlings to establish.

2. **Rocklea and Capricorn land systems** (collectively 34.8 per cent)

These two rugged hill systems are the second and third largest on the station. They support poor hard spinifex (HSHI) pastures of extremely low pastoral value with very small inclusion of better quality pastures such as mulga creekline (MUCR) and stony chenopod (STCH). Range condition is mostly good and there are no special management requirements.

3. **Ashburton land system** (12.1 per cent)

Range condition of this flood plain system varies from good to bad with patches of moderate and severe erosion. Eighteen per cent, 34 per cent and 48 per cent of the 61 traverse recordings made on the system indicated good, fair and bad range condition respectively.

Patches of country — about 14 sq. km in total — are very seriously degraded and should not be grazed. Duck Creek paddock contains areas of concern with patches of massive wind hummocking under snakewood shrubs. Although the paddock contains some areas of pasture in quite good condition the most practical way to facilitate recovery of the very bad areas is to close the whole paddock to grazing for a number of years and to actively promote the further spread of buffel grass

Some very serious degradation also occurs in Ballajong paddock and a regeneration programme involving fencing and destocking the problem areas or destocking the whole paddock for a number of years is also required. There are a number of other small areas of severe erosion in some other paddocks.

Although parts of the Ashburton system are still very productive it is, at present, estimated to be expressing only 35 per cent of its potential in terms of overall productivity or carrying capacity.

4. **Boolaloo land system** (10 per cent)

This system consists of granite hills and tor fields with adjacent sandy plains. The hills support hard spinifex which is of little use for grazing, but the sandy plains support useful soft spinifex (SOSP) pastures. Pasture condition is mostly good and there is no erosion. As described for the Stuart system (see 1) fire is a necessary management tool for the spinifex on this system.

5. The remaining eleven land systems on the station collectively occupy only 24 per cent of the area. Condition of most of these systems is good. Exceptions to this are the Dollar and Paraburdoo systems where considerable pasture degradation has occurred and, in the case of the drainage floor unit of the Paraburdoo system, rill and gully erosion is common.

6. Mt. Stuart is quite well-developed in terms of sheep paddocks (except in the east) and artificial waters. However, additional watering points are required in the north-west of the station to make maximum use of the Stuart land system.

7. Mt. Stuart has recently changed over from sheep to cattle and the old sheep fences will be inadequate for cattle control. It is likely that many of the old fences will not be upgraded to cattle standards and a return to a more open range grazing system can be expected on much of the station. Provided some degree of stock control can be exercised by manipulating numbers on waters this type of system may be acceptable on the hard stony land systems. However, on the softer highly productive systems,.

some of which have severe degradation problems, complete stock control is essential and adequate paddocking must be provided.

8. Recommended cattle unit capacity for present condition is 1 250 adults or 1 560 total cattle.

9. Capability cattle unit capacity if all country was in good range condition is 2 110 adults or 2 640 total cattle.

INDIVIDUAL STATION REPORT

MT STUART STATION — **207 100 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km) Good	Fair	Bad	E/D*	Sheep unit capacity Recommended	Capability
Stuart	400	STCH	21	139	—	—	869	1 328
		HSHI	160	—	—	—	400	400
		SOSP	29	37	14	—	716	1 000
Rocklea	365	HSHI	234	89	6	—	493	559
		STCH	2	7	9	—	70	149
		MUCR	13	—	5	—	179	225
Capricorn	357	HSHI	250	—	—	—	425	425
		SSGF	89	—	—	—	267	267
		MUCR	18	—	—	—	225	225
Ashburton	250	TGCE	9	21	41	14	1 005	4 250
		CHAT	25	25	33	—	603	1 038
		CHMA	25	25	32	—	570	1 025
Boolaloo	207	HSHI	114	—	—	—	194	194
		SOSP	83	—	—	—	1 038	1 038
		STCH	5	5	—	—	67	83
Dollar	124	STCH	22	50	27	—	487	822
		MUCR	6	—	13	0.5	118	238
		TGER	2	4	—	—	67	100
Boolgeeda	114	HSHI	57	43	8	—		270
		SOSP	6	—	—	—	75	75
Uaroo	56	HSSP	41	—	—	—	123	123
		SOSP	4	11	—	—	141	188
River	47	TGCE	8	3	3	—	470	700
		MUCR	10	4	3	—	157	213
		STCH	9	—	—	—	75	75
		No Veg	7	—	—	—	—	—
Robe	40	SOSP	36	—	—	—	225	225
		HSHI	4	—	—	—	10	10
Paraburdoo	32	STCH	—	8	16	—	72	199
		CHAT	—	1	3	2	16	75
		SSGF	2	—	—	—	6	6
Kooline	31	SSGF	25	—	—	—	75	75
		MUCR	3	—	—	—	38	38
		CHAT	—	3	—	—	17	38
Newman	29	HSHI	29	—	—	—	49	49
Augustus	14	MSGF	13	—	—	—	26	26
		MUCR	1	—	—	—	13	13
Edward	5	CHAT	—	2	2	—	22	50
		STCH	—	1	—	—	5	8
		SSGF	—	—	—	—	—	—
Ethel	.01	SSGF	—	—	—	—	—	—
		CHAT	—	—	—	—	—	—
		MUCR	—	—	—	—	—	—
TOTALS	2 071		1 358	476	221	16.5	9 408	15 822

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1 adult	total	At Conversion rate 7.5:1 adult	total
Recommended cattle unit capacity	1 880	2 350	1 250	1 560
Capability cattle unit capacity	3 160	3 950	2 110	2 640

Declared stock numbers (1979) ..... 694 cattle, 100 sheep

MT. VERNON STATION — Meekatharra and Upper Gascoyne Shires

Location

Mt. Vernon station is located on the Collier, Mt. Egerton and Turee Creek 1:250 000 map sheets. Access to the station is to the south via Mulgul station and thence to Meekatharra about 360 km distant. Paraburdoo is about 193 km north-west by road via Mininer station. The station has common boundaries with Bulloo Downs, Tangadee, Pingandy, Mininer and Turee Creek stations and vacant crown land.

Area within survey

Entire station 404 686 ha.

Description

The Ashburton River runs for about 150 km through the full length of the station initially in an east to west direction and then turning in a north-west direction. The Ethel River, a large tributary of the Ashburton, runs through the south-eastern part of the station.

The plain land systems of the Ashburton River valley are flanked on both sides by rough hills and mountains. Twenty-two per cent of the station area consists of rugged sandstone mountain ranges, hills and ridges of the Augustus land system (18.9 per cent) and rough dolomite hills of the Mulgul system (3.1 per cent). Pastoral value is extremely low and some of the most rugged country is in fact of no use for pastoral purposes.

About 37 per cent of the station is of low pastoral value. A number of distinctive landforms occur in this category including highly dissected plains and slopes of the Egerton system (8.6 per cent), cobble plains of the Ethel system (7.8 per cent), shale hills and saline drainage floors of the Kooline system (7.9 per cent), and dolerite hills of the Charley system (7.6 per cent). Pastures on these systems are mainly stony short grass forb (SSGF) and mulga short grass forb (MSGF).

About 24 per cent of the station consists of systems of moderate pastoral value which include gently undulating shale plains of the Ruby land system and distinctive calcrete and laterite low plateaux, mesas and gravelly plains of the Table and Laterite systems.

The Ashburton land system (11.2 per cent) is always found flanking the Ashburton River and its major tributaries. It consists of active flood plains with deep silty loams and clayey soils extending through the full length of the property as a belt averaging about 2 to 3 km wide although occasionally up to 5 km. The system supports productive saltbush and bluebush (CHAT, CHMA) pastures and pastoral value is high. Two other alluvial plain systems, Edward (5 per cent) and River (0.5 per cent) occur on the station and these are also of high pastoral value.

A total of 16 land systems occur on the station, and characteristics of these are summarised in Table 1.

Condition statements for each land system and for the whole station (total over all systems) have been derived from observations made whilst traversing on the station and are presented in Table 2.

Table 1 — LAND SYSTEMS ON MT. VERNON STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hills, ridges and plateaux with skeletal soils and tall shrublands or hard spinifex grasslands	18.9	
	Mulgul — rough dolomite hills supporting low shrubs and sparse mulga	3.1	
	Divide — sand plain and minor dunes with hard spinifex grasslands	.01	
			22.0
Low (20 to 30ha/s.u.)	**Egerton** — highly dissected plains and slopes with sparse mulga shrublands	8.6	
	Kooline — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	7.9	
	Ethel — cobble plains with sparse mulga and other Acacia spp. shrublands	7.8	
	Charley — dolerite hills and ridges and restricted lower plains, tall and low shrublands	7.6	
	Collier — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	5.5	
			37.4
Moderate (10 to 20ha/s.u.)	**Table** — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	11.0	
	Laterite — small laterite mesas and gravelly plains with mulga shrublands	5.3	
	Ruby — gently undulating shale plains with sparse mulga and cassia shrublands	4.2	
	Ford — gently undulating stony plains with a few low hills; mulga shrublands	1.7	
	Tangadee — low shale hills and undulating plains with mulga woodlands	1.7	
			23.9
High (5 to 10ha/s.u.)	**Ashburton** — active floodplains and backplains with deep silty loam and clayey soils, shrublands and tussock grasslands	11.2	
	Edward — alluvial plains with sparse degraded saltbush, bluebush and other shrub pastures	5.0	
	River — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	0.5	
			16.7
Very high (<5ha/s.u.)			0
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS

(560 recordings on 16 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Ashburton	99	47	39	11	2	1	15	41	30	13	16	50	34
Augustus	49	96	2	2	—	61	27	10	—	2	88	10	2
Charley	31	97	3	—	—	19	39	29	13	—	58	42	—
Collier	23	100	—	—	—	22	56	22	—	—	78	22	—
Edward	44	20	66	14	—	—	32	38	23	7	32	34	34
Egerton	42	100	—	—	—	41	38	19	2	—	79	21	—
Ethel	70	85	11	3	1	7	34	37	19	3	41	49	10
Ford	3	100	—	—	—	—	100	—	—	—	100	—	—
Kooline	30	77	23	—	—	17	23	47	13	—	40	50	10
Laterite	28	79	21	—	—	—	36	39	25	—	36	53	11
Mulgul	6	83	17	—	—	17	33	50	—	—	50	50	—
River	3	—	67	33	—	—	—	67	33	—	—	67	33
Ruby	57	88	12	—	—	7	44	33	16	—	51	40	9
Table	67	91	9	—	—	7	50	29	13	1	57	40	3
Tangadee	8	87	13	—	—	25	25	37	13	—	49	38	13
Total over all land systems	560	76	19	4	1	14	33	33	16	4	48	39	13

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 47 sites on 12 land systems.

Range condition and recommendations

1. **Augustus land system** (18.9 per cent of station area)

This rugged hill system supports mulga short grass forb (MSGF) pastures with small areas of mulga creek line (MUCR) pastures along the major rivers and creeklines. The more rugged units of the system are little grazed and the whole system is largely in good range condition.

2. **Ashburton land system** (11.2 per cent)

This flood plain system supports productive and drought-resistant pastures of saltbush (CHAT) and bluebush (CHMA). Fifty per cent of the traverse records on the system indicated fair range condition and 16 per cent and 34 per cent, respectively, indicated good and bad range condition. Minor and moderate erosion in the form of wind hummocking, surface sealing, stripping and rilling is common on parts of the alluvial plains.

Although parts of the system are in good condition and in general the system is better than elsewhere in the catchment, the fact that one-third is in bad range condition is a matter of concern. The saltbush (CHAT) pastures of the system are very sensitive to grazing and without adequate control of stock can be expected to continue to decline. Apart from a few small paddocks near the homestead and Bronco bore the station is run on the open range principle. In these circumstances control of stock numbers and season of grazing on the system is not possible. Control of stock cannot be achieved by manipulating numbers on or by closing down artificial watering points because of the many permanent and semi-permanent natural pools and springs in the Ashburton River and its major tributaries.

The system is the most valuable for grazing on the station and a long-term development programme of fencing is required otherwise future pasture productivity and landscape stability cannot be assured.

3. **Table land system** (11 per cent)

This system consists of extensive low calcrete plateaux, mesas and plains and supports useful mulga short grass forb (MSGF), cassia short grass forb (CSGF) and mulga creekline (MUCR) pastures. Overall range condition is good or fair.

Most units of the system are resistant to erosion even if shrub pastures are seriously depleted. An exception to this are some drainage floor and lower plain units. Occasional spelling over a growing season is desirable.

4. **Egerton land system** (8.6 per cent)

This distinctive system consists of highly dissected slopes and plains with hardpan and supports mulga short grass forb (MSGF), stony short grass forb (SSGF) pastures and minor areas of hard spinifex (HSHI) and mulga creekline (MUCR) pastures.

The system is not very productive or attractive to livestock. Range condition is good or fair. The system rarely shows any accelerated erosion.

5. **Kooline land system** (7.9 per cent)

About 80 per cent of this system consists of low shale hills, ridges and footslopes supporting poor stony short grass forb (SSGF) pasture, which are invariably in good or fair condition. The remainder of the system consists of saline plains and flow zones with braided channels. These support useful saltbush (CHAT) and mulga creekline (MUCR) pastures which are degraded to fair or poor condition. At present there is only patchy minor erosion on the saline plains and flow line units, but they are sensitive to overuse and susceptible to erosion. Control of grazing intensity and season of grazing is necessary, but fencing is only practical where there are large areas of the units or where there are areas of the units adjacent to other sensitive and valuable systems such as Edward (see 10).

6. **Ethel land system** (7.8 per cent)

This system consists of broad raised cobble plains and saline plains found along river valleys and often marginal to flood plain systems such as Ashburton. Pastures are sparse stony short grass forbs (SSGF) with minor inclusions of saltbush (CHAT) and samphire. Condition is largely good or fair although about a quarter of the saltbush areas have deteriorated to bad condition. Due to the stony nature of the system there is no erosion.

7. **Charley land system** (7.6 per cent)

The hill and footslope units of this system support mulga short grass forb (MSGF) and cassia short grass forb (CSGF) pastures and are in good or fair range condition.

Minor, but important units of the system are lower plains with sluggish drainage and drainage floors. These support useful tussock grass (TGER) and swamp bluebush (CHMA) pastures. They receive preferential grazing and are about evenly distributed between good, fair and bad range condition. A small area near O'Briens mill shows extreme pasture degradation and some erosion.

8. **Collier land system** (5.5 per cent)

Pastures on this stony hill and upland system are in good or fair condition and there is no erosion.

9. **Laterite land system** (5.3 per cent)

The laterite mesas and footslopes of this system support mulga short grass forb (MSGF) and stony short grass forb (SSGF) pastures. Coudition is good or fair, and there is no erosion. Drainage floors of the system support more attractive and productive tussock grass (TGER) and chenopod shrub (CHMA) pastures. Range condition is about evenly distributed between fair and bad. Spelling over a few growing seasons, coupled with conservative use for the rest of the year, is required to improve pasture condition.

10. **Edward land system** (5 per cent)

This alluvial plain system supports valuable drought-resistant shrub pastures such as saltbush and bluebush (CHAT, CHMA) and stony chenopods (STCH). Because of its duplex soils with sandy surface horizons and clay below the system is extremely sensitive to disturbance. Maintenance of good vegetative cover is essential for landscape stability, and if pastures are depleted, complete degradation of the system to bare, eroded clay flats can occur.

Range condition of the system on this station as indicated by 44 traverse recordings is about evenly distributed between good, fair and bad. Overall condition of the system is generally better than elsewhere in the survey area.

A large area of the Edward system along the Angelo River in the north of the station is in good condition although some parts show rill and gutter erosion caused by past floods. The area does not receive much grazing pressure due to the general lack of permanent waters. If additional waters are provided to bring the area into full production it is imperative that it be paddocked so that control of stock numbers and season of use is absolute. If the area is brought into full use without this control it is a certainty that it will degrade severely to the extent frequently seen elsewhere in the survey area.

Other smaller areas of the Edward system occur in the north-west of the station and condition is fair to bad. A development programme to fence these areas together with adjacent sensitive units of the Kooline system is required.

11. **Ruby land system** (4.2 per cent)

This system consists of broad, gently undulating plains on shale with smaller areas of cobble plains and saline drainage floors. Pastures are predominantly cassia short grass forb (CSGF) with small inclusions of more productive pasture types such as stony chenopod (STCH) and mulga creekline (MUCR). Range condition is generally good or fair although some drainage floors are in bad condition with degraded pastures and minor erosion. About 1 sq. km of a saline drainage floor near O'Briens mill is extremely degraded. The area needs complete spelling from grazing for a number of years, but in the absence of paddockiug this is not possible.

12. The remaining five land systems, Mulgul, Ford, Tangadee, River and Divide collectively occupy 7 per cent of the total area. Generally the condition of all systems is acceptable with pastures in good or fair condition and no erosion. An exception to this is some parts of the River system which show marked pasture decline and moderate erosion.

13. As previously mentioned the station is run on the open range principle, and it is not possible to control stock numbers properly or season of use properly. Assumiug that the station is adequately watered (which is largely the case) this means that stock are free to graze selectively over the station. In practice the softer, more productive land systems or units of land systems with pastures attractive to livestock are preferentially overgrazed.

On the harder stony land systems open range grazing may be acceptable in that it does not cause serious vegetation degradation or promote erosion. However, on some systems it is not an acceptable management practice. On these systems it is incompatible with the maintenance of long-term stability of the vegetation and soil resources and, as is abundantly evident elsewhere in the survey area, ultimately results in severe degradation of the landscape.

A gradual long-term development programme of fencing is required on a number of land systems. The Edward system (possibly in conjunction with parts of the Kooline system) and the Ashburton system should receive top priority. Subsequent programmes should involve other systems or parts of systems such as River, Ruby, Charley, Table and Laterite.

14. The recommended cattle unit capacity for present condition and assuming full development is 2 210 adults or 2 760 total cattle.

15. The capability cattle unit capacity if all the station was in good range condition is 3 110 adults or 3 890 total cattle.

INDIVIDUAL STATION REPORT

MT VERNON STATION — **404 686 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km) Good	Fair	Bad	E/D*	Sheep unit capacity Recommended	Capability
Augustus	766	MSGF	692	36	—	—	1 438	1 456
		MUCR	25	13	—	—	357	475
Ashburton	453	CHAT	48	114	65	—	1 709	2 838
		CHMA	38	100	88	—	1 405	2 825
Table	444	MSGF	151	71	—	—	817	888
		CSGF	120	53	5	—	769	890
		MUCR	16	25	3	—	347	550
Egerton	347	MSGF	195	65	—	—	975	1 040
		SSGF	52	4	—	—	110	112
		MUCR	10	21	—	—	241	388
Kooline	321	SSGF	148	115	—	—	674	789
		MUCR	11	18	3	—	246	400
		CHAT	—	13	13	—	140	325
Ethel	317	SSGF	114	135	5	—	620	762
		CHAT	12	23	12	—	371	588
		MUCR	13	3	—	—	179	200
Charley	310	MSGF	116	55	—	—	315	342
		CSGF	44	61	—	—	403	525
		TGER	11	12	10.5	0.5	319	568
Collier	221	MSGF	101	21	—	—	467	488
		SSGF	41	14	—	—	151	165
		STCH	29	15	—	—	316	365
Laterite	214	SSGF	38	48	—	—	210	258
		MSGF	39	46	—	—	294	340
		TGER	—	22	21	—	254	718
Edward	201	CHAT	57	59	57	—	1 345	2 163
		STCH	—	6	18	—	54	199
		SSGF	—	4	—	—	8	12
Ruby	170	CSGF	68	44	12	—	496	620
		MUCR	12	12	2	—	223	325
		STCH	9	9	1	1	122	166
Mulgul	126	MSGF	95	—	—	—	380	380
		CSGF	17	8	—	—	109	125
		MUCR	—	6	—	—	33	75
Ford	68	MSGF	20	19	—	—	137	156
		SSGF	9	8	—	—	43	51
		CHAT	4	4	4	—	93	150
Tangadee	67	MSGF	23	34	—	—	194	228
		CHMA	3	4	—	—	66	88
		MUCR	1	2	—	—	24	38
River	22	MUCR	4	5	4.5	0.5	105	175
		STCH	2	3	—	—	32	42
		No Veg	3	—	—	—	—	—
Divide	0.2	HSSP	—	—	—	—	—	—
		MUCR	—	—	—	—	—	—
TOTALS	4 047		2 391	1 330	324	2	16 591	23 288

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	3 320	4 150	2 210	2 760
Capability cattle unit capacity	4 660	5 830	3 110	3 890

Declared stock numbers (1979) ..... 1 200 cattle

NANUTARRA STATION — West Pilbara Shire

Location

Nanutarra station is located on the eastern edge of the Yanrey 1:250 000 map sheet and the western edge of the Wyloo sheet. The homestead is situated close to the North West Coastal Highway where it crosses the Ashburton River about 379 km north of Carnarvon.

The station has common boundaries with Minderoo, Mt. Minnie, Cane River, Mt. Stuart, Glenflorrie and Uaroo stations.

Area within survey

Entire station 369 004 ha.

Description

A large number of different land forms and land systems are present. The Parry Range (Augustus land system) runs from the north to the south-east through the property. The Ashburton River runs east to west and is flanked by the potentially high value flood plain systems, Ashburton and Globe.

Broad sandy and clayey plains of the Uaroo and Stuart land systems occur mostly in the north of the property and collectively occupy about 43.2 per cent of the total area. These systems together with sandy plains associated with the Boolaloo and Giralia systems support mixed soft and hard spinifex and are of moderate pastoral value.

In the south of the property rugged hill systems of low or very low pastoral value predominate. These include the Capricorn system (which is also scattered elsewhere through the station) consisting of metamorphosed sedimentary rocks, Augustus, Collier and Kooline systems and the Boolaloo system with characteristic rounded granite hills.

A distinctive, but relatively unimportant land system in the west of the station is Nanutarra which consists of low mesas and buttes formed from horizontally bedded sediments.

A total of 18 land systems occur on the property and these are briefly described and their pastoral value for good range condition status shown in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) are presented in Table 2. These statements were derived from records made whilst traversing on the station.

Range evaluation sites

Detailed descriptions and measurements of landform,

Table 1 — LAND SYSTEMS ON NANUTARRA STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hills, ridges and plateaux with skeletal soils and tall shrublands or hard spinifex grasslands	10.8	
	Capricorn — rugged hills and ridges with low shrublands or hard spinifex	8.0	
			18.8
Low (20 to 30ha/s.u.)	**Kooline** — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	2.1	
	Collier — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	0.7	
	Prairie — granite hills and undulating stony plains with low and tall shrublands	0.2	
			3.0
Moderate (10 to 20ha/s.u.)	**Uaroo** — broad sandy plains with hard and soft spinifex grasslands	26.1	
	Stuart — plains of low or moderate relief with snakewood shrublands and hard and soft spinifex hummock grasslands	17.1	
	Boolaloo — granite hills, domes, tor fields and sandy plains, spinifex grasslands and shrubby grasslands	12.2	
	Giralia— linear dunes and broad sandy plains supporting hard and soft spinifex	4.6	
	Nanutarra — low mesas and hills with soft and hard spinifex	2.4	
	Dollar — stony plains with open snakewood shrublands	0.3	
	Robe — low plateaux, mesas and buttes of limonite with soft and hard spinifex pastures	0.2	
			62.9
High (5 to 10ha/s.u.)	**Globe** — degraded alluvial plains supporting snakewood shrublands and minor tussock grasslands	12.3	
	Yankagee — plains with dunes and numerous claypans, soft spinifex and snakewood shrublands	0.2	
	Cheetara — alluvial clay plains with gilgais, mixed open tussock grasslands and tall shrublands	.01	
			12.5
Very high (<5ha/s.u.)	**Ashburton** — active floodplains and backplains with deep silty loam and clayey soils, shrublands and tussock grasslands	1.8	
	River — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	0.7	
	Rous — alluvial plains, sandy and duplex soils with snakewood and other shrublands	0.3	
			2.8
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(596 recordings on 15 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Ashburton	28	82	11	7	—	4	21	57	18	—	25	64	11
Augustus	15	93	—	7	—	33	27	33	7	—	60	33	7
Boolaloo	73	90	10	—	—	47	38	14	1	—	85	14	1
Collier	4	100	—	—	—	75	—	25	—	—	75	25	—
Capricorn	11	91	—	9	—	46	27	18	9	—	73	18	9
Giralia	16	100	—	—	—	25	63	6	6	—	87	13	—
Globe	156	32	31	22	15	—	11	31	40	18	11	37	52
Kooline	9	100	—	—	—	67	33	—	—	—	100	—	—
Nanutarra	4	100	—	—	—	100	—	—	—	—	50	50	—
Prairie	3	100	—	—	—	100	—	—	—	—	100	—	—
River	2	100	—	—	—	—	100	—	—	—	100	—	—
Rous	3	100	—	—	—	67	33	—	—	—	100	—	—
Stuart	87	97	3	—	—	20	46	25	9	—	66	32	2
Uaroo	182	92	7	—	1	38	42	16	3	1	80	18	2
Yankagee	3	67	—	—	33	—	67	—	33	—	67	—	33
Total over all land systems	596	77	12	7	4	25	33	23	14	5	57	27	16

vegetation, soils and range condition were made at 42 sites on 7 land systems.

Range condition and recommendations

1. All the spinifex based plains land systems on the station are in good range condition. These include land systems Uaroo (26.1 per cent of station area), Giralia (4.6 per cent) and parts of Stuart and Boolaloo.

   Pastures are a mixture of hard and soft spinifex (HSSP and SOSP) and burning on a systematic basis every four or five years can maintain the spinifex in a reasonably attractive and useful condition for stock. The systems are resistant to degradation and erosion although some wind erosion can occur if a prolonged dry spell occurs after burning. Re-establishment of vegetative cover and stabilisation occurs rapidly after rain.

2. The major units of the stony hill land systems Augustus (10.8 per cent), Capricorn (8 per cent), Nanutarra (2.4 per cent), Collier (0.7 per cent) and parts of Kooline, Prairie and Boolaloo are in good range condition. Pastures are mulga short grass forb (MSGF) or hard spinifex (HSHI) and are in good condition. In some cases restricted areas of lower plains and drainage floors associated with the hill systems have received heavy use and mulga creekline pastures (MUCR) are degraded to fair or poor condition and there is patchy erosion.

3. **Globe and Ashburton land systems**

   The flood plain systems Globe (12.3 per cent) and Ashburton (1.8 per cent) associated with the Ashburton River are largely in bad or fair range condition. On the Globe system 52 per cent of the 156 traverse recordings indicated bad range condition, 37 per cent indicated fair condition and 11 per cent indicated good condition. In many areas pastures are badly degraded and minor, moderate and severe erosion is widespread.

   Reports by early explorers and surveyors and evidence from relic sites indicate that the alluvial plain unit of the Globe system once supported productive saltbush (CHAT) pastures. However, these pastures were very sensitive to grazing and the duplex soils of the unit were inherently susceptible to erosive forces once the vegetation was depleted. The plains are now bare or wind hummocked with patchy stands of snakewood and other Acacia species. Ground cover consists of poor low shrubs, extremely patchy buffel grass and numerous ephemerals in season. The system no longer has any worthwhile drought durability.

   About 55 sq. km of the Globe system is so severely degraded that it should not be used for grazing and requires special remedial treatments. Exclusion of stock will require additional fencing or the decision to close up an existing paddock or paddocks. The main areas of concern are in Globe Hill, River, Homestead and Bediada paddocks.

   A regeneration programme involving destocking and cultivation is essential, but need not commence in all areas at once. River and Homestead paddocks are recommended to receive high priority.

   Contour strip cultivation and seeding with buffel grass is required in order to ensure recovery within a reasonable time period. Buffel grass has proven ability to establish in this environment and is already well established on restricted parts of the Globe system and elsewhere has a tenuous foothold. Cultivation and reseeding techniques are well proven in various pastoral areas. It is not possible to indicate the time period necessary for full recovery, but reasonable recovery could be expected in about 5 years at the end of which controlled grazing could re-commence and treatments on other areas start.

4. Nanutarra is well developed in terms of artificial watering points and paddocks although many of the fences are very old and are poorly effective as stock barriers. However, with some upgrading the presence of these improvements means that a systematic programme of grazing deferment over growing seasons can be implemented on a paddock by paddock basis.

5. Noticeable features of Nanutarra country are the marked extremes of range condition encountered. The large areas of spinifex and hill country are all in good condition. Although these classes of country are only of moderate or low pastoral value they are

inherently stable and resistant to grazing. On the other hand the sensitive river frontage country is invariably degraded to fair or bad condition. Every effort should be made to distribute stock throughout the property and to make maximum use of the stable spinifex and hill pastures so that grazing pressure can be reduced on the Ashburton River frontage.

6. The recommended sheep unit capacity for present condition is 19 990 adults or 24 990 total sheep.

7. The capability sheep unit capacity if all country was in good range condition is 25 880 adults or 32 350 total sheep.

INDIVIDUAL STATION REPORT

NANUTARRA STATION — **369 004 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Uaroo	964	HSSP	704	—	—	—	2 112	2 112
		SOSP	218	42	—	—	3 074	3 250
Stuart	630	STCH	106	134	12	—	1 574	2 092
		HSHI	244	8	—	—	624	630
		SOSP	81	45	—	—	1 387	1 575
Globe	453	CHAT	6	60	128	55	893	3 113
		TGER	62	83	32	—	1 838	2 956
		SOSP	6	21	—	—	249	338
Boolaloo	449	HSHI	247	—	—	—	420	420
		SOSP	162	18	—	—	2 174	2 250
		STCH	—	22	—	—	110	183
Augustus	397	MSGF	324	53	—	—	728	754
		MUCR	10	7	3	—	174	250
Capricorn	294	HSHI	205	—	—	—	349	349
		SSGF	50	24	—	—	198	222
		MUCR	8	3	4	—	130	188
Giralia	170	HSSP	70	15	—	—	240	255
		SOSP	85	—	—	—	1 063	1 063
Nanutarra	88	SOSP	38	37	—	—	393	469
		HSSP	13	—	—	—	39	39
Kooline	78	SSGF	64	—	—	—	192	192
		MUCR	6	2	—	—	86	100
		CHAT	—	6	—	—	50	75
Ashburton	67.5	TGCE	8	12	3	—	650	1 150
		CHAT	5	8	2	7.5	134	281
		CHMA	8	12	2	—	190	275
Collier	27	MSGF	15	—	—	—	60	60
		SSGF	6	1	—	—	20	21
		STCH	3	2	—	—	35	42
River	26	MUCR	3	4	2	—	66	113
		TGCE	3	3	2	—	217	400
		STCH	2	2	1	—	29	42
		No veg	4	—	—	—	—	—
Rous	11	TGCE	2	2	—	—	140	200
		STCH	2	2	—	—	27	33
		SOSP	1	1	—	—	21	25
		No veg	1	—	—	—	—	—
Dollar	10	STCH	4	4	—	—	53	66
		MUCR	—	1	—	—	6	13
		TGER	—	1	—	—	8	17
Yankagee	9	SOSP	2	2	—	—	42	50
		TGCH	1	1	—	—	47	66
		CHAT	—	1	—	—	8	13
		No veg	2	—	—	—	—	—
Robe	8	SOSP	7	—	—	—	88	88
		HSHI	1	—	—	—	6	6
Prairie	8	MSGF	4	—	—	—	16	16
		SSGF	3	—	—	—	9	9
		MUCR	1	—	—	—	13	13
Cheetara	0.3	TGER	0.3	—	—	—	5	5
TOTALS	3 690		2 791.3	645	191	62.5	19 987	25 879

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

Recommended sheep unit capacity ..... 19 990 adults — 24 990 total

Capability sheep unit capacity ..... 25 880 adults — 32 350 total

Declared stock numbers (1979) ..... 15 808 sheep, 300 cattle

NYANG STATION — West Pilbara Shire

Location

Nyang station is located on the Yanrey and Winning Pool 1:250 000 map sheets. The homestead is situated on the Yannarie River about 23 km south-east of Barradale on the North West Coastal Highway. The station has common boundaries with Yanrey, Uaroo, Winning and Marilla stations.

Area within survey

Entire station 123 847 ha.

Description

Nyang station consists mainly of broad, sandy plains supporting hard spinifex and some soft spinifex. The Yannarie River runs from the south-east to the north-west through the centre of the property.

The two largest land systems are Uaroo (55.8 per cent of the station area) and Giralia (21.4 per cent) which, when correctly managed, are of moderate pastoral value. In the centre and south-east of the property gently undulating stony plains of the Mundong system (7.7 per cent) occur. The system supports snakewood and mulga shrublands and is of moderate pastoral value.

The Winning system (6.4 per cent) consisting of low hills and lower plains with mixed shrubs and spinifex pastures occurs in the south of the property. The productive lower plains of the Winning system are not as large on Nyang as on other properties; nevertheless the system is of moderate pastoral value. At the present time it is not being used for grazing.

Nearly all of the station is accessible to livestock, although parts are not being used due to lack of water. Rugged hills of the Augustus and Capricorn systems occupy only 1.9 per cent of the station area and occur only in the north-east and south-east of the station. A few low hills and ridges of the Collier (3.4 per cent) system are also found in the same general areas.

A total of 10 land systems occur on the property and these are briefly described and their pastoral value for good range condition status shown in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) are presented in Table 2. These statements were derived from records made whilst traversing on the station.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 15 sites on 6 land systems.

Range condition and recommendations

1. **Uaroo and Giralia land systems** (collectively 77.2 per cent of station area)

   These large, spinifex based, plain land systems are in good or fair range condition. Pastures are a mixture of hard and soft spinifex (HSSP and SOSP). The former is of very little use for grazing, but soft spinifex is of moderate value with good drought durability. Old, mature spinifex stands are useless for grazing and management must be aimed at maintaining the pastures in as attractive condition to stock as possible. Spinifex pastures must be burnt on a regular basis about every 4 or 5 years and burning should be late in the year. Burnt areas should be deferred from grazing for 8 to 10 weeks over the growing season following the fire in order to encourage establishment of grasses, desirable shrubs and spinifex seedlings.

   The systems are generally resistant to degradation, although some wind erosion can occur if a prolonged dry spell occurs after burning. Re-establishment of vegetative cover and stabilisation occurs rapidly after rain.

2. **Mundong land system** (8.7 per cent)

   Most of the Mundong land system is in fair range

Table 1 — LAND SYSTEMS ON NYANG STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hills, ridges and plateaux with skeletal soils, tall shrublands or hard spinifex grasslands	1.0	
	Capricorn — rugged hills and ridges with shrublands or hard spinifex	0.9	
			1.9
Low (20 to 30ha/s.u.)	**Collier** — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	3.4	
	Egerton — highly dissected plains and slopes with sparse mulga shrublands	1.5	
			4.9
Moderate (10 to 20ha/s.u.)	**Uarco** – broad sandy plains with hard and soft spinifex grasslands	55.8	
	Giralia— linear dunes and broad sandy plains supporting hard and soft spinifex	21.4	
	Mundong — gently undulating plains with open snakewood and mulga shrublands	7.7	
	Stuart — plains of low or moderate relief with snakewood shrublands and hard and soft spinifex hummock grasslands	1.5	
			86.4
High (5 to 10ha/s.u.)	**Winning** — low hills and broad lower plains with snakewood shrublands, chenopod and soft spinifex pastures	6.4	6.4
Very high (<5ha/s.u.)	**Rous** — alluvial plains, sandy and duplex soils with snakewood and other shrublands	0.4	0.4
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(186 recordings on 8 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Augustus	2	100	—	—	—	—	100	—	—	—	100	—	—
Collier	8	62	38	—	—	—	38	49	13	—	38	49	13
Egerton	5	100	—	—	—	—	20	40	40	—	20	80	—
Giralia	23	100	—	—	—	61	35	4	—	—	96	4	—
Mundong	35	88	9	3	—	—	17	29	45	9	17	69	14
Rous	1	100	—	—	—	—	100	—	—	—	100	—	—
Stuart	2	100	—	—	—	50	50	—	—	—	100	—	—
Uaroo	110	92	8	—	—	20	53	18	9	—	72	24	4
Total over all land systems	186	91	8	1	—	20	42	20	16	2	63	32	5

condition, although some restricted areas are also in good and bad condition. Pastures are moderately degraded (46 per cent and 9 per cent of traverse records indicated poor and very poor pasture condition respectively), but there is no erosion.

Most of the Mundong system occurs in Tank and Arrijool paddocks which have a history of heavy stocking. In order to improve pasture condition the paddocks require spelling over a number of consecutive growing seasons and conservative stocking for the remainder of the year.

3. The remaining land systems on the station are largely in good or fair range condition. There are no serious problem areas of pasture degradation or erosion.

4. Large areas of the Uaroo and Giralia systems, in the south-west, west and to a lesser extent in the north of the station, are poorly developed in terms of paddocks and stock waters and are not utilised by livestock. A number of additional waters are required to bring this country into production and to ensure a more even distribution of stock.

5. The recommended sheep unit capacity for present condition and assuming full development (which is not the case) is 7 490 adults or 9 360 total sheep.

6. The capability sheep unit capacity if all country was in good range condition is 8 340 adults or 10 430 total sheep.

INDIVIDUAL STATION REPORT

NYANG STATION — **124 847 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Uaroo	696	HSSP	411	97	—	—	1 427	1 524
		SOSP	156	32	—	—	2 216	2 350
Giralia	267	HSSP	127	7	—	—	395	402
		SOSP	126	7	—	—	1 633	1 633
Mundong	96	STCH	7	44	4	—	286	457
		TGER	—	14	10	—	151	401
		SSGF	8	9	—	—	38	51
Winning	79	CHAT	47	—	—	—	588	588
		SOSP	20	—	—	—	250	250
		HSHI	12	—	—	—	30	30
Collier	43	MSGF	23	—	—	—	92	92
		SSGF	6	5	—	—	28	33
		STCH	—	9	—	—	45	75
Egerton	19	MSGF	3	11	—	—	45	56
		SSGF	1	2	—	—	7	9
		MUCR	—	2	—	—	22	25
Stuart	18	STCH	3	4	—	—	45	58
		HSHI	7	—	—	—	18	18
		SOSP	2	2	—	—	42	50
Augustus	13	MSGF	12	—	—	—	24	24
		MUCR	1	—	—	—	13	13
Capricorn	12	HSHI	8	—	—	—	14	14
		SSGF	3	—	—	—	9	9
		MUCR	1	—	—	—	13	13
Rous	5	TGCE	—	2	—	—	40	40
		STCH	—	1	1	—	7	17
		SOSP	—	1	—	—	8	13
		No veg	—	—	—	—	—	—
TOTALS	1 248		984	249	15		7 486	8 335

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

Recommended sheep unit capacity ..... 7 490 adults — 9 360 total
Capability sheep unit capacity ..... 8 340 adults — 10 430 total
Declared stock numbers (1979) ..... 6 988 sheep

PINGANDY STATION — Upper Gascoyne, West Pilbara and Meekatharra Shires

Locatiou

Pingandy station is located on the Turee Creek and Mt. Egerton 1:250 000 map sheets. The nearest town is Paraburdoo about 174 km north by road via Mininer station. There is also access to Meekatharra to the south-east via Mt. Vernon station. The station has common boundaries with Ashburton Downs, Mininer, Mt. Vernon, Dooley Downs and Amelia stations and to vacant crown land.

Area within survey

Entire station 154 447 ha.

Description

About 48 per cent of this station consists of rugged sandstone and dolomite mountain country of negligible grazing value and a further 23 per cent consists of low, rough shale hills of very low value.

About 28 per cent of Pingandy consists of dissected terrain with low plateaux and mesas and their breakaway slopes. This country consists of the Egerton, Ethel, Table and Laterite land systems which vary from low to moderate in their pastoral value.

About 1 per cent of the station consists of narrow flood plains, banks and channels of the productive River land system.

The systems are briefly described and their pastoral value for good range condition status indicated in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) are presented in Table 2. These statements are derived from traverse records.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 5 sites on 5 land systems.

Range condition and recommendations

1. **Angustus land system** (35 per cent of the total station area)

   Overall range condition of this large land system is fair to good. It consists of rugged mountains and hills supporting stony short grass forb (SSGF) pastures of very low productivity, which are in good condition and are inherently resistant to erosion. Small inclusions of better quality pastures are generally degraded.

2. **Egertou land system** (17.9 per cent)

   The range condition of this system is good. The system consists of narrow, raised hardpan plains and their extensive dissection zones. The bulk of pastures consist of mulga short grass forbs (MSGF) and stony short grass forbs (SSGF) of very low productivity. Pasture condition is good and there is no erosion. Small inclusions of mulga creekline pasture (MUCR) are degraded and there is occasional minor erosion.

3. **Collier land system** (15.5 per cent)

   Range condition of this stony land system is mostly good with some minor areas in fair condition. Stony short grass forb (SSGF) and mulga short grass forb (MSGF) pastures show some degradation in parts. There is no erosion.

Table 1 — LAND SYSTEMS ON PINGANDY STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hills, ridges and plateaux with skeletal soils supporting tall shrublands	35.0	
	Mulgul — rough dolomite hills supporting low shrubs and sparse mulga	9.3	
			44.3
Low (20 to 30ha/s.u.)	**Egerton** — highly dissected plains and slopes with sparse mulga shrublands	17.9	
	Collier — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	15.5	
	Kooline — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	6.8	
	Ethel — cobble plains with sparse mulga shrublands	3.5	
			43.7
Moderate (20 to 30ha/s.u.)	**Charley** — dolerite hills and ridges and restricted lower plains; tall and low shrublands	3.3	
	Jamindie — stony hardpan plains and stony rises with groved mulga shrublands	0.7	
			4.0
	Table — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	5.9	
	Laterite — small laterite mesas and gravelly plains with mulga shrublands	0.7	
			6.6
High (5 to 10ha/s.u.)	**River** — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	1.4	1.4
Very high (<5ha/s.u.)			0
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(84 recordings on 9 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Augustus	12	100	—	—	—	—	59	33	8	—	58	42	—
Charley	2	100	—	—	—	50	50	—	—	9	100	—	—
Collier	1	100	—	—	—	—	100	—	—	—	100	—	—
Egerton	35	94	6	—	—	48	37	9	6	—	86	11	3
Ethel	9	100	—	—	—	11	67	22	—	—	78	22	—
Laterite	2	100	—	—	—	—	100	—	—	—	100	—	—
Mulgul	11	100	—	—	—	9	73	18	—	—	82	18	—
River	4	75	25	—	—	—	25	25	50	—	25	50	25
Table	8	87	13	—	—	37	13	37	13	—	50	50	—
Total over all land systems	84	95	5	—	—	27	48	18	7	—	75	23	2

4. Condition of the remaining eight land systems which collectively comprise thirty-two per cent of the station area is indicated in Table 2. These are mostly unproductive systems and are generally in fair to good condition except for small pockets of better quality pastures along the drainage lines. These restricted areas receive preferential use by stock and pasture condition is often only fair or poor and there is occasional minor erosion.

5. Pingandy Station is a very small cattle enterprise which has only been worked actively since the 1950s. Cattle are run on the open range principle, watering at a few artificial watering points and permanent pools and springs. There are virtually no fences and it is economically impractical to suggest fencing a property such as this which consists of rugged hills and stony plains of very poor pastoral value.

6. While the great bulk of pastures on Pingandy are in good or excellent condition, some of the small inclusions of better quality mulga creekline (MUCR), stony chenopod (STCH) and saltbush (CHAT) pastures are partly degraded to fair condition. However, further serious deterioration is not likely to occur provided stock are distributed as widely as possible over the property and numbers do not exceed about 800 total head.

7. Recommended cattle unit capacity for present condition is 680 adults or 850 total cattle.

8. Capability cattle unit capacity if all country was in good range condition is 790 adults or 990 total cattle.

INDIVIDUAL STATION REPORT

PINGANDY STATION — **154 447 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Augustus	540	MSGF	513	—	—	—	1 026	1 026
		MUCR	7	20	—	—	196	338
Egerton	276	MSGF	207	—	—	—	828	828
		SSGF	44	—	—	—	88	88
		MUCR	13	7	5	—	230	310
Collier	239	MSGF	97	34	—	—	490	526
		SSGF	52	8	—	—	172	179
		STCH	29	14	5	—	312	397
Mulgul	144	MSGF	108	—	—	—	216	216
		CSGF	13	10	6	—	107	144
		MUCR	—	7	—	—	145	90
Kooline	104	SSGF	39	43	3	—	208	256
		MUCR	2	3	5	—	55	125
		CHAT	3	2	4	—	65	113
Table	91	MSGF	46	—	—	—	182	182
		CSGF	22	10	4	—	148	182
		MUCR	4	4	1	—	75	114
Ethel	54	SSGF	34	9	—	—	120	130
		CHAT	4	2	2	—	75	101
		MUCR	2	1	—	—	23	34
Charley	51	MSGF	28	—	—	—	56	56
		CSGF	8	7	2	—	52	87
		TGER	1	2	3	—	27	56
River	23	MUCR	6	6	3	—	118	118
		STCH	3	2	—	—	35	42
		No veg	3	—	—	—	—	—
Laterite	11	SSGF	2	2	—	—	10	12
		TGER	—	3	—	—	15	30
		MSGF	2	2	—	—	12	16
Jamindie	11	SSGF	2	7	—	—	19	27
		MUCR	—	1	—	—	6	12
		TGER	—	1	—	—	5	10
TOTALS	1 544		1 294	207	43		5 116	5 915

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	1 020	1 280	680	850
Capability cattle unit capacity	1 180	1 480	790	990

Declared stock numbers (1979) ..... 400 cattle

PRAIRIE DOWNS STATION — Meekatharra and East Pilbara Shires

Location

Prairie Downs station is at the eastern end of the Ashburton River catchment on the Newman 1:250 000 map sheet. A small section of the station extends into the Fortescue River catchment.

The station is about 80 km west-southwest from the mining town of Newman and has common boundaries with Turee Creek, Bulloo Downs, Sylvania and Ethel Creek stations and vacant crown land.

Area within survey

Entire station 227 408 ha.

Description

The station is composed of many different landforms including low granite plains and hills in the east, hardpan plains and sandstone hills in the centre and west and rough hill country in the south and north.

About 14 per cent of the station is of very low pastoral value and consists of rugged ranges, plateaux and hills of the Augustus, Newman and Rocklea land systems.

Undulating granitic plains and low hills of the Prairie system in the east occupy about 23.5 per cent of the total station area. The stony hardpan plain system Jamindie occupies about 21 per cent. Both of these systems provide some useful grazing but are generally of low pastoral value. A total of about 64.3 per cent of the station area is of low pastoral value and this includes other land systems such as Kunderong (6.2 per cent), Nirran (4.0 per cent), Collier (3.9 per cent) and Egerton (5.1 per cent).

About 18.7 per cent of the station is of moderate pastoral value. This country includes hardpan plains with large groves of the Nooingin system (8.9 per cent), hardpan plains with thin sand cover of the Cadgie system (3.5 per cent), calcrete platforms and plains of the Warri system (2.4 per cent) and stony gilgai plains of the Turee (1.0 per cent) system.

A total of 22 land systems are found on the station. All these systems are briefly described in Table 1.

Condition statements for land systems and for the whole station were derived from observations made whilst traversing on the station and are presented in Table 2.

Table 1 — LAND SYSTEMS ON PRAIRIE DOWNS STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Rocklea** — basalt hills and restricted stony plains with hard spinifex	9.9	
	Augustus — rugged mountain ranges, hills, ridges and plateaux with skeletal soils and tall shrublands or hard spinifex grasslands	3.7	
	Newman — rugged jaspilite plateaux, ridges and mountains with hard spinifex	2.1	
	Platform — narrow raised plains and extensive dissected slopes with hard spinifex and shrubs	0.7	
	Boolgeeda — stony plains with hard spinifex grassland or mulga shrublands	0.1	
			16.5
Low (20 to 30ha/s.u.)	**Prairie** — granite hills and undulating stony plains with low and tall shrublands	23.5	
	Jamindie — stony hardpan plains and stony rises with groved mulga shrublands	21.3	
	Kunderong — sandstone hills and outcrop plains covered in dwarf scrub, minor hardpan plains	6.2	
	Egerton — highly dissected plains and slopes with sparse mulga shrublands	5.1	
	Nirran — undulating stony plains and low hills with mulga shrublands	4.0	
	Collier — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	3.9	
	Charley — dolerite hills and ridges and restricted lower plains; tall and low shrublands	0.3	
			64.3
Moderate (10 to 20ha/s.u.)	**Nooingnin** — hardpan plains and large groves with mulga shrublands	8.9	
	Cadgie — hardpan plains with thin sand cover and sandy banks, soft spinifex and mulga	3.5	
	Warri — low calcrete platforms and plains with mulga and cassia shrublands	2.4	
	Spearhole — gently undulating hardpan plains with groved mulga shrublands	1.2	
	Paraburdoo — stony gilgai plains derived from basalt with snakewood shrublands	1.0	
	Turee — stony plains with numerous gilgaied depressions supporting tussock grasses and very sparse low shrublands	1.0	
	Table — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	0.4	
	Laterite — small laterite mesas and gravelly plains with mulga shrublands	0.2	
	Robe — low plateaux, mesas and buttes of limonite with soft and hard spinifex pastures	0.1	
			18.7
High (5 to 10ha/s.u.)	**River** — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	0.5	0.5
Very high (<5ha/s.u.)		0	0
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS

(298 recordings on 10 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Cadgie	22	86	14	—	—	—	59	32	9	—	59	32	9
Collier	9	100	—	—	—	56	44	—	—	—	100	—	—
Jamindie	62	100	—	—	—	18	56	23	3	—	74	26	—
Kunderong	22	86	14	—	—	—	5	50	36	9	5	81	14
Newman	1	100	—	—	—	—	100	—	—	—	100	—	—
Nirran	24	96	4	—	—	17	17	45	21	—	33	63	4
Nooingnin	57	100	—	—	—	2	47	46	5	—	49	51	—
Prairie	36	78	19	3	—	—	11	47	36	6	11	67	22
Turee	8	100	—	—	—	—	50	50	—	—	50	50	—
Warri	7	86	14	—	—	—	—	14	43	43	—	43	57
Total over all land systems	298	94	6	—	—	8	37	37	15	3	46	47	7

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made on 30 sites on 11 land systems.

Range condition and recommendations

1. **Prairie land system** (23.5 per cent)

   This system supports stony short grass forb (SSGF) and mulga short grass forb (MSGF) pastures with small, but valuable inclusions of mulga creekline (MUCR) and bluebush (CHMA) pastures. The SSGF and MSGF pastures are in fair range condition, but the MUCR and bluebush pastures are mostly in bad condition. The latter two pasture types are the most attractive to stock and are preferentially grazed. As well as pasture deterioration there is minor erosion.

   The worst area of deterioration is near Round Hill bore where bluebush pastures on an extensive drainage floor are seriously depleted. The bluebush will be eliminated from the area if action is not taken soon to reduce stock numbers at this bore and to spell completely over a number of growing seasons.

2. **Jamindie land system** (21.3 per cent of the station area)

   This stony hardpan system is generally in fair to good condition. Stony short grass forb (SSGF) pastures of the system are in fair to good condition while better quality, more productive mulga creekline (MUCR) and tussock grass (TGER) pastures are in fair condition.

   The most important pasture on this system is the mulga creekline type found in groves on the hardpan plains and also along creeklines. The condition of the whole system is determined by the number and vigour of the edible shrubs and perennial grasses in the groves. When a decline in the number and vigour of desirable shrubs is evident the system should be spelled over a number of growing seasons to allow the important shrubs to recover.

3. **Nooingnin land system** (8.9 per cent)

   This flat hardpan plain system supports stony short grass forb (SSGF) pastures on the broad plains, mulga creekline (MUCR) pastures in the large groves and some tussock grass (TGMI) pastures. Condition is fair to good.

   The MUCR and TGMI pastures are the most productive, durable and attractive to stock and receive preferential use. Condition of the whole system is best assessed by observing the composition and vigour of the desirable shrubs of the MUCR pastures in the groves. Maintaining the system and its pastures in their present acceptable condition will require periods of spelling or reduced stocking over growing seasons.

   In the absence of paddocking, stock control can only be partly achieved by manipulating numbers on waters or by periodically closing down watering points.

4. **Kunderong land system** (6.2 per cent)

   This system consists of rugged sandstone hills, undulating stony plains and minor peripheral hardpan plains. Pastures are stony short grass forb (SSGF), mulga short grass forb (MSGF) and some tussock grasses (TGER).

   The SSGF pastures are in good condition whilst the other two types are generally in fair condition. The largest stony units of the system are inherently resistant to erosion, but occasional patchy erosion occurs on drainage floors and other minor units. Taken overall the system is acceptable. Occasional spelling over a growing season is required to improve pasture condition.

5. **Turee land system** (1.0 per cent)

   This system consists of flat, stony gilgai plains flanking some major rivers and creeks. Although the system is small, parts of it support productive and moderately durable tussock grass (TGER) pastures with some useful shrubs. Pasture condition is fair to good and there is no erosion.

6. Seventeen land systems occupy the remaining 39 per cent of the station's area. These are hill and stony systems of low productivity and range condition is mostly good.

7. The station is run on the open range principle. There are few fences, the only paddock being at the homestead for short-term holding purposes and there are no permanent natural watering points. Station improvements consist of artificial watering points often with an adjacent set of yards.

   A long-term fencing programme is required so

that complete control of grazing can be exercised. In the absence of fencing, stock control for pasture maintenance purposes can only be achieved by manipulating stock numbers on waters or by periodically closing down watering points. At the present time, the station is not particularly well watered, and the evidence seen during survey suggests that in the past stock numbers on some waters have been excessive.

8. The station is not yet fully developed as there are considerable areas in the east and north which are poorly utilised or not utilised due to the lack of permanent stock waters. Country suitable for development exists in both areas. One recommended area is directly east of the homestead and is based on pastures of the Warri system. Other areas to the south-east consist of mixed country of the Cadgie, Nooingnin, Prairie and Jamindie land systems.

   A programme of gradual development of extra water supplies in the areas outlined is essential. This will enable a more equitable spread of existing stock over the station and allow reduction in pressure on degraded areas such as near Round Hill bore so that pastures can recover.

9. The recommended carrying capacity for present condition and assuming full development (which is not yet the case, see 8) is 1 020 adults or 1 280 total cattle.

10. The capability cattle unit capacity, if all country was in good range condition and fully developed, is 1 380m adults or 1 730 total cattle.

INDIVIDUAL STATION REPORT

PRAIRIE DOWNS STATION — **227 408 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km) Good	Fair	Bad	E/D*	Sheep unit capacity Recommended	Capability
Prairie	536	MSGF	19	198	19	—	708	944
		SSGF	54	143	17	—	474	642
		MUCR	—	33	53	—	356	1 075
Jamindie	485	SSGF	314	89	—	—	762	806
		MUCR	29	29	—	—	522	725
		TGER	—	24	—	—	202	401
Rocklea	225	HSHI	162	41	—	—	316	345
		STCH	6	5	—	—	75	91
		MUCR	6	5	—	—	103	138
Nooingnin	202	SSGF	73	79	—	—	265	304
		MUCR	11	17	—	—	231	350
		TGMI	11	11	—	—	276	367
Kunderong	141	SSGF	12	95	—	—	226	321
		TGER	—	11	6	—	112	284
		MSGF	—	15	2	—	49	68
Egerton	115	MSGF	65	21	—	—	323	344
		SSGF	17	2	—	—	37	38
		MUCR	7	3	—	—	104	125
Nirran	91	MSGF	28	56	—	—	280	336
		MUCR	3	3	1	—	57	88
Collier	89	MSGF	49	—	—	—	196	196
		SSGF	22	—	—	—	66	66
		STCH	18	—	—	—	149	149
Augustus	85	MSGF	81	—	—	—	162	162
		MUCR	4	—	—	—	50	50
Cadgie	81	SOSP	31	16	8	—	547	688
		SSGF	15	9	2	—	46	52
Warri	54	MSGF	—	43	—	—	129	172
		CHAT	—	3	3	—	32	75
		MUCR	1	2	2	—	30	63
Newman	47	HSHI	47	—	—	—	80	80
Spearhole	26	MSGF	18	—	—	—	72	72
		MUCR	4	—	—	—	50	50
		HSHI	4	—	—	—	10	10
Paraburdoo	24	STCH	9	9	—	—	120	149
		CHAT	2	2	—	—	42	50
		SSGF	2	—	—	—	6	6
Turee	22	SSGF	7	4	—	—	29	33
		TGER	—	9	—	—	76	150
		MUCR	—	2	—	—	11	25
Platform	16	HSHI	14	—	—	—	24	24
		SOSP	2	—	—	—	25	25
River	12	MUCR	8	—	—	—	100	100
		STCH	2	—	—	—	17	17
		No veg	2	—	—	—	—	—
Table	9	MSGF	4	—	—	—	16	16
		CSGF	4	—	—	—	20	20
		MUCR	1	—	—	—	13	13
Charley	6	MSGF	2	1	—	—	6	6
		CSGF	2	1	—	—	13	15
Laterite	4	SSGF	1	1	—	—	5	6
		MSGF	1	1	—	—	7	8
		TGER	—	—	—	—	—	—
Boolgeeda	2	HSHI	2	—	—	—	5	5
		SOSP	—	—	—	—	—	—
Robe	2	SOSP	2	—	—	—	25	25
		HSHI	—	—	—	—	—	—
TOTALS	2 274		1 178	983	113		7 657	10 370

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1 adult	total	At Conversion rate 7.5:1 adult	total
Recommended cattle unit capacity	1 530	1 920	1 020	1 280
Capability cattle unit capacity	2 070	2 590	1 380	1 730

Declared stock numbers (1979) ..... 877 cattle

ROCKLEA STATION — West Pilbara Shire

Location

This station is found on the Mt. Bruce and Turee Creek 1:250 000 map sheets and stretches from the Nanutarra-Wittenoom road in the north to Paraburdoo in the south. The homestead is about two kilometres south of the Nanutarra-Wittenoom road and about 80 km south-west of Tom Price.

The station has common boundaries with Ashburton Downs, Mininer, Turee Creek and Wyloo stations and vacant crown land.

Area within survey

Entire station 184 903 ha.

Description

The useful grazing country on this station is effectively divided into northern and southern halves by a range of basalt hills of which Mt. Jope is part.

About 70 per cent of the station consists of rugged hills and mountains and associated footslopes and narrow valleys. The remainder consists of stony gilgai plains on basalt, undulating plains on granite, low stony plains, low mesas and buttes and restricted narrow flood plains along major rivers.

The hills and mountains, the largest of which is Mt. Jope, are mostly composed of basalt and belong to the Rocklea land system. Smaller areas of ironstone and sandstone hills belong to the Newman and Capricorn systems respectively. Pastures on these systems consist of stony short grass forb (SSGF) and hard spinifex (HSHI) and are of very low pastoral value.

Dissected plains and mesas of the Table, Robe and Platform systems are found in northern parts of the station, but collectively only occupy 2.7 per cent of the total station area. Pastures are similar to the hill land systems previously described.

Stony plains on the station consist of the Prairie, Wona and Boolgeeda systems which carry a variety of pastures of very low to moderate pastoral value. The Wona system forms distinctive undulating cracking clay plains on basalt plateaux and ridge tops of the Rocklea system.

Stony basalt plains and valley floors of the Paraburdoo system occupy 13.3 per cent of the station area. They support useful stony chenopod (STCH) and some saltbush (CHAT) pastures. Pastoral value is moderate. The River land system (1.6 per cent) consists of narrow active flood plains adjacent to major rivers and creeklines and supports mulga creekline (MUCR), stony chenopod (STCH) and some tussock grass (TGCE) pastures. Pastoral value is very high. These two systems support a large proportion of the station's stock.

A total of thirteen land systems occur on the station and are briefly characterised in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) are presented in Table 2. These statements were derived from observations made whilst traversing on the station.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 20 sites on 5 land systems.

Range condition and recommendations

1. **Rocklea land system** (67.4 per cent of the station area)

Table 1 — LAND SYSTEMS ON ROCKLEA STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Rocklea** — basalt hills and restricted stony plains with low shrubs and hard spinifex	67.4	
	Newman — rugged jaspilite plateaux, ridges and mountains with hard spinifex	2.7	
	Boolgeeda — stony plains with hard spinifex grassland or mulga shrublands	1.5	
	Capricorn — rugged hills and ridges with low shrublands or hard spinifex	0.3	
	Platform — narrow raised plains and extensive dissected slopes with hard spinifex and shrubs	0.3	
			72.2
Low (20 to 30ha/s.u.)	**Prairie** — granite hills and undulating stony plains with low and tall shrublands	7.5	
	Ethel — cobble plains with sparse mulga and other Acacia spp. shrublands	0.01	
			7.5
Moderate (10 to 20ha/s.u.)	**Paraburdoo** — stony gilgai plains derived from basalt with snakewood shrublands	13.3	
	Wona — basalt upland plains with snakewood or very sparse low cassia shrublands	2.9	
	Robe — low plateaux, mesas and buttes of limonite with soft and hard spinifex pastures	1.7	
	Table — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	0.7	
	Dollar — stony plains with open snakewood shrublands	0.1	
			18.7
High (5 to 10ha/s.u.)			0
Very high (<5 ha/s.u.)	**River** — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	1.6	1.6
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS

(237 recordings on 7 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Boolgeeda	5	100	—	—	—	—	—	80	—	—	—	100	—
Paraburdoo	87	62	24	7	7	—	15	32	38	15	14	53	33
Prairie	14	36	21	7	36	—	—	29	29	42	—	36	64
River	8	38	49	—	13	—	—	75	25	—	—	62	38
Rocklea	98	81	14	5	—	10	36	23	29	2	45	38	17
Robe	24	92	—	8	—	13	13	53	17	4	25	67	8
Table	1	100	—	—	—	—	—	100	—	—	—	100	—
Total over all land systems	237	71	18	6	5	5	21	35	30	9	26	49	25

Massive basalt hills, ridges, plateaux and foot slopes comprise 90 per cent of this system. Much of this country is poorly assessible and is of limited use for pastoral purposes. In northern parts the hills support hard spinifex (HSHI) pastures which are poorly productive and generally unattractive to livestock. In southern areas the hills support rather better shrubby pastures (MSGF). Range condition is mostly good or fair.

The remaining 10 per cent of the system consists of narrow river valleys and drainage floors. These support good quality pastures in conditions varying from good to very poor. There is occasional erosion on these lower units but, taken overall, the system is stable.

2. **Paraburdoo land system** (13.3 per cent)

This system consists of the broader valley floors and plains between basalt hills of the Rocklea system. The system supports productive but sensitive stony chenopod (STCH) and saltbush (CHAT) pastures beneath snakewood shrubs. Condition of the STCH pastures is fair with patches in good and bad condition. However, the saltbush pastures which occupy the drainage floors are considerably degraded and condition is mostly bad. The drainage floors frequently show active erosion.

About 8 sq. km of the system shows extreme degradation and should not be grazed. The largest single area of extreme degradation is near Globe well in the south-east of the station. This watering point is no longer in use and should remain so until pastures recover.

The Paraburdoo system being readily accessible and supporting attractive pastures has received preferential over-grazing by sheep and cattle in the past. Considerable areas require spelling over a number of consecutive growing seasons and only light use for the remainder of the year. Control of stock numbers is essential and, in the absence of paddocks as is the present case, can only be attempted by limiting the number of stock on watering points or periodically closing down watering points.

The Paraburdoo system is the most important for grazing (apart from the small River system) on the station and a development programme of fencing is required so that proper controlled management can be achieved.

3. **Prairie land system** (7.5 per cent)

This granite based system is found in the north-west of the station and supports mulga short grass forb (MSGF) and stony short grass forb (SSGF) and smaller areas of more valuable mulga creekline (MUCR) and bluebush (CHMA) pastures. The MSGF and SSGF pastures are generally in fair to poor condition. The better quality MUCR and CHMA pastures have been heavily overused and are largely in very poor condition. Minor to severe erosion is common on the drainage floor unit of the system.

In its present condition the whole system is capable of safely supporting only 50 to 80 cattle units on a yearlong basis which is about 58 per cent of its potential for good condition. The system requires spelling over a number of growing seasons to promote pasture recovery. As there are no fences stock control can only be attempted by manipulating numbers on water.

4. **Wona land system** (2.9 per cent)

This elevated plain system on basalt has cracking clay soils and supports stony chenopod (STCH), *Cassia* aff. *hamersleyensis* (CSGF) and hard spinifex (HSHI) pastures. The former two pasture types are in fair condition while the latter is in good condition.

5. The remaining nine land systems on the station constitute 8.9 per cent of the station area. The systems, excepting River, are stony, unproductive types and are all in good condition. The pastures of River land system are degraded in parts with some wind and water erosion while in other areas, especially towards Kazput Pool, they are in original condition.

6. The station changed from sheep to cattle in the early 1960s. It then had numerous fences and about forty watering points. After the change to cattle the fences were not upgraded and have fallen into complete disrepair. Many of the watering points have become derelict, but the present management is upgrading some points.

7. The station is run on the open range system. Cattle are mustered yearly into yards adjacent to watering points. This management system reduces the options for pasture management to varying the cattle numbers at each watering point or closing a watering point down and moving the cattle elsewhere. On some country the degree of control possible by these means is inadequate for proper management. One reason for this is that numerous springs and rock holes in the hills of the station limit the degree of control that can be exercised by manipulating artificial waters.

8. The Paraburdoo, River and Wona land systems support many of the cattle on the station although they only comprise 17.8 per cent of the station area. These systems have been over-utilised in the past and their pastures are degraded and there are areas of serious erosion. Regeneration and stabilisation is imperative if the station's productivity is to be maintained or improved. To do this complete stock control is essential and a fencing programme is required on the Paraburdoo and River systems.

9. The recommended cattle unit capacity for present condition and assuming full development is 940 adnlts or 1 180 total cattle.

10. The capability cattle unit capacity if all country was in good range condition is 1 420 adults or 1 780 total cattle.

INDIVIDUAL STATION REPORT

ROCKLEA STATION — **184 903 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Rocklea	1 246	MSGF	673	359	90	—	3 949	4 984
		STCH	15	27	20	—	300	515
		MUCR	24	12	25	1	449	775
Paraburdoo	247	STCH	30	103	55	—	874	1 560
		CHAT	5	10	21	8	186	550
		SSGF	3	10	2	—	32	45
Prairie	138	MSGF	15	43	3	—	196	244
		SSGF	—	33	22	—	99	165
		MUCR	—	13	9	—	101	275
Wona	53	STCH	20	20	10	—	286	415
		HSHI	3	—	—	—	8	8
Newman	51	HSHI	51	—	—	—	87	87
Robe	31	SOSP	28	—	—	—	175	175
		HSHI	3	—	—	—	5	5
River	30	TGCE	—	4	5	—	97	450
		MUCR	4	5	2	—	84	138
		STCH	2	3	1	—	34	50
		No veg	4	—	—	—	—	—
Boolgeeda	28	HSHI	27	—	—	—	68	68
		SOSP	—	1	—	—	8	13
Table	12	MSGF	4	2	—	—	22	24
		CSGF	3	2	—	—	21	25
		MUCR	1	—	—	—	13	13
Capricorn	5	HSHI	4	—	—	—	7	7
		SSGF	1	—	—	—	3	3
		MUCR	—	—	—	—	—	—
Platform	5	HSHI	4	—	—	—	7	7
		SOSP	1	—	—	—	13	13
Dollar	2	STCH	—	2	—	—	10	17
		MUCR	—	—	—	—	—	—
		TGER	—	—	—	—	—	—
Ethel	1	SSGF	1	—	—	—	2	3
		CHAT	—	—	—	—	—	—
		MUCR	—	—	—	—	—	—
TOTALS	1 849		926	649	265	9	7 067	10 634

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	1 410	1 760	940	1 180
Capability cattle unit capacity	2 130	2 660	1 420	1 780

Declared stock numbers (1979) ..... 1 200 cattle

TANGADEE STATION — Meekatharra Shire

Location

Tangadee station is located on the far east of the Ashburton River catchment on the Collier 1:250 000 map sheet and is about 320 km north by road from Meekatharra. The station has common boundaries with Bulloo Downs, Mt. Vernon and Mulgul stations and vacant crown land.

Area within survey

Entire station 186 362 ha.

Description

Much of Tangadee is rugged and hilly, although there are some extensive areas of plains, especially in the east. The most rugged hill system is Augustus (10.3 per cent of total station area) consisting of massive sandstone ridges and hills in central and southern parts of the property. Pastoral value is very low. Other hill systems with less relief and with some large areas of undulating stony uplands and broad drainage floors are Collier (17.6 per cent), Tangadee (11.1 per cent) and Charley (3.8 per cent). These systems are fairly accessible to stock and support mulga short grass forb (MSGF) pastures and minor areas of stony chenopod (STCH) and chenopod (CHMA) pastures. Pastoral value is low to moderate.

The dissected hardpan plain system Egerton (14 per cent) occurs scattered over the western, central and northern parts of the station. It supports sparse mulga short grass forb (MSGF) and stony short grass forb (SSGF) pastures of low pastoral value. In the east of the property broad hardpan plains of the Jamindie (16.8 per cent) and Three Rivers (11.8 per cent) systems extend for up to 30 km. The plains support poor stony short grass forb (SSGF) pastures with minor areas of more productive pastures on small groves and sandy banks.

All land systems found on the station are briefly described and their pastoral value for good range condition status is indicated in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) are presented in Table 2. These statements were derived from observations made whilst traversing on the station.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soil and range condition were made at 20 sites on 10 land systems.

Range condition and recommendations

1. **Collier land system** (17.6 per cent of total station area)

   This is the largest land system on the station and the condition of the pastures on its hills and stony plain is mostly good and there is no erosion.

2. **Jamindie land system** (16.8 per cent)

   Range condition of this system is fair or good. Some grove units and parts of the broad plains show obvious loss of palatable shrubs, but generally this is

Table 1 — LAND SYSTEMS ON TANGADEE STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hills, ridges and plateaux with skeletal soils and tall shrublands or hard spinifex shrublands	10.3	
	Divide — sand plain and minor dunes with hard spinifex grasslands	6.2	
	Mulgul — rough dolomite hills supporting low shrubs and sparse mulga	0.4	
			16.9
Low (20 to 30ha/s.u.)	**Collier** — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	17.6	
	Jamindie — stony hardpan plains and stony rises with groved mulga shrublands	16.8	
	Egerton — highly dissected plains and slopes with sparse mulga shrublands	14.0	
	Three Rivers — broad hardpan plains with minor sandy banks and sparse mulga shrublands	11.8	
	Charley — dolerite hills and ridges and restricted lower plains; tall and low shrublands	3.8	
	Ethel — cobble plains with sparse mulga and other Acacia spp. shrublands	1.0	
			65.0
Moderate (10 to 20ha/s.u.)	**Tangadee** — low shale hills and undulating plains with mulga woodlands	11.1	
	Laterite — small mesas and gravelly plains with mulga shrublands	3.1	
	Table — low calcrete plateaux mesas and cassia shrublands	2.3	
	Warri — low calcrete platforms and plains with mulga and cassia shrublands	1.2	
	Ford — gently undulating stony plains with a few low hills, mulga shrublands	0.01	
			17.7
High (5 to 10ha/s.u.)	**River** — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	0.4	
			0.4
Very high (<5ha/s.u.)			0
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(274 recordings on 12 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Ashburton	1	—	100	—	—	—	—	100	—	—	—	100	—
Augustus	4	75	25	—	—	50	25	25	—	—	75	25	—
Charley	17	76	24	—	—	6	24	52	6	12	29	59	12
Collier	29	100	—	—	—	21	59	17	3	—	79	21	—
Divide	6	100	—	—	—	33	50	17	—	—	83	17	—
Egerton	49	98	2	—	—	45	51	4	—	—	96	4	—
Ethel	5	100	—	—	—	—	40	40	20	—	40	60	—
Jamindie	48	98	2	—	—	6	33	51	10	—	38	62	—
Laterite	9	89	11	—	—	—	44	44	11	—	44	56	—
Table	8	100	—	—	—	—	50	50	—	—	50	50	—
Tangadee	57	89	11	—	—	5	26	46	21	2	32	61	7
Three Rivers	41	73	27	—	—	—	12	54	27	7	22	66	12
Total over all land systems	274	91	9	—	—	14	35	36	13	2	50	46	4

not severe. There is no erosion. Some parts of the system are not utilised due to the lack of stock waters.

3. **Egerton land system** (14.0 per cent)

This relatively large but poorly productive system is in good range condition.

4. **Three Rivers land system** (11.8 per cent)

Most of the Three Rivers system is in fair range condition with smaller areas in good and bad condition. There is some patchy minor erosion.

Condition of this system is best assessed by inspecting the sandy banks which occur on the broad plains. The banks are a minor unit, but support the most productive pastures and the abundance and vigour of desirable shrubs and grasses on the banks reflects the overall condition of the system. Occasional protection from grazing over a growing season is required to maintain the pastures.

Sections of the Three Rivers system are only partly utilised for grazing due to the absence of permanent watering points.

5. **Tangadee land system** (11.1 per cent)

Low hills, ridges and undulating shale interfluves are the largest units of this system and support mulga short grass forb (MSGF) pastures. Pasture condition is good or fair and there is no erosion. More productive chenopod (CHMA) and mulga creekline (MUCR) pastures occur on minor units such as drainage floors and creeklines. These pastures are favoured by stock, and in some areas mostly to the west of Tangadee homestead, have received heavy use. Here pasture condition has deteriorated to fair or poor and there is occasional minor erosion. Pasture condition can only improve if grazing intensity and grazing period can be controlled. Although the area is unfenced some degree of stock control could be achieved by manipulating numbers on watering points and by periodically closing off waters.

6. Pasture condition on the remaining land systems on the station is nearly all good or fair, and there is no erosion.

7. The station has only limited potential for livestock production — 82 per cent of the property is of low or very low pastoral value. Parts of the property are poorly watered, and a number of additional watering points are required to make better use of existing country and to improve distribution of stock.

8. The recommended cattle unit capacity for present condition and assuming full development is 960 adults or 1 200 total cattle.

9. The capability cattle unit capacity assuming all country was in good range condition is 1 080 adults or 1 350 total cattle.

TANGADEE STATION

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Collier	327	MSGF	180	—	—	—	720	720
		SSGF	66	16	—	—	230	246
		STCH	39	20	6	—	436	540
Jamindie	313	SSGF	101	159	—	—	441	520
		MUCR	10	27	—	—	274	463
		TGER	—	16	—	—	134	267
Egerton	262	MSGF	196	—	—	—	784	784
		SSGF	42	—	—	—	841	841
		MUCR	21	3	—	—	279	300
Three Rivers	221	SSGF	40	121	22	—	284	366
		TGMI	8	25	5	—	360	635
Tangadee	208	MSGF	60	112	5	—	586	708
		CHMA	—	14	7	—	115	263
		MUCR	3	5	2	—	72	125
Augustus	192	MSGF	182	—	—	—	364	364
		MUCR	10	—	—	—	125	125
Divide	115	HSSP	85	18	—	—	197	206
		MUCR	10	2	—	—	136	150
Charley	71	MSGF	13	26	—	—	65	78
		CSGF	9	11	4	—	86	120
		TGER	—	4	4	—	47	134
Laterite	58	SSGF	10	12	1	—	56	69
		MSGF	13	10	—	—	82	92
		TGER	—	12	—	—	101	200
Table	42	MSGF	12	9	—	—	75	84
		CSGF	10	5	2	—	69	85
		MUCR	1	2	1	—	27	50
Warri	22	MSGF	3	11	4	—	53	72
		CHAT	—	1	1	—	11	25
		MUCR	—	2	—	—	11	25
Ethel	18	SSGF	14	—	—	—	42	42
		CHAT	—	3	—	—	25	38
		MUCR	—	1	—	—	6	13
River	8	MUCR	2	3	1	—	45	75
		STCH	—	1	—	—	5	8
		No veg	1	—	—	—	—	—
Mulgul	7	MSGF	5	—	—	—	10	10
		CSGF	1	—	—	—	5	5
		MUCR	1	—	—	—	13	13
TOTALS	1 864		1 148	651	65		7 212	8 104

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	1 440	1 800	960	1 200
Capability cattle unit capacity	1 620	2 030	1 080	1 350

Declared stock numbers (1979) ..... 700 cat

TUREE CREEK STATION — Meekatharra Shire

Location

Turee Creek station is found on the Turee Creek and Newman 1:250 000 map sheets and is about 140 km directly south-west from the iron ore town of Newman. The station has common boundaries with Mininer, Mt. Vernon, Prairie Downs, Rocklea, Juna Downs stations and vacant crown land.

Area within survey

Entire station 277 715 ha.

Description

This property is split into two blocks separated by vacant crown land. The homestead is located on the southern block which is the larger and more productive of the two. It consists of broad alluvial plains of the Turee land system (12.1 per cent of the station's area) which are flanked by either hardpan plains of the Nooingnin and Jamindie land systems or rugged hills of the Kunderong system.

The northern block consists of a narrow river valley (River land system) which is flanked by the mountainous Capricorn and Newman land systems in the west and by undulating hardpan plains of the Jamindie system in the east.

A total of twenty-one land systems are found on the station, and the five largest (Jamindie, Kunderong, Turee, Nooingnin and Kooline) collectively occupy 62 per cent of the total station area. The systems are briefly described and their pastoral value for good range condition status indicated in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) are summarised in Table 2. These statements are derived from the traverse data.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 36 sites on 11 land systems.

Range coudition and recommendations

1. **Jamindie land system** (10.6 per cent of total station area)

Table 1 — LAND SYSTEMS ON TUREE CREEK STATION

Pastoral value	Land systems	Per cent of area
Very low (>30ha/s.u.)	**Divide** — sand plain and minor dunes with hard spinifex grasslands	4.2
	Newman — rugged jaspilite plateaux, ridges and mountains with hard spinifex	2.7
	Platform — narrow raised plains and extensive dissected slopes with hard spinifex and shrubs	2.7
	Capricorn — rugged hills and ridges with low shrublands or hard spinifex	2.5
	Rocklea — basalt hills and restricted stony plains with hard spinifex	1.2
	Boolgeeda — stony plains with hard spinifex grassland or mulga shrublands	0.9
		14.2
Low (20 to 30ha/s.u.)	**Jamindie** — stony hardpan plains and stony rises with groved mulga shrublands	19.6
	Kunderong — sandstone hills and outcrop plains covered in dwarf scrub, minor hardpan plains	15.3
	Egerton — highly dissected plains and slopes with sparse mulga shrublands	4.7
	Kooline — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	6.6
	Ethel — cobble plains with sparse mulga and other Acacia spp. shrublands	0.5
	Charley — dolerite hills and ridges and restricted lower plains; tall and low shrublands	0.1
		46.8
Moderate (10 to 20ha/s.u.)	**Turee** — stony plains with numerous gilgaied depressions supporting tussock grasses and very sparse low shrublands	12.1
	Nooingnin — hardpan plains and large groves with mulga shrublands	9.0
	Warri — low calcrete platforms and plains with mulga and cassia shrublands	4.8
	Table — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	4.0
	Paraburdoo — stony gilgai plains derived from basalt with snakewood shrublands	1.2
	Cadgie — hardpan plains with thin sand cover and sandy banks, grasslands and mulga shrublands	0.5
	Laterite — small laterite mesas and gravelly plains with mulga shrublands	0.1
		31.7
High (5 to 10ha/s.u.)	**River** — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	3.7
	Edward — alluvial plains with sparse degraded saltbush, bluebush and other shrub pastures	3.6
		7.3
Very high (<5ha/s.u.)		0
		100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS

(413 recordings on 15 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Capricorn	4	75	25	—	—	—	25	50	25	—	25	50	25
Divide	4	—	75	25	—	—	—	—	50	50	—	—	100
Edward	24	50	46	4	—	—	4	29	67	—	4	67	29
Egerton	7	43	—	57	—	—	29	14	57	—	29	14	57
Ethel	8	74	13	13	—	—	—	62	38	—	—	75	25
Jamindie	92	89	8	2	1	1	33	49	12	5	33	59	8
Kooline	4	50	25	25	—	—	25	25	50	—	25	25	50
Kunderong	49	78	20	2	—	—	6	39	31	24	6	61	33
Newman	3	100	—	—	—	—	67	33	—	—	67	33	—
Nooingnin	28	96	—	4	—	—	18	29	46	7	18	75	7
Platform	23	83	17	—	—	—	78	13	9	—	78	22	—
River	9	67	33	—	—	—	67	22	11	—	67	22	11
Table	29	97	3	—	—	3	46	10	38	3	48	45	7
Turee	100	85	13	2	—	—	1	28	54	17	1	76	23
Warri	29	94	3	3	—	3	24	46	24	3	28	62	10
Total over all land systems	413	82	14	4	—	1	22	33	34	10	22	60	18

Range condition of this stony hardpan system is fair to good; of the 92 recordings made on the system, 33 per cent, 60 per cent and 8 per cent showed good, fair and bad condition, respectively. Stony short grass forb (SSGF) pastures occur on about 83 per cent of the system and are in good condition whereas the other pastures of the system — tussock grasses (TGER) and mulga creekline (MUCR) — are in fair or bad condition. The latter two pasture types are more productive and drought resistant than the SSGF pastures and are preferentially grazed.

Condition of the Jamindie system should be monitored by observing the condition of desirable shrubs in the groves and narrow drainage tracts. Occasional spelling over one or two growing seasons is required to maintain shrub vigour. Most of the Jamindie system is unfenced and the only way spelling could be carried out is by closing down watering points.

2. **Kunderong land system** (15.3 per cent)

This system consists of rugged sandstone hills which were poorly sampled on traverse and plains which were well sampled. The overall range condition as per traverse data is fair to poor and this reflects the condition of the accessible, more productive plains units. The hills and other areas supporting unproductive stony short grass forb (SSGF) pastures comprise 73 per cent of the system and are invariably in good or fair condition. The plain units support mulga creekline (MUCR) and tussock grass (TGER) pastures which are degraded and sometimes eroded.

3. **Turee land system** (12.1 per cent)

This system is the most important grazing country on the station and is in fair to bad condition. It consists of stony crabhole plains supporting tussock grass (TGER), mulga creekline (MUCR) and stony short grass forb (SSGF) pastures. The pastures have been preferentially grazed and have changed from a mixture of edible shrubs and perennial grasses to pure grass stands or, in some areas, to bare ground. Although the shrubs are only a minor component of the pasture they are a source of high quality fodder during droughts. Their disappearance has reduced pasture durability and the number of animals it can support.

This system is in particularly poor condition around No. 2 well and in the holding paddocks surrounding the homestead. These areas should have priority in a pasture recovery programme.

A further large area of the system is found on the eastern side of the station along Tunnel Creek. At present this area is unfenced and management is on the open range principle. Stock control can only be exercised by manipulating numbers on each watering point or by closing down waters. A programme of fencing is required so that grazing pressure can be properly controlled and pastures maintained in good condition. Fencing would also facilitate mustering and improved animal husbandry.

4. **Nooingnin land system** (9.0 per cent)

This system consists of flat hardpan plains with large groves and sandy banks. Overall condition is fair.

The hardpan plains support very unproductive stony short grass forb (SSGF) pastures which are in good condition. The groves have the potential to support productive mulga creekline (MUCR) pastures, but are now degraded to fair or bad condition.

An area of 12.6 sq. km between No. 8, No. 9 and Limestone bores is severely degraded and eroded. Recovery cannot occur unless stock are excluded from the area.

A long term fencing programme is required to bring this system under proper control. In the present unfenced situation the recovery of degraded shrubby pastures can only be attempted by manipulating cattle numbers at each bore and controlling season of use by closing down mills and moving cattle.

5. **Edward land system** (3.6 per cent)

This system consists of tributary plains supporting sparse saltbush in the south-western corner of the

property near Kennedy well. Condition is fair to bad.

The system is productive, but is very sensitive to use and requires careful management if it is not to deteriorate further. Stock numbers need to be well distributed and carefully controlled and to do this an additional watering point is required.

6. The remaining sixteen land systems comprise 40 per cent of the station and are generally in fair to good condition. The more productive areas are generally in fair to poor condition while the stony unattractive areas are in good condition.

7. The station is managed on the open range system, but has the advantage of some holding paddocks near the homestead. Although there is little erosion on the property, the best pastures are degraded and steps need to be taken to regenerate these.

8. Recommended cattle unit capacity for present condition is 1 330 adults or 1 660 total cattle.

9. Capability cattle unit capacity if all the station were in good condition is estimated at 2 030 adult cattle or 2 540 total cattle.

INDIVIDUAL STATION REPORT

TUREE CREEK STATION — **277 715 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km) Good	Fair	Bad	E/D*	Sheep unit capacity Recommended	Capability
Jamindie	546	SSGF	162	256	31	4	739	906
		MUCR	7	52	7	—	397	825
		TGER	11	16	—	—	318	451
Kunderong	425	SSGF	—	323	—	—	646	969
		TGER	—	13	38	—	444	852
		MSGF	9	31	11	—	151	204
Turee	334	SSGF	—	131	31	2	309	492
		TGER	3	108	26	—	1 043	2 288
		MUCR	—	26	7	—	166	413
Nooingnin	249	SSGF	34	129	14	10	276	374
		MUCR	11	21	—	3	253	438
		TGMI	13	9	5	—	309	451
Kooline	184	SSGF	82	68	1	—	384	453
		MUCR	5	5	8	—	116	225
		CHAT	3	7	5	—	108	186
Warri	133	MSGF	35	53	18	—	299	424
		CHAT	4	7	2	—	113	163
		MUCR	7	7	—	—	126	175
Egerton	130	MSGF	74	24	—	—	368	392
		SSGF	9	12	—	—	51	63
		MUCR	7	4	—	—	109	138
Divide	115	HSSP	104	—	—	—	208	208
		MUCR	5	6	—	—	96	138
Table	111	MSGF	38	18	—	—	206	224
		CSGF	18	18	8	—	160	220
		MUCR	5	6	—	—	96	138
River	103	MUCR	50	17	—	—	719	838
		STCH	—	21	—	—	105	174
		No veg.	15	—	—	—	—	—
Edward	99	CHAT	5	54	26	—	576	1 063
		STCH	—	12	—	—	60	100
		SSGF	1	1	—	—	5	6
Platform	76	HSHI	65	—	—	—	111	111
		SOSP	10	1	—	—	134	138
Newman	76	HSHI	76	—	—	—	129	129
Capricorn	70	HSHI	49	—	—	—	83	83
		SSGF	12	6	—	—	48	54
		MUCR	2	1	—	—	21	38
Rocklea	34	HSHI	31	—	—	—	53	53
		STCH	2	—	—	—	17	17
		MUCR	1	—	—	—	12	12
Paraburdoo	34	STCH	4	14	8	—	119	216
		CHAT	—	6	—	—	50	75
		SSGF	2	—	—	—	6	6
Boolgeeda	25	HSHI	18	6	—	—	55	60
		SOSP	1	—	—	—	13	13
Ethel	15	SSGF	7	5	—	—	31	36
		CHAT	2	—	—	—	25	25
		MUCR	—	1	—	—	6	12
Cadgie	14	SOSP	4	4	2	—	90	125
		SSGF	3	1	—	—	11	12
Laterite	3	SSGF	1	—	—	—	3	3
		MSGF	1	—	—	—	4	4
		TGER	—	1	—	—	8	17
Charley	1	MSGF	1	—	—	—	4	4
		CSGF	—	—	—	—	—	—
		TGER	—	—	—	—	—	—
TOTALS	2 777		1 009	1 501	248	19	9 989	15 234

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1 adult	total	At Conversion rate 7.5:1 adult	total
Recommended cattle unit capacity	2 000	2 500	1 330	1 660
Capability cattle unit capacity	3 050	3 810	2 030	2 540

Declared stock numbers (1979) ..... 1 522 cattle

UAROO STATION — West Pilbara Shire

Location

The bulk of Uaroo station is located on the Yanrey 1:250 000 map sheet with smaller areas on the Wyloo, Edmund and Winning Pool sheets. The North West Coastal Highway runs through the property, and the homestead is located about 130 km south-southeast of Onslow.

The station has common boundaries with Nanutarra, Glenflorrie, Winning, Nyang and Yanrey stations.

Area within survey

Entire station 246 997 ha.

Description

Many different landforms are present on the station. In the far north and north-west low plains of the Uaroo land system predominate (34.3 per cent of total station area), and there are also numerous prominent hills and ridges of the Augustus (9.0 per cent), Capricorn (22.1 per cent) and Boolaloo (1.5 per cent) systems. The centre of the property consists of a series of broad sandy or stony valleys flanked by massive ridges and hills. In the south rugged hills of the very low pastoral value Capricorn land system predominate and there are also low stony plains of the Mundong system (7.7 per cent) which is of moderate pastoral value.

Rous Creek runs south to north tbrough the property for about 60 km and for some of this distance is flanked by the high pastoral value alluvial plains system Rous (4.3 per cent).

A total of 13 land systems are present on the station. These are briefly described and their pastoral value for good range condition status indicated in Table 1.

Condition statements for land systems and for the station as a whole (total over 11 land systems) are presented in Table 2. These statements were derived from traverse records.

Range evaluation sites

1. **Uaroo land system** (34.3 per cent of total station area)

   Seventy-five per cent of the traverse recordings made on this spinifex based system indicated good range condition. Fifteen per cent and 10 per cent of the recordings indicated fair and bad range condition respectively.

   Generally the broad plains of tbe Uaroo system are resistant to grazing and show no erosion. However, some of the smaller units of the system such as tracts receiving sheet flow have received excessive use in the past and are now severely degraded and eroded.

   A total of about 12 sq. km is very severely degraded and should not be grazed. One area of concern is in Racecourse paddock about 2 km to the west of the homestead. Otber areas are near McCarty's bore, Mulvie bore and in Yalgetty paddock. The area in Racecourse paddock could be protected from grazing by a few kilometres of fencing; it is suitable for treatment and requires strip cultivation and seeding with bnffel grass. The other areas may be more difficult to cultivate but are capable of supporting buffel grass.

   The Uaroo system supports a mixture of hard and soft spinifex. The former is of very little use for grazing, but soft spinifex is of moderate value with

Table 1 — LAND SYSTEMS ON UAROO STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Capricorn** — rugged hills and ridges with low shrublands or hard spinifex	22.1	
	Augustus — rugged mountain ranges, hills, ridges and plateaux, with skeletal soils and tall shrublands or hard spinifex grasslands	8.9	
	Boolgeeda — stony plains with hard spinifex grassland or mulga shrublands	0.2	
			31.2
Low (20 to 30ha/s.u.)	**Koolline** — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	13.7	
	Collier — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	2.6	
	Prairie — granite hills and undulating stony plains with low and tall shrublands	0.2	
			16.5
Moderate (10 to 20ha/s.u.)	**Uaroo** — broad sandy plains with hard and soft spinifex grasslands	34.3	
	Mundong — gently undulating plains with open snakewood and mulga shrublands	7.7	
	Giralia— linear dunes and broad sandy plains supporting hard and soft spinifex	2.1	
	Stuart — plains of low or moderate relief with snakewood shrublands and hard and soft spinifex hummock grasslands	2.1	
	Boolaloo — granite hills, domes, tor fields and sandy plains, spinifex grasslands and shrubby grasslands	1.5	
	Nanutarra — low mesas and hills with soft and hard spinifex	0.1	
			47.8
High (5 to 10ha/s.u.)	**Rous** — alluvial plains, sandy and duplex soils with snakewood and other shrublands	4.5	4.5
Very high (<5ha/s.u.)			0
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(255 recordings on 10 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Augustus	11	82	—	9	9	37	18	36	9	—	55	27	18
Boolaloo	2	100	—	—	—	100	—	—	—	—	100	—	—
Capricorn	10	100	—	—	—	70	30	—	—	—	100	—	—
Collier	1	100	—	—	—	—	100	—	—	—	100	—	—
Giralia	12	100	—	—	—	59	25	8	8	—	83	17	—
Kooline	39	87	5	5	3	5	53	31	8	3	59	33	8
Mundong	26	85	15	—	—	—	60	32	8	—	58	38	4
Rous	15	40	53	7	—	—	20	53	27	—	20	53	27
Stuart	9	100	—	—	—	11	45	44	—	—	56	44	—
Uaroo	130	85	8	2	5	41	34	14	5	6	75	15	10
Total over all land systems	255	86	9	2	3	30	37	22	7	4	67	24	9

good drought durability. Old, mature spinifex stands are useless for grazing and management must be aimed at maintaining the pastures in as attractive condition to stock as possible. Spinifex pastures must be burnt on a regular basis about every 4 or 5 years and burning should be late in the year. Burnt areas should be deferred from grazing for 8 to 10 weeks over the growing season following the fire in order to allow desirable grasses, forbs and low shrubs to become established.

Some sections of the Uaroo system in the north-west and elsewhere on the property are poorly utilised or not utilised due to the lack of stock waters. A number of additional waters are required to ensure a more even distribution of stock.

2. **Capricorn (22.1 per cent), Kooline (13.7 per cent) and Augustus (8.9 per cent) land systems**

Nearly all parts of these hill systems are in good range condition with pastures in excellent or good condition and no erosion. Pasture degradation and patchy erosion is present on some minor units such as narrow drainage floors and lower plains. Although the latter units are relatively small in size they are attractive to stock and carry useful shrubby mulga creekline pastures (MUCR) and, on the Kooline system, saltbush (CHAT) pastures. These areas can only be maintained by conservative stocking and occasional spelling over a growing season.

3. **Mundong land system** (7.7 per cent)

This stony plains system is located in the south of the station and supports useful stony chenopod pastures (STCH) and some sparse tussock grass (TGER) pastures. Its condition is fair or good and it has not received much grazing in the past. Additional stock water supplies should be developed so that full utilisation can be made of this piece of country and to assist with an overall programme of better stock distribution on the station.

4. **Rous land system** (4.5 per cent)

Condition of this alluvial plain system is very variable. Of fifteen traverse recordings made on the system 20 per cent, 53 per cent and 27 per cent indicated good, fair and bad range condition, respectively.

About 9 sq. km is very severely degraded and eroded and should not be grazed. The largest single area of degradation is in Racecourse paddock and is continuous with a piece of severely degraded Uaroo land system. Complete protection from grazing and treatments involving mechanical works and seeding as outlined for the Uaroo system (see 1) are required.

5. The remaining seven land systems which collectively occupy 8.8 per cent of the station area are in good or fair condition with no erosion.

6. In terms of paddocks Uaroo is reasonably well-developed, although some fences are in poor condition — elsewhere fences have been recently upgraded. However, the station is not particularly well-watered and has a number of dry areas and corners and unserviceable mills. Additional waters and better distribution of stock are required to enable grazing pressure to be reduced on some traditionally heavily grazed areas.

7. The recommended sheep unit capacity for present condition and assuming full development is 10 740 adults or 13 430 total sheep.

8. The capability sheep unit capacity if all country was in good range condition is 13 790 adults or 17 240 total sheep.

INDIVIDUAL STATION REPORT

UAROO STATION — **246 997 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Uaroo	847	HSSP	538	80	—	—	1 484	1 854
		SOSP	163	33	21	12	2 381	2 863
Capricorn	545	HSHI	382	—	—	—	649	649
		SSGF	136	—	—	—	408	408
		MUCR	14	6	7	—	231	338
Kooline	339.4	SSGF	217	61	—	—	773	834
		MUCR	27	—	7	0.4	361	424
		CHAT	5	19	3	—	228	338
Augustus	220.3	MSGF	148	61	—	—	388	418
		MUCR	3	3	5	0.3	71	138
Mundong	190	STCH	41	67	—	—	675	896
		TGER	6	42	—	—	453	802
		SSGF	24	10	—	—	92	102
Rous	110	TGCE	8	26	8	—	946	2 100
		STCH	8	14	8	9	152	324
		SOSP	7	8	7	—	177	275
		No veg.	7	—	—	—	—	—
Collier	64	MSGF	30	5	—	—	135	140
		SSGF	12	4	—	—	44	48
		STCH	8	4	1	—	88	108
Giralia	53	HSSP	21	5	—	—	73	78
		SOSP	26	1	—	—	333	338
Stuart	51	STCH	7	14	—	—	128	174
		HSHI	13	7	—	—	44	50
		SOSP	6	3	1	—	103	125
Boolaloo	37	HSHI	20	—	—	—	34	34
		SOSP	14	1	—	—	183	188
		STCH	2	—	—	—	17	17
Prairie	6	MSGF	3	—	—	—	38	38
		SSGF	2	—	—	—	6	6
		MUCR	1	—	—	—	13	13
Boolgeeda	5	HSHI	4	—	—	—	10	10
		SOSP	1	—	—	—	13	13
Nanutarra	2	SOSP	2	—	—	—	13	13
		HSSP	—	—	—	—	—	—
TOTALS	2 470		1 906	474	68	21.7	10 744	13 786

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

Recommended sheep unit capacity ..... 10 740 adults — 13 430 total
Capability sheep unit capacity ..... 13 790 adults — 17 240 total
Declared stock numbers (1979) ..... 10 000 sheep, 100 cattle

ULLAWARRA STATION — West Pilbara Shire

Location

Ullawarra station is located on the Edmund 1:250 000 map sheet on the southern boundary of the Ashburton River catchment. It neighbours Amelia, Edmund, Glenflorrie, Kooline, Maroonah and Wanna stations and the Barlee Range Wildlife Sanctuary.

Area within survey

Eighty-five per cent (139 272 ha) of the station falls within the survey area. The remainder is in the Gascoyne River catchment and was mapped during the Gascoyne River survey (1970) but no station report was prepared. The whole station (163 177 ha) is considered in this report.

Description

This station consists of rugged hills, mountains and ridges with associated footslopes, narrow valleys, drainage floors and restricted stony plains. Hill land systems Augustus, Ullawarra, Charley and Collier comprise 89 per cent of the station area. The remaining country consists of stony plain of the Boolgeeda, Egerton, Jamindie, Scoop and a few other minor systems and narrow floodplains of the River system.

About 94 per cent of the station is of very low or low pastoral value and some parts of this are sufficiently rugged and inaccessible to be of no value. Only 3.5 per cent and 2.4 per cent are of moderate and high value respectively.

A total of 13 land systems are present on the station, and these are briefly described according to their landform and vegetation type in Table 1.

Condition statements for land systems and the whole station (total over all land systems) are presented in Table 2. These statements were derived from data recorded whilst traversing on the station.

Range evaluation sites

Detailed description and measurements of landforms, vegetation, soils and range condition were made at 13 sites on 5 land systems.

Range condition and recommendations

1. **Augustus land system** (52 per cent of the station area)

   This system consists of low hills and mountains which support poor hard spinifex (HSHI) and mulga short grass forb (MSGF) pastures. Small inclusions of mulga creekline pasture (MUCR) are found along the narrow drainage lines and these are in good to fair condition. Access to this land system is difficult even on foot, and it offers little attractive grazing and is of very low pastoral value.

2. **Ullawarra land system** (26.6 per cent)

   This system consists of shale and dolerite hills and supports varied pastures of mulga short grass forb (MSGF), cassia short grass forb (CSGF) and bluebush (CHMA) pastures. These pastures are generally in good or fair condition. However, on some areas CSGF pastures have been overgrazed and now support only annuals in season. This CSGF

Table 1 — LAND SYSTEMS ON ULLAWARRA STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hills, ridges and plateaux, with skeletal soils and tall shrublands or hard spinifex grasslands	52.0	
	Boolgeeda — stony plains with hard spinifex grassland or mulga shrublands	1.0	
			53.0
Low (20 to 30ha/s.u.)	**Ullawarra** — dolerite and shale hills and restricted stony plains and drainage floors with mulga and minor chenopod shrublands	26.8	
	Charley — dolerite hills and ridges and restricted lower plains; tall and low shrublands	6.7	
	Collier — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	3.8	
	Egerton — highly dissected plains and slopes with sparse mulga shrublands	2.1	
	Jamindie — stony hardpan plains and stony rises with groved mulga shrublands	1.3	
	Ethel — cobble plains with sparse mulga and other Acacia spp. shrublands	0.4	
			41.1
Moderate (10 to 20ha/s.u.)	**Scoop** — stony plains with snakewood and chenopod shrublands	2.5	
	Table — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	0.9	
	Nadarra — plains and calcrete rises with chenopod shrublands and hard spinifex grasslands	0.1	
			3.5
High (5 to 10ha/s.u.)	**River** — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	1.7	
	Bibbingunna — clay flats with crabholes and sluggish drainage; chenopod and tussock grass pastures	0.7	
			2.4
Very high (<5ha/s.u.)		0	0
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(198 recordings on 8 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Augustus	21	100	—	—	—	52	38	10	—	—	90	10	—
Boolgeeda	3	100	—	—	—	67	33	—	—	—	100	—	—
Charley	7	100	—	—	—	71	29	—	—	—	100	—	—
Collier	13	77	23	—	—	23	46	23	8	—	69	23	8
River	18	94	6	—	—	17	55	28	—	—	72	28	—
Scoop	16	100	—	—	—	—	31	56	13	—	31	69	—
Table	3	100	—	—	—	33	34	33	—	—	67	33	—
Ullawarra	117	91	9	—	—	38	27	26	9	—	65	31	4
Total over all land systems	198	92	8	—	—	35	33	25	7	—	68	29	3

pasture *(Cassia* aff. *hamersleyensis)* is very sensitive to grazing.

3. **Charley land system** (6.7 per cent)

   This system is composed of massive dolerite ridges which support mulga short grass forb (MSGF), cassia short grass forb (CSGF — *Cassia oligophylla*) and minor tussock grass (TGER) pastures, all of which are in good or fair condition.

4. The remaining 14.5 per cent of the station's area is made up of 10 land systems. Condition of these systems is fair or good.

5. This station carried sheep in the recent past and many miles of fencing were erected over rugged hills to provide paddocks. Numerous watering points were also installed.

   Since the property changed to cattle, the fences have fallen into disrepair and most of the waters are no longer working. Grazing is on the uncontrolled open range principle.

6. Very few cattle were seen and total numbers were estimated at only about 500 head. The station appeared not to have been effectively stocked for some years. As a result of the lack of grazing, most of the pastures are in good condition, except for some small areas of badly degraded drainage floors and upland basalt plains.

7. Recommended cattle unit capacity for present condition and assuming full development is 690 adults or 860 total.

8. Capability cattle unit capacity assuming all country was in good range condition is 790 adults or 990 total.

9. This station is not a viable pastoral unit. Any future transfer as a single entity should not be permitted and efforts should be made to amalgamate all or part of Ullawarra with the adjoining property Edmund. Failing this, it is recommended that the property revert to crown land or become part of the Barlee Range Wildlife Sanctuary.

INDIVIDUAL STATION REPORT

ULLAWARRA STATION — **163 177 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Augustus	849	MSGF	807	—	—	—	1 614	1 614
		MUCR	38	4	—	—	497	525
Ullawarra	437	MSGF	292	44	—	—	650	672
		CHMA	23	42	5	—	598	875
		CSGF	22	9	—	—	137	155
Charley	109	MSGF	60	—	—	—	120	120
		CSGF	37	—	—	—	185	185
		TGER	6	6	—	—	151	200
Collier	62	MSGF	26	8	—	—	128	136
		SSGF	12	4	—	—	44	48
		STCH	8	4	—	—	86	100
Scoop	40	STCH	12	4	10	—	140	216
		CHAT	6	1	1	—	86	100
		MUCR	—	5	1	—	31	75
Egerton	34	MSGF	20	6	—	—	96	104
		SSGF	4	1	—	—	14	15
		MUCR	2	1	—	—	33	38
River	28	MUCR	14	4	—	—	197	225
		STCH	4	2	—	—	43	50
		No veg.	4	—	—	—	—	—
Jamindie	21	SSGF	5	12	—	—	28	34
		MUCR	1	2	—	—	23	38
		TGER	—	1	—	—	8	17
Boolgeeda	17	HSHI	16	—	—	—	40	40
		SOSP	1	—	—	—	13	13
Table	14	MSGF	5	2	—	—	26	28
		CSGF	4	2	—	—	26	30
		MUCR	1	—	—	—	13	13
Bibbingunna	12	CHMA	—	6	—	—	50	75
		TGER	—	6	—	—	50	100
Ethel	7	SSGF	6	—	—	—	18	18
		CHAT	1	—	—	—	13	13
		MUCR	—	—	—	—	—	—
Nadarra	2	STCH	1	—	—	—	8	8
		CHMA	1	—	—	—	13	13
		HSHI	—	—	—	—	—	—
TOTALS	1 632		1 439	176	17		5 179	5 893

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	1 040	1 300	690	860
Capability cattle unit capacity	1 180	1 480	790	990

Declared stock numbers (1979) ..... 900 cattle

URALA STATION — West Pilbara Shire

Location

Urala station is located on the Onslow 1:250 000 map sheet with a very small area extending on to the Yanrey sheet. The station fronts the coast and the mouth of the Ashburton River is located in the north-west of the station near the old Onslow township. The station has common boundaries with Minderoo and Koordarrie stations.

Area within survey

Entire station 55 988 ha.

Description

The station consists of broad, gently undulating sand plain, low lying sand plain, sand dunes, clay plains and bare saline mud flats and tidal creeks with dense fringing mangrove communities.

The largest land system on the station is Littoral. About 70 per cent of this system consists of saline mud flats with no vegetation. The remaining smaller units of the system support soft spinifex (SOSP) and samphire pastures. Overall pastoral value is very low.

Only three other systems, namely Onslow, Yankagee and Dune, are present on the station and these collectively occupy 47.6 per cent of the total area. These systems support soft spinifex and tussock grass pastures (including introduced buffel grass) and pastoral value is high.

Further brief descriptions of the systems are provided in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) are presented in Table 2. These statements were derived from observations made whilst traversing on the station.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soil and condition status were made at 6 sites on 1 land system.

Range condition and recommendations

1. **Littoral land system** (52.4 per cent of station area)

   Condition of the small areas of samphire and soft spinifex pastures on this system is good and there is no erosion.

2. **Onslow land system (41 per cent)**

   Overall range condition of this mixed spinifex and tussock grass system is good. There are occasional areas where pasture deterioration is evident and condition status is fair. No areas in bad condition were seen.

   Buffel grass has established well on parts of the Onslow system and, in some cases, now dominates over the soft spinifex.

3. **Yankagee (3.5 per cent) and Dune (3.1 per cent) land systems**

   Overall range condition of these soft spinifex systems is good.

   Fire is an important management tool on these systems and on the Onslow system. Old, mature spinifex stands are of no use for grazing and management must be aimed at maintaining the pastures in as attractive condition as possible to stock. To do this the spinifex must be burnt on a regular basis about every 4 or 5 years and burning should be late in the year. Burnt areas should be deferred from grazing for 8 to 10 weeks over the growing season following the burn in order to allow desirable grasses and low shrubs to become established.

4. The station is well-paddocked, but not particularly well-watered due to high salinity of much of the ground water. Additional waters probably in the form of dams are required in the south and south east if maximum use of available pastures is to be made.

Table 1 — LAND SYSTEMS ON URALA STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Littoral** — extensive bare coastal mudflats flanked by mangroves and narrow sandy plains..	52.4	52.4
Low (20 to 30ha/s.u.)			0
Moderate (10 to 20ha/s.u.)			0
High (5 to 10ha/s.u.)	**Onslow** — sand plain, dunes and clay plains with soft spinifex and tussock grasses.....	41.0	
	Yankagee — plains with dunes and numerous claypans, soft spinifex and snakewood shrublands	3.5	
	Dune — dune fields with soft spinifex and minor hard spinifex grasslands.....	3.1	
			47.6
Very high (<5ha/s.u.)			0
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS

(60 recordings on 2 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Littoral	3	100	—	—	—	—	100	—	—	—	100	—	—
Onslow	57	95	5	—	—	21	58	19	2	—	79	21	—
Total over all land systems	60	95	5	—	—	20	60	18	2	—	80	20	—

An area on the eastern side of the Ashburton River in the vicinity of the old Onslow township does not appear to be used to any great extent. Despite difficulty of access at certain times of the year this area should be brought into production so that stock can be better distributed over the property.

5. The recommended sheep unit capacity for present condition and assuming full development is 4 870 adults or 6 090 total sheep.

6. The capability sheep unit capacity if all country was in good range condition is 5 220 adults or 6 530 total sheep.

INDIVIDUAL STATION REPORT

URALA STATION **55 988 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Littoral	293	SOSP	18	—	—	—	225	225
		SAMP	18	—	—	—	72	72
		STCH	8	4	—	—	86	100
		No veg	245	—	—	—	—	—
Onslow	230	SOSP	98	15	—	—	1 350	1 413
		TGMI	49	31	—	—	1 079	1 336
		TGCE	32	—	—	—	1 600	1 600
		No veg	5	—	—	—	—	—
Yankagee	20	SOSP	8	—	—	—	100	100
		TGCH	4	—	—	—	132	132
		CHAT	—	3	—	—	25	38
		No veg	5	—	—	—	—	—
Dune	17	SOSP	15	—	—	—	188	188
		TGER	1	—	—	—	17	17
		No veg	1	—	—	—	—	—
TOTALS	560		507	53	—	—	4 874	5 221

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

Recommended sheep unit capacity ..... 4 870 adults — 6 090 total

Capability sheep unit capacity ..... 5 220 adults — 6 530 total

Declared stock numbers (1979) ..... 3 335 sheep

WANNA STATION — Upper Gascoyne Shire

Location

Wanna station lies on the divide between the catchments of the Ashburton and Gascoyne Rivers and is wholly located on the Edmund 1:250 000 map sheet. The homestead is about 440 km north-east by road from Carnarvon with access via Gascoyne Junction and Gifford Creek station. There is also access to Meekatharra via Mt. Augustus station.

The station has common boundaries with Amelia, Dooley Downs, Mt. Augustus, Gifford Creek, Edmund and Ullawarra stations.

Area within survey

About 51 per cent of the station (133 847 ha) falls within the survey area. The remainder is in the Gascoyne River catchment and was mapped during the Gascoyne River catchment survey (1970). As a result of the 1970 survey a report was prepared for that portion of the station falling within the Gascoyne catchment.

This report refers mainly to that part of the station falling within the catchment of the Ashburton River although some comments about the southern portion within the Gascoyne River catchment are also made.

Description

The northern half of the station which was subject to detailed survey consists of massive ranges and hills with some narrow valleys and stony plains.

About 72 per cent of the area is of low pastoral value and consists of rough hills of the Ullawarra, Charley and Collier land systems and stony plains of the Ethel and Egerton systems.

Only 3.4 per cent of the surveyed area is of moderate or high pastoral value. Country of moderate value consists of the Scoop and Table land systems (collectively occupying 0.8 per cent of the station area) which support mixed pastures including stony chenopod (STCH), mulga creekline (MUCR) and saltbush (CHAT). The River system (2.6 per cent) is of high value and consists of narrow active floodplains flanking major rivers and creeks and supports productive mulga creekline (MUCR) pastures.

A total of 10 land systems occur on the area surveyed and all are briefly described in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) are presented in Table 2. These statements were derived from observations made whilst traversing on the station.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soil and range condition were made at 8 sites on 3 land systems.

Range condition and recommendations

1. Range condition of all the land systems on the portion of Wanna surveyed is either good or fair. Seventy-three per cent and 27 per cent of the 108 recordings made whilst traversing indicated good and fair range condition respectively (see Table 2). There are no problems of pasture degradation or erosion.

2. Although the southern half of the station was not subject to detailed survey, parts of it, including most of the watering points, were briefly inspected. At the time of survey (June 1978) the station was not occupied and most of the mills were either not operating or were derelict. Cattle carcasses (up to 20)

Table 1 — LAND SYSTEMS ON WANNA STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Augustus** — rugged mountain ranges, hills, ridges and plateaux, with skeletal soils and tall shrublands or hard spinifex grasslands	69.9	
	Mulgul — rough dolomite hills supporting low shrubs and sparse mulga	2.5	
			72.4
Low (20 to 30ha/s.u.)	**Ullawarra** — dolerite and shale hills, restricted stony plains and drainage floors, with mulga and minor chenopod shrublands	9.6	
	Ethel — cobble plains with sparse mulga and other Acacia spp. shrublands	6.1	
	Charley — dolerite hills and ridges and restricted lower plains with tall and low shrublands	5.1	
	Collier — undulating stony uplands, low hills and ridges and stony lower plains with mulga shrublands	1.9	
	Egerton — highly dissected plains and slopes with sparse mulga shrublands	1.5	
			24.2
Moderate (10 to 20ha/s.u.)	**Scoop** — stony plains with snakewood and chenopod shrublands	0.6	
	Table — low calcrete plateaux, mesas and lower plains with mulga and cassia shrublands	0.2	
			0.8
High (5 to 10ha/s.u.)	**River** — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	2.6	2.6
Very high (<5ha/s.u.)			0
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS

(108 recordings on 8 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Augustus	30	97	—	3	—	70	30	—	—	—	97	3	—
Collier	2	100	—	—	—	50	50	—	—	—	100	—	—
Ethel	33	97	3	—	—	36	40	18	6	—	76	24	—
Mulgul	6	100	—	—	—	—	34	33	33	—	33	67	—
River	4	100	—	—	—	100	—	—	—	—	100	—	—
Scoop	4	100	—	—	—	—	25	25	50	—	25	75	—
Table	1	100	—	—	—	100	—	—	—	—	100	—	—
Ullawarra	27	96	4	—	—	—	52	26	22	—	52	48	—
Total over all land systems	108	97	2	1	—	37	37	15	11	—	73	27	—

perhaps 6 months to 1 year old were common around non-operative watering points. The total number of live cattle on the whole station was estimated to be less than 400.

3. The station appears to be operated on a spasmodic opportunistic basis. The northern surveyed part of the station is operated on the open range principle which is acceptable for this class of country provided that the number of stock on watering points are controlled. The rugged and unproductive nature of the area makes fencing and further development impractical and uueconomic.

4. The recommended cattle unit capacity for present condition of the northern surveyed part of the station is 540 adults or 680 total cattle.

5. The capability cattle unit capacity of the surveyed area if all country was in good range condition is 580 adults or 720 total cattle.

INDIVIDUAL STATION REPORT

WANNA STATION

Area surveyed 133 847 ha

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Augustus	936	MSGF	889	—	—	—	1 778	1 778
		MUCR	31	16	—	—	476	588
Ullawarra	129	MSGF	58	41	—	—	178	198
		CHMA	11	10	—	—	209	263
		CSGF	9	—	—	—	45	45
Ethel	81	SSGF	57	8	—	—	187	195
		CHAT	9	3	—	—	137	150
		MUCR	2	2	—	—	36	50
Charley	69	MSGF	38	—	—	—	76	76
		CSGF	23	—	—	—	115	115
		TGER	4	4	—	—	100	134
River	34	MUCR	22	—	—	—	275	275
		STCH	7	—	—	—	58	58
		No veg	5	—	—	—	—	—
Mulgul	33	MSGF	17	8	—	—	45	50
		CSGF	—	7	—	—	21	35
		MUCR	—	1	—	—	6	13
Collier	26	MSGF	14	—	—	—	56	56
		SSGF	7	—	—	—	21	21
		STCH	5	—	—	—	42	42
Egerton	20	MSGF	15	—	—	—	60	60
		SSGF	3	—	—	—	9	9
		MUCR	2	—	—	—	25	25
Scoop	8	STCH	3	2	—	—	35	42
		CHAT	—	2	—	—	17	25
		MUCR	—	1	—	—	6	13
Table	2	MSGF	1	—	—	—	4	4
		CSGF	1	—	—	—	5	5
		MUCR	—	—	—	—	—	—
TOTALS	1 338		1 233	105	—	—	4 022	4 325

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity (part station)	800	1 000	540	680
Capability cattle unit capacity (part station)	870	1 090	580	730

Declared stock numbers (1979) ..... 280 cattle

WYLOO STATION — West Pilbara Shire

Location

Most of Wyloo station is located on the Wyloo 1:250 000 map sheet, but parts of the station also extend into the Edmund, Mt. Bruce and Turee Creek sheets. The homestead is situated about 200 km west by road from the township of Tom Price. The station has common boundaries with Rocklea, Ashburton Downs, Kooline, Glenflorrie and Mt. Stuart stations and vacant crown land.

Area within survey

Entire station 328 037 ha.

Description

At its western end Wyloo station has about 30 km of frontage to the Ashburton River which runs in a north-west direction through the property. The Hardy River runs from the east through the full length of the property and joins the Ashburton River about 10 km south-west of the homestead. The important alluvial plain land systems, Ashburton and River, are closely associated with the rivers and collectively occupy 6.6 per cent of the total station area. Pastoral value is potentially very high. Tributary plain systems, Edward and Cheela, occupy 8.4 per cent of the station area and pastoral value is potentially high.

Rugged hill land systems flank the river plains in the west, north and south of the property. The Kooline system consisting of rough shale hills, saline drainage floors and broad braided creeks occurs in the west and south and occupies 30.8 per cent of the total area. Pastoral value is low. High sandstone, dolomite and jaspilite ranges and plateaux of the Capricorn and Newman systems and basalt hills of the Rocklea system occur in the centre and north of the property. Pastoral value is very low.

A number of stony plains systems such as Paraburdoo, Dollar and Boolgeeda are associated with the hill systems.

A total of 16 land systems occur on the property and these are briefly described and their pastoral value for good range condition indicated in Table 1.

Condition statements for land systems and for the station as a whole (total over all land systems) are presented in Table 2. These statements are derived from traverse data.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 42 sites on 10 land systems.

Range condition and recommendations

1. **Kooline land system** (30.8 per cent of the station area)

   Some rugged hilly sections of the Kooline system in the west and elsewhere on the property have not been developed for pastoral purposes and are too poor for development. Elsewhere on the property

Table 1 — LAND SYSTEMS ON WYLOO STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Capricorn** — rugged hills and ridges with low shrublands or hard spinifex	16.9	
	Rocklea — basalt hills and restricted stony plains with hard spinifex	13.6	
	Boolgeeda — stony plains with hard spinifex grassland or mulga shrublands	6.5	
	Newman — rugged jaspilite plateaux, ridges and mountains with hard spinifex	3.6	
	Augustus — rugged mountain ranges, hills, ridges and plateaux with skeletal soils and tall shrublands or hard spinifex grasslands	1.1	
			41.7
Low (20 to 30ha/s.u.)	**Kooline** — rough shale hills, saline drainage floors and broad braided creeks, sparse shrubs	30.8	
	Prairie — granite hills and undulating stony plains with low and tall shrublands	1.2	
			32.0
Moderate (10 to 20ha/s.u.)	**Paraburdoo** — stony gilgai plains derived from basalt with snakewood shrublands	6.0	
	Dollar — stony plains with open snakewood shrublands	3.6	
	Stuart — plains of low or moderate relief with snakewood shrublands and hard or soft spinifex hummock grasslands	0.8	
	Robe — low plateaux, mesas and buttes of limonite with soft and hard spinifex pastures	0.6	
	Boolaloo — granite hills, domes, tor fields and sandy plains, spinifex grasslands and shrubby grasslands	0.3	
			11.3
High (5 to 10ha/s.u.)	**Cheela** — degraded alluvial plains with very sparse shrublands	6.1	
	Edward — alluvial plains with sparse degraded saltbush, bluebush and other shrub pastures	2.3	
			8.4
Very high (<5ha/s.u.)	**Ashburton** — active floodplains and backplains with deep silty loam and clayey soils, shrublands and tussock grasslands	4.9	
	River — narrow active flood plains flanking major rivers and creeks with moderately dense tall shrublands	1.7	
			6.6
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(479 recordings on 11 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Ashburton	41	68	27	5	—	—	10	32	29	29	10	51	39
Boolgeeda	38	68	29	3	—	—	21	58	18	3	21	61	18
Cheela	74	11	43	27	19	—	—	15	47	38	—	14	86
Capricorn	94	79	15	6	—	3	40	31	24	2	43	39	18
Dollar	66	54	29	14	3	—	6	21	52	21	6	49	45
Edward	9	11	11	11	67	—	—	11	45	44	—	11	89
Kooline	51	67	25	6	2	6	22	35	27	10	27	46	27
Paraburdoo	43	44	45	9	2	—	—	28	51	21	—	51	49
Prairie	2	100	—	—	—	—	—	—	100	—	—	100	—
River	18	33	45	22	—	—	11	44	39	6	11	56	33
Rocklea	43	85	10	5	—	24	26	38	5	7	50	38	12
Total over all land systems	479	56	28	11	5	3	16	30	35	16	20	41	39

low shale hills and footslopes (the largest units of the system) are occasionally utilised by livestock. Pastures are poor quality stony short grass forb (SSGF) and range condition is good or fair.

Other units such as saline lower plains and drainage floors with braided streams receive preferential use. These units have the potential to support valuable chenopod (CHAT) and mulga creekline (MUCR) pastures. Past levels of use have been excessive and have resulted in serious pasture deterioration and widespread erosion. In order to improve condition many areas require spelling over a number of consecutive growing periods and conservative stocking for the rest of the year. Such a management programme automatically presupposes adequate fencing and paddocks.

2. **Capricorn, Rocklea, Boolgeeda and Newman land systems**

These four land systems are the second, third, fourth and eighth largest on the station and collectively occupy 40.6 per cent of the total station area. They are of very low pastoral value. Condition of the large hilly parts is invariably good but condition of the more attractive pastures on the smaller units is sometimes poor or very poor. However, taken overall, there are no serious problems of degradation or landscape instability on these systems.

3. **Cheela land system** (6.1 per cent)

This alluvial plains system occurs as a single area in the east of the property. The original shrub and perennial grass pastures on the system are seriously degraded and considerable wind and water erosion has occurred in the past and is still occurring. The traverse data presented in Table 2 details the severity of degradation on the system.

About 96 sq. km is degraded to the extent that pastures are short-lived ephemerals after rain or episodic flooding. Very few palatable shrubs remain, and the pasture has no drought durability. For much of the year the ground surface is bare and completely exposed to the action of wind and water.

The area is well-equipped with artificial waters (but is entirely unfenced) to make opportunistic use of the flush of annual growth in season. However, the area has far higher potential for grazing livestock than it can realise in its present condition — it is presently assessed as producing at only 13 per cent of its capacity.

A regeneration project on the severely degraded area is required as a matter of urgency. Recovery of perennial vegetation and consequeut stabilisation of the landscape can only be achieved if the area is closed to graziug for a number of years. To do this and for future management it is imperative that the area be fenced.

The area is suitable for strip cultivation and seeding treatments to hasten the recovery process. Buffel and birdwood grass and possibly some chenopod shrubs should be seeded in test areas. Because of the vagaries of the climate it is impossible to accurately predict the length of time required for recovery, but it is anticipated that the minimum time for closure to grazing would be five years.

4. **Paraburdoo land system** (6 per cent)

The major units of the system are stony basalt plains and slopes supporting snakewood shrubs. All the stony chenopod (STCH) pastures beneath the snakewood show some degradation, but generally this is not severe. Overall condition of this unit is fair and there is no erosion.

Small, but important units of the system are drainage floors supporting attractive chenopod (CHAT) pastures. Pasture condition is predominantly poor or very poor and erosion is common. Eighty-six per cent of the traverse observations made on drainage floors indicated bad range condition.

5. **Ashburton land system** (4.9 per cent)

Ten per cent, 51 per cent and 39 per cent of the traverse recordings made on the system respectively indicated good, fair and bad range condition. Some minor wind and water erosicn in the form of patchy scalds, hummocks and surface stripping occurs, but generally is not serious. Shrub and grass vegetation varies from very sparse to quite dense. The introduced buffel grass has established well on banks, levees and parts of the floodplain. It has also stabilised or partly stabilised areas of past wind hummocking.

Despite the fact that pastures are degraded and producing well below their potential the system is reasonably productive and stable. Condition could

be improved by spellng over a number of growing seasons and actively promoting the spread of buffel grass. Control of grazing pressure and season of use is possible at the present time as the system is already paddocked, but pasture and stock management could be further improved by additional subdivision.

6. **Dollar land system** (3.6 per cent)

The majority of the system is in fair condition, but there are also some substantial areas in bad condition. Degradation consists of considerable loss of desirable perennial shrubs in stony chenopod (STCH) and mulga creekline (MUCR) pastures. Little erosion is present on the former pasture type as it is confined to inherently resistant gibber plains, but moderate and severe sheeting, rilling and gullying is common on drainage floors supporting MUCR pastures.

An area of about 2 sq. km about 8 km south-west from Wyloo homestead near Turner bore is very severely degraded and should be withdrawn from use. Elsewhere the system needs spelling over a number of growing seasons and conservative stocking for the remainder of the year.

7. **Edward land system** (2.3 per cent)

Wherever this system occurs on the station it is profoundly degraded. Thirty-two per cent (24 sq. km) of the system is severely damaged with very poor pasture condition and active erosion. This area should be closed to grazing. The remainder of the system is in bad range condition and requires special management.

The Edward system once supported productive chenopod (CHAT) and stony chenopod (STCH) pastures, but it is extremely sensitive under grazing. In many areas sandy surface layers of the original duplex soils have been stripped leaving hard bare clay plains. Rilling, guttering and sheeting is widespread on broad drainage zones.

Rehabilitation can be achieved, but only if the areas are fenced to enable complete stock control. Strip cultivation treatments to promote water penetration and provide a seedbed on hard scalded surfaces will be necessary on the worst sections. Seeding with birdwood and buffel grasses and a range of chenopod shrubs should be undertaken.

8. The remaining six land systems on the station occupy 5.7 per cent of the area. With the exception of the River land system they are of little significance in terms of carrying capacity. Condition is mostly good or fair.

9. The condition of the plains country on Wyloo clearly indicates that past levels of use have been excessive and that past management systems have been deficient. Very large numbers of sheep were run almost exclusively on the river frontages and adjacent plains. The capacity of the country to carry stock without damage to the vegetation and landscape was considerably overestimated.

In attempting to assess a safe carrying capacity for the station as a whole it must be remembered that about 45 per cent of the area is undeveloped and consists of rocky hills and ranges of negligible pastoral value.

10. Recommended cattle unit capacity for present condition is 1 370 adults or I 710 total cattle.

11. Capability cattle unit capacity if all country was in good range condition is 2 950 adults or 3 690 total cattle.

INDIVIDUAL STATION REPORT

WYLOO STATION — **328 037 ha**

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Kooline	1 009	SSGF	331	438	58	—	1 956	2 481
		MUCR	13	34	54	—	528	1 263
		CHAT	—	27	54	—	359	1 013
Capricorn	553	HSHI	290	97	—	—	590	658
		SSGF	64	63	11	—	335	414
		MUCR	7	6	15	—	170	350
Rocklea	446	HSHI	233	145	24	—	565	683
		STCH	3	8	11	—	87	183
		MUCR	15	4	3	—	219	275
Boolgeeda	214	SSGF	55	130	18	—	452	609
		SOSP	3	5	3	—	89	138
Cheela	203	TGER	—	3	48	51	184	1 703
		CHAT	—	3	43	45	132	1 138
		TGCE	—	5	5	—	117	500
Paraburdoo	196	STCH	—	142	7	—	724	1 237
		CHAT	—	4	28	3	103	438
		SSGF	—	12	—	—	24	36
Ashburton	160	TGCE	7	47	26	—	1 376	4 000
		CHMA	7	47	26	—	496	1 000
Newman	120	HSHI	120	—	—	—	204	204
Dollar	118	STCH	3	61	30	—	390	780
		MUCR	—	8	8	2	58	188
		TGER	2	—	4	—	47	100
Edward	76	CHAT	—	—	41	24	103	813
		STCH	—	7	2	—	39	75
		SSGF	—	2	—	—	4	6
River	56	MUCR	—	20	—	—	110	250
		TGCE	—	11	6	—	240	850
		STCH	2	6	3	—	53	91
		No veg.	8	—	—	—	—	—
Prairie	39	MSGF	17	—	—	—	68	68
		SSGF	4	11	1	—	36	48
		MUCR	1	2	3	—	33	75
Augustus	35	MSGF	33	—	—	—	66	66
		MUCR	1	1	—	—	18	25
Stuart	26	STCH	4	7	—	—	68	91
		HSHI	10	—	—	—	25	25
		SOSP	3	2	—	—	54	63
Robe	18	SOSP	8	8	—	—	84	100
		HSHI	2	—	—	—	3	3
Boolaloo	11	HSHI	6	—	—	—	10	10
		SOSP	4	—	—	—	50	50
		STCH	—	1	—	—	5	8
TOTALS	3 280		1 256	1 367	532	125	10 264	22 108

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

	At Conversion rate 5:1		At Conversion rate 7.5:1	
	adult	total	adult	total
Recommended cattle unit capacity	2 050	2 560	1 370	1 710
Capability cattle unit capacity	4 420	5 530	2 950	3 690

Declared stock numbers (1979) ..... 1 500 cattle

YANREY STATION — West Pilbara Shire

Location

Yanrey station is located on the Yanrey 1:250 000 map sheet and the homestead is about 50 km north by road from Barradale roadhouse which is on the North West Coastal Highway. The station has common boundaries with Giralia, Koordarrie, Minderoo, Nanutarra, Uaroo and Nyang stations.

Area within survey

Entire station 250 782 ha.

Description

All of Yanrey is usable grazing country consisting of broad sandy plains with dunes, and extensive alluvial clay plains.

The Yannarie River flows from the south and floods out and dissipates over a broad, low lying plain area to the west of the station homestead. The low lying area constitutes the Yanrey land system (4.5 per cent of the station area). This system supports a coolibah woodland with a dense tussock grass ground layer and is of very high pastoral value. Two other alluvial plain systems, Rous and Minderoo, are also classified as being of very high pastoral value giving a collective total of 30.4 per cent of the station's area in this category.

Just under 34 per cent of the station is of high pastoral value. These areas are the alluvial clay plain systems Cheetara and Globe in the centre and east of the property and the sandy plains and dunes of the Yankagee, and Dune systems in the north-west.

Nearly all of the remainder of the station (35.8 per cent) is of moderate pastoral value and consists of sandy plains and dunes of the Giralia system and plains with thin sand cover of the Uaroo system.

A number of other systems occur on the station but because of their very small area they are of little significance. All of the systems (15) on the station are briefly described and their pastoral value for good range condition shown in Table 1.

Condition statements for land systems and for the station as a whole (total over all systems) have been prepared from data collected whilst traversing on the station and are presented in Table 2.

Range evaluation sites

Detailed descriptions and measurements of landform, vegetation, soils and range condition were made at 34 sites on 8 land systems.

Range condition and recommendations

1. **Giralia land system** (24.4 per cent of station area)

   This large sandy system which supports a mixture of hard and soft spinifex (HSSP and SOSP) is mostly in good range condition.

   Hard spinifex is of very little use for grazing but soft spinifex is of moderate value and has good drought durability. Old, mature spinifex stands are useless for grazing and management must be aimed at maintaining the pastures in as attractive condition to stock as possible. To do this the spinifex must be burnt on a regular basis about every 4 or 5 years and burning should be late in the year. Burnt areas

Table 1 — LAND SYSTEMS ON YANREY STATION

Pastoral value	Land systems	Per cent of area	
Very low (>30ha/s.u.)	**Littoral** — extensive bare coastal mudflats flanked by mangroves and narrow sandy plains	0.1	0.1
Low (20 to 30ha/s.u.)	**Egerton** — highly dissected plains and slopes with sparse mulga shrublands	0.1	0.1
Moderate (10 to 20ha/s.u.)	**Giralia**— linear dunes and broad sandy plains supporting hard and soft spinifex	24.4	
	Uaroo — broad sandy plains with hard and soft spinifex grasslands	10.3	
	Boolaloo — granite hills, domes, tor fields and sandy plains, spinifex grasslands and shrubby grasslands	0.7	
	Robe — low plateaux, mesas and buttes of limonite with soft and hard spinifex pastures	0.1	
	Nanutarra — low mesas and hills with soft and hard spinifex	0.1	
			35.6
High (5 to 10ha/s.u.)	**Cheetara** — alluvial clay plains with gilgais, mixed open tussock grasslands and tall shrublands	11.4	
	Globe — degraded alluvial plains supporting snakewood shrublands and minor tussock grasslands	10.9	
	Yankagee — plains with dunes and numerous claypans, soft spinifex and snakewood shrublands	10.6	
	Dune — dune fields with soft spinifex and minor hard spinifex grasslands	0.8	
	Onslow — sand plain, dunes and clay plains with soft spinifex and tussock grass	0.1	
			33.8
Very high (<5ha/s.u.)	**Minderoo** — alluvial plains supporting tall shrublands and tussock grasslands and areas of sand supporting hummock grassland	15.9	
	Rous — alluvial plains, sandy and duplex soils with snakewood and other shrublands	10.0	
	Yanrey — active flood plains with grassy woodlands	4.5	
			30.4
			100.0

Table 2 — CONDITION STATEMENTS DERIVED FROM TRAVERSE RECORDS
(422 recordings on 12 land systems)

Land system	No. of recordings	Total erosion (%)				Pasture condition (%)					Range condition (%)		
		nil	minor	mod.	severe	exc.	good	fair	poor	v. poor	good	fair	bad
Boolaloo	1	100	—	—	—	100	—	—	—	—	100	—	—
Cheetara	45	96	4	—	—	—	11	49	31	9	11	78	11
Dune	5	100	—	—	—	100	—	—	—	—	100	—	—
Giralia	95	97	3	—	—	64	23	12	1	—	87	13	—
Globe	52	19	39	25	17	—	6	34	33	27	6	31	63
Minderoo	75	75	12	4	9	25	27	27	8	13	52	29	19
Onslow	2	100	—	—	—	50	50	—	—	—	100	—	—
Robe	1	100	—	—	—	—	100	—	—	—	100	—	—
Rous	49	50	24	12	24	—	31	31	24	14	31	33	36
Uaroo	62	100	—	—	—	65	32	3	—	—	97	3	—
Yankagee	24	100	—	—	—	70	13	13	4	—	83	17	—
Yanrey	11	100	—	—	—	9	18	55	18	—	27	73	—
Total over all land systems	422	79	11	5	5	34	22	23	13	8	56	27	17

should be deferred from grazing for 8 to 10 weeks over the growing season following the fire in order to encourage establishment of desirable grasses and shrubs.

The system is generally resistant to degradation, although some wind erosion can occur if a prolonged dry spell occurs after burning. Re-establishment of vegetative cover and stabilisation occurs rapidly after rain.

2. **Minderoo land system** (15.9 per cent)

Range condition of the Minderoo system is extremely variable as the units of the system vary markedly in their sensitivity to grazing.

Sand dunes and sand plains comprise 25 per cent of the system and support soft spinifex (SOSP) pastures. These units are relatively resistant to grazing and pasture condition is good and there is no erosion.

Plains with through drainage, gilgai plains and swamps and depressions comprise about 55 per cent of the system and support a range of tussock grass pastures such as weeping grass (TGCH) and mitchell grass (TGAS). Range condition is mostly fair although considerable areas are also in good and bad condition. Due to the lack of slope and heavy clay soils of the gilgai plains and swamps no erosion occurs even when pastures are severely depleted. On the other hand, plains with through drainage often show moderate wind and water erosion.

Plains supporting snakewood occupy about 15 per cent of the system and this unit is inherently very sensitive to grazing. Stony chenopod (STCH) and chenopod (CHAT) pastures are now severely degraded and the duplex soils of the unit have been actively eroded. The soil surface is often bare and scalded and wind hummocking under the snakewood shrubs is widespread.

About 18 sq. km mostly of the snakewood plains unit of the Minderoo system are so severely degraded that they should not be grazed. The major areas of concern are east of Cronks bore in Lower Myallie paddock and in northern parts of Two Mile paddock. A large area of severely degraded Globe land system also occurs in Lower Myallie paddock and this paddock should be closed to grazing for a number of years. In order to hasten recovery strip contour cultivation and seeding with buffel and birdwood grass should be undertaken.

3. **Cheetara land system** (11.4 per cent)

This system consists of flat clay plains with and without gilgais and supports Roebourne plains grass (TGER) pastures and shrubs. Pasture condition is predominantly fair and there is no erosion. A systematic system of spelling paddocks over one or two growing seasons is required to improve pasture condition.

4. **Globe land system** (10.9 per cent)

Condition of this system varies from good to severely degraded. Some units of the system are far more sensitive to grazing use than others and condition varies accordingly. The most sensitive unit is the alluvial plain unit supporting snakewood. Thirty of the 47 recordings (64 per cent) made on this unit indicated bad range condition. Shrub pastures are badly depleted and erosion in the form of hummocking, scalding and thin surface sheeting is widespread.

About 31 sq. km of the Globe system is so degraded and unstable that it should be closed to grazing.

The main problem areas are in North Goonagarrie, Lower Myallie and Paddy's paddocks. North Goonagarrie paddock is relatively small and should be completely closed to grazing for such time as is necessary for reasonable recovery to be effected. Remedial treatments to hasten recovery should be undertaken and these will involve strip cultivation and seeding with buffel and birdwood grass.

Parts of Lower Myallie and Paddy's paddocks also require complete spelling for a number of years. Additional fencing would be required to do this or alternatively the whole paddock could be closed to grazing. Regeneration programmes in these two paddocks need not commence concurrently with the programme in North Goonagarrie paddock.

The time period for full regeneration cannot be accurately predicted, but it is anticipated that partial recovery will require about five years of complete protection from grazing and the cultural treatments previously mentioned.

5. **Rous land system** (10 per cent)

   This alluvial plain system flanks the Yannarie River and supports mixed pastures of buffel grass (TGCE), stony chenopods (STCH) and soft spinifex (SOSP). Overall condition as indicated by traverse data is about evenly distributed between good, fair and bad. Soils of the system are frequently duplex with coarse sandy surface horizons overlying clay. Some areas show moderate and severe erosion and vegetation is very sparse; elsewhere the system is stable with a good cover of shrubs, soft spinifex and introduced buffel grass.

   Sixteen sq. km of the system, mostly near Paddy's bore and 2 Mile Well, are very seriously degraded and require special treatment including exclusion of stock and strip cultivation and seeding.

6. The remaining 10 land systems which collectively occupy 27.4 per cent of the total station area are in good or fair range condition. There are no serious problems of pasture degradation or erosion.

7. About 85 per cent of Yanrey is well-developed in terms of paddocks and watering points. However, considerable areas of the Yankagee and Minderoo systems in the north-west and north of the property are very poorly utilised due to the lack of stock waters. Ground water is usually very saline but the area should be brought into production by constructing dams at suitable locations.

   Pastoral value of this country is high and it is vital that it is brought into use so that grazing pressure can be reduced on areas that are currently receiving excessive use and so that regeneration work involving destocking on problem areas can commence.

8. A feature of Yanrey is the sharp contrast in condition encountered between land systems and also between units of the one land system. As a generalisation all the spinifex-based systems are in good condition. The regularly flooded tussock grass plain systems (e.g. Yanrey) are in good or fair condition frequently with dense and highly productive vegetation. Other alluvial plain systems have land units and pasture types which are sensitive to grazing and, from the evidence of severe degradation seen during survey, it is obvious that past levels of use on these particular units have been excessive.

9. A total of about 65 sq. km of country is of particular concern because of the severely degraded condition of the vegetation and soils. As outlined elsewhere in this report these areas require drastic remedial treatments including destocking and cultivation and seeding. Paddocks containing country requiring treatment are listed approximately in order of decreasing urgency.

   1. North Goonagarrie
   2. Lower Myallie
   3. Paddy's
   4. Two Mile
   5. Five Mile

10. The recommended sheep unit capacity for present condition and assuming full development and use of the property (which is not the case at present, see 7) is 24 030 adults or 30 040 total sheep.

11. The capability sheep unit capacity if all country was in good range condition is 38 190 adults or 47 140 total sheep.

YANREY STATION

INDIVIDUAL STATION REPORT

250 782 ha

Land system	Area (sq. km)	Pasture lands	Range condition (sq. km)				Sheep unit capacity	
			Good	Fair	Bad	E/D*	Recommended	Capability
Giralia	612	HSSP	275	31	—	—	887	918
		SOSP	266	40	—	—	3 657	3 825
Minderoo	400	TGCH	62	110	48	—	3 744	7 260
		SOSP	94	6	—	—	1 225	1 250
		STCH	3	14	25	18	145	498
		No veg.	20	—	—	—	—	—
Cheetara	285	TGER	31	223	31	—	2 484	4 760
Globe	273	CHAT	5	38	76	31	568	1 875
		TGER	10	54	43	—	763	1 787
		SOSP	6	10	—	—	158	200
Yankagee	266	SOSP	101	—	—	—	1 263	1 263
		TGCH	40	19	—	—	1 586	1 947
		CHAT	19	18	—	—	387	463
		No veg.	69	—	—	—	—	—
Uaroo	259	HSSP	189	—	—	—	567	567
		SOSP	70	—	—	—	875	875
Rous	251	TGCE	27	28	40	—	2 032	4 750
		STCH	—	24	48	16	216	730
		SOSP	29	21	—	—	537	625
		No veg.	18	—	—	—	—	—
Yanrey	112	TGCH	9	77	—	—	1 375	2 838
		TGCE	20	6	—	—	1 120	1 300
Dune	21	SOSP	18	—	—	—	225	225
		TGER	2	—	—	—	33	33
		No veg.	1	—	—	—	—	—
Boolaloo	18	HSHI	10	—	—	—	17	17
		SOSP	7	—	—	—	88	88
		STCH	—	1	—	—	5	8
Nanutarra	3	SOSP	3	—	—	—	19	19
		HSSP	—	—	—	—	—	—
Robe	2	SOSP	2	—	—	—	13	13
		HSHI	—	—	—	—	—	—
Onslow	2	SOSP	1	—	—	—	13	13
		TGMI	1	—	—	—	17	17
		TGCE	—	—	—	—	—	—
		No veg.	—	—	—	—	—	—
Egerton	2	MSGF	2	—	—	—	8	8
		SSGF	—	—	—	—	—	—
		MUCR	—	—	—	—	—	—
Littoral	2	SOSP	1	—	—	—	13	13
		SAMP	1	—	—	—	4	4
		STCH	—	—	—	—	—	—
		No veg.	—	—	—	—	—	—
TOTALS	2 508		1 412	720	311	65	24 027	38 189

*Areas of extreme degradation; severe erosion and/or pasture degradation, zero carrying capacity.

Recommended sheep unit capacity ..... 24 030 adults — 30 040 totals

Capability sheep unit capacity ..... 38 190 adults — 47 740 totals

Declared stock numbers (1979) ..... 12 731 sheep, 1 102 cattle

PHOTO PLATES

The following photographs show some of the many different types of country found within the survey area and illustrate the variable condition of the pastures and soils.

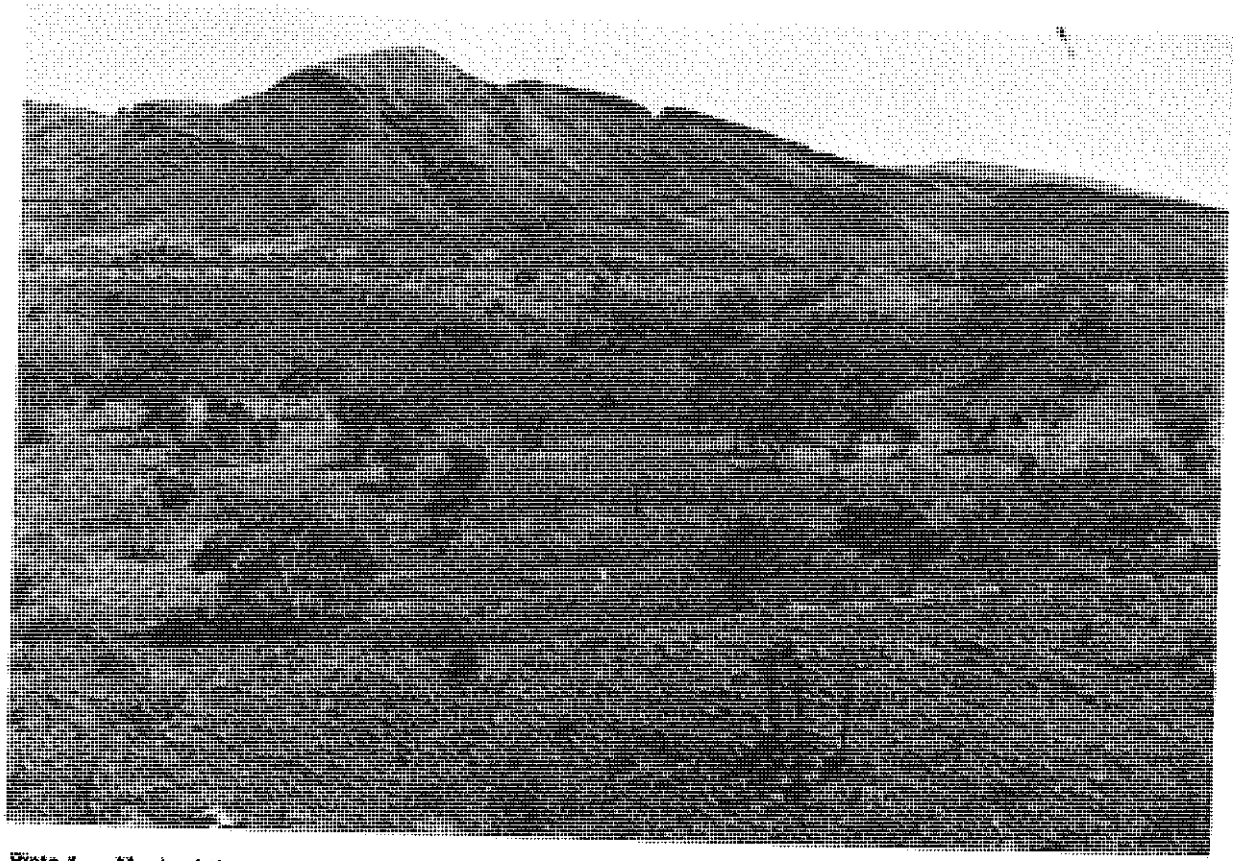


Plate 1 — Much of the area, particularly in the north and east, consists of rough hills and ranges of low or very low pastoral value. Some sections are sufficiently rugged as to be unsuitable for pastoral purposes. Pastures are either hard spinifex or mulga short grass forb. Pasture condition is good or very good and the shallow stony soils are inherently resistant to erosion. Platform land system with hills of the Newman system in the background, Q. 374.

Plate 2 — Sandy plains supporting hard spinifex (*Triodia lanigera, T. basedowii)* or mixtures of hard spinifex and soft spinifex *(Triodia pungens, Plectrachne schinzii)* are extensive in coastal areas and also occur in eastern parts. Pastoral value varies from very low to moderate depending on the proportion of soft spinifex in the stand. Spinifex pastures are relatively stable under grazing and their condition is usually fair to very good. Wind erosion can occur if a prolonged dry period follows burning but stabilisation occurs rapidly after rain. Divide land system, Q67.

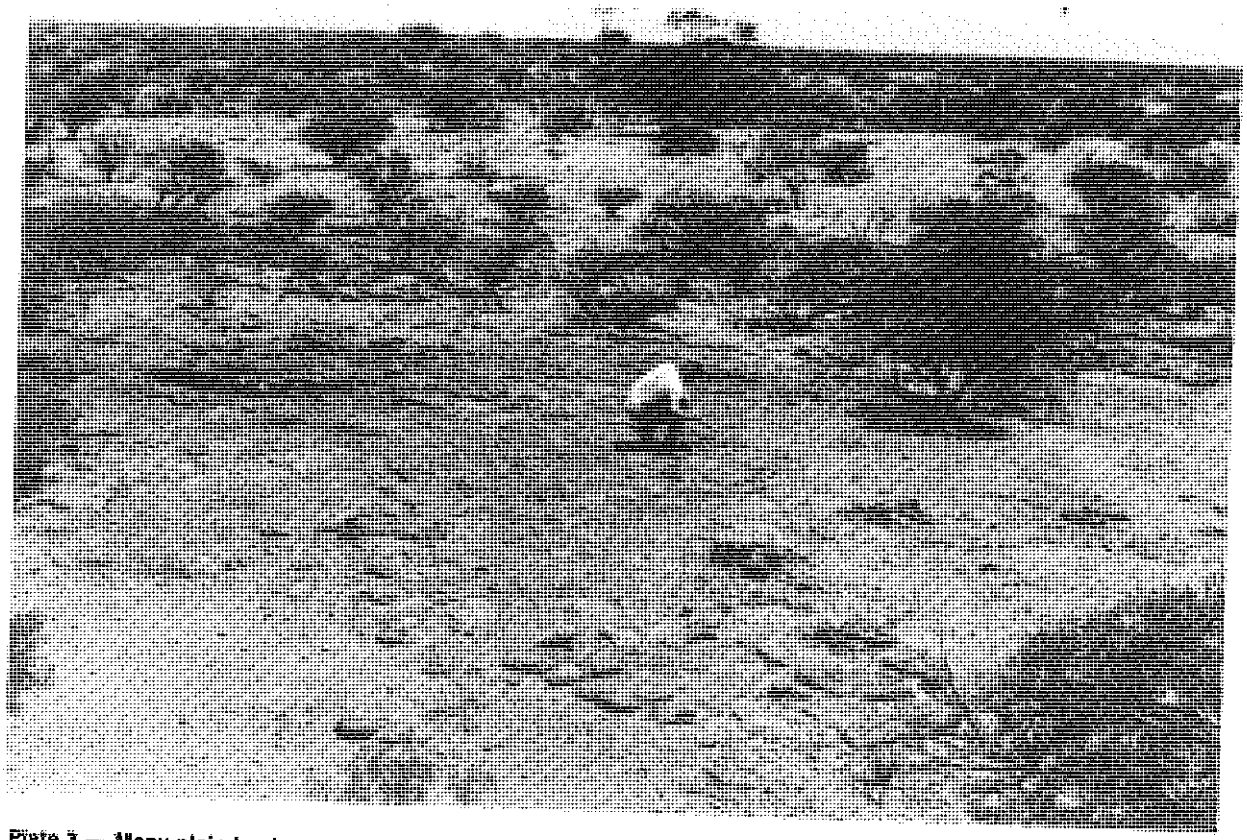


Plate 3 — Many plain land systems in the east of the survey area are underlain at shallow depth by a red brown hard pan layer cemented by silica. Pastures consist of very sparse *Acacia* and other shrubs with annual grasses and forbs in season. Overall pastoral value is very low as there are few durable shrubs for times of drought. In some cases the few useful shrubs have been lost due to overgrazing. Generally there is no erosion. Egerton land system with hardpan exposed at the surface, Q66.

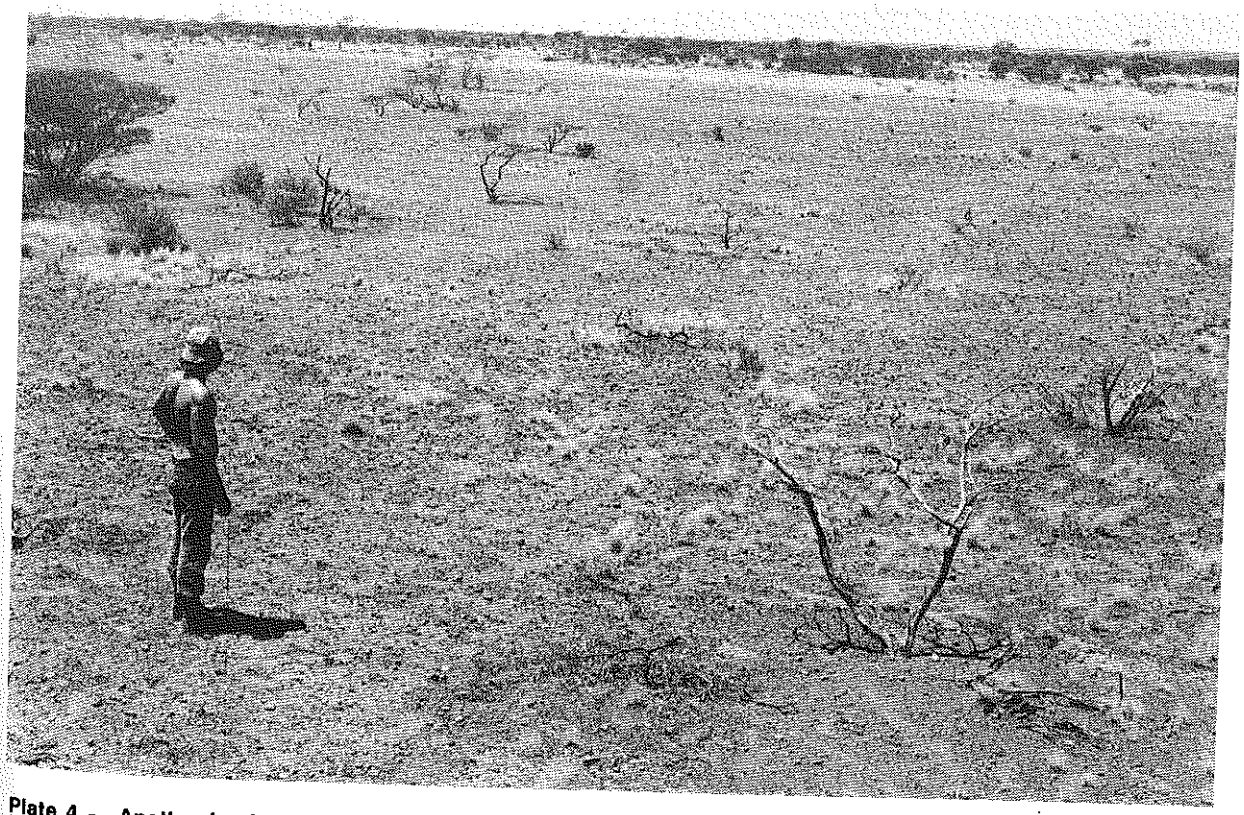


Plate 4 — Another hardpan plain land system showing sparse stony short grass forb pastures. Some of the few perennial shrubs are moribund or dead. Range condition is fair and carrying capacity is very low. Three Rivers land system, Q73.

Plate 5 — Although, taken overall, the stony hills, stony plains and hardpan plains of the catchment are poorly productive they do support small, dense areas of useful pastures. These are in parts of the landscape, such as along creeklines, drainage foci and groves, which are favoured by extra water running on from adjacent areas. The range condition of the country can be judged by the abundance and vigour of desirable shrubs and grasses in these locations. Condition throughout the catchment is variable ranging from extremely degraded with active erosion to very good. Narrow drainage floor in very good condition, Kooline land system. Desirable low shrubs include cotton bush *(Ptilotus obovatus)*, **ruby saltbush** (*Enchylaena tomentosa)*, **tall saltbush** *(Rhagodia eremaea)* **and Wilcox bush** *(Eremophila leucophylla)* **Q365.**

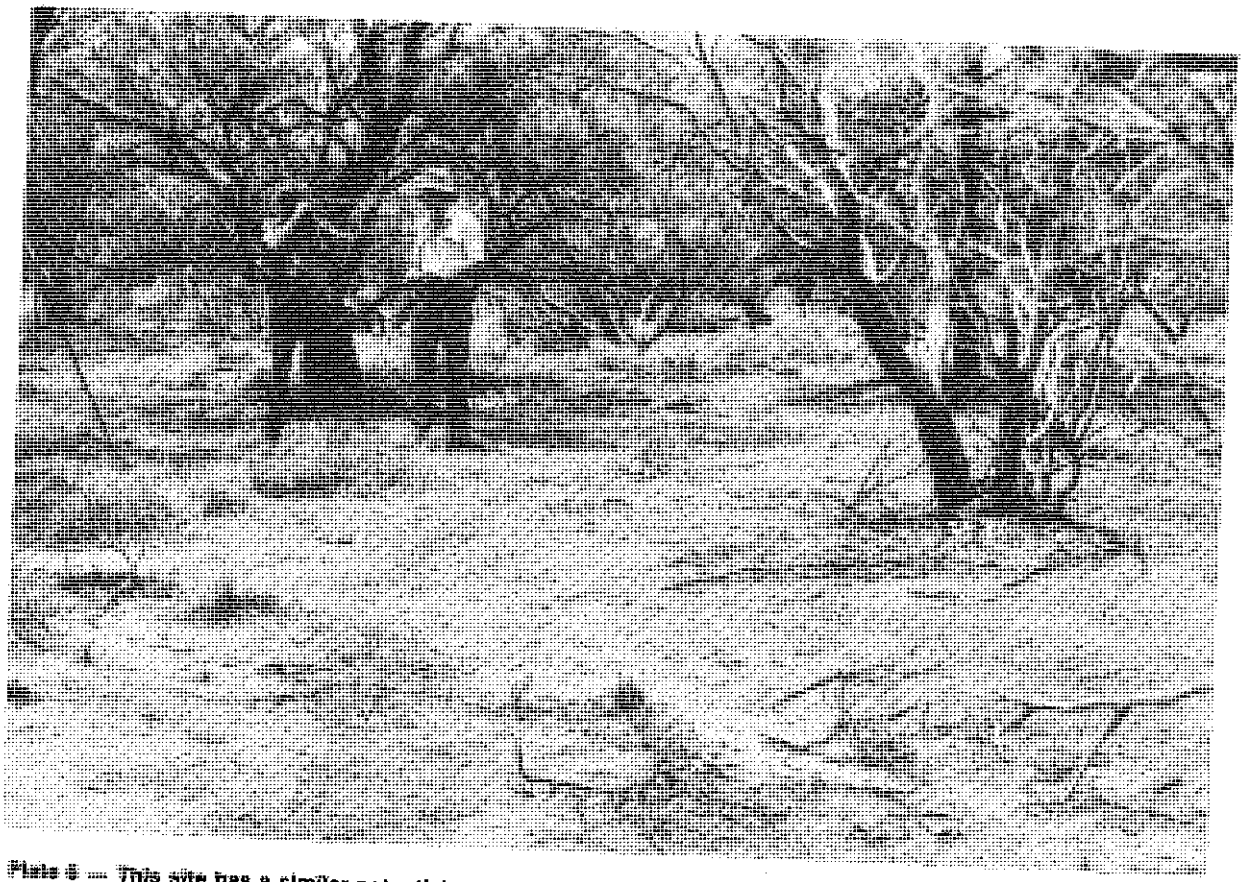


Plate 6 — This site has a similar potential to that shown in Plate 5. Pasture condition is poor as the important low shrub layer and sparse perennial grasses have been eliminated by overgrazing. As yet there is little erosion on this site but water flow through the area has accelerated due to the lack of ground cover and channel incision and redistribution of soil is increasing. Narrow drainage floor, Mundong land system, Q524.

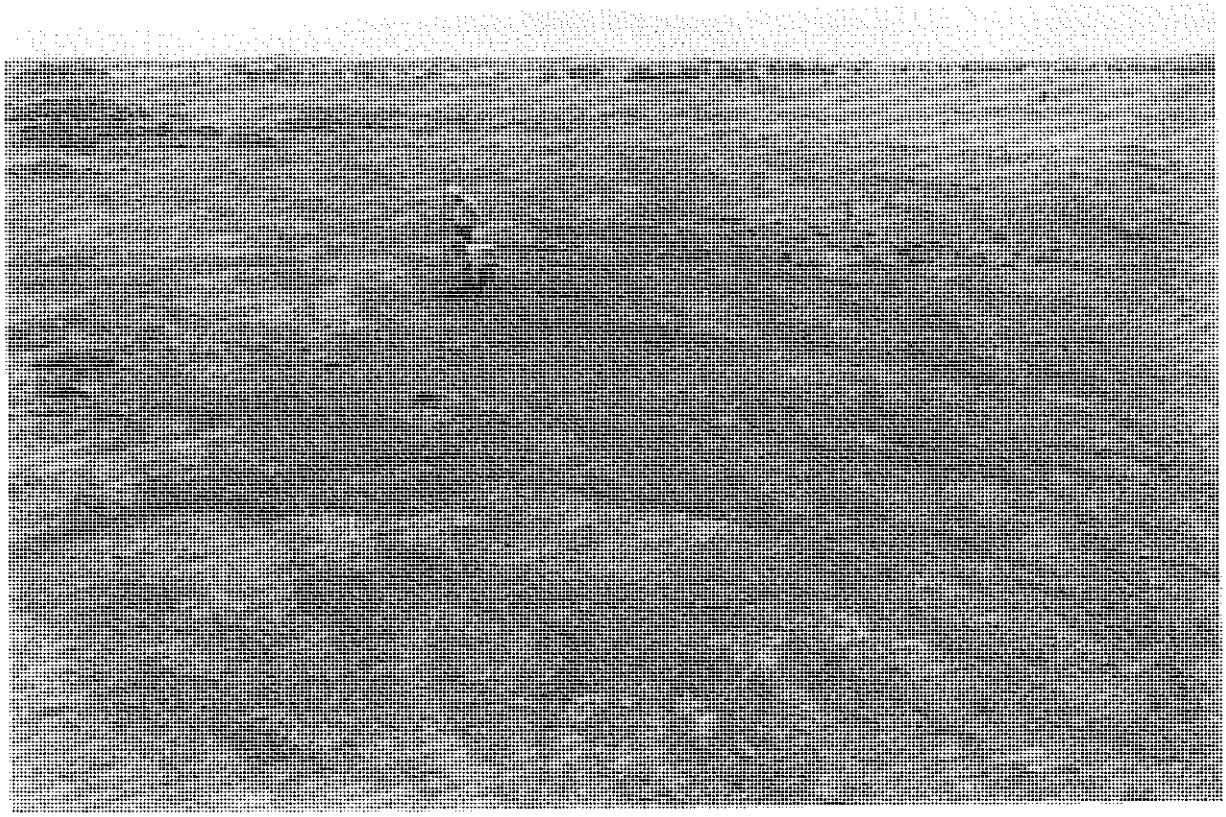


Plate 7 — A number of valuable alluvial plain land systems flank the Ashburton River. Parts of these are in good condition with highly productive pastures, but other parts are profoundly degraded with extensive stripped, scalded surfaces devoid of perennial vegetation. Severely degraded flood plain Ashburton land system, Q255.

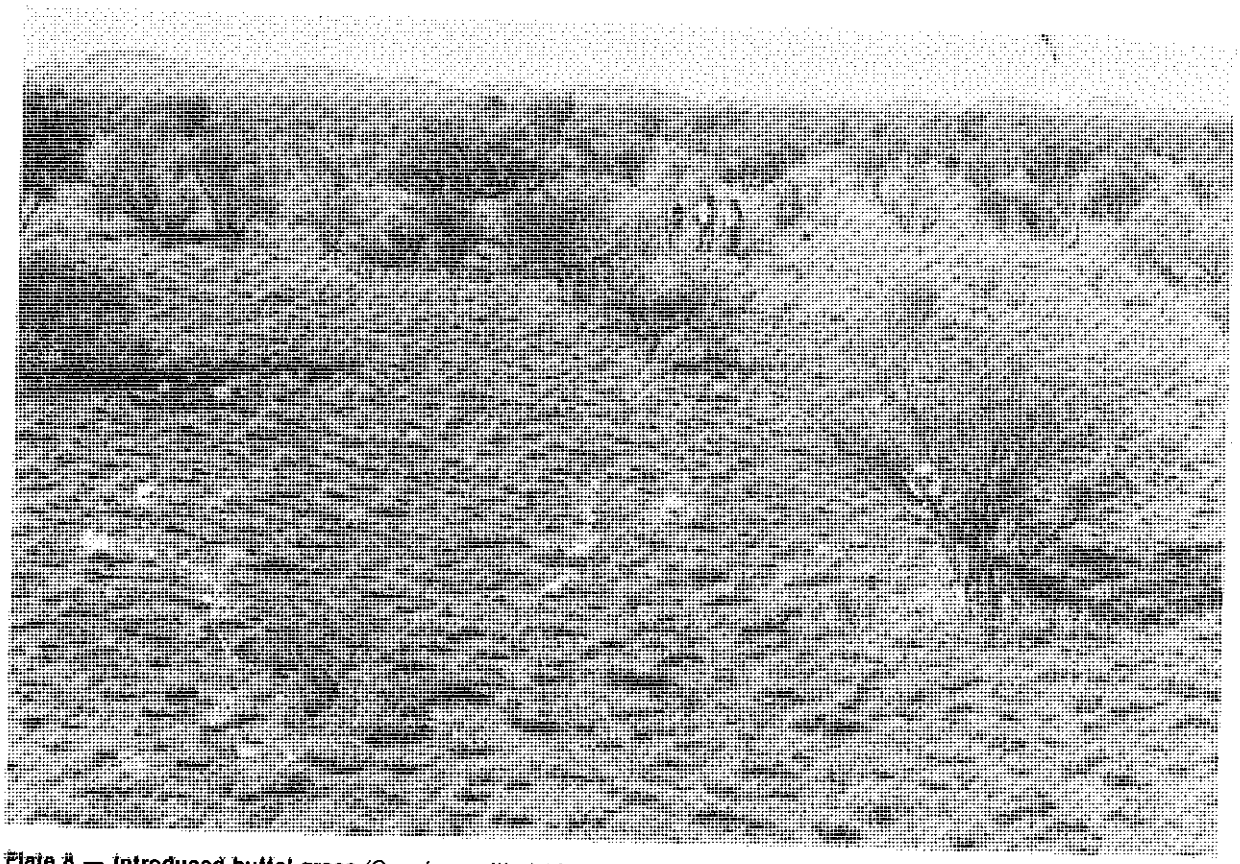


Plate 8 — Introduced buffel grass *(Cenchrus ciliaris)* has established well and stabilised some parts of flood plains flanking the Ashburton River and its major tributaries. Flood plain in good condition, Ashburton land system, Q342.

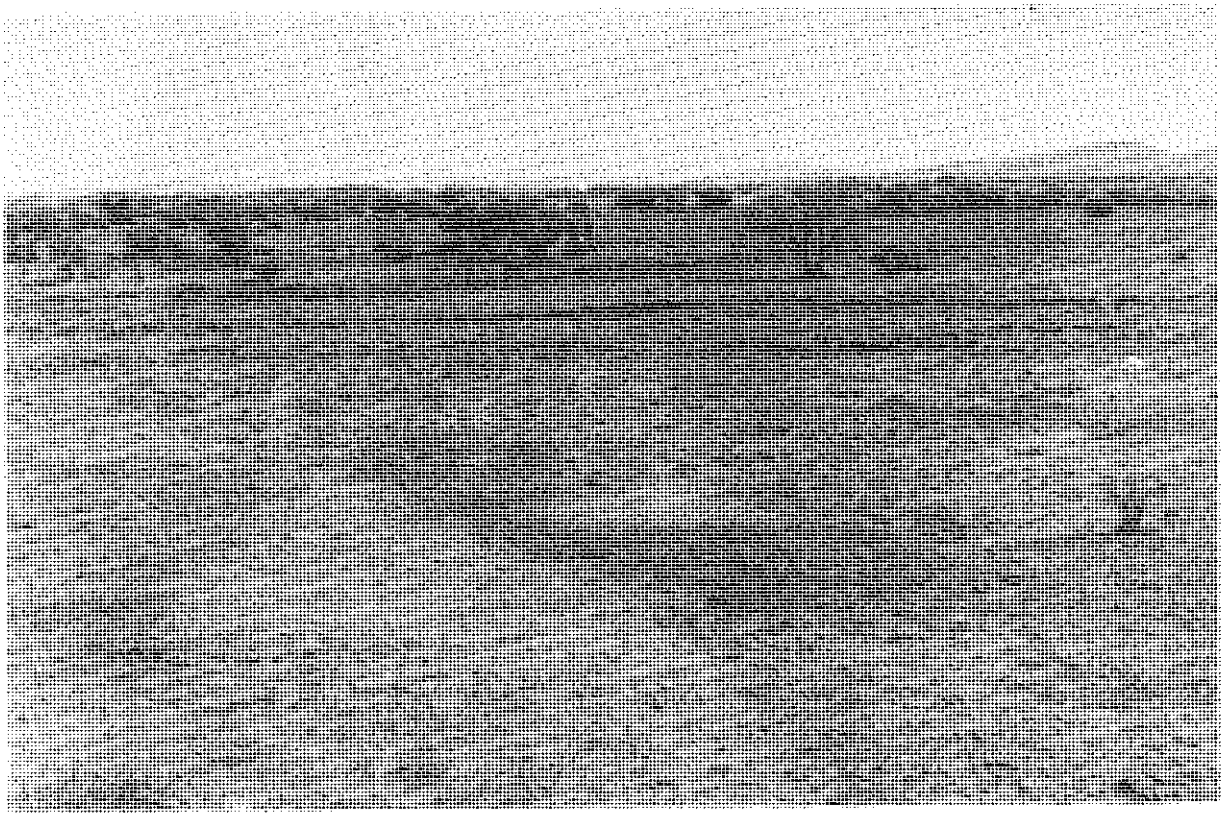


Plate 9 — The Cheela Plains area of about 200 sq km near the confluence of the Beasley and Hardey Rivers is nearly all in bad range condition. Desirable perennial shrubs and grasses are absent over extensive areas and erosion in the form of thin sheeting, shallow rilling and guttering is common. After rain the plains produce a profusion of annual forbs and grasses which provide nutrious but short-term feed. The annuals are rapidly grazed out leaving the soil surface exposed to wind and water. There are no reserves of feed for poor or drought seasons. The area has the potential to support highly productive perennial based pastures and a regeneration programme is urgently required. Such a programme will involve strip cultivation and seeding and complete control of stock. Cheela land system, Q329.

Plate 10 — Alluvial plains of the Edward land system often occur below low shale hills in central parts of the survey area. More than 60 per cent of the system is in bad range condition with seriously depleted pastures and active erosion. About 14 per cent (147 sq km) shows extreme degradation, with no perennial vegetation and bare, sealed clay surfaces. Sandy surface horizons of the original duplex soils have been completely removed by wind deflation and water action. Rehabilitation of these areas is possible but will require special cultivation and seeding techniques and complete protection from grazing for up to 10 years. Severely degraded plain Edward land system.

Plate 11 — Alluvial plain in good range condition, Edward land system. This site is one of the few of the Edward system seen in this condition during the survey. Excellent stands of saltbush *(Atriplex bunburyana)* **and bluebush** *(Maireana pyramidata)* **indicate the high production potential of the system. Unfortunately the duplex soils of the system are highly susceptible to erosion once the vegetative cover is reduced. The system can only be safely used for pastoral purposes where control of intensity of grazing and season of use is complete.**

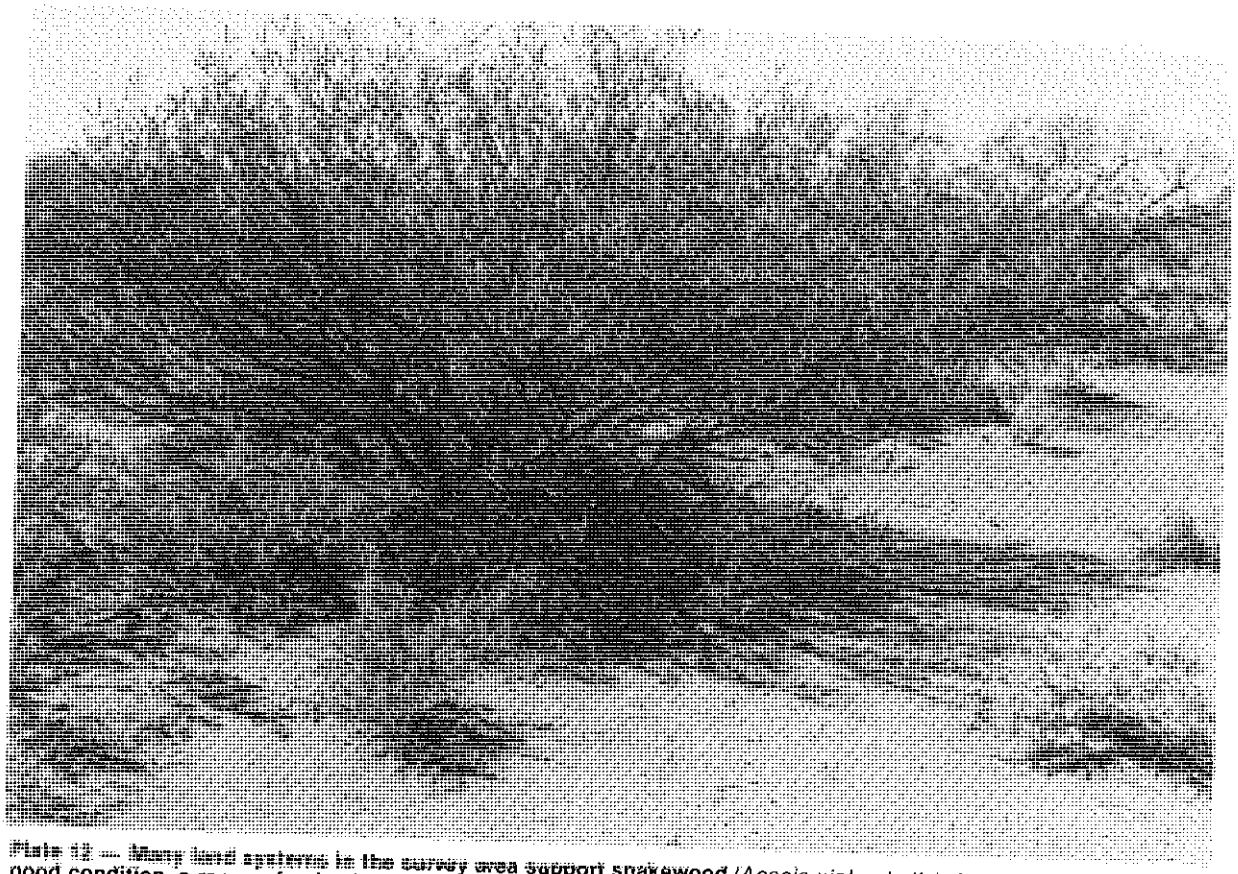


Plate 12 — Many land systems in the survey area support snakewood *(Acacia xiphophylla)* shrublands with, when in good condition, a range of palatable low shrubs growing beneath the snakewood. In many cases over use has led to almost complete loss of the low shrubs, wind and water erosion and death of the snakewood. This plate shows a snakewood community in good condition with numerous saltbush *(Atriplex bunburyana)* and ruby saltbush *(Enchylaena tomentosa)* low shrubs. Yankagee land system.

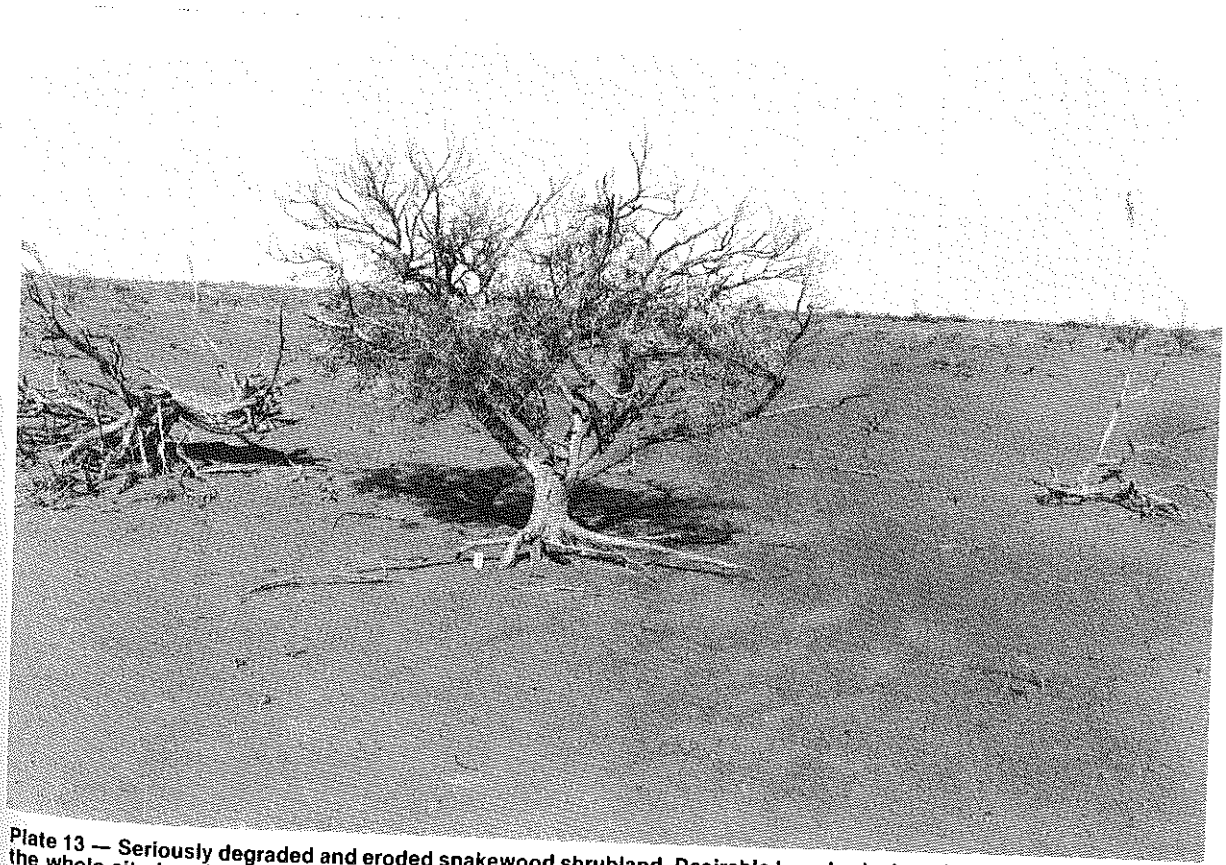


Plate 13 — Seriously degraded and eroded snakewood shrubland. Desirable low shrubs have been lost completely and the whole site is subject to wind erosion. Globe land system.

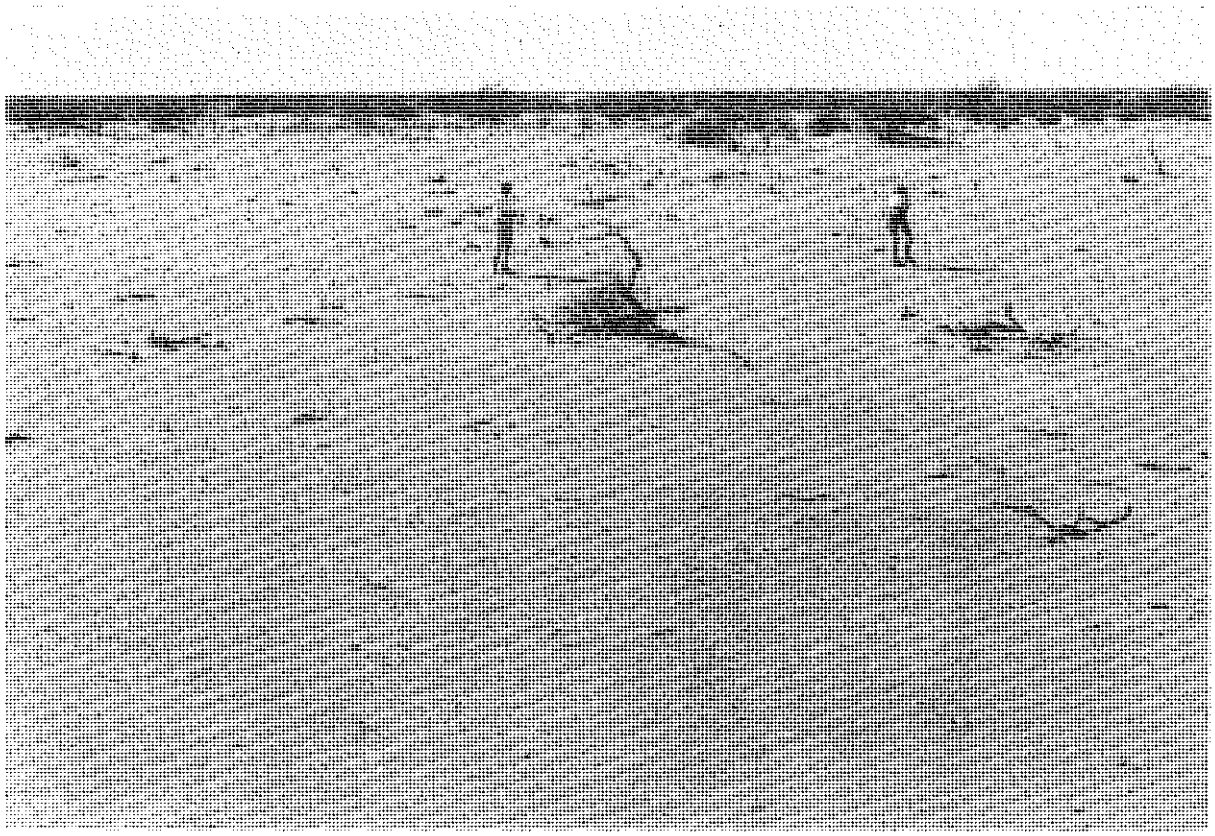


Plate 14 — Extreme degradation of a snakewood shrubland. Overgrazing over many years has reduced the ground cover, increased the adverse effects of drought seasons and hastened erosion processes. The net effect is total destruction of the perennial vegetation leaving a bare, windswept, hummocky plain. Recovery could be readily effected by complete removal from grazing use and cultivation works and seeding with buffel *(Cenchrus ciliaris)* and other grasses. Globe land system, Q611.

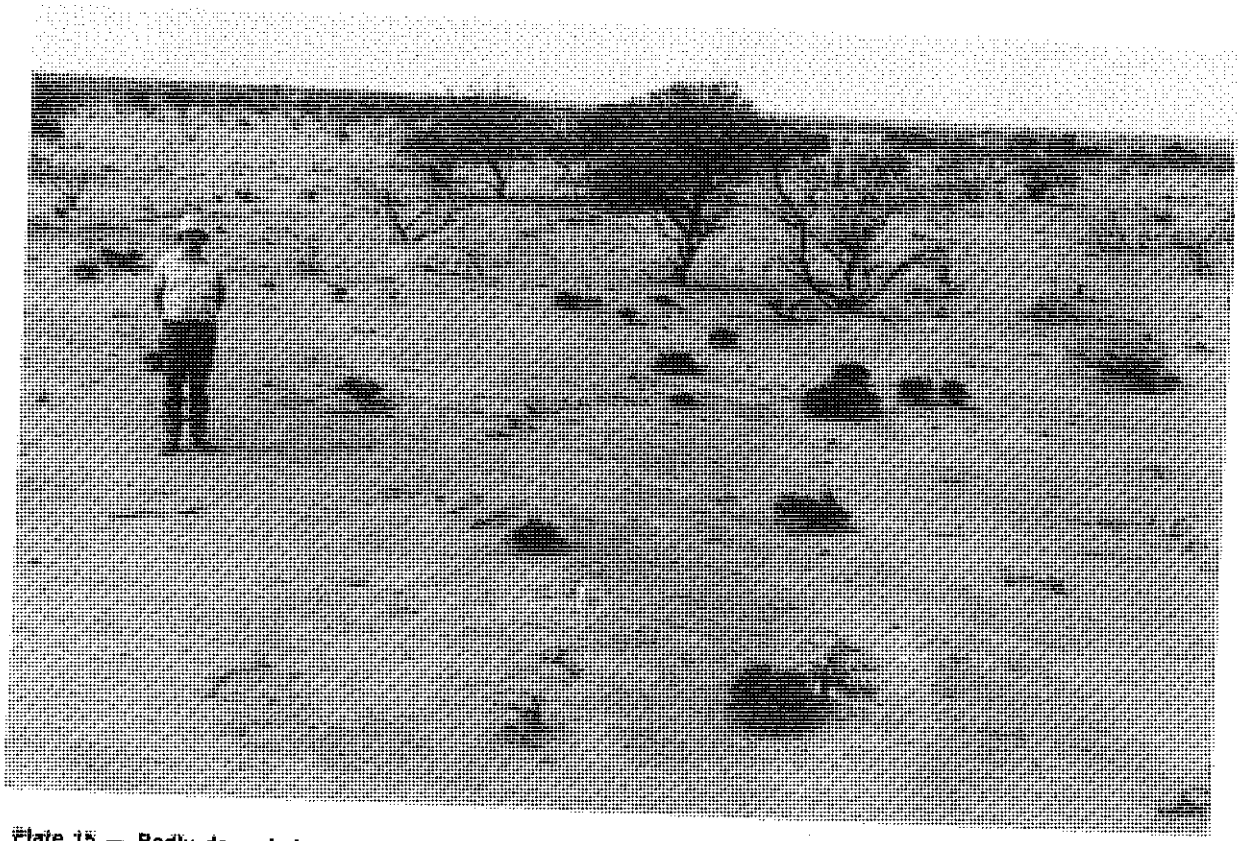


Plate 15 — Badly degraded snakewood shrubland with many of the mature shrubs dying. The small plants in the foreground are snakewoods which have adopted a "bonsai" growth habit as a result of heavy grazing as young plants. Excessive grazing has elminated any other useful low shrubs and the soil surface is partly stripped and sealed. The site is producing at far below its potential and requires complete protection from grazing for a number of years. Donovan land system.

Plate 16 — In western parts of the survey area perennial grass pastures as well as shrub pastures occur on broad clay plains associated with the Ashburton River. Range condition varies from good to bad. This plate shows a tussock grassland of Roebourne Plains grass *(Eragrostis xerophila)* **in good condition. Gilgai plain, Globe land system, Q489.**

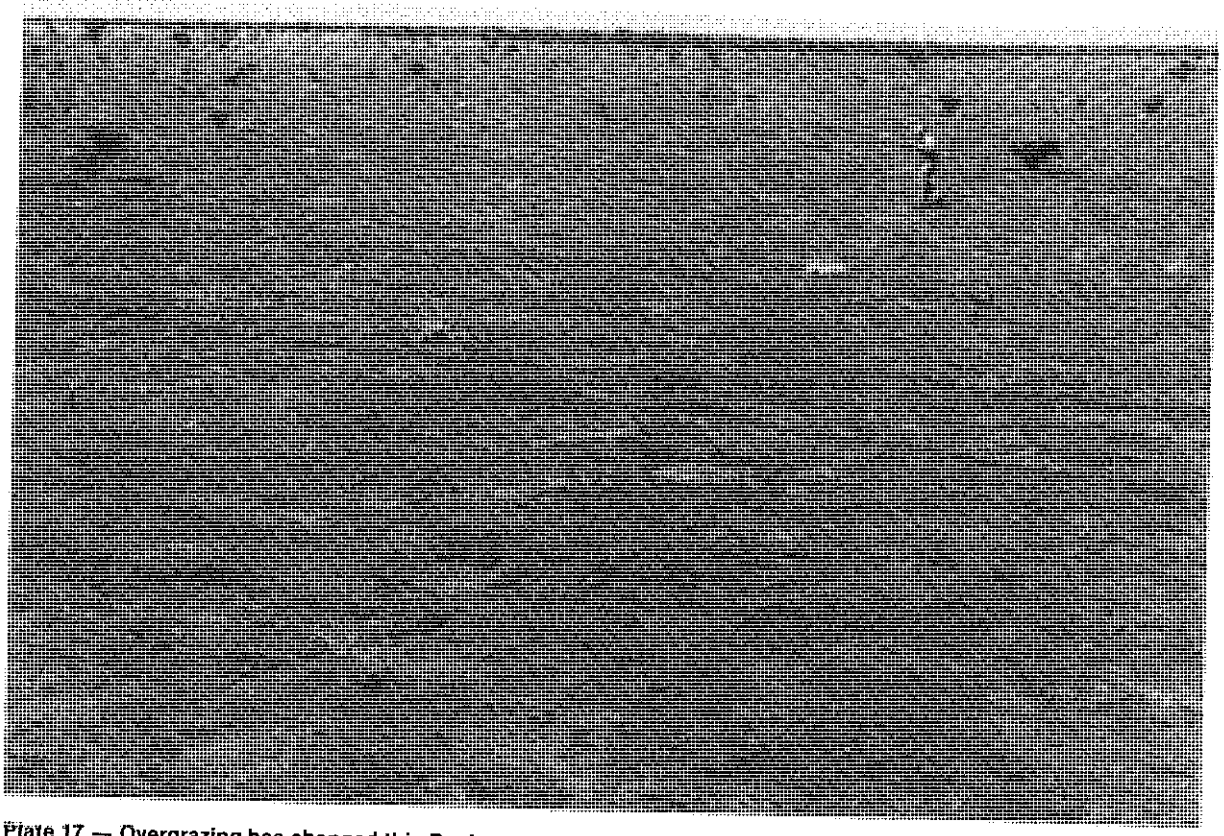


Plate 17 — Overgrazing has changed this Roebourne Plains grass *(Eragrostis xerophila)* site from a perennial tussock grassland to an annual herbfield. The pasture has no durability. The site has the potential to carry a grass stand similar to that shown in Plate 16. Gilgai plain, Cheetara land system, Q499.

Plate 18 — Total degradation of an alluvial plain close to the Ashburton River. Globe land system, Q472.

Plate 19 — Alluvial plains flanking the lower reaches of the Ashburton River show extremes of condition sometimes in close proximity. There is evidence that profound changes in terms of vegetation and soil movement have occurred since settlement. Much of the original vegetation has been lost but the introduced buffel grass *(Cenchrus ciliaris)* is well established in parts and has formed a stable disclimax. This plate shows severe erosion with barely surviving remnants of large coolibah trees *(Eucalyptus coolabah)* perched on exposed roots. The area is recoverable by strip cultivation, seeding and complete stock control. Nanyarra land system.

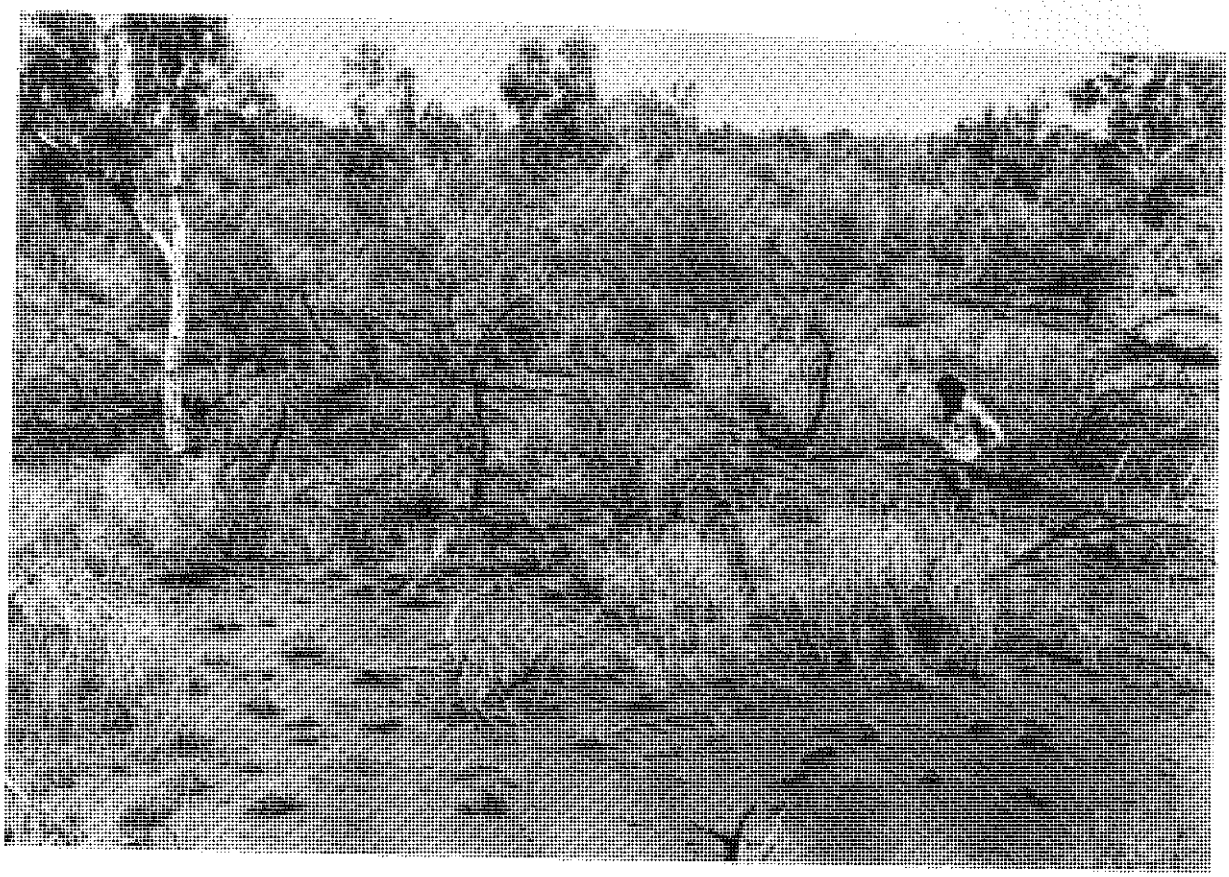


Plate 20 — Flood plain in fair to good condition, Nanyarra land system. The introduced buffel grass *(Cenchrus ciliaris)* **is well established as a ground layer beneath bardie bush** *(Acacia victoriae)* **and coolibah trees** *(Eucalyptus coolabah)* **Q568.**

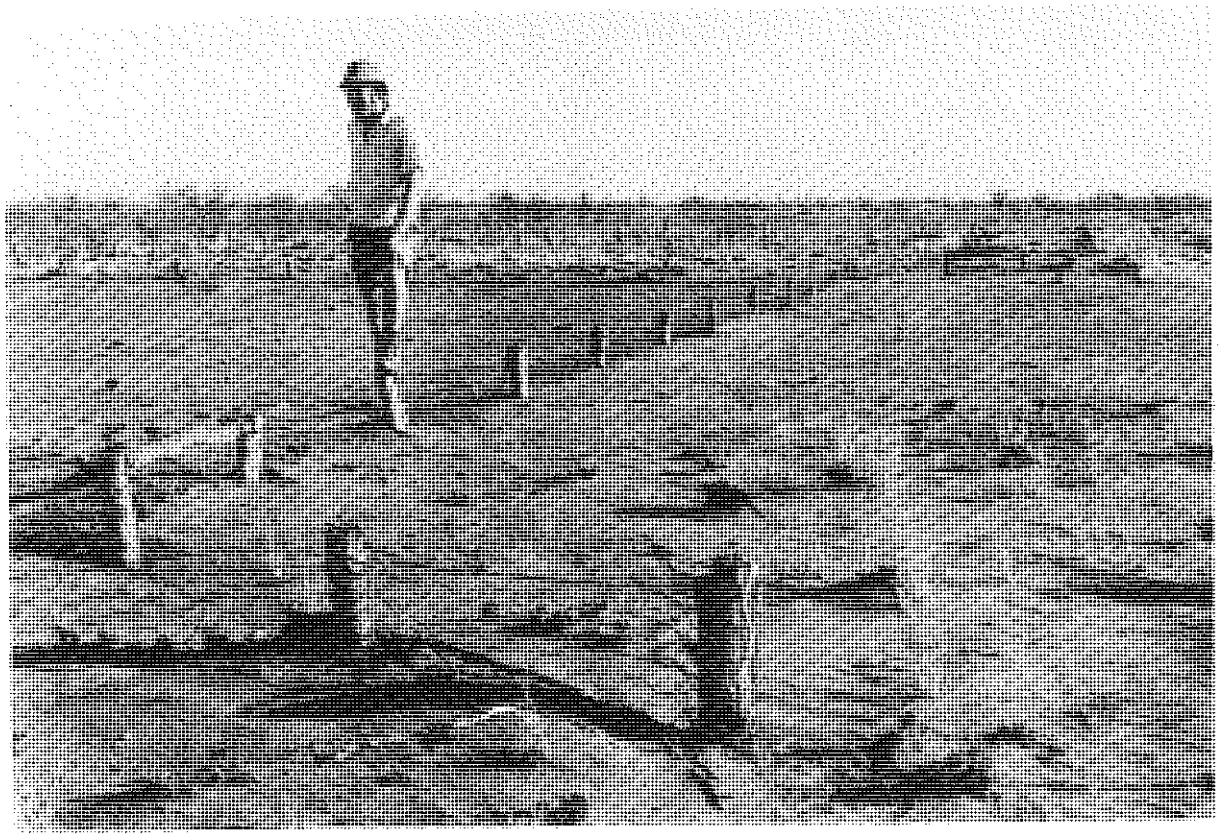


Plate 21 — Evidence of recent, massive redistribution of soil by wind. These sheep yards are buried by sandy soil to almost 1 m deep. Buffel grass *(Cenchrus ciliaris)* has a tenuous foothold. Nanyarra land system.

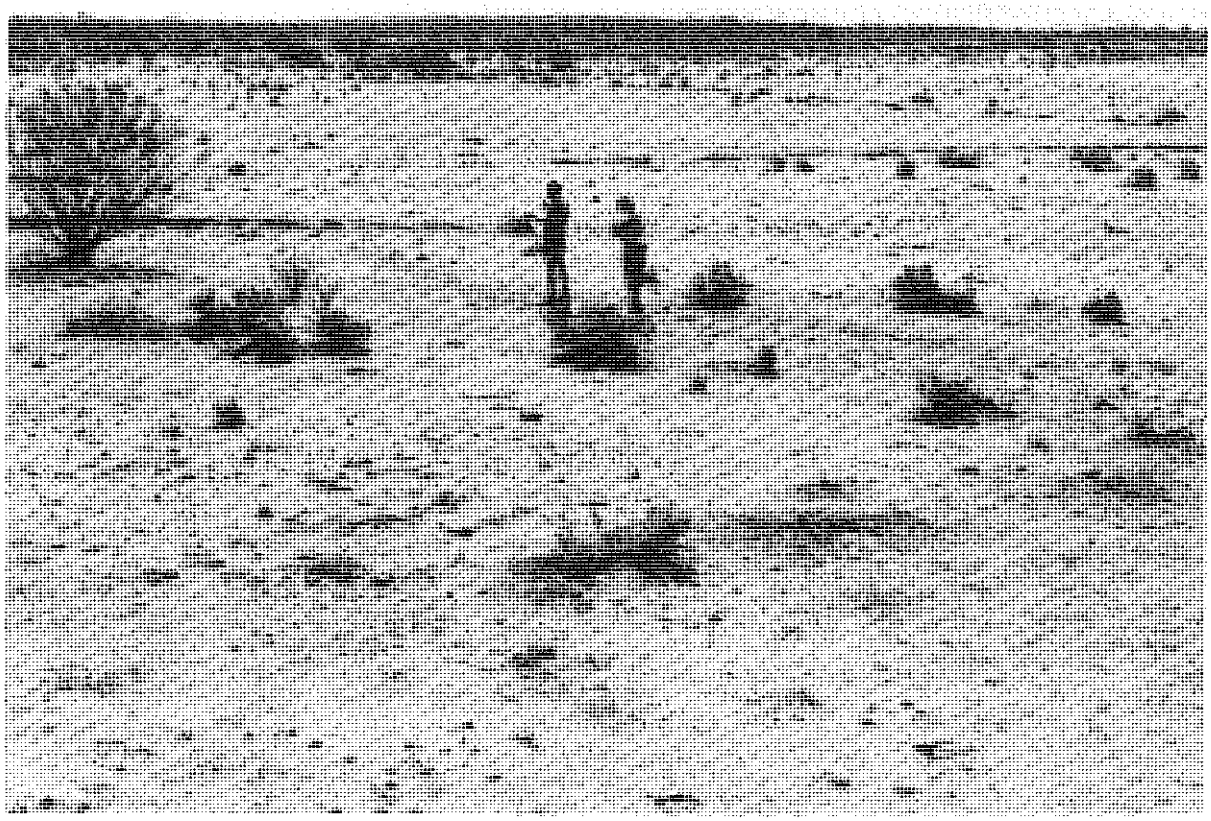


Plate 22 — Some of the most valuable pastures in the survey area are the bluebush *(Maireana pyramidata, M. polypterygia)* **and salt bush** *(Atriplex bunburyana)* **types. These are favoured by livestock and have frequently received preferential over use especially where they occur as small inclusions surrounded by poorer quality, less attractive pastures. Control of intensity of grazing and season of grazing is necessary to promote recovery. Degraded drainage floor, Prairie land system, Q167.**

Plate 23 — This plate shows a saltbush pasture in good condition and indicates its potential for high production. The site is a favoured one for vegetation in that it receives additional water shed from adjacent slightly higher units of the land system. As well as saltbush *(Atriplex bunburyana)* **there are many other valuable shrubs such as tall saltbush** *(Rhagodia eremaea)*, **Wilcox bush** *(Eremophila leucophylla)* **and ruellia** *(Reullia primulacea)*. **Nadarra land system. Q667.**

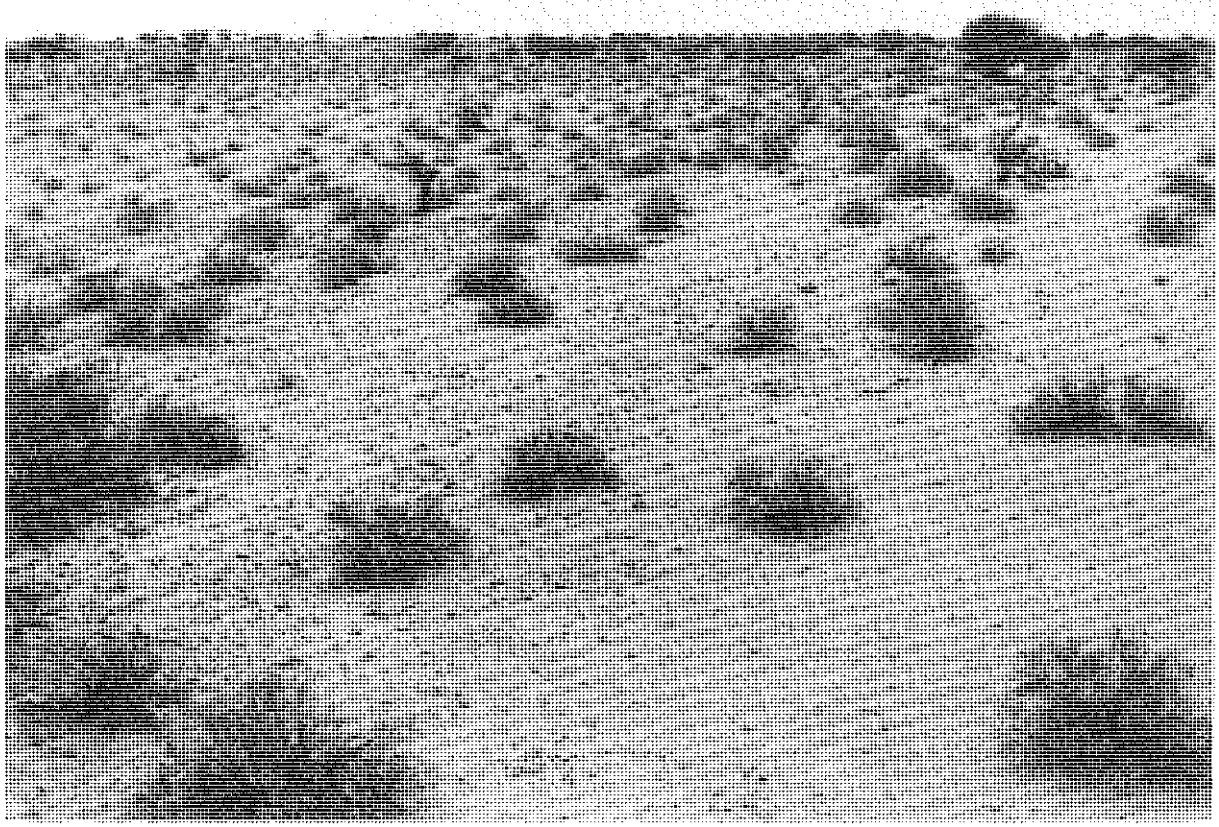


Plate 24 — This plate shows a Gascoyne bluebush *(Maireana polypterygia)* **pasture on the Firecracker land system. The bluebush forms a distinctive low shrubland and there are also a few tall shrubs of snakewood** *(Acacia xiphophylla)*. **Pasture condition is fair to good and there is no erosion on this site. However, parts of the Firecracker land system are extremely sensitive under grazing and severe erosion can occur. Q643.**

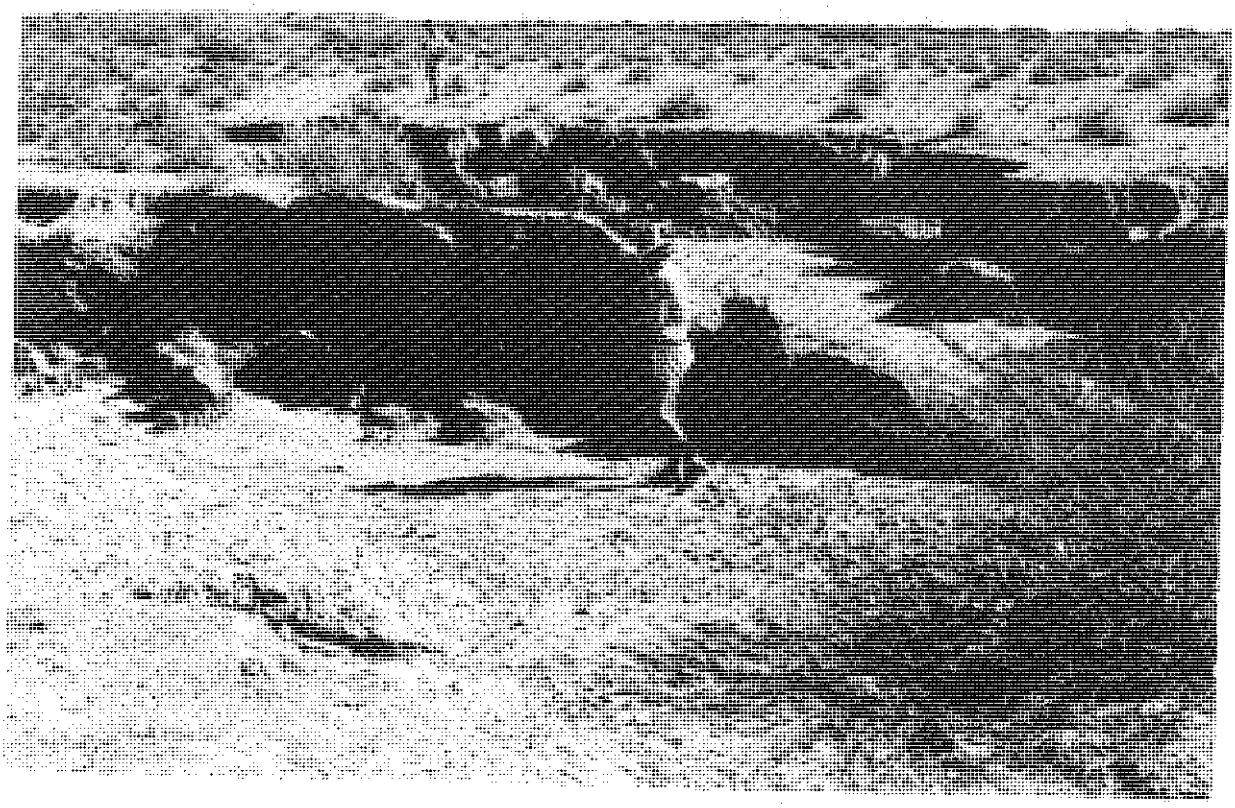


Plate 25 — Active gully erosion on the Firecracker land system. Despite a reasonable cover of bluebush shrubs the site is rapidly degrading. Gullies often commence along sheep pads or tracks where these travel down long slopes. Very careful control of grazing intensity, season of use and the positioning of watering points and access tracks is essential if the resource base is to be maintained. Near Q635.

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APPENDIX

LAND SYSTEM MAPS

1:250 000 scale

Onslow

Yanrey

Wyloo

Mount Bruce

Winning Pool

Edmund

Turee Creek

Newman

Mount Egerton

Collier

GARRY L. DUFFIELD, Government Printer, Western Australia

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